Earthworks and Remediation Plan

Chilton Square

King's Cross Central
General Partner Ltd

May 2023

KING'S CROSS

Intended for
King's Cross Central Limited Partnership

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KING'S CROSS CHILTON SQUARE EARTHWORKS AND REMEDIATION PLAN

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CHILTON SQUARE
EARTHWORKS AND REMEDIATION PLAN

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EXECUTIVE SUMMARY

PURPOSE OF THE REPORT	Ramboll have been appointed by King's Cross Central Limited Partnership to provide geo-environmental services to support the development of Chilton Square at King's Cross. This report comprises the Earthworks and Remediation Plan for the site in accordance with the requirements of Planning Condition 18 of the Kings Cross Outline Planning Permission reference 2004/2307/P, 2004.
APPROXIMATE GRID REFERENCE	530098, 183890 APPROXIMATE AREA (ha) 0.12
SITE DESCRIPTION	The site, Chilton Square, is currently occupied by a gantry supporting four storeys of portacabins, which are serving as temporary offices for contractors working on the S4 development. To the north of the site lies Canal Reach road and beyond this what is known as the T Plots. To the east lies Plot S5, to the south Plot S4 and to the west Plot S3, with all plots having recently been redeveloped. Lewis Cubitt Park is located to the south-east of the site. The Thameslink Canal tunnels run beneath the site, and the realigned Camden Sewer (and associated exclusion zone) runs underneath the north-eastern boundary of the site.
SITE HISTORY	Between 1746 and 1834, the site comprised large open fields. The first indication of the sites use as railway land appears on the 1862 map, with this railway land labelled as part of a goods depot from 1871, and this use continuing relatively unchanged until around 1994. A roundhouse carriage / engine shed occupied the majority of the site from 1860 to 1932. During the period between 1968 and the early 1990s, historical maps show a significant contraction of the goods and railway infrastructure with the gradual reduction in goods buildings and the closure of ancillary buildings, and the site was labelled to be in use as a freightliner terminal. By the early 1990s, the majority of the wider King's Cross Central (KXC) site (including Chilton Square) had been cleared and remained relatively undeveloped until implementation of the KXC development in 2008.
PROPOSED DEVELOPMENT	The proposed development for Chilton Square comprises a new local play / amenity space fronting Canal Reach, within Development Zone S, to the north of the KXC development site. The space is intended for the benefits of surrounding residents and potentially others, with proposed site zoning including social & swing play, fitness and bridges & climbing. Access to the site will be provided via Canal Reach to the north, Lewis Cubitt Park to the south-east and from the area between Buildings S3 and S4 to the south-west.
GROUND INVESTIGATION	Ground investigations have been undertaken across the adjacent plots S5 (between 6th April and 10th May 2018), S3 (between 8th April and 18th September 2019) and S4 (between 7th December 2020 8th January 2021) by Concept under part-time supervision by Ramboll. The plots S4 and S5 ground investigations included five (5 No.) exploratory locations on / adjacent to the Chilton Square site as follows: • WS02 (centre of site) – window sample borehole advanced to 4.0 m bgl. • WS06 (south-east of site) – window sample borehole advanced to 1.2 m bgl. • PM01 (east of site) – cable percussion/rotary borehole advanced to 40.0 m bgl. • RC01 (north-east of site) – cable percussion/rotary borehole advanced to 40.0 m bgl. • TP02 (adjacent to the eastern site boundary) – trial pit advanced to 3.65 m bgl. A programme of geo-environmental laboratory analysis was undertaken on selected samples, with five to six ground gas and groundwater monitoring visits undertaken following the intrusive works.
GEOLOGY	The geology comprises Made Ground at varying thicknesses between approximately 2.10 and 3.70 m, overlying a discontinuous thin band of Alluvium underlain by Weathered London Clay, London Clay Formation, Lambeth Group Formation, Thanet Sand Formation and the Chalk Formation.

HYDROLOGY	The nearest surface water body is the Regent's Canal, part of the wider Grand Union Canal network, located approximately 290 m south-west of the site at its closest point.
HYDROGEOLOGY	The Made Ground and Alluvium are unclassified, while the London Clay is classified as an Unproductive Strata and the Lambeth Group as a Secondary A Aquifer. The Thanet Sands and Upper Chalk located at depth are classified as Principal Aquifers.
CONTAMINATION FINDINGS	The soil analytical results from the 5 No. exploratory locations within / adjacent to the site have been re-screened against the assessment criteria for a Public Open Space 1 (green space close to housing) scenario, given the proposed use of the site as a play area. Limited evidence of soil contamination was encountered in relation to a POS 1 end use, with the majority of determinands analysed falling below the assessment criteria. 4-Isopropyltoluene was identified above laboratory detection limits in samples taken from PM01 (east of site), at depths of 2.0 m and 2.50 m below ground level (bgl). High PID readings were also identified at these depths, with soils described as having a 'strong ammonium odour' from 2.0 - 3.0 m bgl. Concentrations of 4-Isopropyltoluene were not identified above laboratory detection limits in the four other Made Ground samples submitted for VOC analysis, including a sample from PM01 at 3.90 m, and the ammonium odour was not identified in any other location. As such, it is considered likely that this is a localised impact. Potential pathways to future site users are eliminated by the paving hardstanding which is proposed to cover this area. Asbestos fibres were identified within two of the 10 Made Ground samples (PM01 (east of site) and WS06 (south-east of site)). Quantitative analysis identified concentrations lower than laboratory detection limits of <0.001%w/w. Again, potential pathways to future site users are eliminated by the paving hardstanding which is proposed to cover these areas. One groundwater sample from WS02 (centre of site) was obtained from perched water within the Made Ground. Elevated sulphate was detected; however, this concentration is not considered to pose a significant risk to controlled waters or future site users. Concentrations of ammonium and naphthalene in leachate samples from PM01 (0.30 - 0.60 m) and TP02 (2.0 m) exceeded the adopted assessment criteria. However, there was limited correlation between the leachate and groundwater data from the Plot S5 ground investigation, with PAHs below detection limits in groundwater and ammonium also only marginally above assessment criteria in one location.
GROUND GAS	Ground gas monitoring was undertaken as part of the ground investigations across the three adjacent plots as follows: Plot S5 on six occasions in 2018; Plot S3 on five occasions in 2019; and Plot S4 on six occasions in 2021. This included the monitoring of three locations (WS02, WS06 and PM01) on the subject site. The results from the wider area are also considered to give good indication of the likely ground gas regime at the site. Plots S3, S4 and S5 were all classified as Characteristic Situation 1 (CS1) scenario (very low risk), indicating that no ground gas protection measures are required as part of the proposed developments. Based on these findings, the site can also be classified as CS1. Depleted oxygen concentrations were recorded across the three adjacent plots (including locations on the subject site). However, work in confined spaces is not anticipated to be required as part of the proposed development, meaning the risk to construction workers is eliminated.
PRELIMINARY WASTE ASSESSMENT	Based on the HazWasteOnline Assessment for exploratory locations relating to the subject site, the Made Ground soils and Alluvium are classified as non-hazardous. However, the assessments undertaken across the adjacent plots indicate a potential for approximately 6 - 30 % of Made Ground soils to be classified as hazardous waste.

It is reasonable to expect that the Natural Ground soils are likely to be suitable for disposal as inert waste, as all Alluvium and London Clay samples analysed from adjacent plots were assessed as non-hazardous.

Due to the detection of asbestos in two samples from the site, and the nature of asbestos, contractors should allow for previously unidentified asbestos, ensure to maintain vigilance throughout the works and ensure that material containing the asbestos follows the appropriate waste stream.

EARTHWORKS REQUIREMENTS

Earthworks at the site are anticipated to comprise breaking out of current hardstanding and initial shallow level reduced dig across the site (site strip), with excavation of soils down to agreed depths (to be confirmed but for the purpose of this earthworks strategy a nominal depth of 0.25 m bgl has been used). Following this, additional excavations will be undertaken to construct the play area (where play safety surfacing is present) and soft landscaped planting areas comprising excavations to agreed depths (minimum of 0.60 m bgl). Localised deeper excavations for play structure foundations will be undertaken to a maximum approximate depth of 1.50 m bgl following initial excavation to 0.60 m bgl and excavations for tree pits (with vertical depths anticipated to similar to that of the foundations). An imported capping layer of minimum 600mm thickness will be installed in the play area and soft landscaped planting areas.

The earthworks at Chilton Square are anticipated to include the excavation of approximately 960 m^3 of Made Ground and Alluvium, which equates to approximately 113 lorry movements from site. These excavation calculations have been estimated using proposed development and foundation drawings and on the assumption that finished site levels will be equal to current site levels. It is worth noting adjustments will be made as the design is developed and therefore these calculations should be reassessed closer to the time to determine more accurate amounts.

PRELIMINARY REMEDIATION STRATEGY

PRELIMINARY REMEDIATION STRATEGY

No specific remediation measures are deemed necessary; however, Ramboll recommends an imported capping layer of minimum 600 mm thickness is required in all soft landscaped areas and where play safety surfacing is present (i.e., the play area). In soft landscaping (planting areas), it is recommended that a minimum of 600 mm thickness of material (topsoil/subsoil) is required. Ramboll recommends that the capping layer in the play area (where play safety surfacing is present) should be a minimum of 600 mm thickness which is to comprise the play safety surfacing (Corkeen / Hardwood Chips), subbase (Type 3) and imported fill/subbase material.

A number of good practice measures are recommended to be incorporated as part of the development which should include:

- An Environmental Management Plan (EMP) should be implemented.
- The preparation of an Asbestos Management Plan for the site.
- An unforeseen contamination protocol should be established and environmental watching brief visits to be undertaken by Ramboll throughout earthworks.
- A Verification Report should then be prepared documenting the successful completion of work in accordance with the requirements of this Earthworks and Remediation Plan.

1. INTRODUCTION

1.1 Brief

Ramboll UK Limited (Ramboll) have been instructed to provide an Earthworks and Remediation Plan (ERP) to support a Reserved Matters Submission for Chilton Square of the King's Cross Central (KXC) development.

The King's Cross Central Redevelopment site was granted Outline Planning Permission in 2004 under application reference 2004/2307/P. Land Contamination matters are dealt with under Condition 18 which states that *"relevant applications for approval of the reserved matters shall be accompanied by an Earthworks and Remediation Plan to deliver appropriate site levels and ground conditions for that part of the development. All works shall be carried out in accordance with the Earthworks and Remediation Plan as approved'.*

The subject site (Chilton Square) is not defined in the Outline Planning Permission, rather there is a vague recognition of the provision of play in Development Zone S: 'New local play / amenity space would be provided within the development zone for the benefit of residents and potentially others'.

The purpose of this draft ERP is to provide information pertaining to the ground conditions and prevailing geo-environmental setting at the site in the context of the development proposal. In addition, this document highlights the potential contamination risks present at the site and provides a strategy for addressing the identified risks as part of the earthworks and construction phases of the development.

1.2 Previous Reports

This ERP should be read in the context of the following overarching documents which were submitted in support of the original KXC outline planning application and / or the Reserved Matters submissions for KXC plots S3, S4 and S5. Such plots (S3, S4 and S5) are located adjacent to Chilton Square; therefore, associated documents have included assessment of the immediate surrounds including the subject site itself:

- King's Cross Central Environmental Statement (ES) Volume 4: Part 16 Soils and Contamination Specialist Report, Arup, May 2004;
- King's Cross Central ES Volume 5: Supplement, Arup, September 2005; and,
- King's Cross Revised Code of Construction Practice (CoCP), RPS, September 2005.

To date, Ramboll has completed combined Geo-environmental and Geotechnical Desk Studies (DBA) for Plot S5 (dated January 2017), Plot S3 (dated April 2019), and Plot S4 (dated July 2020), located adjacent to the east, west and south of Chilton Square, respectively. Following the recommendation for site-specific exploratory works for each plot, intrusive Phase II site investigations of plots S5, S3 and S4 were undertaken by Concept Engineering Consultants Ltd. (formerly Concept Site Investigations) in 2018, 2019 and 2020 respectively, as per Ramboll's specification and under the technical supervision of Ramboll.

Previous reports used in the preparation of this ERP have been presented as Table 1-1 below.

Table 1-1: List of Previous Reports

Report Title	Author	Date
King's Cross Project Contract 4 for Borehole Investigations at King's Cross	Soil Mechanics Ltd	**July 1993**
Contract L Phase 3 Ground Investigations King's Cross / St Pancras Geotechnical Report	Foundation and Exploration Services	**February 1996**
Contract 2 for Phase 4 Ground Investigations in Project Area 100	Soil Mechanics Ltd	**October 1997**
King's Cross Plot S5 Geotechnical and Geoenvironmental Desk Study	Ramboll UK Ltd	**January 2017**
King's Cross Central Plot S5 Site Investigation Report	Concept Site Investigations	**July 2018**
King's Cross Plot S5 Ground Contamination Interpretative Report	Ramboll UK Ltd	**September 2018**
King's Cross Central Redevelopment Plot S3 Geoenvironmental and Geotechnical Desk Study	Ramboll UK Ltd	**April 2019**
King's Cross Building Plot S3 Factual Ground Investigation Report	Concept Engineering Consultants Ltd	**October 2019**
King's Cross Plot S3 Geoenvironmental and Geotechnical Interpretive Report	Ramboll UK Ltd	**October 2019**
Kings Cross Plot S4 Geoenvironmental and Geotechnical Desk Study	Ramboll UK Ltd	**July 2020**
Kings Cross Building Plot S4 Factual Ground Investigation Report	Concept Engineering Consultants Ltd	**February 2021**
Kings Cross Plot S4 Geoenvironmental and Geotechnical Interpretive Report	Ramboll UK Ltd	**March 2021**

2. SITE CHARACTERISATION

2.1 Site Description

The site is located within the London Borough of Camden and constitutes part of the King's Cross Central (KXC) Development. The site has an approximate National Grid Reference 530098, 183890, and is circa 0.12 hectares in size. The red line boundary for Chilton Square is shown in Figure 2.1 below and site location plan is provided in Appendix 1.

Figure 2.1: Chilton Square Redline Boundary. Source: Erect Architecture.

The site is irregular in shape and is bound by Canal Reach road to the north; Plot S5 to the east; Lewis Cubitt Park to the south-east; Plot S4 to the south; and Plot S3 to the west.

At the time of the site walkover, the site was predominantly occupied by a gantry supporting four storeys of temporary office / welfare space utilised by Laing O'Rourke and their sub-contractors, which has been present since at least May 2022. An underlying roadway provides access to the adjacent Plot S4 development from Canal Reach, and access routes associated with the adjacent Plots S5 and S3 are present to the east and west of the gantry, respectively.

The topography of the site is generally flat and of a similar topography to the surrounding plots. As with the adjacent Plots S3 and S4, the site levels were reportedly raised using building rubble and resurfaced with asphalt in circa June 2014 by Carillion, for the use of the site as a temporary storage and welfare area to serve the development of plots to the south.

With regard to site constraints, the Thameslink Canal tunnels run beneath the site, running from the north-east to the south-west. The realigned Camden Sewer (and associated exclusion zone) runs directly underneath the south-eastern portion of the site in a westerly direction, before changing direction to run beneath the north-eastern site boundary. A Site Constraints Plan is included as Figure 2.2 below.

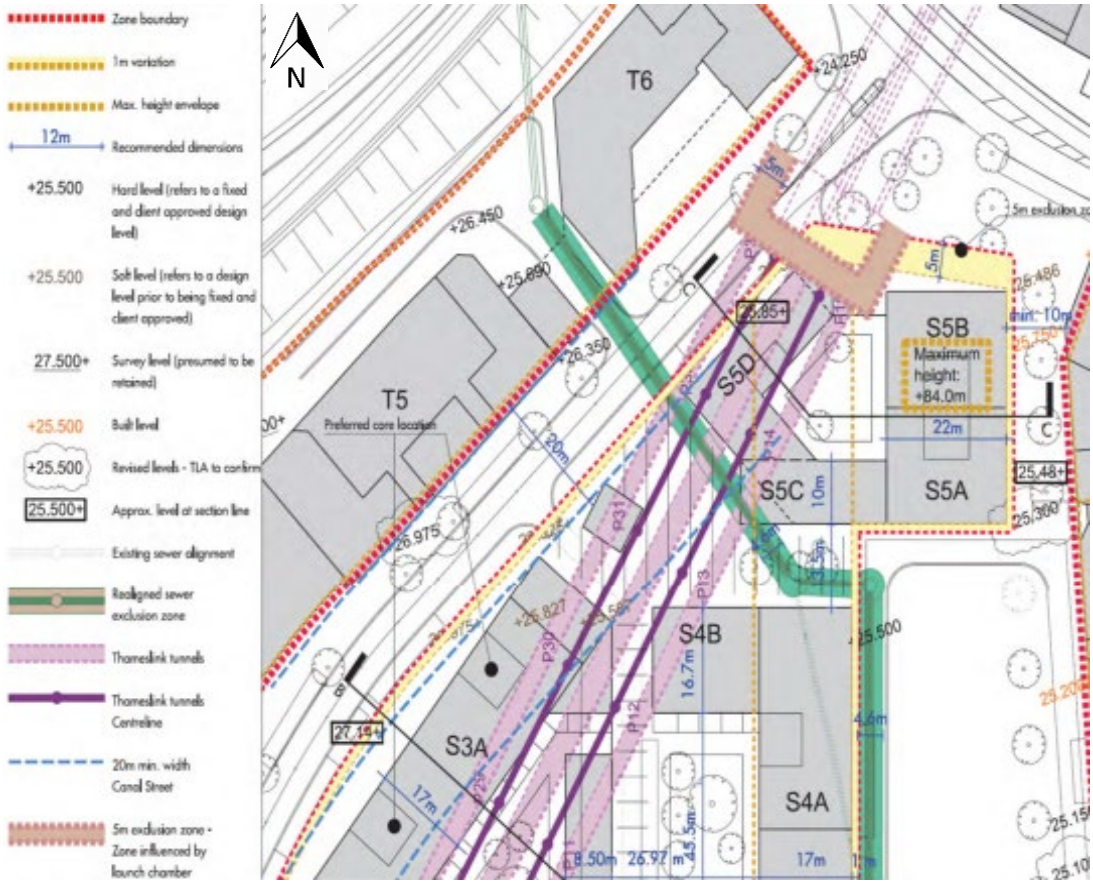


Figure 2.2: Site Constraints Plan showing the Thameslink Tunnels and Camden Sewer (with Chilton Square positioned between Plots S3, S4 and S5). Source: S Plots Briefing Pack.

2.2 Site Surroundings

The surrounding land comprises:

- **North:** Canal Reach (roadway stemming off York Way to the north-east).
- **East:** Plot S5 is nearing completion as a mixed-use, residential-led development of up to 16 storeys, containing both affordable and private apartments, retail and commercial space and a car park.
- **South-east:** Lewis Cubitt Park (public open space).
- **South:** Plot S4 is nearing completion as a mixed tenure residential development of up to 14 storeys over basement level, with a ground floor of retail, residential lobbies, amenity space and entrances.
- **West:** Plot S3 is nearing completion as a commercial office development of up to 11 storeys, with several retail units included at ground level.

2.3 Proposed Development

The proposed development for Chilton Square comprises a new local play / amenity space fronting Canal Reach, within Development Zone S to the north of the King's Cross Central development site. The space is intended for the benefits of surrounding residents and potentially others, with site access provided via Canal Reach to the north of the site, Lewis Cubitt Park to the south-east and from the area between Buildings S3 and S4 to the south-west.

The design concept for Chilton Square is based on 3D DNA, with connecting strands of the double helix comprising planes of nets, ropes, steels and timbers intended to offer opportunities for play

including climbing, balancing, walking, running and swinging, as well as fitness and lounging opportunities for socialising, watching and eating.

Approximately 45% of Chilton Square is occupied by the play area itself which is primarily covered in safety play surfacing of "Corkeen" (a bound surface) and "Hardwood Chips" (a loose surface), but also incorporates soft landscaped areas comprising planting of shrubs, grasses and tress. The remaining area (55%) of Chilton Square outside of the play area comprises hardstanding of paving with discrete areas of soft landscaping for planting. A total of approximately 15% of Chilton Square comprises soft landscaped areas with planting of shrubs, grasses and trees (not including areas of tree planting in Corkeen and Hardwood Chips).

A proposed general arrangement plan (Erect Architecture, Drawing Number 398-CS-200GA) is contained within Appendix 1.

2.4 Site History

A summary of the history of the site and its immediate surroundings is presented in Table 2-1. Potentially contaminative activities are shown in bold.

Table 2-1: Site History

Time	Site	Surrounding
Pre 1871	Rocque's Map of London shows the area of the site as undeveloped and covered by open fields. No significant deviations from this are shown on Tomson's Map (1801), Greenwood's Map (1827) or Bartlett's Map (1834). By Standford's Map of 1862, the site is occupied by a number of **railway tracks.**	On Rocque's map, the surrounding area is undeveloped with a small settlement (Pancras Wells) shown to the north of the site. Tomson's Map of 1801 shows significant development in the vicinity of the site. On Greenwood's map of 1827, extensive development has taken place to the north and west of the site. A **tank farm** associated with a **gas works** is shown approximately 500 m to the south. Continued development has occurred on Bartlett's Map of 1834. On Standford's map of 1862, there have been significant developments within the immediate vicinity of the site with the redevelopment of the area as **railway land** with associated **rail tracks** and ancillary buildings. Regent's Canal, later labelled as the Grand Union Canal is shown approximately 90 m south-west of the site and runs from south-east to north-west prior to heading west.
1871 to 1896	The site is mapped as part of a '**Goods Depot'**. Part of a **roundhouse carriage shed** occupied the majority of the site, with **railway lines** associated with the Great Northern Railway encroaching onto the south-eastern portion of the site.	There are no significant changes in the surrounding area over this period of time, however the surrounding area contains a number of significant features including (but not limited to): • A railway **turntable** is located approximately 20 m south-west of the site. • A **Locomotive cleaning shed** is located approximately 50 m south-west along with associated railway lines. • A **coal depot** with associated **railway lines** and **engineers' workshop** are located approximately 100m and 200 m north of the site, respectively. • A **railway line** is located approximately 140 m to the west of the site, running north to south out of St Pancras Railway Station which is located approximately 770 m to the south of the site. • A **good's shed,** labelled to be operated by Midlands Railway, is located approximately 230 m south-west of the site and contains associated **railway lines**. • **King's Cross Station** is located approximately 640 m south-east of the site. • Rows of streets of terraced houses are shown from approximately 240 m east of the site.

Time	Site	Surrounding
1896 to 1946	The carriage shed was now labelled as an **engine shed**. No further significant changes noted.	In the immediate surrounds, the coal depot located to the north of the site and the locomotive shed located to the south-west of the site were no longer labelled.
1946 to 1962	By 1946 the engine / carriage shed is no longer present and the site is instead occupied by further **railway sidings**.	A **goods shed** with associated **railway lines** is now present at the former location of the coal depot. Two **engine sheds** and associated **workshops** were located approximately 130 m and 170 m south-west of the site. Continued residential development of streets and terraced houses is apparent to the east of the site. By the early 1930s the gas works are no longer labelled, however the **gas cylinders** are still shown. By the late 1940s, **St Pancras Hospital** is labelled as a hospital for Tropical Diseases, approximately 350 m south-west of the site.
1962 to 1978	The railway lines present on site have been demolished by the late 1960s, and the site is noted to be in use as a **freightliner terminal.**	The removal of on-site railway sidings in 1968 coincides with the removal of goods depots, Engine sheds and associated workshops on the land within the radius of 100 m from the site. By the early 1970s, some previous terraced streets situated approximately 500 m to the northeast of the site are no longer shown and had been replaced by several industrial buildings labelled as a **sand and gravel depot**, **warehouses, garages** and Beaconsfield buildings.
1978 to 1993	**Railway lines** encroach onto the site from the north.	The area to the north of the site was noted to be in use as **King's Cross Freight and Freightliner Terminal** by 1988, associated features of the terminal included a **tank and conveyer** located approximately 165 m north-west and **electricity substation** located approximately 100 m north-east. No other significant changes occurred to the surrounding area.
1993 to 2010	By 2006, all railway sidings and lines have been removed from site. The Channel Tunnel Rail Link was noted to be under construction on the site.	Some railway sidings / lines situated immediately to the north of the site are shown to have been removed. Between 1999 and 2006 complete removal of the railway sidings has occurred in the surrounds to the north and south of the site, and the Channel Tunnel Rail link is labelled as under construction.
2010 to 2023	The Channel Tunnel Rail Link is first noted on site in the 2010 map. In the last few years, Chilton Square has been occupied by temporary portacabins located upon a gantry, which serve as the offices / welfare for the adjacent Plot S4 development.	Since 2010, the King's Cross Central Redevelopment has included the development of several plots surrounding Chilton Square. Plot S3 to the south is constructed as an office building, Plot S4 to the east as a mixture tenure residential building and Plot S5 to the north as a mixed-use residential led development.

2.5 Potential Contamination

With reference to the Department of the Environment Industrial Profile for Railway Engineering Works, DoE, typical contaminants of concern associated with former railway land-uses include:

- Fuels, oils and hydraulic lubricants as a result of past spills;
- Heavy metals such as mercury associated with old relay switches;

- Solvents associated with maintenance activities (degreasing and thinning);
- Creosotes used to preserve timber-based infrastructure;
- Polychlorinated biphenols associated with electrical infrastructure (substations and transformers);
- Herbicides / pesticides associated with vegetation control; and,
- Asbestos containing material (ACM) used in locomotive lagging, rail stock breaks and insulation and building infrastructure (cabling, ducts).

The site and surrounding area have been occupied by a variety of railway infrastructure including goods and coal depots, carriage / engine sheds, locomotive cleaning sheds, tracks and works. Therefore, any potential contaminants of concern associated with the historical railway land use could potentially be site wide.

Brownfield sites, such as this, are seldom underlain by natural soils but rather a general Made Ground fill material of variable thickness and chemical composition. The presence of Made Ground beneath the site is considered likely (the assessment of which is discussed herein) and therefore it is not unusual to encounter low levels of ACM, heavy metals and poly aromatic hydrocarbons (PAHs).

The presence of a significant thickness of Made Ground does present a potential source of hazardous ground gas including elevated concentrations of Methane (CH_4) and or Carbon Dioxide (CO_2).

2.6 Unexploded Ordnance

RPS Explosives Engineering Team has carried out a separate desktop study which specifically considers the potential presence of historical Unexploded Ordnance (UXO) at the KXC regeneration area. Within this report, two High-Explosive bombs are recorded to have landed on / adjacent to the site between 1940 and 1941 on bombsight.org.

In order to mitigate the risk of UXO, it is recommended that a UXO management plan is in place prior to commencing intrusive works and that all site personnel attend an Explosive Ordnance Site Safety and Awareness Briefing. Furthermore, for any intrusive works (e.g., excavations, exploratory boreholes and piling), an Explosives Safety Engineer should be on call.

Contractors risk assessments and method statements (RAMS) covering all groundwork should take into consideration the information presented within RPS's UXO Risk Assessment.

3. GROUND CONDITIONS

Combined geo-environmental and geotechnical ground investigations have been undertaken at the adjacent plots S5 (between 6th April and 10th May 2018), S3 (between 8th April and 18th September 2019) and S4 (between 7th December 2020 8th January 2021) by Concept Engineering Consultants Limited (Concept) under part-time technical supervision by Ramboll. The geo-environmental findings of each ground investigation are provided in detail within the corresponding Ground Contamination Interpretative Report (GCIR) / Geo-environmental and Geotechnical Interpretive Report (GIR) (refer to Table 1-1 for reference).

The ground investigations undertaken across Plots S4 and S5 included exploratory hole locations within / adjacent to the Chilton Square site boundary. As such, the findings at these locations have been summarised for the purpose of this document within the following sections. References are also made to the findings of the Plot S3 ground investigation where relevant.

3.1 Exploratory Works

The scope of the Plot S5 ground investigation (2018) comprised the following:

- 2 No. cable percussive boreholes to a maximum depth of 40.0 m bgl.
- 4 No. cable percussive boreholes with rotary follow on to a maximum depth of 40.0 m bgl.
- 5 No. dynamic sampling boreholes to a maximum depth of 4.0 m bgl.
- 5 No. trial pits to a maximum depth of 3.65 m bgl.
- Pressuremeter Testing.
- Instrumentation monitoring and sampling.

The scope of the Plot S3 ground investigation (2019) comprised the following:

- 4 No. cable percussive boreholes to a maximum depth of 50.0 m bgl.
- 1 No. cable percussion follow on rotary borehole to a depth of 40.0 m bgl.
- 1 No. rotary borehole to a depth of 6.0 m bgl.
- 1 No. open hole rotary borehole to a maximum depth of 17.5 m bgl.
- 5 No. dynamic window sample boreholes to a maximum depth of 5.25 m bgl.
- 4 No. mechanically excavated trial pits to a maximum depth of 3.0 m bgl.

The scope of the Plot S4 ground investigation (2020 / 2021) comprised the following:

- 2 No. cable percussive boreholes to a maximum depth of 45.0 m bgl.
- 6 No. dynamic window sample boreholes to a maximum depth of 6.0 m bgl.

Geo-environmental laboratory analysis was undertaken as part of all three ground investigations, and groundwater and gas monitoring were undertaken following intrusive works.

Five (5 No.) of the above exploratory locations were located on / adjacent to Chilton Square, as follows:

- **PM01** (Plot S5 GI) – cable percussion / rotary borehole advanced to 40.0 m bgl – located in the east of the site.
- **RC01** (Plot S5 GI) – cable percussion / rotary borehole advanced to 40.0 m bgl – located in the north-east of the site
- **TP02** (Plot S5 GI) – trial pit advanced to 3.65 m bgl – located adjacent to the eastern site boundary.
- **WS02** (Plot S4 GI) – window sample borehole advanced to 4.0 m bgl – located in the centre of the site.
- **WS06** (Plot S4 GI) - window sample borehole advanced to 1.2 m bgl – located in the south-east of the site.

A plan showing the exploratory hole locations from the Plot S4 and Plot S5 ground investigations that relate to Chilton Square is contained within Appendix 1.

3.2 Geology

A summary of the geology encountered beneath Chilton Square during the Plot S4, and Plot S5 ground investigations is summarised in Table 3-1 below. Based on available BGS records, the Lambeth group is understood to be underlain by the Thanet Sands and Upper Chalk Formation, which were not encountered during the ground investigations.

Table 3-1: Summary of Ground Conditions

Stratum	Top Depth (m AOD)	Thickness Range (m bgl)	Description of Stratum
Made Ground	+25.65 to +26.54	2.10 to 3.70	Predominantly concrete or asphalt, overlying brown silty and / or sandy CLAYs to sandy GRAVELs. Gravel comprising fine to coarse angular to rounded brick, concrete, flint, chert, asphalt, ash, clinker, ceramic, slag and glass.
Alluvium	+23.96	1.50	Firm to locally stiff, dark greyish mottled blue silty CLAY with occasional rootles and organic traces. Encountered adjacent to the eastern site boundary only in TP02.
London Clay	+23.27 to +22.46	34.20 to 34.50	Firm brown mottled blue and bluish grey CLAY with occasional selenite crystals. Very stiff, brownish grey slightly sandy silty CLAY with rare pockets of light brown fine sand.
Lambeth Group	-11.24 to -11.28	Extent not proven	*Upper Mottled Beds* Very stiff, dark brown/grey mottled bluish grey slightly sandy silty CLAY.

3.3 Hydrogeology

Under the Water Framework Directive, the Environment Agency (EA) classified geological stratum to reflect the importance of aquifers in terms of groundwater as a resource (drinking water supply) but also their role in supporting surface water flows and wetland ecosystems. The Aquifer classifications for the underlying stratum have been summarised as Table 3-2, below.

Table 3-2: Environment Agency Aquifer Classification

Stratum	Environment Agency Aquifer Classification	Environment Agency Aquifer Description
Made Ground	Unclassified	Unclassified
Alluvium	Unclassified	Unclassified
The London Clay Formation	Unproductive Stratum	Low permeability that has negligible significance for water supply or river base flow
Lambeth Group	Secondary A Aquifer	Permeable layers capable of supporting water supplies at a local rather than strategic scale, and in some cases forming an important source of base flow to rivers.
Thanet Sands	Principal Aquifer	Highly permeable layers capable of supporting significant water storage. Able to support large water abstractions.

Upper Chalk Formation	Principal Aquifer	Highly permeable layers capable of supporting significant water storage. Able to support large water abstractions.

According to the Environment Agency, the Made Ground and superficial deposits are not classified; the London Clay is an unproductive stratum; the Lambeth Group is classified as a Secondary A Aquifer; and the Thanet Sands and Upper Chalk are classified as Principal Aquifers and are considered to be in hydraulic connectivity.

The site is not located within a Groundwater Source Protection Zone (GSPZ); with the nearest being an Outer Catchment Zone situated approximately 490 m to the east of the site. As of 2020, the nearest Groundwater Abstraction Licence is situated approximately 190 m to the north-west of the site, within a borehole at the King's Cross Concrete Plant for non-potable use (Mineral Products: General Use relating to Secondary Category). There are no groundwater abstractions for public water supply located within 2 km of the site (as of 2020).

During the ground investigations across the adjacent plots, no groundwater strikes were recorded at the exploratory locations situated within / adjacent to the Chilton Square boundary.

During the groundwater monitoring rounds, shallow groundwater was encountered within the Made Ground beneath Chilton Square at +23.58 mAOD (WS02). WS06 and PM01 were dry, and RC01 was not installed for monitoring purposes. Across the adjacent Plot S5, the average shallow groundwater level within the Made Ground and top of the London Clay was found to range between +20.00 mAOD to +25.50 mAOD. Within the S4 Plot, the average shallow groundwater level within the Made Ground and top of the London Clay was found to range between +20.86 mAOD to +23.99 mAOD. It should be noted that groundwater levels are likely to fluctuate for several reasons including variable permeability in the Made Ground, seasonal variations, heavy rainfall and leaking water mains.

Perched water associated with the Made Ground encountered may potentially be in hydraulic connectivity with the Secondary A Aquifers. As a result, although unlikely, perched water underlying the site within the Made Ground may also be in hydraulic continuity with Regents Canal located within 300 m from the subject site (via the secondary A Aquifers).

Perched groundwater is not defined as 'controlled water' and is therefore not classified as receptor of the water environment under the Environmental Protection Act 1990 and water legislation.

3.4 Hydrology

There are no surface water features on-site. The nearest surface water body is the Regent's Canal, part of the wider Grand Union Canal (GUC) network and located approximately 290 m south-west of the site at its closest point.

The GUC is a hydraulically isolated water body flowing east. The canal is contained within the combination of canal wall and clay liner construction. As of 2020, the nearest surface water abstraction is located approximately 410 m south-west of the site at Camley Street Nature Park. The water is used for make-up or top up water for ponds on site; however, no details of annual abstraction rates are available.

Historically, throughout the development of central London, the majority of natural tributaries to the River Thames have been culverted, dried up or in-filled. Records obtained from 'lost rivers' (Barton, 1992) indicates that the nearest of these (The Fleet) is located approximately 580 m to the south-west of the site and flows southwards into the River Thames following an approximate route of the Grand Union Canal.

3.5 Ground Gas

Ground gas monitoring was undertaken as part of the ground investigations across the adjacent plots as follows: Plot S5 on six occasions between 20th July and 30th August 2018; Plot S3 on five occasions between 17th June and 26th July 2019; and S4 on six occasions between 12th January and 24th March 2021. This included the monitoring of three (3 No.) boreholes (WS02, WS06 and PM01) located on Chilton Square. The results from the wider area are also considered to give a good indication of the likely ground gas regime at the site.

In accordance with CIRIA C665 (at the time of the assessments), Plots S3, S4 and S5 were classified as Characteristic Situation 1 (CS1) scenario (very low risk), indicating that no ground gas protection measures are required as part of the proposed developments. Based on these findings, Chilton Square can also be classified as CS1.

The reduced level dig and earthworks across the site are anticipated to reduce the levels of Made Ground (considered to be the source of ground gas) and further reduce the risk.

It should be noted that depleted oxygen concentrations were recorded at all three adjacent plots during the monitoring of boreholes installed within the Made Ground (including WS02 (12.5 % v/v), WS06 (15.5 % v/v) and PM01 (17.6 % v/v) on Chilton Square). Further consideration of this should be undertaken to ensure that ground gas risks are managed throughout the construction stage; however, work in confined spaces is not anticipated to be required.

The site lies within a lower probability radon affected area, as less than 1% of homes are above the action level. Consequently, no radon protection measures are deemed necessary for any future development.

3.6 Ground Contamination

Evidence of ground contamination is comprehensively discussed in detail as part of the Plot S5 GCIR (Ramboll 2018), Plot S3 GIR (Ramboll 2019) and Plot S4 GIR (Ramboll 2022). The following section provides a summary of the findings relevant to Chilton Square.

3.6.1 Soils

The exploratory hole logs are included within the Factual Ground Investigation Reports produced by Concept for Plot S5 (dated 2018), Plot S3 (dated 2019) and Plot S4 (dated 2021). With reference to the logs for the five (5 No.) exploratory locations within / adjacent to Chilton Square, visual evidence of contamination was limited to anthropogenic inclusions of brick, concrete, slag, ceramic, glass, asphalt, ash and clinker within the Made Ground deposits.

Olfactory evidence of contamination included a strong ammonium odour identified at PM01 (eastern boundary of the site) between 2.00-2.10 m bgl and 2.30-3.00 m bgl, which corresponded with high PID readings of 283.4 parts per million (ppm) and 472.7 ppm, respectively. Coal ash was also identified at this location between 2.00-2.10 m bgl.

As part of the ground investigation works, chemical laboratory testing was undertaken on soil samples for a range of potential contaminants including:

- Heavy metals/Semi-metals - Arsenic, Boron, Cadmium, Chromium, hexavalent Chromium, Copper, Lead, Mercury, Nickel, Selenium and Zinc);
- Inorganics – Sulphate and Cyanide;
- Organics - Total Petroleum Hydrocarbons, Poly Aromatic Hydrocarbons (PAHs), Phenols, BTEX, Polychlorinated Biphenyls, volatile and semi-volatile organic compounds (VOCs and SVOCs); and
- Asbestos identification with subsequent quantification.

From the five exploratory locations within / adjacent to Chilton Square, a total of 12 soil samples were submitted for laboratory analysis, with ten obtained from the Made Ground (0.25 m to 3.90 m bgl), one from the alluvium (3.0 m bgl) and one from the London Clay Formation (3.90 m bgl).

Within the ground investigation reports produced for the adjacent plots, soil results were compared against generic assessment criteria (GAC) for a residential end use. Given that Chilton Square is proposed to be developed as a local play / amenity space, the soil analytical results from exploratory locations on / adjacent to the site have been re-screened against the GAC for a public open space (POS) 1 (green space close to housing) scenario for soils of 1% organic matter. Benzo(a)pyrene has been used as a surrogate marker for the carcinogenic PAH compounds.

4-Isopropyltoluene, a VOC, was identified above laboratory limits of detection in two Made Ground soil samples from PM01, with concentrations of 170 µg/kg and 71 µg/kg recorded at 2.0 m and 2.50 m bgl, respectively. These elevated concentrations were associated with the strong ammonium odour and high PID readings of 283.4 ppm (2.00 m) and 472.7 ppm (2.50 m) noted in the logs provided by Concept. Concentrations of 4-Isopropyltoluene were not identified above laboratory limits of detection in the three other Made Ground samples submitted for VOC analysis, including a sample from PM01 at 3.90 m bgl.

No other exceedances were identified during the screening assessment. Refer to Appendix 2 for the soil screening table.

Asbestos in the form of chrysotile loose fibres was encountered in Made Ground soil samples from PM01 (0.30 m bgl) and WS06 (1.10 m bgl). However, when analysed for quantification, both samples reported an asbestos content of <0.001% w/w (below the limits of detection). No visible asbestos was recorded during the ground investigation.

In terms of the POS 1 screening criteria, Ramboll considers an asbestos quantification above 0.001% w/w to be an exceedance. If quantification exceeds 0.001% w/w, the concentration must be <0.01% w/w (i.e., very low levels as per watch Point 12 CL:AIRE JIWG CAR-SOIL 2016) and additional risk assessment will be required to confirm suitability for use. An asbestos quantification above 0.01% w/w is considered unsuitable for use.

The soil analytical results from ground investigations undertaken across the adjacent plots can be considered to provide further context, however it should be noted that the results were screened against different GAC to Chilton Square in line with the proposed site uses (commercial scenario for Plot S3 and residential scenario for plots S4 and S5). For Plot S3, contamination was limited to two detections of asbestos in the form of chrysotile loose fibres (<0.001 % w/w), with no exceedances of the commercial GAC identified during the screening assessment. For Plot S4, naphthalene and beryllium marginally exceeded the residential GAC at two locations in the centre of Plot S4, and asbestos was detected in two samples in the form of chrysotile loose fibres (again <0.001 % w/w). For Plot S5, failures of the screening assessment (residential GAC) were limited to PAHs (benzo(a)pyrene, benzo(a)anthracene, benzo(b)fluoranthene, dibenzo(a,h)anthracene and naphthalene) in up to six samples, selected VOCs and SVOCs above minimum reporting values and the identification of asbestos at five locations in the form of chrysotile loose fibres (<0.001 % w/w). Overall, limited evidence of soil contamination was identified in relation to the proposed site uses for each plot.

3.6.2 Groundwaters

One groundwater sample from WS02 (located in the centre of Chilton Square) was obtained from perched water within the Made Ground and submitted for subsequent laboratory analysis for contaminants listed in section 3.6.1 above. Groundwater analysis results were compared against

selected Water Quality Standards (WQS) in relation both to human health risk and controlled waters risk.

Elevated sulphate was detected in the groundwater sample from WS02 at a concentration of 1560 mg/l, which exceeded the controlled waters GAC of 400 mg/l. This was consistent with findings across Plots S3, S4 and S5. No other exceedances were recorded.

A leachate assessment was undertaken as part of the Plot S5 ground investigation and included analysis of samples from PM01 (0.30-0.60 m) and TP02 (2.00 m). Results were screened against the soil leachate WQS. Concentrations of ammonium in the sample from PM01 exceeded WQS (320,000 µg/l compared to 500 µg/l). Naphthalene was identified in the leachate sample from TP02 at a concentration of 1.20 µg/l, which exceeded WQS of 0.075 µg/l.

The groundwater analytical results from across the adjacent plots can also be considered. At Plot S3, elevated sulphate was detected in most of the groundwater samples for controlled waters risk, with a maximum concentration of 999 mg/l being recorded compared to the GAC of 400 mg/l. Slightly elevated concentrations of vanadium (82 µg/l) and cyanide (55 µg/l) were detected in one sample compared to the EQS of 60 µg/l and 50 µg/l, respectively. Overall, these concentrations are not considered to pose a significant risk as they are within the same order of magnitude as the GAC and are likely reflective of background water quality in the area rather than an indication of on-site source of contamination.

At Plot S4, elevated sulphate was detected in most of the groundwater samples (from both the Made Ground and London Clay) for controlled waters risk, with a maximum concentration of 3,510 mg/l being recorded. Slightly elevated concentrations of chromium were detected in groundwater within the London Clay at two locations at concentrations of 19 µg/l (hexavalent chromium) and 5.1 µg/l (chromium III), compared to the EQS of 3.4 µg/l and 4.7 µg/l respectively. Overall, these concentrations are not considered to pose a significant risk to controlled waters. For chromium III, the detected concentration is localised and within the same order of magnitude as the GAC and is likely reflective of background water quality in the area rather than an indication of an on-site source of contamination.

At Plot S5, soil leachate data highlighted the potential for ammonium (as discussed above) and naphthalene (1.20 µg/l detected at one location compared to the WQS of 0.075 µg/l)) to be mobilised within the Made Ground. However, there was limited correlation between the leachate and groundwater data, as PAHs were not identified at concentrations greater than laboratory limits of detection, and ammonium was identified at a concentration greater than the GAC in only one groundwater sample (see below).

All four groundwater samples analysed as part of the Plot S5 investigation exceeded the WQS for sulphate, with a maximum concentration of 999 mg/l being recorded. Single exceedances of boron (880 µg/l compared to the WQS of 750 µg/l) and ammonium (790 µg/l compared to the WQS of 500 µg/l) were identified. It is considered unlikely that the exceedances of sulphate, ammonium and boron are indicative of an on-site source of contamination due to the lack of identified sources and limited correlation with soils leachate data.

Refer to the respective ground investigation reports for plots S3, S4 and S5 for the full groundwater analytical results.

3.7 Preliminary Waste Classification

The results of the preliminary waste classifications undertaken for the adjacent plots S3, S4 and S5 are discussed in detail in the corresponding ground investigation reports. The following section provides a summary of the findings with a focus on those relating to Chilton Square.

3.7.1 Results

A total of 10 No. soil samples from exploratory locations within / adjacent to Chilton Square (comprising nine Made Ground samples and one alluvium sample) were submitted for HazWasteOnline Assessment to determine the potential for soils to be classified as hazardous waste. This included samples from WS02 (0.20 m and 1.20 m), WS06 (0.25 m and 1.10 m), RC01 (0.30 m), PM01 (2.0 m, 2.50 m and 3.90 m) and TP02 (2.0 m and 3.0 m). All samples were classified as non-hazardous by HazWasteOnline.

Results of the HazWasteOnline Assessment undertaken for samples obtained during ground investigations at the adjacent three plots have also been considered as follows:

- For Plot S3, out of 49 samples analysed (comprising 43 from the Made Ground and six from the London Clay), three Made Ground samples were classified as 'hazardous', with the remaining 46 samples 'non-hazardous' (approximately 6% of samples were hazardous).
- For Plot S4, all 32 samples analysed (comprising 24 from the Made Ground and eight from the London Clay) were classified as 'non-hazardous'.
- For Plot S5, out of the 31 samples analysed (comprising 27 from the Made Ground and four from the natural soils), eight Made Ground samples were classified as 'hazardous', with the remaining 23 samples 'non-hazardous' (approximately 30% of samples were hazardous).

3.7.2 Asbestos

Trace detections of asbestos in the form of loose chrysotile fibres were detected in two of the Made Ground samples (PM01 and WS06) at concentrations of <0.001% by volume (i.e., below laboratory method reporting limits).

The Hazardous Waste (England and Wales) Regulations 2005 requires that any waste having an asbestos content greater than 0.1% weight/weight (w/w) be classified as Hazardous Waste. Any waste with an asbestos content of less than 0.1% w/w can be classified as non-hazardous waste, unless there are other contaminants present which would make the waste hazardous.

Additionally, if the waste contains fibres that are free and dispersed then the waste will be hazardous if the waste as whole contains 0.1% or more asbestos.

Where the waste contains identifiable pieces of asbestos (i.e., any particle of a size than can be identified as potentially being asbestos by a competent person by the naked eye), then the asbestos must be assessed separately. The waste is hazardous if the concentration of asbestos in the pieces alone is 0.1%.

3.7.3 Interpretation

Based on the outcome of the HazWasteOnline Assessment for exploratory locations within / adjacent to Chilton Square, the Made Ground soils and Alluvium are both classified as non-hazardous waste. However, the HazWasteOnline Assessment for the adjacent plots indicates a potential for approximately 6–30% of Made Ground samples to be classified as hazardous waste. Based on the assessment for the adjacent plots, the London Clay can be classified as non-hazardous.

The majority of the Made Ground underlying Chilton Square is likely to be suitable for acceptance at a waste disposal facility as non-hazardous waste; however, it would be prudent to make an allowance for a smaller proportion of the Made Ground to be disposed as stable non-reactive hazardous waste or hazardous waste, which may require pre-treatment prior to disposal.

For the purposes of waste classification, the occurrence of only traces of asbestos at <0.001% w/w means the Made Ground material will not be classified as hazardous waste due to asbestos content as these concentrations are well below the 0.1% hazardous waste threshold.

Based on our experience it is anticipated that the Alluvium and London Clay soils would be classified as inert waste, subject to waste acceptance criteria (WAC) analysis. The Natural Ground soils encountered displayed no significant evidence of visual / olfactory contamination.

On this basis, and with the benefit of experience on several plots within the KXC development site it is considered that, pending agreement with potential receiving facilities, the indicative waste classifications summarised above are applicable to the site soils at Chilton Square.

The final classification of the arisings generated as part of this development is ultimately dependent on the outcome of the necessary additional testing required under current legislative requirements post excavation and through negotiations with the intended receiving facility.

Given the inherent heterogeneity of Made Ground soils and the positive identification of asbestos it would be prudent to make a provisional allowance for encountering isolated fragments and fibres of asbestos that will need to be disposed of under appropriate Duty of Care procedures.

Subject to the implementation of appropriate material segregation strategies, e.g., separating Made Ground from inert London Clay, it may be possible to register the development site as a "Donor Site" under the CL:AIRE Industry Code of Practice such that site won materials are not classified as wastes. As part of the framework, clean naturally occurring site won materials (e.g., London Clay) could be transferred to a "Receiver Site" for reuse, thereby increasing reuses, sustainability and reducing disposal costs. A Material Management Plan (MMP) approved by a Qualified Person and CL:AIRE will need to be developed and implemented on site.

4. EARTHWORKS STRATEGY

4.1 Anticipated Construction Activities

The anticipated construction activities likely to be undertaken as part of the proposed development have been summarised below:

I. Breaking out of current hardstanding and initial shallow level reduced dig across the site (site strip), with excavation of soils down to agreed depths (to be confirmed but for the purpose of this earthworks strategy a nominal depth of 0.25 m bgl has been used). This material characterised for waste disposal purposes, and removed from site;

II. Construction of the play area (where play safety surfacing is present) and surrounding soft landscaped planting areas comprising excavations to agreed depths (minimum of 0.60 m bgl). Excavations for play structure foundations to a maximum approximate depth of 1.50 m bgl following initial excavation to 0.60 m bgl. Localised excavations for tree pits with vertical depths anticipated to be similar to that of the play structure foundations. Excavated materials characterised for waste disposal purposes and removed from site; and,

III. Importation of capping layer (assumed in line with Ramboll recommendations made in section 4.2.2 below) for play area and soft landscaped planting areas.

Proposed finished levels across the site range from +26.50 m AOD (north-west of the site) and +25.42 m AOD (south-east of the site).

Approximately 45% of Chilton Square is proposed to be occupied by the play area itself which is primarily covered in safety play surfacing of "Corkeen" (a bound surface) and "Hardwood Chips" (a loose surface) both classified as "hardstanding", but also incorporates soft landscaped areas comprising planting of shrubs, grasses and tress. The remaining area (55%) of Chilton Square outside of the play area comprises hardstanding of paving with discrete areas of soft landscaping for planting. A total of approximately 15% of Chilton Square comprises soft landscaped areas with planting of shrubs, grasses and trees.

4.2 Estimated Volumes

Based on available information pertaining to the proposed development, conservative estimated volumes of material requiring excavation and importation have been calculated and the findings are summarised within Table 4-1 and excavation assumptions.

Table 4-1: Estimated Excavated Volumes

Excavation Type	Made Ground / Alluvium Volume (m^3)
Site strip	Approximately 310 m^3
Play area and planting areas	Approximately 370 m^3
Tree pits	Approximately 255 m^3
Infrastructure (play structure foundations)	Approximately 25 m^3
Sub-totals	Approximately 960 m^3
Total Excavation = Approximately 960 m^3	

Excavation Assumptions:

- Total volumes of excavated Made Ground / Alluvium are based on the stratigraphy encountered during the ground investigation (up to 3.70 m thickness of Made Ground overlying a discontinuous band of Alluvium).
- A nominal depth of 0.25 m bgl has been used for the initial shallow level reduced dig across the site (site strip).
- The play area (where play safety surfacing is present) and soft landscaped (planting areas) excavations are assumed to be to a minimum of 0.60 m bgl (600 mm), based on the proposed installation of a 600 mm thick imported capping layer in these areas.
- Tree pits are the same size (12 m^3) for all 21 planted trees proposed on site. Tree pit volumes and number of trees are based on Erect Architecture, Drawing Number 398-CS-200GA (refer to Appendix 1).
- A nominal value of 25 m^3 is provided as a conservative estimate for excavations associated with play structure foundations.
- Volumes quoted are only estimates based on the information and drawings provided to Ramboll.

Table 4-2: Estimated Imported Volumes

Importation Type	Engineered Fill	Type 3 Sub-base (*unknown subbase)	Imported Topsoil/Subsoil
Play safety surfacing subbase (Type 3)	-	Approximately 40 m^3	-
Fill material beneath play safety surfacing subbase	Approximately 170 m^3	-	-
Tree pits	-	-	Approximately 255 m^3
Soft landscaping planting areas (not including tree pits).	-	-	Approximately 115 m^3
Infrastructure (play structure foundations backfill)	Approximately 25 m^3	-	-
Subbase beneath paved areas		Approximately *65m^3	
Sub-totals	Approximately 195 m^3	Approximately 105 m^3	Approximately 370 m^3
Estimated Total Imported Volume = 670 m^3			

Importation Assumptions:

- Estimated volumes for imported fill material beneath play safety surfacing subbase is based on the play safety surfacing materials thickness as specified in Stantec, Drawing Number 332410744_900_SK04. The Thickness of fill material beneath the play safety surfacing and subbase have been calculated by subtracting proposed thicknesses of play safety surfacing and subbase from 600 mm. Ramboll recommends a minimum 600 mm thickness capping layer in this area (as detailed in Section 4.4.2).
- Volumes of subbase (Type 3) beneath play area surfacing is based on a 100 mm thickness as proposed in Stantec, Drawing Number 332410744_900_SK04.
- Tree pits are the same size (12 m^3) for all 21 planted trees proposed on site. Tree pit volumes and number of trees are based on Erect Architecture, Drawing Number 398-CS-200GA (refer to Appendix 1).
- Soft landscaping planting areas is based on areas depicted as 'planting in ground' on Erect Architecture, Drawing Number 398-CS-200GA (refer to Appendix 1) and assumes an importation of a minimum 600 mm thickness of topsoil/subsoil.

- A nominal value of 25 m^3 is provided as a conservative estimate for imported engineered fill for backfill surrounding play structure foundations.
- A nominal value of 80 m^3 is provided as a conservative estimate for imported subbase for beneath paved areas, with an assumed thickness of 100 mm.

As part of the construction works for Chilton Square, it is anticipated that there will be **approximately 960 m^3** of cut and **670 m^3** of fill.

These excavation calculations have been estimated using drawings presented in Appendix 1 and on the assumption that finished site levels will be equal to current site levels. It is worth noting adjustments will be made as the design is developed and therefore these calculations should be reassessed closer to the time to determine more accurate amounts.

4.3 Estimated Lorry Movements

The total number of lorry movements carrying excavated soils and imported fill/aggregate has been estimated based on 8.50 m^3 of unbulked (as dug) material per lorry movement (King's Cross Central Environmental Statement, Arup, May 2004).

4.3.1 Export

The estimated number of lorry movements carrying all excavated material as described in above is **113.** This estimate assumes that no excavated material (Made Ground or Alluvium) are to be re-used on-site and therefore, are based on a worse-case scenario assuming the assumptions made for the volume calculations remain accurate. These movements will be either to off-site material disposal or recycling facilities, or to sites elsewhere within the wider KXC development area, for temporary storage prior to re-use elsewhere in the KXC development.

Once the final design drawings are produced, these amounts can be recalculated and potentially reduce the number of lorry movements.

4.3.2 Import

The estimated number of lorry movements carrying all imported material as described in above is **79.** This estimate relies on the accuracy of the assumptions made for volume calculations as described earlier within this Section.

4.4 Suitability of Materials for Reuse on Site

For the purposes of this document, suitable material is defined as 'material that, by its chemical and physical composition, is suitable for use as part of the proposed development'.

Conversely, unsuitable material is defined as 'material that, by its chemical and physical composition, is only suitable for off-site disposal either to landfill or treatment facility and cannot be incorporated into the proposed development'.

4.4.1 Soft Landscaping Material

As detailed above approximately 15% of Chilton Square comprises soft landscaped areas with planting of shrubs, grasses, and trees. Trees planted directly in the ground are required to have a minimum of 12 m^3 of soil in the tree pit, as specified by Erect Architecture, Drawing Number 398-CS-200GA (refer to Appendix 2). Note, tree pit soil specification is to be developed by soil specialists and civil engineers in RIBA Stage 4.

Due to the presence of ACM in the Made Ground, site soils are not considered suitable for use within the proposed soft landscaping due to the potential exposure to future site users. Similarly, based on a number of physical parameters, the Made Ground soils are not deemed suitable as a growing medium.

An imported capping layer will be required for all soft landscaped areas (i.e., planting areas). Ramboll recommends a minimum of 600 mm thickness of material (topsoil/subsoil) is required for such areas. The imported material for use in soft landscaped areas must comply with Ramboll's public open space (POS) 1 (green space close to housing) screening criteria, as presented in Appendix 2.

Ramboll do not consider the Corkeen and Hardwood Chips play safety surfacing and accompanying subbase (as detailed within Stantec, Drawing Number 332410744_900_SK04 included in Appendix 1) as hardstanding which is sufficient in removing a potential pollutant linkage. As specified in the General Arrangement Drawing (Erect Architecture, Drawing Number 398-CS-200GA included in Appendix 2), a 100 mm thick inert subbase (Type 3) is required beneath the Corkeen and Hardwood Chip surfacing in the play area in order to maintain the correct pH balance in soils within tree pits. For the purposes of this Earthworks Strategy, Ramboll consider the play area (where play safety surfacing is present) as a soft landscaped area; therefore, imported material will be required beneath the finished surfacing to form a capping layer.

Ramboll recommends that the imported capping layer in the play area should be a minimum of 600 mm thickness which is to comprise the play safety surfacing (Corkeen / Hardwood Chips), subbase (Type 3) and imported fill/subbase material. For example, in the area of loose play surfacing (Hardwood Chips) the following sequence is recommended (proposed thicknesses of Hardwood Chips, Eco Grid and subbase is obtained from Stantec, Drawing Number 332410744_900_SK04): a minimum of 250 mm Hardwood Chips, 50 mm Eco Grid, 100 mm Type 3 subbase and 250 mm imported fill / subbase forming a minimum 600 mm thickness capping layer. The imported material must comply with Ramboll's public open space (POS) 1 (green space close to housing) screening criteria, as shown in Appendix 2.

4.4.2 Engineering Fill (below roads and hardstanding)

In the context of this subsection entitled 'suitability of materials', engineering fill is defined as the site-won material that is suitable as fill to structures for applications within carriageways, pedestrian pavements and hard-landscaped areas and not imported fill.

Based on the ground conditions established from the ground investigation, assuming the geotechnical soundness of site-won material, the underlying Made Ground, Alluvium and London Clay is likely to be considered chemically suitable below hardstanding (i.e., paved areas on site outside of the play area); however, the identification of asbestos in two locations means Made Ground soils are considered unsuitable for re-use within future service corridors. Should unforeseen contamination be encountered, re-assessment will be required to determine whether the material is suitable below hardstanding.

Due to the potential aggressivity of the underlying Made Ground, it is recommended that imported aggregate is used within all future service corridors, with particular reference to the potential for permeation of hydrocarbons into potable water supply lines. Furthermore, it is recommended that prior to backfill, a Terram (or similar) demarcation layer is installed within each corridor.

4.4.3 Unsuitable Materials

No chemically or geotechnically unsuitable material will be imported to the site. Any site-won material that is unsuitable for use as part of the proposed development will be removed from the site to a suitably licensed landfill or treatment facility under appropriate Duty of Care Procedures.

Materials which do not have the appropriate geotechnical properties in accordance with the Highways Agency Specification for Highway Works based on the proposed end use will be deemed unsuitable. This could include the following materials:

- Soft cohesive material, not suitable as fill under new pavement or hard landscaped areas;
- Contaminated material;
- Made Ground with unsuitable engineering properties (e.g., high fines content, high moisture content, significant quantities of organic matter); and,
- Other material designated as unsuitable due to lack of compliance with particular engineering fill parameters, and as determined in the Specification for Highway Works.

All unsuitable excavated material will require information that is appropriate to the receiving waste facility. This may include:

- Material description;
- Standard Chemical Testing; and
- Waste Acceptance Criteria (WAC) Testing as appropriate.

All material disposed off-site will be accompanied by the appropriate duty of care documents.

4.4.4 Treatment and Re-use

The Section 106 of the Outline Planning Permission requires the developer to re-use site won materials where possible. Although, Chilton Square is to be submitted to planning under a separate planning permission, some materials may be suitable for re-use in other areas of the KXC site following excavation, subject to validation testing to confirm chemical and geotechnical suitability.

No re-use of Made Ground has been agreed and it is anticipated that this will be removed from site as a predominantly non-hazardous waste. Although not anticipated if re-use of material is proposed then a Materials Management Plan (MMP) must be put in place, prior to any reuse taking place.

Based on the results of the ground investigation, the need to undertake pre-treatment of soils prior to disposal or re-use is unlikely. The protocols and procedures to be adopted on-site, should any areas of unforeseen contamination be encountered, are outlined in Section 6 of this document.

As discussed in Section 3.7 of this report, of the eleven Made Ground samples submitted for asbestos identification, two samples returned positive results in the form of chrysotile loose fibres. Whilst it is acknowledged that none of the subsequent quantification analysis reported concentrations >0.001% w/w, due to the inherent heterogeneity of Made Ground soils, asbestos as either free-fibres or fragments cannot be ruled out entirely.

Should visible fragments of asbestos be identified during any earthwork activities, on the advice of a suitably licenced contractor / qualified personnel, ACM fragments will need to be segregated from any associated soils and stockpiled in a controlled manner (double bagged, segregated and adequately labelled) for subsequent off-site disposal as hazardous waste under suitable duty of care.

4.5 Material Handling

4.5.1 Stockpiling and Re-use On-site

No material re-use has been agreed for the site.

Excavated materials shall be adequately segregated in accordance with material type (Made Ground, Alluvium and London Clay, depending on the depths of the excavations) and temporarily

stockpiled for classification, prior to disposal offsite. If visual or olfactory evidence of contamination is observed, then this material should be segregated and stockpiled separately and removed from site as appropriate.

4.5.2 Contaminated Material

Where suspected impacted material is encountered, material will be segregated and placed upon impermeable polythene sheeting or hardstanding for subsequent classification prior to disposal.

Mitigation measures including the use of dust suppression methods and containment via bunding shall be implemented to restrict dust entrainment and surface water run-off from the temporary stockpile in order to reduce the potential for contaminant migration.

4.5.3 Drainage of Excavated Areas

It is considered likely that perched water within the Made Ground / Alluvium above the London Clay will be encountered as part of the earthworks.

Where encountered, a localised sump and pump methodology will be adopted on-site. Assuming no evidence of impact is observed the water will be discharged to the KXC site-wide drainage network, specifically the combined sewer system.

Prior to the commencement of earthworks on-site, discharge consent will be sought by the contractor from the operator.

Where practicable, excavations and superficial soils will be kept free of standing water in order to minimise any potential risks associated with access and or ground stability.

5. GROUND CONTAMINATION RISK ASSESSMENT

The source, pathway, receptor (S-P-R) model for Chilton Square has been produced based on the results from ground investigations undertaken at the adjacent plots S4 and S5 (which included exploratory locations on / adjacent to the subject site) and following the re-screening of soil analytical results from such locations as part of this report, as is contained below.

5.1 Environmental Risk Assessment

Environmental risks are assessed within the risk management framework established in Part IIA of the Environmental Protection Act (EPA) 1990 (HMSO, 1990), which provides a statutory definition of contaminated land. To fall within this definition it is necessary that, as a result of the condition of the land, substances may be present on or under the land such that:

- Significant harm is being caused or there is a significant possibility of such harm being caused; or,
- Pollution of controlled water is being or is likely to be caused.

Risk from contamination is assessed by consideration of possible linkages between contaminant sources and potential receptors which could be harmed or polluted.

The key aspect of the contaminated land risk management framework is the development of a Conceptual Site Model (CSM) which illustrates the spatial interaction between the potential sources and receptors on site.

For a risk of pollution or environmental harm to occur as a result of ground contamination, all of the following elements must be present:

- A source, i.e., a substance that is capable of causing pollution or harm;
- A receptor, i.e., something which could be adversely affected by the contaminant; and,
- A pathway, i.e., a route by which the contaminant can reach the receptor.

If one of these elements is absent there can be no significant risk. If all are present then the degree of the risk is a function of the magnitude and mobility of the source, the sensitivity of the receptor and the nature of the migration pathway.

5.2 Conceptual Site Model

5.2.1 Sources

The potential sources of contamination summarised in Section 3.6 are based on the available ground investigation results.

Table 5-1: Sources of Contamination

Source	Comments
Asbestos	Asbestos within the Made Ground (PM01 at 0.30 m and WS06 at 1.10 m) detected as loose chrysotile fibres at concentrations <0.001%.
Made Ground	4-Isopropyltoluene, a volatile organic compound, was identified above laboratory limits of detection in two soil samples from PM01 (170µg/l at 2.0 m and 71µg/l at 2.50 m), associated with a strong ammonium odour and PID readings in the Made Ground. Leachable ammonium and naphthalene were identified above WQS values in the leachate data for PM01 (ammonium) and TP02 (naphthalene), respectively. Unknown organic and inorganic contaminants may be present. Possible phytotoxic contaminants.
Groundwater	Elevated sulphate was detected at a concentration of 1560 mg/l, which exceeded the controlled waters GAC of 400 mg/l in WS02 (centre of the site).

Source	Comments
Ground Gas	Depleted oxygen concentrations were recorded at all three adjacent plots during the monitoring of the Made Ground, including WS02 (12.5 % v/v), WS06 (15.5% v/v) and PM01 (17.6% v/v) located on the subject site. The site is considered to be in Characteristic Situation 1 (CS1).
Underground Structures	Unknown organic and inorganic contaminants may be present associated with previously unidentified underground structures.

5.2.2 Receptors

The site-specific receptors that could potentially be affected by the contamination hazards are summarised in Table 5-2.

Table 5-2: Receptors

Feature		Comments
On-site		
Future Site Users		The proposed development comprises a new local play / amenity space for use by surrounding residents and potentially others. As such, future site users will include children using the play area as well as accompanying adults.
Construction Workers		Construction workers coming into contact with asbestos, potentially contaminated soils, or groundwater during the redevelopment works, particularly during the earthworks.
Controlled Waters	Groundwater	The underlying Lambeth Group (Secondary A Aquifer), Thanet Sands and Upper Chalk (Principal Aquifers) are separated from the Made Ground by a significant thickness of London Clay (approximately 30 m).
	Surface Water	The Grand Union Canal lies approximately 290 m south-west of the site at its closest point.
Building Materials		Materials associated with the redevelopment (e.g., foundations for play structure, tree pit structures), underground water and / or sewer pipes.
Flora and Fauna		Future flora and fauna within soft landscaped areas as part of the proposed development.
Off-site		
Adjacent Site Users		Residential and commercial properties within the vicinity of the site.

5.2.3 Pathways

In order for the contaminants identified to reach potential receptors, there has to be a viable pathway for the contaminant. Potential pathways have been refined in relation to the source impacts and receptors identified during the ground investigation and are presented in Table 5-3.

Table 5-3: Potential Pathways

Receptor	Applicable Pathway	Comments
Human Health	Direct contact with contaminated soils and inhalation and ingestion of dusts	The shallow Made Ground soils have been identified to contain asbestos fibres, albeit at low levels. It is understood that soft landscaped areas are due to be included as part of the proposed development (approximately 15% of the total site area), meaning future site users have the potential to be exposed to the direct contact, inhalation, and ingestion pathways with contaminated soils in soft landscaped areas. This likelihood is increased for young children using the play area. As such, site soils are not considered suitable for use within soft landscaped areas.

Receptor	Applicable Pathway	Comments
		Potential pathways to future site users with the underlying Made Ground soils will be limited in areas of hardstanding comprising paved areas outside of the play area, where the 4-Isopropyltoluene exceedances and asbestos detections were recorded. However, the potential for contact with underlying soils will remain in soft landscaped areas of the site (including areas of play safety surfacing) unless an imported capping layer is installed. An imported capping layer will be required for all soft landscaped areas (i.e., planting areas). Ramboll recommends a minimum of 600 mm thickness of material (topsoil/subsoil) is required for such areas. Ramboll recommends that the capping layer in the play area (where play safety surfacing is present) should be a minimum of 600 mm thickness which is to comprise the play safety surfacing (Corkeen / Hardwood Chips), subbase (Type 3) and imported fill material. Construction workers have the potential to come into direct contact with asbestos within the Made Ground during site enabling works and construction activities, particularly foundation excavation works. There is also the potential for ingestion and inhalation of dusts by construction workers and adjacent site users; however, it is assumed that appropriate Health, Safety and Environmental procedures will be adopted during development works to mitigate potential risks.
	Inhalation of hazardous ground gases and depleted oxygen	Depleted concentrations of oxygen have the potential to accumulate in confined spaces. However, work in confined spaces is not anticipated to be required as part of the development works. In addition, it is anticipated that the majority of Made Ground will be removed.
Controlled Waters	Leaching and vertical migration of soil impacts to the Grand Union Canal and underlying Secondary A and Principal Aquifer followed by migration of contaminants within the Aquifers	The groundwater exceedance of sulphate recorded in WS02 is not considered significant and is thought to be indicative of the surrounding background levels (elevated sulphate concentrations are synonymous with the London Clay Formation). The areas of hardstanding included as part of the proposed development will limit the potential leaching of contaminants in these areas due to the lack of surface water infiltration (approximately 55% of the site comprised paving). In addition to this, a proportion of Made Ground soils are anticipated to be excavated and removed from the site as part of the proposed development, and as such the potential contaminant source will be reduced. No piling or deep foundations are anticipated to be required as part of the proposed development, therefore the potential for the creation of preferential pathways into the underlying aquifers is ruled out. Horizontal migration of contaminants to surface water courses is considered unlikely, with the closest surface water body, the Grand Union Canal, located approx. 290 m south-west of the site at its closes point.
Construction Materials and Structures	Attack and permeation into water supply pipes	Underground potable water supply pipes have the potential to come into direct contact with contaminated soils. TPH and PAHs within the Made Ground did not exceed the relevant GACs but were detected at concentrations several orders of magnitude above detection limits which could potentially permeate into potable water supply pipes.
Flora and Fauna	Plant Uptake	The shallow Made Ground soils are not considered suitable as a growing medium for future flora within soft landscaped areas with reference to BS 3882:2015 'Specification for topsoil and requirement for reuse'. An imported capping layer will be required for all soft landscaped areas (i.e., planting areas). Ramboll recommends a minimum of 600 mm thickness of material (topsoil/subsoil) is required for such areas.

5.3 Qualitative Risk Assessment

Potential pollutant linkages are identified using the source-pathway-receptor framework detailed above. An assessment of the potential significance of each linkage is then made by consideration of the likely magnitude and mobility of the source, the sensitivity of the receptor and nature of the migration / exposure pathways.

Table 5-4 forms an assessment of the significance of potential pollutant linkages associated with the site.

Table 5-4: Results of the Contaminated Land Risk Assessment

Source	Pathway	Receptor	Potential Severity	Probability	Risk
Soil Impacts					
Made Ground (Asbestos in soils recorded up to 1.10 m bgl)	Direct contact, inhalation, ingestion of soil, dust, and vapour	Future Site Users	Severe	Unlikely	High [1]
		Construction Workers	Severe	Likely	High [2]
	Soil and dust ingestion and inhalation	Adjacent Site Users	Severe	Unlikely	Moderate/Low [2]
Phytotoxic Contaminants (e.g., copper)	Root Uptake	Flora	Mild	Low Likelihood	Low [1]
Organic Contaminants	Permeation of organics	Water Supply Pipes	Mild	Low Likelihood	Low
Made Ground (ammonium and naphthalene)	Leaching and vertical migration of soil impacts	Grand Union Canal	Medium	Unlikely	Low
	Leaching and vertical migration of soil impacts to the Secondary A and Principal Aquifers via preferential pathways	Secondary A Aquifer (Lambeth Group) Principal Aquifer (Thanet Sands and Upper Chalk)	Medium	Unlikely	Low
Underground Structures (unknown organic and inorganic contaminants)	Direct contact, inhalation, ingestion of soil, dust, and vapour	Construction Workers	Medium	Low Likelihood	Moderate/Low [2]
	Soil and dust ingestion and inhalation	Adjacent Site Users	Medium	Unlikely	Low [2]

Source	Pathway	Receptor	Potential Severity	Probability	Risk
	Leaching and vertical migration of impacts	Grand Union Canal	Medium	Unlikely	Low
	Leaching and vertical migration of impacts to the Secondary A and Principal Aquifers via preferential pathways	Secondary A Aquifer (Lambeth Group) Principal Aquifer (Thanet Sands and Upper Chalk)	Medium	Unlikely	Low
	Permeation of organics	Water Supply Pipes	Mild	Unlikely	Very Low
Groundwater Impacts					
Groundwater (sulphate)	Leaching and vertical migration of groundwater impacts	Grand Union Canal	Medium	Unlikely	Low
	Vertical migration of impacts to the Secondary A and Principal Aquifers via preferential pathways	Secondary A Aquifer (Lambeth Group) Principal Aquifer (Thanet Sands and Upper Chalk)	Medium	Unlikely	Low

Notes:

Assessment completed assuming site in current condition. Should site levels be altered during development, a reassessment would be required.

Assessment completed assuming no remediation / mitigation in place.

[1] If an imported capping layer (as described in Section 4.4.2) is installed within soft landscaped areas and where play safety surfacing is present (i.e., the play area), the risk is mitigated to low.

[2] Given the use of appropriate PPE and on-site health and safety precautions, risk to site development workers and adjacent site users would be reduced to low.

6. REMEDIATION STRATEGY

In accordance with the King's Cross Central Environmental Statement, Part 16, Arup May 2004, during the construction phases, mitigation measures to prevent the risk of harm to human health and risk of pollution to controlled waters will be implemented as detailed within the ES and CoCP.

In accordance with Part 16.4.16, the subject site falls within the Area 4 defined as Railway Lands.

The following Section outlines the ground contamination risk assessment for Chilton Square and the remediation strategy to be adopted based on available site-specific data.

6.1 Conceptual Site Model

As highlighted in Section 5, a conceptual site model was developed in order to detail the level of risk associated with each exposure pathway was developed for the proposed development. A summary of plausible pathways of potentially significant concern has been provided in Table 6-1. For the purposes of this document, 'potentially significant' is defined as having been assigned a level of risk greater than 'low'.

Table 6-1: Summary of Potentially Significant Pollution Pathways

Source	Pathway	Receptor	Potential Severity	Probability	Risk
Made Ground (Asbestos)	Direct contact, inhalation, ingestion of soil, dust, and vapour	Future Site Users	Severe	Unlikely	High [1]
		Construction Workers	Severe	Likely	High [2]
	Soil and dust ingestion and inhalation	Adjacent Site Users	Severe	Unlikely	Moderate/Low [2]
Underground Structures (unknown organic and inorganic contaminants)	Direct contact, inhalation, ingestion of soil, dust, and vapour	Construction Workers	Medium	Low Likelihood	Moderate/Low [2]

Notes:

[1] If an imported capping layer (as described in Section 4.4.2) is installed within soft landscaped areas and where play safety surfacing is present (i.e., the play area), the risk is mitigated to low.

[2] Given the use of appropriate PPE and on-site health and safety precautions, risk to site development workers and adjacent site users would be reduced to low.

6.2 Site Specific Remediation Strategy

No specific remediation measures are deemed necessary; however, Ramboll recommends an imported capping layer of minimum 600 mm thickness is required in all soft landscaped areas and where play safety surfacing is present (i.e., the play area). In soft landscaping (planting areas), it is recommended that a minimum of 600 mm thickness of material (topsoil/subsoil) is required. Ramboll recommends that the capping layer in the play area (where play safety surfacing is present) should be a minimum of 600 mm thickness which is to comprise the play safety surfacing (Corkeen / Hardwood Chips), subbase (Type 3) and imported fill/subbase material.

A number of good practice measures are recommended to be incorporated as part of the development which should include:

- An Environmental Management Plan (EMP) should be implemented in order to prevent construction work and future operations from giving rise to contamination.
- The preparation of an asbestos management protocol for the site.
- An unforeseen contamination protocol should be established, and an environmental watching brief undertaken by Ramboll throughout groundworks to provide guidance in the event that unexpected or gross contamination is encountered.
- A Verification Report should then be prepared documenting the successful completion of work in accordance with the requirements of this Earthworks and Remediation Plan.

6.3 Unforeseen Contamination

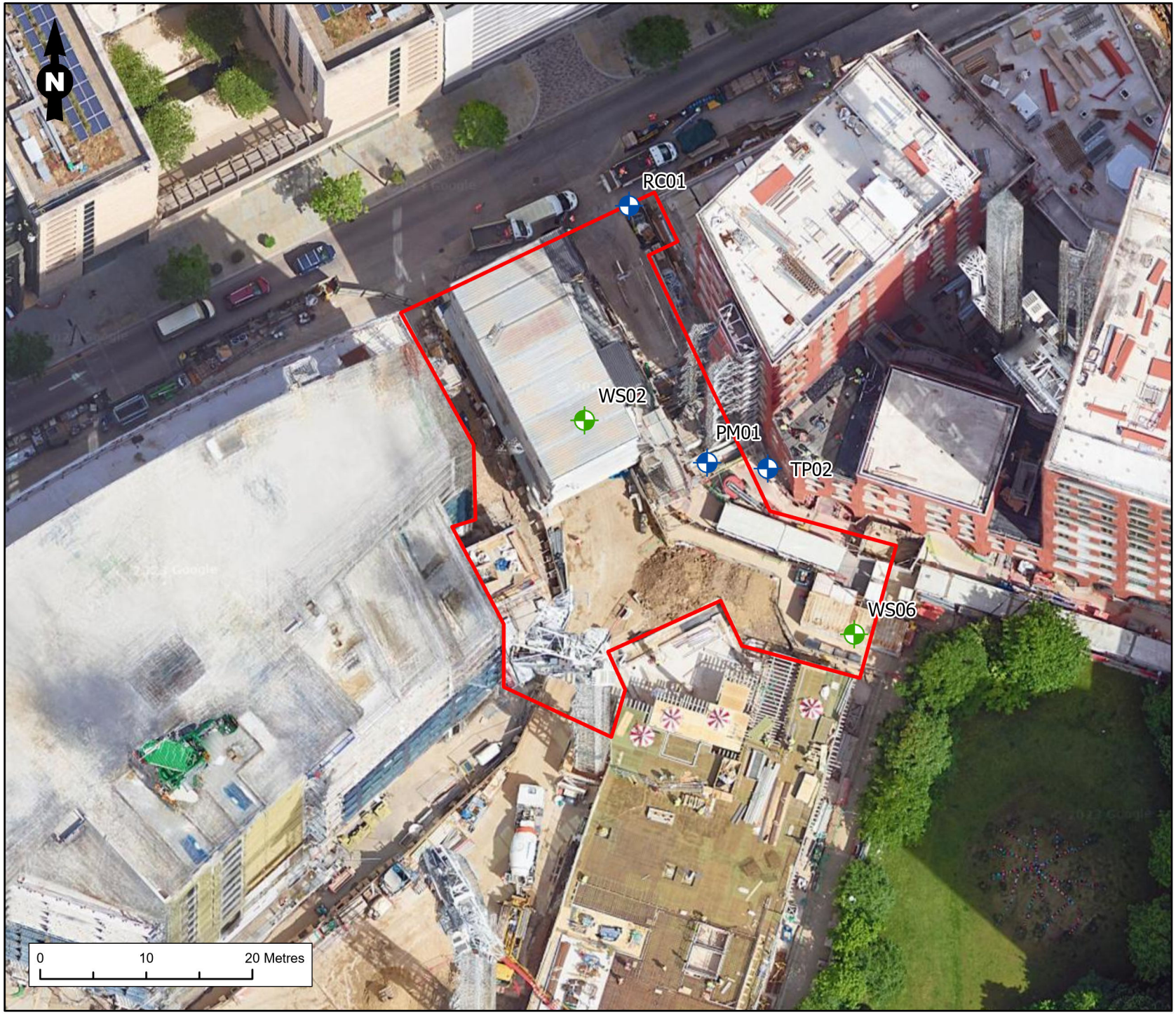
It is not anticipated that significant unforeseen contamination will be encountered on the site; however, in the unlikely event that previously, unidentified contamination is encountered during the construction phase of works, the following approach will be implemented.

- Any remediation required will be carried out in accordance with the principles of the site wide remediation strategy as set out in the KXC ES, Vol 4 Part 16 (Paragraph 16.6.7 to 16.6.9); and,
- A series of Environmental Watching Brief visits will be undertaken during the earthworks and any contaminated materials identified during earthworks will be segregated and dealt with in line with paragraph 16.6.9 of the KXC ES. This states that if unforeseen contamination is identified during the course of the works, the construction manager would instruct specific investigations, advise the Local Authority and liaise on the remediation methodology as appropriate.
- A Verification Report will be produced to close out the recommendations of this ERP.

6.4 Good Practice Risk Management Measures

Good practice risk management measures should be adopted as part of the construction phases of works. The good practice risk management measures to be adopted have been tabulated and presented below in Appendix 3 of this ERP.

APPENDIX 1
FIGURES



Legend

- S4 Exploratory Hole Location
- S5 Exploratory Hole Location
- Site Boundary

Figure Title

Exploratory hole locations from Plot S4 and S5 Ground Investigations relating to Chilton Square

Project Name

King's Cross Chilton Square

Project Number	Figure No.
1620005613-003	1
Date	**Prepared By**
April 2023	MP
Scale	**Issue**
1:500 @A4	1

Client

King's Cross Central Limited Partnership

RAMBOLL

Coordinate System: British National Grid. Projection: Transverse Mercator. Datum: OSGB 1936.

Raised Table

Canal Reach

+26.750 FFL

3.0m clear

+26.300 FFL

Stantec is reviewing if cover for redundant utility could be removed

S3

2.5m clear

+26.000 FFL

S4

Break tank type and location in abeyance

2.0m clear

2.5m

2.0m clear

2.0m clear

2.5m clear

S5

Cubitt Park

Legend

Trees and Planting
Refer to: ERA Tree and planting schedule and Water Scape's irrigation info

Trees in ground
Refer to 700DET series
For tree pit with tree grill min 12m3 soil volume/ tree required
If tree sits in hardwood chip, the whole area of the hardwood chip becomes the treepit buildup.

- **TPi** (pinus)
- **TPr** (Prunus)
- **TB** (birch)
- **TC** (Cercidiphyllum)
- Trees in ground by others

Trees in ground with limited soil space (70cm diam root ball)

- **TB-s** (birch-small)

Planting
Refer to planting schedule

- Planting in ground
- Living willow den open on one side
- Living willow tunnel open on two sides surfacing below tunnel to be Corkeen

Trees in above ground container
Refer to ER Spec 6.0

- **TB-C** (birch in container)
- **TPr-C** (Prunus in container)

Play Safety Surface
Refer to ER SPEC 3.2/3.3

Bound Play Safety Surface "Corkeen"
Depth: varies 50mm-110mm depending on Critical Fall Height.
Subbase: inert (to maintain PH balance in treepits) & fine free (required for Corkeen warranty) MOT3 (depth to Civil's specification)
Corkeen area overlabs proposed tree pit area: Tree pit soil specification together with subbase to be reviewed and developed with soil specialist and civil engineer in Stage 4

1.5m wide clear path zone in Corkeen (indicative dash line shown)

Loose Play Safety Surface "Hardwood Chips"
Depth: 250mm
Bottom layer to be: Eco Grid
Subbase if required to be: inert (to maintain PH balance in treepits) & fine free (required for Corkeen warranty):
Hardwood Chips area overlaps proposed tree pit area: Tree pit soil specification together with subbase to be reviewed and developed with soil specialist and civil engineer in Stage 4

Play Structure
Refer to: 500LAY & 5XXDET series for individual play unit information & ER Spec 5.0

Free Fall Area:
Refer to 3/511DET for setting out principle

Free Fall Area of proposed play equipment - Critical Fall Height indicated as + xxxx : Contractor to verify final equipment height on site to calculate required safety surfacing depth below

Paving
Subbase design to Civil's Info
ER Spec 3.7

Paving To Tie-In With Existing

Utility Covers
Refer to Civil's Info

- c — Recessed manhole cover infilled with Corkeen
- y — Cover infilled with Yorkstone paving
- p — Solid cover set in planting bed

Features

- Natural flat top boulder (height varies from 150mm FFL to 350mm FFL) ER Spec 3.6
- Paving Slab ER Spec 3.9
- B — Bollards - Fixed ER Spec 4.4
- BR — Bollards - Removable ER Spec 4.4
- Signage ER Spec 4.7
- Bench ER Spec 4.2
- Timber Platform ER Spec 5.93

Drinking Fountain & Break Tank
Refer to Civil's Info, ER Spec 4.1 for Drinking fountain & ER Spec. 3.9 for paving slab below

Cycle/Scooter Stores

- Cycle rack ER Spec 4.5 Hard paving below ER Spec 3.8
- Scooter rack ER Spec 4.6 Hard paving below ER Spec 3.8

Lighting
Refer to Speirs and Major information

- Lighting column

Annotations

- Site Boundary
- xx.xx Proposed Levels

General Notes

Play Safety - All structures, fittings, surfacing and finishes to conform with BS EN 1176 and BS EN 1177

Specification - To be read in conjunction with ER specification 398-CS-910SPE & other consultant information

TO BE PRINTED IN COLOUR FOR INFORMATION TO BE READ ACCURATELY

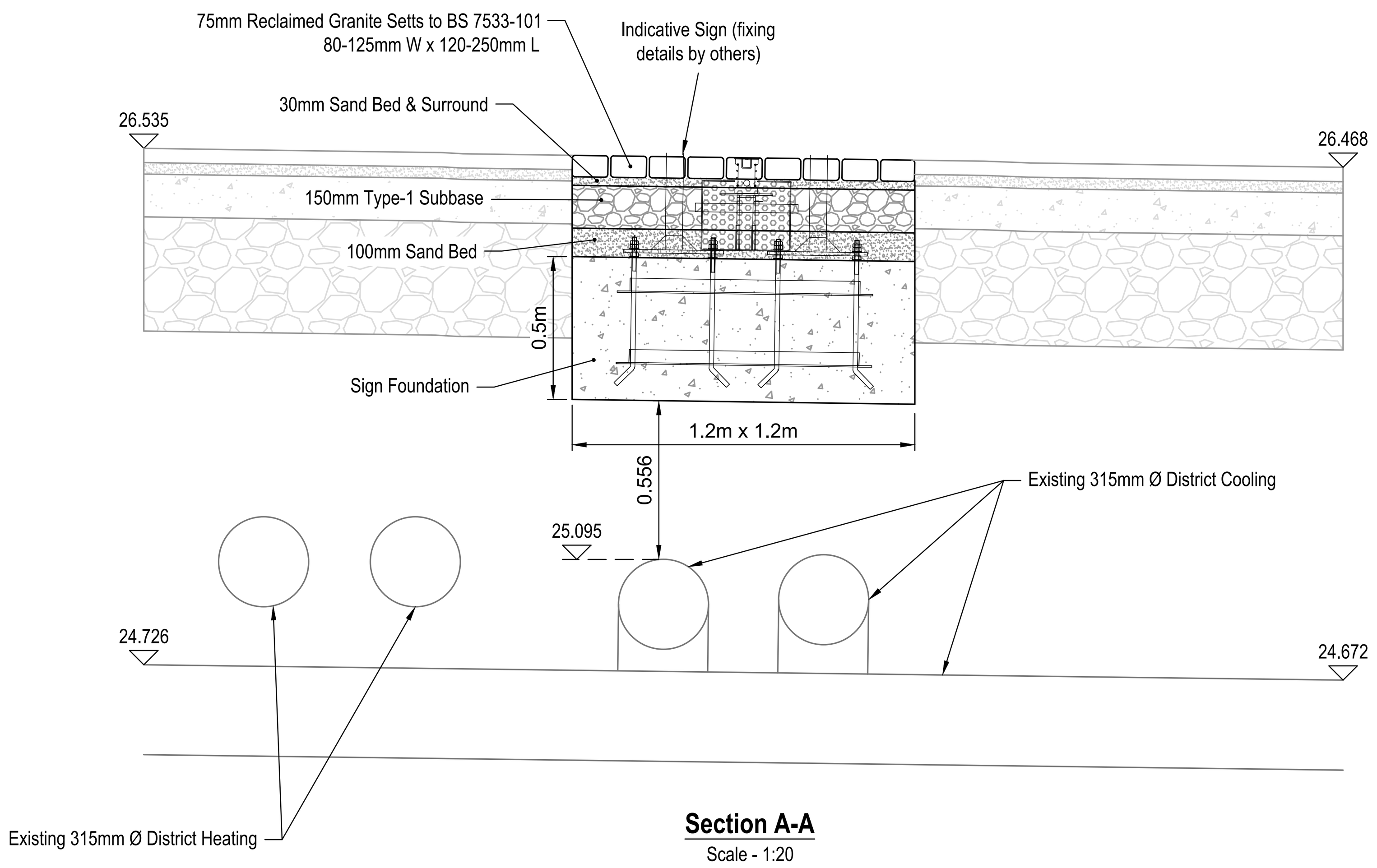
ERECT ARCHITECTURE
22B Regent Studios, 8 Andrews Rd, London E8 4QN +44 (0)20 7254 6336

client Kings Cross Central Limited Partnership
project Chilton Square
title GA Plan
scale 1:100 at A1

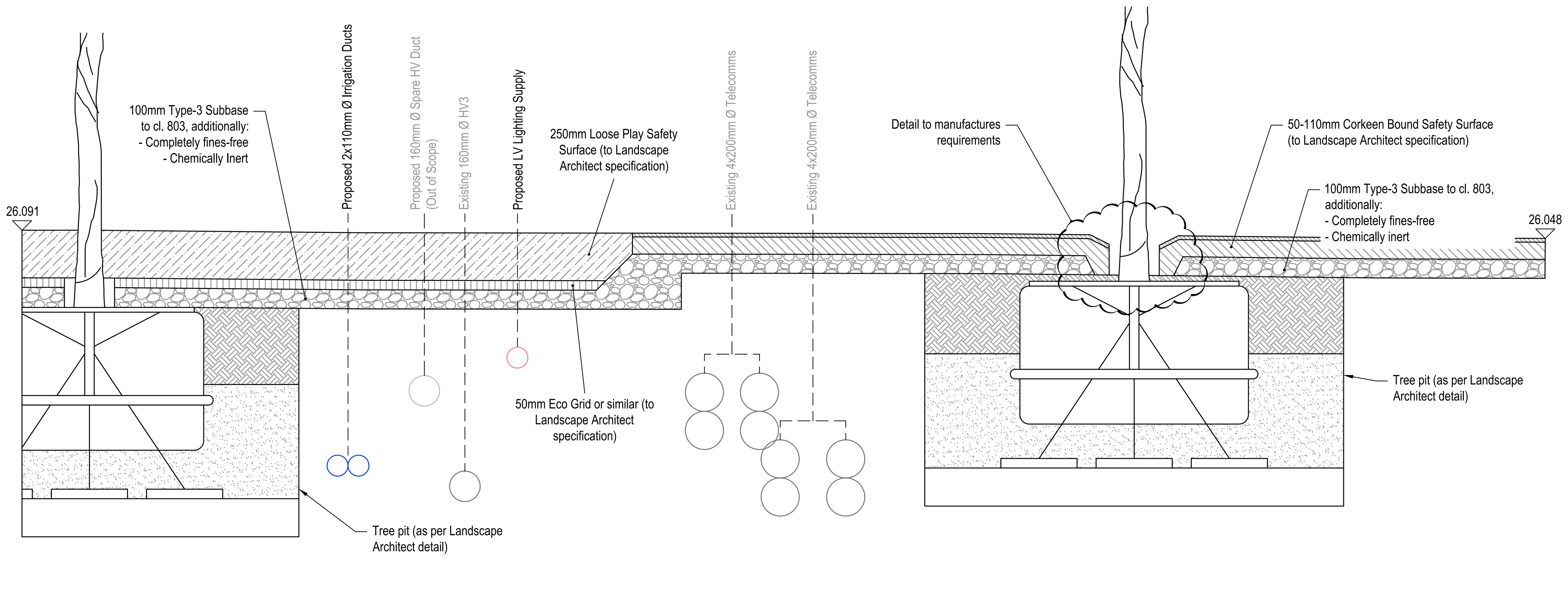
rev.	date	description
A	17/02/2023	Issued for Costing & Coordination
B	24/02/2023	Issed for Coordination
C	03/03/2023	Issued for ER Draft
D	16/03/2023	Issued for Coordination; lighting TBC, cost revised
E	27/03/2023	Issued for ER second draft
F	11/04/2023	Issued for Coordination

drawing no. 398-CS- 200GA
revision F

0m 1m 5m 1:100



Section A-A
Scale - 1:20



Section B-B
Scale - 1:20

KEY:

- Thameslink tunnels outline
- Wayfinder Sign and Foundation (location TBC)

PROPOSED UTILITIES: (not delivered in this scope)

- Sprinkler main comms
- Telecomms
- LV
- HV07
- Sprinkler mains
- Potable Water
- LP Gas
- Tenants LV / Data In-Ground Box with 2x50mm Ø Ducts
- District Heating
- Surface Water Drainage
- Foul Water Drainage
- Surface Water Attenuation

LANDSCAPE ELEMENTS

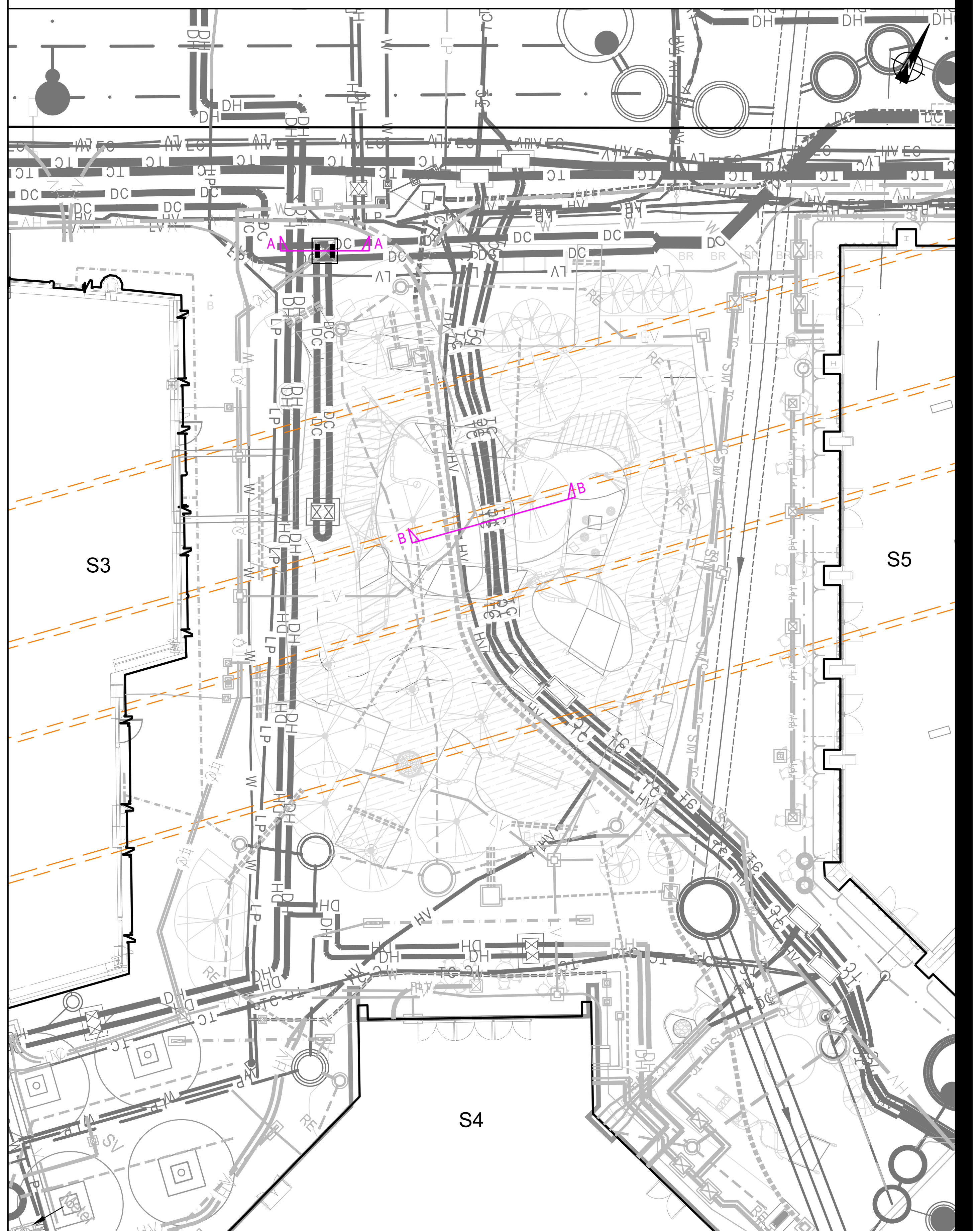
- Tree in pot / In Ground Tree Pit (by others)
- Play Features (by others)
- Stepping Stones (by others)
- Bench (by others)
- Bollard / Removable Bollard (by others)
- Cycle Racks (by others)

AS-BUILT UTILITIES: (see note 5)

- Existing LV
- Existing HV
- Existing LP Gas
- Existing Potable Water
- Existing Telecomms
- Existing District Heating
- Existing District Cooling
- Existing Pedestal Card Reader Duct
- Existing Surface Water Drainage
- Existing Foul Water Drainage
- Existing Combined Drainage
- Existing Slot Drain with Sump Unit
- Existing SW Manhole
- Existing FW Manhole

NJUG MINIMUM UTILITY COVER DEPTHS

LV	= 450mm Footway	= 600mm Carriageway
HV	= 450mm - 600mm Footway	= 750mm Carriageway
Gas	= 600mm Footway	= 750mm Carriageway
Water	= 750mm - 900mm Footway	= 750mm - 900mm Carriageway
Comms	= 250mm - 350mm Footway	= 450mm - 600mm Carriageway



Section Marker Location Plan
Scale - 1:200

Stantec

Stantec UK Limited
ASHFORD
Unit 10, Connect 38, 1 Dover Place, Ashford TN23 1FB
Tel: +44 1233 527 250
www.stantec.com/uk

Notes

UTILITIES NOTE: The position of any existing public or private sewers, utility services, plant or apparatus shown on this drawing is believed to be correct, but no warranty to this is expressed or implied. Other such plant or apparatus may also be present but not shown. The Contractor is therefore advised to undertake their own investigation where the presence of any existing sewers, services, plant or apparatus may affect their operations.

NOTES:

1. Plot S2 layout taken from AHMM drawing: 18083_00_Ground_190322.
2. Plot S3 layout taken from Allford Hall Monaghan Morris drawing: 18083_(00)_105 Rev06 received 27.07.2020.
3. Plot S4 layout taken from Allies and Morrison drawing: KXC-S4-001-19075-20-1GF-P1 (Rev P1) received 02.11.2020.
4. Plot S5 layout from Alison Brooks Architects drawing: KXC-S5-001-A-ABA2433D-20-1GF revC03 received 02.12.2020.
5. Where as-built information has been provided (for prior drainage and utility installation) it has been used to inform the current design; the Engineer cannot guarantee the accuracy or reliability of third-party information, and, where no as-built information has been forthcoming, prior design information has been used.
6. Proposed activity / play feature layout provided by Erect Architecture, received 24.02.2023.
7. Final tree planting location, species and layout subject to acceptance and confirmation from statutory undertakers (Metropolitan and Thames Water).
8. Refer to Erect Architecture drawings 398-CS-700DET to 702DET for details of proposed tree pits.
9. Information stated an in relation to the Thameslink Tunnels has been provided to Stantec by LCR in drawings 014-DCN-1D003-00938-AA and -AB.
10. Refer to drawing 332410744-900-700-02 for **maximum** permissible extent of vertical root barriers relative to below ground services, play feature foundations and Thames Water guidance.

RESIDUAL RISKS

Normal construction risks which a competent contractor would be expected to identify have not been listed.

- Unexploded ordnance
- Interface with public highway
- Existing and proposed utilities
- Work on live sewer
  - Confined spaces
  - Deep connections
  - Inundation from existing flows
- Temporary site services (locations NOT recorded)
- Stability of existing structures
- Live site access/haul roads
- Thameslink Tunnels

		By	Appd	YYYY.MM.DD
A	Park layout updated, section BB & Note 10.	AGM	IM	2023.03.23

Issued/Revision

BE	-	IM	2023.02.27
Dwn.	Dsgn.	Chkd.	YYYY.MM.DD

Issue Status

FOR INFORMATION

This document is suitable only for the purpose noted above. Use of this document for any other purpose is not permitted.

Client/Project Logo

Client/Project
KINGS CROSS CENTRAL LIMITED PARTNERSHIP

Title
KINGS CROSS CENTRAL
CHILTON SQUARE
UTILITY CROSS SECTIONS

Project No. 332410744
Scale 1:200 @ A1
Revision A
Drawing No. 332410744_900_SK04

APPENDIX 2
SOIL SCREENING TABLE

Screening Table
Project / Site name: King Cross

				S4 GI	S4 GI	S4 GI	S4 GI	S4 GI	S5 GI	S5 GI	S5 GI	S5 GI	S5 GI	S5 GI	S5 GI
Lab Sample Number				1724127	1724247	1724248	1731940	1731941	941686	950656	950657	950658	941684	961682	961683
Sample Reference				WS02	WS02	WS02	WS06	WS06	PM01	PM01	PM01	PM01	RC1	TP2	TP2
Depth (m)				0.2	1.2	3.9	0.25	1.1	0.3	2	2.5	3.9	0.3	2	3
Strata				MG	MG	LC	MG	MG	MG	MG	MG	MG	MG	MG	ALL
Analytical Parameter (Soil Analysis)	**Units**	**Limit of detection (LOD)**	**Generic Assessment Criteria (Public Open Space 1)**												
Asbestos in Soil	Type	N/A	Detected*	Not-detected	Not-detected	-	Not-detected	Detected	Detected	Not-detected	Not-detected	Not-detected	Not-detected	Not-detected	Not-detected
Asbestos in Soil Screen / Identification Name								Chrysotile - Loose Fibres	Chrysotile - Loose Fibres						
Asbestos Quantification	%w/w	0.001	Please refer to note at base of table.					<0.001	<0.001						
General Inorganics															
pH - Automated	pH Units	N/A	-	8.30	8.20	7.80	8.90	8.50	9.8	8.5	8.1	8.2	9.8	8	8.1
Total Cyanide	mg/kg	1	24	< 1	< 1	< 1	< 1.0	< 1.0	<1	<1	<1	<1	<1	<1	<1
Water Soluble Sulphate as SO4 16hr extraction (2:1)	mg/kg	2.5	-	4100	4400	4700	220	3200	<2.5	870	370	290	2100	750	91
Water Soluble SO4 16hr extraction (2:1 Leachate Equivalent)	g/l	0.00125	-	2.0	2.2	2.40	0.11	1.6	1.1	0.87	0.37	0.29	2.1	0.75	0.091
Organic Matter	%	0.1	-			< 0.1	-	1.5	2.8	6.2	5	0.5	1.4	7	0.8
Total Phenols															
Total Phenols (monohydric)	mg/kg	1	380	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Speciated PAHs															
Naphthalene	mg/kg	0.05	4900	0.24	< 0.05	< 0.05	< 0.05	< 0.05	0.38	1.2	<0.05	<0.05	<0.05	0.79	<0.05
Acenaphthylene	mg/kg	0.05	15000	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
Acenaphthene	mg/kg	0.05	15000	0.30	< 0.05	< 0.05	< 0.05	< 0.05	0.28	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
Fluorene	mg/kg	0.05	9900	0.31	< 0.05	< 0.05	< 0.05	< 0.05	0.4	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
Phenanthrene	mg/kg	0.05	3100	2.3	0.91	< 0.05	0.22	0.37	3	1.2	0.22	<0.05	0.97	1	<0.05
Anthracene	mg/kg	0.05	74000	0.48	< 0.05	< 0.05	< 0.05	< 0.05	0.7	0.49	0.11	<0.05	0.22	0.44	<0.05
Fluoranthene	mg/kg	0.05	3100	2.10	1.3	< 0.05	0.29	0.70	3.6	2.2	0.4	<0.05	1.8	1.7	<0.05
Pyrene	mg/kg	0.05	7400	2.0	1.3	< 0.05	0.28	0.66	3.2	1.9	0.38	<0.05	1.5	1.9	<0.05
Benzo(a)anthracene	mg/kg	0.05	see BaP	1.00	0.81	< 0.05	0.24	0.63	2	0.69	<0.05	<0.05	1	1	<0.05
Chrysene	mg/kg	0.05	see BaP	1.10	0.75	< 0.05	0.16	0.36	1.8	0.72	<0.05	<0.05	0.83	0.7	<0.05
Benzo(b)fluoranthene	mg/kg	0.05	see BaP	0.88	0.61	< 0.05	< 0.05	0.47	2.4	0.6	<0.05	<0.05	1.2	1	<0.05
Benzo(k)fluoranthene	mg/kg	0.05	see BaP	0.42	0.58	< 0.05	< 0.05	0.31	0.77	0.27	<0.05	<0.05	0.56	0.27	<0.05
Benzo(a)pyrene	mg/kg	0.05	10	0.89	0.62	< 0.05	< 0.05	0.41	1.8	0.3	<0.05	<0.05	1.1	0.48	<0.05
Indeno(1,2,3-cd)pyrene	mg/kg	0.05	see BaP	0.50	0.32	< 0.05	< 0.05	0.23	1.1	<0.05	<0.05	<0.05	0.68	<0.05	<0.05
Dibenz(a,h)anthracene	mg/kg	0.05	see BaP	0.13	< 0.05	< 0.05	< 0.05	< 0.05	0.22	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
Benzo(ghi)perylene	mg/kg	0.05	see BaP	0.66	0.39	< 0.05	< 0.05	0.23	1.3	<0.05	<0.05	<0.05	0.8	<0.05	<0.05
Total PAH															
Speciated Total EPA-16 PAHs	mg/kg	0.8	-	13.50	7.57	< 0.80	1.19	4.37	22.9	9.57	1.11	<0.8	10.6	9.38	<0.8
Heavy Metals / Metalloids															
Arsenic (aqua regia extractable)	mg/kg	1	79	12	14	11	6	15	12	25	15	16	12	17	9.9
Beryllium (aqua regia extractable)	mg/kg	0.06	2.2	1.2	1.3	1.4	0.3	1.2	-	-	-	-	-	-	-
Boron (water soluble)	mg/kg	0.2	21000	5.4	1.2	1.9	0.7	2.0	8.2	3.1	3.7	1.9	7	5.2	1.7
Cadmium (aqua regia extractable)	mg/kg	0.2	140	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	<0.2	<0.2	<0.2	<0.2	0.2	<0.2	<0.2
Chromium (hexavalent)	mg/kg	1.2 / 4	21	< 1.2	< 1.2	< 1.2	< 1.2	< 1.2	<4	<4	<4	<4	<4	<4	<4
Chromium (III)	mg/kg	1	1500	39	42	48	13	40	-	-	-	-	-	-	-
Chromium (aqua regia extractable)	mg/kg	1	1500	39	42	49	13	40	28	36	38	63	26	27	46
Copper (aqua regia extractable)	mg/kg	1	12000	53	41	27	39	66	38	140	81	29	48	130	19
Lead (aqua regia extractable)	mg/kg	1	630	82	65	17	50	65	85	100	200	12	110	75	15
Mercury (aqua regia extractable)	mg/kg	0.3	120	-	0.50	-	-	-	-	-	2.6	-	0.3	-	-
Nickel (aqua regia extractable)	mg/kg	1	230	34	39	43	11	35	20	40	27	44	18	27	22
Selenium (aqua regia extractable)	mg/kg	1	1100	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	1.7	< 1.0	< 1.0	1.1	2.2	1.1
Vanadium (aqua regia extractable)	mg/kg	1	2000	63	76	88	22	75	-	-	-	-	-	-	-
Zinc (aqua regia extractable)	mg/kg	1	81000	130	93	76	45	100	90	91	88	90	120	57	87
Monoaromatics & Oxygenates															
Benzene	µg/kg	1	47	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	-	< 1.0	-
Toluene	µg/kg	1	55000	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	17	< 1.0	< 1.0	-	< 1.0	-
Ethylbenzene	µg/kg	1	23000	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	-	< 1.0	-
p & m-xylene	µg/kg	1	38000	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	-	< 1.0	-
o-xylene	µg/kg	1	38000	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	-	< 1.0	-
MTBE (Methyl Tertiary Butyl Ether)	µg/kg	1	74000	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	-	< 1.0	< 1.0	< 1.0	-	< 1.0	-
Petroleum Hydrocarbons															
TPH-CWG - Aliphatic >EC5 - EC6	mg/kg	0.001	530000	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	<0.001	<0.001	<0.001	<0.001	-	<0.001	-
TPH-CWG - Aliphatic >EC6 - EC8	mg/kg	0.001	560000	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	<0.001	<0.001	<0.001	<0.001	-	<0.001	-
TPH-CWG - Aliphatic >EC8 - EC10	mg/kg	0.001	12000	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	<0.001	0.026	0.018	<0.001	-	<0.001	-
TPH-CWG - Aliphatic >EC10 - EC12	mg/kg	1	13000	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	-	6.6	-
TPH-CWG - Aliphatic >EC12 - EC16	mg/kg	2	13000	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	5.4	2.8	< 2.0	< 2.0	-	25	-
TPH-CWG - Aliphatic >EC16 - EC21	mg/kg	8	250000	< 8.0	< 8.0	< 8.0	< 8.0	< 8.0	38	26	< 8.0	< 8.0	-	93	-
TPH-CWG - Aliphatic >EC21 - EC35	mg/kg	8	250000	< 8.0	< 8.0	< 8.0	< 8.0	< 8.0	270	230	< 8.0	< 8.0	-	420	-
TPH-CWG - Aliphatic (EC5 - EC35)	mg/kg	10	-	< 10	< 10	< 10	< 10	< 10	-	-	-	-	-	-	-
TPH-CWG - Aromatic >EC5 - EC7	mg/kg	0.001	-	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	<0.001	<0.001	<0.001	<0.001	-	<0.001	-
TPH-CWG - Aromatic >EC7 - EC8	mg/kg	0.001	-	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	<0.001	0.017	<0.001	<0.001	-	<0.001	-
TPH-CWG - Aromatic >EC8 - EC10	mg/kg	0.001	5000	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	<0.001	<0.001	<0.001	<0.001	-	<0.001	-
TPH-CWG - Aromatic >EC10 - EC12	mg/kg	1	5000	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	1.2	4.9	< 1.0	< 1.0	-	< 1.0	-
TPH-CWG - Aromatic >EC12 - EC16	mg/kg	2	5000	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	3.5	11	< 2.0	< 2.0	-	5.3	-
TPH-CWG - Aromatic >EC16 - EC21	mg/kg	10	3800	10	< 10	< 10	< 10	11	53	32	<10	<10	-	51	-
TPH-CWG - Aromatic >EC21 - EC35	mg/kg	10	3800	37	< 10	< 10	< 10	23	470	180	<10	<10	-	370	-
TPH-CWG - Aromatic (EC5 - EC35)	mg/kg	10	-	47	< 10	< 10	< 10	35	-	-	-	-	-	-	-
VOCs															
Chloromethane	µg/kg	1	-	-	-	-	-	< 1.0	-	< 1.0	< 1.0	< 1.0	-	< 1.0	-
Chloroethane	µg/kg	1	-	-	-	-	-	< 1.0	-	< 1.0	< 1.0	< 1.0	-	< 1.0	-
Bromomethane	µg/kg	1	-	-	-	-	-	< 1.0	-	< 1.0	< 1.0	< 1.0	-	< 1.0	-
Vinyl Chloride	µg/kg	1	-	-	-	-	-	< 1.0	-	-	-	-	-	-	-
Trichlorofluoromethane	µg/kg	1	-	-	-	-	-	< 1.0	-	< 1.0	< 1.0	< 1.0	-	< 1.0	-
1,1-Dichloroethene	µg/kg	1	-	-	-	-	-	< 1.0	-	< 1.0	< 1.0	< 1.0	-	< 1.0	-
1,1,2-Trichloro 1,2,2-Trifluoroethane	µg/kg	1	-	-	-	-	-	< 1.0	-	< 1.0	< 1.0	< 1.0	-	< 1.0	-
Cis-1,2-dichloroethene	µg/kg	1	-	-	-	-	-	< 1.0	-	< 1.0	< 1.0	< 1.0	-	< 1.0	-
MTBE (Methyl Tertiary Butyl Ether)	µg/kg	1	-	-	-	-	-	< 1.0	-	< 1.0	< 1.0	< 1.0	-	< 1.0	-
1,1-Dichloroethane	µg/kg	1	-	-	-	-	-	< 1.0	-	< 1.0	< 1.0	< 1.0	-	< 1.0	-
2,2-Dichloropropane	µg/kg	1	-	-	-	-	-	< 1.0	-	< 1.0	< 1.0	< 1.0	-	< 1.0	-
Trichloromethane	µg/kg	1	-	-	-	-	-	< 1.0	-	< 1.0	< 1.0	< 1.0	-	< 1.0	-
1,1,1-Trichloroethane	µg/kg	1	-	-	-	-	-	< 1.0	-	< 1.0	< 1.0	< 1.0	-	< 1.0	-
1,2-Dichloroethane	µg/kg	1	-	-	-	-	-	< 1.0	-	< 1.0	< 1.0	< 1.0	-	< 1.0	-
1,1-Dichloropropene	µg/kg	1	-	-	-	-	-	< 1.0	-	< 1.0	< 1.0	< 1.0	-	< 1.0	-
Trans-1,2-dichloroethene	µg/kg	1	-	-	-	-	-	< 1.0	-	< 1.0	< 1.0	< 1.0	-	< 1.0	-
Benzene	µg/kg	1	-	-	-	-	-	< 1.0	-	< 1.0	< 1.0	< 1.0	-	< 1.0	-
Tetrachloromethane	µg/kg	1	-	-	-	-	-	< 1.0	-	< 1.0	< 1.0	< 1.0	-	< 1.0	-
1,2-Dichloropropane	µg/kg	1	-	-	-	-	-	< 1.0	-	< 1.0	< 1.0	< 1.0	-	< 1.0	-
Trichloroethene	µg/kg	1	-	-	-	-	-	< 1.0	-	< 1.0	< 1.0	< 1.0	-	< 1.0	-
Dibromomethane	µg/kg	1	-	-	-	-	-	< 1.0	-	< 1.0	< 1.0	< 1.0	-	< 1.0	-
Bromodichloromethane	µg/kg	1	-	-	-	-	-	< 1.0	-	< 1.0	< 1.0	< 1.0	-	< 1.0	-
Cis-1,3-dichloropropene	µg/kg	1	-	-	-	-	-	< 1.0	-	< 1.0	< 1.0	< 1.0	-	< 1.0	-
Trans-1,3-dichloropropene	µg/kg	1	-	-	-	-	-	< 1.0	-	< 1.0	< 1.0	< 1.0	-	< 1.0	-
Toluene	µg/kg	1	-	-	-	-	-	< 1.0	-	< 1.0	< 1.0	< 1.0	-	< 1.0	-
1,1,2-Trichloroethane	µg/kg	1	-	-	-	-	-	< 1.0	-	< 1.0	< 1.0	< 1.0	-	< 1.0	-
1,3-Dichloropropane	µg/kg	1	-	-	-	-	-	< 1.0	-	< 1.0	< 1.0	< 1.0	-	< 1.0	-
Dibromochloromethane	µg/kg	1	-	-	-	-	-	< 1.0	-	< 1.0	< 1.0	< 1.0	-	< 1.0	-
Tetrachloroethene	µg/kg	1	-	-	-	-	-	< 1.0	-	< 1.0	< 1.0	< 1.0	-	< 1.0	-
1,2-Dibromoethane	µg/kg	1	-	-	-	-	-	< 1.0	-	< 1.0	< 1.0	< 1.0	-	< 1.0	-
Chlorobenzene	µg/kg	1	-	-	-	-	-	< 1.0	-	< 1.0	< 1.0	< 1.0	-	< 1.0	-
1,1,1,2-Tetrachloroethane	µg/kg	1	-	-	-	-	-	< 1.0	-	< 1.0	< 1.0	< 1.0	-	< 1.0	-
Ethylbenzene	µg/kg	1	-	-	-	-	-	< 1.0	-	< 1.0	< 1.0	< 1.0	-	< 1.0	-
p & m-Xylene	µg/kg	1	-	-	-	-	-	< 1.0	-	< 1.0	< 1.0	< 1.0	-	< 1.0	-
Styrene	µg/kg	1	-	-	-	-	-	< 1.0	-	< 1.0	< 1.0	< 1.0	-	< 1.0	-
Tribromomethane	µg/kg	1	-	-	-	-	-	< 1.0	-	< 1.0	< 1.0	< 1.0	-	< 1.0	-
o-Xylene	µg/kg	1	-	-	-	-	-	< 1.0	-	< 1.0	< 1.0	< 1.0	-	< 1.0	-
1,1,2,2-Tetrachloroethane	µg/kg	1	-	-	-	-	-	< 1.0	-	< 1.0	< 1.0	< 1.0	-	< 1.0	-
Isopropylbenzene	µg/kg	1	-	-	-	-	-	< 1.0	-	< 1.0	< 1.0	< 1.0	-	< 1.0	-
Bromobenzene	µg/kg	1	-	-	-	-	-	< 1.0	-	< 1.0	< 1.0	< 1.0	-	< 1.0	-
n-Propylbenzene	µg/kg	1	-	-	-	-	-	< 1.0	-	< 1.0	< 1.0	< 1.0	-	< 1.0	-
2-Chlorotoluene	µg/kg	1	-	-	-	-	-	< 1.0	-	< 1.0	< 1.0	< 1.0	-	< 1.0	-
4-Chlorotoluene	µg/kg	1	-	-	-	-	-	< 1.0	-	< 1.0	< 1.0	< 1.0	-	< 1.0	-
1,3,5-Trimethylbenzene	µg/kg	1	-	-	-	-	-	< 1.0	-	< 1.0	< 1.0	< 1.0	-	< 1.0	-
tert-Butylbenzene	µg/kg	1	-	-	-	-	-	< 1.0	-	< 1.0	< 1.0	< 1.0	-	< 1.0	-
1,2,4-Trimethylbenzene	µg/kg	1	-	-	-	-	-	< 1.0	-	< 1.0	< 1.0	< 1.0	-	< 1.0	-
sec-Butylbenzene	µg/kg	1	-	-	-	-	-	< 1.0	-	< 1.0	< 1.0	< 1.0	-	< 1.0	-
1,3-Dichlorobenzene	µg/kg	1	-	-	-	-	-	< 1.0	-	< 1.0	< 1.0	< 1.0	-	< 1.0	-
p-Isopropyltoluene / 4-Isopropyltoluene	µg/kg	1	-	-	-	-	-	< 1.0	-	170	71	< 1.0	-	< 1.0	-
1,2-Dichlorobenzene	µg/kg	1	-	-	-	-	-	< 1.0	-	< 1.0	< 1.0	< 1.0	-	< 1.0	-
1,4-Dichlorobenzene	µg/kg	1	-	-	-	-	-	< 1.0	-	< 1.0	< 1.0	< 1.0	-	< 1.0	-
Butylbenzene	µg/kg	1	-	-	-	-	-	< 1.0	-	< 1.0	< 1.0	< 1.0	-	< 1.0	-
1,2-Dibromo-3-chloropropane	µg/kg	1	-	-	-	-	-	< 1.0	-	< 1.0	< 1.0	< 1.0	-	< 1.0	-
1,2,4-Trichlorobenzene	µg/kg	1	-	-	-	-	-	< 1.0	-	< 1.0	< 1.0	< 1.0	-	< 1.0	-
Hexachlorobutadiene	µg/kg	1	-	-	-	-	-	< 1.0	-	< 1.0	< 1.0	< 1.0	-	< 1.0	-
1,2,3-Trichlorobenzene	µg/kg	1	-	-	-	-	-	< 1.0	-	< 1.0	< 1.0	< 1.0	-	< 1.0	-

				S4 GI	S4 GI	S4 GI	S4 GI	S4 GI	S5 GI	S5 GI	S5 GI	S5 GI	S5 GI	S5 GI	S5 GI
Lab Sample Number				1724127	1724247	1724248	1731940	1731941	941686	950656	950657	950658	941684	961682	961683
Sample Reference				WS02	WS02	WS02	WS06	WS06	PM01	PM01	PM01	PM01	RC1	TP2	TP2
Depth (m)				0.2	1.2	3.9	0.25	1.1	0.3	2	2.5	3.9	0.3	2	3
Strata				MG	MG	LC	MG	MG	MG	MG	MG	MG	MG	MG	ALL
Analytical Parameter (Soil Analysis)	**Units**	**Limit of detection (LOD)**	**Generic Assessment Criteria (Public Open Space 1)**												
SVOCs															
Aniline	mg/kg	0.1	-	-	-	-	-	< 0.1		-	-	-	-	-	-
Phenol	mg/kg	0.2	-	-	-	-	-	< 0.2		-	-	-	-	-	-
2-Chlorophenol	mg/kg	0.1	-	-	-	-	-	< 0.1		<0.1	<0.1	<0.1	-	<0.1	-
Bis(2-chloroethyl)ether	mg/kg	0.2	-	-	-	-	-	< 0.2		<0.2	<0.2	<0.2	-	<0.2	-
1,3-Dichlorobenzene	mg/kg	0.2	-	-	-	-	-	< 0.2		-	-	-	-	-	-
1,2-Dichlorobenzene	mg/kg	0.1	-	-	-	-	-	< 0.1		-	-	-	-	-	-
1,4-Dichlorobenzene	mg/kg	0.2	-	-	-	-	-	< 0.2		-	-	-	-	-	-
Bis(2-chloroisopropyl)ether	mg/kg	0.1	-	-	-	-	-	< 0.1		<0.1	<0.1	<0.1	-	<0.1	-
2-Methylphenol	mg/kg	0.3	-	-	-	-	-	< 0.3		-	-	-	-	-	-
Hexachloroethane	mg/kg	0.05	-	-	-	-	-	< 0.05		<0.05	<0.05	<0.05	-	<0.05	-
Nitrobenzene	mg/kg	0.3	-	-	-	-	-	< 0.3		<0.3	<0.3	<0.3	-	<0.3	-
4-Methylphenol	mg/kg	0.2	-	-	-	-	-	< 0.2		-	-	-	-	-	-
Isophorone	mg/kg	0.2	-	-	-	-	-	< 0.2		<0.2	<0.2	<0.2	-	<0.2	-
2-Nitrophenol	mg/kg	0.3	-	-	-	-	-	< 0.3		<0.3	<0.3	<0.3	-	<0.3	-
2,4-Dimethylphenol	mg/kg	0.3	-	-	-	-	-	< 0.3		<0.3	<0.3	<0.3	-	<0.3	-
Bis(2-chloroethoxy)methane	mg/kg	0.3	-	-	-	-	-	< 0.3		<0.3	<0.3	<0.3	-	<0.3	-
1,2,4-Trichlorobenzene	mg/kg	0.3	-	-	-	-	-	< 0.3		-	-	-	-	-	-
2,4-Dichlorophenol	mg/kg	0.3	-	-	-	-	-	< 0.3		<0.3	<0.3	<0.3	-	<0.3	-
4-Chloroaniline / p	mg/kg	0.1	-	-	-	-	-	< 0.1		<0.1	<0.1	<0.1	-	<0.1	-
Hexachlorobutadiene	mg/kg	0.1	-	-	-	-	-	< 0.1		-	-	-	-	-	-
4-Chloro-3-methylphenol	mg/kg	0.1	-	-	-	-	-	< 0.1		<0.1	<0.1	<0.1	-	<0.1	-
2,4,6-Trichlorophenol	mg/kg	0.1	-	-	-	-	-	< 0.1		<0.1	<0.1	<0.1	-	<0.1	-
2,4,5-Trichlorophenol	mg/kg	0.2	-	-	-	-	-	< 0.2		<0.2	<0.2	<0.2	-	<0.2	-
2-Methylnaphthalene	mg/kg	0.1	92	-	-	-	-	< 0.1		<0.1	<0.1	<0.1	-	1	-
2-Chloronaphthalene	mg/kg	0.1	-	-	-	-	-	< 0.1		<0.1	<0.1	<0.1	-	<0.1	-
Dimethylphthalate	mg/kg	0.1	-	-	-	-	-	< 0.1		<0.1	<0.1	<0.1	-	<0.1	-
2,6-Dinitrotoluene	mg/kg	0.1	-	-	-	-	-	< 0.1		<0.1	<0.1	<0.1	-	<0.1	-
Acenaphthylene	mg/kg	0.05	-	-	-	-	-	< 0.05		-	-	-	-	-	-
Acenaphthene	mg/kg	0.05	-	-	-	-	-	< 0.05		-	-	-	-	-	-
2,4-Dinitrotoluene	mg/kg	0.2	-	-	-	-	-	< 0.2		<0.2	<0.2	<0.2	-	<0.2	-
Dibenzofuran	mg/kg	0.2	120	-	-	-	-	< 0.2		<0.2	<0.2	<0.2	-	0.3	-
4-Chlorophenyl phenyl ether	mg/kg	0.3	-	-	-	-	-	< 0.3		<0.3	<0.3	<0.3	-	<0.3	-
Diethyl phthalate	mg/kg	0.2	-	-	-	-	-	< 0.2		<0.1	<0.1	<0.1	-	<0.1	-
4-Nitroaniline	mg/kg	0.2	-	-	-	-	-	< 0.2		<0.2	<0.2	<0.2	-	<0.2	-
Fluorene	mg/kg	0.05	-	-	-	-	-	< 0.05		-	-	-	-	-	-
Azobenzene	mg/kg	0.3	-	-	-	-	-	< 0.3		<0.3	<0.3	<0.3	-	<0.3	-
Bromophenyl phenyl ether	mg/kg	0.2	-	-	-	-	-	< 0.2		<0.2	<0.2	<0.2	-	<0.2	-
Hexachlorobenzene	mg/kg	0.3	-	-	-	-	-	< 0.3		<0.3	<0.3	<0.3	-	<0.3	-
Carbazole	mg/kg	0.3	-	-	-	-	-	< 0.3		<0.3	<0.3	<0.3	-	<0.3	-
Dibutyl phthalate	mg/kg	0.2	-	-	-	-	-	< 0.2		-	-	-	-	-	-
Anthraquinone	mg/kg	0.3	-	-	-	-	-	< 0.3		-	-	-	-	-	-
Butyl benzyl phthalate	mg/kg	0.3	-	-	-	-	-	< 0.3		<0.3	<0.3	<0.3	-	<0.3	-
Dibenz(a,h)anthracene	mg/kg	0.05	-	-	-	-	-	< 0.05		-	-	-	-	-	-
PCBs by GC-MS															
PCB Congener 28	mg/kg	0.001	-	-	< 0.001	< 0.001	-	< 0.001	-	-	-	-	-	-	-
PCB Congener 52	mg/kg	0.001	-	-	< 0.001	< 0.001	-	< 0.001	-	-	-	-	-	-	-
PCB Congener 101	mg/kg	0.001	-	-	< 0.001	< 0.001	-	< 0.001	-	-	-	-	-	-	-
PCB Congener 118	mg/kg	0.001	-	-	< 0.001	< 0.001	-	< 0.001	-	-	-	-	-	-	-
PCB Congener 138	mg/kg	0.001	-	-	< 0.001	< 0.001	-	< 0.001	-	-	-	-	-	-	-
PCB Congener 153	mg/kg	0.001	-	-	< 0.001	< 0.001	-	< 0.001	-	-	-	-	-	-	-
PCB Congener 180	mg/kg	0.001	-	-	< 0.001	< 0.001	-	< 0.001	-	-	-	-	-	-	-
Total PCBs by GC-MS															
Total PCBs	mg/kg	0.007	-	-	< 0.007	< 0.007	-	< 0.007	-	-	-	-	-	-	-
Stone Content	%	0.1	-	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Moisture Content	%	0.01	-	12	19	21	5.7	22	14	15	24	20	14	19	18
Total mass of sample received	kg	0.001	-	0.5	1.5	1.5	2.0	2.0	2	0.74	0.66	1.8	2	1.7	1.70

Notes:
If quantification exceeds 0.001% w/w, the concentration must be <0.01% w/w (i.e., very low levels as per watch Point 12 CL:AIRE JIWG CarSoil 2016) and additional risk assessment will be required to confirm suitability for use. An asbestos quantification above 0.01% w/w is considered unsuitable for use.

Exceedance

APPENDIX 3
GOOD PRACTICE RISK MANAGEMENT MEASURES

Appendix 3: Proposed Good Practice Risk Management Measures

Category of Mitigation	Description of Mitigation Measures
Protective measures during construction	Many of the potentially significant effects on the construction work force are mitigated as part of the health and safety precautions. Risk to construction workers should be dealt with by the Contractor based on the identified hazards. These should also be revised based on the ground conditions encountered during on-site activities. The Contractor will be responsible for site health and safety and will manage the risk through control of suitable Health and Safety measures including provision of PPE, education of the workforce and inductions for all site staff and visitors. The proposed development is subject to CDM Regulations. Works to be undertaken in accordance with the Construction Code of Practice.
Construction Environmental Management Plan	An Construction Environmental Management Plan (CEMP) should be implemented in order to prevent construction work and future operations from giving rise to land contamination. The EMP should include the risk management measures proposed above as well as the following measures: • Mitigation and risk management measures identified in this report; • Legislative compliance; • Noise and Vibration Management; • Imported soils control and verification; • Site Welfare; • Control of Excavation Works; • Waste Management; • Air Quality and Dust; and, • Environmental Accidents and Emergency Situations. • Protocol for dealing with areas of unforeseen contamination including procedures to be adopted in the event that Asbestos Containing Material is identified (see below).
Site Enabling and Clearance works	Good practice approaches including bunding of materials should be implemented in order to minimise cross contamination of excavation materials and / or perched water, if encountered in any excavations during the site works. Should any previously unidentified contamination be encountered during site works, an environmental watching brief will be required.
Underground Services	Laying underground services in potentially contaminated Made Ground materials has the potential to establish preferential flow pathways. In addition, certain contaminants e.g., hydrocarbons may penetrate and impact on water supply. Therefore, materials should be used appropriate to the level of contamination identified on site, particularly with regard to underground mains water supply.
Landscaping	Site Made Ground soils are not considered suitable for the build-up of soft landscaped areas across the site or on part of the wider KXC development due to the presence of asbestos. Soils imported for use within soft landscaped areas should be deemed suitable for use.

Category of Mitigation	Description of Mitigation Measures
Waste Management	Waste disposal should be undertaken in accordance with current legislative requirements. The potential presence of asbestos containing material may have a significant cost implication for the disposal of soil materials.
Asbestos Management Protocol (can be incorporated into EMP)	Asbestos Containing Material has been identified within the shallow Made Ground soils. Details of on-site procedures to be adopted in the event that asbestos containing material is suspected and or encountered. Details may include but not limited to: • Monitoring; • Watching briefs; • Competency of personnel; • Licenced contractors; and • HSE notification (if required).
Unforeseen Contamination	If encountered, any remediation will be carried out in accordance with the principles of the remediation strategy for the wider KXC masterplan site and set out in the KXC ES, Vol 4 Part 16 (Paragraph 16.6.7 to 16.6.9) A contamination watching brief will be maintained during the construction phase and any contaminated materials identified during earthworks will be segregated and dealt with appropriately. If unforeseen contamination is identified during the course of the works, the construction manager would instruct specific investigations, advise the Local Authority and liaise on the remediation methodology as appropriate. The results of any validation testing will form the basis of a Remediation Plan/Report for the Chilton Square site. Outline procedure to be adopted in the event of encountering any unforeseen contamination: • Soil contamination: to be sampled either in-situ or as part of an excavated stockpile stored and segregated; • Asbestos Containing Material (ACM): specific precautions will need to be implemented in accordance with Control of Asbestos Regulations (CAR) 2012 and CIRIA C733; • Underground Fuel Storage Tanks (USTs): although not anticipated these cannot be ruled out entirely. Decommissioning of any identified tanks to be undertaken in accordance with Environment Agency guidance (PPG27). • Validation testing will be undertaken, and a record of the mitigation implemented will be maintained for subsequent reporting.
Verification	The Verification Plan outlines a formal monitoring procedure to be conducted throughout the works and will determine whether the remediation objective has been met. In accordance with EA guidance document a 'Verification and Remediation of Land Contamination Report SC030114/R1' (2010) will need to be produced in order to verify the completion of works and any previously unforeseen contamination encountered during the construction phase of works. Testing of materials for chemical suitability is to ensure that materials on site are not likely to cause

Category of Mitigation	Description of Mitigation Measures
	risk to human health, future structures, or the environment following development of the site. All laboratory analysis conducted as part of the verification phase of works will need to be submitted to a UKAS / MCERTs accredited laboratory to ensure the accuracy of data obtained. Information contained within the Verification Report will include, but not limited to: • Summary verification works from site diary; • Plan denoting sample locations; • Plan showing the location of re-use of site derived materials; • Quantities of re-used, imported and disposed material; • Waste Classification Certificates; • Receiving / Originating Sites; • Sources, type of import and placement location; • Carrier / receiving facility Licences; • Details and demonstration of any relevant permits or exemptions required by the Environment Agency for re-using material or importing material, particularly where there is the potential for material being considered waste; • Waste Transfer Notes; • Areas of unexpected contamination and subsequent works conducted; • Details of any water discharges / off-site removal of groundwater; • Laboratory Chemical testing results of validation samples, imported material, waste material; • Details of remediation measures taken, i.e., verification of depth, chemical composition and identification of marker layer; • Photographic log / site diary of works; • Details of site audits completed; • Details of watching briefs completed (site works diary); and • Details of any liaison and agreements with Regulators.

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