

1 VINYL SQUARE

THE OLD VINYL FACTORY

Joseph
Homes.

THE OLD
VINYL FACTORY

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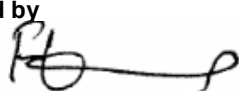
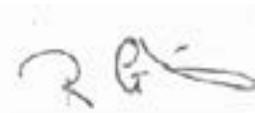
LAND CONTAMINATION REPORT

NOVEMBER 2019



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PHASE 1 ENVIRONMENTAL REVIEW
THE OLD VINYL FACTORY
BLYTH ROAD, HAYES
CATHEDRAL GROUP
DS-MER00566-13-58
22 MARCH 2013

					PHASE 1 ENVIRONMENTAL REVIEW THE OLD VINYL FACTORY BLYTH ROAD, HAYES CATHEDRAL GROUP DS-MER00566-13-58
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EXECUTIVE SUMMARY

SCOPE

Merebrook was instructed by Cathedral Group to prepare a Phase 1 Environmental Review report for the Old Vinyl Factory site.

The development proposals for a mixed use residential and commercial development include hard and soft landscaping and associated infrastructure. No private gardens are proposed.

This report is required for inclusion in the land sale information pack for the site. The purpose of the report is to review all historic investigations on the site, assess the likely contaminative status of the site and to provide recommendations for addressing identified risks/liabilities as appropriate.

SITE SETTING

The site is located to the west of the Hayes and Harlington train station in the London Borough of Hillingdon. The site is triangular in shape and is approximately 5.6 hectares in size with the centre of the site located at National Grid Reference TQ091795 (509181, 179575).

SITE HISTORY

Historic plans show that by 1895, the site was largely undeveloped with a few terraced buildings located along the western boundary of the site. By 1914, the site had been significantly developed with the construction of the gramophone factory, a printing press, associated buildings and infrastructure. Thereafter, a succession of developments and land use changes took place on the site until the early 1990s when parts of the site were developed into its current layout.

ENVIRONMENTAL SETTING

The geology beneath the site consists of Made Ground over Brickearth, Taplow Gravels, London Clay, Lambeth Group and the Chalk Formation. The Taplow Gravels are classified as a Principal Aquifer and groundwater flow is in a south easterly direction. The Grand Union canal is located at approximately 200m to the north of the site. There are no abstraction licenses within 500m of the site. It is understood that historically, there were six abstraction wells on the site which have since been decommissioned. The site is not located within a Source Protection Zone.

CONCEPTUAL SITE MODEL AND RISK ASSESSMENT

Considering the available information for the site, a Conceptual Site Model and qualitative risk assessment has been undertaken. Based on the assessment, the following risk ratings have been assigned:

- The overall risk to future site users has been assessed as Low/Moderate due to the presence of localised contamination in the shallow Made Ground. The risks can be mitigated to Low through the implementation of a clean cover system in the proposed soft landscape areas.
- The risk to construction workers has been assessed as Low assuming appropriate health and safety procedures are employed on site.
- The overall risk from ground gas (methane and carbon dioxide) is considered to be Low and ground gas protection measures are not required.
- The risk to shallow groundwater in the Taplow Gravels within the site has been assessed as Low due to the absence of elevated concentrations of potential contaminants in the groundwater underlying the site as well as no significant soil based source of contamination on the site.
- It should be noted that elevated concentrations of hydrocarbons and chlorinated solvents have been reported on the Gatefold development site located to the south east of the site. The contamination is associated with on-going processes in the pressing plant. However, due to the groundwater flow direction, being in a south easterly direction, the offsite source of contamination is unlikely to affect the groundwater quality beneath the proposed development site.

Overall, whilst low level contamination (typically associated with ash and clinker) has been identified on the site, the associated risks can be effectively managed without incurring significant abnormal development costs



GEOTECHNICAL CONSIDERATIONS

The foundation solution for the site would include a mixture of shallow foundations and piled foundations.

Underground obstructions and remnant foundations have been identified on the site. It is considered likely that the excavations of underground obstructions on the site could generate significant quantities of aggregate for reuse on the site, provided they are chemically and geotechnically suitable.

The tunnels identified on the site can be bridged over and do not require removal.

Soakaways are likely to represent a suitable drainage solution for the site.



SECTION 1 INTRODUCTION

1.1 BRIEF

- 1.1.1 Merebrook Consulting Limited (Merebrook) has been commissioned by Cathedral Group to prepare a Phase 1 Environmental Review report for the Old Vinyl Factory, Blythe Road, Hayes.
- 1.1.2 The development proposals for a mixed use residential and commercial development include hard and soft landscaping and associated infrastructure. No private gardens are proposed in the development.
- 1.1.3 This report is required for inclusion in the land sale information pack for the site.
- 1.1.4 The purpose of the report is to review all historic investigations on the site, assess the likely contaminative status of the site, assess the likely foundation solutions and engineering considerations for the site and to provide recommendations for addressing identified risks/liabilities as appropriate.
- 1.1.5 The historic reports for the site include the following:
- i.* Geo-Environmental Assessment Report, Thorn EMI Complex, Blyth Road, Oscar Faber for Hayes Resolution (Hayes) Limited & Middlesex Development Company Limited, August 1999 (Ref: PJHB/CED/CEN.FinalReport02);
 - ii.* Radiological Survey of Blyth Road Site, Hayes, AEA Technology, August 1999 (REF:AEAT - 5977);
 - iii.* Tree Pit and Water Feature Investigation, RPS 2002 (Ref: LC8383 – letter report);
 - iv.* RPS (2010) Phase 2 Environmental Site Investigation Report for London Gate, Blyth Road, Hayes. A report prepared by RPS for J E R Partners. Ref. HLEL137484/001R dated September 2010; and
 - v.* Geotechnical & Environmental Investigation Report for Purple Hayes, Hayes. Ref RG/HLEI15948. A letter report dated 08 March 2011 and prepared by RPS for Cathedral Group.

1.2 OBJECTIVES

- 1.2.1 The objectives of the Phase 1 Environmental Review are to:
- i.* Review the historical and current land uses associated with the site and assess the potential for ground contamination;
 - ii.* Review historic site investigation reports and identify potential pollutant linkages;



- iii.* Construct a Conceptual Site Model (CSM) and undertake a preliminary (qualitative) risk assessment; and
- iv.* Provide preliminary recommendations to address any significant risks or potential liabilities identified.

1.2.2 The contaminative status of the site and the implications with respect to the future development has been interpreted in accordance with the current published guidance on source-pathway-receptor risk assessment.

1.2.3 The geotechnical and engineering considerations for the site have been assessed by reviewing the existing site investigation reports and geotechnical data for the site in relation to the development proposals.

1.3 LIMITATIONS

1.3.1 This report has been prepared for Cathedral Group for the sole purpose described above and no extended duty of care to any third party is implied or offered.

1.3.2 Third parties making reference to the report should consult Cathedral Group and Merebrook as to the extent to which the findings may be appropriate for their use.

SECTION 2 SITE SETTING AND LAND USE

2.1 SITE LOCATION

2.1.1 The site is located to the west of the Hayes and Harlington train station in the London Borough of Hillingdon.

2.1.2 The site is triangular in shape and occupies an area of approximately 5.6 hectares. The centre of the site is located at National Grid Reference TQ091795 (509181, 179575).

2.1.3 A site location plan for the site is shown on Drawing MER00566/00 in Appendix 1.

2.2 SITE DESCRIPTION AND SITE WALKOVER

2.2.1 The site is currently made up of number of historic buildings, some of which were refurbished as part of the London Gate development. A site plan showing the currently buildings on the site is shown in Drawing 0157/0002/00 dated 26 July 2012. The drawing is included in Appendix 1. Existing structures on the site include:

- i.* Jubilee House (formerly known as Apollo House) which is a three storey 1930's brick building with a warehouse extension (The Pressing Plant) located in the eastern part of the site. Jubilee House is currently vacant;
- ii.* The Pressing Plant is a small factory which is currently used for the production of vinyl records;

- iii. The Power House (formerly known as Neptune House) is a vacant two storey brick boiler house located along the north eastern boundary of the site, adjacent to Blyth Road. The building has an existing chimney;
 - iv. The Record Store (formerly known as Phoenix House) is a derelict building located in the south of the site, adjacent to the railway line. The building is currently vacant;
 - v. The Cabinet Building (formerly known as Vulcan House) is a semi derelict office building, which is located in the centre of the site;
 - vi. The Shipping Building (formerly known as Mercury House) is a refurbished and partially let building located along the south western boundary of the site. The building is currently used as office space;
 - vii. An electrical substation is located between The Record Store, The Cabinet and the Shipping Building to the south west of the site; and
 - viii. The Marketing Suite (labelled Vinyl) for the new development located in the north western corner of the site

2.2.2 There are soft and hard landscape areas within the site. Specifically, the majority of the western part of the site consists of car parking and hard standing areas as well as soft landscaping along Blyth Road and between the existing car parking spaces.

2.2.3 No evidence of significant contamination or invasive plant species such as Japanese Knotweed has been identified on the site. However, there is the significant evidence of feral pigeons and foulings in the Jubilee House (formerly Apollo House). The removal of this is likely to be complicated by the asbestos fragments identified within the building.

2.3 **SITE TOPOGRAPHY**

2.3.1 The site is generally flat with the existing ground levels varying between +31.50mAD in the east of the site and +32.09m AOD in the west of the site.

2.3.2 The existing site levels are shown on Drawing 0157/002/00 dated 26 July 2012 included in Appendix 1.

2.4 **SITE SURROUNDINGS**

2.4.1 The site's surrounding are a mixture of commercial and residential land uses.

2.4.2 The site's surroundings and the land uses are summarised as follows:

 - i. North: commercial properties with associated car parking spaces. Historically, most of the buildings immediately north of Blyth Road were associated with the Old Vinyl Factory. There are areas of soft landscaping along Blyth Road to the north of the site.



- ii.* South: Railway line extending to the Hayes and Harlington railway station, which is located to the south east of the site. There is a mixture of residential and commercial properties beyond the railway land.
- iii.* West: Commercial and residential properties with associated private gardens. These properties are located along Dawley Road.
- iv.* East: Historic warehouses which were parts of factory within the proposed development site. The site will be redeveloped into the Gatefold Building under a separate planning consent.

2.5 PUBLISHED GEOLOGY AND HYDROGEOLOGY

- 2.5.1 Based on the British Geological Survey (BGS) 1:50,000 scale survey sheet No 269, the anticipated ground conditions of the site include Brickearth over Taplow Gravels, London Clay, Lambeth Group and Chalk. Due to the development history of the site, Made Ground should be anticipated to be present on the site.
- 2.5.2 The Taplow Gravels are classified as a Principal Aquifer. There are no known records of groundwater abstractions within 500m of the site.
- 2.5.3 The London Clay is classified as an Unproductive Strata and the significant depth relatively impermeable London Clay is likely to protect the groundwater in the deeper Lambeth Group and Chalk Aquifer from any potential shallow contamination in the Made Ground.
- 2.5.4 Historic records indicate that there have been up to six abstraction wells within the site. Though it is understood that these have since been decommissioned, the records were not reviewed during the preparation of this report.

2.6 HYDROLOGY

- 2.6.1 There are no surface water bodies on the site.
- 2.6.2 The Grand Union Canal is located at approximately 200m to the north east of the site. The River Crane is located approximately 900m to the southeast of the site.
- 2.6.3 The site is not located in a site at risk from flooding from surface or groundwater sources.

2.7 RADON GAS

- 2.7.1 With reference to the BRE Report 211: 2001, the site is not shown to lie within a Radon Affected Area as defined by the Health Protection Agency. Guidance issued by the Buildings Research Establishment (BRE-211) indicates that no radon protection measures are necessary at the site.



2.8 SITE HISTORY

- 2.8.1 The site history, based on a review of the historic and current maps, dating from 1879 to present is summarised below. Potentially contaminative land uses are shown in bold. Copies of the maps used in this review are provided in Appendix 2.

Table 1: Summary of the key features shown on historic maps

Data Source	The Old Vinyl Factory site / Surroundings
1865 County Series Map (1:2,500 scale)	The majority of the site is shown as open undeveloped land. A row of terraced housing is present along the western boundary of the site.
	The majority of the site's surrounding are shown as open undeveloped land. Two semi-detached terraced houses are shown along the western boundary of the site. The land to the north of the site is marked as Brick Field . A railway line is shown along the southern boundary of the site.
1895 County Series Map (1: 2,500 scale)	With the exception of further construction of terraced buildings along the western boundary of the site, the majority of the site has remained unchanged.
	With the exception of further development along the western boundary of the site, there have been no significant changes in the site's surroundings.
1914 County Series Map (1: 2,500 scale)	There have been significant developments on the site, particularly in the centre and eastern part of the site. The development is associated with the construction of a gramophone factory with associated buildings and structures including tanks, railway lines and a printing press . The railway line on the site extends into the areas north of the site.
	Significant changes have been taken place in the site surroundings, particularly to the north of the site. Industrial land uses to the north of the site, include the gramophone factory, gravel pits; mack partition works; brewing sugar works; printing works; marble, slate and granite works, engineering works, wharfs and railway lines .
1935 County Series Map (1: 2,500 scale)	There have been further changes on the site. These are related to the construction of structures including buildings, tramlines and tanks in the western part of the site. The terraced buildings historically present along the western boundary of the site have been replaced by large structures. A chimney is shown on the structure located in the north western corner of the site. The Printing Press (Goss Works) present along the south eastern boundary of the site has been demolished and replaced by a large structure extending across the south eastern boundary of the site.
	There have been further developments to the north of the site. These are related to the construction of additional structures associated with the gramophone factories . There has been further construction of terraced housing along the western boundary of the site.
1965 County Series Map (1: 2,500 scale)	There have been no significant changes to the layout of the existing buildings on the site. However, the largest building located in the centre of the site is now marked a gramophone & electronic works . One the buildings to the southeast of the site is marked as a warehouse . The tramlines present on previous maps are no longer shown.
	There have been limited changes in the site's surroundings. The majority of the buildings to the north are now marked as works (e.g. gramophone & engineering works, printing & engineering works, oil works) and warehouses .



Data Source	The Old Vinyl Factory site / Surroundings
1978 -1982 National Grid Map (1: 2,500 scale)	There have been limited changes to the site's setting. The changes have included in the removal of some of the historic tanks in the west and south east of the site. There have been limited changes to the setting of the site surroundings. A Science Museum has been constructed to the north of the site. Some of the historic buildings are now marked as depots . Electrical substations are marked on adjacent to some of the buildings located to the north of the site.
1987 -1993 National Grid Map (1: 2,500 and 1:1,1,250 scales)	All the structures in western part of the site have been demolished and the area is shown as open land. The majority of the site's surroundings have remained relatively unchanged.
2012 Mastermap (1:1,250 scale)	The site has been redeveloped into its present day setting. The western part of the site is predominantly car parking spaces. An electrical substation is shown in the south western corner of the site. No significant changes in the site's surroundings. The area to the north of the site is marked as Warnford Industrial Estate.

2.8.2 In summary, historical plans show that:

- i. By 1895, the site was largely undeveloped with a few semidetached buildings located along the western boundary of the site. By 1914, the site had been significantly developed with the construction of the gramophone factory, a printing press and associated buildings including infrastructure such as tanks and tramlines. Between 1914 and the early 1960's, a sequence of demolition of some of the existing buildings with the construction of new structures was undertaken with additional industrial uses at the site such as electronic works. By the early 1990's, some of the buildings on the site, particularly in the western half of the site has been demolished and replaced with present day car parking spaces.
- ii. Land use changes in the site's surroundings between 1895 and the early 1980s have included the expansion of the gramophone factory in the northern part of the site as well as the development of several industries including engineering works, warehouses, printing works and sugar works. The historic activities within the site and immediate surroundings have the potential to have led to ground contamination off site.

2.8.3 Given the nature of the historical mapping process (scale, representation of conditions at discrete time intervals frequency etc), any such maps and plans may not provide a comprehensive account of a site's history. Identification of pertinent land uses and associated potentially contaminative activities may therefore be absent from mapping records.

2.8.4 The historic and current land uses within the site are potential sources of contamination on the site. The potentially contaminative land uses include the use of the site as a pressing plant, tanks, tramlines, fuel storage and electrical



substations. The main potential contaminants of concern from these land uses include organic (total petroleum hydrocarbons and polycyclic aromatic hydrocarbons, chlorinated solvents, volatile organic hydrocarbons), inorganic (e.g. metals) contaminants and ground gases.

SECTION 3 REVIEW OF HISTORIC SITE INVESTIGATION REPORTS

3.1 INTRODUCTION

3.1.1 Several phases of ground investigations have been undertaken at the site between 1999 and 2011 for a number of land owners. The investigations include the following reports:

- i.* Geo-Environmental Assessment Report, Thorn EMI Complex, Blyth Road, Oscar Faber for Hayes Resolution (Hayes) Limited & Middlesex Development Company Limited, August 1999 (Ref: PJHB/CED/CEN.FinalReport02).
- ii.* Radiological Survey of Blyth Road Site, Hayes, AEA Technology, August 1999 (REF:AEAT - 5977).
- iii.* Tree Pit and Water Feature Investigation, RPS 2002 (Ref: LC8383 – letter report).
- iv.* RPS (2010) Phase 2 Environmental Site Investigation Report for London Gate, Blyth Road, Hayes. A report prepared by RPS for J E R Partners. Ref. HLEL137484/001R dated September 2010. This report included a detailed review of previous reports, namely the 1999 Oscar Faber Geo-Environmental Assessment Report, the AEAT 1999 Radiological Survey report and the 2002 RPS Tree Pit and Water Feature Investigation.
- v.* Geotechnical & Environmental Investigation Report for Purple Hayes, Hayes. Ref RG/HLEI15948. A letter report dated 08 March 2011 and prepared by RPS for Cathedral Group. This report was supplementary to the RPS investigation undertaken in 2010 and included commentary on the geotechnical risks and foundation design.

3.1.2 A site plan showing the location of all the investigations undertaken between 2010 and 2011 is shown on Drawing MER00566/00 in Appendix 1.

3.1.3 A detailed review of the investigations is presented in the following sections.

3.2 OSCAR FABER (1999) GEOENVIRONMENTAL ASSESSMENT REPORT

3.2.1 The investigation and risk assessments were undertaken prior to site purchase by Resolution (Hayes) Ltd and Middlesex Development Company.

3.2.2 The scope of the investigation included 16 cable percussive boreholes, 19 window sample boreholes, soil screening with a Geiger counter and the analyses of soil



and groundwater samples for a range of potential contaminants typical of the historic land uses on the site.

- 3.2.3 No radiological contamination was identified using the Geiger counter.
- 3.2.4 Based on the risk assessments undertaken, widespread soil contamination was not identified during the site investigation. Localised hotspots were identified in shallow samples of Made Ground. However, no impact on the groundwater quality was identified.
- 3.2.5 It should be noted that the assessment criteria were based on now superceded ICRLC threshold levels. As such the data was assessed by RPS in 2010 in the Phase 2 Environmental Site Investigation discussed further below.

3.3 **AEAT (1999) RADIOLOGICAL SURVEY REPORT**

- 3.3.1 The survey was undertaken in order to investigate radiological conditions at the site, specifically within Vulcan House (The Cabinet Building), Apollo House, Jubilee House, Phoenix House (The Record Factory) and associated external areas where access was available.
- 3.3.2 Based on the radiological survey, it was concluded that although minor radiological contamination was identified it was generally consistent with natural background levels and did not represent a significant hazard to site personnel or future site users.

3.4 **RPS (2002) TREE PIT AND WATER FEATURES INVESTIGATION REPORT**

- 3.4.1 This was related to soil samples collected from excavated tree and water pits. These were excavated for the construction of water features during the refurbishment of Mercury House (The Shipping Building) and Vulcan House (The Cabinet Building).
- 3.4.2 A total of 29 tree pit and four water feature pit samples were collected and analysed. Based on the risk assessment undertaken, elevated concentrations of phytotoxic zinc and copper were identified in the Made Ground.
- 3.4.3 The data obtained as part of this investigation was further assessed in the RPS (2010) Phase 2 Environmental Site Investigation report detailed below.

3.5 **RPS (2010) PHASE 2 ENVIRONMENTAL INVESTIGATION REPORT**

- 3.5.1 The objective of the investigation was to assess the ground contamination status (soil and groundwater) due to the historical and current industrial land uses on the site. The report also included a review of all previous investigations undertaken at the site as detailed above.
- 3.5.2 The investigations also included the Gatefold Building located to the south eastern corner of the site. The Gatefold Building is not part of the proposed development



site boundary and as such data related to this site is not specifically discussed in detail in this report.

3.5.3 The 2010 site investigation and follow on monitoring undertaken in September 2010 included the following:

- i.* The drilling of 12 boreholes to a maximum depth of 6.0 meters below ground level (mbgl) at locations which were either targeting potential contamination sources or were for achieving site coverage;
- ii.* The drilling of eight window sampler boreholes to a maximum depth of 2.2mbgl for site coverage;
- iii.* Installation of six groundwater and ground gas monitoring wells, with subsequent groundwater sampling from four of the boreholes. Ground gas monitoring was undertaken on two occasions; and
- iv.* Analyses of a total of 25 samples for potential inorganic and organic contaminants typical of the historic and current land uses on the site.

3.5.4 Based on the objectives of the investigation, Merebrook consider that a suitable scope of investigation, including site coverage and testing regime was adopted for the site.

3.5.5 The ground conditions encountered included Made Ground (up to 1.9m in thickness) over Brickearth (up to 1.5m in thickness), Taplow Gravel Formation (up to 4.6m) and the London Clay Formation. Groundwater was encountered within the Taplow Gravels Formation at depths of between 3.05 and 3.32mbgl.

3.5.6 Limited evidence of visual or olfactory signs of contamination was identified during the ground investigations.

3.5.7 As part of the environmental assessment completed, the following was undertaken:

- i.* Risks to human health were assessed by developing Site Specific Assessment Criteria using CLEA v1.06 for both a residential and commercial land use scenario. The screening values derived were also used to assess historic data from previous investigations completed in 1999 by Oscar Faber and 2002 by RPS.
- ii.* Risk to controlled waters was assessed by comparing the concentration of potential contaminants against Environmental Quality Standards.
- iii.* Risk due to ground gases were assessed using the Modified Wilson and Card approach in accordance with CIRIA C665 guidance for the commercial developments and the NHBC Traffic Light System for the Residential developments within the site.



- 3.5.8 Merebrook consider that the risk assessment approach used above is appropriate and consistent with current guidance.
- 3.5.9 Based on the human health risk assessment completed, using all ground investigation data from 1999 to 2010, the following conclusions were made:
- i.* None of the potential inorganic contaminants in the samples analysed (between 1999 and 2010) were reported above their respective screening levels for commercial land use;
 - ii.* No elevated contaminants above the screening levels were reported in any of the Natural Ground samples analysed;
 - iii.* The majority of the potential organic contaminants were reported below their respective screening levels for the residential land use. However, elevated concentrations of PAHs, particularly benzo (a) pyrene, benzo (a) anthracene and dibenzo (ah) anthracene was reported above the screening levels in two of the samples analysed;
 - iv.* No elevated concentrations of potential contaminants were reported in the groundwater samples analysed and as such the risk to groundwater were assessed as Low.
- 3.5.10 Based on the ground gas risk assessment for the entire Old Vinyl Factor site (including the Gatefold Building) completed:
- i.* Using the Modified Wilson and Card approach for commercial properties, the site was assessed as a Characteristic Situation 1, and no special ground gas protection measures were recommended.
 - ii.* Using the NHBC Traffic Light System for low rise residential properties, the site was classified as a Red Site and ground gas protection measures were recommended for the residential properties. This was due to the elevated concentrations of 30.4%v/v and 3.1%v/v for methane and carbon dioxide respectively as well as flow rates of 0.2l/h. The most elevated concentrations were recorded in a borehole located within the Gatefold Building which is not currently part of site considered in this assessment.
- 3.5.11 Since the completion of the RPS (2010) investigations and assessments, the Gatefold site has been sold off and the data for the site is not considered to directly relevant to the assessment of ground gas risks on the Old Vinyl site, as discussed in the current report.
- 3.5.12 Based on the ground gas data presented in the RPS (2010) report, Merebrook have reassessed the data, specific to the Old Vinyl Factory site. The maximum concentrations of ground gases were 1.8%v/v for carbon dioxide and 2.1%v/v for methane. The maximum recorded flow rate was 0.2%v/v. In accordance with the NHBC Traffic Light System, the estimated worst case Gas Screening Value of



0.0042l/h for methane and 0.0036l/h for carbon dioxide. In accordance with the NHBC Traffic Light System, the site can be classified as a Green Site suggesting that ground gas protection measures are unlikely. However, elevated ground gases, due to the presence of volatile organic contaminants in groundwater has been identified at an offsite location (Gatefold Building) to the south east of the site. If remediation on the adjacent land has not been undertaken, low level ground gas protection measures may be required in the immediate vicinity of the Gatefold Building.

3.6 RPS (2011) GEOTECHNICAL & ENVIRONMENTAL SITE INVESTIGATION

3.6.1 The objective of the letter report was to provide information on the potential environmental and geotechnical constraints associated with the purchase and redevelopment of the site. This included preliminary foundation design, subsurface obstructions in the central area of the site and investigated potential contamination in the eastern part of the site.

3.6.2 The site investigation included a number of boreholes within the Gatefold Building located to the south eastern boundary of the site. The data from this site is not specifically reviewed in detail in the current Environmental Review report.

3.6.3 The ground investigation completed in February 2011 included the following:

- i.* The drilling of four boreholes (BH100 to BH104) to a depth of 20 meters below ground level (mbgl) with associated in situ geotechnical testing (SPT), ground contamination and geotechnical sampling;
- ii.* Two shallow groundwater installations in the Taplow Gravels Formation for groundwater monitoring;
- iii.* Two of the boreholes were installed for shallow groundwater monitoring. Due to the potentially contaminative activities in the Vinyl Factory (The Pressing Plant), boreholes BH103 and BH104 were located within the factory building in order to target potential contamination. BH101 and BH103 were located across the site for site coverage and to obtain geotechnical information to inform substructure design;
- iv.* The excavation of eight trial pits for the investigation of underground obstructions as well as the collection of ground contamination and geotechnical samples;
- v.* The analyses of a total of 29 soil samples from a depth range 0.3 to 3.5mbgl, for a range of potential contaminants typical of the historic land use at the site;
- vi.* The analysis of five water samples from the groundwater monitoring installations across the site (2010 and 2011); and
- vii.* Three rounds of ground gas monitoring from existing installations.



- 3.6.4 Based on the objectives of the investigation, Merebrook consider that a suitable scope of investigation, including site coverage and testing regime was adopted for the site.
- 3.6.5 The ground conditions identified consisted of Made Ground (0.4 to 2.6m in thickness) over Brickearth (maximum thickness of 2.4m), the Taplow Gravel Formation (3.4 to 5.4m in thickness) and the London Clay Formation. Within the Made Ground, obstructions likely to be remnant slabs and utility trenches were identified at depths of up to 2.0mbgl in the vicinity of Neptune House (presently known as the Power House).
- 3.6.6 During the investigation, no visual or olfactory evidence of contamination was identified within the Old Vinyl Factory site. No elevated concentrations of hydrocarbon or chlorinated solvents were recorded in the groundwater beneath the Old Vinyl Factory site.
- 3.6.7 Within the Gatefold Building, located to the south eastern boundary of the site, visual and olfactory evidence of contamination in the form of petroleum hydrocarbons was identified in the shallow groundwater in the Taplow Gravel Formation at depths of between 3.0mbgl and 5.10mbgl. The thickness of free phase product identified in one of the historic boreholes on the site was <10mm. Groundwater flow direction is in a south easterly direction, and contamination at this off site source is unlikely to affect the groundwater quality on the site.
- 3.6.8 As part of the environmental assessment undertaken, the following was completed:
- i.* The CLEA v1.06 was used to develop Site Specific Assessment Criteria for assessing risk to human health. In total, chemical data from 29 samples was used in the assessment of the risk to human health.
 - ii.* Groundwater data obtained from the 2010 and 2011 investigations were compared against UK Drinking Water Standards to assess the risk to Controlled Waters, specifically the underlying Taplow Gravel Formation classified as a Principal Aquifer.
 - iii.* Ground gas risk assessments were undertaken in accordance with the Modified Wilson and Card Method in CIRIA C665.
- 3.6.9 Merebrook consider that the risk assessment approach used above is appropriate and consistent with current guidance.
- 3.6.10 Based on the human health risk assessments undertaken a number of potential contaminants including polyaromatic hydrocarbons (PAHs) and metals were reported above their respective screening levels for residential land use. The contamination was localised in the shallow Made Ground as associated within the presence of ash and clinker.



- 3.6.11 The Controlled Water Risk Assessment showed that the concentration of the majority of the potential contaminants analysed in the groundwater within the Old Vinyl Factory site were below their respective screening values.
- 3.6.12 The ground gas monitoring was undertaken for both the Gatefold Building and the Old Vinyl Factory site. The most elevated concentrations of methane (2.1%v/v), carbon dioxide (7.3%v/v) as well as the maximum flow rates (0.3l/hr) were recorded in the Gatefold Building (off site). Within the Old Vinyl Factory site, the most elevated concentrations of methane and carbon dioxide were 0.2%v/v and 0.7%v/v respectively. The highest flow rate was 0.1l/h. Merebrook have assessed the ground gas data in relation to the Modified Wilson and Card approach (CIRIA C665) for commercial properties and the NHBC Traffic Light system for low rise residential developments.
- 3.6.13 Based on the ground gas data, the Gas Screening Values for methane and carbon dioxide have been calculated as 0.0002l/h and 0.0007l/h respectively. In accordance with the Modified Wilson and Card (CIRIA C665) and the NHBC Traffic Light System, the calculated Gas Screening Values equate to a Characteristic Situation 1 site (very low risk) and a Green Site respectively. This would suggest that no ground gas protection measures are required for new developments on the Old Vinyl Factory site.
- 3.6.14 However, elevated ground gases, due to the presence of volatile organic contaminants in groundwater has been identified at an offsite location (Gatefold Building) to the south east of the site. If remediation on the adjacent land has not been undertaken, low level ground gas protection measures may be required in the immediate vicinity of the Gatefold Building.

3.7 SUMMARY AND ENVIRONMENTAL DATA QUALITY

- 3.7.1 In all the investigations undertaken on the site, several boreholes were terminated at shallow depth, due to the presence of concrete obstructions across the site.
- 3.7.2 The ground conditions at the site, based on the published geology and information from all historic investigations at the site is presented in Table 2 below.

Table 2: Summary of the ground conditions at the Old Vinyl Factory site

Stratum	Depth to Top of Stratum	Thickness	Description	Geotechnical Properties
Made Ground	0	0.4 – 2.6	Variable composition including granular and cohesive materials such as brick, concrete, ash and clinker	Unsuitable founding stratum without further treatment
Brickearth	0.3 - 0.7	0 - 2.4	A soft to firm sandy clay with flint gravel. Mostly present in the western part of the site	SPT values in the deposits ranged from N = 17 to N>50 corresponding to a range from medium dense to very dense compaction
Taplow	0.4 - 2.6	3.4 -5.5	Orangey brown sandy fine to	SPT values in the deposits



Stratum	Depth to Top of Stratum	Thickness	Description	Geotechnical Properties
Gravels			coarse gravel of flint Groundwater in this stratum was identified at depths of between 3.05 to 3.32mbgl	ranged from N = 17 to N>50 corresponding to a range from medium dense to very dense compaction
London Clay	4.3	Unproven	Stiff brown blue/grey slightly sandy clay	SPT N values ranged from N = 18 and N = 50. Calculated shear strengths for the London Clay range from 81kN/m ² to 225kN/m ² , corresponding to a range from stiff to very stiff consistency.

3.7.3 A summary of all the risk assessments (human health, controlled waters, ground gas risk and radiological assessments) for the site, based on all historic data is presented below:

- i. The majority of the potential contaminants in the samples analysed were reported below their respective screening values.
- ii. Localised areas of PAH contamination have been identified in the shallow Made Ground across the site. These are associated with ash and clinker fragments and it was considered to be of limited mobility across the site and as such unlikely to impact on the groundwater at the site.
- iii. Elevated concentrations of phytotoxic contaminants (zinc and copper) were identified in the shallow Made Ground.
- iv. Elevated concentrations of potential contaminants were not identified in the groundwater samples obtained from boreholes across the site.
- v. However, at an offsite location (the Gatefold Building) which is located to the south east of the site, groundwater contamination (hydrocarbon and chlorinated solvents) related to on-going processes at the site have been identified. Due to the groundwater flow direction in a south easterly direction, it is unlikely that the contamination identified off site could affect the groundwater quality within the Old Vinyl Factory site.
- vi. No elevated ground gases (methane and carbon dioxide) were recorded in boreholes within the Old Vinyl Factory site and based on the ground gas risk assessment, no ground gas protection measures are required. However, elevated ground gases, due to the presence of volatile organic contaminants in groundwater has been identified at an offsite location (Gatefold Building) to the south east of the site. If remediation on the adjacent land has not been undertaken, low level ground gas protection measures may be required in the immediate vicinity of the Gatefold Building.



- vii.* Historic radiological surveys undertaken at the site (by RPS in 1999) concluded that significant radiological contamination was not present on the site. However, where minor contamination was present, it was generally consistent with natural background levels and did not represent a significant hazard to current and future site users.

3.7.4 Overall, based on the review of the all the investigations undertaken at the site between 1999 and 2011, it is considered that an adequate level of site investigation, including the targeting of potential sources of contamination, has been undertaken at the site. The risk assessments undertaken have been in accordance with current UK guidance and it is considered that the identified pollutant linkages and proposed risk management measures are adequate for the site. It is not considered that further investigations are required for the site to assess environmental risks.

3.8 **GEOTECHNICAL CONSIDERATIONS**

3.8.1 The ground investigations undertaken at the site in 2011 include and assessment of the geotechnical properties of the underlying soils and a commentary on the likely foundation solutions to be adopted for the new build on the site.

3.8.2 The data presented in the RPS (2011) Geotechnical and Environmental Investigation Report is presented below.

3.8.3 As part of the ground investigations:

- i.* Sub surface obstructions including remnant foundations, concrete slabs and tunnels were identified at the site, in the vicinity of the Power House (formerly Neptune House);
- ii.* The Taplow Gravels Formation typically consisted of sands and gravels with SPT N values ranging from N= 17 to N>50. This corresponds to a dense to very dense compaction.
- iii.* The London Clay was described as stiff brown and blue/grey clay with variable sand and silt layers SPT N values ranged from N = 18 to N = 50. The SPT N Values were used to estimate that the shear strength for the London Clay ranged from 81kN/m² to 225kN/m² corresponding to a range from stiff to very stiff consistency.

3.8.4 Based on the site investigation data and the proposed development details (mixed use scheme including both low and high rise buildings and multi storey car parks), a preliminary geotechnical assessment was undertaken as summarised below:

3.8.5 Due to the inherent variability of the Made Ground, it is not considered suitable as a bearing layer without treatment.



- 3.8.6 The underlying Brickearth was described as soft to firm, and therefore is also unlikely to provide a suitable bearing layer for shallow foundations without improvements.
- 3.8.7 The foundation solutions for the development are likely to include shallow foundations and piles.
- 3.8.8 Shallow Foundations
- 3.8.8.1 For low-rise buildings (fewer than three storeys), traditional strip foundations bearing within the Taplow Gravel are likely to be appropriate. The foundations should fully penetrate the Made Ground and the Brickearth and extend at least 150mm into the bearing layer.
- 3.8.8.2 Foundation depths of up to 2mbgl would be required across the majority of the site. However, in the western area, foundations may need to be deepened. The formation layer should be inspected by a qualified engineer for cohesive or loose pockets and to confirm the gravels are of the required density.
- 3.8.8.3 If soft or loose pockets are encountered, these should be excavated and replaced with suitably compacted granular material or alternatively the foundations could be taken deeper in order to bear upon a suitable layer.
- 3.8.8.4 Groundwater within the Taplow Gravel was typically found to be resting at depths greater than 3mbgl. Significant groundwater control measures are therefore unlikely to be required during foundation construction, unless excavations to depths greater than 3m are proposed. However, the adopted bearing pressures should allow for the shallow groundwater.
- 3.8.8.5 For the taller structures proposed on site, piled foundations will be adopted. Where strip foundations need to be deepened to more than 2.5m bgl, it may be more cost effective to consider a piled solution once the piling rig has been mobilised to site.
- 3.8.9 Piled Foundations
- 3.8.9.1 The proposed development comprises a number of multi-storey car parks and a number of buildings with more than three storeys are also proposed. Piled foundations are likely to be appropriate for these structures. Either driven or bored piles may be considered. However, driven piles may refuse within the dense Taplow Gravel at shallow depths and therefore bored piles may be a more appropriate option. A specialist piling contractor should be consulted in this regard.
- 3.8.9.2 A number of underground tunnels are located beneath the central section of the site. Prior to piling, it will be necessary to ensure that the piling process will not impact on the integrity of the tunnels. In addition to the tunnels, a number of other obstructions were encountered beneath the site. Some pre-pile probing would therefore be prudent in order to assess the feasibility of the proposed pile locations.



- 3.8.9.3 A preliminary assessment of pile working loads has been made, assuming the use of bored piles and the ground model presented in Table 3, below. This assessment is for preliminary guidance only and should be confirmed with a specialist piling contractor prior to construction. Furthermore, average ground conditions for the site have been assumed and the detailed design should take into account the variable thickness of the shallow deposits across the site.

Table 3: Ground model used for preliminary pile calculations (RPS, 2010)

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Strata	Depth (mbgl)	SPT N (average)	Average undrained shear strength Cu kN/m ²	Adhesion factor α
Made Ground / Brickearth	0.0 – 1.5	Ignored in assessment, expect to provide unit weight		
Taplow Gravels	1.5 – 5.0	50		
London Clay	1.5 - 10		115	0.45

- 3.8.9.4 The Made Ground and Brickearth have been ignored in the assessment, other than applying an assumed unit weight. The calculations have been made for individual piles and the action of groups of piles has not been considered. Potential settlements associated with pile groups should be considered in the detailed design.
- 3.8.9.5 A summary of the calculated working loads for bored piles is presented in Table 4, below. The calculated safe working loads are for preliminary design purposes only and specialist piling contractors should be consulted with regards to the design and performance of their foundations.

Table 4: Summary of preliminary pile working loads

Pile Length	Pile Diameter		
	300mm	450mm	600mm
15m	250kN	360kN	470kN
18m	330kN	530kN	700kN

3.8.10 Floor Slabs

- 3.8.10.1 Where Made Ground is present to depths of greater than 0.6m, NHBC guidelines recommend adopting suspended floor slabs. However, following ground improvement across the building footprint, ground bearing slabs could also be considered.



3.8.11 Excavations

- 3.8.11.1 Excavation through the Made Ground, Brickearth and the Taplow Gravel should be possible with conventional earth moving plant. However, a number of below ground concrete structures have been identified and it is likely that a mechanical breaker would be required in order to remove these where necessary. Excavations in granular deposits are unlikely to remain stable and shoring or battering systems may be required. Shoring will be mandatory where access is required for construction personnel. It is recommended that trial pitting be carried out in the vicinity of proposed deeper foundations prior to the start of the development, in order to confirm the likely stability of the

SECTION 4 CONCEPTUAL SITE MODEL AND RISK ASSESSMENT

4.1 REGULATORY CONTEXT

- 4.1.1 A Conceptual Site Model (CSM) and environmental risk assessment have been constructed using the framework established in Part IIA of the Environmental Protection Act (EPA) 1990 and detailed in Contaminated Land Report CLR11 - Model Procedures for the Management of Land Contamination.
- 4.1.2 Risk from contamination has been assessed using the source-pathway-receptor and pollutant linkage methodology, also known as the CSM, based on the relationship between the identified sources and receptors. Under the Part IIA framework, a risk can only exist if the following three components of a pollutant linkage are present:
- i.* A source of contamination or a substance capable of causing harm;
 - ii.* A pathway by which the contaminant can reach the receptor; and
 - iii.* A receptor that could be adversely affected by the contaminant.
- 4.1.3 The potential sources, pathways and receptors identified at the Old Vinyl Factory site are summarised in the following sections.

4.2 POTENTIAL SOURCES

- 4.2.1 Based on a review of the site investigation data available for the site, the historic and existing land uses on the site have resulted in some minor contamination with PAHs and phytotoxic metals in the shallow soils. The PAH contamination is associated with the presence of ash and clinker in the shallow Made Ground. Elevated concentrations of ground gases (carbon dioxide) have also been identified within the shallow Made Ground.



4.3 RECEPTORS

4.3.1 The potential impacts of contamination sources have been considered with respect to the following site specific receptors:

- i.* The general public and present site users;
- ii.* Residents and occupants of future developments;
- iii.* Groundwater in the Taplow Gravels and underlying Lambeth Group and/or Chalk;
- iv.* Adjacent Land; and
- v.* Infrastructure.

4.4 PATHWAYS

4.4.1 The potential pathways for contaminant migration at the site include direct contact, inhalation, leaching and lateral/vertical migration as well, as gaseous flow pathways.

4.4.2 The site is underlain by highly permeable Taplow Gravel over relatively impermeable London Clay, which is a non-aquifer. Groundwater flow direction on the site is in a south easterly direction. It is therefore anticipated that any lateral or vertical migration of contamination will be confined to the Taplow Gravel. Groundwater contamination has been identified at a location to the south east of the site. Due to the groundwater flow direction being in a south easterly direction, this off site source of contamination is unlikely to affect the groundwater quality on the site.

4.4.3 It is considered that the London Clay will act as an aquitard overlying the likely water-bearing Lambeth Group and Chalk bedrock. This is likely to restrict any deeper migration of contaminants on to site from off-site areas.

4.5 POLLUTANT LINKAGES AND RISK RATINGS

4.5.1 The existence of a pollutant linkage requires a pathway by which the receptor could be exposed to the source. A qualitative assessment of risk is thus considered in the first instance with respect to the site in its current condition and is summarised in the sections below.

4.5.2 General Public and present site users

4.5.2.1 The majority of the site consists of hard standing areas and the site is currently secured, preventing access to members to the public and unauthorised users. Therefore, the risk to the general public and present site users is considered to be low.



4.5.3 Residents of future development

4.5.3.1 The proposed development for the site is a mixed use development including both residential and commercial areas. Ground contamination related to PAHs associated with ash and clinker has been identified in the shallow Made Ground soils. The elevated concentrations may represent a potential risk to future residents *via* ingestion and inhalation of soil and soil-derived dust and *via* dermal contact. However, subject to the use of a clean cover system in the soft landscape areas, the risk to future site users is considered to be Low.

4.5.3.2 No elevated concentrations of ground gases have been recorded on the site and ground gas protection measures are not required. However, elevated ground gases, due to the presence of volatile organic contaminants in groundwater has been identified at an offsite location (Gatefold Building) to the south east of the site. If remediation on the adjacent land has not been undertaken, low level ground gas protection measures may be required in the immediate vicinity of the Gatefold Building.

4.5.4 Groundwater

4.5.4.1 The site is underlain by the Taplow Gravels Formation which is classified as a Principal Aquifer. No elevated concentrations of potential contaminants have been identified in the groundwater underlying the site and as such the risk to controlled waters have been assessed as Low.

4.5.4.2 Due to the significant depths of cohesive and relatively impermeable London Group clays separating groundwater in the Chalk from the shallow Made Ground and potential contamination, no risks to the underlying chalk aquifer are considered likely. As such the risks to the Chalk aquifer have been assessed as being Low.

4.5.5 Construction workers

4.5.5.1 Potentially, construction workers are initially at the greatest risk from exposure to hazardous contamination due to excavation works and during the handling of materials including imported soils. Providing that dust levels are kept within statutory limits and appropriate health and safety procedures are adhered to during the construction phase, the levels of chemical contamination recorded to date are not considered to present an acute risk to human health. However, due to the presence of asbestos in the existing buildings on the site, a possibility of asbestos fibre release cannot be ruled out at this stage and contingency measures to address asbestos issues will be required.

4.5.6 Adjacent land

4.5.6.1 The low contamination levels found on the site are unlikely to present a risk to adjacent land considering that the majority of the site is currently hard standing. As such the risk to adjacent land from site derived contamination is considered to be low.



4.5.6.2 Elevated concentrations of ground gases have not been recorded on the site. As such the site is unlikely to be a significant source of ground gases affecting adjacent land. The risks due to ground gases have been assessed as Low.

4.5.7 Infrastructure

4.5.7.1 Elevated concentrations of phytotoxic contaminants (zinc, copper and nickel) have been identified on the site. It is therefore considered that the existing soils within the site could pose a risk in planted areas and as such the risks have been assessed as Low/Moderate. Suitable planting media will be required in the soft landscaped areas.

4.5.7.2 Localised elevated concentrations of organic and inorganic contamination have been identified within the Made Ground. Water companies generally have stringent requirements regarding the quality of soil in which polymeric services are laid and they may insist upon protected services. Their specific requirements should be verified with the service provider.

4.6 **OVERALL RISK RATINGS AND GEOTECHNICAL CONSIDERATIONS**

4.6.1 Based on the assessments undertaken, and the likely absence of any gross contamination sources present on site, the following ratings have been arrived at:

- i.* The overall risk to future site users has been assessed as Low, provided a clean cover system in soft landscape areas is adopted to mitigate the risk due to low levels of contamination identified in the shallow Made Ground.
- ii.* The risk to construction workers has been assessed as Low assuming appropriate health and safety procedures are employed on site.
- iii.* The overall risk from ground gas is considered to be Low and no ground gas protection measures are required for new developments on the site. However, elevated ground gases, due to the presence of volatile organic contaminants in groundwater has been identified at an offsite location (Gatefold Building) to the south east of the site. If remediation on the adjacent land has not been undertaken, low level ground gas protection measures may be required in the immediate vicinity of the Gatefold Building.
- iv.* The risk to shallow groundwater in the Taplow Gravels has been assessed as Low due to the absence of significant contamination in the groundwater underlying the site.

4.6.2 Based on the geotechnical assessments undertaken for the site:

- i.* The foundation solutions for the scheme could include a mixture of shallow foundations and piled foundations;
- ii.* The shallow Made Ground and Brickearth on the site are unsuitable founding stratum;



- iii.* There are obstructions in the ground, including remnant foundations and tunnels that could affect substructure construction. It is however, considered that, where present, these structures can be bridged over to enable substructure construction; and
- iv.* Soakaways are likely to represent a suitable drainage solution for the site. However, specific investigations are required to determine the site specific infiltration rates.

SECTION 5 CONCLUSIONS

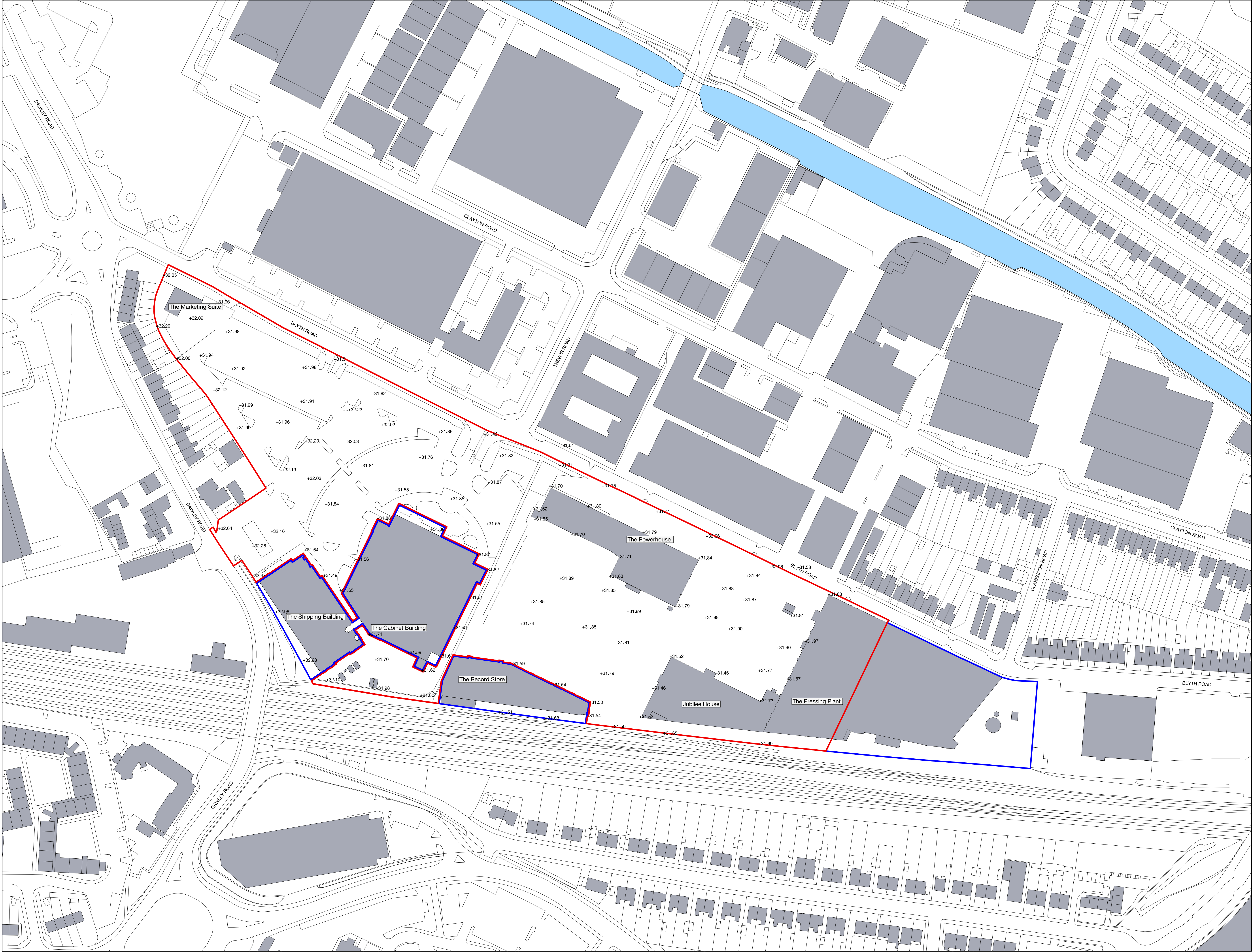
5.1 CONCLUSIONS

- 5.1.1 A Phase 1 Environmental Review of existing data has been undertaken for the Old Vinyl Factory site
- 5.1.2 A ground contamination assessment in accordance with the source-pathway-receptor and pollutant linkage methodology has been undertaken in conjunction with a preliminary risk assessment. A number of pollutant linkages have been identified at the site that will require management as part of the site redevelopment works.
- 5.1.3 Whilst low level contamination (typically associated with ash and clinker) has been identified on the site, the associated risks can be effectively managed without incurring significant abnormal development costs.
- 5.1.4 It is considered likely that the excavations of underground obstructions on the site could generate significant quantities of aggregate for reuse on the site, provided they are chemically and geotechnically suitable. The tunnels identified on the site can be bridged over and do not require removal. The piling solution for the site would include a mixture of shallow foundations and piled foundations. Soakaways are likely to represent a suitable drainage solution for the site.



APPENDIX 1
DRAWINGS

- Drawing 0157/002/00
- Drawing MER00566/00



Notes

- Planning Application Boundary
- Other land in the Applicant's control
- +00.00 Existing ground levels

No project license issued. This drawing should not be used to calculate areas for development or otherwise. The drawing should not be used for any other purpose. All work must comply with relevant British Standards and Building Regulations requirements. Changes to the drawing are to be made to the original.

To be read in conjunction with the Development Specification that forms part of the application.



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Client

PURPLEXED LLP

Project

The Old Vinyl Factory Masterplan

Drawing

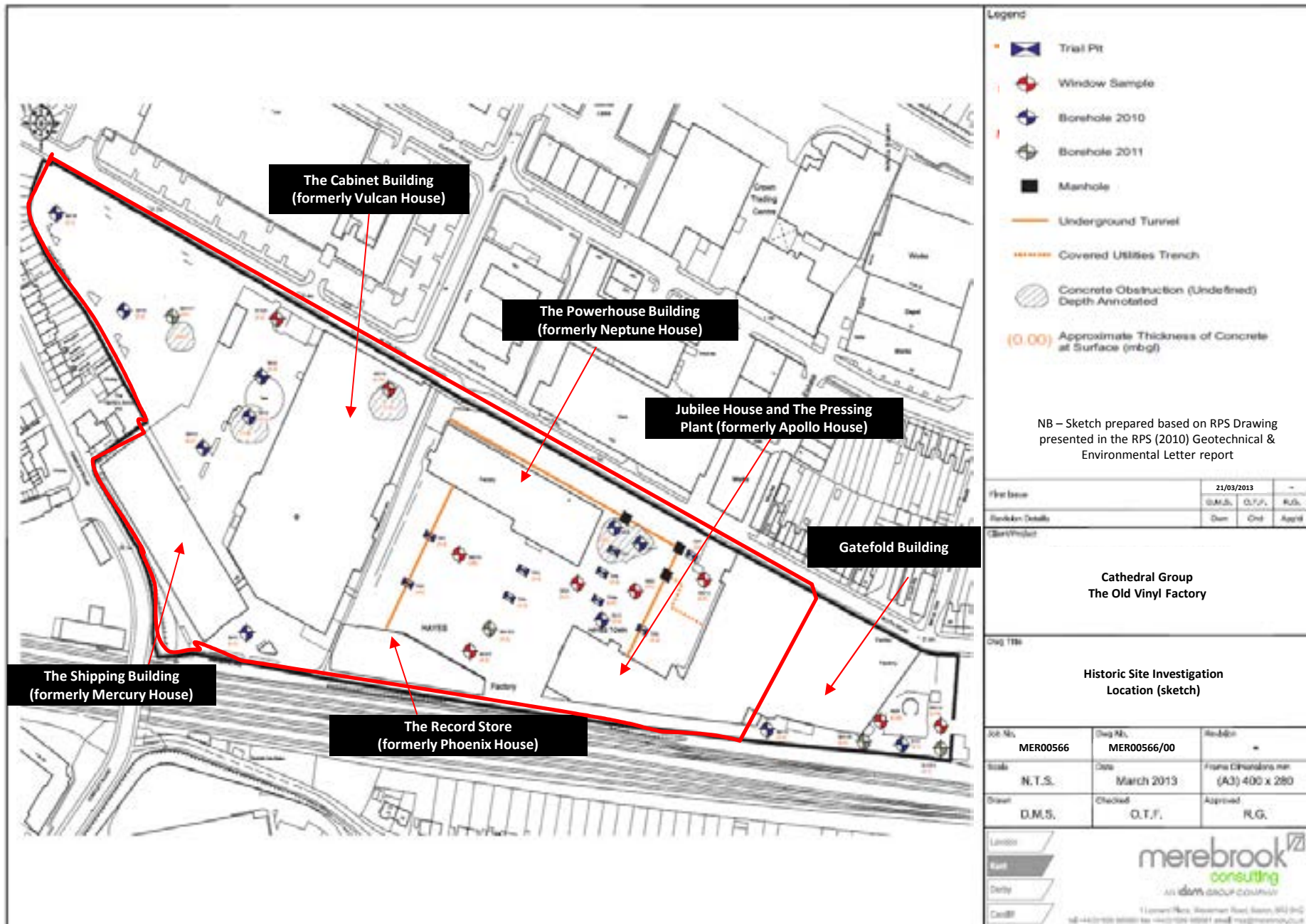
Parameter Plan 02: Existing Ground Levels

Project Number	Status
0157	PLANNING
Drawing No.	Revision
0002	00
Scale at A1 (A3)	Date
1:1000 (1:2000)	26/07/2012
Drawn by	Checked by
BM/CL	LL

Scale Bar

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APPENDIX 2 ▪ Historic Maps

Site Details:

THE OLY VINYL FACTORY
BLYTH ROAD., UB3 1HA

Client Ref: PURPLE HAYES-19.03.2013-OTF

Report Ref: HMD-154-698569

Grid Ref: 509250, 179574

Map Name: MasterMap

Map date: 2012

Scale: 1:1,250

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Site Details:

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Client Ref: PURPLE HAYES-19.03.2013-OTF

Report Ref: HMD-154-698569

Grid Ref: 509250, 179574

Map Name: National Grid

Map date: 1987-1992

Scale: 1:1,250

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Report Ref: HMD-154-698569

Grid Ref: 509250, 179574

Map Name: County Series

Map date: 1935

Scale: 1:2,500

Printed at: 1:2,500



Surveyed 1935
Revised 1935
Edition N/A
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Report Ref: HMD-154-698569

Grid Ref: 509250, 179574

Map Name: County Series

Map date: 1865

Scale: 1:2,500

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