MDC – Work Package 3

Archaeology Detailed Desk Based Assessment

Whitechapel Station

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1 Non-technical Summary

This report presents the results of Archaeological Detailed Desk Based Assessment (DDBA) of three sub-sites that form part of Crossrail Site 210 Whitechapel Station, located within the Central Section, route window C8. The report assesses the impact of proposed Crossrail works on archaeological deposits that may survive within the three sub-sites (Cambridge Heath Road Shaft; Durward Street Shaft and Interchange; and the worksite for the Fulbourne Street Ticket Hall).

The Crossrail worksites for Whitechapel Station site are located within the London Borough of Tower Hamlets and parts of the site lay within an Area of Archaeological Importance. The Crossrail worksites for Whitechapel Street Station exhibit a potential for archaeological deposits ranging in date from the Roman to the post-medieval. A potential for Roman remains can be expected due to the London to Colchester Roman road to the south of the Crossrail worksites at Whitechapel station. In general, Saxon and medieval archaeological evidence from the zone is limited and scattered, as befits a largely rural landscape. By the time of Rocque's map of 1746, the area from Whitechapel towards the City was built-up, with less intensive occupation eastwards along Mile End Road.

There are no known underground obstructions at the locations of the three sub-sites. A number of buildings identified in the obstruction survey are situated close to the sub-sites, although these are unlikely to have disturbed archaeological deposits. The construction of Whitechapel station, railway cutting and suburban development will have caused significant disturbance. It is also known that the area was heavily bombed during World War II, consequently, bomb damage may have disturbed archaeological deposits.

Previous evaluation fieldwork within the Crossrail worksites for Whitechapel Station indicates that industrial activity (including brickearth quarries and the extensive basements of late 19th/early 20th century phases of Albion Brewery) will have significantly reduced the survival of earlier archaeological features. The East London Line is in an 8m deep cutting that passes northwest-southeast through Durward Street. The District Line platforms (running east-west and forming the southern boundary of the Crossrail Worksites) are in a cutting approximately 3m below the street level of Durward Street. Archaeological deposits are unlikely to survive within the railway cuttings.

The construction of the shafts at Durward Street and Cambridge Heath Road will remove all archaeological deposits that survive in their footprints. Construction at the worksite for the Fulbourne Street ticket hall also has the potential to impact upon archaeological deposits.

Archaeological field evaluation will be required at the Cambridge Heath Road Shaft, Durward Street Shaft & Interchange and the worksite site for the Fulbourne Street Ticket Hall and will inform an appropriate mitigation design, which will constitute *preservation-by-record* (e.g. archaeological excavation and/or watching brief).

General watching briefs are required at the establishment of worksites on Durward Street (the bus stand area and Essex Wharf); and at worksite establishement and utilities diversions taking place within the Sainsbury's car park.

Furthermore, the historic sett surface on Winthrop Street should be replaced in its original position upon completion of Enabling Works that may necessitate removal of the surface. The surface should also be protected if construction vehicles are to be using the route. Further NLBH Assessment will be carried out to determine the level of recording required for railway heritage features identified by London Underground (LU) at Whitechapel Station.

2 Introduction

2.1 Scheme Background

Crossrail is a major new cross-London rail link designed to serve London and the south-east. The scheme will include the construction of a twin bore tunnel on an east-west alignment under central London and the upgrade of existing rail lines to the east and west of central London. It also includes the construction of new central London stations, providing interchange with London Underground, National Rail and London bus services, and the upgrading or renewal of existing stations outside central London.

The Crossrail route is divided into four sections: a central section in central London, and outside of central London, western, north-eastern and south-eastern sections. Each section is further sub-divided into route windows, within which are located a number of archaeological sites. The subject of this Detailed Desk Based Assessment (DDBA) is Site 210 Whitechapel Station, located within the Central Section, route window C8.

2.2 Nature and Extent of Work

Whitechapel Station

The Crossrail works at Whitechapel Station can be subdivided into the following key elements:

- New shaft off Cambridge Heath Road which serves for ventilation / intervention and emergency escape shaft plus an adjoining, smaller diameter, draft relief shaft which will also be used for construction access;
- Two new shafts either side of the ELL and off Durward Street. The larger, DSS, serving as an interchange, ventilation, intervention / emergency escape shaft, and the smaller West Stair Shaft providing interchange access between Crossrail, the District Line and direct access to the ELL northbound platform;
- New Crossrail Station tunnels running east-west between the shafts at Cambridge Heath Road and Durward Street;
- The new ticket Hall off Fulbourne Street which will serve the new Crossrail Station as well as the existing East London, District and Hammersmith & City Lines providing direct interchange between all lines and access through to the existing LU ticket hall.

The following sub-sites within the new Whitechapel Station will be addressed in this DDBA:

- Cambridge Heath Road Shaft;
- Durward Street Shaft and Interchange;
- Work Site for Fulbourne Street Ticket Hall.

The Crossrail works are divided into Enabling Works and Main Works. Enabling Works are defined as those works that are required to facilitate the main construction works, and as such are required prior to the start of the Main Works programme.

The Construction and Construction Process Report, Section 12 of the Civil, Structural & Tunnel Engineering Report Whitechapel Station Volume 3 of 8 (CR-SD-WHI-CE-RT-00002) provides a detailed sequence of Enabling and Main Works taking place at Whitechapel Station. Section 12 is reproduced in Appendix 9.4.

2.3 Limitations

The DDBA was limited by the following omissions:

- Information regarding existing foundations is currently incomplete in the Running Tunnels & Shafts Obstructions Report (Crossrail 2007a).
- No consultation with users, custodians, and interested bodies has yet been carried out.

The following sources have not been examined in detail for this DDBA and are not considered relevant:

- Trade directories; wills, rate books; census returns; business accounts; historic photographs; lithographs; prospects and paintings; sale particulars; inland revenue maps; fire insurance plans;
- Land registry for property registers, title deeds and title plans, registered leases, conveyances, transfers, deeds, property agreements;

The following sources were unavailable at the time of report preparation.

- Data from preliminary works, such as boreholes or test pits, conducted in advance of construction;

2.4 Surface Geology and Topography

The records of the British Geological Survey (Sheet 256 – North London – of the 1:50,000 Series Geological Map, Solid and Drift Edition 1994) indicate that the Crossrail worksites for Whitechapel Station are underlain by Recent Taplow Gravel and River Terrace Deposits over Palaeogene London Clay over Lambeth Group over Thanet Sand resting unconformably on Cretaceous Chalk. Recent Langley Silt is shown immediately north, to the west and also to the north of the intersection of Vallance Road and Whitechapel Road to the east.

Ground level is fairly uniform across the zone, varying from 113m ATD in the west to 108m ATD above the edge of the alluvial silts with a further fall to the south-east to 104m ATD, reflecting the slight slope down to the Thames.

The assumed stratigraphy at the Crossrail worksites for Whitechapel Station, as determined in the Scheme Design Submission Civil, Structural & Tunnel Engineering Report Volume 3 of 8 (Document Number: CR-SD-WHI-CE-RT-0002) is shown in the table below:

Structure	Durward Street Box (& West Stair Shaft)	Fulbourne Street Ticket Hall Box	Cambridge Heath Road Shaft and Draught Relief Shaft
Approximate top of base slab level (mATD)	81	110 (platform) 99.8 (interchange)	81
Pile toe level (mATD)	67.8	83	70
Stratigraphy	Elevation (mATD)		
Ground level – Made Ground	112 ± 0.5	112.5 ± 1	111.5 ± 1
Top of Alluvium	N/A	110 ± 1	109± 1
Top of River Terrace Deposit	106.5 ± 3		108 ± 1
Top of London Clay	105 ± 1	103.5 ± 2	104.5 ± 1
Top of Lambeth Group	79 ± 1		80 ± 1
MLGH	70 ± 1		
Top of Thanet Sand	61 ± 2		
Top of Chalk	49 ± 3		

Table 1. Assumed stratigraphy: Crossrail worksites for Whitechapel Station (Crossrail 2008a)

Refer to drawing numbers P30101-C1M14-G00-D-50121 & 50122 (Appendix 9.1) for geological cross-sections and the locations of the boreholes mentioned in the text.

3 Aims and Objectives of the Assessment

3.1 Aims & Objectives

The objective of the DDBA is to understand the site-specific issues of survival or past removal of potential archaeological remains, localised truncation from individual basements etc., and to identify any pertinent historical records relating to each site. The results of this analysis will be used to formulate site-specific Written Schemes of Investigation (WSIs).

In summary, the purpose of the DDBA is to:

- Identify more fully the ground conditions at each of the sub-sites;
- Review the construction impacts; and
- Identify further archaeological evaluation required at each of the sub-sites, which will in turn inform subsequent phases of mitigation planning.

4 Methodology

4.1 Approach

The Detailed Desk Based Assessment (DDBA) is a targeted research exercise using existing written, graphic, photographic and electronic information to identify the likely character, extent, quality and value of the known or potential archaeological resource at a specific site.

DDBA is not required for every worksite and is carried out only in cases where additional information is required to inform decisions regarding an appropriate mitigation strategy. The decision as to whether DDBA is required at a particular site is based on:

- The importance of the known or potential archaeological resource;

- The nature of the construction works; and
- Any gaps in the existing archaeology information gathered to date for the Crossrail ES and the Crossrail Archaeology Programming Assessment (1E0318-G0E00-00006 Rev. B).

A higher level Archaeological Desk Based Assessment (DBA) was carried out in 2003/4 for the Crossrail ES, comprising generic or area based research that fed into the archaeological baseline for the Crossrail scheme. This DDBA updates that baseline and takes into consideration the following data should they have the potential to contribute to the site-specific WSIs:

- Design development since the ES and all associated information collected by Crossrail;
- Changes to the Statutory and Local Authority designations;
- Targeted archaeological and documentary data;
- Targeted historical research, such as map regression;
- Geotechnical and/or geological data, and aerial and ground survey data;
- Any additional data, such as chance finds, relevant fieldwork results etc;
- Visual Site Appraisal; and
- Non-listed built heritage Assessment.

4.2 Standards and Guidance

This DDBA has been carried out in accordance with Crossrail standards and guidance:

- Crossrail. 2008d. Archaeology, Procedure for Detailed Desk Based Assessment, Document Number 23042008-96BA-OAKW.
- Crossrail. 2008e. Archaeology Generic Written Scheme of Investigation, Document Number 14022008-44ES-P2Z1.

4.3 Sources Consulted

In producing this DDBA, data relevant to the individual sub-sites was collected from the following sources:

- NMR/SMR records, held by English Heritage and local authorities, provided by MoLAS in the following formats:
  - Shapefiles (.shp) of the full GLSMR dataset; burial grounds (polygons and points), Registered parks and gardens, Scheduled Monuments, and site codes;
  - SMR Central Route Section Full Description: 948 Farringdon Station.doc; and
  - Links to the Greater London Sites and Monuments Record - Search Report listing full GLSMR descriptions for MDC 2, 3 and 4.
- Records of archaeological priority zones or equivalent areas designated by local authorities, provided by MoLAS as shapefiles (.shp);
- LAARC (London Archaeological Archive and Resource Centre) fieldwork database and summaries, provided by MoLAS in the following formats:
  - Whitechapel Site LAARC summaries.doc;
  - Whitechapel site summary table.doc;
- Historic mapping, provided by MoLAS, comprising the following maps:

  - 1969, 1963, 1948, 1938, 1914, 1913 and 1873 OS Mapping
  - 1824 – Greenwood's map of London
  - 1819 and 1799 – Richard Horwood's map of London, Westminster and Southwark
  - 1746 – John Rocque's map of London
  - 1703– Gascoyne's map of London
- Historic place names records;
- Unpublished archaeological reports, including data not yet available on the LAARC database, provided by MoLAS:
  - Crossrail MDC2 3 & 4 Archaeological Sites Not Available on the LAARC Website.doc
- Historic Building records and conservation area appraisals and management plans;
- Geotechnical Sectional Interpretative Report 3: Liverpool Street to Pudding Mill Lane and Isle of Dogs Volume 3 (1D0101-C1G00-00509), including reviews of the following datasets by the Crossrail geotechnical team:
  - Geological mapping (held by the British Geological Survey);
  - Previous geotechnical assessment of the site by Arup (Crossrail Geotechnical Interpretative Report Sectional Interpretative Report – Nov 1992)

Additional documentary materials used to inform the DDBA included:

- Further technical reports held by Crossrail:
  - Crossrail. 2005. Crossrail, Assessment of Archaeological Impacts, Technical Report. Part 2 of 6, Central Section: Westbourne Park to Stratford and Isle of Dogs. Document Number 1E0318-C1E00-00001. February 2005.
  - Crossrail. 2006a. Geotechnical Desk Study, Liverpool Street to Pudding Mill Lane and Isle of Dogs. Document Number 1D0101-C1G00-00509.
  - Crossrail. 2006b. Archaeology Programming Assessment. Document Number 1E0318-G0E00-00006 Rev. B.
  - Crossrail. 2007. MDC Work Package 3, Running Tunnels & Shafts Obstructions Report. Document Number CR-SD-CT1-CE-RT-00015.
  - Crossrail. 2008a. Scheme Design Submission, Civil, Structural & Tunnel Engineering Report, Volume 3 of 8. Document Number CR-SD-FAR-CE-RT-00002.
  - Crossrail. 2008b. Crossrail, MDC3 Archaeology, Updated Baseline Assessment. Document Number 20032008-84MB-YYK5

5 Results

5.1 Archaeological and Historical Background

The general archaeological potential in the Whitechapel Station area is described in the Crossrail Archaeological Impact Assessment (Crossrail 2005) and subsequent Updated Baseline Assessment (Crossrail 2008b). This DDBA updates the baseline with data regarding archaeological interventions and GLSMR data from within and adjacent to the sub-sites. Site summaries and GLSMR data for each of the sites mentioned in this section are provided in

Appendices 9.2 and 9.3. The locations of the archaeological sites mentioned in this section are presented in Drawing Number P30103-C1M14-E00-D-50001 (Appendix 9.1).

The site falls within an Area of Archaeological Importance, designated by London Borough Tower Hamlets to encompass the line of the Roman Road between London and Colchester. (Crossrail 2005).

There are no Scheduled Monuments, located within or nearby Whitechapel Station.

The following burial grounds are located within 100m of the site:

- A Quaker burial ground in Vallance Road Gardens *may* originally have extended further to the south (GLSMR 082268, BG 214, 1799 Horwood map). The Crossrail works *do not extend to this burial ground.*
- Brady St Jewish burial ground (GLSMR 0837767, BG 213) lies within the search area *but outside the Crossrail site.*
- The Old Montague/Davenant Street burial ground lies within the search area *but outside the Crossrail site (*GLSMR 081050, BG215).
- Another burial ground in Hanbury Street (GLSMR 082267, BG 216) on the north side of Old Montague Street and *is located outside the Crossrail site.*
- During the Great Plague of 1665 the parish of St Dunstan's Stepney Green acquired c 1.25 acres of waste on the north side of Whitechapel road near Stonebridge for use as an emergency burial ground. Its location was recorded by Sir Christopher Wren in 1673. Basil Holmes locates it on the north side of Mile End Road, south of the junction of Lisburn and Collingwood Streets, *which could place it within the site of the possible Cambridge Heath Shaft worksite.*
- St Mary Moorfields Catholic church had an additional burial ground in Whitechapel, referred to as being in Dog Row (Cambridge Heath Road) off Whitechapel Road, placing it *in the general vicinity of the Crossrail site (exact location is unknown).*
- The London Hospital burial ground (BG 217) is located c 200m south of the proposed protective works. *This is beyond the Crossrail site, on the south side of Whitechapel.*

Prehistoric

Virtually no artefacts of Palaeolithic or Mesolithic date have been recovered from this area suggesting a generally low potential for the Taplow terrace gravels. Despite the favourable geological and topographical conditions of the terrace gravels and brickearth, there is virtually no evidence for a settled agricultural landscape during the later prehistoric periods. However, this may simply reflect a lack of fieldwork as elsewhere on similar terrain, such as the gravel terraces both east and west of London, extensive Middle Bronze Age to Iron Age field systems and agricultural settlements have been found.

Roman

During the Roman period a main arterial road ran east from the Aldgate at *Londinium* to Colchester, following the line of Whitechapel Road as far as Whitechapel Underground Station, then passing north-east to cross the river Lea at Old Ford. This road has been archaeologically recorded in the Old Ford area, together with an associated settlement and cemetery. This evidence is not, however, predicted to extend to the Crossrail route. A second road ran from just south of the Aldgate to Shadwell, south-east of the Crossrail worksites for Whitechapel Station, where there was another settlement, apparently grouped around a substantial residence, adjacent to the marshland bordering the Thames.

Saxon/Medieval

In general, Saxon and medieval archaeological evidence from this area is limited and scattered, as befits a largely rural landscape.

Outside the City, to the east of the precincts of St Mary Spital, was a marshy area known in the medieval period as the Bishop of London's fields, then as Lollesworth, then Spital Fields. It appears to have been an open area up to the 16th century.

During the Great Plague of 1665 the parish of St Dunstan's Stepney acquired c. 1.25 acres of waste land on the north side of Whitechapel Road near Stonebridge for the use as an emergency burial ground. This could fall within the Cambridge Heath Shaft worksite.

An additional burial ground used by St Mary Moorfields Catholic Church may also be located within the Whitechapel Station site. The site is referred to as being in Dog Row (Cambridge Heath Road) off Whitechapel Road. However, it had disappeared by the 19th century and its exact location is unknown.

Post Medieval

An indication of the early Post-medieval expansion of London is provided by the defensive circuit erected around it by the Parliamentary government in the 1640s. The linear bank and ditch earthwork were punctuated by forts and batteries, including a fort at Whitechapel, later known as the Mount, and a redoubt near Brick Lane. The connecting earthworks intersect the Crossrail route in the area of Valence Road, although the locations are not precisely known. The Crossrail works at Whitechapel Station do not extend to the likely location of the defences. The evidence indicates that they lay further west. Elements of the ditch, excavated to the south of Whitechapel station, did not closely match reconstructions of the line of the defences, suggesting that local construction layout were more complex than historic sources indicate. This area, on the fringes of London, was used for related activities and there are a number of burial grounds, including those for non-conformists, around Whitechapel and Stepney.

By the time of Rocque's map of 1746, the area from Whitechapel towards the City was built-up, with less intensive occupation eastwards along Mile End Road. The City suburbs gradually expanded over the zone until Stepney was engulfed in the 1840s. Urbanisation was accelerated by the original terminus at Shoreditch station opened in 1840 (enlarged and renamed Bishopgate in 1847), this site is now Bishopgate Goods Yard. Commercial Street, the latest major addition to the road network, was constructed in the mid-19th century. Within the site of the Durward Street Shaft and Interchange historic maps show a distillery. Recent surveys for works taking place on the East London Line encountered a brick lined shaft approximately 15m in diameter on the location of the former distillery. The shaft was investigated by camera to a depth of c.20m, at which point rubble fill was encountered. The actual depth of the shaft is unknown. The approximate location of the shaft is shown on Drawing Number P30103-C1M14-E00-D-50001 (Appendix 9.1).

The Albion Brewery, which was formerly located in the footprint of the Cambridge Heath Road Shaft sub-site, was originally constructed in the early 1800s near the Mile End Turnpike by the landlord of the Blind Beggar public house, Richard Ivory. After being leased by John Hoffman for 10 years the brewery's lease was bought at auction in 1818 by Blake and Mann, a Lambeth Brewer. After the retirement of Philip Blake, the company became 'John Mann, Brewer' and then 'Mann and Sons' in 1843. In 1846 Robert Crossman and Thomas Paulin became partners in the business, which consequently changed its name to 'Mann, Crossman & Paulin and Company'. The brewery flourished and in 1901 it became a public company. In 1959 the company merged with Watney, Combe, Reid and Co to form 'Watney, Mann'. A little later, in 1972 the company was bought by Grand Metropolitan who closed it in 1979. In the 1990s the entrance block (172 Whitechapel Road) was converted into flats, the majority of the brewery buildings were demolished and turned into a car park for Sainsbury's.

The most notable development in terms of overall effect to the development of the Whitechapel area was the construction of Whitechapel Station and railway. Whitechapel station was first

opened by the East London Railway (ELR) on 10 April 1876 as Whitechapel. The District Railway (DR) opened their own station, with adjacent entrances, on 6 October 1884. In 1902 with the extension of the District Railway beyond Whitechapel, to Bromley-by-Bow via Mile End, the booking hall facilities for the District and East London Railways were combined. Through services from the District Railway and Metropolitan Railway (MR) to the East London Railway were withdrawn in 1905 and 1906 respectively. MR through services began serving the station again on 31 March 1913. In 1936, underground passages and stairs connecting the District line platforms with the East London line were added. Between 1979 and 1982, the East London line platforms were refurbished and in January 1995, improved Underground Ticketing System (UTS) ticket gates were installed in the booking hall. The East London line platforms were refurbished again in 1995-1998 during the closure of the East London line for repairs to the Thames Tunnel (LU, 2003).

The Cambridge Heath Road Shaft is located to the rear of The Blind Beggar public house, which fronts onto Whitechapel Road. The Blind Beggar was built in 1894 on the site of another inn, established before 1654. It is a common tourist attraction for Salvationists, situated as it is on the site at which the Salvation Army started when in 1865 William Booth preached his first sermon. In the 1960s the Blind Beggar gained notoriety in London's East End gangster scene when Ronnie Kray murdered an associate of a rival gang, George Cornell, as he was sitting at the former saloon bar.

5.2 Site Specific Historic Map Regression

Historic development at the three sub-sites has been assessed through the analysis of historic mapping, Ordnance Survey mapping and observations made during a visual site appraisal. While early historic maps are a useful tool in the identification of archaeological potential, their inaccuracy means that they cannot be relied on for specific impact locations. Historic mapping becomes more accurate as time progresses, with the Ordnance Survey first edition providing the first reliable mapping resource for the identification of impacts.

The historic maps consulted are listed in section 4.3 and are reproduced in Appendix 9.1, Drawing Numbers P30103-C1M14-E00-D-50101 to 50116.

Cambridge Heath Road Shaft

18th century: The 1703 Gascoyne map shows the development site labelled as *sunken gardens* and is indicated to be short rectangular plots of land. Between the 1703 Gascoyne map and 1746 Rocque map these sunken gardens have been developed into housing properties fronting onto Whitechapel Road and Cambridge Heath Road, known then as White Chappell Road and Dog Row respectively. The 1746 mapping also shows a Ducking Pond which may extend into the north-western corner of the Cambridge Heath Road shaft site.

19th century: The site is shown to be still occupied by residential housing on the 1819 Horwood map, now labelled as Trinity Alms Houses. This housing looks to have changed from irregular housing to terraced homes by the creation of the 1873 Ordnance Survey Map. A brewery is also shown extending into the centre of the Cambridge Heath Road sub-site on the 1819 Map with associated Alms Houses to the south, labelled Drayners Alms Houses. By the close of the 19th century the Albion Brewery has extended to encompass the majority of the sub-site.

20th century: The Albion Brewery buildings are shown clearly on the 1938 OS map and demonstrate that large area of yard were also a part of the complex. No significant changes take place within the proposed development site until1948 when only two terraced houses remain with the site (within the northeast corner); the remaining area is shown to be undeveloped. London County Council Bomb Damage maps show the buildings fronting Whitechapel Road to the east and west of 172 Whitechapel Road (the entrance block) were seriously damaged and damaged beyond repair respectively during World War II.

The Site Today: Following the demolition of the last two remaining terraced houses the site is currently occupied by an area of car parking to the rear of the Blind Beggar Public House and a Sainsbury's car park.

Worksite for Fulbourne Street Ticket Hall

18th century: The 1703 Gascoyne map shows the development site within a large area of open land. Between the 1703 Gascoyne map and 1746 Rocque map the development site is shown to contain residential development within the northwest section of the site and a pond labelled as a "Ducking Pond" to the east. By the end of the 18th century, shown on the 1799 Horwood Map, terraced housing has been built on the newly labelled Greyhound Lane; Woods Row and Court Street. Whitechapel Road was significantly developed with rows of terraced housing fronting onto the street.

19th century: Between the 1746 Rocque map and 1824-26 Greenwoods map the site area has been significantly developed to the east with housing and is labelled as Ducking Pond Row. This housing looks to have changed from irregular housing to terraced homes by the creation of the 1873 Ordnance Survey Map. The 1873 Map also shows that Ducking Pond Row has been renamed Bucks Row (this will go on to become Durward Street). The area also has a mix of industry and housing with a warehouse, stables and a chemical works falling within the worksite boundary.

20th century: The entire site changes dramatically by the 1913 Ordnance Survey Map with the construction of Whitechapel Station. Court Street and Fulbourne Street (formerly Thomas Street) now form bridges over the newly constructed railway cutting, which has removed all buildings from within its footprint. Durward Street lies immediately north of the cutting, but it is uncertain whether the cutting extended into this part of the Crossrail worksite.

The Site Today: The development site is still occupied by the railway cutting; Whitechapel Station building; and Durward Street.

Durward Street Shaft and Interchange

18th century: The 1703 Gascoyne map shows the development site within a large area of open land. At the end of the 18th century some development has occurred at the southern extent of the Crossrail worksite in the form of a row of terraced houses fronting onto Ducking Pond Row (the forerunner of Durward Street).

19th century: The 1819 Horwood map shows industrial development on the site with the construction a 'Distillery'. It is at this location that a large brick lined shaft, probably relating to the distillery, was recently encountered during works for the East London Line. To the west of the sub-site the area has been extensively developed for housing but to the immediate east are areas of open ground including a Jews Burial Ground. By the 1873 Ordnance Survey Map, the distillery has been demolished and a railway line has been constructed running north-south into the Crossrail sub-site. Within the site itself is a circular structure labelled as a tank and a large rectangular warehouse fronting onto Bucks Row, the future Durward Street.

20th century: The site has been entirely developed with large buildings by the 1913 Ordnance Survey map. Of particular note is the construction of the underground railway, the future East London Line. This railway line forms the backbone of the Durward Street Shaft sub-site, passing straight through its centre. The large scale development around the underground railway is labelled as Essex Wharf on the 1938 Ordnance Survey map.

5.3 Visual Site Appraisal

A Visual Site Appraisal (VSA) was carried out on the site. The aims of the VSA, where practicable, are to:

- Analyse the topography of the area and identify buildings, services or archaeological structures (above and below ground) which will have compromised the integrity of the resource or may act as a constraint on future evaluation or mitigation;
- Examine the immediate surroundings of the site for evidence of truncation that may continue in to the site;
- Note any topographical features, which might be a focus for human activity, and identify and describe any geomorphic or manmade activity that could mask archaeological sites;
- Determine the current state of preservation of monuments and surrounding land-use, noting current and potential activities that threaten their long term preservation.

Results

Cambridge Heath Road Shaft

The area of the Cambridge Heath Road Shaft is currently occupied by an area of car parking to the rear of the Blind Beggar Public House (Figure 1) and a Sainsbury's car park (Figure 2). The site is bounded to the south by the backs of buildings fronting onto Whitechapel Road, with the eastern boundary formed by Cambridge Heath Road, the north and west fall within the Sainsbury's car park . Behind the Public House is a significant dip, possibly caused by subsidence from early industrial activity including brickearth quarrying or from the extensive basements of the late 19th/early 20th century phases of the Albion Brewery. The Sainsbury's car park is flat, presumably having been levelled for its current use.

Figure 1. View to the rear of the Blind Beggar Public House

Figure 2. The Sainsbury's Car park, facing west

Construction Site for Fulbourne Street Ticket Hall

It is unlikely that archaeological remains survive in the area of the railway cutting, however, the triangle of land immediately north of the cutting, centred on Durward Street is at a significantly higher level and therefore archaeological deposits may survive. This area, which falls within the northernmost part of the construction site for Fulbourne Ticket Hall is bounded to the south by the railway cutting and to the north by the buildings fronting onto Durward Street. It is generally flat, and is currently used as a combination of roadway, car parking and a bus stop (Figure 3).

A Grade II Listed cast iron circular cannon type parish boundary marker is located on the corner of Fulbourne Street and Durward Street falling immediately adjacent to the Fulbourne Street Worksite. The boundary marker (Figure 4) is approximately 1m in height and dates to 1818. It includes the following embossed lettering: CH^{T}.CH $MIDD^{X}$ 1818. It marks the boundaries of the parishes of Christ Church and Spitalfields.

Figure 3. View of Durward Street facing west

Figure 4. Boundary Marker located on the corner of Fulbourne Street and Durward Street

Durward Street Shaft and Interchange

Immediately north of Durward Street within the boundary of the Durward Street Shaft Worksite Visual Site Appraisal identified areas of land in which archaeological evaluations could be undertaken prior to demolition (Figure 5). These include a car park immediately west of the underground railway and an area of hardstanding sandwiched between the underground line and Swanlea School. To the north of this is an area of scrub and trees part of which is above the underground line.

Figure 5. Part of the Durward Street Shaft and Interchange site visible from Durward Street

5.4 Known Disturbance to Archaeological Horizons

A number of buildings identified in the obstruction survey lie close to the sub-sites, although, these are unlikely to have affected archaeological deposits within the Crossrail worksites for Whitechapel Station.

The area was heavily bombed during WWII, so there is a possibility that bomb damage may also have disturbed archaeological deposits.

Durward Street Shaft and Interchange

The construction of the East London Line railway cutting (8m in depth) will have removed all archaeological deposits along its route to the level of the London Clay. The extent to which the construction of the railway cuttings extended beyond its current boundaries is uncertain, therefore is it assumed that the construction disturbance extends only 1m beyond the existing retaining walls.

Construction of the North East Storm Relief Sewer, that runs on a rough north-south route through the sub-site, will have removed archaeological deposits along its route.

Worksite for Fulbourne Street Ticket Hall

The existing District and Hammersmith & City Underground railway lines will have removed all archaeological remains along its route. Furthermore the construction of Whitechapel station and

other suburban development will have removed all archaeological deposits within their footprints.

Cambridge Heath Road Shaft

The development site formerly contained sunken gardens and terraced houses. The extent to which the foundations and cellars associated with these former buildings have damaged archaeological remains is unknown, however up to 2m of Made Ground is predicted at this site overlying alluvial deposits and it is considered unlikely that the foundations of previous buildings would have truncated beyond this depth.

Evaluation fieldwork at the former Albion Brewery (ABR93) on part of the site has suggested that industrial activity (including brickearth quarries and the extensive basements of late 19th/early 20th century phases of Albion Brewery) will have significantly reduced the survival of earlier archaeological features.

Archive drawings of the Albion Brewery (Figure 6) show that the basement extends into the southernmost section of the Sainsbury's car park, just beyond the existing boundary wall. Archaeological deposits will have been removed to at least the depths of these basements, although alluvial and river terrace deposits may survive beneath the depths of the basements.

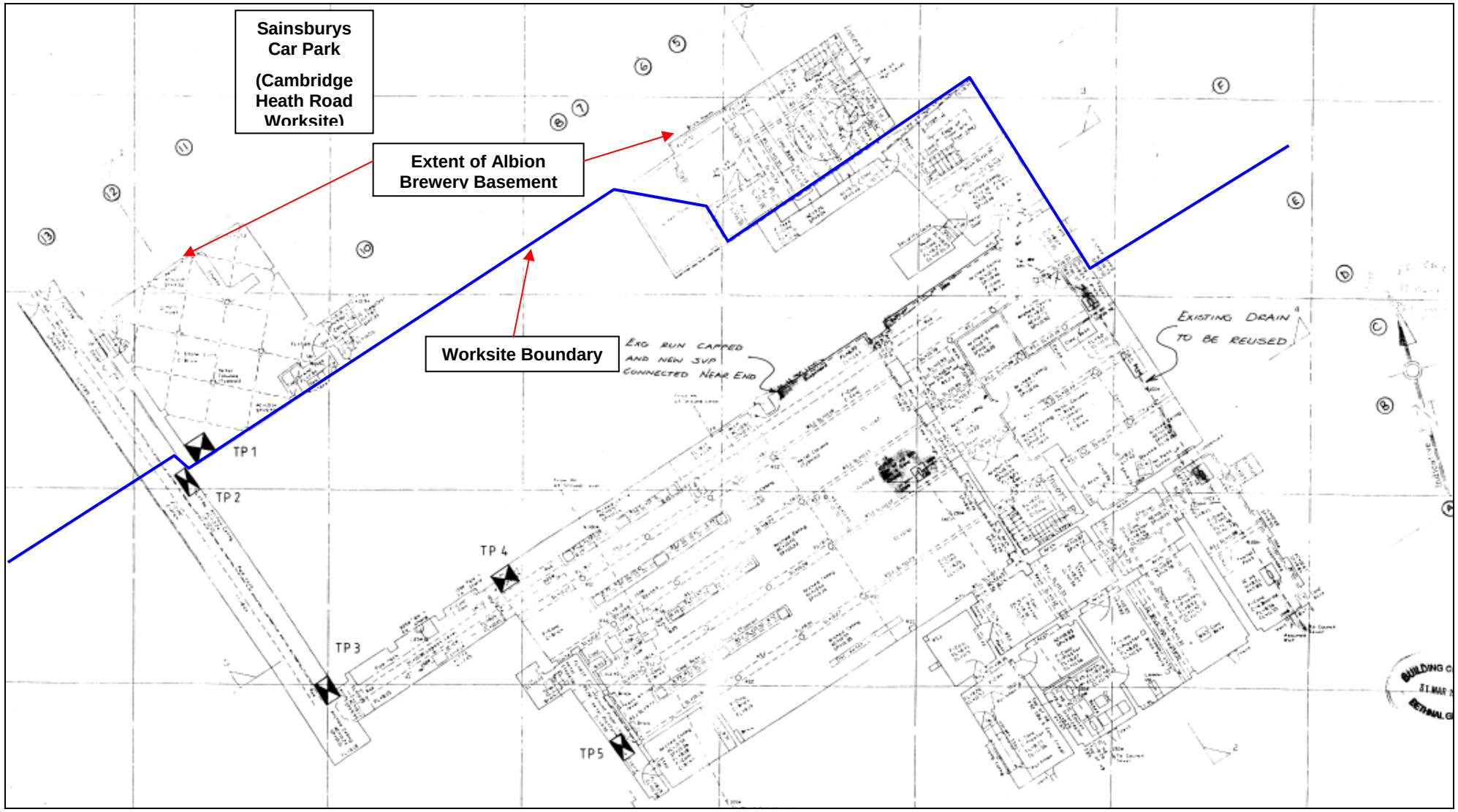

Figure 6. Basement Plan of the Albion Brewery

5.5 Deposit Modelling

The tables below set out the depths of known deposits at the site, based on information from geotechnical boreholes and archaeological interventions in the vicinity of each area. Please refer to Appendix 9.1 for the following drawings for the locations of boreholes and archaeological sites included in this section:

Geotechnical boreholes: P30101-C1M14-G00-D-50121 and 50122.

Archaeological sites: P30103-C1M14-E00-D-50001

Deposit Survival Drawings: P30103-C1M14-E00-D-50130; 50131; and 50132

The dispersed spread of the geotechnical investigations across the Whitechapel Street Station site has limited the ability to develop a detailed deposit model at individual sub-sites.

BH/Site No.	SG1EA	SG1E	WCA03	ABR93	BH WH10E	BH WH10EA	BH WH11R	BH WH12
Superficial Deposits (inc. Made Ground, Alluvium and River Terrace Deposits where encountered)	Ground level: 111.32m ATD Made Ground: to 110.72m ATD (End of Borehole)	Ground level: 111.30 mATD Made Ground: to 107.50m ATD, including bottom layer with organic black clay included. RTD: to 105.40m ATD	Gravels truncated by basement slab at 109.2m ATD	Ground rises from North to South. Gravels at 108.7-109.7m ATD	Ground level: 111.79m ATD Made Ground: to 109.59m ATD (brick footings) End of borehole	Ground level: 111.76m ATD Made Ground: to 110.56m ATD (brick footings) End of borehole	Ground level: 111.85m ATD Made Ground: to 109.75m ATD Possible alluvium: to 105.95 RTD: to c. 102m ATD	Ground level: 112m ATD Made Ground: to 109.90m ATD Possible alluvium: to 108.70m ATD RTD: to 104.10m ATD
London Clay	-	105.40 to 104.30m ATD (End of Borehole)	-	-	-	-	c. 102 to 79m ATD	104.10 to 74.20m ATD

Table 2. Cambridge Heath Road Shaft

BH/Site No.	DUR96	COU05	RLP05	WRA05	BH WH6
Superficial Deposits (inc. Made Ground, Alluvium and River Terrace Deposits where encountered)	Gravels at 9.2m OD cut by 17th and 18th century pits. Brickearth truncated by large undated pit/ditch feature and 20th century wall foundations	Base of archaeological deposits at 10.0OD. Highest 11.1m OD.	Natural deposits and ground levels rise from the east to west. Abrupt change from brickearth to Taplow sands and gravels in Princess Alexandra Garden. Gravels at 8.4-10.5m OD. Base of archaeological deposits 10.0-11.0m OD.	Taplow gravels at 10.0m OD. Highest archaeological deposits at 11.1m OD. Lowest 9.8m OD.	Ground level: 113.10m ATD Made Ground: to 110.30m ATD Alluvium: to 109.10m ATD RTD: to 103.80m ATD
London Clay	-	-	-	-	103.80 to 79.20

Table 3. Worksite Site for the Fulbourne Street Ticket Hall

BH/Site No.	WH5E	WH3TW	WH2R	WH1R	WH4P	WH16R	WH13R	DUR96	SEL92
Superficial Deposits (inc. Made Ground, Alluvium and River Terrace Deposits where encountered)	Ground level: 111.92m ATD Made Ground: to 109.22m ATD RTD: to 106.02m ATD	Ground level: 111.77m ATD Made Ground: to 104.87m ATD	Ground level: 111.74m ATD Made Ground to 106.59m ATD RTD: to 105.14m ATD	Ground Level: 111.94m ATD Made Ground: to 110.09m ATD Alluvium: to 109.14m ATD RTD: to 105.09m ATD	Ground level: 111.25m ATD Made Ground: to 109.20m ATD Alluvium: to 108.70m ATD RTD: to 104.50m ATD	Ground level: 111.97m ATD to 104.77m ATD (7.20 in thickness)	Ground level: 111.97 to 104.57m ATD (7.40 in thickness)	Gravels at 9.2m OD cut by 17th and 18th century pits. Brickearth truncated by large undated pit/ditch feature and 20th century wall foundations.	Ground rising from east to west. Undisturbed gravels at western end of site at 9.65m OD. No archaeological features.
London Clay	106.02 to 104.92m ATD (End of Borehole)	104.87 to 79.12m ATD (25.75 in thickness)	105.14m to 78.69m ATD (26.45 in thickness	105.09 to 79.29m ATD (25.80 in thickness)	104.50 to 79.05m ATD (25.45 in thickness)	104.77 to 78.97m ATD (25.80 in thickness)	104.57 to 78.97m ATD (25.60 in thickness)	-	-
Lambeth Group	-	79.12 to 62.32m ATD (16.80 in thickness)	78.69m to 60.64m ATD (18.05 in thickness)	79.29 to 61.79m ATD (17.50 on thickness)	79.05 to 61.70m ATD (17.35 on thickness)	78.97 to 70.97m ATD End of Borehole	78.97 to 69.97m ATD End of Borehole	-	-
Thanet Sands	-	62.32 to 60.97m ATD End of Borehole	60.64m to 58.74m ATD End of Borehole	61.79 to 59.64 ATD End of Borehole	61.70 to 49.40m ATD (12.3 on thickness)	-	-	-	-
Chalk	-	-	-	-	49.40 to 42.00m ATD End of Borehole	-	-	-	-

Table 4. Durward Street Shaft and Interchange

5.6 Non-listed built heritage

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

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.

The detailed 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;
- Other important non-listed buildings and structures of historic interest outside conservation areas (e.g. the standing walls at Stepney Green), locally listed station buildings and railway structures and any industrial and defence archaeology of significance.

The Crossrail Environmental Statement and supporting Specialist Technical Reports define the baseline built heritage resources (both statutorily protected and non-listed) across the route, the potential significant impacts, mitigation and any residual impacts after that mitigation is employed (Crossrail 2009).

The results of a NLBH Assessment of the Whitechapel Station Area is provided in the Table 5 below. The location of NLBH assets are shown on drawing number P30103-C1M14-E00-D-50004 (Appendix 9.1).

London Underground (LU) have prepared a list of Railway Heritage Features at Whitechapel Station. This is reproduced in full in Appendix 9.5. The features to be affected by Crossrail works are set out in Table 5. Further assessment is required to determine the presence/absence of such NLBH railway features.

The NLBH Assessment was supplemented by street furniture surveys carried out by EWMA, which identified all elements of street furniture at Whitechapel Station. The results of the EWMA survey were reviewed to identify street furniture of historic significance.

Name [Figure Ref]	Image	Description	Significance	Impact
Historic sett surface on Winthrop Street [1]		Granite sett surface continuing from Durwood Street to Kempton Court. Good survival of late 19th century rectangular setts laid in rows. Some ground disturbance has been caused by modern services and patches of poor reinstatement.	Makes a positive contribution to the character and appearance of the Whitechapel Conservation Area.	The road is to be used to provide access to the Whitechapel Station worksite and may also be impacted upon by the diversion of utilities.
Footbridge leading to District Line Platforms		Timber panelled footbridge with glazing, leading to the District Line platforms	Of historic and architectural interest as an early (1936) addition to the station	To be demolished.

Name [Figure Ref]	Image	Description	Significance	Impact
Platforms 1/2 and 3/4		At east end both islands have canopies, steel girder uprights supporting steel sheet cladding and a glazed apex, along with decorative valances. To the western ends the platforms are covered by a later development.	Of some historic interest as part of the 19th century station, although the platforms have undergone piecemeal repair and modernisation	To be demolished.
2 Low level subways leading from plat forms 1/2 and 3/4 to platform 5		Finishes include extensive use of Poole large profile ceramic tiles, in oatmeal/yellow, with decorative bands in blue, green and orange. Above the staircases are two fine 1938 Standard Signs Manuel pattern v/e bronzed framed signs.	Of historic interest as part of the early 29th century amalgamation of stations. Also of architectural interest due to the use of London Underground branded design (*see below)	To be demolished.
East London Line Platforms 5/6		The open sections of the platforms display fine brick retention walls, with details and replica lighting.	Although the platform itself is only of marginal historic interest as part of the development of the station, it does contain a number of historically interesting features	To be partially demolished.
Non-public Areas		The non-public areas of the station, particularly the area in the basement used as staff accommodation has extensive and important survivals of early passageways, staircases and rooms.	Possible surviving features of historic or architectural interest. Further investigation required.	Further inspection required to determine extent of disturbance.

Table 5. Non-listed built heritage railway features identified at Whitechapel Station

6 Discussion

6.1 Summary and Interpretation of Results

Durward Street Shaft and Interchange

Natural

Ground level at the sub-site is consistent at just under 112m ATD with the East London Line passing through the sub-site on a northwest-southeast orientation. The railway cutting is 8m deep. Boreholes from within the sub-site (WH5E; WH3TW; WH2R; WH1R; WH13R; WH14P; and WH14R) demonstrate that Made Ground is present across the site to varying depths, but that alluvial deposits may also survive at some locations (boreholes WH1R and WH4P). A layer of River Terrace Deposits overlie the London Clay across the sub-site in varying thicknesses dependent on the level of truncation by Made Ground.

This indicates that River Terrace Deposits and possibly an Alluvial layer are likely to be encountered at this sub-site

Present Buildings

These comprise a car park immediately west of the East London Line railway cutting and an area of hardstanding sandwiched between the ELL and Swanlea School. To the north of this is an area of scrub and trees part of which is above the ELL. The depth of foundations at the caretakers house are unknown. Construction of the North East Storm Relief Sewer will have removed archaeological deposits along its route.

Earlier Buildings

Historic maps show that the area was largely undeveloped until the early 19th century when the area was developed as a distillery, a fact highlighted by the recent discovery of a large brick lined Victorian shaft at the sub-site, which is probably related to this industry. To the west of the sub-site the area was extensively developed for housing but to the immediate east were areas of open ground including a Jews Burial Ground. By 1873, the distillery was demolished and a railway line constructed running north-south into the Crossrail sub-site. By the early 20th century the site was entirely developed, particularly in terms of the underground railway, which would become the East London Line. This railway line forms the backbone of the Durward Street Shaft sub-site, passing straight through its centre. The large scale development around the underground railway is labelled as Essex Wharf on the 1938 Ordnance Survey map.

Potential Archaeological Deposits

There is no potential for the survival of archaeological deposits within the railway cutting for the East London Line. However, boreholes within the sub-site (see table 4) indicate that a layer of River Terrace Deposits exists across much of the site and alluvial deposits may also survive in pockets. Made Ground can generally be expected at approximately 112.00m ATD to between 110.00 and 105.00m ATD, overlying c. 1-4m of River Terrace Deposits. Alluvial deposits, if present, will overlie the RTDs at about 109m ATD. This indicates that horizontally stratified deposits are unlikely to survive at this sub-site, however, cut features may survive within the RTDs and Alluvial deposits. Generally, archaeological remains could date from the Roman to the post-medieval periods, including low potential for Roman remains relating to the London to Colchester Roman Road that ran to the south of the site.

The extent to which modern building has truncated archaeological deposits is unknown, however, there is the potential for the survival of post-medieval remains within the Made Ground relating to the industrial development of the area, and in particular the distillery that formerly occupied the site.

Impact of Proposals – Enabling Works

- Installation of the Diaphragm walls for the Durward Street shaft will remove all archaeological deposits within their footprint.

- Demolition of the school caretaker's house; adjacent stores building; existing utilities to the school; and relocation of an existing EDF sub-station in the school grounds are unlikely to affect archaeological deposits.
- Enabling Works that need to be undertaken on the ELL prior to the construction of the shafts at Durward Street are unlikely to affect archaeological deposits as the works are located within the existing ELL cutting.
- Diversion of utilities serving Whitechapel Sports Centre are unlikely to affect archaeological deposits, as they are located within upper layers of Made Ground.
- Enabling Works relating to the North Eastern Storm Relief Sewer (NESRS) may affect archaeological deposits, however, the scope and extent of these protective measures is to be confirmed.
- Establishment of the worksites may partially remove archaeological remains.

Impact of Proposals – Main Works

- Durward Street Shaft
  - Excavation behind existing retaining walls down to ELL levels will remove all archaeological remains at that location, if not truncated previously by the original construction of the retaining walls;
  - Excavation of the shaft from within the diaphragm walls will remove all archaeological remains at that location.
- West Stair Shaft
  - Piling of the three sides of the shaft will remove all archaeological remains in the footprint of the piles and pile caps;
  - Excavation behind the existing retaining walls down to ELL level will remove all archaeological remains at that location, if not truncated previously by the original construction of the retaining walls;
  - Excavation of the shaft will remove all archaeological remains in its footprint.

Work Site for Fulbourne Street Ticket Hall

Natural

Ground level at the sub-site is at approximately 113.10m ATD (BH WH6) on Durward Street. The majority of the works at this sub-site are located with the cutting of the District and Hammersmith & City Underground Lines and as such will not affect archaeological deposits, which have already been truncated to the level of the London Clay.

Beneath Durward Street borehole WH6 indicates that Made Ground is present to a depth of 110.30m ATD overlying c.1m of alluvium. River Terrace Deposits were also recorded at this location from a depth of 109.10 to 103.80m ATD overlying the London Clay. It is likely that that River Terrace Deposits and an Alluvial layer may be encountered at this sub-site

Present Buildings

The worksite is currently occupied by Durward Street. Services at this location are unlikely to have truncated beneath the level of Made Ground.

Earlier Buildings

The sub-site was open land to the north of the former Roman Road (London to Colchester) until the mid 18th century when the site contained some residential development with a Ducking Pond to the east. By the mid 19th century the surrounding area was significantly developed with

housing. Durward Street was called Ducking Pond Row at that point and was renamed Bucks Row by 1873. By the early 20th century the site was called Durward Street.

Potential Archaeological Deposits

There is no potential for the survival of archaeological deposits within the railway cutting for the District and Hammersmith & City Underground lines. Borehole WH6, within the sub-site, (see table 3) indicates that a layer of River Terrace Deposits exists across much of the site, underlying a 1m layer of alluvium. Made Ground can generally be expected at approximately 113.00 to 110.0m ATD indicating that horizontally stratified deposits are unlikely to survive at this sub-site, however, cut features may survive within the RTDs and Alluvial deposits.

The site has been a road since the area was developed in the mid 19th century although it is uncertain the extent to which the alignment of the road has altered, particularly in light of the construction of the railway cutting to the immediate south and ELL in the east. The extent of the truncation resulting from the construction of the District and Hammersmith & City line cutting and retaining walls is unknown, however, it is assumed that only 1m beyond the extent of the retaining wall was removed. This appears to be confirmed by the results of borehole WH6 which shows surviving alluvial and RTDs within the sub-site.

Generally, archaeological remains could date from the Roman to the post-medieval periods, including low potential for Roman remains relating to the London to Colchester Roman Road that ran to the south of the site.

Impact of Proposals – Enabling Works

- Establishment of the worksite including offices, workshops, welfare and a laydown area may partially remove archaeological remains within the Made Ground;
- Footing for the tower crane, which is to be located at different points in the worksite depending on the construction stage, will partially remove all archaeological remains within the footprint of the crane footings.

Cambridge Heath Road Shaft

Natural

Ground level at the sub-site is consistent at around 111.5±1m ATD. Boreholes from within the sub-site (SG1E and SG1EA) show the presence of Made Ground to approximately 107.5m ATD overlying River Terrace Deposits, beneath which is the London Clay (at 105.40m ATD). The bottom layers of the RTDs include black organic deposits. Boreholes just outside of the sub-site (WH10E and WH10EA) encountered brick footings with Made Ground at around 110m ATD, at which point the boreholes ended. To the south of the sub-site borehole WH12 identified 1m of alluvium underlying the Made Ground at a depth of 109.90 to 108.70m ATD. The results of these boreholes show that the level of survival of Alluvium and RTDs across the site varies, with some areas likely to be truncated by previous development on the site and some with the potential for surviving alluvial deposits. It is likely that RTDs will be encountered overlying the London Clay across the site.

Present Buildings

The site is currently occupied by a Sainsbury's car park.

Earlier Buildings

Historic mapping from 1703 shows the sub-site in use as sunken gardens, shortly after, the area was developed into housing properties fronting onto Whitechapel Road and Cambridge Heath Road. 1746 mapping shows a Ducking Pond which may extend into the north-western corner of Cambridge Heath Road sub-site. By the 19th century the sub-site is still in residential use. This housing looks to have changed from irregular housing to terraced homes by the time that the 1873 Ordnance Survey Map was produced. A brewery is also shown extending into the centre

of the Cambridge Heath Road sub-site on the 1819 Map with associated Alms Houses to the south. By the close of the 19th century the Albion Brewery has extended to encompass the majority of the sub-site. The Albion Brewery was present until1948 mapping, which depicts only two terraced houses remain with the site (within the northeast corner). The basement of the Albion Brewery extends into the southernmost section of the Sainsbury's car park, just beyond the existing boundary wall. Archaeological deposits will have been removed to at least the depths of these basements, although alluvial and river terrace deposits may survive beneath them.

Potential Archaeological Deposits

Boreholes within the sub-site (see table 2) indicate varying degrees of truncation have occurred across the sub-site. Made Ground to around 107.50m ATD overlies River Terrace Deposits and possibly surviving pockets of alluvium. The foundations of former buildings, probably relating to the Albion Brewery and housing that existed on the site have also been encountered in boreholes. This has been confirmed by archaeological evaluation at ABR93, which found extensive basements in part of the footprint of the Albion Brewery.

Archaeological potential on the site includes remains relating to sunken gardens that once occupied part of the site; possible burials relating to the Great Plague of 1665, when the parish of St Dunstan's Stepney acquired c. 1.25 acres of waste land on the north side of Whitechapel Road near Stonebridge for the use as an emergency burial ground; and post-medieval remains relating to former housing and the Albion Brewery. Generally, archaeological potential in the area could date from the Roman to the post-medieval periods, including low potential for Roman remains relating to the London to Colchester Roman Road that ran to the south of the site.

Impact of Proposals – Enabling Works

- Demolition of an existing boundary retaining wall will have no impact on archaeological deposits;
- Possible strengthening works to the basement of the Albion brewery will have no impact on archaeological deposits; and
- The diversion of local services located within Sainsbury's car park may partially remove archaeological deposits.
- Establishment of the worksite, including offices, workshops, welfare, batching plant and laydown area may partially remove archaeological deposits.

The detailed scope of these works will be defined during detailed design.

Impact of Proposals – Main Works

- Installation of the diaphragm walls will remove all archaeological remains at those locations;
- Excavation of the shaft to the underside of ground floor ring beam level (110.6m ATD) will remove all archaeological remains to that depth (e.g. within Made Ground);
- Excavation of the shaft to approximately106.0m ATD will remove all archaeological remains within the footprint of the shaft.

6.2 Predicted Impacts to the Archaeological Resource

The table below summarises the construction impacts discussed above.

Sub-Site	Scheme Impact	Maximum Depth of Impact	Impact to Archaeology	Predicted Depth of Archaeological Remains	Works Stage	
					Enabling Works	Main Works
Durward Street Shaft and Interchange	Durward Street Shaft: Installation of the Diaphragm walls	c. 30m BGL	Remove all archaeological remains.	Made Ground: c.112.00 to c.109.00m ATD Alluvium (possible): c.109.00m ATD to c.108.00m ATD River Terrace Deposits: c.108.00 to c.104.00m ATD	✔	
	Enabling Works relating to the North Eastern Storm Relief Sewer (NESRS)	Tbc	Scope of works to be confirmed.		✔	
	Durward Street Shaft: Excavation behind existing retaining walls down to ELL levels	To ELL level	Remove all archaeological remains.			✔
	Durward Street Shaft: Excavation of the shaft from within the diaphragm walls	c.30m BGL	Remove all archaeological remains.			✔
	West stair shaft: Piling of the three sides of the shaft	13m BGL	Remove all archaeological remains.			✔

Sub-Site	Scheme Impact	Maximum Depth of Impact	Impact to Archaeology	Predicted Depth of Archaeological Remains	Works Stage	
					Enabling Works	Main Works
	West stair shaft: Excavation behind the existing retaining walls down to ELL level	To ELL level	Remove all archaeological remains.			✔
	West stair shaft: Excavation of the shaft	13m BGL	Remove all archaeological remains.			✔
Work Site for Fulbourne Street Ticket Hall	Worksite establishment	c.0.4 to 0.8m BGL	Partially remove archaeological deposits	Made Ground: 113.10m to 110.30m ATD Possible alluvium: 110.30m to 109.10m ATD River Terrace Deposits: 109.10m to 103.80m ATD	✔	
	Tower crane footings	1.5 to 2m BGL	Partially remove archaeological deposits		✔	
Cambridge Heath Road Shaft	Worksite establishment	c.0.4 to 0.8m BGL	Partially remove archaeological deposits	Varies across the sub-site. See Table 2.	✔	
	Service diversions in Sainsbury's car park	1-2m BGL	Partially remove archaeological deposits		✔	
	Installation of the diaphragm walls		Remove all archaeological remains within the footprint of the walls.			✔

Sub-Site	Scheme Impact	Maximum Depth of Impact	Impact to Archaeology	Predicted Depth of Archaeological Remains	Works Stage	
					Enabling Works	Main Works
	Excavation of the shaft to the underside of ground floor ring beam level	110.6m ATD	Remove all archaeological remains to that depth (e.g. within Made Ground)			✔
	Excavation of the shaft	106.0m ATD	Remove all archaeological remains within the footprint of the shaft.			✔

Table 6 Summary table of the predicted impacts to the archaeological resource

7 Recommendations

7.1 Proposed Evaluation Strategy

Archaeological evaluation will establish the degree of archaeological survival and thereby refine the time required for further archaeological excavations (if needed). Typical field evaluation methods include non-intrusive surveys, such as geo-archaeological investigation; small-scale intrusive surveys (e.g. observation and recording works integrated with geotechnical site investigations, drilling of geo-archaeological boreholes and excavation of archaeological trial trenches). Further descriptions of archaeological evaluation can be found in the Crossrail Archaeology Generic Written Scheme of Investigation (Document number 14022008-44ES-P2Z1).

Archaeological evaluation will be required at the following sub-sites to determine the nature, extent and survival of archaeological remains and to inform the mitigation design:

- Durward Street Shaft and Interchange
- Construction Site for Fulbourne Street Ticket Hall
- Cambridge Heath Road Shaft

All of the above archaeological field evaluation set out below should occur at Enabling Works stage, and sooner wherever possible, to determine the potential for survival of archaeological remains and to inform the mitigation design. Full details of the evaluation methodology are described in the Whitechapel Station Specific WSI (Document Number CR-SD-WHI-EN-SY-00001).

7.2 Non-Listed Built Heritage Assessment and Recording

The following further assessment and mitigation is required for elements of railway heritage:

- Inspection of the non-public areas of the station, particularly the basement area to determine the survival of possible features of historic or architectural interest, e.g. early passageways; staircases; and rooms.
- English Heritage Level II survey of Whitechapel Station to cover all elements identified by LU. Specific mitigation measures may also include:

- Footbridge to be retained or replaced with replica, if not feasible, should be offered to the London Transport Museum.
- Subway - tiles to be retained and re-used if possible. Subway signs to be replaced in new station, if applicable. If not possible, elements should be offered to the London Transport Museum.
- Platforms 5/6 - signage to be replaced in new station. Timber poster frame to be offered to the London Transport Museum

The following further mitigation is required for elements of street furniture:

- Works necessitating the removal of the historic sett surface on Winthrop Street should consider protection of the surface where possible and replacement of the surface in original position upon completion.

7.3 Proposed Mitigation Strategy

The results of the archaeological evaluation will inform the mitigation design, and will comprise *preservation-by-record* (e.g. archaeological excavation and/or watching brief). These mitigation measures are described in the Crossrail Archaeology Generic Written Scheme of Investigation (Document number 14022008-44ES-P2Z1).

The following mitigation measures will also be required at the Crossrail worksites for Whitechapel Station:

Durward Street Shaft and Interchange

- General watching brief at the establishment of the worksite on Durward Street (Essex Wharf).

Work Site for Fulbourne Street Ticket Hall

- General watching brief at the establishment of the worksite on Durward Street (Bus Stand Area).

Cambridge Heath Road Shaft

- General watching brief will be required at the utilities diversions with the Sainsburys Car Park.
- General watching brief at the establishment of the worksite at the Sainsbury's Car Park.

8 References

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Museum of London. London Archaeological Archive and Research Centre (LAARC) Website. http://www.museumoflondon.org.uk/laarc/

9 Appendices

9.1 Plans and Illustrations

Title	Drawing Number
Archaeological Baseline	P30103-C1M14-E00-D-50001
Whitechapel Station Areas of Archaeological Evaluation	P30103-C1M14-E00-D-50003
Non-Listed Built Heritage Location Plan	P30103-C1M14-E00-D-50004
Whitechapel Station Historical Mapping 1703 Gascoyne's Map of London	P30103-C1M14-E00-D-50101
Whitechapel Station Historical Mapping1746 – John Rocque's map of London	P30103-C1M14-E00-D-50102
Whitechapel Station Historical Mapping 1799 Richard Horwood's map of London, Westminster and Southwark (East)	P30103-C1M14-E00-D-50103
Whitechapel Station Historical Mapping 1799 Richard Horwood's map of London, Westminster and Southwark (West)	P30103-C1M14-E00-D-50104
Whitechapel Station Historical Mapping 1819 Richard Horwood's map of London, Westminster and Southwark (North)	P30103-C1M14-E00-D-50105
Whitechapel Station Historical Mapping 1819 Richard Horwood's map of London, Westminster and Southwark (East)	P30103-C1M14-E00-D-50106
Whitechapel Station Historical Mapping 1819 Richard Horwood's map of London, Westminster and Southwark (West)	P30103-C1M14-E00-D-50107
Whitechapel Station Historical Mapping 1824-26 Greenwood's map of London (East)	P30103-C1M14-E00-D-50108
Whitechapel Station Historical Mapping 1824-26 Greenwood's map of London (West)	P30103-C1M14-E00-D-50109
Whitechapel Station Historical Mapping 1873 OS Mapping	P30103-C1M14-E00-D-50110
Whitechapel Station Historical Mapping 1913 OS Mapping	P30103-C1M14-E00-D-50111
Whitechapel Station Historical Mapping 1914 OS Mapping	P30103-C1M14-E00-D-50112
Whitechapel Station Historical Mapping 1938 OS Mapping	P30103-C1M14-E00-D-50113
Whitechapel Station Historical Mapping 1948 OS Mapping	P30103-C1M14-E00-D-50114
Whitechapel Station Historical Mapping 1963 OS Mapping	P30103-C1M14-E00-D-50115
Whitechapel Station Historical Mapping 1969 OS Mapping	P30103-C1M14-E00-D-50116
Whitechapel Station Geological Section Eastbound Tunnel	P30101-C1M14-G00-D-50121
Whitechapel Station Geological Section Westbound Tunnel	P30101-C1M14-G00-D-50122
Whitechapel Station Potential Survival of Archaeological Deposits – West Stair Lift	P30101-C1M14-E00-D-50130
Whitechapel Station Potential Survival of Archaeological Deposits - Cambridge Heath Road Shaft	P30101-C1M14-E00-D-50131
Whitechapel Station Potential Survival of Archaeological Deposits – Durward Street Shaft	P30101-C1M14-E00-D-50132

Location of Victorian well

Durward Street Shaft

Cambridge Heath Road Shaft

Fulbourne Street Ticket Hall

MLO63681 SEL92

MLO69014 BG213 Jews' Burial Ground

BGZ05

MLO3961

MLO64323 ABR93

BS 240

MLO3836

MLO87488 DUR96

BDY85281

MLO25726

BG214

MLO3929

BG216

MLO25727

MLO24982 DAV77

MLO57281

COU05

MLO3941

MLO3974

BG215

WCA05

MLO10343

MLO35401

RLP05

MLO10364

MLO67281

MLO75409

MLO76258

WCA03

MLO64337

BSW94

MLO73477

MAP98

MLO73308

MLO3985

MLO23055

RLN05 BG 217

MLO98022

MLO3856

10000 10100 10200 10300 10400 10500 10600 10700

REV	DATE	DESCRIPTION	BY	CHKD	APP	CAD	ACC
A01	05/12/2008	FIRST ISSUE - SCHEME DESIGN	PWC	MC	DSW		

LEGEND

- MLO21941 Greater London Sites and Monuments Record
- ATL89 Site Codes
- Archaeological Priority Zone
- BG205 Burial Ground
- L036 Scheduled Ancient Monuments
- Registered Parks and Gardens
- Crossrail Worksite

Scale 1:1000

20m 0 20m 40m 60m 80m 100m

N

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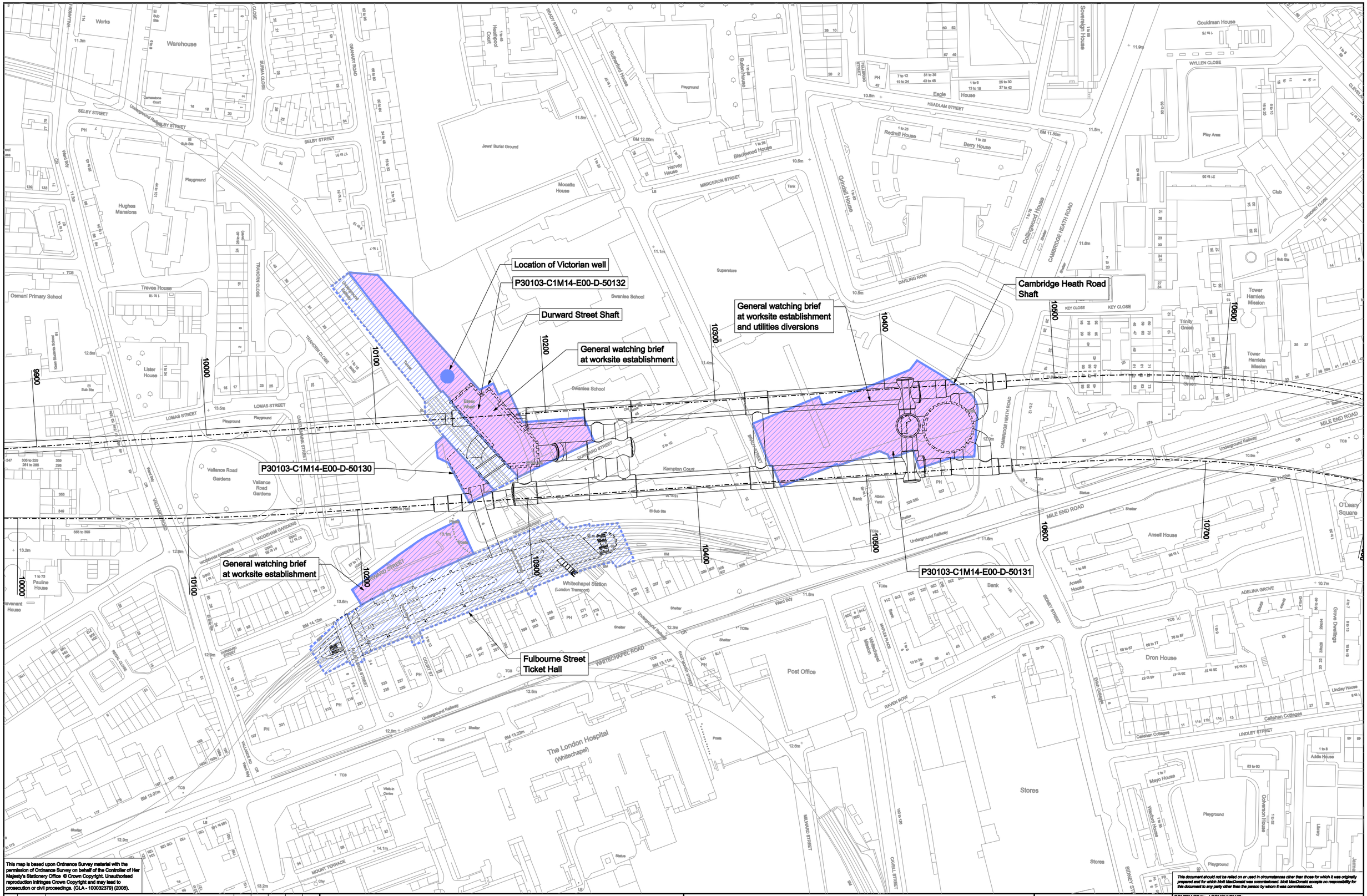
TITLE :
WHITECHAPEL STATION
ARCHAEOLOGICAL BASE LINE

SCALE :	DRAWING AND CAD FILE No :	REV :
1:1000 @ A1	P30103-C1M14-E00-D-50001	A01

RESTRICTED



REV	DATE	DESCRIPTION	BY	CHKD	APP	CAD	ACC
A02	05/12/2008	SCHEME DESIGN 3 ISSUE	PWC	MC	DSW		

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Trial trench evaluation during enabling works

Scale 1:1000

20m 0 20m 40m 60m 80m 100m

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TITLE :
WHITECHAPEL STATION
ARCHAEOLOGY
AREAS FOR EVALUATION

SCALE :	DRAWING AND CAD FILE No :	REV :
1:1000 @ A1	P30103-C1M14-E00-D-50003	A02

RESTRICTED

[1]

Historic street furniture

Scale 1:1000

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N

REV	DATE	DESCRIPTION	BY	CHKD	APP	CAD	ACC
A02	05/12/2008	SCHEME DESIGN 3 ISSUE	PWC	MC	DSW		

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

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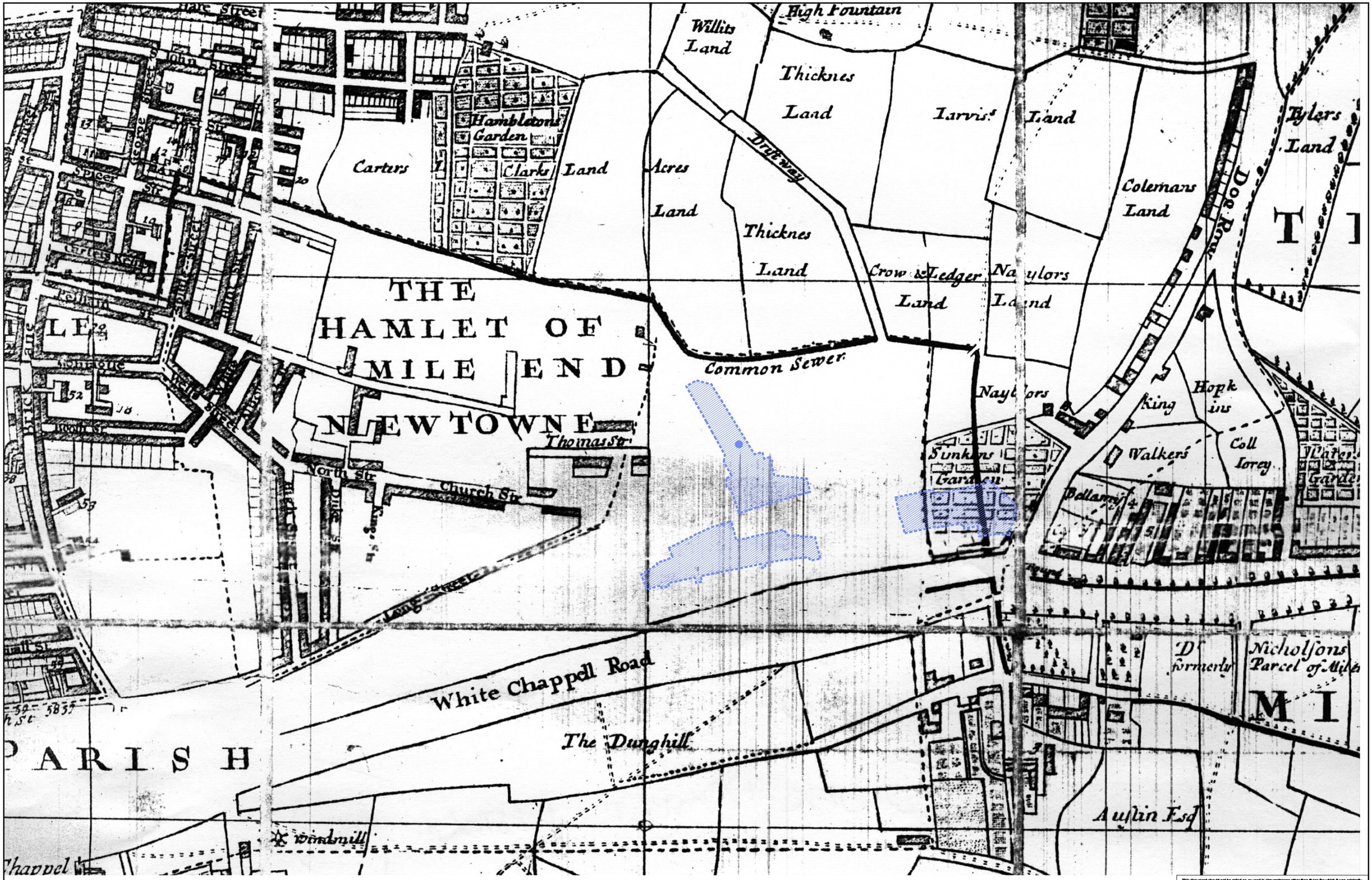
TITLE :
WHITECHAPEL STATION
NON-LISTED BUILT HERITAGE
LOCATION PLAN

SCALE :	DRAWING AND CAD FILE No :	REV :
1:1000 @ A1	P30103-C1M14-E00-D-50004	A02

RESTRICTED



REV	DATE	DESCRIPTION	BY	CHKD	APP	CAD	ACC
A02	05/12/2008	SCHEME DESIGN 3 ISSUE	AB	MC	DSW		

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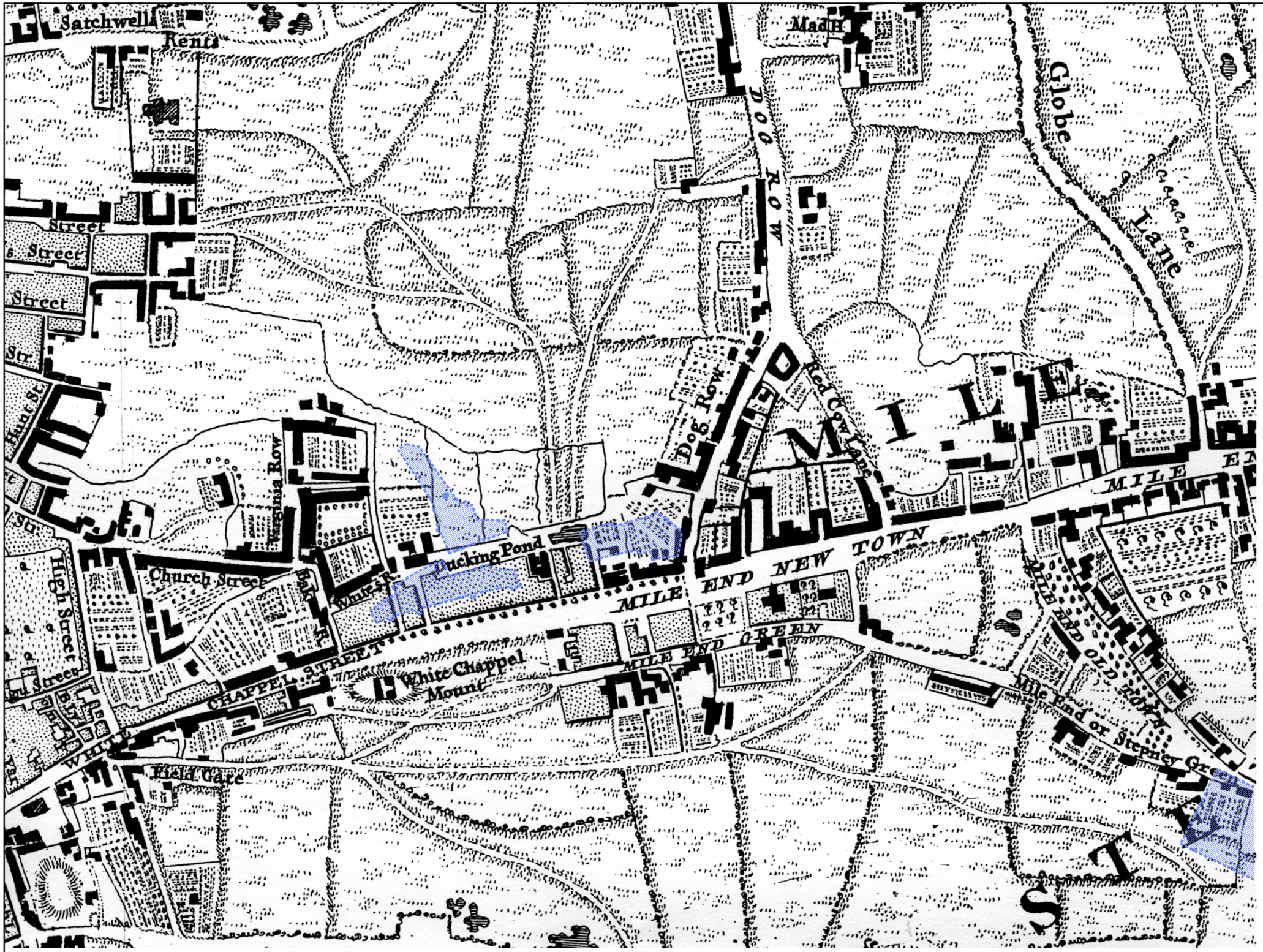
TITLE :
WHITECHAPEL STATION
HISTORICAL MAPPING
GASCOIGNE 1703 (WEST)

SCALE :	DRAWING AND CAD FILE No :	REV :
NTS @ A1	P30103-C1M14-E00-D-50101	A02

RESTRICTED



REV	DATE	DESCRIPTION	BY	CHKD	APP	CAD	ACC
A02	05/12/2008	SCHEME DESIGN 3 ISSUE	AB	MC	DSW		

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TITLE :
WHITECHAPEL STATION
HISTORICAL MAPPING
ROCQUE 1746

SCALE :	DRAWING AND CAD FILE No :	REV :
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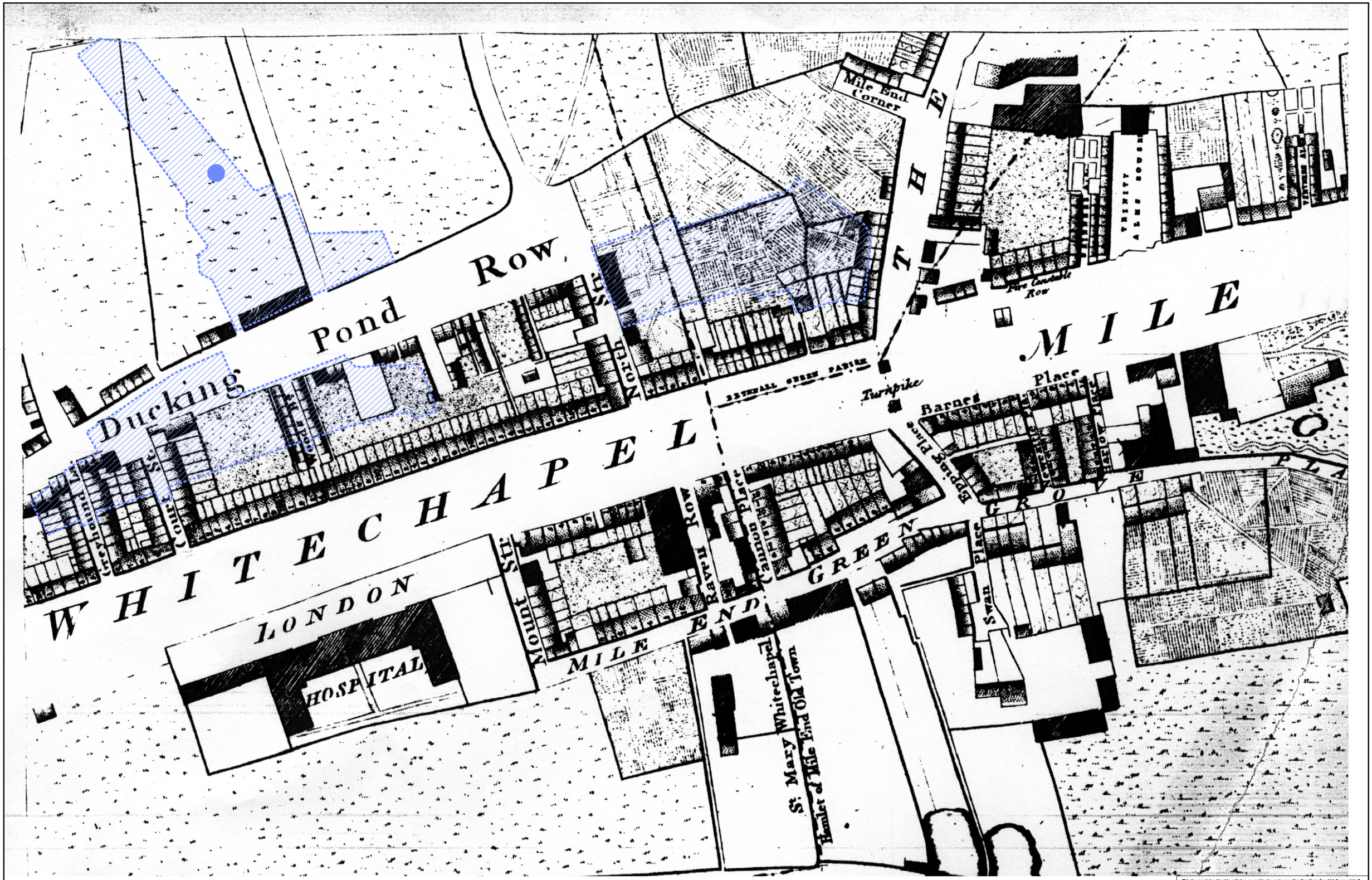
RESTRICTED



REV	DATE	DESCRIPTION	BY	CHKD	APP	CAD	ACC
A02	05/12/2008	SCHEME DESIGN 3 ISSUE	AB	MC	DSW		

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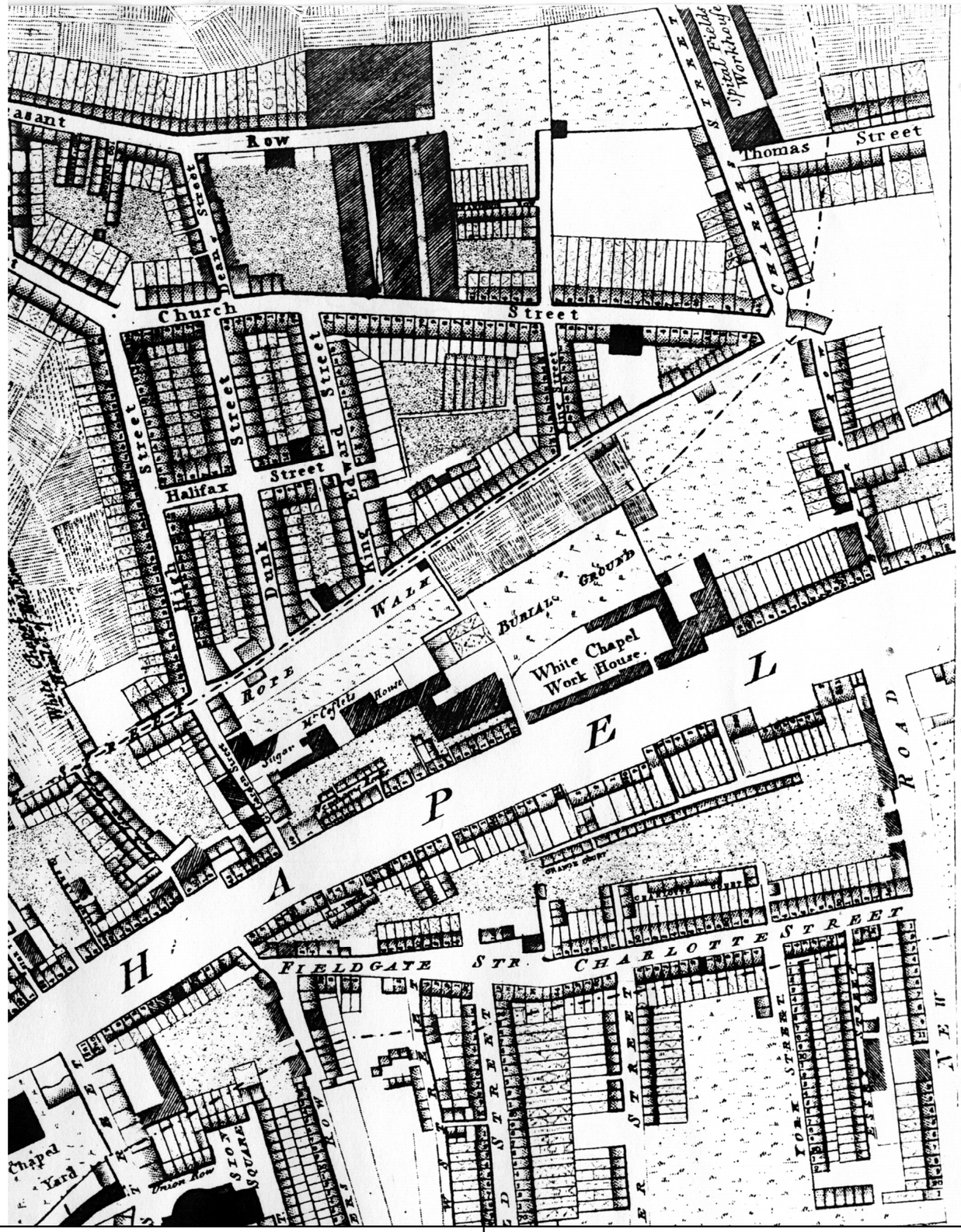
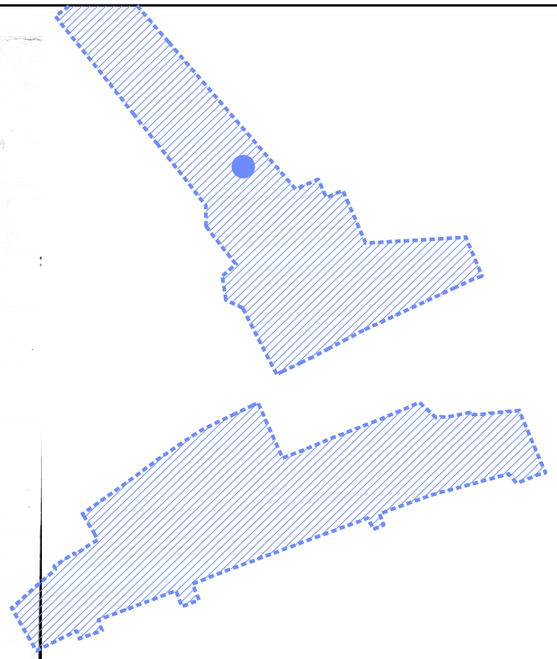
TITLE :
WHITECHAPEL STATION
HISTORICAL MAPPING
HORWOOD 1799 (EAST)

SCALE :	DRAWING AND CAD FILE No :	REV :
NTS @ A1	P30103-C1M14-E00-D-50103	A02

RESTRICTED





LEGEND

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REV	DATE	DESCRIPTION	BY	CHKD	APP	CAD	ACC
A02	05/12/2008	SCHEME DESIGN 3 ISSUE	AB	MC	DSW		

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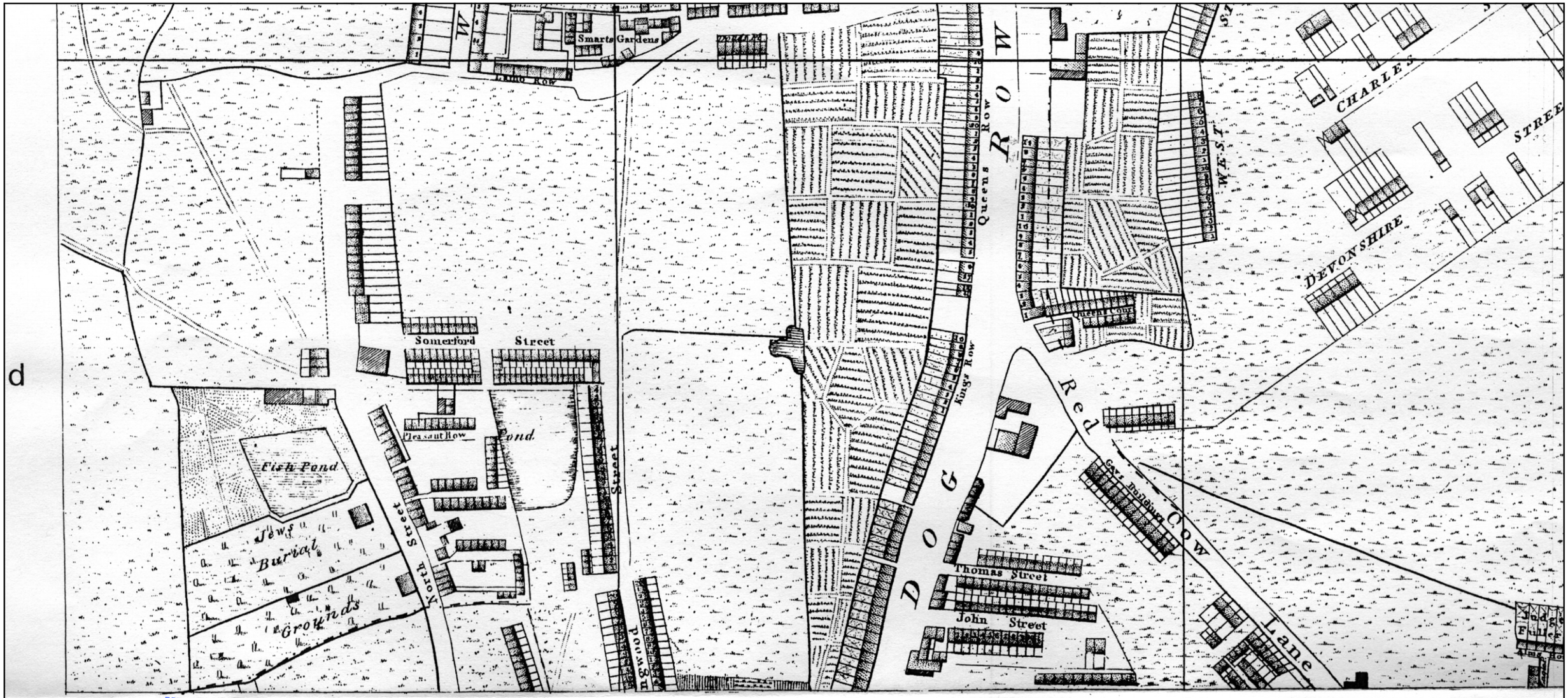
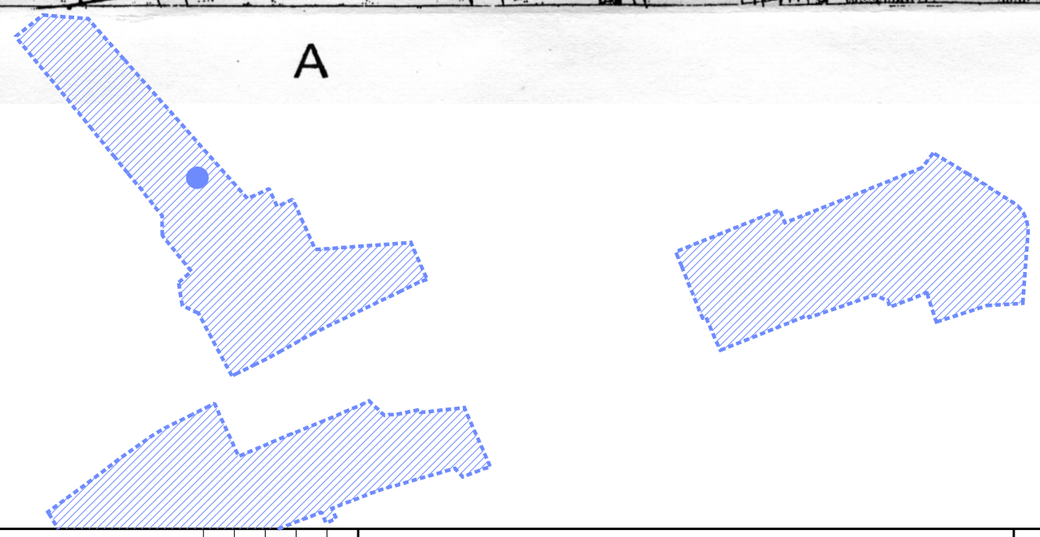
TITLE :
WHITECHAPEL STATION
HISTORICAL MAPPING
HORWOOD 1799 (WEST)

SCALE :	DRAWING AND CAD FILE No :	REV :
NTS @ A1	P30103-C1M14-E00-D-50104	A02

RESTRICTED





REV	DATE	DESCRIPTION	BY	CHKD	APP	CAD	ACC
A02	05/12/2008	SCHEME DESIGN 3 ISSUE	AB	MC	DSW		

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TITLE :
WHITECHAPEL STATION
HISTORICAL MAPPING
HORWOOD 1819 (NORTH)

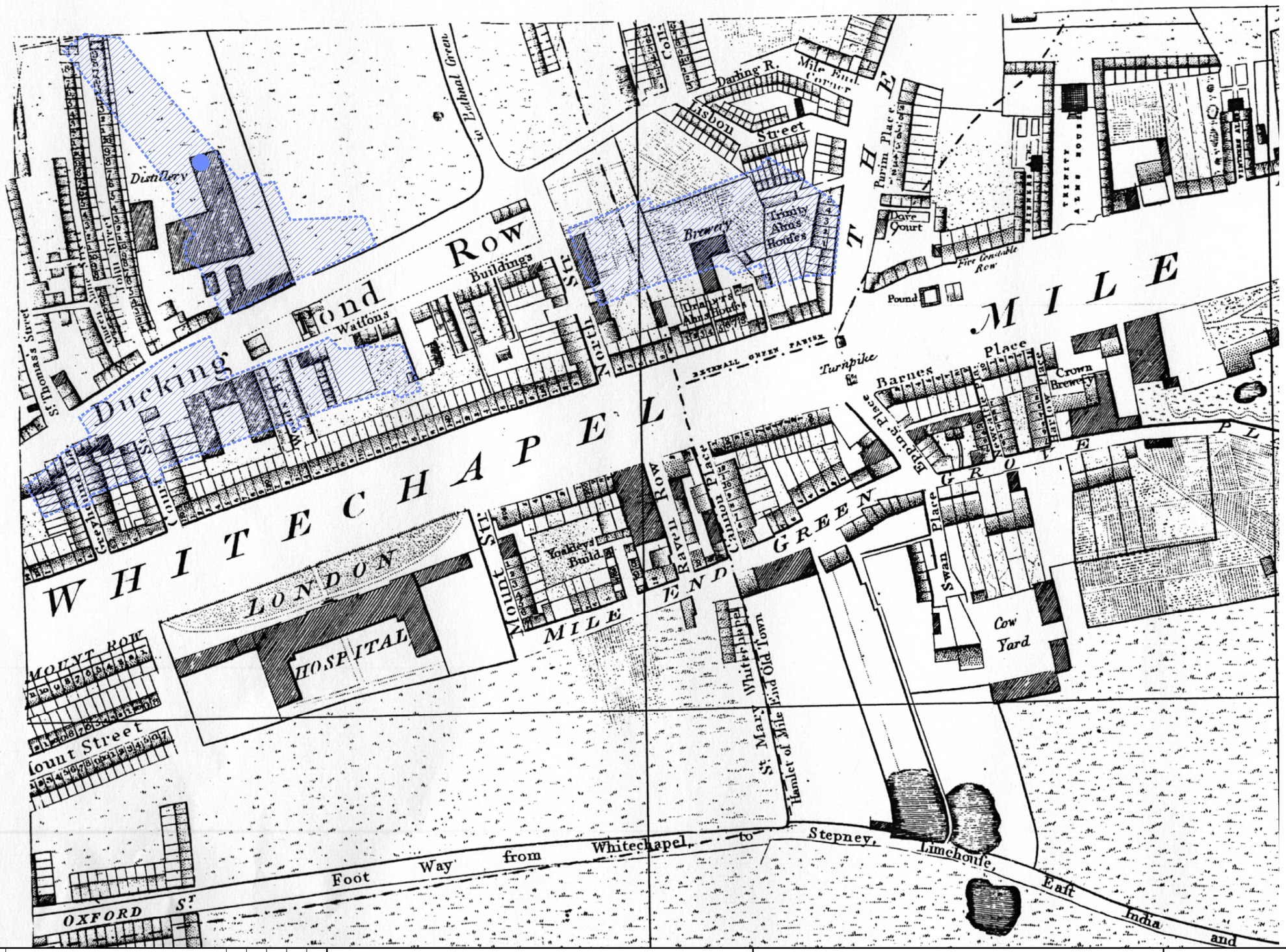
SCALE :	DRAWING AND CAD FILE No :	REV :
NTS @ A1	P30103-C1M14-E00-D-50105	A02

RESTRICTED

A

B

a



REV	DATE	DESCRIPTION	BY	CHKD	APP	CAD	ACC
A02	05/12/2008	SCHEME DESIGN 3 ISSUE	AB	MC	DSW		

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TITLE :
WHITECHAPEL STATION
HISTORICAL MAPPING
HORWOOD 1819 (EAST)

SCALE :	DRAWING AND CAD FILE No :	REV :
NTS @ A1	P30103-C1M14-E00-D-50106	A02

C

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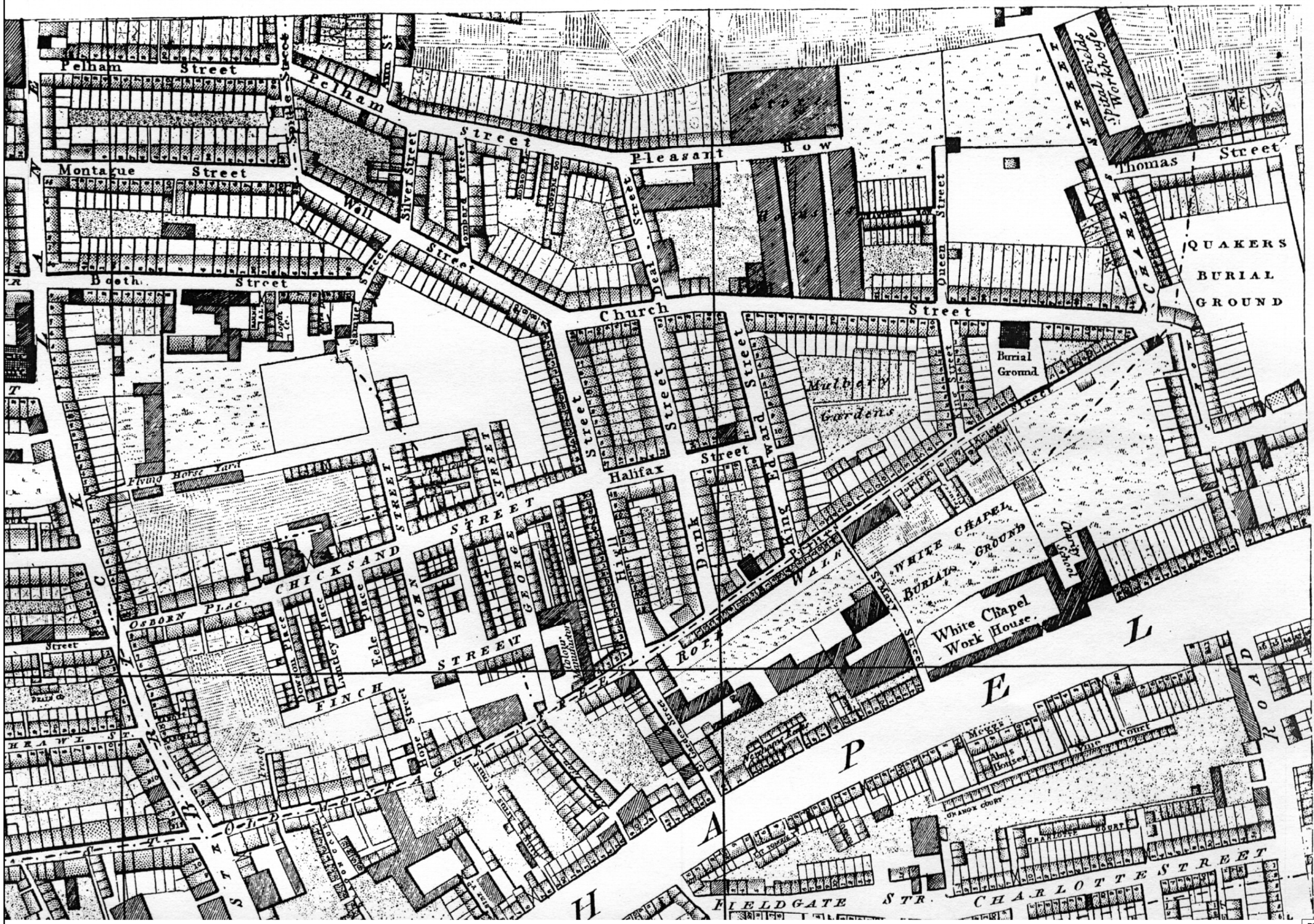

REV	DATE	DESCRIPTION	BY	CHK'D	APP	CAD	ACC
A02	05/12/2008	SCHEME DESIGN 3 ISSUE	AB	MC	DSW		

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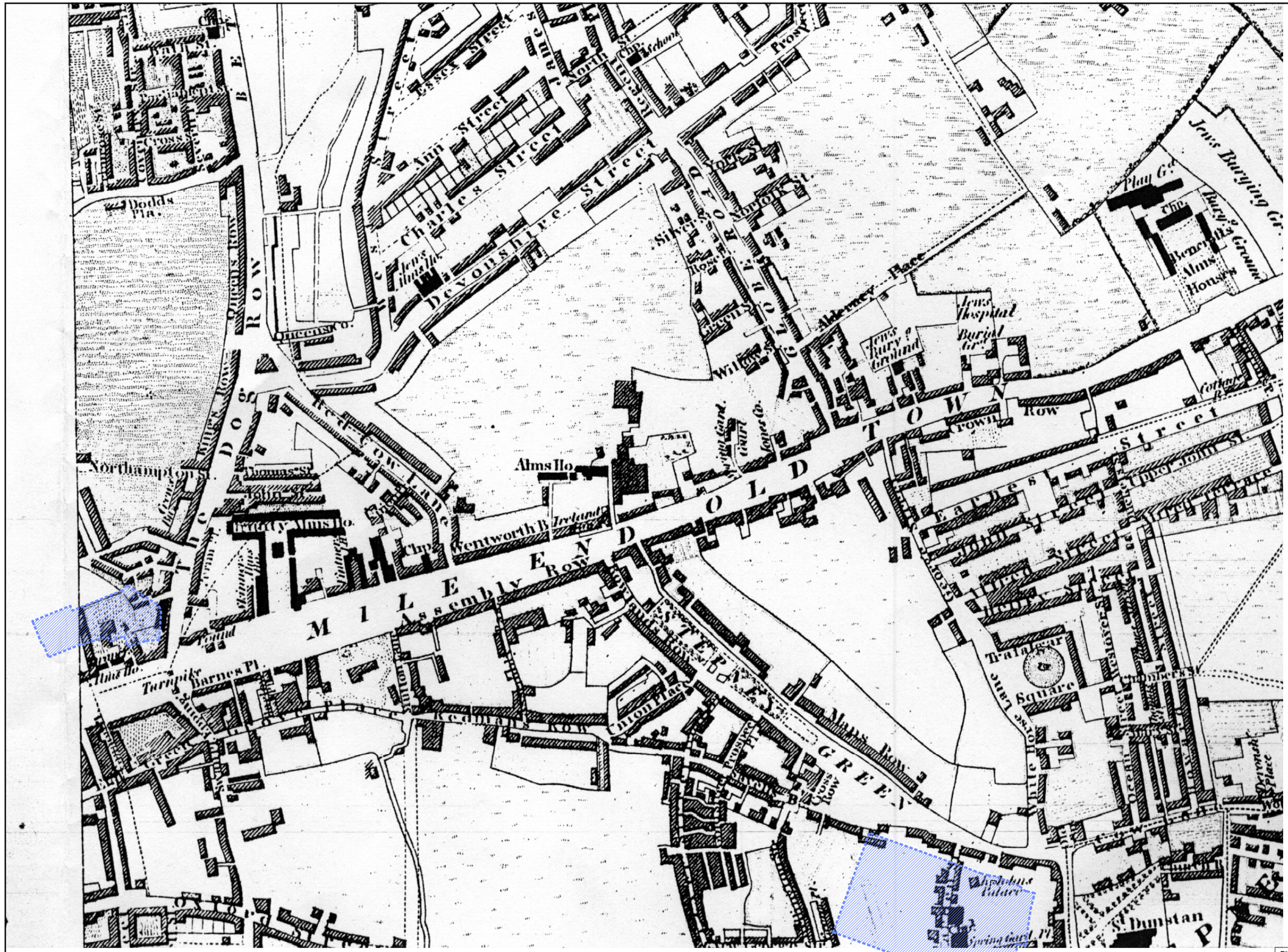
TITLE :
WHITECHAPEL STATION
HISTORICAL MAPPING
HORWOOD 1819 (WEST)

SCALE :	DRAWING AND CAD FILE No :	REV :
NTS @ A1	P30103-C1M14-E00-D-50107	A02

RESTRICTED



REV	DATE	DESCRIPTION	BY	CHKD	APP	CAD	ACC
A02	05/12/2008	SCHEME DESIGN 3 ISSUE	AB	MC	DSW		

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TITLE :
WHITECHAPEL STATION
HISTORICAL MAPPING
GREENWOOD 1824-26 (EAST)

SCALE :	DRAWING AND CAD FILE No :	REV :
NTS @ A1	P30103-C1M14-E00-D-50108	A02

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REV	DATE	DESCRIPTION	BY	CHKD	APP	CAD	ACC
A02	05/12/2008	SCHEME DESIGN 3 ISSUE	AB	MC	DSW		

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TITLE :
WHITECHAPEL STATION
HISTORICAL MAPPING
GREENWOOD 1824-26 (WEST)

SCALE :	DRAWING AND CAD FILE No :	REV :
NTS @ A1	P30103-C1M14-E00-D-50109	A02

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A02	05/12/2008	SCHEME DESIGN 3 ISSUE	AB	MC	DSW		

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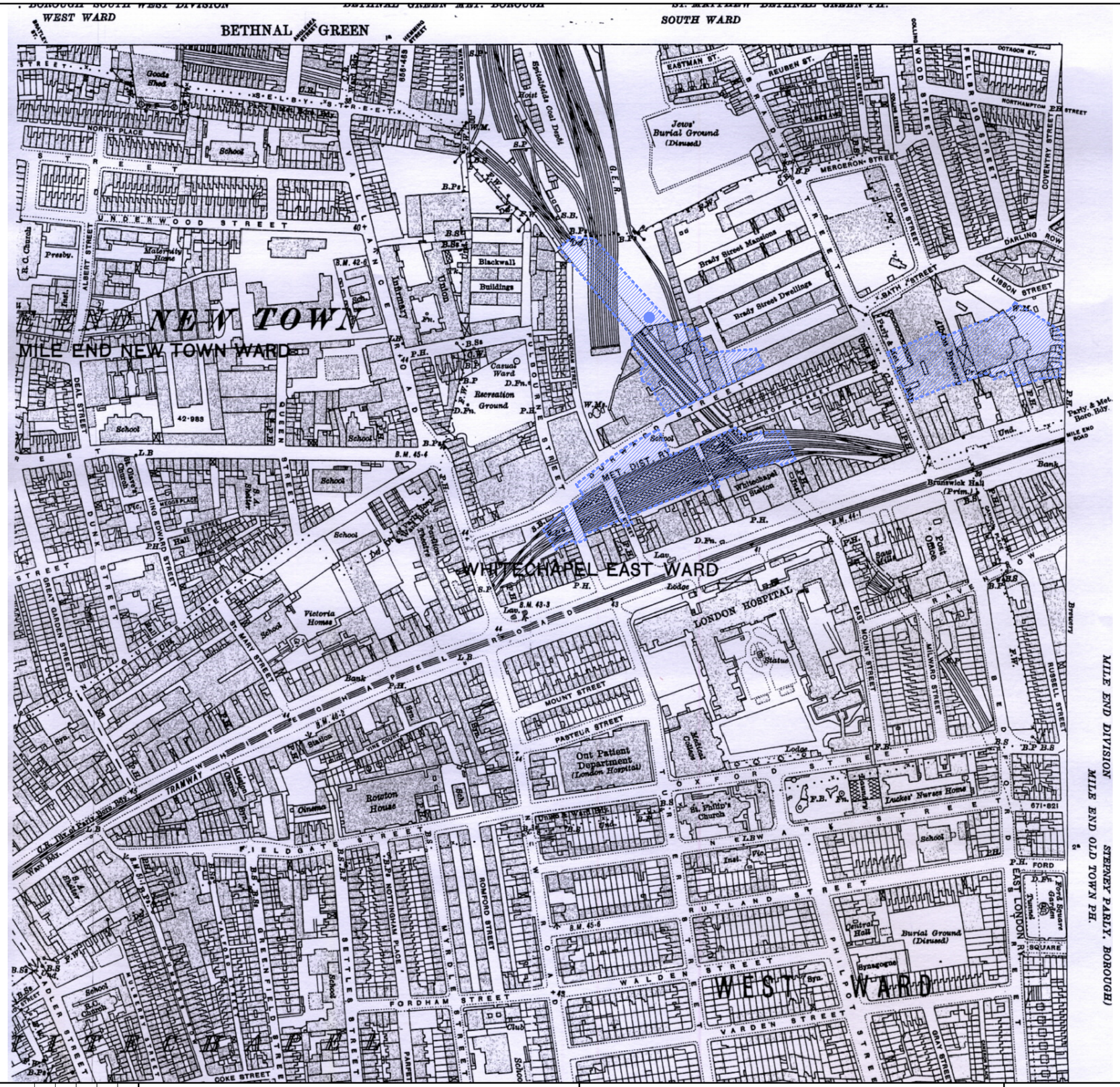
TITLE :
WHITECHAPEL STATION
HISTORICAL MAPPING
ORDNANCE SURVEY 1873

SCALE :	DRAWING AND CAD FILE No :	REV :
NTS @ A1	P30103-C1M14-E00-D-50110	A02



REV	DATE	DESCRIPTION	BY	CHKD	APP	CAD	ACC
A02	05/12/2008	SCHEME DESIGN 3 ISSUE	AB	MC	DSW		

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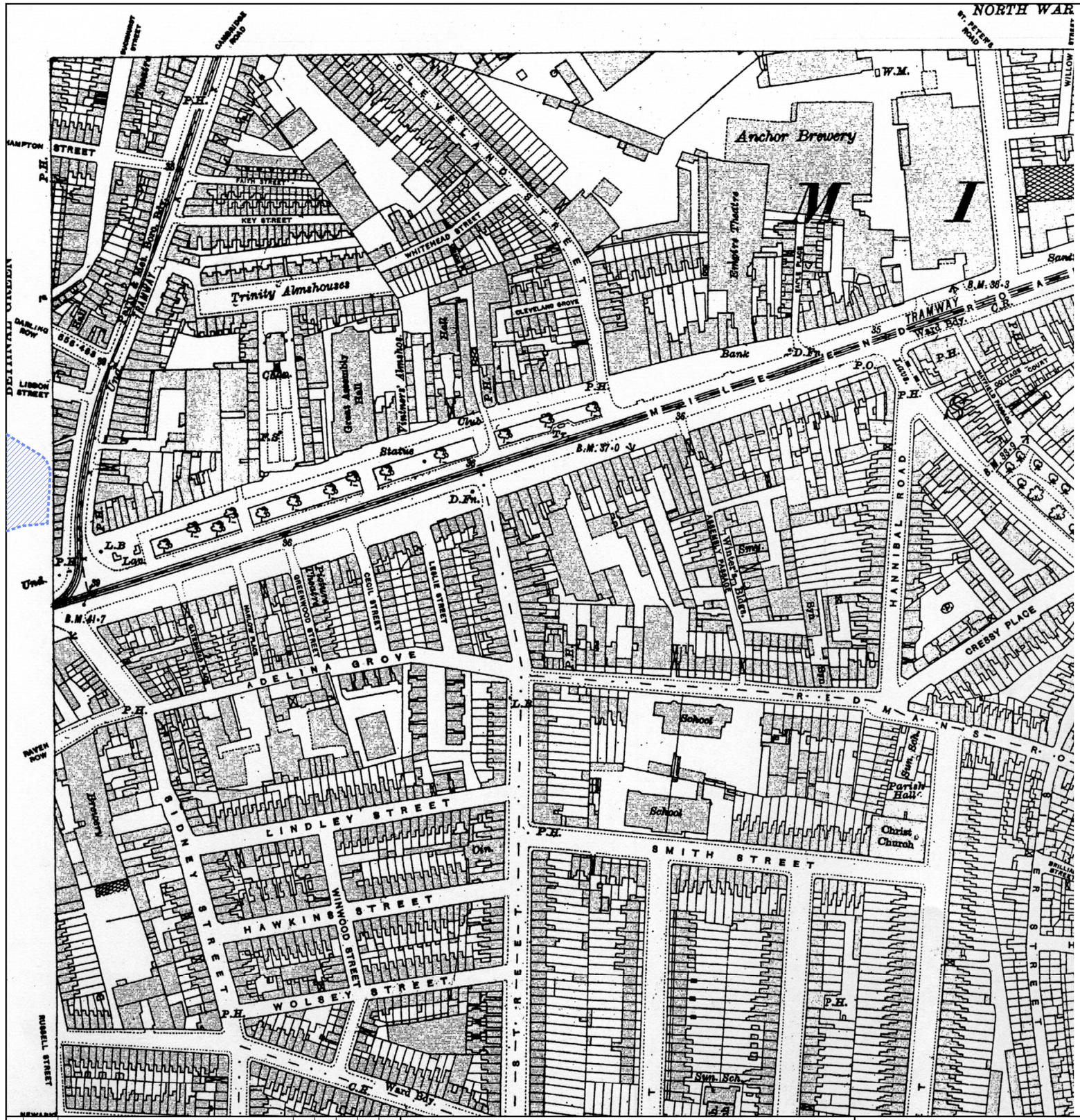
TITLE :
WHITECHAPEL STATION
HISTORICAL MAPPING
ORDNANCE SURVEY 1913

SCALE :	DRAWING AND CAD FILE No :	REV :
NTS @ A1	P30103-C1M14-E00-D-50111	A02

RESTRICTED



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REV	DATE	DESCRIPTION	BY	CHKD	APP	CAD	ACC
A02	05/12/2008	SCHEME DESIGN 3 ISSUE	AB	MC	DSW		

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TITLE :
WHITECHAPEL STATION
HISTORICAL MAPPING
ORDANCE SURVEY 1914

SCALE :	DRAWING AND CAD FILE No :	REV :
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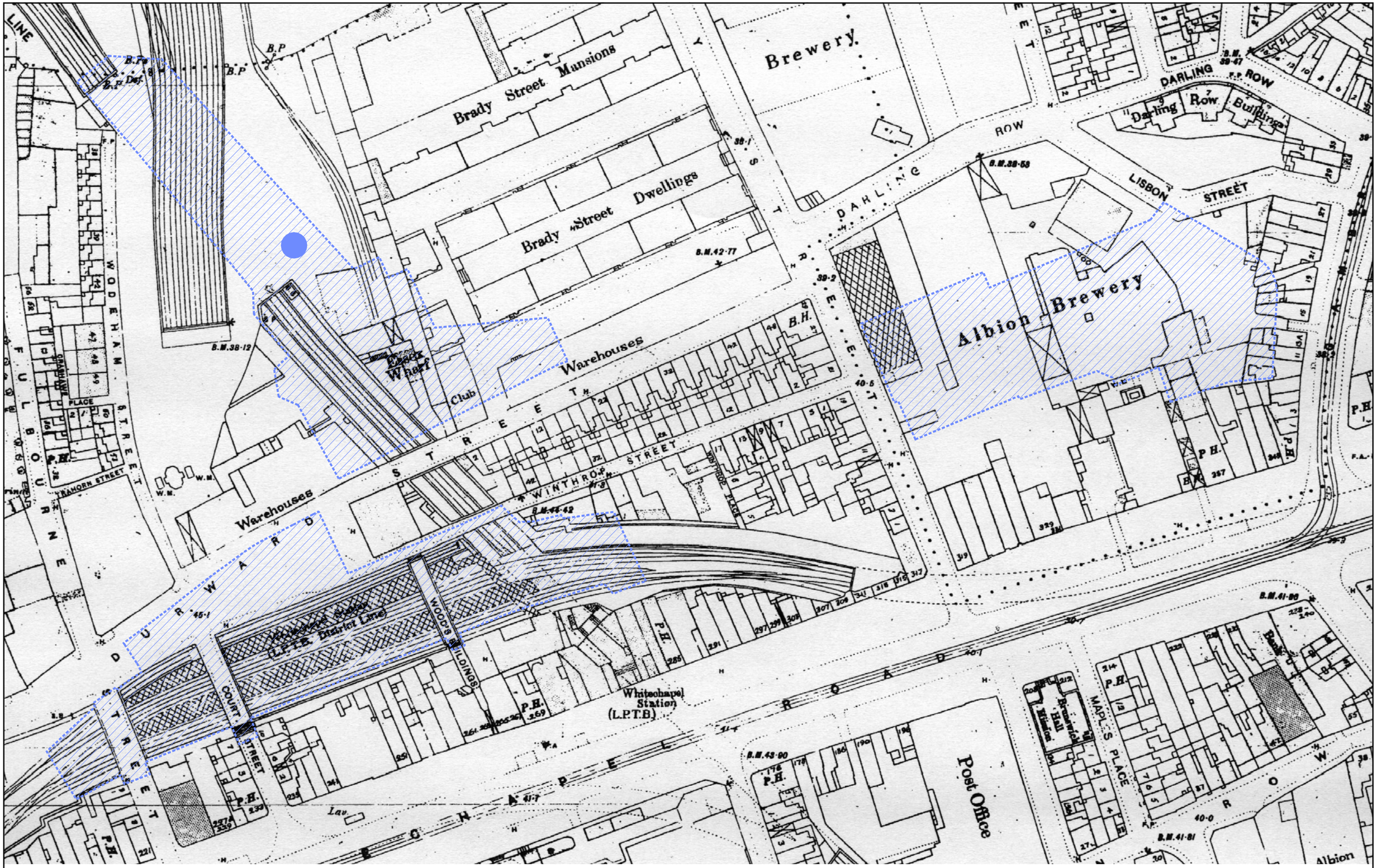

REV	DATE	DESCRIPTION	BY	CHKD	APP	CAD	ACC
A02	05/12/2008	SCHEME DESIGN 3 ISSUE	DJC	MC	DSW		

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TITLE :
WHITECHAPEL STATION
HISTORICAL MAPPING
ORDANCE SURVEY 1938

SCALE :	DRAWING AND CAD FILE No :	REV :
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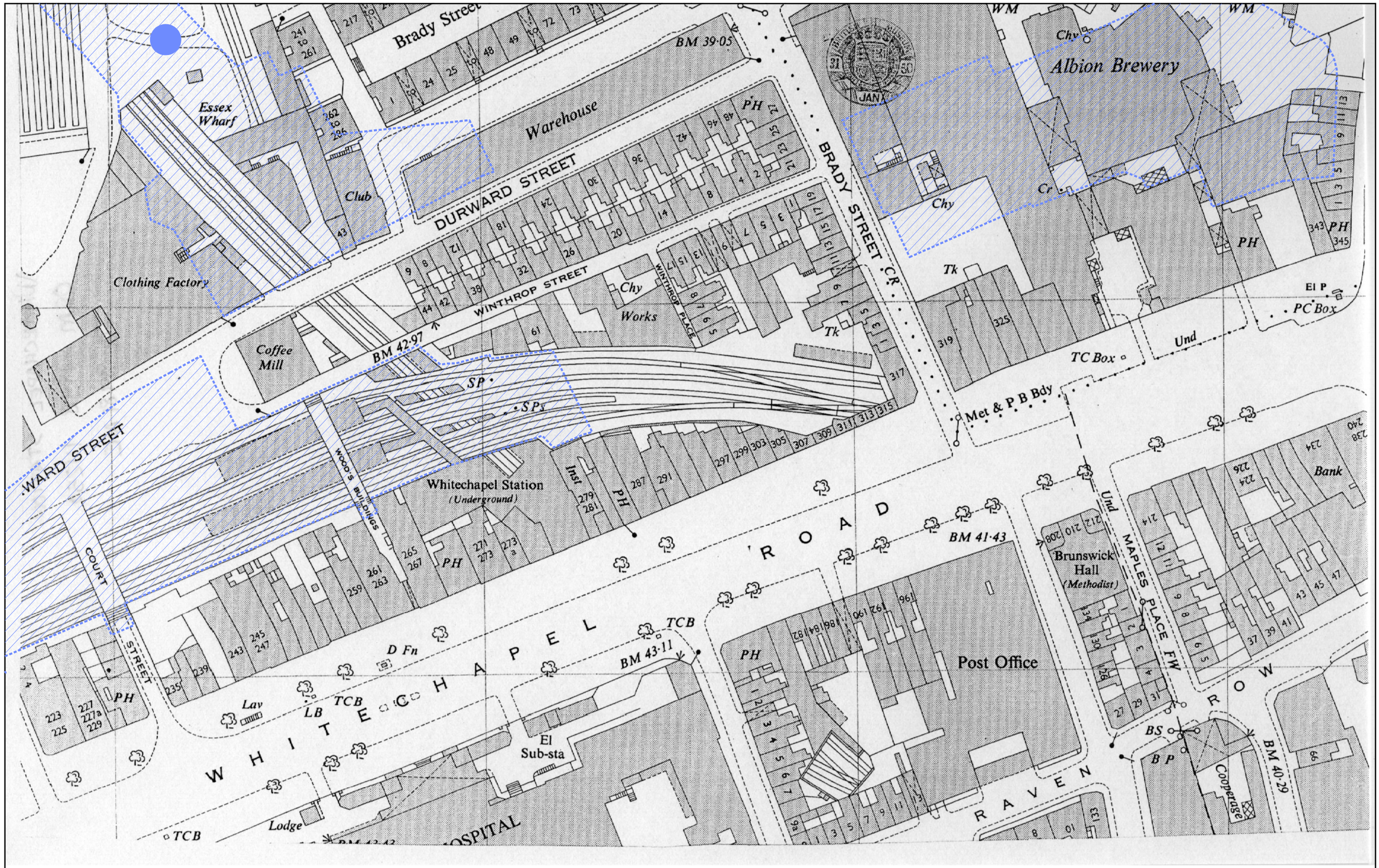

REV	DATE	DESCRIPTION	BY	CHKD	APP	CAD	ACC
A02	05/12/2008	SCHEME DESIGN 3 ISSUE	DJC	MC	DSW		

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TITLE :
WHITECHAPEL STATION
HISTORICAL MAPPING
ORDANCE SURVEY 1948

SCALE :	DRAWING AND CAD FILE No :	REV :
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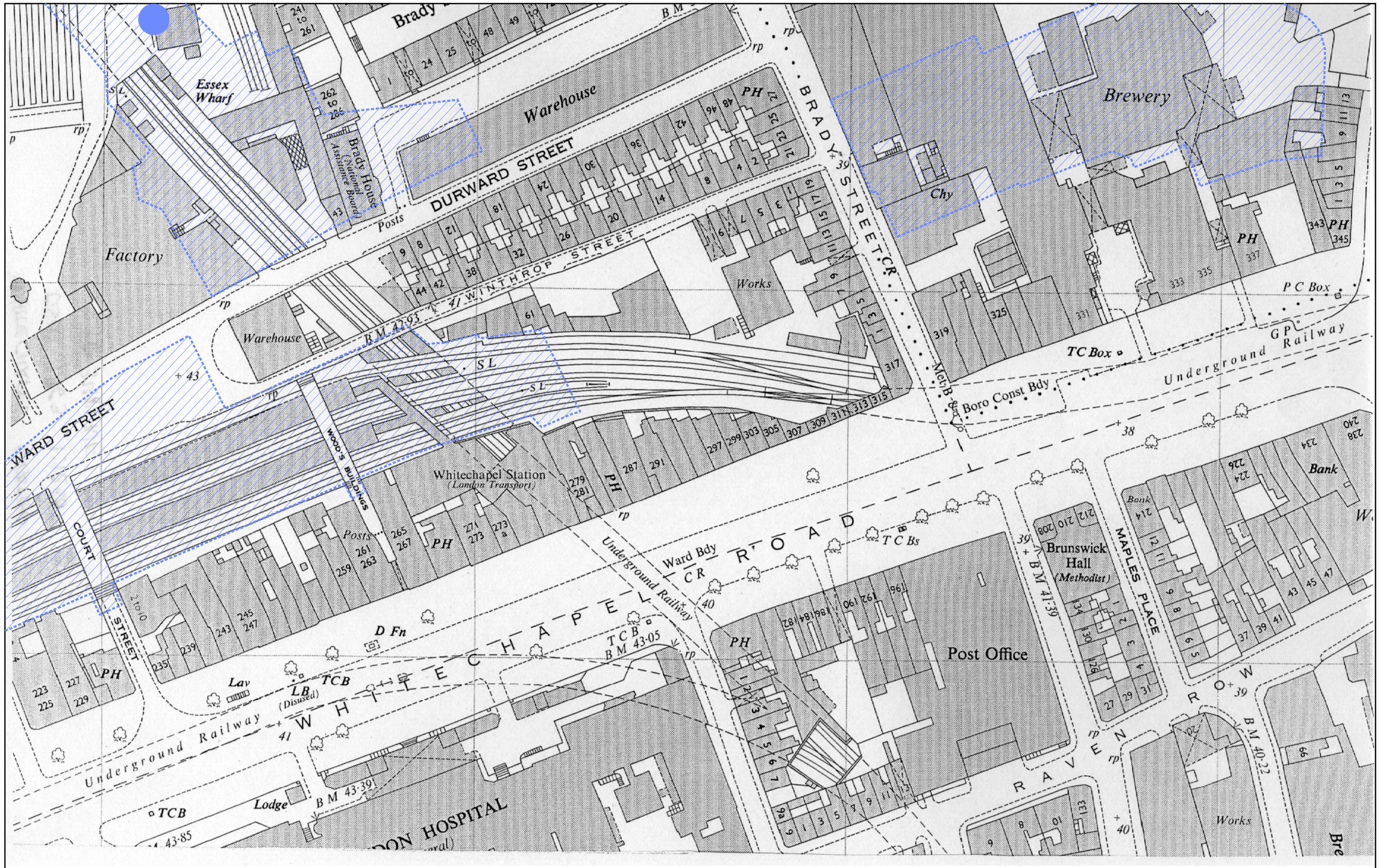
RESTRICTED



REV	DATE	DESCRIPTION	BY	CHKD	APP	CAD	ACC
A02	05/12/2008	SCHEME DESIGN 3 ISSUE	DJC	MC	DSW		

LEGEND

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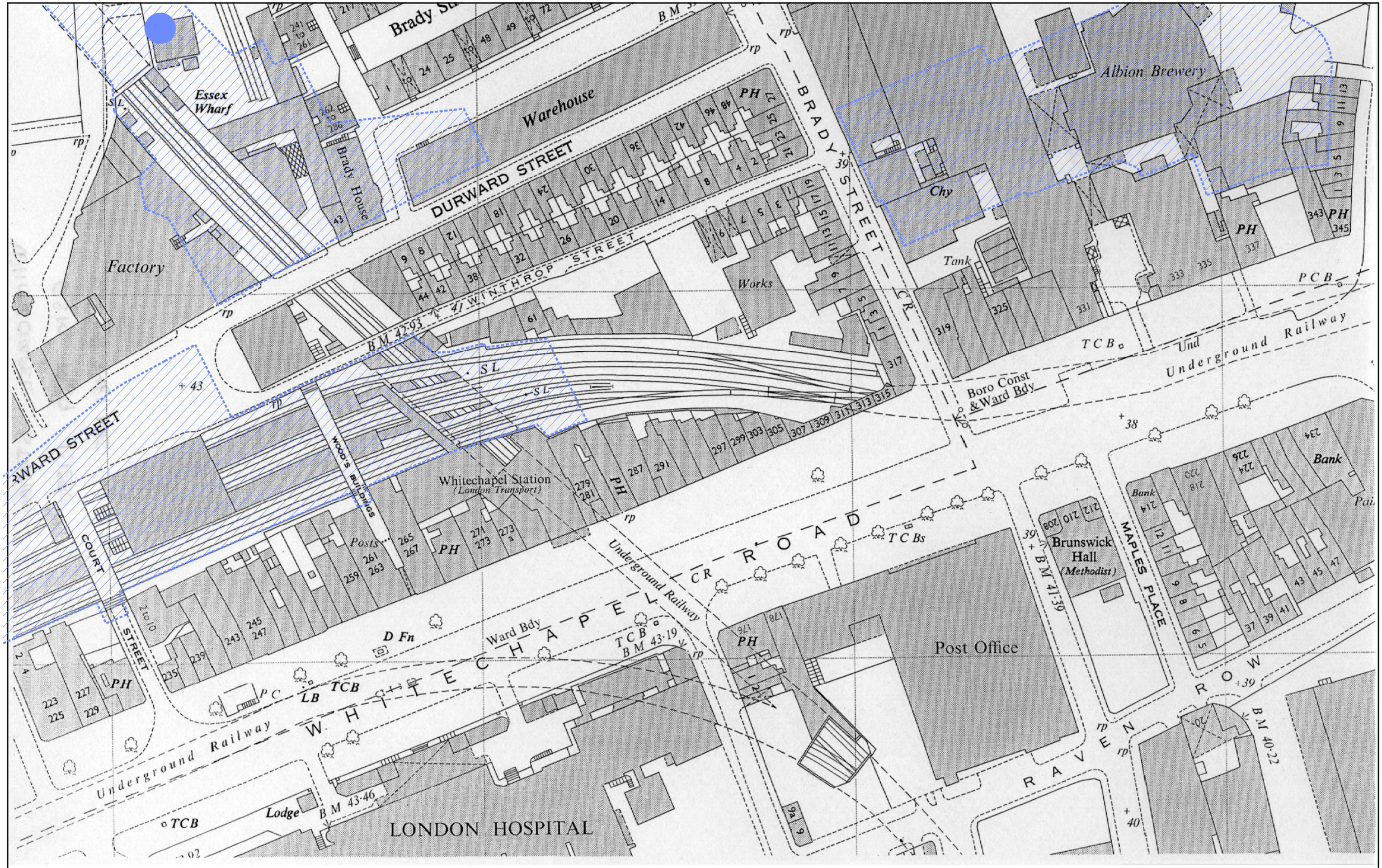
TITLE :
WHITECHAPEL STATION
HISTORICAL MAPPING
ORDANCE SURVEY 1963

SCALE :	DRAWING AND CAD FILE No :	REV :
NTS @ A1	P30103-C1M14-E00-D-50115	A02

RESTRICTED



REV	DATE	DESCRIPTION	BY	CHKD	APP	CAD	ACC
A02	05/12/2008	SCHEME DESIGN 3 ISSUE	DJC	MC	DSW		

LEGEND

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TITLE :
WHITECHAPEL STATION
HISTORICAL MAPPING
ORDANCE SURVEY 1969

SCALE :	DRAWING AND CAD FILE No :	REV :
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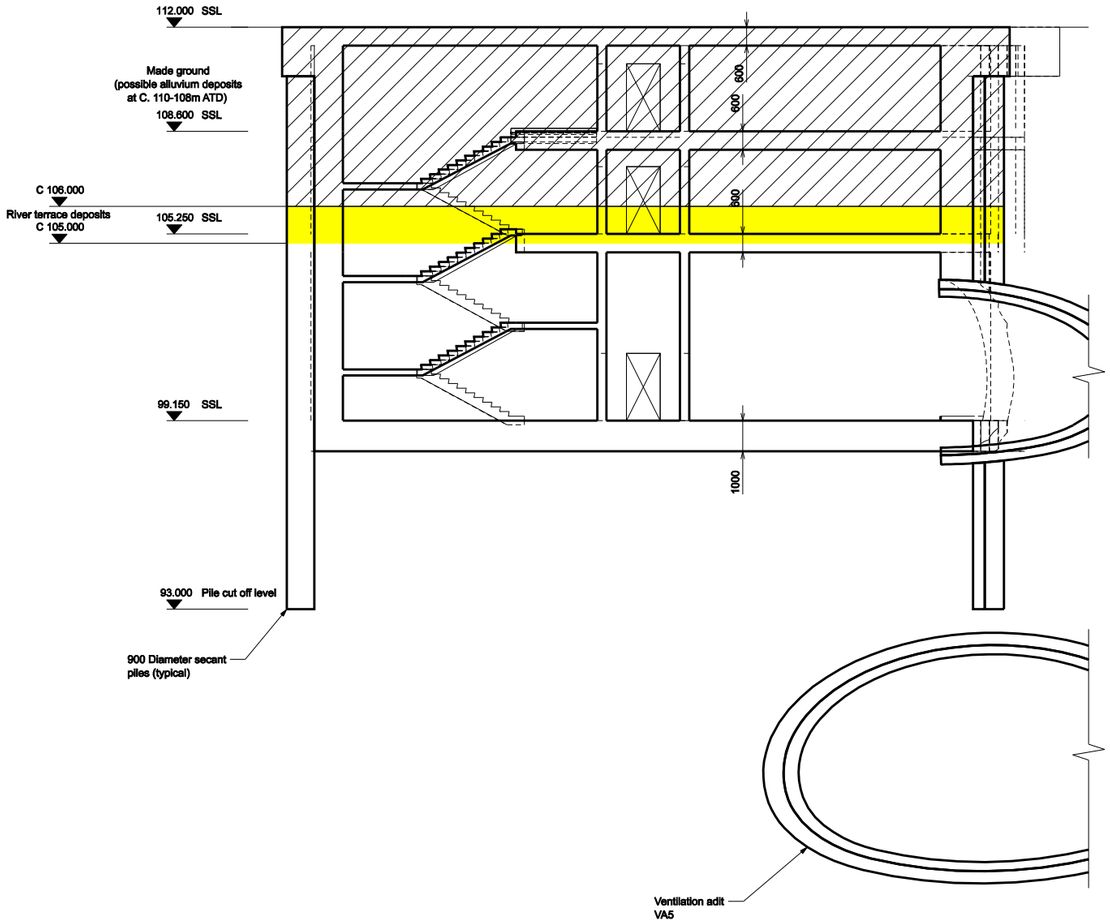
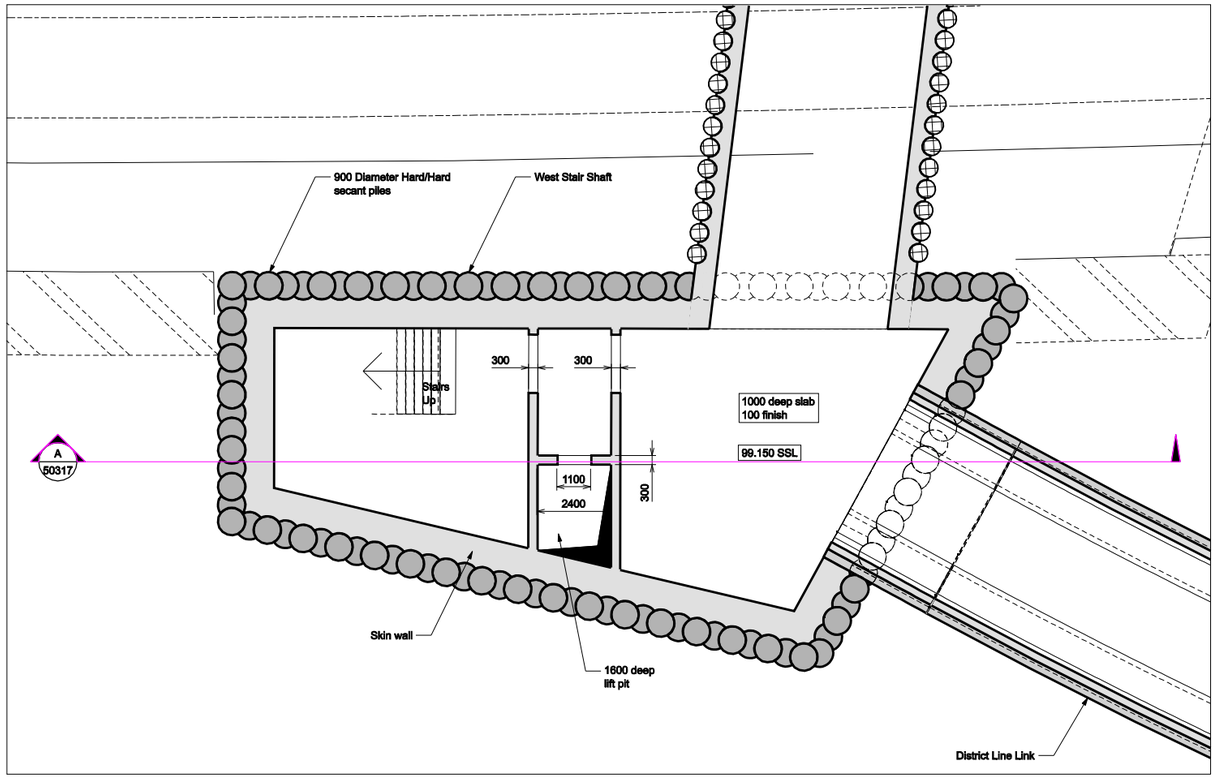
RESTRICTED



Section A - A

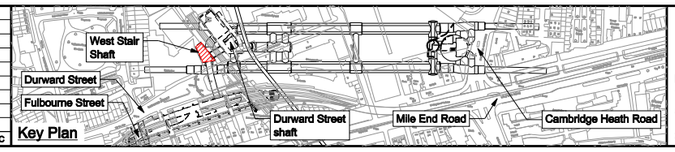
For section location refer to drawing number
P30201-C1M14-C00-D-50315



Plan at SSL 99.150
Interchange Level

(See Drawing P30103-C1M14-E00-D-50003 for areas of archaeological investigation)

REV	DATE	DESCRIPTION	BY	CHKD	APP	CAD	ACC
A02	14/12/07	FIRST ISSUE - SCHEME DESIGN	AB	SPA	DSW		
B01	05/12/2008	SCHEME DESIGN 3 ISSUE	DC	MC	DSW		



Key Plan

Key
Made ground
River terrace deposits

Notes
1. For general notes refer to drawing number P30201-C1M14-C00-D-50101.

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

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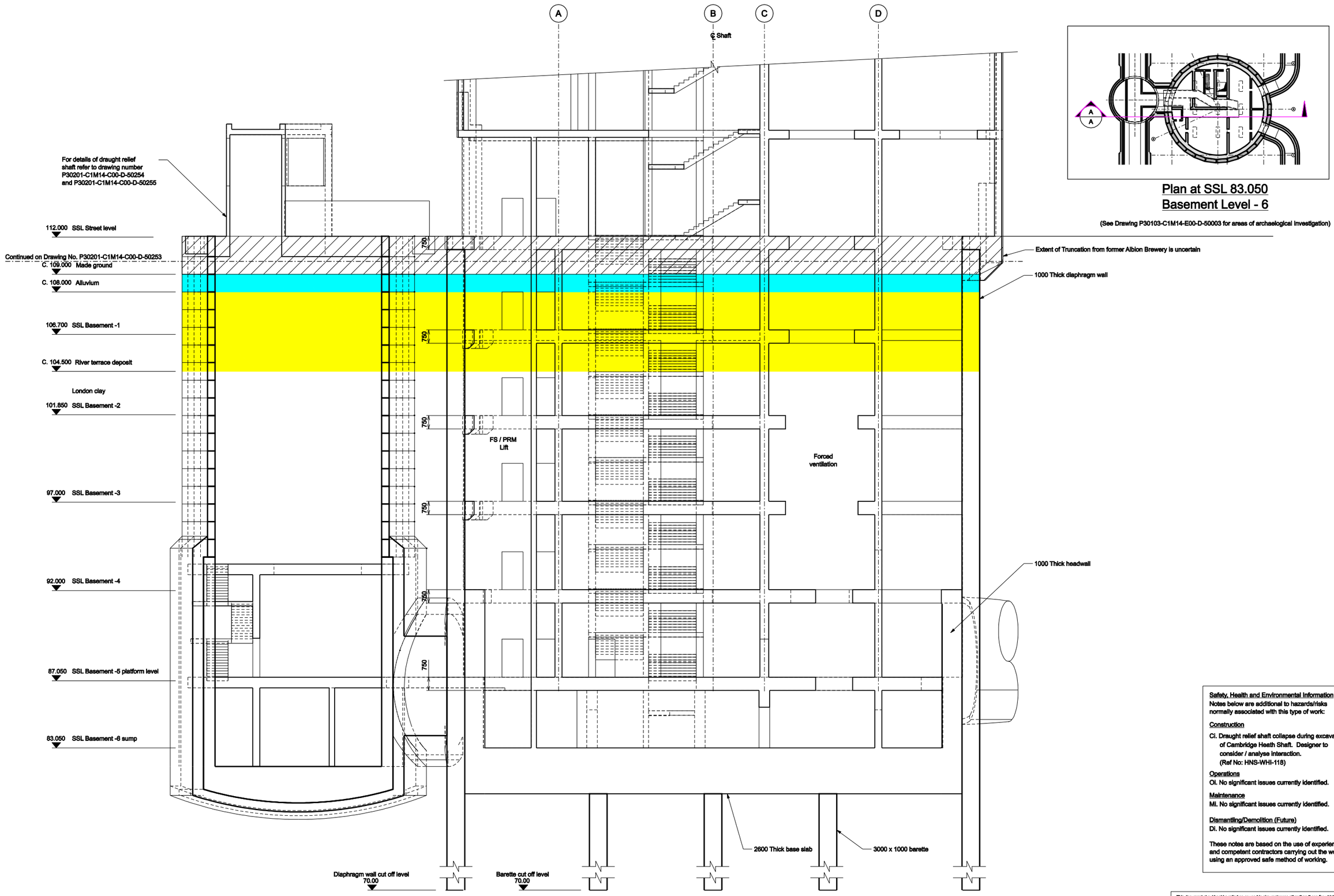
1. Confirmation of all survey data must be obtained from the Crossrail survey team.
2. Coordinates to the London Survey Grid, heights to the London height datum which is 100 metres below Ordnance Datum Newlyn. See Crossrail standard CR-STD-010.

CONTRACT No. / CONSULTANT :
1199 / MOTT MACDONALD

TITLE :
WHITECHAPEL STATION
WEST STAIR SHAFT POTENTIAL SURVIVAL OF ARCHAEOLOGICAL DEPOSITS

SCALE :	DRAWING AND CAD FILE No :	REV :
1:100 @ A1	P30103-C1M14-E00-D-50130	A01



Plan at SSL 83.050
Basement Level - 6

(See Drawing P30103-C1M14-E00-D-50003 for areas of archaeological investigation)

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

Construction

Ci. Draught relief shaft collapse during excavation of Cambridge Heath Shaft. Designer to consider / analyse interaction. (Ref No: HNS-WHI-118)

Operations

Oi. No significant issues currently identified.

Maintenance

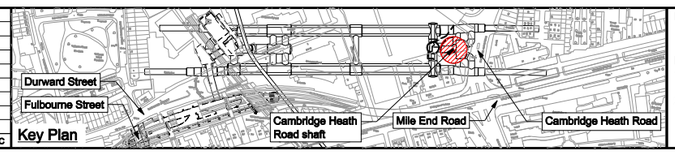
Mi. No significant issues currently identified.

Dismantling/Demolition (Future)

Di. No significant issues currently identified.

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	CAD	ACC
A01	05/12/2008	SCHEME DESIGN 3 ISSUE	DC	MC	DSW		



Key Plan

Key
- Made ground
- Alluvium including Moorfield marsh deposits
- River terrace deposits

Notes
1. For general notes refer to drawing number P30201-C1M14-C00-D-50101.
2. For borehole location refer to drawing number P30101-C1M14-G00-D-50121 - volume 8.

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

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CONTRACT No. / CONSULTANT :
1199 / MOTT MACDONALD

TITLE :
WHITECHAPEL STN. CAMBRIDGE HEATH RD. POTENTIAL SURVIVAL OF ARCHAEOLOGICAL DEPOSITS SECTION A - A

SCALE :	DRAWING AND CAD FILE No :	REV :
1:100 @ A1	P30103-C1M14-E00-D-50131	A01

RESTRICTED

A | B | C | D | E | F | H | I | J

8900 | 5700 | 5700 | 5700 | 4450 | 2750 | 6400 | 8550

Roof Level
123.200

Level +1
116.650

Ground Level
112.350

Made ground
(possible Alluvial deposits at
C. 110.000 to 108.000m ATD)

106.000
River terrace deposits
C. 105.000

Level -1
Basement
105.250

London Clay

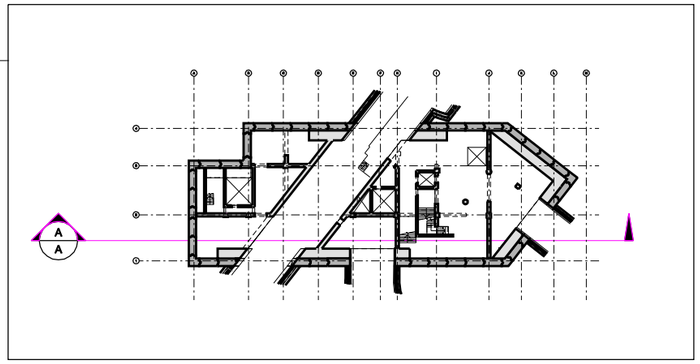
Level -2
Basement
99.150

Level -3
Basement
93.850

Level -4
Basement
86.900

Level -5
Basement
81.850

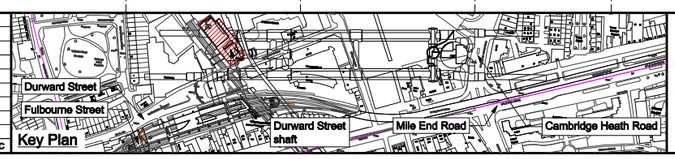
67.750m ATD



G.A. Plan at SSL 86.900
Level - 4

(See Drawing P30103-C1M14-E00-D-50003 for areas of archaeological investigation)

REV	DATE	DESCRIPTION	BY	CHKD	APP	CAD	ACC
A01	05/12/2008	SCHEME DESIGN 3 ISSUE	DC	MC	DSW		



Key Plan

Key
- Made ground
- River terrace deposits

Notes
1. For general notes refer to drawing number P30201-C1M14-C00-D-50101.
2. For location of section refer to drawing numbers P30201-C1M14-C00-D-50303 to 50310.

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

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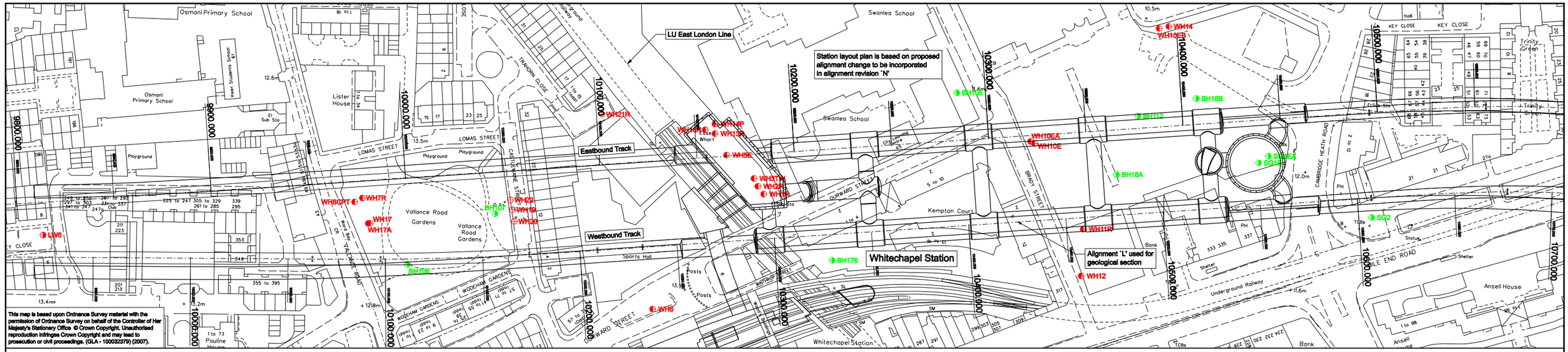
3. All dimension are in metres unless stated otherwise.

CONTRACT No. / CONSULTANT :
1199 / MOTT MACDONALD

TITLE :
WHITECHAPEL STN. DURWARD ST. SHAFT
POTENTIAL SURVIVAL OF ARCHAEOLOGICAL DEPOSITS SECTION D-D

SCALE :	DRAWING AND CAD FILE No :	REV :
1:100 @ A1	P30103-C1M14-E00-D-50132	A01

RESTRICTED



Longitudinal Section
Scale H=1:1000, V=1:500

Key

- Crossrail boreholes package 1 (FES) (2002)
- Crossrail additional boreholes (FES) (2003)
- Third party boreholes
- 18.32m (L) Offset from centre line (left or right)
- Interpreted geological boundary
- Existing ground level
- Cohesion less layers, potentially water bearing (Principle particle size silt, sand or gravel) - within LC and upper LG
- Recorded water level during water strike
- Water strike level
- Maximum recorded groundwater level (piezometer)
- Piezometer tip level and sand filter zone
- ? Indicates uncertainty in stratum boundary level and/or extent

Notes

1. The scheme plan and vertical alignment is Revision L alignment.
2. This drawing presents the existing geotechnical information provided by GCG and third party information gained from other sources. This includes FES Factual Reports (1D0101-C1G00-00001, 00007): GCG interpretative report (1D0101 C1G00-00007-GSIR3) : GCG monitoring report (1D0101 C1G00-00506) : GCG desk study (1D0101 G0G00-50003). Where required Mott Macdonald have re-interpreted the existing data for the purposes of the ground model construction.
3. The geotechnical long sections have been interpreted principally from the boreholes closest to the section line. However, the overall geological structure has been interpreted from all the data available. Where exploratory holes are offset from the section line, strata boundaries shown on the long section may not coincide with the strata boundaries within individual exploratory holes.
4. For detailed information regarding stratigraphical and material type, reference should be made to the individual factual exploratory hole records for development of design sections.
5. Most reliance has been placed on the crossrail ground investigation boreholes.
6. Applicability of ground hazards to the site location is based on the factual evidence to date and is subject to change following subsequent ground investigation phases, ongoing geotechnical Input and Interpretation throughout the design development phase.
7. Chainages shown on plan and sections are indicative only, and subject to change. Both sections chainages increase running West to East.
8. Excavation depths are subject to design change, hence the relative position of hazards to the excavation will change accordingly.
9. It is possible the unidentified scour hollows could be present in the vicinity of lost river courses.
10. The quality of the logging of BH 112, & BH 18B is poor.
11. Boreholes WH16R and WH13R contain multi-point sampling (MPS) systems each comprising of six standpipe piezometers.
12. Some boreholes are not shown on the section due to absence of detailed material descriptions.
13. Drawings based on available information up to April 07.

Stratigraphic Units

MG	Made Ground	A2, A3, B	London Clay Formation Sub Strata	LMB	Lower Mottled Beds
AL	Alluvium	LC	Unclassified London Clay	LG	Unclassified Lambeth Group
LS	Langley Silt	HF	Harwich Formation	UF	Upnor Formation
RTD	River Terrace Deposits	USB	Upper Shelly Beds	TS	Thanet Sand Formation
WR	Weathered London Clay	UMB	Upper Mottled Beds	BUB	Bullhead Beds
		LTB	Laminated Beds	CK	Chalk
		LSB	Lower Shelly Beds		

Scale 1:500 — 10m 0 10m 20m 30m 40m 50m

Scale 1:1000 — 20m 0 20m 40m 60m 80m 100m

N

REV	DATE	DESCRIPTION	BY	CHKD	APP	CAD	ACC
A02	17/12/2007	FIRST ISSUE - SCHEME DESIGN	AB	BJL	DSW		

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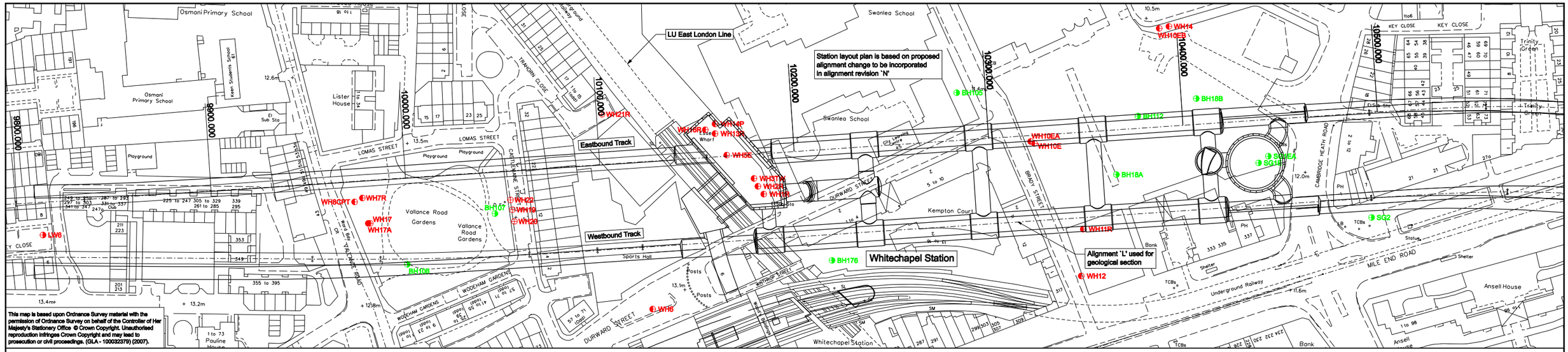
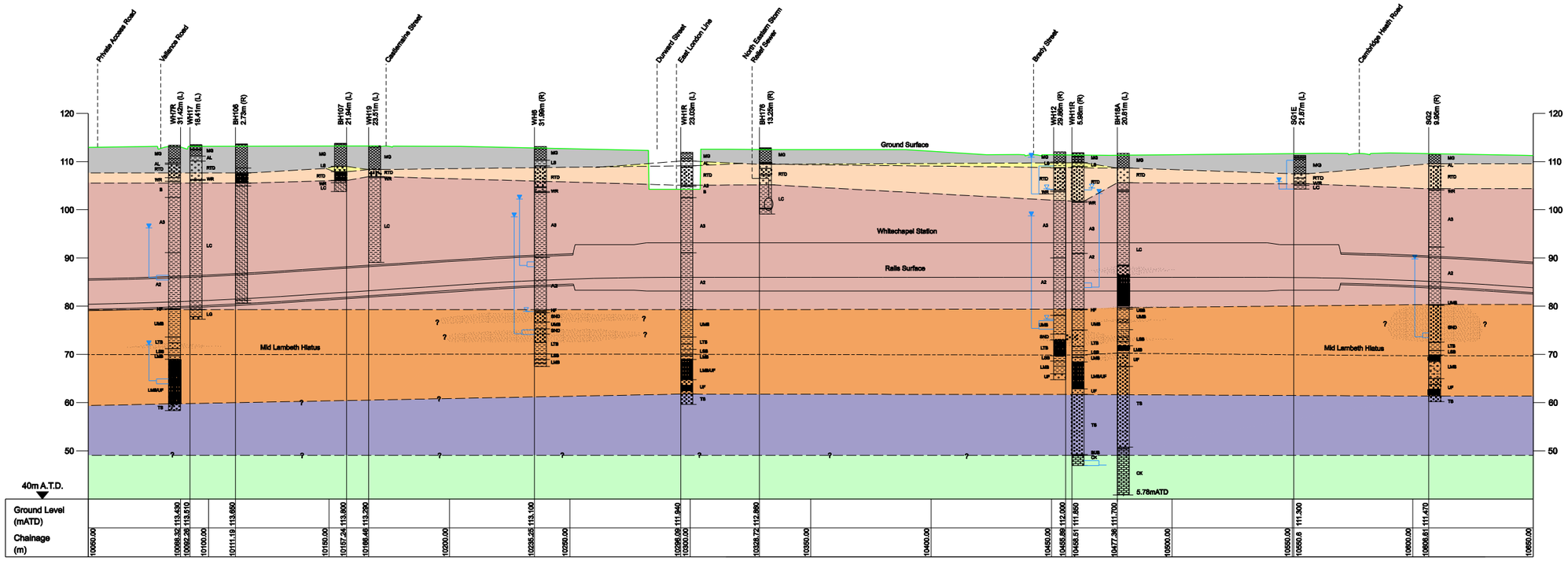
CONTRACT No. / CONSULTANT : 1199 / MOTT MACDONALD

TITLE : WHITECHAPEL STATION GEOLOGICAL SECTION EASTBOUND TUNNEL

SCALE :	DRAWING AND CAD FILE No :	REV :
1:1000 @ A1	P30101-C1M14-G00-D-50121	A02





Longitudinal Section
Scale H=1:1000, V=1:500

Key

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- Crossrail additional boreholes (FES) (2003)
- Third party boreholes
- 18.32m (L) Offset from centre line (left or right)
- Interpreted geological boundary
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- Cohesion less layers, potentially water bearing (Principle particle size silt, sand or gravel) - within LC and upper LG
- Recorded water level during water strike
- Water strike level
- Maximum recorded groundwater level (piezometer)
- Piezometer tip level and sand filter zone
- ? Indicates uncertainty in stratum boundary level and/or extent

Notes

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REV	DATE	DESCRIPTION	BY	CHKD	APP	CAD	ACC
A02	17/12/2007	FIRST ISSUE - SCHEME DESIGN	AB	BJL	DSW		

Stratigraphic Units

MG	Made Ground	A2, A3, B	London Clay Formation Sub Strata
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WR	Weathered London Clay	UMB	Upper Mottled Beds
		LTB	Laminated Beds
		LSB	Lower Shelly Beds
		LMB	Lower Mottled Beds
		LG	Unclassified Lambeth Group
		UF	Upnor Formation
		TS	Thanet Sand Formation
		BUB	Bullhead Beds
		CK	Chalk

Scale 1:500: 10m 0 10m 20m 30m 40m 50m

Scale 1:1000: 20m 0 20m 40m 60m 80m 100m

N

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CONTRACT No. / CONSULTANT : 1199 / MOTT MACDONALD

TITLE :
WHITECHAPEL STATION
GEOLOGICAL SECTION
WESTBOUND TUNNEL

SCALE :	DRAWING AND CAD FILE No :	REV :
1:1000 @ A1	P30101-C1M14-G00-D-50122	A02

9.2 Previous Archaeological Interventions in the Area

The list below comprises a gazetteer of archaeological excavations and observations within the vicinity of the site.

Site record: FIG01

Site name	
Site location	40-46 Fieldgate Street, E1
Borough	Tower Hamlets
Year	2001
Greater London SMR No.	
National Grid Ref.	TQ34358155
Organisation	MOLAS
Type of fieldwork	evaluation
Archaeological periods	18th century, 19th century, 20th century
Summary	London Archaeologist Round-up 2001: Natural brickearth was truncated by the construction of a 19th or 20th-c basement. Three rubbish and cesspits, probably dating from the 18th c, survived beneath the basement. Two of the pits were aligned with the terraced buildings on Fieldgate Street, dated to 1755 and 1819.
Related sites:	*None linked*

Site record: DUR96

Site name	Whitechapel Sports Centre Site
Site location	Durward Street, E1
Borough	Tower Hamlets
Year	1996

Greater London SMR No.	083584
National Grid Ref.	TQ34608192
Organisation	MOLAS
Type of fieldwork	evaluation
Archaeological periods	unknown, Post-Medieval, 19th century, 20th century
Summary	See Also: 'London Archaeologist Round-up 1996': In one trench natural brickearth was cut by a large pit or ditch which was truncated by 19th-20th-c foundation walls and slab. In the second trench natural gravels were cut by large regular post-medieval features which are likely to be related to horticultural activity on the site. Modern dumping sealed all features.

Site record: WCA03

Site name	
Site location	319-329 Whitechapel Road, E1
Borough	Tower Hamlets
Year	2003
Greater London SMR No.	
National Grid Ref.	TQ34838189
Organisation	MOLAS
Type of fieldwork	watching brief
Archaeological periods	18th century; 19th century; 20th century

Summary	See Also: 'London Archaeologist Round-up 2003': Natural gravels were observed beneath 18th-19th cellars along the south frontage of the site. Elsewhere modern overburden was encountered.
Related sites:	*None linked*

Site record: ABR93

Site name	Albion Brewery
Site location	Whitechapel Road, E1
Borough	Tower Hamlets
Year	1993
Greater London SMR No.	
National Grid Ref.	TQ34848200
Organisation	MOLAS
Type of fieldwork	evaluation
Archaeological periods	18th century/19th century, 19th century
Summary	See Also: 'London Archaeologist Round-up 1993': A 45m long stretch of an 18th-19th c brick sewer, referred to in contemporary documents as 'The common sewer', was revealed. The backfill included a William IV mug, indicating that it fell into disuse after 1830. Brickearth quarries post-dated the construction of the sewer.
Related sites:	*None linked*

Site record: SEL92

Site name	British Rail Coal Depot
Site location	Selby Street, E1

Borough	Tower Hamlets
Year	1992
Greater London SMR No.	
National Grid Ref.	TQ34508210
Organisation	MOLAS
Type of fieldwork	evaluation
Archaeological periods	19th century
Summary	See Also: 'London Archaeologist Round-up 1992(3)': Evaluation Feb 1992 Samuel Lewis Trust. Features relating to the construction of the brick railway viaduct were found.
Related sites:	*None linked*

Site record: WHD92

Site name	Whitechapel West Housing
Site location	139-149 Whitechapel Road, E1
Borough	Tower Hamlets
Year	1992
Greater London SMR No.	
National Grid Ref.	TQ34338167
Organisation	MOLAS
Type of fieldwork	watching brief
Archaeological	Post-Medieval, 19th century

periods

Summary

See Also: 'London Archaeologist Round-up 1992(3)': Watching brief Aug 1992 Shell UK Ltd. Natural sand and waterlain deposits were overlain by a series of external dumps, the upper two probably relating to the backyards or gardens of medieval properties fronting onto Whitechapel Road. To the NE a post-medieval well was located and, further E, garden soils dating to the 17th-20th centuries were truncated by brick foundations of a probable 19th c building fronting onto Davenant Street.

9.3 Gazetteer of the Known Archaeological Resource

Record ID	Description	Subject(s)	Period(s)	Relevant Sub-Sites
MLO3301	30-44 Walden Street, TQ 3470 8147, post-medieval terraced house; de-Listed.	Terraced House	Post-medieval	Fulbourne Street Ticket Hall Construction Site
MLO3719	Deal Street, TQ 3420 8199, the location of model dwellings designed by architect William Beck and built by the Metropolitan Association in 1845, to improve the dwelling of the industrious classes. Demolished in 1974.	Flats Model Dwelling	Post-medieval	Fulbourne Street Ticket Hall Construction Site
MLO3771	144-170 Whitechapel Road, TQ 3455 8172, location of a post-medieval terraced house, now de-Listed.	Terraced House	Post-medieval	Fulbourne Street Ticket Hall Construction Site
MLO3836	Old Montague Street, TQ 344 819, a pinkish-buff Roman two handled globular amphora was found in an unspecified area of this site in 1887.	Find spot	Roman	Fulbourne Street Ticket Hall Construction Site
MLO3929	Whitechapel, TQ 344 818, two horseshoes with keyhole shaped opening in the centre, were found at an unspecified location on this site; one was found in 1869.	Find spot	Medieval / Post-medieval	Fulbourne Street Ticket Hall Construction Site
MLO3941	Whitechapel Road (near London Hospital), TQ 3460 8180, a medieval Sieburg pot was dug up (15 feet deep) from an unspecified location on this site.	Find spot	Medieval	Fulbourne Street Ticket Hall Construction Site
MLO3956	Sidney Street, TQ 3502 8180, location of the house of Sir George Philpots, said to have been in the family by 1484.	Manor house	Medieval & Post-medieval	Cambridge Heath Road Shaft
MLO3961	Whitechapel Road, TQ 349 820, medieval mail armour was found prior to 1935.	Find spot	Medieval	Cambridge Heath Road Shaft
MLO3973	Whitechapel Road, TQ 349 820, medieval or post-medieval horseshoe found at this location at an unspecified date.	Find spot	Medieval & Post-medieval	Cambridge Heath Road Shaft
MLO3974	Whitechapel, TQ 344 817, a medieval course red-brown unglazed jug was found at an unspecified location in this site.	Find spot	Medieval	Fulbourne Street Ticket Hall Construction Site
MLO3985	Cambridge Heath Road, TQ 3488 8270, medieval and post-medieval road following a route from Mile End, Bethnal Green north to join the London to Cambridge road at Stamford Hill.	Road	Medieval and Post-medieval	Cambridge Heath Road Shaft
MLO4003	Mile End Road, TQ 3515 8200, location of Almshouses for 'twelve widows of the company'.	Almshouses	Medieval & Post-medieval	Cambridge Heath Road Shaft
MLO73481	3-11 Maples Place E1, TQ 3491 8191,a series of early 18th century pits were recorded, as were 60 sherds of residual post-medieval pottery, during an evaluation carried out by SAS (Site Code MAP98).	Occupation evidence	Post-medieval	Cambridge Heath Road Shaft
MLO73482	3-11 Maples Place E1, TQ 3491 8191, the remains of several Victorian buildings were recorded during an evaluation carried out by SAS (Site Code MAP98).	Building	Post-medieval	Cambridge Heath Road Shaft

Record ID	Description	Subject(s)	Period(s)	Relevant Sub-Sites
MLO7384	39-49 Walden Street, TQ 3472 8150, post-medieval terraced house.	Terraced House	Post-medieval	Fulbourne Street Ticket Hall Construction Site
MLO10365	Whitechapel, TQ 3403 8223, post-medieval ditch and bank from Whitechapel to Kingsland Roads.	Siegework	Post-medieval	Fulbourne Street Ticket Hall Construction Site
MLO10377	Shoreditch, TQ 3307 8213, the line of a post-medieval ditch and bank extended north to New River Head fort.	Siegework	Post-medieval	Fulbourne Street Ticket Hall Construction Site
MLO18323	Davenant Street, TQ 3440 8180, a 100m long excavation line (Site Code DAV77) failed to find the Roman road to Colchester. Post-medieval burials were found on the western side of the site (see MLO24982).	Negative evidence	Unknown	Fulbourne Street Ticket Hall Construction Site
MLO23055	Whitechapel Rd near London Hospital, TQ 3470 8170, an early medieval necklace made from blue glass beads was found in this area.	Find spot	Early medieval	Fulbourne Street Ticket Hall Construction Site
MLO24277	Deal Street, TQ 3423 8202, the location of model dwellings designed by architect William Beck and built by the Metropolitan Association *c.*1850, to improve the dwelling of the industrious classes. Demolished in 1974.	Flats Model Dwelling	Post-medieval	Fulbourne Street Ticket Hall Construction Site
MLO24982	Davenant Street, TQ 3440 8180, post-medieval burials were observed in a contractor's trench on the western side of the site during an excavation by ILAU in 1977 (Site Code DAV77). The burials are likely to have originated from a burial ground noted by Holmes in 1896 as being called the Workhouse burial ground whose entrance was in St Mary's Street. The workhouse was built in 1768 upon a former burial ground and a piece of land to he north, which was set aside for burials and consecrated in 1796. The workhouse site became the playground of the Davenant Schools prior to 1896. It eastern extent of the burial ground is unclear; early OS maps and some older plans suggest that the addition to the school has been built in the burial ground. In 1833 the size was given as 2776 square yards, but in 1832 it is stated that, 196 cholera cases were interred in an adjoining piece of land.	Cemetery	Post-medieval	Fulbourne Street Ticket Hall Construction Site
MLO25727	Old Montague Street, TQ 3438 8183, The location of a post-medieval burial ground and chapel, depicted on the A-Z of Regency London, north of the Whitechapel Burial Ground. Holmes noted in 1896 that this burial ground adjoined the chapel extending from Hanbury Street to Old Montague Street. This is also known as Mile End New Town burial ground; a school and other buildings were erected within it, and all that was left was a paved yard, about 250 square yards in size, west side of the chapel.	Cemetery	Post-medieval	Fulbourne Street Ticket Hall Construction Site
MLO25728	Vallance Road, TQ 3450 8190, the location of a Quaker burial ground. The burial ground in marked on the A-Z of Regency London, and noted by Holmes in 1896 as being called the Friends burial ground, covering an area of nearly one acre. It was acquired in 1687 by the Friends of Devonshire House Division and by 1896 had been turned into a public garden. It is now known as the Vallance Ground Recreational Ground.	Cemetery	Post-medieval	Fulbourne Street Ticket Hall Construction Site
MLO35401	144-170 Whitechapel Road, TQ 3455 8172, location of a post-medieval terraced house, now de-Listed.	House	Post-medieval	Fulbourne Street Ticket Hall Construction Site

Record ID	Description	Subject(s)	Period(s)	Relevant Sub-Sites
MLO57752	32 New Road, TQ 3457 8145, one of a group of five early 19th century houses; not Listed.	Terraced House	Post-medieval	Fulbourne Street Ticket Hall Construction Site
MLO61871	New Road, TQ 3456 8153, a large post-medieval ditch was recorded, on the suspected line of the Civil War defences, during an excavation by MoLAS (Site Code NRN94). Dating evidence recovered was comparable with a construction date of 1643. No rampart was located. A Civil War date is likely, but it would be more conclusive if a comparable section of ditch with traces of a rampart were found surviving nearby. Environmental sampling suggested that the ditch had silted up naturally until c.1780, and had then been deliberately infilled.	Ditch / Siegework	Post-medieval	Fulbourne Street Ticket Hall Construction Site
MLO61873	New Road, TQ 3456 8153, a northeast-southwest aligned row of postholes, probably representing a fence line was recorded during an excavation by MoLAS (Site Code NRN94). The fills were similar to a layer of silt which post-dated the consolidated of ditch (MLO61871), and dated by pottery to 1780-1900 and by two tobacco pipes *c.*1780-1820.	Fence line	Post-medieval	Fulbourne Street Ticket Hall Construction Site
MLO61875	New Road, TQ 3456 8153, a post-medieval gravel surface cut by several ruts and possibly associated with fence line (MLO61873) was recorded during excavation (Site Code NRN94).	Surface	Post-medieval	Fulbourne Street Ticket Hall Construction Site
MLO61876	New Road, TQ 3456 8153, undated north-south aligned linear feature, possibly a ditch. (Site Code NRN94).	Ditch	Unknown	Fulbourne Street Ticket Hall Construction Site
MLO63674	48-50 New Road London Medical College Newark Building, TQ 3456 8153,a major cut feature truncating the natural brickearthwas recorded during evaluation work by MoLAS (Site Code NRN92) and interpreted as the eastern edge of the Civil War ditch of 1642. The fill, contained mid 16th to 17th century pottery, indicated that it remained open for a long time before finally being levelled in the 19th century. The levelling material contained much late 18th century and early 19th century pottery.	Ditch	Post-medieval	Fulbourne Street Ticket Hall Construction Site
MLO63681	Selby Street (British Rail Coal Depot), TQ 3450 8210, features relating to the construction of the brick railway viaduct were recorded during an archaeological evaluation undertaken by MoLAS (Site Code SEL92)..	Viaduct	Post-medieval	Fulbourne Street Ticket Hall Construction Site
MLO63682	139-149 Whitechapel Road, TQ 3433 8167, a series of external dumps relating to the backyards or gardens of medieval properties fronting onto Whitechapel Road sealed waterlain deposits and natural sand. (Site Code WHD92).	Cultivation soil	Medieval	Fulbourne Street Ticket Hall Construction Site
MLO63683	139-149 Whitechapel Road, TQ 3433 8167, a post-medieval well was recorded in the north-eastern part of the site during a watching brief carried out by MoLAS (Site Code WHD92).	Well	Post-medieval	Fulbourne Street Ticket Hall Construction Site
MLO63684	139-149 Whitechapel Road, TQ 3433 8167, post-medieval garden soils of 17th–20th century were recorded as being truncated by the brick foundations of a probable 19th century building fronting onto Davenant St. (Site Code WHD92).	Cultivation soil	Post-medieval	Fulbourne Street Ticket Hall Construction Site
MLO64323	Albion Brewery, TQ 3484 8200, a 45m long section of 18th-19th century brick built sewer, referred to contemporary documents as the 'Common Sewer' was recorded during an archaeological evaluation undertaken by MoLAS (Site Code ABR93).	Sewer	Post-medieval	Cambridge Heath Road Shaft
MLO64337	Brady Street, TQ 3483 8188, late 17th century quarry pits were recorded during an	Quarry	Post-medieval	Fulbourne Street Ticket

Record ID	Description	Subject(s)	Period(s)	Relevant Sub-Sites
	archaeological evaluation (Site Code BSW94).			Hall Construction Site, Cambridge Heath Road Shaft
MLO64338	Brady Street, TQ 3483 8188, 19th century buildings were recorded truncating 18th century yards which sealed earlier quarry pits (Site Code BSW94).	Yard	Post-medieval	Fulbourne Street Ticket Hall Construction Site, Cambridge Heath Road Shaft
MLO67281	Brady Street, TQ 3473 8188, 'a number' of 18th and 19th century pits were recorded as having removed approximately 90% of the natural brickearth (Site Code BDY95). The surviving brickearth was cut by numerous plough or wheel rut marks, of probable 18th century date.	Occupation evidence	Post-medieval	Fulbourne Street Ticket Hall Construction Site
MLO67282	Brady Street, TQ 3473 8188, a post-medieval pond was recorded sealed by modern overburden. The pond appeared to have been constructed in the late 17th or mid 18th century and corresponds to the ditching pond shown on John Roque's Map. (Site Code BDY95).	Pond	Post-medieval	Fulbourne Street Ticket Hall Construction Site
MLO67466	Durward Street, TQ 3460 8192, a number of large rectangular features of post-medieval date, possibly related to horticultural activity, were recorded during an evaluation undertaken by MoLAS (Site Code DUR96). The remainder of the stratigraphy comprised 19th century or 20th century foundation walls and demolition dumping.	Structure	Post-medieval	Fulbourne Street Ticket Hall Construction Site
MLO69014	Brady Street E1, TQ 3460 8210, post-medieval cemetery covering approximately four acres. Closed to burials since 1858, it is crowded with tombstones and there are no longer proper pathways. Part of the site t is higher than the rest, the soil having been raised and the ground used a second time; this was known as the "strangers'" part.	Cemetery	Post-medieval	Fulbourne Street Ticket Hall Construction Site
MLO73477	3-11 Maples Place E1, TQ 3491 8191, a single sherd of Roman grey ware was recovered during an evaluation carried out by SAS (Site Code MAP98).	Find spot	Roman	Cambridge Heath Road Shaft
MLO73479	3-11 Maples Place E1, TQ 3491 8191, a possible Saxon loom weight made from Roman tile was recovered during an evaluation carried out by SAS (Site Code MAP98).	Find spot	Early medieval	Cambridge Heath Road Shaft
MLO73480	3-11 Maples Place E1, TQ 3491 8191, four sherds of medieval pottery were recovered during an evaluation carried out by SAS (Site Code MAP98).	Find spot	Medieval	Cambridge Heath Road Shaft
MLO75393	12-16 Greatorex Street, TQ 34250 81690, the fills of 15th –18th century quarry pits were recorded, during monitoring of geotechnical pits (Site Code OMT01). In one trial pit, a Tudor rubbish dump was encountered. The natural brickearthwas encountered at 9.8m - 11m OD.	Quarry	Post-medieval	Fulbourne Street Ticket Hall Construction Site
MLO75409	The Royal London Hospital Pathology and pharmacy building, TQ 34750 81750, post-medieval dump deposits, the upper layers of which were truncated by pitting, were recorded during a watching brief (Site Code NWK01). The dump deposits sealed a layer of dirty gravel, which may have been a surface; this overlaid a layer of weathered brickearth containing clay pipe dated *c.*1580, which sealed clean brickearth.	Dump & pit	Post-medieval	Fulbourne Street Ticket Hall Construction Site

Record ID	Description	Subject(s)	Period(s)	Relevant Sub-Sites
MLO75418	Queen Mary's New School of Medicine and Dentistry, TQ 34620 81520, A large northwest-southeast aligned post-medieval ditch was recorded in the southern half of the site, during evaluation work (Site Code QMY02). This ditch may be the same feature as recorded in NRN92 due to the similar orientation as the Civil War defences visible on Vertue's plan of *c.*1703. However, the lack of stratified 17th century material makes it difficult to attribute the ditch to the Civil War period. Much of the rest of the site had been deeply disturbed severely truncating the archaeology.	Ditch	Post-medieval	Fulbourne Street Ticket Hall Construction Site
MLO75781	40-46 Fieldgate Street E1, TQ 3435 8155, a 19th or 20th century basement truncated the natural brickearthand 3 rubbish pits of 18th century date. These were recorded during archaeological evaluation (Site Code FIG01) and were probably associated with terraced building built on Fieldgate Street between 1755 and 1819.	Occupation evidence	Post-medieval	Fulbourne Street Ticket Hall Construction Site
MLO76258	319-329 Whitechapel Rd, TQ 34830 81896, the entire frontage with Whitechapel Road, except the eastern end, had been cellared below ground surface for at least 10m from the current pavement. Although constructed in the 19th century, the backfill contained modern material. Natural gravels were observed beneath the cellar floors. Along the eastern side of the site, 20th century concrete footings had truncated the site. (Site Code WCA03).	Negative evidence	Unknown	Fulbourne Street Ticket Hall Construction Site, Cambridge Heath Road Shaft
MLO78231	The Front Green Royal London Hospital, TQ 3475 8161, post-medieval deposits comprising ashy fill deposits were recorded below the cellars of former terrace houses facing Whitechapel Road. These extensive fill deposits may indicate quarrying, took place after a successful petition to flatten the Mount fort by the hospital authorities at the end of the 18th century. No evidence of a former burial ground on the site, disturbed graves or disarticulated human bone was recorded. A rise in the ground level to a metre above that of the surrounding Whitechapel and New Roads indicates a topographic replacement of the Mount as an elevated feature. (Site Code RLO03).	Quarry	Unknown to Post-medieval	Fulbourne Street Ticket Hall Construction Site
MLO98022	The Royal London Hospital Whitechapel Road E1, TQ 34743 81695, post-medieval burial deposits comprising disarticulated human remains outside the limits of a known 18th –19th century walled burial ground. In situ articulated remains may be evidence of an earlier burial ground attached to an early phase of the hospital; these remains were not excavated. Natural deposits were encountered between 10.05m and 10.35m AOD.	Cemetery	Post-medieval	Fulbourne Street Ticket Hall Construction Site
MLO98043	Royal London Hospital, TQ 34697 81635, an archaeological watching brief was carried out by MoLAS (Site Code RLP05), evidence positive or negative is unspecified.	Unspecified intervention	Unknown	Fulbourne Street Ticket Hall Construction Site
MLO98098	Buckhurst Street [Saint Bartholomew's Gardens] Tower Hamlets E1, TQ 34940 82213, the possible location of the burial ground attached to St Bartholomew's church. Archaeological evaluation by MoLAS (Site Code BGZ05) proved that the burial ground did not extend into the site. Archaeological deposits recorded were likely to be post WWII.	Negative evidence	Post-medieval	Cambridge Heath Road Shaft
MLO98341	179-181 Whitechapel Road (The Davenant Centre) EC1, TQ 34415 81737, a post-medieval cemetery was recorded during a watching brief carried out by MoLAS in 2005-6 (Site Code WRA05). A graveyard soil containing disarticulated human bone was recorded across the site. The site was in the basement of the Davenant Centre and its external grounds. The centre was built in 1818 and was originally the Davenant School, replacing an earlier building of 1681.	Cemetery	Post-medieval	Fulbourne Street Ticket Hall Construction Site

Record ID	Description	Subject(s)	Period(s)	Relevant Sub-Sites
	The 1874 edition ordnance survey map shows a burial ground extending under the courtyard and the rear block of the existing building. The denisty of burials in parts of the site very high with many graves being disturbed or truncated by later burials and the foundations of the 1818 building. There was a distinct lack of coffins, possibly indicating their social status.			
MLO 082267	During the Great Plague of 1665 the parish of St Dunstan's Stepney Green acquired c 1.25 acres of waste on the north side of Whitechapel road near Stonebridge for use as an emergency burial ground. Its location was recorded by Sit Christopher wren in 1673. Basil Holmes locates it on the north side of Mile End Road, south of the junction of Lisburn and Collingwood Streets, *which could place it within the possible Cambridge Heath Road Ticket Hall or the Siansbury's Carpark Worksite.*	Cemetery	Post-medieval	Cambridge Heath Road Shaft

9.4 Construction and Construction Process Report

12 Construction and Construction Process Report

12.1 Introduction

12.1.1 This report draws together the information relating to the construction of Whitechapel Station including Construction, Methodology and Sequence, Advanced Works, Enabling Works and Contractors worksites.

12.1.2 Each of these topics has been divided into the four geographic work areas that make up Whitechapel Station namely Cambridge Heath Shaft (and Draught Relief shaft), the Durward Street Shafts, Fulbourne Street Ticket Hall and the tunnel works to be constructed from the Sainsbury's Car Park worksite.

12.1.3 Details of construction risks, the extents of demolition, lorry histograms, Environmental Impacts, Plant schedules and the Construction Programme are addressed in other Sections of this Scheme Design Submission.

12.2 Methodology and Sequence

12.2.1 Station Draught Relief Shaft

To enable the earliest possible access for construction of the platform tunnels this shaft will be excavated after the installation of the diaphragm walls but prior to excavation of Cambridge Heath shaft.

At the location of the Draught Relief shaft the top of the London Clay is some 8m to 9m below ground level, and overlain by made ground and potentially water bearing river Terrace Gravels. The upper shaft will therefore be constructed using concrete segment linings excavated by the traditional method of a wet caisson or by dewatering and underpinning to a cut off in the London Clay and then underpinning to final depth. The lower section of the shaft is then to be constructed using SCL methods to facilitate the breakouts for the access adits to the platform tunnels.

12.2.2 Cambridge Heath Shaft

Cambridge Heath Shaft will be constructed from a series of diaphragm wall panels providing both temporary and permanent ground support. Given the depth of the panels they will need to be constructed to a high degree of verticality. To ensure the stability of the panels as they are excavated the use of a bentonite slurry or other suitable drilling polymer will be required.

On completion of the diaphragm walls the shaft will be excavated to full depth using excavators loading into skips for lifting to the surface using a tower crane.

The base slab for the shaft is located at or very close to the interface between the London Clay and Lambeth group. At this depth it is not envisaged that any dewatering will be required for excavation; however as a precaution depressurisation of the lower strata through the use of bleed wells will be required to ensure that failure of the ground at the base of the shaft does not occur. For further details of depressurisation requirements please refer to section 10.2.4.

The escape passage and ventilation tunnels will be constructed either from the station tunnels or from the base of the shaft depending on access, programme and worksite constraints. To ensure stability of the shaft the permanent lining to the shaft at low level will need to be completed prior to the breaking out of the diaphragm walls for these connections.

Construction of the shaft will be carried out in the following sequence:

1. Complete advance utility diversion works and demolition of the existing buildings on the site;
2. Once the worksite has been established (see drawings P30103-C1M14-C00-D-50231 and 232) a guide wall will be constructed for the installation of the diaphragm wall panels. Each diaphragm wall panel will be excavated using a hydrofraise type rig, with bentonite slurry or other suitable drilling polymer being used to maintain stability;
3. Excavate shaft to underside of ground floor ring beam level, 110.6m ATD. Breakdown top of wall and construct ring beam and capping beam to shaft walls (see drawing P30103-C1M14-C00-D-50281 for construction sequence);
4. Working from ground level excavate shaft to approximately 106.0m ATD and construct in-situ concrete waling beam as detailed on structural drawings. Following adequate curing repeat the above sequence to shaft levels 101.0m, 96.0m and 91.0m ATD;
5. Excavate to level 87.950m ATD and then 84.950 and install temporary ring beam to support shaft;
6. Excavate to underside of base slab, level 81.0m ATD and for sump;
7. Construct sump, base slab to shaft and ring beams to shaft openings, installing waterproof membranes as detailed on design drawings;
8. Working back up the shaft construct internal walls and intermediate slabs in in-situ concrete;
9. Construct the ground floor slab 113.0m ATD and above shaft structure;
10. Commence Builders Work including cavity walls to shaft, M&E installations and Fit Out.

12.2.3 Durward Street and West Stair shafts

The two shafts at Durward Street are located either side of the ELL which in turn is located within a 9m deep cutting. When this is combined with the very limited worksites available and constraints that will be imposed due to the close proximity of Swanlea School, the Whitechapel Sports Centre and NESRS the construction of these shafts will offer a major challenge. In order to increase the available work area, comply with the Crossrail Commitments / Compliance Register and provide protection to the railway it is first proposed that a substantial combined crash deck / working platform is erected over the

railway. Due to the heavy loads that will need to be carried and for ease of erection / dismantling over the railway this deck will need to be of steel construction and will need to be founded on piles. These piles along with the restraints necessary to ensure the stability of the existing retaining walls when constructing the shafts are being installed as part of an enabling works package agreed to be carried out as part of the ELL upgrade works, see section 12.4.

Figure 12-1-ELL Cutting at Intermediate Concourse Location

Durward Street Shaft

The Durward Street shaft (DSS) will be constructed from a series of diaphragm wall panels providing both temporary and permanent ground support. Given the depth of the panels they will need to be constructed to a high degree of verticality. To ensure the stability of the panels as they are excavated the use of either a bentonite slurry or other suitable drilling polymer will be required. Due to its location the wall of the shaft closest to the ELL cannot be installed until the existing retaining wall and its foundations have been removed.

The shaft will be excavated using excavators loading into skips for lifting to the surface using a tower crane. As the excavation is progressed the walls will be propped at appropriate levels using a combination of permanent steel and insitu concrete waling beams and struts as shown on the design drawings.

The base slab for the shaft is located close to the interface between the London Clay and Lambeth group. At this depth it is not envisaged that any dewatering will be required for excavation; however as a precaution depressurisation of the lower strata through the use of bleed wells will be required to ensure that failure of the ground at the base of the shaft does not occur. For further details of depressurisation requirements please refer to section 10.2.4.

The escape passage and ventilation tunnels will be constructed either from the station tunnels or from the base of the shaft depending on access, programme and worksite constraints. To ensure stability of the shaft the permanent lining to the shaft at low level will need to be completed prior to the breaking out of the diaphragm walls for these connections.

Due to the restricted nature of the site, excavation of the shaft box will be carried out by ‘semi top-down’ methods. A number of tension and plunge column piles will be installed within the box, together with steel columns up to surface level to counter uplift and provide a means of support for the intermediate slabs during top down construction and in the final arrangement.

Construction of the shaft will be carried out in the following sequence:

1. Remove / Divert any cables from existing retaining wall not previously replaced / relocated as part of the ELL upgrade works;
2. Clear any obstructions and install diaphragm walls for the three sides of the shaft remote from the ELL retaining wall. This work will be carried out from the worksite (see drawings P30103-C1M14-C00-D-50361 and 362) in the grounds of Swanlea school;
3. Break down diaphragm wall panels and cast capping beams;
4. Install tension piles and install plunge columns for shaft;
5. Excavate behind the existing retaining wall down to ELL level, leaving a berm or providing suitable propping to support the rear wall, demolish the brick retaining wall and its foundations and construct guide walls for remaining diaphragm wall panels;
6. Lower rig into excavation and construct diaphragm wall adjacent to the platform on the line of the demolished retaining wall. Because of the proximity to the railway, this work will have to be carried out in a highly controlled manner. Temporary closure of the platform will not be necessary as the trains stop short of this location. Further protection during construction and to facilitate the use of a crane to service the construction will be provided by the crash deck erected over the tracks;
7. Break out the top of the diaphragm wall and construct the new ELL facing wall back up to street level;
8. Excavate the shaft from within the diaphragm walls, constructing the intermediate in-situ concrete waling beams and props at the appropriate levels to provide support to the walls. Additional stiffening (by internal beams) of the diaphragm walls will be required for structural stability in the locality of any openings within each of the intermediate slabs and at the openings for the escalator shaft;
9. Suspend excavation at formation level 99.3m ATD to excavate ELL underpass;
10. Following excavation of underpass resume excavation and construction of remaining intermediate waling beams and struts to final formation of base slab and sump;
11. Construct sump, base slab to shaft and ring beams to shaft openings;
12. Working back up the shaft construct internal walls and intermediate slabs in in-situ concrete;

In order to provide a construction phase layout which can later be incorporated into the permanent works, there is a three phase construction requirement for the insitu slabs, walers and struts at levels 1 to 3. At these levels, the headroom requirements do not allow a downstand beam through the stair landings.

a. The 1000mm thick slab (between gridlines 2 & 3) and the 600mm thick slab (between gridlines I & L) will be cast on the ground during the top-down construction. The walers and horizontal struts are then installed; including an extra strut across the central stair void between gridlines E & F;

b. Following excavation of the shaft and during bottom-up construction, the remaining 600mm thick slab is cast with 400mm deep downstand beams around the struts, except for the central stair landing slab at grid E;

c. The strut on gridline E is cut out through the central stair landing. The 600mm thick slab is cast here and then the final strut through the stair between gridlines E & F is removed.

13. Following completion of the lining to basement level -3 excavate the ventilation adits and escape passages connecting the shaft box to the platform tunnels;
14. Following completion of the escalator upper chamber break through wall and construct escalator shaft and lower circulation chamber to the platforms as described in Volume 8;
15. Construct the ground floor slab 112.35m ATD and above shaft structure, and;
16. Commence builders work, M&E works and internal fit out.

This sequence of construction is shown on drawings P30103-C1M14-C00-D-50381 to 383.

The proposals for the semi top down sequence, showing the areas where voids will be left in the slabs to allow further excavation, are attached in Appendix L.

West Stair Shaft

The West Stair shaft will be constructed from a series of secant piled walls providing both temporary and permanent ground support. Given the depth of the walls they will need to be constructed to a high degree of verticality. With the increase in depth of piles to accommodate the ventilation plenum they will need to be excavated with the use of either a bentonite slurry or other suitable drilling polymer. Due to its location the piled wall of the shaft closest to the ELL cannot be installed until the existing retaining wall has been removed.

Due to the restricted nature of the site excavation of the shaft box will be carried out by ‘semi top-down’ methods. The shaft will be excavated using a mini excavator loading into skips for lifting to the surface using a support crane. As the excavation is progressed the piles will be propped at appropriate levels using a combination of permanent steel waler beams and struts.

Following initial site establishment, works construction will be carried out in the following sequence:

1. Remove or divert cables currently running along the existing ELL retaining wall (if not already carried out as part of ELL advance works).
2. Working from within the area of the sports centre car park, pile the three sides of the shaft remote from the platform edge and temporary anchor piles for propping;
3. Break down piles and cast capping beams;
4. Excavate behind the existing retaining wall down to ELL level, providing suitable propping to support the rear wall, demolish the brick retaining wall and its foundations and construct guide walls for remaining piles;
5. Working from deck above ELL, pile wall on the line of the demolished retaining wall;
6. Break out the top of the piles and construct the new facing wall back up to street level;
7. Excavate the shaft to final formation of base slab and sump, constructing the intermediate steel waler beams and props at the appropriate levels to provide support to the walls;
8. Cast base slab and sump and ring beams to openings for ELL Underpass and District Line Link tunnel;
9. Excavate ELL underpass and District Line Link tunnel;
10. Construct remaining internal structure including MIP lift shaft and street level roof slab;
11. Waterproof structure, backfill and Reinstate Sports Centre car park, and;
12. Commence builders work, M&E works and internal fit out.

This sequence of construction is shown on drawings P30103-C1M14-C00-D-50381 to 383.

East London Line Underpass

The ELL underpass is to be formed as a cut and cover box between piled walls. To minimise the impact of this construction on the operation of the ELL the Installation of the piles and construction of the roof slab for the underpass is to be undertaken as part of an advanced works package by the ELL upgrade project. This will allow the excavation and construction of the base slab for the passage to be undertaken whilst trains are running on the line above.

The passageway will be excavated from Durward Street shaft as soon as the shaft has been excavated to the appropriate level. The construction sequence being as follows:

1. Break out diaphragm wall to Durward Street shaft for access to passage;
2. Excavate passage, transporting material back to Durward Street shaft for hoisting to surface, and blinding floor of excavation as work progresses. Break out piles to West Stair shaft;
3. Install reinforcement and cast base slab then skin walls to passage; and;
4. Builders Work, M&E installations and internal fit out to be completed concurrently with fit out of shafts

12.2.4 Fulbourne Street Ticket Hall

In order to maintain train services at Whitechapel Station during construction of the new Fulbourne Street Ticket Hall will be carried out in two stages:

- Stage 1 will consist of construction of the western end of the new ticket hall between Fulbourne Street and Woods Building's footbridge including the new link to Durward Street.
- Stage 2 will consist of construction of the eastern end of the new ticket hall from Woods Building's footbridge up to, and including the ELL connections.

During Stage 1 public access to the District Line platforms will be maintained via the existing Whitechapel Station ticket hall, staircases and subways.

Stage 2 will not commence until the Stage 1 section of the new Fulbourne Street Ticket Hall and pedestrian link to Durward Street have been commissioned and opened to the public. This will provide alternative access to the District Line and ELL enabling the closure of the existing District Line footbridge and subways to construct the eastern section of the new ticket hall. Access to the ELL from the existing Whitechapel ticket hall will be maintained at all times.

Fulbourne Street Ticket Hall Stage 1 Construction

1. Piled foundations and Cut and Cover Box Construction

   Installation of the piles for the new ticket hall cannot commence until all of the existing structures above the railway in the area of new construction, including the platform canopies, have been demolished and where required their foundations removed. Due to the size of pile required for the piled foundations for the ticket hall deck and cut and cover box it will be necessary to utilise a full size CFA type rig working off the central platform. This rig and any support cranes will have to be lifted down onto the platform in sections from the site in Durward Street during night time possessions and then re-assembled within the platform worksite. Similarly all subsidiary plant and materials will be craned in during night time possession periods, with piling being carried out during normal hours wherever possible.

   Following completion of piling, the main escalator box down to Crossrail interchange level will be excavated and concrete lined working bottom up. For this work excavated material may be removed by crane up to a temporary deck located above the District Line eastbound track as shown on drawing P30103-C1M14-C00-D-50631 and then to the site in Durward Street. Subject to a structural assessment it is proposed that the first span of the Booking–On Centre is retained and strengthened to form this deck. Cranage for lifting props and other materials may be provided by a small gantry crane running the length of the box along the line of the piles or a small mobile crane sited at platform level.

2. District Line Link Tunnel

   Working from Fulbourne Street box the connection to West Stair box will be excavated and lined using SCL methods. Due to the limited clay cover, ground stabilisation will be required to the Thames Gravels above this tunnel. This ground treatment will primarily be carried out from the station boxes at either end of the passage with additional treatment if required from the worksite in Durward Street or tunnel face.

   Settlement analysis will determine whether any protective measures will be required to the Sports Hall and No.6 Durward Street whilst carrying out the tunnelling work in view of the relatively low cover.

   Removal of excavated materials and cranage for the delivery of materials for the tunnelling work will be the same as for construction of the Interchange cut and cover box.

3. Ticket Hall Deck Construction

   Following completion of the tunnelling, the western section of the ticket hall deck and new Fulbourne Street bridge will be constructed along with the western lift shaft and escalators down to platform level.

   The columns to support the deck will be constructed in steel on the previously installed pile-caps. Precast planks spanning between the top flanges of steel crossbeams to the columns will be used as permanent formwork for the deck. Installation of the remaining elements of the frame, the tie beams and roof frames will continue until all the steelwork is complete. The steel columns and crossbeams will then be encased in concrete and the insitu concrete slab topping to the ticket hall deck cast.

   Due to the limited clearance above the railway, steel beams will be required for construction of the new Fulbourne Street Bridge. Permanent formwork will be laid between the lower flanges of these beams to allow concreting of the deck to take place. The remaining ground bearing slab forming the platform can then be completed. This method will allow construction to be carried out in the shortest possible time and minimise disruption to the operation of the railway. Installation of the pre-cast elements / steel beams will be carried out during a series of night-time possessions utilising a mobile crane positioned in the worksite in Durward Street.

4. Fulbourne Street Ticket Hall, Plant Rooms & Ticket Hall Canopy

   These will be constructed above the ticket hall deck using fabricated secondary steel members with appropriate cladding systems.

   As soon as the ticket hall structure has been made watertight; builders work, M&E fit out including the installation of the lifts and escalators down to platform and Interchange levels and the completion of architectural finishes to the new station facilities will commence.

   Following site establishment and completion of enabling works detailed in Section 12.4, Stage 1 construction will be carried out in the following sequence:

   1. Working from the District Line platform remove obstructions and install the piles for the interchange level box as far as Wood's Building footbridge and foundation piles for the ticket hall slab and Western escape core;

2. Break down piles and cast capping beams;
3. Install temporary props at platform level and excavate box down to full depth, providing intermediate temporary waling beams and propping as necessary;
4. Cast base slab and sump followed by skin walls and intermediate slabs and install permanent props as shown on structural drawings, removing temporary props as work progresses;
5. Excavate and line Interchange link tunnel to Durward Street;
6. Concurrently with excavation of the Interchange box, excavate for pile caps for columns and escape core, break down piles and construct pile caps. Construct columns and escape core;
7. Working from west to east construct new Fulbourne Street bridge and ticket hall slab;
8. Following on behind slab commence erection of ticket hall canopy and new station facilities and plant rooms;
9. Commence builders work, M&E works and internal fit out.
10. Test and commission new ticket hall. Open new ticket hall and new link to the ELL at Durward Street

Fulbourne Street Ticket Hall Stage 2 (ELL Pedestrian Over-bridge & Access Routes)

1. Piling Works

Completion of the piling at the east end of the new District line platform cannot commence until the footbridge from the existing station ticket hall has been removed and backfilling of the existing subways to the ELL has been completed. A full size piling rig suitable for installing cased piles will be required to carry out the piling work. This requirement is due partly to the size of piles that will need to be installed and also to the need to install a number of piles through the backfilled subways. Servicing of these works will be carried out from the Durward Street worksite as for the stage 1 Works. Possession working will be required to install a number of the piles due to the close proximity to both the District Line and ELL which will prevent a method being adopted that will allow the work to be undertaken without disruption to one or other of these lines.

For the 600mm diameter piles for the access works to the southbound ELL platform (beyond the end of the District line platforms) a low headroom Klemm type rig will be used. This rig will need to be lifted in from the car park of Kempton Court during a night time closure. This type of rig is required due to the close proximity of this work to the eastbound District line track and restricted workspace available to carry out these works. Servicing of these works will be from the Durward Street worksite and across disused District Line bridge No. D124.

2. Escalator & Staircase Boxes

Following completion of piling the ELL access boxes will be excavated and concrete lined working bottom up. For this work excavated material may be removed by conveyor up to the eastern end of the completed ticket hall deck and then over the tracks to the site in Durward Street. Cranage for lifting props, materials and shuttering may be provided by small mobile cranes sited at platform / track level.

As for the piling works access to the eastern box will be across disused bridge No. D124. Therefore, to maintain access to these works they will need to be completed prior to excavation and lining of the western box.

3. Bridge D124 removal and construction of ELL Platform Openings

Construction of the ELL platform openings will not commence until the two escalator and staircase boxes have been fully excavated and lined. This is to limit any impact on the operation of the ELL platforms from the erection of hoardings. Also, due to the limited clearance between the top of the openings and underside of the existing bridge this work cannot commence until the disused rail bridge No. D124 has been removed. Due to its size and weight the removal of this bridge will not be possible as a single unit but will require staged removal. Two possible methods are possible for this work:

- The setting up of a large mobile crane in the car park of Kempton Court for the lifting out of the bridge in sections and subsequent transport of the bridge away from the work area by road, or;
- The use of a track mounted crane to lift out the bridge in sections and its subsequent removal by either rail or road.

The method chosen will ultimately be down to the contractor's preference and the availability of suitable worksites, plant and engineering trains to carry out the work. It will also have to be based on the geometry of local access routes and the need to avoid worsening, where possible, the loss of private parking facilities within the car park of Kempton Court. A weekend closure of both the District Line and ELL line will be required to carry out this work.

Following bridge removal, hoardings will be set up on the ELL platforms and the new platform openings formed by effectively cutting deep slots in the two retaining walls. To minimise any noise and dust impacts on the operation of the railway removal of the brickwork will, as far as possible, be by a combination of core drilling and wire sawing. This should ensure that this work can primarily carried out during normal daytime hours with removal of material at night.

4. New Pedestrian Footbridge & Completion of Ticket Hall Deck

Following completion of the platform openings the new pedestrian footbridge over the ELL will be installed. For this bridge it is proposed to use the existing retaining walls as supports. These will be broken down to a suitable level to enable the construction of new abutment pad stones and the installation of either reinforced concrete or structural steel cill beams above the new platform openings. The ends of the main girders for the new footbridge will bear onto line rocker bearings that will subsequently bear onto these cill beams. As for removal of bridge D124 a large

mobile crane will need to be set up in the car park of Kempton Court for the installation of the new bridge.

Following installation of the bridge construction the ticket hall slab and canopy will be completed as described in “Fulbourne Street Tickte Hall Stage 1 Construction” including the installation of a new link to the existing Whitechapel station ticket hall and fitting out. Again the completion of this work will require access to the car park of Kempton Court for a large mobile crane.

Following site establishment and completion of enabling works detailed in Section 12.4, Stage 2 construction will be carried out in the following sequence:

1. Working from the District Line platform and across bridge D124 install piles for the eastern ELL access box;
2. Break down piles and cast capping beam;
3. Install temporary props at District Line level and excavate eastern box down to full depth, providing intermediate temporary waling beams and propping as necessary;
4. Cast base slab and sump followed by skin walls, and internal structure;
5. Working from the District Line platform install piles for the western ELL access box;
6. Break down piles and cast capping beam;
7. Install temporary props at District Line level and excavate western box down to full depth, providing intermediate temporary waling beams and propping as necessary;
8. Cast base slab and sump followed by skin walls, and internal structure;
9. Working from west to east construct remainder of ticket hall slab, install new footbridge across the ELL and new link to existing Whitechapel ticket hall;
10. Following on behind slab and bridges complete erection of ticket hall canopy and construct any remaining new station facilities and plant rooms;
11. Complete builders work, M&E works and internal fit out to eastern end of structure;
12. Test and commission and open new links to the ELL and original ticket hall.

A significant part of these works will need to be carried out at nights and week-ends and will require access to a large area of the car park of Kempton Court for lifting operations. This will have significant environmental impacts on the residents of both Kempton Court and No. 6 Durward Street which will need to be considered in detail as the design and programme of works are further developed.

12.2.5 Subsurface Works

The subsurface works consists of construction of all of the below ground passages, namely the platform tunnels, TBM launch and reception chambers, station cross-passages, ventilation tunnels and escalator shaft including machine chamber.

As a general principle all of these works are to be constructed using sprayed concrete lining (SCL) tunnelling methods with permanent secondary linings of in-situ concrete in public areas and sprayed concrete in non public areas.

Details of construction of these tunnels are given in Volume 8 Sections 6.7 to 6.11

12.3 Advanced Works Requirements

It is understood that the definition for Advance Works is those Enabling Works that need to be undertaken ahead of the main construction contracts solely because of programme constraints/drivers.

On this basis the following activities are currently understood as needing to be carried out as Advance Works:

1. All Utility Diversions including relocation of domestic services Swanlea School, relocation of the sub-station in the school grounds, relocation of domestic services Whitechapel Sports Centre and removal of the Fulbourne Street 22kv cable bridge;
2. New access and protective measures to the NESRS;
3. Environmental protective measures (noise, dust etc), removal of entrance canopy, demolition of caretakers accommodation and the construction of alternative access routes to Swanlea School;
4. Relocation of emergency escape routes, utility diversions and dismantling of high-level walkway from Whitechapel Sports Centre;
5. Enabling works to ELL for the shafts at Durward Street (Piling, pilecaps, removal and relocation of a number of railway services and construction of the new ELL underpass roof);
6. Construction of the District Line West Ham Turn-back facility and plain lining through Whitechapel Station;
7. Relocation of railway related services from structures to be demolished Whitechapel Station;
8. Planning for and first phase of demolition of structures over the existing Whitechapel Station.

A detailed description of these works is included in Section 12.4. The co-ordination and management of these works is currently being undertaken by EWMA with the exception of Advance works to the ELL which will be undertaken by the ELL project during the planned closure of the line in 2008.

The scoping documents currently being prepared are as summarised in Table 12-1.

Ref	Title	Document Number
WHI1	District Line Utilities	CR-SD-WHI-TP-SP-00003
WHI2 a	Durward Street Shaft - Dismantling, removal and storage of Swanlea School glass canopy	CR-SD-WHI-TP-SP-00004
WHI2 b	Durward Street Shaft - Demolishing Caretakers House and Storage Buildings	CR-SD-WHI-TP-SP-00005
WHI2 c	Durward Street Shaft - Rebuilding of the alternative housing for Caretakers and Reconstruction of the Storage Buildings	CR-SD-WHI-TP-SP-00006
WHI2 d	Durward Street Shaft - Diverting services within Swanlea school courtyard	CR-SD-WHI-TP-SP-00007
WHI2 e	Durward Street Shaft - Relocate EDF substation within Swanlea School courtyard	CR-SD-WHI-TP-SP-00008
WHI2 f	Durward Street Shaft - Sound insulating of Swanlea School	CR-SD-WHI-TP-SP-00009
WHI3 a	West Stair Shaft - Demolishing Sports Centre storage facility	CR-SD-WHI-TP-SP-00010
WHI3 b	West Stair Shaft - Dismantling of the Sports Centre high level walkway	CR-SD-WHI-TP-SP-00011
WHI3 c	West Stair Shaft - Divert utilities in the Sports Centre car park	CR-SD-WHI-TP-SP-00012
WHI3 d	West Stair Shaft - Relocation of fire escapes on Sports Centre	CR-SD-WHI-TP-SP-00013
WHI5 a	Cambridge Heath Road Shaft - Diverting services in Sainsbury's car park	CR-SD-WHI-TP-SP-00014
WHI5 b	Cambridge Heath Road Shaft - Potentially strengthening the Albion Brewery basement	CR-SD-WHI-TP-SP-00015
WHI6	Strengthening Bridges (Winthrop and Durward Street)	CR-SD-WHI-TP-SP-00016
WHI8	Stabilisation Work to Well adjacent to Covered Way 126	CR-SD-WHI-TP-SP-00017
WHI9 a	Whitechapel Station - Diversions of services in footway north of Station North Wall in Durward Street	CR-SD-WHI-TP-SP-00018
WHI9 b	Whitechapel Station - Temporary diversion of EDF 22KV circuits from Cable Bridge along Durward St.and then south over Wood's Building to reconnect in Whitechapel Road.	CR-SD-WHI-TP-SP-00019
WHI10	Environmental Deliverables	CR-SD-WHI-EN-SP-00001

Table 12-1 – Summary of Detailed Design Advanced Works scopes

12.4 Enabling Works Requirements

12.4.1 This section details the scope of enabling works required for the construction of Whitechapel Station with the exception of Utility diversions (Surface and Rail) which are covered in Section 10.3.13 and 10.3.14 and Settlement Mitigation which is covered in Sections 10.2.14, 10.2.16 and 10.2.17.

Cambridge Heath Shaft and Tunnelling Worksite

There are no significant Enabling Works activities required for construction of the Cambridge Heath Shaft. Minor enabling works in order to establish the worksite for both Cambridge Heath and the tunnelling works will include demolition of an existing boundary retaining wall, possible strengthening works to the basement of the Albion brewery and the diversion of local services and partial dismantling of the car park canopy to Sainsbury's Superstore.

A detailed scoping document for the design of the strengthening works to the Albion Brewery Basement is currently being prepared. The detailed scope for the remainder of the works will be defined during detailed design once the necessary Surveys and detailed discussions with the property owners have been undertaken.

Durward Street and West Stair shafts

Due to the location of these shafts in close proximity to Swanlea School, Whitechapel Sports Centre, the ELL and the NESRS a significant number of major enabling works are required to be undertaken. To ensure that the overall programme for Whitechapel station is achieved the majority of these works will need to be undertaken as part of the Advanced Works scope.

- Enabling Works to Swanlea School

Installation of the Diaphragm walls for the Durward Street shaft needs to be undertaken within 3m of the main school building and requires existing access routes to the school to be rearranged, and a section of the glass canopy of the school, including its foundations to be removed. Further, in order to comply with the Crossrail Commitments and to ensure that the Crossrail works can be undertaken during daytime it will be necessary to undertake a detailed noise assessment of the school building and provide significant noise screening. To achieve the required level of noise mitigation the walls to the building may need to be reconstructed.

It will only be possible to carry out the detailed surveys necessary to determine the full extent of these works and then undertake the necessary modifications to the school during school holiday periods. These are very limited and hence make these works one of the most critical to be undertaken as part of the Crossrail Programme.

Furthermore, in order to construct the shaft and provide space for a worksite in front of the school it will be necessary to demolish the school caretaker's house and adjacent stores building, relocate utilities to the school, and reposition an existing EDF sub-station in the school grounds will require relocation. A proposed alternative location for the sub-station and stores building has been identified within the school grounds.

Noise mitigation measures to the school will need to be undertaken prior to these works commencing.

Scoping documents for the detailed design of these works are currently being prepared.

- Enabling Works to the ELL

Enabling works that need to be undertaken on the ELL prior to the construction of the shafts at Durward Street include the removal of any utilities from the existing retaining walls and associated cabinets remaining following completion of the ELL upgrade works, the installation of piled foundations and the combined crash / working platform between Durward Street and covered way CW126, installation of stabilisation works to the sections of existing retaining wall not being demolished by the Crossrail works and the piles and roof slab of the new subway below the ELL platforms and tracks.

In order to minimise any disruption to the operation of the ELL following re-opening after upgrading, and gain maximum programme advantage, these works with the exception of the design and installation of the crash deck are currently being undertaken by the ELL Project Team during their planned closure. In addition discussions are currently ongoing with the ELL project team to agree modifications to their track slab design to take account of predicted settlements from the Crossrail works and to agree revised cable routings through the platform area to minimise any requirement to alter cable routes when forming the new platform openings as part of the Fulbourne Street ticket hall works.

A key requirement of the crash deck is that it will need to be designed such that it incorporates a combined interchange stair and escape route from the north end of ELL to replace one that is being installed as part of the current upgrading works.

- Enabling Works to Whitechapel Sports Centre

Possession of the car park and the single storey storage facility adjacent to Whitechapel Sports Centre will be required for the construction of the West Stair shaft. Enabling works that are required to be undertaken for this include the relocation of two fire escapes from the building, diversion of the utilities serving the building as these are currently located within the car park area and demolition of the storage facility. Further, as it will be necessary to undertake piling works within a metre of the building a walkway at high level giving access to the roof of the building will need to be temporarily dismantled and stored until the piling works have been completed. The detailed scope for these works will be defined during detailed design once the necessary surveys and detailed discussions with the property owners have been undertaken.

Scoping documents for the detailed design of these works are currently being prepared.

- NESRS

This major Thames Water storm sewer runs beneath both Swanlea School and Kempton Court flats and is located within a few metres of the DSS and escalator. The sewer is greater than three metres in diameter, of cast iron construction with a concrete lining and is known to surcharge quickly during rainstorms. Large ground movements adjacent to the sewer are predicted from the construction of DSS, the platform tunnels and construction of the escalator shaft. In order to protect the sewer from this movement substantial protective works will be required. The scope and extent of these protective measures is subject to ongoing detailed discussion with Thames Water, and may include the construction of an additional access shaft to the sewer, possibly located in the grounds of Swanlea School. These protective measures will need to be undertaken prior to the commencement of construction of the DSS's.

Fulbourne Street Ticket Hall

Enabling works for Fulbourne Street Ticket Hall include construction of the West Ham turnback facility, re-signalling and plain lining of the District line tracks at Whitechapel, diversion / replacement of rail cable services at Whitechapel station, vacation of the Booking–On Centre office above Whitechapel Station, planning for and demolition of structures above Whitechapel Station.

- West Ham Turnback Facility and Plain Lining

Currently there are four live tracks and a siding at Whitechapel Station. In order to construct the new ticket hall this has to be reduced to two live tracks only. To implement this, a new facility for the reversing of trains (Turnback) will need to be provided at West Ham Station. This facility is currently planned to be designed and constructed by Metronet as advanced works.

Concurrently with this work, plain lining and re-signalling of the tracks at Whitechapel can be carried out. For scheme design it has been assumed that with limited modifications to alignment, the northern most of the existing tracks at Whitechapel can be retained and that a new through line can be provided approximately on the line of the existing southern siding. The use of these two tracks will give the greatest width of platform for construction of the new ticket hall and should avoid the need to replace bridges D124A and D124B across the ELL. The design and carrying out of these realignments is currently planned to be being undertaken by Metronet.

As part of carrying out this realignment work the signalling and other cable services at Whitechapel Station will need to be replaced. All equipment and cables for this work will need to be specified to be Section 12 compliant as Whitechapel station will become a Section 12 station when Crossrail opens.

- Replacement of cable services

As part of constructing Fulbourne Street Ticket Hall all of the existing structures on the District Line platforms and over the railway will need to be demolished. Early trace and tag surveys are therefore required to identify the railway services that will need to be relocated to carry out this demolition. The design and implementation of these service diversions will then need to be undertaken as early as possible to ensure that the programme for construction at Whitechapel is achieved.

These works are described in more detail in section 10.3.14.

- Strengthening Works Durward Street & Winthrop Street Bridges & existing Station retaining walls

As identified in Section 12.2.3 there will be a requirement to remove / lift into place a large quantity of heavy items when building the new Fulbourne Street Ticket Hall. This work will involve the use of very large mobile crane possibly up to a capacity of 1000tonnes. Both these loads and the cranes will need to be conveyed across the bridges over the ELL. Also when setting up the cranes they will need to be sited close to the existing retaining walls to the District line. Before any of this work can take place a detailed structural assessment of

the bridges and retaining wall will be required and if necessary they will need to be strengthened to ensure that they can carry the necessary loads. Intrusive surveys of these structures are currently being arranged as part of these assessments.

- Demolition Activities

A significant amount of demolition will be required for construction of the new Fulbourne Street Ticket Hall. Major structures that need to be demolished include Fulbourne Street bridge, Fulbourne Street cable bridge Court Street bridge, Woods Building bridge and the Booking–On Centre office from above the District Line and the removal of Rail bridge D124 from above the ELL. In addition to these, all of the existing District line canopies, staircase from Whitechapel Ticket Hall and platform furniture will need to be removed along with any foundations that may obstruct the installation of piles for the new structures. Details of the structures to be demolished are shown on Drawing No.P30103-C1M14-C00-D-50641 included in Appendix J.

All of this work will require detailed planning and need to be carried out during night-time and week-end possessions of the railway. Obtaining the necessary agreements from LU and London Rail for the carrying out of this work along with the booking of all possessions that will be required may take between 18 months and 2 years to arrange. It is therefore essential that the planning for these works is undertaken well in advance of the main works commencing. A demolition Feasibility Report for these works has been prepared by a demolition specialist (J F Hunt) on behalf of EWMA.

12.5 Contractor's Compound and Worksite

12.5.1 Three main worksites are required for construction purposes. These are at:-

- Sainsbury's Car Park for Cambridge Heath Shaft, the Draught Relief Shaft and the tunnelling works;
- Durward Street (Essex Wharf) for Durward Street and West Stair shafts;
- Durward Street (Bus Stand area) for Fulbourne Street Ticket Hall.

12.5.2 Each site fulfils a different purpose in the construction process as described below. Whilst these sites form the main focal point of operations, other satellite sites will be required for activities such as compensation grouting and lorry holding.

Sainsbury's Car Park

Figure 12-2-Panoramic View of Sainsbury's Car Park

Location	Sainsbury's Car Park / Car Park to 333-335 Whitechapel Road / Garden & Conservatory of Blind Beggar Public House
Area (m^2)	5300m^2 Approx. Full area (all usable)
Proposed Use	Cambridge Heath Shaft Construction Construction of Draught Relief Shaft and Tunnels Site offices, welfare, stores and workshops for surface and tunnel works Cranage and static plant (including batching plant) Spoil stockpile & feed conveyor

This site which primarily occupies a large section of Sainsbury's car park immediately to the rear of the Blind Beggar public house will be used for the construction of the Cambridge Heath Road Shaft and the Draught Relief shaft which will in turn be used for construction of the station platform and other tunnels. This will entail the construction of some 500 metres of station tunnel as well as cross passages and ventilation tunnels. This will involve the excavation of nearly 75,000 cubic meters of ground (in the solid) and the construction of about 26,000 cubic meters of concrete works over a three year period necessitating in excess of 4,800 lorry movements to and from the Cambridge Heath Road / Sainsbury's Car Park site. Detailed discussion with London Borough of Tower Hamlets will be needed to determine the preferred timing of lorry movements for the scheme as currently configured.

Figure 12-3-Rear of Nos. 333-335 Whitechapel Road and Blind Beggar Public House

Two drawings have been prepared to show the layout of the site during the main phases of construction:

- Drawing P30103-C1M14-C00-D-50231 shows the layout during construction of CHS;
- Drawing P30103-C1M14-C00-D-50232 shows the layout during excavation of the main tunnels.

These drawings highlight the key requirements needed at each stage of construction including:-

- *Offices, workshops and Welfare.* Whilst the precise location and layout may be varied it should be noted that there will be considerable workforce engaged on underground work requiring a reasonably large area for changing and welfare facilities, in addition to the office and workshop requirements.

- *Ventilation shaft construction area*. Following excavation, this shaft will be used to construct the main tunnels for the station. For this purpose, and subject to the contractor's detailed method of working, it will be fitted with a vertical conveyor for lifting excavated material from the tunnels and a travelling gantry crane for lifting in plant and machinery, reinforcement, shutters and the like. Shotcrete and later concrete will either be conveyed or transported by re-mixer trucks from the batching plant to the shaft, for both the SCL work as well as for the finished inner lining and internal works. Underground these materials will either be transported to where they are needed by pump or by rubber tyred vehicle.
- *Batching Plant Area.* Use of an on site batching plant is a prerequisite for underground SCL work, ensuring a reliable supply of shotcrete where control of the stability of the ground is paramount. It also ensures the appropriate quality and mix are under direct control and supervision. Depending on the demand and output capacity the batching plant may also be able to supply concrete for construction of the shafts.
- *Laydown Area.* The same worksite areas will be used for both the shaft and underground works teams for the temporary storage of materials prior to use in the works.

Access to and egress from the site will be off Cambridge Heath Road with a route through the site onto Brady Street for lorries travelling on to the Durward Street Sites.

Durward Street (Essex Wharf)

Location	Essex Wharf / Swanlea School Gardens / LU ELL / Whitechapel Sports Centre Car Park
Area (m^2)	$4500m^2$ Approx on east side of ELL (Swanlea School, Essex Wharf & ELL Covered Way CE126) $400m^2$ on west side of ELL
Proposed Use	Intermediate Concourse and ventilation shaft construction Interchange Link to Northbound ELL Platform Site offices, welfare, stores and workshops Relocated substation

This site for the construction of the two shafts at Durward Street divided in two by the ELL. The area to the west of the ELL occupies the car park of the Sports Centre and will be used to construct the west stair shaft. After construction of the shaft the site will be backfilled and reinstated as a car park.

Figure 12-4-Panoramic View of Essex Wharf West Shaft Site from Durward Street

To the north and east the major part of the site is within the LU-owned Essex Wharf area but the site extends to the north to encompass covered way CW126 above the ELL and to the east to include part of the grounds of Swanlea School including an 11 kV electrical substation and the school caretaker's house, which will be demolished.

Figure 12-5-Panoramic View of entrance to Essex Wharf East Site off Durward Street

In order to provide protection to the ELL, to increase the space available for construction of the shafts and to provide access for heavy vehicles to the Essex Wharf site without passing through the School grounds (a Parliamentary Commitment) a temporary working platform is to be constructed over the top of the ELL between Durward Street and Covered Way CW126.

Two drawings have been prepared to show the layout of the site during the main phases of construction:

- Drawing P30103-C1M14-C00-D-50361 details the site layout for Diaphragm Walling and bored pile installation;
- Drawing P30103-C1M14-C00-D-50362 details the site layout for excavation of the two shafts.

These drawings highlight the key requirements needed at each stage of construction including:

- *Offices, workshops and Welfare.* Whilst the precise location and layout may be varied it should be noted that an assessment has been carried out on the condition of the roof beams to covered way CW126 which has revealed them to be in a poor state. Crossrail's contractors will not be permitted to place any significant loads in this area

without either carrying out suitable strengthening measures or by bridging over the existing structure.

- *Shaft construction areas.* As previously noted the available work area adjacent to the shafts is to be increased through the provision of a deck constructed over the ELL and by the demolition of the single storey storage facility to Whitechapel Sports Centre. The deck will need to be of robust construction as it will need to withstand the large loads generated from the operation of major construction plant such as piling rigs. Further, this deck needs to be designed such that an emergency escape route from the northern end of the ELL platforms can be provided at all times.
- *Laydown Area.* A combined laydown area will be provided on Essex Wharf for construction of both shafts.

To allow through movements of Lorries travelling from the site, the bollards in Durward Street will be removed so trucks can enter from Brady Street via Durward Street and leave via Valance Road.

Durward Street (Bus Stand area)

Location	Durward Street / District Line Platforms / Kempton Court Car Park
Area (m^2)	1500m^2 Approx Durward Street Up to 4800m^2 District Line Platforms and trackbed Up to 500m^2 Kempton Court Car Park
Proposed Use	Construction of Fulbourne Street Ticket Hall Passenger Link to Crossrail and Construction of new ELL access and escapes.

The worksite for construction of Fulbourne Street Ticket Hall occupies the whole of the LU District Line platforms and associated tracks at Whitechapel Station. Limited access will also be required to the Southern end of the ELL (ELL) platforms for the construction of new platform access stair openings and replacement of the central District line bridge (D124). It is not intended that any works be carried out within the existing Whitechapel Road Ticket Hall or to the existing access stairs to the ELL platforms.

All of the works associated with the construction of Fulbourne Street Ticket Hall will be serviced from a site in Durward Street in the area currently occupied by a bus stand and car park.

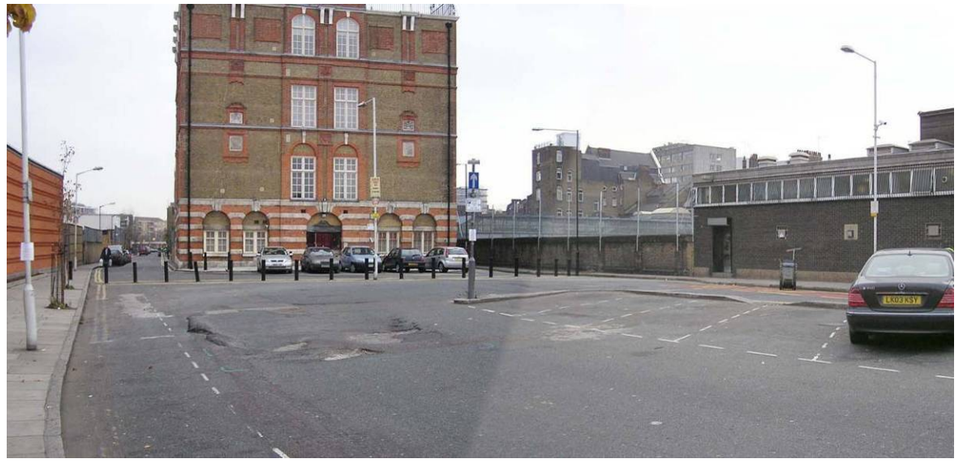

Figure 12-6-Durward Street – worksite area for Fulbourne Street Ticket Works

A secondary site is required for limited periods in Kempton Court car park. This site is required for replacement of the existing District Line railway bridge D124 and construction of the new pedestrian connections to the ELL platform and existing Whitechapel Station Ticket hall.

A number of short term closures of Winthrop Street will be required for lifting equipment and material to and from the worksite. Pedestrian access will be maintained to Winthrop Street throughout the construction period. Emergency vehicle access to Kempton Court will be maintained throughout the construction period – the ways to achieve this will be agreed with the Fire Service. In the event of short term closure of the access from Winthrop Street alternative access to Kempton Court can be made from the Durward Street entrance but this is not suitable for some larger vehicles

Figure 12-7-Winthrop Street

Four drawings have been prepared to show the layout of the site during the main phases of construction of Fulbourne Street Ticket Hall:

- Drawing P30103-C1M14-C00-D-50631 details the site layout for the Stage 1 bored pile installation and interchange box excavation;
- Drawing P30103-C1M14-C00-D-50632 details the site layout for construction of the Stage 1 ticket hall deck and station canopy;
- Drawing P30103-C1M14-C00-D-50633 details the site layout for the Stage 2 bored pile installation and interchange box excavation;
- Drawing P30103-C1M14-C00-D-50634 details the site layout for construction of the Stage 2 ticket hall deck and station canopy.

These drawings highlight the key requirements needed at each stage of construction including:

- *Offices, workshops and Welfare.* It will only be possible to provide limited facilities on this construction site and they will have to be easily movable to suit access requirements for cranage when erecting the new ticket hall deck. The main facilities will be provided on the Essex Wharf site. There will be no provision for offices within the Kempton Court site area.
- *Station Platforms.* A minimum usable platform width of 3.0m will be provided where ever possible on the District Line platforms during construction. This will need to be reduced locally for a limited period to 2.5m during installation of piles and construction of capping beams for the interchange level boxes and to 2.0m on the westbound platform during installation of the piles and construction of pilecaps for the columns to support the ticket hall deck.
- *Laydown Area.* Only a limited area for laydown area will be available in the Durward Street site and as for the offices it will need to be relocated to suit access for cranage when erecting the new ticket hall deck. The main area for laydown will be provided on the Essex Wharf site. There will be no provision for laydown within the Kempton Court site area.

As previously noted the bollards in Durward Street will be removed so trucks can enter the worksite from Brady Street via Durward Street and leave via Valance Road.

12.6 Conclusions

12.6.1 The foregoing sections describe the construction processes assumed for the scheme design of Whitechapel Station. These details will need to be developed further as the scheme progresses into detailed design.

12.6.2 The following construction issues have not been addressed at this stage and will need to be developed as part of the next design stage:

- A clear scope for the Advanced Works need to be agreed;
- The scope of enabling works required to Swanlea School, Whitechapel Sports Centre and the NESRS have not been finalised as they are waiting the outcome of a number of surveys and discussion with the property / asset owners;
- Requirements for strengthening works to the existing bridges and structures as this work is waiting the completion of structural surveys.

9.5 Whitechapel Station, List of Railway Heritage Features (LU)

WHITECHAPEL STATION
List of Railway Heritage Features

BRS Code: M153/D061
LUL code: WPL

History

The station was first opened by the East London Railway (ELR) on 10 April 1876 as Whitechapel. The District Railway (DR) opened their own station, with adjacent entrances, on 6 October 1884. In 1902 with the extension of the District Railway beyond Whitechapel, to Bromley-by-Bow via Mile End, the booking hall facilities for the District and East London Railways were combined. Through services from the District Railway and Metropolitan Railway (MR) to the East London Railway were withdrawn in 1905 and 1906 respectively. MR through services began serving the station again on 31 March 1913. In 1936, underground passages and stairs connecting the District line platforms with the East London line were added. Between 1979 and 1982, the East London line platforms were refurbished and in January 1995, improved Underground Ticketing System (UTS) ticket gates were installed in the booking hall. The East London line platforms were refurbished again in 1995-1998 during the closure of the East London line for repairs to the Thames Tunnel.

Exterior***

The entrance forms the ground floor of a 3 storey brick built façade, the upper storeys of which are separate accommodation.

- To the west a single semi-circular arch topped door, leading to accommodation above, matched to the west by two large arched entrances, which lead to the ticket hall. The brickwork features decorative stringcourses and mouldings.
- Two modern style glass and tubular steel canopies**.
- To the west survives the remnant of the earlier station entrances, with vestigial signage.

Key

* LUL recommends that this feature be retained and restored unless major redevelopment is proposed, in which case being resited elsewhere in the station or offered to London's Transport Museum would be a suitable alternative.

** LUL recommends that this feature be retained and restored but a suitable alternative may be to replicate if done sensitively and to match exactly the original specification.

*** LUL strongly recommends that, because of its historical and/or design importance, this feature be retained and restored in situ.

Notes

1. For the avoidance of doubt, nothing in this document represents a contractual instruction under the PPP or other contract. However, Infracos are reminded of their PPP contractual obligations under clause 51 of the Service Contract, clause 1.9 of Appendix 15 of Schedule 2.1 and clause 1(m) of Appendix 4 of Schedule 3.1.
2. Text in *italics* indicates remedial or enhancement works that are suggested by LUL.

Ticket Hall

- Entered by way of a small vestibule leading to stairs down, with a retail kiosk to right. Plain painted finishes.

- Ticket hall***.

- A fine surviving hall, with a high ceiling supported by 5 decorated cast/wrought iron ribs***.

- Inset to left the UTS ticket suite, with much surviving timber panelling and moulding***, to the right accommodation and control room, fronted by similar panelling and moulding***.

The hall opens out onto an overbridge, straddling the East London line platforms. To the right, stairs to platform 6, to the left passageway leading to platforms 1/2 & 3/4 and staircase to platform 5.

Finishes and features

- Exposed brick, with detailing and moulding**. A 'lean-to' shelter in timber and with glazing sits over the overbridge and extends down the staircases. It features an unusual arch formation to the centre of the panelling**.

- Adjacent to this feature is a secondary hall***, with plain rib supports and plain painted finishes. To the east side rises a staircase**, with glazed brickwork, that gives access to platform 5. It has a fine decorative wrought-iron frame to the Bostwick gate**. The hall has much extraneous wiring and service ducting. *A more sympathetic cable*

- A timber panelled, with glazing, footbridge** leads to the District line platforms.

- Suspended from the ceiling is a fine 1930's illuminated train describer***.

Platforms

Platforms 1/2 and 3/4 are twin island platforms.

- At east end both islands have canopies, steel girder uprights supporting steel sheet cladding and a glazed apex, along with decorative valances.

- To the western ends the platforms are covered by a later development.

Low level subways

Leading from platforms 1/2 and 3/4 to platform 5 are two subways.

- Finishes include extensive use of Poole large profile ceramic tiles, in oatmeal/yellow, with decorative bands in blue, green & orange**. Above the staircases are two fine 1938 Standard Signs Manual pattern v/e bronzed framed signs***.

East London line platforms 5/6

Accessed by staircases and subways, as described. The platforms are in a deep level cutting, although the southern areas are covered by overbridges, both road and rail, and the station buildings.

- The staircase to platform 5 has an early pattern timber poster frame*

Finishes

- The open sections of platforms display fine brick retention walls**, with details, and replica lighting.

- The 'covered' sections make extensive use of full height v/e panels, which include integral signage**. These show local and station scenes and were designed by Doug Patterson.

Non-public areas

The non-public areas of the station, particularly that area in the basement used as staff accommodation has extensive and important survivals of early passageways, staircases and rooms. Should work take place affecting theses areas the LT Museum must be informed.