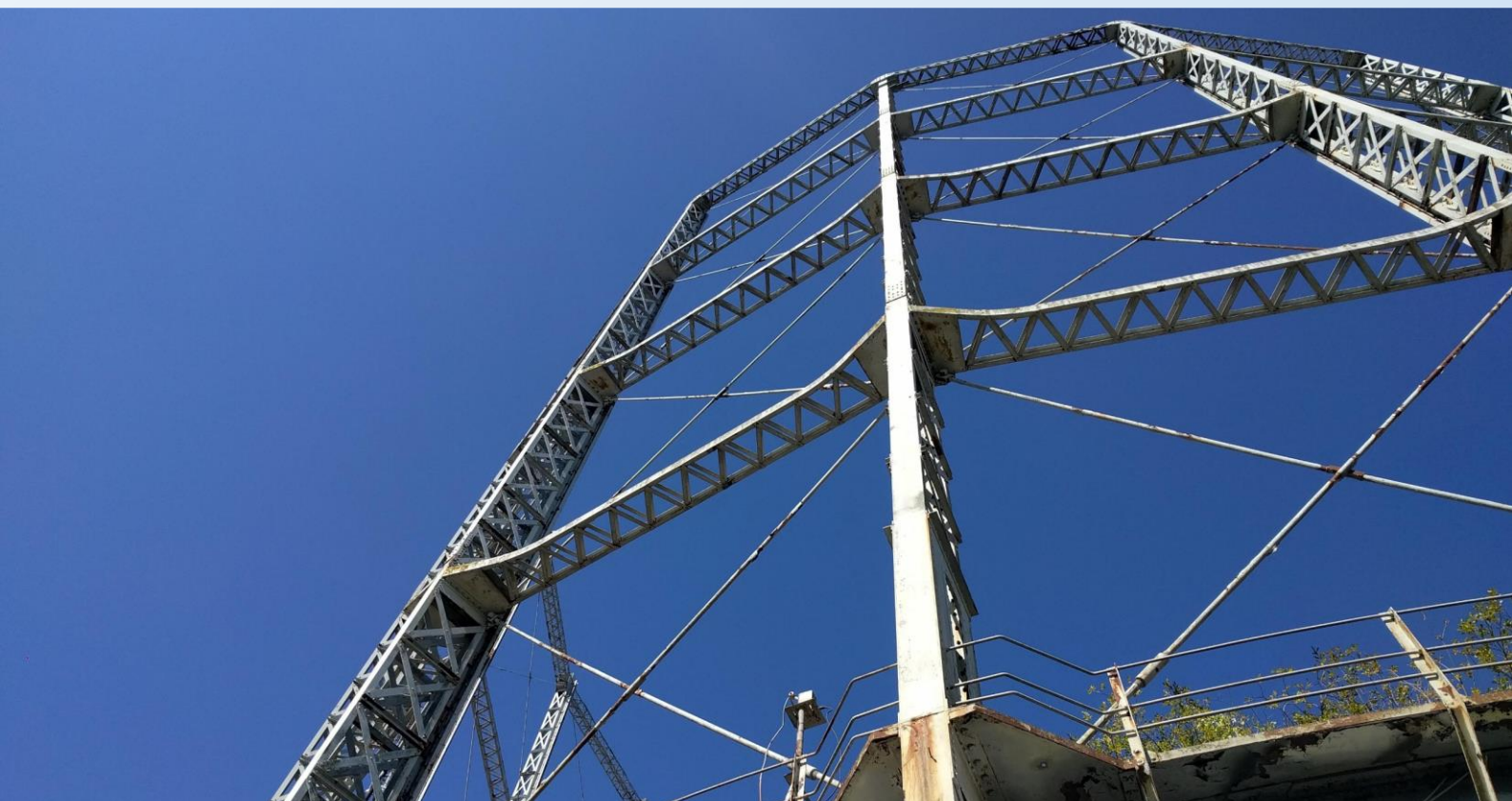




Danescroft (Kenavon Drive Project
Management) LLP

GAS HOLDER SITE, READING

Supplementary Site Investigation & Monitoring
Report





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Supplementary Site Investigation & Monitoring Report

TYPE OF DOCUMENT (VERSION) CONFIDENTIAL

PROJECT NO. 70031882

OUR REF. NO. 70031882-011

DATE: MARCH 2020

Danescroft (Kenavon Drive Project Management) LLP

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Supplementary Site Investigation & Monitoring Report

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QUALITY CONTROL

Issue/revision	First issue	Revision 1	Revision 2	Revision 3
Remarks	Final			
Date	March 2020			
Prepared by	A. Jimenez			
Signature				
Checked by	A. Irlam			
Signature				
Authorised by	K. Rawlins			
Signature				
Project number	70031882			
Report number	70031882-011			
File reference	\\uk.wspgroup.com\central data\Projects\700318xx\70031882 - Reading Gasholder No 4\Deliverables\Supplementary SI & Monitoring Report			

CONTENTS

1.	INTRODUCTION	4
1.1.	TERMS OF REFERENCE	4
1.2.	CONTEXT	4
1.3.	DEVELOPMENT PLANS	4
1.4.	PREVIOUS SITE INVESTIGATIONS & ASSESSMENTS	4
1.5.	AIMS & OBJECTIVES	5
1.6.	PROJECT SCOPE	5
1.7.	LEGISLATIVE CONTEXT AND GUIDANCE	6
1.8.	SOURCES OF INFORMATION	7
1.9.	CONFIDENTIALITY STATEMENT AND LIMITATIONS	8
2.	SUPPLEMENTARY SITE INVESTIGATION & MONITORING WORKS	9
2.1.	SITE WORKS	9
2.2.	GROUND CONDITIONS ENCOUNTERED ON-SITE	10
2.3.	GAS HOLDER FOUNDATION PIT	13
2.4.	GROUNDWATER MONITORING	13
3.	GROUND GAS ASSESSMENT	18
3.1.	GROUND GAS	18
4.	HUMAN HEALTH RISK ASSESSMENT	21
4.1.	SUPPLEMENTARY SURFACE SOIL RISK ASSESSMENT	21
5.	GENERIC CONTROLLED WATERS RISK ASSESSMENT	23
5.1.	CONTEXT	23
5.2.	RATIONALE	23
5.3.	GROUNDWATER DATA	23

5.4.	SURFACE WATER DATA	28
5.5.	SUMMARY OF CONTROLLED WATERS GQRA RESULTS	28
6.	CONCLUSIONS & RECOMMENDATIONS	30
6.1.	UNCERTAINTIES & LIMITATIONS	30
6.2.	FURTHER WORKS	31

TABLES

Table 1-1 – Sources of Information	7
Table 2-1 - Visual and Olfactory Evidence of Contamination	11
Table 2-2 – Measured Groundwater Elevations & Observations	14
Table 2-3 - Recorded Range of In-Situ Geochemistry Measurements (Round 4 & 5)	15
Table 3-1 - Summary of Ground Gas Monitoring Rounds	18
Table 3-2 - Summary of Ground Gas Monitoring Results 2015-2020	19
Table 3-3 - Typical Maximum Concentrations and GSVs	20
Table 4-1 - Summary of Exceedances from Surface Soils from Southern Site Boundary	22
Table 5-1 – Summary of Exceedances of Groundwater Samples against DWS (only October 2019 and February 2020 rounds included)	24
Table 5-2 – Summary of Exceedances of Groundwater samples against AA-EQS	26
Table 5-3 – Summary of Exceedances of Surface Waters Against AA-EQS	28

APPENDICES

APPENDIX A

FIGURES

APPENDIX B

REPORT LIMITATIONS

APPENDIX C

EXPLORATORY HOLE LOGS



APPENDIX D

PHOTOGRAPHIC RECORD

APPENDIX E

GAS AND GROUNDWATER MONITORING DATA

APPENDIX F

HUMAN HEALTH GAC JUSTIFICATION

APPENDIX G

LABORATORY DATA

APPENDIX H

SCREENING TABLES

1. INTRODUCTION

1.1. TERMS OF REFERENCE

WSP was instructed by Danescroft (Kenavon Drive Project Management) LLP (Danescroft) (“the Client”) to undertake a supplementary site investigation and additional monitoring at Gas Holder Site at Alexander Turner Close, Reading (“the Site”). The work was undertaken in accordance with our proposal dated 09 August 2019 (ref. 70031882).

The Site location and current layout are presented in on Figure 70031882-001 and Figure 70031882-002 respectively in **Appendix A**.

1.2. CONTEXT

The Site is currently owned by SGN and comprises a decommissioned gasholder (gasholder No.4) within a palisade fence compound in the west of the Site and an asphalt yard in the east of the Site which is utilised by SGN as a manned storage depot. Railway lines are present to the north, the River Kennet to the southeast and a newly constructed residential development is present to the west.

Danescroft is working on behalf of SGN as a land promoter to package up the Site for divestment in order to sell the Site onto prospective housing developers with approved planning. Planning permission for a high-density residential development was granted in November 2019 (ref. 190627).

1.3. DEVELOPMENT PLANS

The proposed development comprises demolition of existing buildings and Gas Holder, and the erection of new buildings ranging between 2 and 9 storeys in height, providing 130 residential units (Class C3) with associated access, car parking, landscaping and open space. The proposed development plans (Proposed Site Plan¹ and Proposed Ground Floor Plan²) are included in **Appendix A**.

1.4. PREVIOUS SITE INVESTIGATIONS & ASSESSMENTS

The following reports have been produced for the Site for Danescroft since 2017:

1. Off-Site Liability Assessment, Gas Holder Site Reading, WSP, July 2017;
2. Geo-environmental Site Assessment Report, Gas Holder Site Reading, WSP, April 2019;
3. Supplementary Phase 2 Geo-Environmental and Geotechnical Site Assessment, Gas Holder Site, Reading, WSP, July 2019. Reference: 70031882-006; and
4. Gas Holder Site, Reading, Controlled Waters Detailed Quantitative Risk Assessment, WSP, March 2020. Reference 70031882-012.

¹ Gas Holder Reading, Proposed Site Plan, ColladoCollins Architects, 16035 P0-010 Dated 28/03/19 – Planning

² Gas Holder Reading, Proposed Plan – Ground Floor, ColladoCollins Architects, 16035 P0-100 Dated 28/03/19 – Planning.

WSP completed site investigation and assessment works in 2015-2016 on behalf of SGN for continued use of the Site as a depot. In 2018, the results of the 2015 investigation works were re-evaluated by WSP on behalf of Danescroft in light of the proposed residential redevelopment of the Site. This Geo-environmental Site Assessment Report (Ref [3]) was submitted in support of the planning application in April 2019.

Additional intrusive investigation works were undertaken by WSP during spring 2019 on behalf of Danescroft to further assess the ground constraints and potential ground risk for the proposed residential end use, and to better scope the remediation requirements. The works involved targeting areas not previously investigated, further investigation in the area of identified chlorinated solvent contamination, and additional gas and groundwater monitoring. The additional investigation works identified Non-Aqueous Phase Liquid (NAPL) (likely of gasworks origin) within the chalk aquifer in the southwest of the Site which had not previously been identified. These works were reported within the Supplementary Phase 2 Geo-environmental and Geotechnical Site Assessment (Ref [4]).

A controlled water detailed quantitative risk assessment (DQRA) utilised the results of the Site investigation works in April 2019 in order to provide a detailed evaluation of the potential risks to controlled waters receptors associated with the historical use of the Site as operational gas land and to assess the level of remediation required at the Site to support the development of a remediation options appraisal and remediation strategy. The DQRA report has been updated following the results of the second phase of supplementary investigation and monitoring works detailed within this report.

1.5. AIMS & OBJECTIVES

A second phase of supplementary investigation and monitoring works were undertaken in September 2019 to further investigate the NAPL identified in the southwest of the Site, assess impacts to the identified key controlled waters receptors, and to inform the remediation options appraisal and remediation strategy.

This supplementary investigation and monitoring report includes all details on the findings of the September 2019 supplementary site investigation works and subsequent monitoring works. Data from this report has been utilised to provide an update to the DQRA³.

1.6. PROJECT SCOPE

The following scope of works were undertaken to investigate the NAPL identified on Site, and to provide further information to inform the demolition, remediation and Site redevelopment. Additional gas monitoring was undertaken to provide a robust dataset to support the planning condition requirements, and further groundwater sampling and analysis was undertaken to confirm conclusions from the controlled waters DQRA and support a chlorinated solvent assessment (utilising BIOCHLOR) which is contained within the updated DQRA [Ref. 5];

³ Controlled Waters Detailed Quantitative Risk Assessment, Gas Holder Site, Reading. Produced by WSP for Danescroft. Dated March 2020.

1. Three deep boreholes drilled to further investigate the presence of NAPL (300 series wells, positioned up and down gradient of where NAPL has previously been identified), installed as groundwater monitoring / NAPL recovery wells within the chalk.
2. Surface sampling and analysis of soils along the tree line of the southern boundary adjacent to the River Kennet to assess whether soils surrounding retained trees are suitable for proposed end-use.
3. Completion of two rounds of groundwater level gauging (September/October 2019 and February 2020) on all installed monitoring wells on Site to confirm the groundwater flow direction within the River Terrace Gravels.
4. Completion of two rounds of groundwater sampling (September/October 2019 and February 2020) across all monitoring wells on Site, which included monitoring of chlorinated solvent degradation and potential increase of the daughter product concentrations, namely trichloroethene (TCE), cis-1,2-dichloroethene (DCE) and vinyl chloride (VC). Inclusion of a chlorinated solvent assessment (utilising BIOCHLOR) within the updated DQRA Report, March 2020.
5. Completion of three rounds (September/October 2019 and February 2020) of ground gas monitoring to provide a broader range of gas monitoring data (one round to be undertaken during the groundwater sampling visit). One of the ground gas monitoring visits was undertaken in a period of low (<1,000mb) and falling pressure atmospheric conditions.
6. Sampling and analysis of NAPL (where possible) from new 300 series wells (or on any other well where NAPL is identified).
7. River Kennet water levels and riverbed depths obtained to confirm the lack of continuity with the River Terrace Gravel aquifer. The River Kennet was visually inspected to confirm the absence of NAPL migration. Results were utilised to provide an update to the DQRA Report (Version 3).
8. Investigation into the foundation design of the gasholder base (gasholder No. 4) to support the demolition and remediation works.

1.7. LEGISLATIVE CONTEXT AND GUIDANCE

The assessment was undertaken in the legislative context of:

- Part 2A of The Environmental Protection Act (1990); and
- The National Planning Policy Framework (2019).

The following good practice and statutory guidance was considered, and the assessment was undertaken in general accordance with:

- Environment Agency 'Model Procedures for the Management of Land Contamination', CLR11 (2004), which is soon to be replaced by Environment Agency 'Land Contamination: Risk Management', due to be published in 2020;
- NHBC 'Guidance for the Safe Development of Housing on Land Affected by Contamination', R&D66 (2008);

- British Standard 'Guidance on investigations for ground gas. Permanent gases and Volatile Organic Compounds (VOCs)', BS 8576:2013;
- British Standard 'Code of practice for the design of protective measures for methane and carbon dioxide ground gases for new buildings', BS 8485:2015;
- British Standard 'Investigation of Potentially Contaminated Sites – Code of Practice', BS EN 10175:2011;
- Defra 'Environmental Protection Act 1990: Part 2A Contaminated Land Statutory Guidance', PB13735 (2012);
- British Standard 'Guidance on Investigations for Ground Gas – Permanent Gases and Volatile Organic Compounds (VOCs)' BS 8576:2013;
- British Standard 'Code of Practice for Ground Investigations', BS 5930:2015;
- CIRIA C552 Contaminated Land Risk Assessment – A Guide to Good Practice; and
- UK Water Industry Research (UKWIR) (2010). Guidance for the selection of water supply pipe to be used in brownfield sites. Report Ref. No. 10/WM/03/21.

1.8. SOURCES OF INFORMATION

The following relevant sources of previous information were used in the production of this report. Information from these sources relating to the underlying ground conditions has also been utilised in later sections this report, where appropriate:

Table 1-1 – Sources of Information

Source	Report
WSP Reports	WSP (2016) Factual Site Investigation Report, Gasholder No. 4, Kenavon Drive, Reading, May 2016, Project No. 287642I, Revision 1 (for SGN). WSP (2016) Interpretative Site Investigation Report, Gasholder No. 4, Kenavon Drive, Reading, May 2016, Project No. 287642I, Revision 1 (for SGN). WSP (2017) Off-Site Environmental Liability Assessment, Reading Gasholder No. 4, June 2017, Project No. 70031882 (for Danescroft). WSP (2019) Geo-Environmental Site Assessment, Gas Holder Site, Reading, April 2019, Rev 2. Project No. 70031882 (for Danescroft). WSP (2019) Phase 2 Geo-Environmental and Geotechnical Site Assessment, Gas Holder Site, Reading, October 2019, Rev A. Project No. 70031882 (for Danescroft). WSP (2019) Controlled Waters Detailed Quantitative Risk Assessment, Gas Holder Site, Reading, March 2020, Rev 2. Project No. 70031882 (for Danescroft).
Third Party Reports	Factual Environmental Desk Study (March 2005). Atkins Ltd. From an original report titled: Kenavon Drive, Reading (Mentor No.9005) Environmental Assessment Desk Study: Final Interpretative Report. November 1997. WS Atkins Consultants Limited. Factual Environmental Site Investigation Report (March 2005). Atkins Ltd. From an original report titled: Kenavon Drive, Reading (Mentor No.9005) Environmental Site Investigation: Interpretative Report Final. October 1998. WS Atkins Consultants Limited.
Public Information	Environment Agency, 'What's in your Backyard?' (http://apps.environment-agency.gov.uk/wiyby/default.aspx), accessed 22 January 2016.

Source	Report
	Envirocheck® Report (ref 72752172_1_1) September 2015. BGS 'Geology of Britain' online viewer accessed on 23 May 2018 (http://mapapps.bgs.ac.uk/geologyofbritain/home.html). Zetica 'Unexploded Bomb Risk Map' website accessed 23 May 2018 (https://zeticauxo.com/downloads-and-resources/risk-maps/).
Notes:	The report contains British Geological Survey materials ©NERC 2018 and Environment Agency information ©Environment Agency and database right.

1.9. CONFIDENTIALITY STATEMENT AND LIMITATIONS

This report is addressed to and may be relied upon by Danescroft (Kenavon Drive Project Management) LLP. It may not be relied upon or transferred to any other parties without the express agreement of WSP UK Limited in writing. The report should be read and used in full. No responsibility will be accepted where this report is used, either in its entirety or in part, by any other party.

Third party information not directly commissioned by WSP UK Limited and used in the production of this report has been relied upon as being accurate. WSP UK Limited cannot and will not accept any liability for errors and/or omissions in data provided by others in these cases and cannot warrant that works. Report limitations are presented in **Appendix B**.

2. SUPPLEMENTARY SITE INVESTIGATION & MONITORING WORKS

2.1. SITE WORKS

2.1.1. SITE INVESTIGATION SUMMARY

Site investigation works were completed between 17 - 26 September 2019. Three deep boreholes (BH301, BH302A and BH303) were completed to 20 to 20.6m bgl utilising clean drilling techniques and installed as monitoring wells in the chalk aquifer. Borehole locations are shown on Figure 70031882-004 in **Appendix A**.

2.1.2. BOREHOLE RATIONALE

All 300 series wells were drilled and installed with a 100mm diameter wide installation to enable NAPL sampling, abstraction and to facilitate NAPL remediation trials, if required.

BH301 was installed adjacent to BH202 where NAPL was previously identified.

BH302 was drilled to the northwest (downgradient) of BH202.

As the NAPL identified in BH202 was not a Light NAPL (LNAPL), migration pathways may not be in line with the groundwater gradient and may take the path of least resistance within the fractured chalk aquifer. Therefore, BH303 was installed upgradient, between the area of previously identified NAPL (BH202) and River Kennet.

2.1.3. SURFACE SAMPLING

Five surface soil samples (SS01-SS05) were collected along the tree line adjacent to the southern Site boundary (northern bank of the River Kennet) to assess the risk to human health. It is likely that these trees will need to be retained to comply with planning conditions (a 10m wide buffer zone is required alongside the River Kennet, as requested by the Environment Agency in Condition 5 of their planning consultation correspondence for the protection of wildlife and enhancement of biodiversity) and therefore, material surrounding them will need to remain in-situ.

In line with Planning Condition 22 (Biodiversity), no development shall commence, including demolition and any preparatory works, until details of a habitat enhancement scheme have been submitted to and approved in writing by the Local Planning Authority.

2.1.4. GASHOLDER FOUNDATION PIT

One trial pit (GH4) was completed adjacent to the north of gasholder no. 4 to expose the foundations and enable an assessment of the foundation depth and construction.

2.1.5. MONITORING

Following borehole installation, monitoring wells were developed and initial groundwater monitoring and gas monitoring was undertaken in the following weeks between the 30 September and 15 October 2019.

An additional round of groundwater monitoring was undertaken on 10 and 11 February 2020 across all monitoring wells to allow additional assessment of groundwater quality across the Site.

2.2. GROUND CONDITIONS ENCOUNTERED ON-SITE

Ground conditions have been logged in accordance with BS5930:2015, Engineering in Chalk C574 and ES EN ISO 14688 Part 1 where applicable. Detailed logs for all exploratory holes are provided in **Appendix C**, and a photographic record of ground conditions is included as **Appendix D**.

Identified ground conditions largely correspond with previous investigations and comprise Made Ground overlying drift deposits of Alluvium and River Terrace Deposits, which overly solid geology of Chalk.

2.2.1. SURFACE COVER

BH301 was located in an area of weak tarmac. BH302 and BH302A were situated within an area of loose earth.

BH303 was located in the main depot entrance roadway and encountered 0.15m of asphalt. Rail tracks are visible at surface and a sleeper was encountered in the side of the hand dug pit from 0.15 m bgl at this location.

2.2.2. MADE GROUND

Made Ground was identified within each exploratory hole, extending to between 1.70 and 7.50m bgl. The composition of the Made Ground varied and included reworked alluvium, gravels of concrete, brick and wood and gravelly clay with occasional bricks, clinker and wood. Ash was noted within the top two metres of BH302 and BH303.

The deepest Made Ground extended to 7.50m bgl and was encountered at BH302A adjacent to former Gasholder No.3 on the western site boundary. It is assumed that BH302A was potentially located within a former structure or within an historic foundation pit for the former gasholder. At the base of the Made Ground in this location was abundant wood, brick and concrete. An obstruction was encountered at 2.7m in BH302 which is thought to have been within the former pipe inlet pit of former Gasholder No.3. Gasholder No. 3 was largely located on land to the west of the Site.

Base of the Made Ground was noted at 1.7 m bgl and 3.8 m bgl in BH301 and BH303, respectively.

Evidence of contamination within the Made Ground was widespread. Evidence included the following:

- Strong coal tar odours were present in BH301 and BH303 from 1.50 m bgl, and BH302 from 3.8 m bgl;
- Tarry veins were noted within the first two metres at BH301;
- Visible sheen at BH302 at 4.2 m bgl and BH303 at 2 m bgl; and
- Ash was present in the first two metres in BH302 and BH303.

2.2.3. ALLUVIUM

Alluvium was observed underlying the Made Ground within BH301 at 1.7m bgl. Alluvium was not encountered in either BH302A or BH303, as Made Ground extended deeper in these locations. The Alluvium generally comprised black to grey soft silty clay with shell fragments.

Evidence of contamination within the Alluvium was identified which consisted of black staining and strong coal tar odour with elevated PID readings of 90ppm at 2.50m bgl.

2.2.4. RIVER TERRACE GRAVELS

River Terrace Gravels (RTG) were identified in two locations, beneath the Made Ground within BH303 and beneath the Alluvium in BH301. The top of the strata varied from 4.50 m bgl to 5.05 m bgl. The strata generally comprised brownish black (BH301) or white and grey (BH303) sand and gravels. Gravels were predominately chalk, sandstone and flint, and were fine to coarse, sub angular to sub-rounded.

Visual or olfactory evidence of contamination was identified within the RTG within BH301 (drilled adjacent to BH202 where NAPL was previously identified) with brownish black staining, visible NAPL and sheen within the liner and a strong coal tar odour.

2.2.5. CHALK

The upper boundary of the weathered Chalk was noted in the deep boreholes from 5.45 m bgl in BH303, to 8.4 m bgl in BH302A. The Chalk comprised structureless white clayey gravelly sand or sandy gravelly clay/silt with Chalk and flint cobbles and gravels. Chalk was noted to the base of the deep boreholes to a maximum depth of 20.6m bgl (BH302A).

Coal tar odours and visual staining of the core liners were noted in the Chalk in BH301 (located adjacent to BH202); at this location the base of the River Terrace Gravels was also contaminated.

2.2.6. VISUAL AND OLFACTORY EVIDENCE OF CONTAMINATION

A summary of visual and olfactory evidence of contamination identified within Made Ground and natural ground is summarised below in **Table 2-1**.

Table 2-1 - Visual and Olfactory Evidence of Contamination in Soils

ID	Detail	Depth (mbgl)	Strata	Visual Evidence	Olfactory Evidence	Max PID reading(s) (ppm)
BH301	To the southwest of Gasholder No. 4, adjacent to BH202 (location of previously identified NAPL)	0.10 to 1.70	Made Ground	Brick, concrete and clinker with occasional lump of solid tar within vac-ex location.	-	30 (1.50m bgl)
		1.50 to 5.05	Alluvium	Occasionally tarry veins within the alluvial clay.	Strong coal tar odour throughout.	30 (1.50m bgl) 90 (2.50m bgl)
		5.05 to 7.40	River Terrace Gravels	Areas of visible product/sheen.	Strong coal tar odour throughout.	130 (5.50m bgl); 30 (6.50m bgl)
		10.0 to 14.50	Chalk	-	Slight to moderate coal tar odour.	60 (13.8m bgl)
		14.5 to 16.00	Chalk	Obvious product staining of core liner.	-	95 (15.0m bgl) 56 (15.70m bgl)
		16.0 to 20.00	Chalk	Slight product staining to core liner.	-	18 (18.5m bgl)

ID	Detail	Depth (mbgl)	Strata	Visual Evidence	Olfactory Evidence	Max PID reading(s) (ppm)
BH302A	To the west of Gasholder No. 4, downgradient of BH202 (location of previously identified NAPL)	4.20	Made Ground	Visual sheen at 4.20m bgl.	Strong coal tar odour.	-
		4.50 to 7.50	Made Ground	Core liners covered in product.	Very strong coal tar odour.	64 (4.5m bgl)
		5.70 to 5.80	Made Ground	Hydrocarbon staining.	-	
		7.50 to 8.50	No recovery (Chalk?)	-	Coal tar odour.	1 (8.4m bgl)
		8.50 to 16.10	Chalk	-	Coal tar odour.	54 (12.1m bgl)
		16.10 to 19.10	Chalk	Some visual contamination on core liner.	Strong coal tar odour.	44 (18.0m bgl)
		19.1 to 20.60	Chalk	-	Coal tar odour.	13 (19.3m bgl)
BH303	To the south of Gasholder No. 4, upgradient of BH202 (location of previously identified NAPL), between BH202 and River Kennet	1.5 to 5.50	Made Ground and River Terrace Gravels	Cores stained black.	Strong coal tar odour.	50 (4.6m bgl)
		1.9 to 2.20	Made Ground	Visible sheen.	-	28 (1.9m bgl)

2.2.7. NAPL

NAPL was previously encountered during the Site investigation works in April 2019 within the Chalk fissures in BH202 between 15.7-16.7 m bgl, and strong hydrocarbon odours, staining and oily sheens were observed within the RTG at ~6m bgl at the base of the strata.

Whilst developing BH202, a brown NAPL was abstracted from the borehole (photograph contained within Photographic Log in Appendix D [Ref. [3]]). The NAPL was pumped from the base of the borehole installation which formed an emulsion with the groundwater that had a very strong creosote / hydrocarbon odour. Due to the NAPL creating an emulsion with the groundwater, the thickness of free phase product could not be determined with the oil/water interface probe. An estimated 20 litres of emulsified water and NAPL was pumped from BH202. Since the well development of BH202, no further NAPL has been abstracted from this well.

2.2.8. NAPL was noted in 300 series wells in site investigation works in September 2019:

- BH301 (adjacent to BH202): between 5.05-7.40 m bgl, product was noted within the River Terrace Gravels. Product staining was also noted on core liner from 14.5-16.0 m bgl.
- BH302 (adjacent to cross-boundary gasholder): between 4.5-7.5 m bgl, product noted on drilling core liners. Product staining was also noted on core liner from 14.5-16.0 m bgl.

- BH303 (in proximity to southern Site boundary and River Kennet – assumed upgradient location): hydrocarbon sheen noted between 1.9-2.2 m bgl, and coal tar / coal tar odour noted through Made Ground and River Terrace Gravels to 5.5 m bgl. No free product, or visual / olfactory evidence of contamination within the chalk.
- No NAPL identified during well development in any of the 300 series wells.
- No NAPL was able to be drawn up during low flow sampling of the new 300 series wells.
- NAPL was not detected with the interface probe in any of the new wells, however, it has been proven difficult to monitor NAPL of this consistency with a probe.
- A rare globule of product was noted during low flow sampling of BH302 in one of the two groundwater monitoring rounds – insufficient quantity for product sampling/analysis.
- Analysis of purged water from BH202, and sample analysis from BH301 and BH302A show concentrations naphthalene which are indicative of free phase product / NAPL.

2.3. GAS HOLDER FOUNDATION PIT

GH4 was excavated alongside the north of the gas holder in order to determine the depth of the gas holder foundation. The wall of the gas holder extended to 1.25m bgl, sat on a flat concrete pad which extended at least 1.1m out from the gas holder. The roadway adjacent to the gasholder prevented the excavation being extended outwards to the edge of the foundation, therefore the foundation extent and thickness could not be ascertained.

2.4. GROUNDWATER MONITORING

During the supplementary ground investigation works in September 2019, no groundwater strikes were recorded due to the use of water flush during drilling, masking any potential strikes.

Seven exploratory holes were installed at the Site for groundwater monitoring in 2015 (BH101-BH107), six were installed in April 2019 (BH201-204, WS205-206), and three in September 2019 (BH301-303).

In total, five rounds of groundwater monitoring and sampling have been undertaken as follows:

- Round 1 – 24 November 2015 (100 series wells);
- Round 2 – 15 December 2015 (100 series wells);
- Round 3 – 10-17 April 2019 (100 and 200 series wells);
- Round 4 – 30 September-1 October 2019 (100, 200 and 300 series wells);
- Round 5 – 10-11 February (100, 200 and 300 series wells).

Groundwater monitoring results from Rounds 1-3 are presented within the Supplementary Phase 2 Site Assessment Report (October 2019) [Ref. 4]. Round 4 & 5 groundwater monitoring data is included in **Appendix E**. A summary of groundwater elevations and observations from Round 4 & Round 5 is provided in Table 2-2.

Table 2-2 – Measured Groundwater Elevations & Observations

BH ID	Response Zone (m bgl)	Response Strata	Groundwater Levels				Observations (Round)
			(Round 4)		(Round 5)		
			m bgl	m AOD	m bgl	m AOD	
BH301*	12.00 – 16.00	Chalk	2.24	35.31	1.92	35.63	Water clear slight sulphuric odour. Slight sheen on purged water, possible coal tar odour (5)
BH302A	10.00 – 19.00	Chalk	2.34	35.32	2.03	35.63	Hydrocarbon sheen and occasional dark brown globules of product (4) No odour or sheen (5)
BH303	8.00 – 20.00	Chalk	1.90	35.38	1.615	35.661	Little sheen on water (4) No odour or sheen (5)
BH101	1.00 – 3.60	Made Ground	1.18	36.67	1.18	36.67	No odour or sheen (4) No odour or sheen (5)
BH102B	1.00 – 4.50	Alluvium / River Terrace Gravels	0.96	36.24	0.92	36.29	No odour or sheen (4) Occasional black debris in water and mild bitter chemical odour (5)
BH103A	1.00 – 4.50	Alluvium / River Terrace Gravels	0.85	36.29	0.91	36.23	No odour or sheen (4) Slightly turbid with mild hydrocarbon odour (5)
BH104	1.00 – 4.50	Made Ground / Alluvium / River Terrace Gravels	1.97	35.44	1.665	35.745	Yellowish brown tinge & slight sulphurous odour (4) Slightly silty (5)
BH105	8.30 – 10.70	Chalk	1.825	35.445	1.525	35.745	No odour or sheen (4) No odour or sheen (5)
BH106	9.00 – 10.50	Chalk	1.9	35.37	1.62	35.65	No odour or sheen (4) No odour or sheen (5)
BH107	9.00 – 10.50	Chalk	1.885	35.455	1.628	35.712	No odour or sheen (4) No odour or sheen (5)
BH201	5.00 – 7.00	River Terrace Gravels	2.3	35.192	1.94	35.552	Slight brownish tinge and slight hydrocarbon odour (4) No odour or sheen (5)

BH ID	Response Zone (m bgl)	Response Strata	Groundwater Levels				Observations (Round)
			(Round 4)		(Round 5)		
			m bgl	m AOD	m bgl	m AOD	
BH202**	14.70 – 17.70	Chalk	2.2	35.281	1.85	35.552	No odour or sheen (4) Slight coal tar order, water clear (5)
BH203C	5.30 – 7.30	River Terrace Gravels	1.815	35.456	1.51	35.761	No odour or sheen (4) Clear with mild organic/sulphurous odour (5)
BH204	5.00 – 7.00	River Terrace Gravels	1.92	35.379	1.66	35.639	No odour or sheen (4) Clear with fine orange globules, no obvious odour (5)
WS205	0.50 – 1.50	Made Ground	1.225	35.912	1.17	35.967	No odour or sheen

Monitoring round number noted in brackets next to comments.

*BH301 flooded during February monitoring round, base depth not recorded.

**BH202 could not be dipped to base due to an obstruction within the well.

2.4.1. IN-SITU GEOCHEMISTRY MEASUREMENTS

Geochemical parameters were recorded during low flow purging prior to groundwater sampling.

Table 2-3 summarises the conditions observed in the groundwater. Full data included in **Appendix E**.

Table 2-3 - Recorded Range of In-Situ Geochemistry Measurements (Round 4 & 5)

Stratum	Temperature (°C)	Dissolved Oxygen (mg/l)	Electrical Conductivity (µS/cm)	pH	Redox Potential (mV)
Drift Deposits: Made Ground / Alluvium / River Terrace Gravels	7.9 to 19.1	0.03 to 6.56	331 to 1903	6.49 to 7.57	-303 to 49.3
Solid Geology: Chalk	10 to 15.8	0.10 to 8.98	9.3 to 1445	6.72 to 7.45	-176 to 121.4

2.4.2. REFINED HYDROGEOLOGICAL MODEL

Based on the findings of the recent investigation and monitoring works (September-October 2019 & February 2020), the preliminary hydrogeological model that was provided in earlier reports has been refined. The ground conditions encountered in the additional boreholes comprised Made Ground, Alluvium, River Terrace Gravels and Chalk. Numerous obstructions were encountered in the Made Ground associated with former structures, foundations and services.

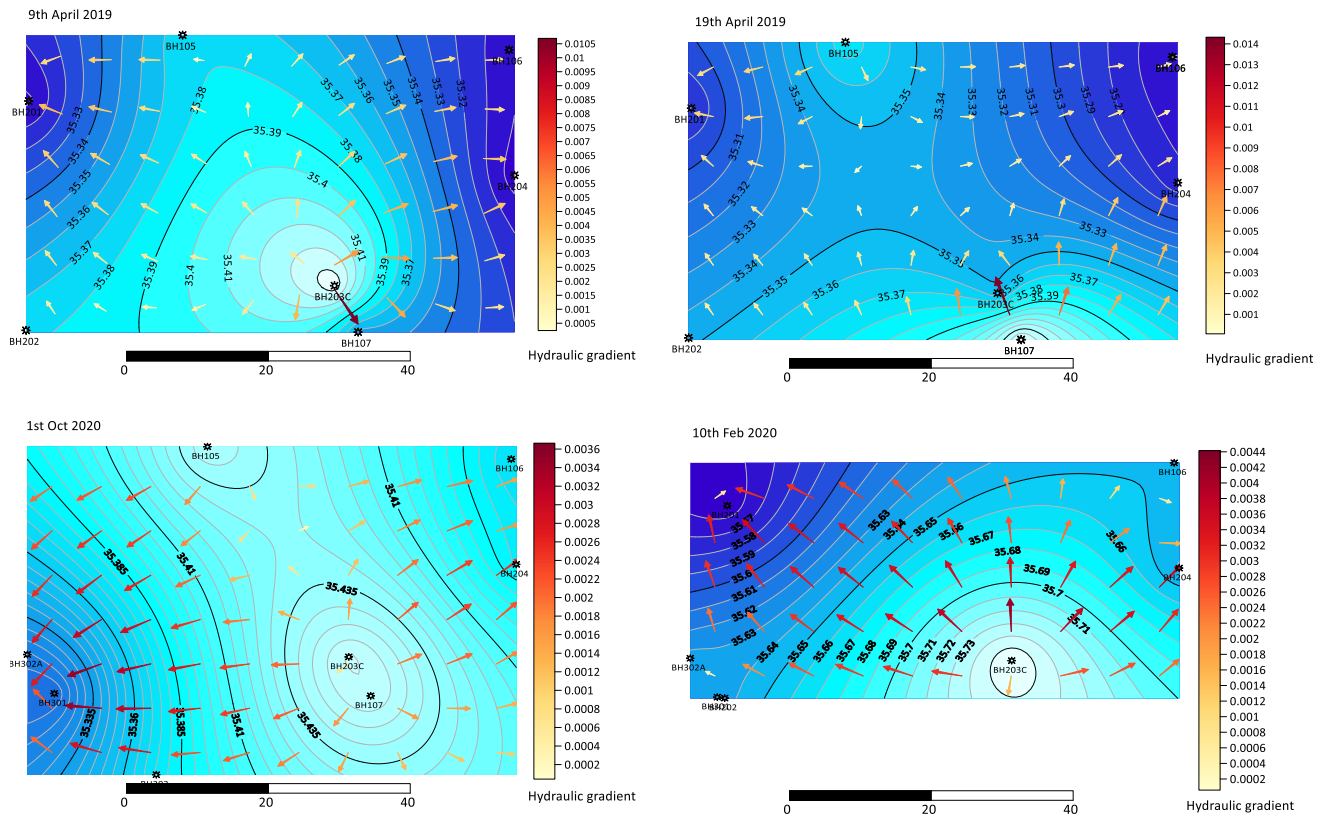
Groundwater in the Made Ground is considered to be perched and given the impermeable nature of the alluvial deposits, the perched groundwater was not expected to be in continuity with the groundwater in the River Terrace Gravels and Chalk. However, this was not really the case as proven by BH302A where Made Ground was identified to directly overlay the Chalk, potentially providing a pathway to the underlying Chalk aquifer. The lack of confinement is likely related to the presence of numerous buried structures and services, and deep Made Ground.

Groundwater level data gathered during two monitoring rounds in April 2019 (9 and 15 April 2019) suggested a north or north east flow direction towards the River Thames located 200 m north (180 m northeast) and away from the River Kennet. Based on the location of the surface waters and regional groundwater flow, the groundwater flow within the RTG was expected to be in a more easterly direction. However, the identified north or northwest flow direction is, however, plausible given that the River Kennet is canalised in the Site area.

A more complete look at the groundwater data, including the five monitoring rounds available since April 2019, show similar water levels within the River Terrace Gravels and Chalk aquifer, suggesting both aquifers are hydraulically connected. As such groundwater levels in the River Terrace Gravels and Chalk have been assessed together. Groundwater configurations from all available monitoring rounds show temporal variation of the groundwater flow direction (Inset 2-1 below). Hydraulic gradients of the River Terrace Gravels and Chalk, however, are consistently low, reflecting only small changes in water levels.

Given that the River Kennet is lined in proximity of the Site and the prevalence of a northeast groundwater direction noted within the groundwater configuration, it is assumed that the groundwater flow beneath the Site has a general flow direction to the northeast towards the confluence of the River Thames and River Kennet.

Inset 2-1 - Groundwater Configuration within the RTG and Chalk Aquifer (9 and 19 April 2019, 1 October 2019 and 10 February 2020)



Groundwater Flow Regime (interpolated)

Includes those results from the River Terrace Gravels (RTG) and Chalk only

3. GROUND GAS ASSESSMENT

3.1. GROUND GAS

3.1.1. GROUND GAS MONITORING

A total of eight shallow boreholes (BH102B, BH103A, BH104, BH202, WS201A, WS202, WS205 and WS206) and three vapour wells (VW201A, VW202 and VW203) were installed as ground gas monitoring locations, with response zones in the Made Ground.

Nine rounds of ground gas monitoring have been undertaken at the Site in total, which include two rounds undertaken immediately following the supplementary investigation works in September & October 2019, and an additional round in February 2020. A minimum of six visits would be required for this type of Site and the proposed development, in line with BS 8576.

Five of the nine monitoring rounds were undertaken in periods of falling atmospheric pressure which is considered to demonstrate worst-case conditions, seven rounds were undertaken during periods of higher pressure (>1,000mb) while two rounds were undertaken during a period of lower pressure (<1,000mb). Table 3-1 summarises the gas monitoring undertaken since 2015.

Table 3-1 - Summary of Ground Gas Monitoring Rounds

Round	Dates	Start pressure	End Pressure	24hr Atmospheric Pressure Trend	Boreholes Monitored*
Round 1	16/11/15	1012	1011	Falling	BH102B, BH103A, BH104
Round 2	24/11/15	1010	1011	Rising	BH102B, BH103A, BH104
Round 3	02/12/15	1020	1020	Falling	BH102B, BH103A, BH104
Round 4	15/15/15	1014	1013	Falling	BH102B, BH103A, BH104
Round 5	09/04/19	1008	1008	Rising	BH102B, BH103A, BH104, BH202, VW201A, VW202, VW203A, WS201A, WS202, WS205, WS206 (BH101, BH106, BH201, BH203C, BH204)
Round 6	15/04/19	1017	1014	Falling	BH102B, BH103A, BH104, BH202, VW201A, VW202, VW203A, WS201A, WS202, WS205, WS206 (BH101, BH106, BH201, BH203C, BH204)
Round 7	30/09/19	1010	1111	Rising	BH102B, BH103A, BH104, BH202, VW201A, VW202, VW203A, WS201A, WS202 (BH301, BH302A, BH303)
Round 8	15/10/19	999	999	Rising	BH102B, BH103A, BH104, VW201A, VW202, VW203A, WS201A, WS202, WS205, WS206
Round 9	10/02/20	995	990	Falling	BH102B, BH103A, BH104, BH202, VW201A, VW202, VW203A, WS201A, WS202, WS205 (BH301, BH302A)

*Locations in brackets are not installed as gas monitoring wells were monitored in error. Data excluded from gas risk assessment.

The full results of all monitoring rounds and a summary of atmospheric conditions are presented within **Appendix E**. A summary of the highest (and lowest in the case of oxygen) recorded gas monitoring results of unflooded wells is presented in Table 3-2.

Table 3-2 - Summary of Ground Gas Monitoring Results 2015-2020

BH ID	Response zone (m bgl)	Max flow rate (l/hr)	Atmospheric pressure range	Max Methane (%) (peak)	Max Carbon dioxide (%) (steady)	Min Oxygen (steady)	Max Hydrogen sulphide (pm)	Max Carbon monoxide (ppm)
BH102B*	1.0-1.2	1.6	999 - 1011	0	0.9	18.9	0	0
BH103A	1.0-1.5	1.1	999 - 1011	0	3.7	1.8	0	0
BH104	1.0-1.5	0.3	999 - 1011	0	9.2	8.4	0	0
BH202	0.5 -1.0	0	999 - 1011	2.4	3.8	9.2	0	0
WS201A	0.6 – 1.1	0.8	999 - 1011	0	4.3	14.7	0	0
WS202	0.5 – 1.3	0.1	999 - 1011	0	4.0	15.3	0	0
WS205	0.5 – 1.5	0.1	999 - 1011	2.8	7.6	0	0	0
WS206**	1.0 – 3.0	0.5	999 - 1011	0	6.0	10.2	0	0
VW201A	0.75 – 1.0	0.4	999 - 1011	0	4.4	11.2	0	0
VW202	0.75 – 1.0	1.2	999 - 1011	0	6.0	4.7	0	0
VW203A	0.75 – 1.0	0.7	999 - 1011	0	5.8	9.4	0	0

*Response zone in BH102B completely flooded during 1 monitoring round

**Response zone in WS206 partially flooded on all monitoring rounds

3.1.2. GROUND GAS RISK ASSESSMENT

Potential risks posed by hazardous ground gases at the Site have been assessed following the guidance contained within BS 8576. This method requires use of both gas concentrations (carbon dioxide and methane) and standpipe flow rates to calculate a gas screening value (GSV).

In-situ gas monitoring data was collected on nine occasions between 2015 and 2020 and is summarised in Section 2.3. A full record of the data is presented in **Appendix E**. A maximum methane concentration of 2.8% (WS205) and a maximum carbon dioxide concentration of 9.2% (BH104) were recorded at the Site. However, the screened section within the gas well in WS205 was partially flooded potentially giving inaccurate gas readings. Excluding the 2.8% methane concentration from WS205, methane was detected to a maximum concentration of 0.1%. As a precautionary measure, the concentration of 2.8% methane has been included for the ground gas risk assessment.

The Typical Maximum Concentrations and GSVs recorded during the ground gas monitoring rounds undertaken at the Site are summarised in **Table 3-3**.

Table 3-3 - Typical Maximum Concentrations and GSVs

	Maximum Flow Rate	Methane		Carbon Dioxide	
		Typical Maximum Concentrations (%)	Gas Screening Value* (l/hr)	Typical Maximum Concentrations (%)	Gas Screening Value* (l/hr)
Measured Concentration	1.6	2.8	0.0448	9.2	0.147

*Gas screening value (GSV) is calculated by multiplying the maximum gas concentration (%) by the maximum measured borehole flow rate (l/hr) as per BS 8576; methane trigger value is 1%; carbon dioxide trigger value is 5%. Where gas flow rates were recorded as <0.1l/hr (GMF 485 LOD), a conservative flow rate estimate of 0.1 l/hr is assumed for the calculation of gas screening values.

The gas risk assessment for the Site is driven by the concentrations of carbon dioxide. The GSV (0.147 l/hr) and low flow rates recorded alone would characterise the Site as a Characteristic Situation 2 (Low Hazard Potential) based on the BS8485:2015 guidance (NHBC equivalent classification of Green/Amber 1), where basic gas protection measures should be included as follows:

Situation A:

Characteristic Situation 2 (low risk).

2 levels of protection are required for a residential building.
Typical scope of protective measures:

- a) Reinforced concrete cast in-situ floor slab (suspended, non-suspended or raft) with at least 1,200 g DPM² and underfloor venting.*
- b) Beam and block or pre-cast concrete slab and minimum 2,000 g DPM/reinforced gas membrane.*
- All joints and penetrations sealed.*

Owing to the hydrocarbon contamination identified on Site, to ensure full protection from potential vapours, the DPM should also be hydrocarbon resistant.

4. HUMAN HEALTH RISK ASSESSMENT

4.1. SUPPLEMENTARY SURFACE SOIL RISK ASSESSMENT

4.1.1. SUPPLEMENTARY SURFACE SOIL SAMPLING RATIONALE

A 10 m ecological corridor along the Site boundary adjacent to the River Kennet is stipulated by the Environment Agency as part of the planning conditions. Retention and protection of some of the trees and vegetation along this boundary is required in accordance with Planning Condition 21 (Tree Protection condition to be adhered to in line with 'Arboricultural Method Statement and Tree Protection Plan').

Soil samples (SS301-SS305) have been taken around the base of the trees in this area to assess their condition and suitability for use in accordance with the proposed residential public open space within this area of the Site.

In order to better assess the Human Health risks within that area, five surface soil samples were taken from five locations around the trees lining the southern boundary of the Site, adjacent to the River Kennet.

4.1.2. HUMAN HEALTH RISK ASSESSMENT RATIONALE

Legislation and guidance on the assessment of contaminated sites, consistent with European Union best practice, acknowledges the need for a tiered risk-based approach. This human health risk assessment represents a generic quantitative risk assessment (GQRA) and involves comparison of Site contaminant levels against generic standards and compliance criteria including an assessment of risk using the source-pathway-receptor model.

WSP has derived a set of Generic Assessment Criteria (GAC) for the generic land use scenarios following the CLEA methodology and using the CLEA Workbook V1.071 computer modelling tool. Further details on the assumptions and methodologies adopted by WSP are provided in **Appendix F**.

Based on the proposed development plans, a residential public open space scenario has been used to assess the risk to human health from soils in this area of the Site. The fraction organic carbon content of the soil samples with low hydrocarbon impact varied from 0.150 to 0.224, which converts to 38.62% and 25.86% soil organic matter (SOM). The samples were screened against a 6% SOM value.

Laboratory certificates of the chemical analysis are provided in **Appendix G** and screening tables that present an assessment of the analytical data is provided in **Appendix H**.

4.1.3. SOIL ASSESSMENT RESULTS

Screening of the soil laboratory data highlighted a single exceedance of the GAC identified in SS301 for benzo(a)pyrene, as summarised in **Table 4-1**. A complete list of results is presented in **Appendix H**.

Table 4-1 - Summary of Exceedances from Surface Soils from Southern Site Boundary

Determinand	GAC (mg/kg)	Max Concentration (mg/kg)	Number of Samples Exceeding GAC	Location of Maximum Exceedance
Benzo (a) pyrene	5.2	9.33	1	SS301

Whilst the concentration in SS301 exceeded the WSP GAC, when the DEFRA Category 4 Screening Level (C4SL) of 10mg/kg is applied, which is the threshold below which land is not considered to be contaminated land, the reported concentration passes.

Therefore, in light of the proposed retention of the trees for ecological benefit along the River Kennet, it is considered that the concentration in SS301 does not pose an unacceptable risk to future users and can be retained on-site / left in-situ.

Asbestos

All five soil samples were analysed for presence/absence of asbestos. No asbestos was identified within any of the samples analysed. Non-asbestos fibres were recorded in SS303 and SS304.

Contaminants such as asbestos can be present in soil in discrete pockets and any sampling frequency cannot guarantee the absence of contaminants of this nature in areas between sample locations. In addition, previous investigation detected asbestos containing fibres in 19 No of the 46 No samples analysed (Ref. [3]). Therefore, despite the absence of asbestos detections within the five samples analysed within the tree area, asbestos presence cannot be rule out.

As with all excavation in Made Ground with potential for the presence of asbestos, appropriate work control procedures, risk assessments and PPE should be adopted and used to manage potential direct contact and asbestos fibres inhalation health risks.

5. GENERIC CONTROLLED WATERS RISK ASSESSMENT

5.1. CONTEXT

A GQRA was previously undertaken based on available data from three sampling rounds gathered since 2015 and included in the Supplementary Phase 2 Geo-environmental and Geotechnical Site Assessment Report (Ref. [4]). Following the September 2019 supplementary investigation two further rounds of groundwater monitoring and sampling have been undertaken. This section includes an update of the previous GQRA to assess the newly gathered groundwater data in order to confirm or update the conceptual site model previously created for the Site.

5.2. RATIONALE

The generic controlled waters risk assessment was conducted in accordance with the principles of The Environment Agency's 'Remedial Targets Methodology: Hydrogeological Risk Assessment for Land Contamination' 2006 (2006) and the 'prevent and limit' approach of the Water Framework Directive (2000/60/EC).

Generic controlled waters risk assessments compare directly measured concentrations with generic assessment criteria (GAC). GAC are selected based on both a hierarchy of relevance to England and the receptor. In this case, the controlled water receptors identified in the CSM were the Secondary A and Principal aquifers and the River Thames. Note that the River Kennet located south of the Site is believed to be lined and likely upgradient of the groundwater flow. However, given the proximity to the Site, surface water samples from the River Kennet were also taken as a precaution. The following hierarchies of GAC were therefore considered to be appropriate:

For the protection of the Aquifers:

- UK Drinking Water Quality Standards (DWS) from The Water Supply (Water Quality) Regulations 2000 (amended 2004).
- World Health Organisation Guidelines for Drinking Water Quality, Fourth Edition, Volume 1, (2011).
- World Health Organisation Petroleum Products in Drinking Water (2008).

For the protection of the Surface Waters:

- Annual Average Environmental Quality Standards (AA-EQS) from The Water Framework Directive (Standards and Classification) Directions (England and Wales) 2015.

All available groundwater data has been screened against the appropriate GAC including:

- Two rounds of groundwater sampling (Rounds 4 and 5), October 2019 and February 2020.
- Two upstream and downstream surface water samples from the River Kennet (October 2019 and February 2020).

5.3. GROUNDWATER DATA

5.3.1. PROTECTION OF THE GROUNDWATER RESOURCE

Groundwater data from the last two sampling rounds undertaken in October 2019 and February 2020 have been screened against the GAC appropriate for the protection of the groundwater

resource. Groundwater exceedances of the GAC for the protection of aquifers is presented in Table 5-1 and in Figure 70031882-SUPP-005 included in Appendix A.

A total of 26 No. contaminants were identified at concentrations that exceeded their respective GAC. Exceedances were related to the following:

- metals: generally sporadic and marginal exceedances with the exception of exceedances of total iron and manganese;
- inorganics: a single marginal exceedance of chloride and relatively high number of exceedances of ammoniacal nitrogen as NH₄ and cyanide throughout the Site;
- PAH compounds: relatively high number of exceedances of benzo(a)pyrene and PAH sum of 4;
- BTEX compounds: sporadic exceedances of toluene, and xylene. A number of exceedances of benzene with maximum concentrations related to the NAPL impacted area within the west corner of the Site;
- TPH compounds: relatively low number of exceedances of high concentration related to the NAPL areas at the west corner of the Site within the Chalk aquifer;
- Chlorinated solvents: relatively few exceedances of high concentration related to detections in the north west corner of the Site and lower exceedances in the southwest and north corner of the Site.

All the above exceedances are consistent with previous exceedances detected within the GQRA included in the Supplementary Phase 2 Geo-environmental and Geotechnical Site Assessment Report (Ref. [4]).

Table 5-1 – Summary of Exceedances of Groundwater Samples against DWS (only October 2019 and February 2020 rounds included)

Determinand	GAC (µg/l)	Max Concentration	No. of samples exceeding GAC	Location of max. exceedance	Consistent with previous rounds (Y/N)
Arsenic	10.0	69.3	6	BH104	Y
Iron (total)	200	22,800	13	BH104	Y
Lead	10.0	14.9	1	BH201	Y (exceedances not previously detected however, concentration similar to previous)
Manganese	50.0	4,270	22	BH104	Y
Nickel	20.0	27.9	3	BH106	Y
Selenium	10.0	23.5	1	BH301	Y

Determinand	GAC (µg/l)	Max Concentration	No. of samples exceeding GAC	Location of max. exceedance	Consistent with previous rounds (Y/N)
Ammoniacal Nitrogen as NH ₄	500	134,000	21	BH302A	Y
Chloride	250,000	275,000	1	BH302A	Y
Cyanide	50.0 (Total Cyanide)	4,430	15	BH102B	Y
Benzo(a)pyrene	0.010	0.365	13	BH102B	Y
PAH sum of 4	0.1	1.454	10	BH201	Y
Benzene	1.0	2,890	11	BH302A	Y
Toluene	700	1,310	2	BH302A	Y
Xylene	500	1,000	2	BH301	Y
Carbon Tetrachloride	3.0	3.59	1	BH107	Y
Tetrachloroethene	10	647	3	BH101	Y
Trichloroethene	10	41.3	2	WS206	Y
Vinyl Chloride	0.50	206	6	BH201	Y
Cis 1,2-Dichloroethene	50.0	1,100	4	WS206	Y
Aliphatic C8-10	300	521	2	BH202	Y
Aliphatic C10-12	300	1,840	3	BH202	Y
Aromatic C5-C7	1	2140	9	BH302A	Y
Aromatic C7-C8	700	1010	1	BH302A	Y
Aromatic C8-10	300	892	3	BH301	Y
Aromatic C10-12	90.0	1,260	3	BH202	Y
Aromatic C12-16	90.0	875	4	BH301	Y
Aromatic C16-21	90.0	347	3	BH301	Y
Aromatic C21-35	90.0	351	1	BH301	Y

5.3.2. PROTECTION OF THE SURFACE WATERS

Groundwater data from the last two sampling rounds undertaken in October 2019 and February 2020 have been screened against the GAC appropriate for the protection of the surface waters. Groundwater exceedances of the GAC for the protection of aquifers is presented in Table 5-2 and in Figure 70031882-SUPP-006 included in Appendix A.

A total of 27 No. contaminants were found in concentrations that exceeded their respective GAC. Exceedances were related to the following:

- metals: generally sporadic and marginal exceedances with the exception of exceedances of total iron, copper, nickel and manganese;
- inorganics: limited relatively marginal exceedances of free ammonia and several exceedances of free cyanide all relatively marginal except for two samples taken from BH102B and BH301;
- PAH compounds: exceedances of anthracene, fluoranthene and benzo(a)pyrene within the River Terrace deposits and Chalk, and high exceedances of naphthalene within the Chalk;
- BTEX compounds: exceedances of benzene, toluene, ethylbenzene and xylene with elevated concentrations limited to the Chalk aquifer generally in the south west corner of the Site;
- TPH compounds: relatively low number of exceedances however, of high magnitude in the samples collected in the western corner of the Site within the Chalk;
- Chlorinated solvents: very limited exceedances related to concentrations detected in the north west corner of the Site.

All the above exceedances are consistent with previous exceedances detected within the GQRA included in the Supplementary Phase 2 Geo-environmental and Geotechnical Site Assessment Report (Ref. [4]), except for significant concentrations of naphthalene detected in samples taken from BH301 and BH302A. The concentration in BH302A is likely related to the sheen and black globules of product detected during sampling. NAPL was purged from BH202 during well development, and though no measurable quantity of NAPL has been detected since the well was developed, the concentrations could be indicative of free-phase product within the chalk fractures in this area (BH301 is located ~0.5m from BH202). These concentrations are consistent with the naphthalene concentrations detected in the NAPL sample taken from BH202 storage IBC in April 2019 and reported in the Ref.[4].

Table 5-2 – Summary of Exceedances of Groundwater samples against AA-EQS

Determinand	GAC (µg/l)	Max Concentration	No. of samples exceeding GAC	Location of max. exceedance	Consistent with previous rounds (Y/N)
Arsenic	50.0	69.3	1	BH104	Y
Copper	1.0	3.62	9	BH101	Y
Iron	1,000	22,800	7	BH104	Y
Lead	1.20	14.9	3	BH201	Y

Determinand	GAC (µg/l)	Max Concentration	No. of samples exceeding GAC	Location of max. exceedance	Consistent with previous rounds (Y/N)
Manganese (unfiltered)	123	4,270	21	BH104	Y
Nickel	4.0	27.9	11	BH106	Y
Zinc	10.9	31.4	3	BH103A	Y
Free ammonia	771	1,097	3	BH302A	Y
Free Cyanide	1.0	80.3	8	BH102B	Y
Phenol	7.7	3,050	2	BH302A	Y
Anthracene	0.10	6.06	5	BH301	Y
Benzo(a)pyrene	0.0002	0.365	15	BH102B	Y
Fluoranthene	0.0063	6.80	23	BH301	Y
Naphthalene	2.0	2,650	4	BH301	N
Benzene	10.0	2,890	6	BH302A	Y
Ethylbenzene	20.0	185	3	BH202	Y
Toluene	74	1,310	2	BH302A	Y
Xylene	30.0	1,000	5	BH301	Y
Tetrachloroethene (PCE)	10.0	647	3	BH101	Y
Trichloroethene (TCE)	10.0	41.3	2	WS206	Y
Aromatic C6-7	10.0	2,140	6	BH302A	Y
Aromatic C7-8	74.0	1,010	2	BH302A	Y
Aromatic C8-10	20.0	892	8	BH301	Y
Aromatic C10-12	2.0	1,230	6	BH301	Y
Aromatic C12-16	2.0	875	5	BH301	Y
Aromatic C16-21	0.1	347	5	BH301	Y
Aromatic C21-35	0.0002	351	3	BH301	Y

5.4. SURFACE WATER DATA

A total of four surface water samples (two upstream and two downstream) were taken from the River Kennet during the monitoring visits carried out in October 2019 and February 2020. Concentrations of metals, inorganics and PAH compounds were detected in the four samples analysed whilst TPH, phenols and VOCs were all below the limit of detection.

The detected metal concentrations included arsenic, barium, boron, cadmium chromium, copper, lead, nickel, zinc, and total iron. The reported concentrations for both the downstream and upstream samples were within the same order of magnitude and the small difference between downgradient and upgradient did not show a consistent pattern. The only exception being the zinc concentration of the downgradient sample taken on February 2020.

Detected concentrations of PAH compounds were also relatively low (maximum total PAH concentration of 0.28 µg/l) and similar in range between the downstream and upstream samples.

Surface water concentrations were also screened against the AA-EQS. Exceeding contaminants are summarised in

Table 5-3, and presented in Table H3 in **Appendix H**.

Concentrations of five contaminants (chromium, copper, zinc, fluoranthene and benzo(a)pyrene) were recorded in exceedance of the AA-EQS. However, concentrations were recorded in both the downstream and upstream samples indicating that the source likely to be upgradient of the River Kennet.

Table 5-3 – Summary of Exceedances of Surface Waters Against AA-EQS

Determinand	GAC (µg/l)	Max Concentration	No. of samples exceeding GAC	Sample locations exceeding GAC
Total Chromium	4.70	10.9	2	Downstream (Feb 2020) Upstream (Oct 2019)
Copper	1.0	2.84	4	All
Zinc	10.9	27.8	1	Downstream (Feb 2020)
Benzo(a)pyrene	0.00017	0.015	4	All
Fluoranthene	0.0063	0.040	4	All

5.5. SUMMARY OF CONTROLLED WATERS GQRA RESULTS

Laboratory results from the samples taken during the October 2019 and February 2020 sampling rounds highlighted groundwater concentrations of several contaminants of concern (CoC) in exceedance of the relevant GAC for the protection of groundwater sources and surface waters. Groundwater exceedances were mainly located within the superficial deposits however, samples taken within the Chalk also recorded exceedances of ammoniacal nitrogen, PAH, TPH, benzene and chlorinated solvents. Generally, exceedances were related to the southwest area (BH202, BH301, BH302, BH303), northwest adjacent to the cross-boundary gas holder (WS206, BH101,

BH201), north of the current gas holder (gas holder no. 4) and adjacent to the above ground liquor tank (BH102B, BH105) and north-eastern area of the Site, in proximity of the identified tar tank (BH103).

The magnitude of the exceeding concentrations and the distribution across the Site are all consistent with the previous findings reported within the Supplementary Phase 2 Geo-environmental and Geotechnical Site Assessment (Ref [4]). To note however, there are significant naphthalene concentrations detected in the samples taken from BH301 and BH302. These concentrations are, consistent with the sheen and black globules detected during groundwater sampling from BH302A and the proximity of BH301 to the identified NAPL in BH202.

Laboratory results of the surface water samples taken from the River Kennet confirmed limited impact in the water quality noted during the previous sampling rounds and the exceedances recorded are likely from an upgradient source. Levels of copper within the surface water sample are within the EA data range for the catchment (no information held on zinc, fluoranthene or BaP). This result is consistent with the CSM which considers the River Thames as the main surface water receptor based on the groundwater flow direction within the RTG towards the north.

Nonetheless, all determinands with recorded exceedances will be further assessed in a subsequent update to the controlled waters detailed qualitative risk assessment (DQRA).

6. CONCLUSIONS & RECOMMENDATIONS

Supplementary investigation and additional monitoring rounds were carried out at the Site between September 2019 and February 2020 to further assess the ground conditions with regard to the NAPL in the southwest of the Site.

Soil, groundwater, and surface water samples were collected during the investigation and the results compared against GAC for the protection of human health and controlled waters.

Soil samples were collected from the surface soils surrounding the trees on the southern Site boundary to confirm suitability for the proposed end use. Based on DEFRA C4SL, the materials surrounding the trees are considered suitable for a Public Open Space Class 1 (Residential) end use and therefore, can be re-used or retained in-situ.

The controlled waters generic quantitative risk assessment was completed on the two additional rounds of sampling. Several contaminants at concentrations exceeding the generic criteria selected for the protection of surface waters and groundwater resources were recorded. Overall, identified exceedances were consistent with previous findings reported in the April 2019 Geo-environmental Site Assessment Report.

Three additional ground gas monitoring visits have been undertaken following the supplementary investigation. Following the updated ground gas risk assessment, the Site has been categorised within Characteristic Situation 2 (low risk) (NHBC equivalent classification of Green/Amber 1), where all new development requires gas protection to be incorporated into the design. Gas protection measures should also be hydrocarbon resistant.

With regards to NAPL, newly installed boreholes located at the southwest corner of the Site did not encounter free phase NAPL in the groundwater. However, black globules were noted in the sampled water from BH302 and confirmed by the laboratory results as oil inclusions. Evidence of contamination was also noted during drilling, including coal tar odours and visual evidence of a product sheen and tarry veins. Evidence of contamination was encountered at depth within the Chalk (up to 20 m bgl in BH301 and BH302A). Despite no measurable free product NAPL in groundwater, evidence indicates the presence of a NAPL plume in the area that could not be determined/confirmed with the available data.

6.1. UNCERTAINTIES & LIMITATIONS

Contaminants such as asbestos can be present in soil in discrete pockets and any sampling frequency cannot guarantee the absence of contaminants of this nature in areas between sample locations. The developer should ensure that suitable precautions, controls and monitoring are in place during earthworks activities and suspicious materials should be managed through appropriate procedures in accordance with the Control of Asbestos Regulations 2012, to ensure the health and safety of all workers and future Site users, and to protect the environment from contamination.

Groundwater data from all available monitoring rounds (five) indicate that the River Terrace Gravels and Chalk aquifer are in hydraulic continuity. Groundwater flow direction shows a temporal variation albeit small groundwater levels changes. An overall north-easterly groundwater direction is inferred for the groundwater beneath the Site, however uncertainty still exists.

Underlying ground conditions beneath the gas holder are currently unknown. No former gas works structures are known to be present beneath the footprint of the gas holder, with exception of the tar mains. Additional investigation works will be required below the gas holder post demolition. There is potential that the NAPL encountered at BH202 within the Chalk to extend below the holder, and the source could have originated from the tar mains.

The NAPL encountered in the south-western area of the Site could not be quantified or measured. The product forming an emulsion with the water and was unable to be detected with the oil/water interface meter. In addition, it has not been possible to sample and analyse this product.

6.2. FURTHER WORKS

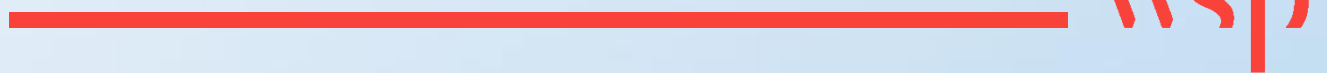
The following further works and assessments are recommended.

- Update the controlled waters detailed quantitative risk assessment with results of the additional monitoring rounds (included under separate cover);
- Additional site investigation & monitoring works are required to characterise ground conditions below the gas holder (post demolition), including further delineation of NAPL may be required below the gas holder following demolition;
- Deliver further field results in respect of water levels to provide a better understanding of flow direction;
- Produce a Remediation Options Appraisal and Remediation Strategy which include options for the remediation of the numerous sources still onsite (tar tanks, gas holder, etc.) and any further impact areas delineated in the detail quantitative assessment.

A piling works risk assessment will be required to be produced by the developer as piling is understood to be the preferred foundation solution for the proposed high-density development. This should be completed in accordance with Environment Agency guidance⁴. It is understood through similar discussions with the Environment Agency, that groundwater monitoring will be required during piling. Therefore, key wells will need sufficient protection during the construction works to enable monitoring during and post construction. Any wells not required will need to be appropriately decommissioned as per Environment Agency guidance.

⁴ Environment Agency (2001). Piling and Penetrative Ground Improvement Methods on Land Affected by Contamination: Guidance on Pollution Prevention. May 2001. NC/99/73

Appendix A



FIGURES



KEY

— SITE BOUNDARY

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Kings Orchard
1 Queen Street
Bristol BS2 0HQ

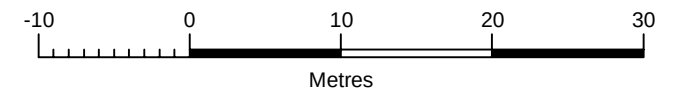
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Client/Project:
**DANESCROFT (KENAVON DRIVE
PROJECT MANAGEMENT) LLP
GASHOLDER SITE AT ALEXANDER
TURNER CLOSE, READING**

Title:
SITE LOCATION PLAN

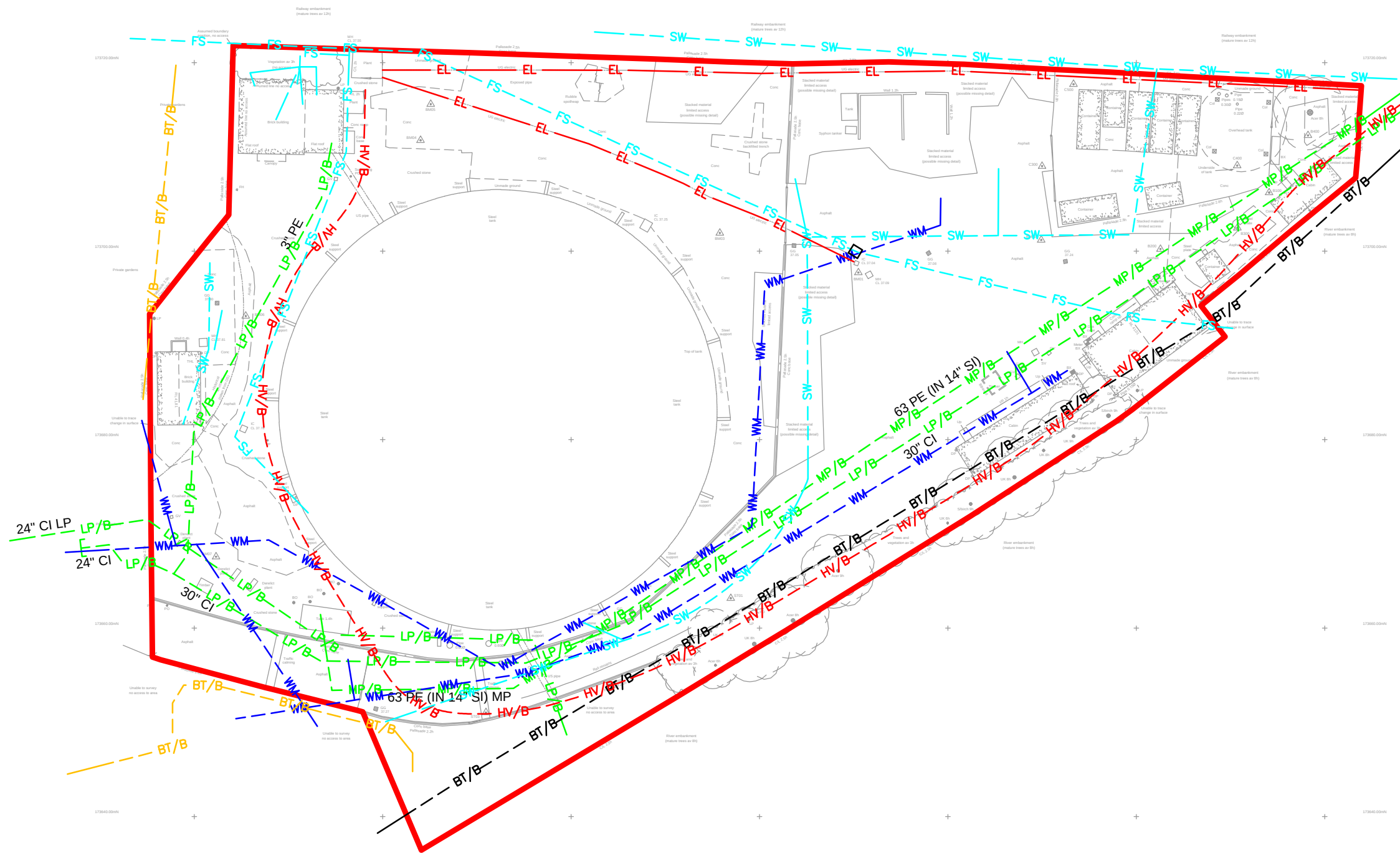
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Project Number:		Drawing Number:		Revision:
70031882		001		

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Project Number:		Drawing Number:																																					
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KEY

— SITE BOUNDARY

KEY TO STATUTORY SERVICES

--- HV/B- H.V. ELECTRIC (BELOW GROUND)

--- LP/B- LP GAS MAIN (BELOW GROUND)

--- MP/B- MP GAS MAIN (BELOW GROUND)

--- BT/B- TELECOM (BELOW GROUND)

KEY TO SERVICES SHOWN IN PREVIOUS REPORT

--- BT/B- TELECOM

--- WM- WATER

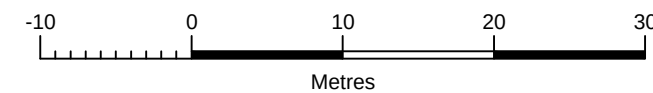
KEY TO PRIVATE SERVICES PROVIDED BY CLIENT

--- FS- FOUL SEWER

--- SW- SURFACE WATER SEWER

KEY TO ADDITIONAL SERVICES SURVEYED ON SITE

--- EL- ELECTRIC CABLE



Rev	Date	Description	By	Chk	App	Notes
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- SERVICE LOCATIONS ARE APPROXIMATE AND BASED ON THIRD PARTY INFORMATION. WSP TAKE NO RESPONSIBILITY FOR THE ACCURACY OF THIS INFORMATION. WHEN LOCATING SERVICES ON SITE REFER TO SERVICE PROVIDER PLANS.



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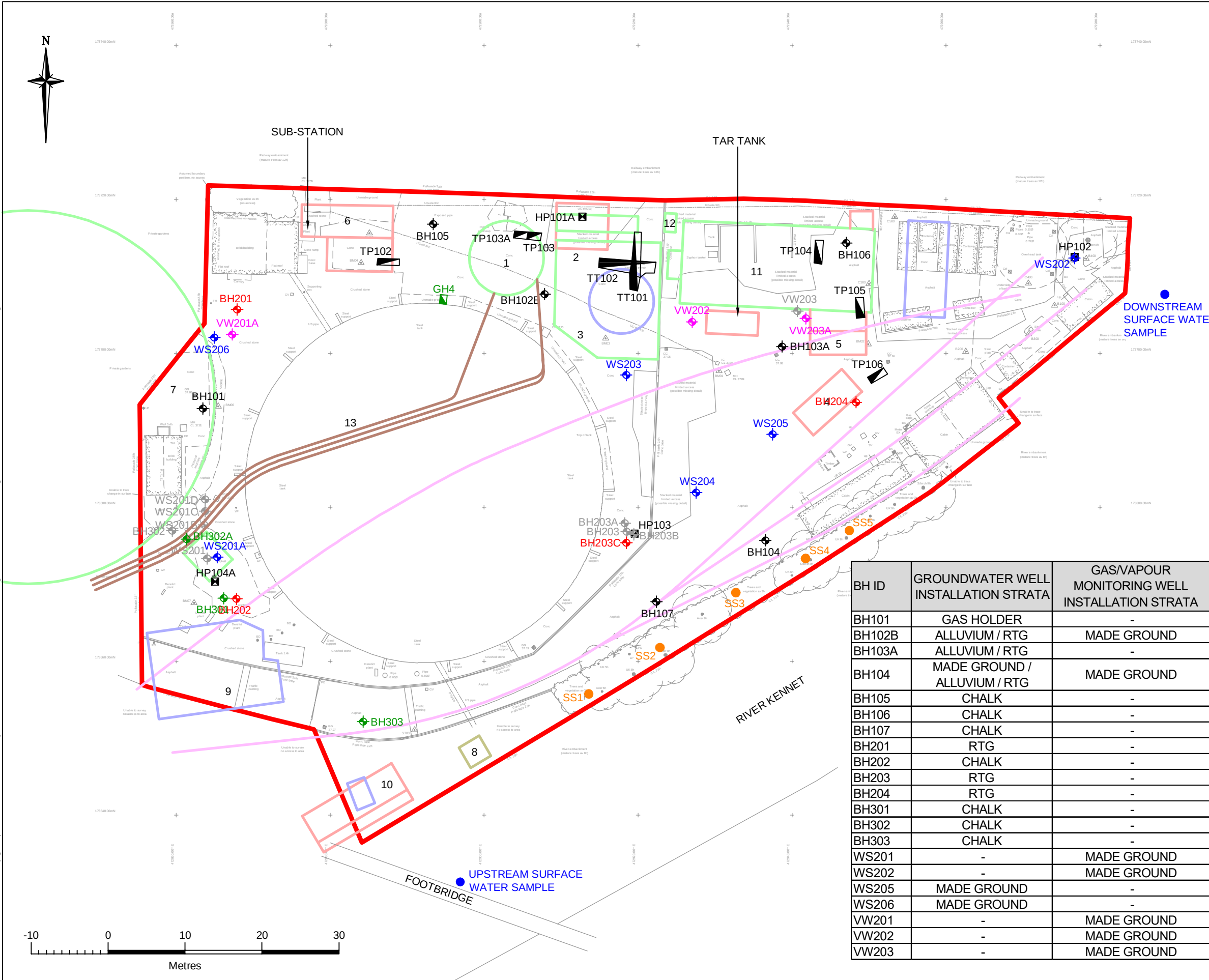
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DANESCROFT (KENAVON DRIVE
PROJECT MANAGEMENT) LLP
Project:
GASHOLDER No. 4
KENAVON DRIVE, READING

Title:
COMPOSITE SERVICE PLAN

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Designed: EW		Approved: PD	
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Project Number:		Drawing Number:	Revision:
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Date: 28/11/2019
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- KEY**
- SITE BOUNDARY
 - BH BOREHOLE LOCATION (2019)
 - BH SUPPLEMENTARY BOREHOLE (2019)
 - GH4 SUPPLEMENTARY TRIAL PIT (2019)
 - WS WINDOW SAMPLE LOCATION (2019)
 - VW VAPOUR WELL LOCATION (2019)
 - SS SOIL SAMPLE LOCATION (2019)
 - BH, WS, VW EXPLORATORY HOLE REFUSAL (2019)

- 2015 EXPLORATORY HOLE LOCATIONS**
- BH
 - HP
 - TP
 - TT

- KEY TO HISTORICAL STRUCTURES**
- DATE FIRST APPEARS ON OS PLAN
- 1899 - 1930
 - 1931 - 1970
 - 1971 ONWARD
- HISTORICAL STRUCTURE (FROM ENGINEERING DRAWING)
- HISTORICAL RAIL LINE (CENTRELINE)
- HISTORICAL TAR MAINS

- STRUCTURES**
- LIQUOR TANK (PRESENT 1899-1938)
 - PURIFIERS (PRESENT 1899-1933)
 - SULPHATE OF AMMONIA WORKS (PRESENT 1899-1933)
 - LIME STORE (PRESENT 1931-1938)
 - OVERHEAD ACID TANKS, LATER CARPENTERS SHOP UNDER (PRESENT 1931-1972)
 - SEPARATING PITS (PRESENT 1957)
 - GASHOLDER (PRESENT 1912-1962)
 - BOOSTER (DATE UNKNOWN)
 - LPG AIR ENRICHMENT PLANT (PRESENT 1973)
 - SCAFFOLD STORE (PRESENT 1957-1972)
 - CONCENTRATED LIQUOR & SULPHATE PLANT (PRESENT 1899-1979)
 - CHIMNEY (PRESENT 1899-1931)
 - TAR MAINS

BH ID	GROUNDWATER WELL INSTALLATION STRATA	GAS/VAPOUR MONITORING WELL INSTALLATION STRATA
BH101	GAS HOLDER	-
BH102B	ALLUVIUM / RTG	MADE GROUND
BH103A	ALLUVIUM / RTG	-
BH104	MADE GROUND / ALLUVIUM / RTG	MADE GROUND
BH105	CHALK	-
BH106	CHALK	-
BH107	CHALK	-
BH201	RTG	-
BH202	CHALK	-
BH203	RTG	-
BH204	RTG	-
BH301	CHALK	-
BH302	CHALK	-
BH303	CHALK	-
WS201	-	MADE GROUND
WS202	-	MADE GROUND
WS205	MADE GROUND	-
WS206	MADE GROUND	-
VW201	-	MADE GROUND
VW202	-	MADE GROUND
VW203	-	MADE GROUND

Rev	Date	Description	By	Chk	App	Notes

Kings Orchard
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Bristol BS2 0HQ
Tel: 44-(0)1179-306200

Client:
DANESCROFT (KENAVON DRIVE PROJECT MANAGEMENT) LLP

Project:
GASHOLDER SITE AT ALEXANDER TURNER CLOSE, READING

Title:
PLAN SHOWING HISTORIC SITE STRUCTURES AND EXPLORATORY HOLE LOCATIONS

Drawn: CEW	Checked: EW		
Designed: EW	Approved:		
Date: 28/11/2019	Scale: 1:500	A3	Sheet:
Project Number: 70031882	Drawing Number: 004	Revision:	

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BH201		
Date	30/09/2019 (µg/l)	10/02/2020 (µg/l)
Ammoniacal Nitrogen as NH4	7050	6930
Total Cyanide	124	-
Arsenic	23.3	20
Iron	8450	6860
Lead	14.9	-
Manganese	734	631
Aromatics >EC5-EC7	-	13
Benzo(a)pyrene	0.365	0.0365
PAH sum of 4	1.454	0.167
Vinyl chloride	206	192
cis-1,2-Dichloroethene	861	917
Benzene	8.35	14.4

BH102B		
Date	1/10/2019 (µg/l)	12/02/2020 (µg/l)
Total Cyanide	4430	2190
Ammoniacal Nitrogen as NH4	26700	15900
Iron	1500	726
Manganese	1300	1130
Benzo(a)pyrene	0.189	0.0632
PAH sum of 4	0.709	0.213

BH105		11/02/2020 (µg/l)
Total Cyanide		90
Ammoniacal Nitrogen as NH4		6830
Arsenic		15.7
Iron		8550
Manganese		872
Benzo(a)pyrene		0.0864
PAH sum of 4		0.3787
Vinyl chloride		13.3
Benzene		2.28

BH103A		
Date	01/10/2019 (µg/l)	11/02/2020 (µg/l)
Ammoniacal Nitrogen as NH4	7350	5880
Total Cyanide	67.7	-
Manganese	135	226
Benzo(a)pyrene	0.0349	0.0187
PAH sum of 4	0.1399	-

BH106		
Date	01/10/2019 (µg/l)	11/02/2020 (µg/l)
Ammoniacal Nitrogen as NH4	11200	6060
Nickel	23.7	27.9
Manganese	485	341

WS206		10/02/2020 (µg/l)
Total Cyanide		310
Ammoniacal Nitrogen as NH4		5280
Iron		640
Manganese		1400
Benzo(a)pyrene		0.0292
PAH sum of 4		0.12
Vinyl chloride		31.7
cis-1,2-Dichloroethene		1100
Benzene		2.12
Trichloroethene		41.3
Tetrachloroethene		284

BH101		
Date	30/09/2019 (µg/l)	10/02/2020 (µg/l)
Total Cyanide	79	-
Benzo(a)pyrene	0.0307	-
PAH sum of 4	0.1335	-
cis-1,2-Dichloroethene	-	138
Trichloroethene	-	25.7
Tetrachloroethene	647	568

BH302A		
Date	01/10/2019	10/02/2020
Total Cyanide	456	200
Ammoniacal Nitrogen as NH4	134000	53600
Chloride	275000	-
Arsenic	26.4	-
Iron	487	372
Nickel	22.9	-
Manganese	638	132
Aliphatics >C10-C12	575	-
Aromatics >EC5-EC7	2140	182
Aromatics >EC7-EC8	1010	-
Aromatics >EC8-EC10	564	-
Aromatics >EC10-EC12	383	-
Aromatics >EC12-EC16	293	-
Benzo(a)pyrene	0.15	0.0313
PAH sum of 4	0.2931	0.1103
Vinyl chloride	3.34	-
Benzene	2890	216
Toluene	1310	-
Total Xylenes	508	-

BH301		
Date	01/10/2019 (µg/l)	10/02/2020 (µg/l)
Total Cyanide	-	500
Ammoniacal Nitrogen as NH4	11400	64900
Total Cyanide	276	-
Iron	-	284
Selenium	23.5	-
Manganese	3690	126
Aliphatics >C8-C10	337	-
Aliphatics >C10-C12	1840	-
Aromatics >EC5-EC7	417	188
Aromatics >EC8-EC10	892	-
Aromatics >EC10-EC12	1230	-
Aromatics >EC12-EC16	875	781
Aromatics >EC16-EC21	347	167
Aromatics >EC21-EC35	351	-
Benzene	721	248
Toluene	819	-
Total Xylenes	1000	-

BH202		10/02/2020 (µg/l)
Total Cyanide		1450
Ammoniacal Nitrogen as NH4		130000
Iron		2370
Manganese		1270
Aliphatics >C8-C10		521
Aliphatics >C10-C12		1890
Aromatics >EC5-EC7		343
Aromatics >EC8-EC10		657
Aromatics >EC10-EC12		1260
Aromatics >EC12-EC16		818
Aromatics >EC16-EC21		129
Vinyl chloride		2.69
Benzene		400

BH303		
Date	01/10/2019 (µg/l)	11/02/2020 (µg/l)
Total Cyanide	-	460
Ammoniacal Nitrogen as NH4	1070	1280
Iron	-	247
Manganese	290	141
Benzene	3.45	-

BH203C		
Date	01/10/2019 (µg/l)	11/02/2020 (µg/l)
Ammoniacal Nitrogen as NH4	2910	1950
Manganese	128	174
Benzo(a)pyrene	-	0.0164
Benzene	-	1.19

BH104		
Date	01/10/2019	11/02/2020
Total Cyanide	153	370
Ammoniacal Nitrogen as NH4	37700	20100
Arsenic	69.3	26
Iron	22800	18500
Manganese	4270	3270

BH107		
Date	01/10/2019 (µg/l)	11/02/2020 (µg/l)
Carbontetrachloride	3.59	-

BH204		11/02/2020 (µg/l)
Manganese		60
Benzo(a)pyrene		0.0149

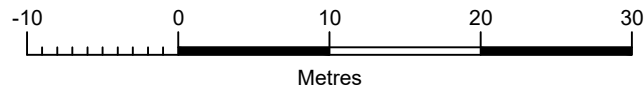
KEY

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- BH BOREHOLE LOCATION (2019)
- BH SUPPLEMENTARY BOREHOLE (2019)
- GH SUPPLEMENTARY TRIAL PIT (2019)
- WS WINDOW SAMPLE LOCATION (2019)
- VW VAPOUR WELL LOCATION (2019)
- SS SOIL SAMPLE LOCATION (2019)
- BH, WS, VW EXPLORATORY HOLE REFUSAL (2019)

- BH 2015 EXPLORATORY HOLE LOCATIONS
- HP
- TP
- TT

KEY	
Test	DWS (µg/l)
Sulphate	250000
Total Cyanide	50
Ammoniacal Nitrogen as NH4	500
Chloride	250000
Total Cyanide	50
Arsenic	10
Barium	700
Beryllium	12
Iron	200
Boron	1000
Cadmium	5
Chromium	50
Copper	2000
Lead	10
Nickel	20
Selenium	10
Manganese	50
Aliphatics >C8-C10	300
Aliphatics >C10-C12	300
Aromatics >EC5-EC7	1
Aromatics >EC7-EC8	700
Aromatics >EC8-EC10	500
Aromatics >EC10-EC12	90
Aromatics >EC12-EC16	90
Aromatics >EC16-EC21	90
Aromatics >EC21-EC35	90
Benzo(a)pyrene	0.01
PAH sum of 4	0.1
Vinyl chloride	0.5
trans-1,2-Dichloroethene	50
cis-1,2-Dichloroethene	50
Carbontetrachloride	3
Benzene	1
Trichloroethene	10
Toluene	700
Tetrachloroethene	10
Ethylbenzene	300
Total Xylenes	500

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 3rd Floor, Kings Orchard, 1 Queen St, Bristol, BS2 0HQ, UK T+ 44 (0) 1179 306 200 wsp.com					
Client: DANESCROFT (KENAVON DRIVE PROJECT MANAGEMENT) LLP					
Site/Project: GASHOLDER SITE AT ALEXANDER TURNER CLOSE READING					
Title: PLAN SHOWING GROUNDWATER CONCENTRATIONS EXCEEDING THE DRINKING WATER STANDARDS					
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Designed: AJ			Approved:		
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Project Number:		Drawing Number:		Revision:	
70031882		SUPP-005			
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BH201		
Date	30/09/2019 (µg/l)	10/02/2020 (µg/l)
Free Cyanide	5.96	-
Iron	8450	6860
Copper	2.49	-
Lead	14.9	-
Manganese	734	631
Aromatics >EC5-EC7	-	13
Aromatics >EC10-EC12	-	10
Fluoranthene	0.219	0.0303
Benzo(a)pyrene	0.365	0.0365
Benzene	-	14.4

BH102B		
Date	01/10/2019 (µg/l)	12/02/2020 (µg/l)
Free Cyanide	80.3	-
Iron	1500	-
Copper	1.38	1.44
Nickel	5.59	4.19
Manganese	1300	1130
Aromatics >EC10-EC12	-	18
Fluoranthene	0.485	0.044
Benzo(a)pyrene	0.189	0.0632

BH103A		
Date	01/10/2019 (µg/l)	11/02/2020 (µg/l)
Free Cyanide	8.47	-
Copper	3.24	-
Zinc	31.3	14
Manganese	135	226
Fluoranthene	0.246	0.468
Benzo(a)pyrene	0.0349	0.0187

BH106		
Date	01/10/2019 (µg/l)	11/02/2020 (µg/l)
Free Cyanide	2.89	-
Nickel	23.7	27.9
Manganese	485	341
Fluoranthene	0.133	0.0201
Anthracene	0.104	-

BH105		11/2/2020 (µg/l)
Iron		8550
Manganese		872
Fluoranthene		0.081
Benzo(a)pyrene		0.0864

WS206		10/02/2020 (µg/l)
Nickel		5.89
Manganese		1400
Aromatics >EC8-EC10		29
Fluoranthene		0.0261
Benzo(a)pyrene		0.0292
Trichloroethene		41.3
Tetrachloroethene		284

BH101		
Date	30/09/2019 (µg/l)	10/02/2020 (µg/l)
Free Cyanide	3.45	-
Copper	3.62	2.77
Aromatics >EC8-EC10	48	51
Fluoranthene	0.0451	0.0143
Benzo(a)pyrene	0.0307	0.00783
Trichloroethene	-	25.7
Tetrachloroethene	647	568

BH302A		
Date	01/10/2019 (µg/l)	10/02/2020 (µg/l)
Free ammonia	1097.156	-
Free Cyanide	28.5	-
Lead	-	1.26
Nickel	22.9	4.05
Manganese	638	132
Phenol	3050	-
Aromatics >EC5-EC7	2140	182
Aromatics >EC7-EC8	1010	-
Aromatics >EC8-EC10	564	62
Aromatics >EC10-EC12	383	69
Aromatics >EC12-EC16	293	54
Aromatics >EC16-EC21	78	14
Aromatics >EC21-EC35	48	11
Naphthalene	10.4	72.4
Fluoranthene	0.875	0.0768
Anthracene	1.47	-
Benzo(a)pyrene	0.15	0.0313
Benzene	2890	216
Toluene	1310	-
Ethylbenzene	86	-
Total Xylenes	508	34.1

BH301		
Date	1/10/2019 (µg/l)	10/02/2020 (µg/l)
Nickel	6.2	12.8
Zinc	31.4	-
Manganese	3690	126
Phenol	-	540
Aromatics >EC5-EC7	417	188
Aromatics >EC7-EC8	492	-
Aromatics >EC8-EC10	892	55
Aromatics >EC10-EC12	1230	59
Aromatics >EC12-EC16	875	781
Aromatics >EC16-EC21	347	167
Aromatics >EC21-EC35	351	-
Naphthalene	2650	1290
Fluoranthene	6.8	0.566
Anthracene	6.06	1.11
Benzene	721	248
Toluene	819	-
Ethylbenzene	127	-
Total Xylenes	1000	31.2

BH202		10/2/2020 (µg/l)
Free ammonia		1064.405
Iron		2370
Manganese		1270
Aromatics >EC5-EC7		343
Aromatics >EC8-EC10		657
Aromatics >EC10-EC12		1260
Aromatics >EC12-EC16		818
Aromatics >EC16-EC21		129
Fluoranthene		0.536
Anthracene		1.02
Benzene		400
Ethylbenzene		185
Total Xylenes		111

BH303		
Date	1/10/2019 (µg/l)	11/02/2020 (µg/l)
Copper	-	1.37
Nickel	10.7	6.61
Manganese	290	141
Fluoranthene	-	0.00887
Benzo(a)pyrene	-	0.00632

BH203C		
Date	1/10/2019 (µg/l)	11/02/2020 (µg/l)
Free Cyanide	4.65	-
Copper	-	1.39
Lead	-	1.65
Manganese	128	174
Fluoranthene	0.00863	0.0282
Benzo(a)pyrene	-	0.0164

BH104		
Date	01/10/2019 (µg/l)	11/02/2020 (µg/l)
Free Cyanide	3.18	-
Arsenic	69.3	-
Iron	22800	18500
Manganese	4270	3270
Fluoranthene	-	0.0118

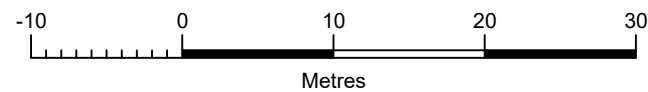
BH204		
Date	01/10/2019 (µg/l)	11/02/2020 (µg/l)
Copper	-	1.01
Fluoranthene	-	0.0163
Benzo(a)pyrene	-	0.0149

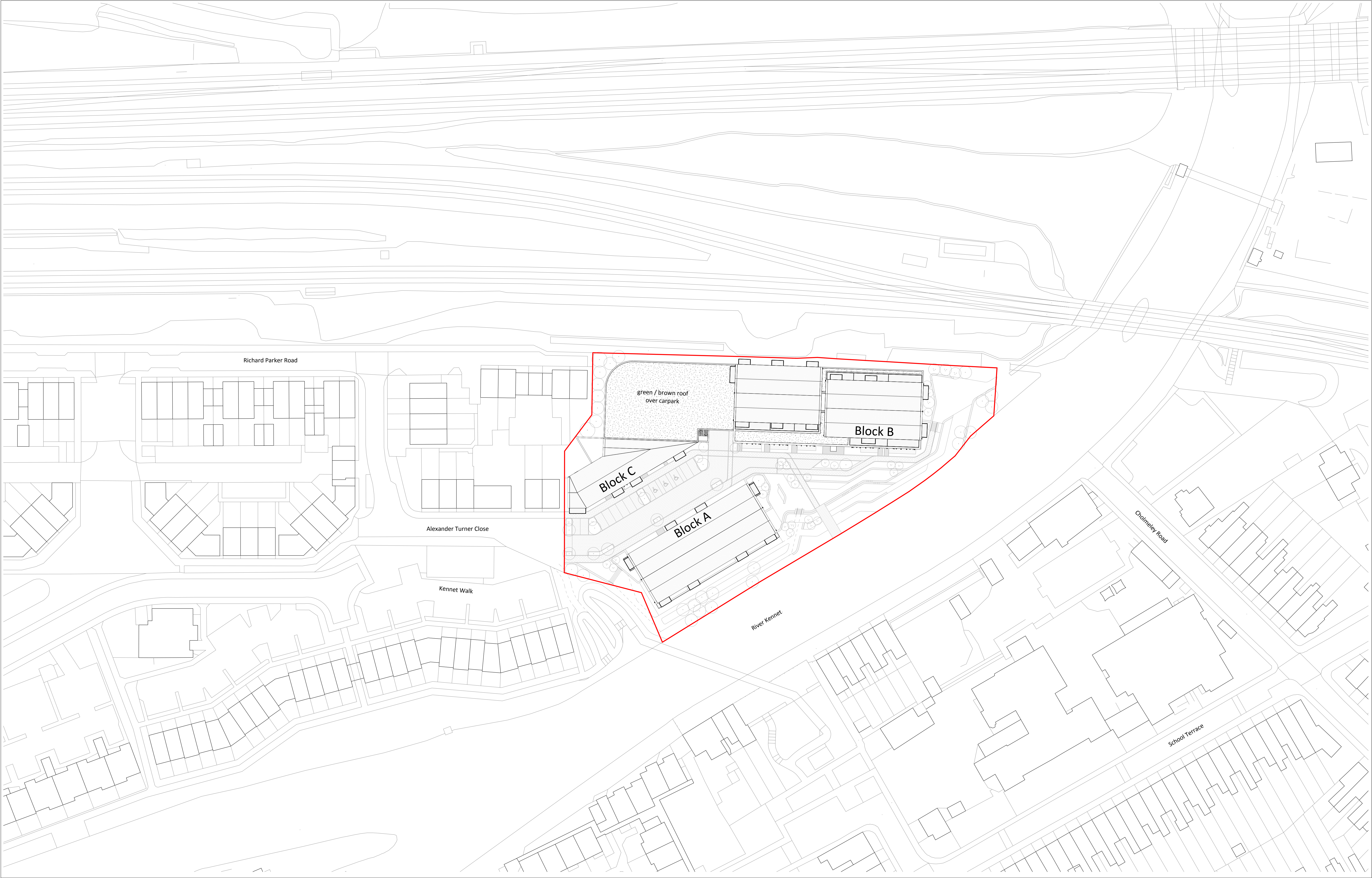
- KEY**
- SITE BOUNDARY
 - BH BOREHOLE LOCATION (2019)
 - BH SUPPLEMENTARY BOREHOLE (2019)
 - GH SUPPLEMENTARY TRIAL PIT (2019)
 - WS WINDOW SAMPLE LOCATION (2019)
 - VW VAPOUR WELL LOCATION (2019)
 - SS SOIL SAMPLE LOCATION (2019)
 - BH, WS, VW EXPLORATORY HOLE REFUSAL (2019)

- KEY**
- BH 2015 EXPLORATORY HOLE LOCATIONS
 - HP
 - TP
 - TT

KEY	
Test	EQS (µg/l)
Free ammonia	600
Free Cyanide	1
Arsenic	50.00
Iron	1000.00
Copper	1
Lead	1.2
Nickel	4.00
Zinc	10.9
Manganese	123
Phenol	7.7
Aromatics >EC5-EC7	10.00
Aromatics >EC7-EC8	74
Aromatics >EC8-EC10	20
Aromatics >EC10-EC12	2.00
Aromatics >EC12-EC16	2.00
Aromatics >EC16-EC21	0.10
Aromatics >EC21-EC35	0.02
Naphthalene	2
Fluoranthene	0.0063
Anthracene	0.1
Benzo(a)pyrene	0.00017
Benzene	10.000
Trichloroethene	10.00
Toluene	74
Tetrachloroethene	10.00
Ethylbenzene	20
Total Xylenes	30

Rev	Date	Description	By	Chk	App
 3rd Floor, Kings Orchard, 1 Queen St, Bristol, BS2 0HQ, UK T+ 44 (0) 1179 306 200 wsp.com					
Client: DANESCROFT (KENAVON DRIVE PROJECT MANAGEMENT) LLP					
Site/Project: GASHOLDER SITE AT ALEXANDER TURNER CLOSE READING					
Title: PLAN SHOWING GROUNDWATER CONCENTRATIONS EXCEEDING THE ENVIRONMENTAL QUALITY STANDARDS					
Drawn: NB		Checked: EW			
Designed: AJ		Approved:			
Date: 13/03/2020	Scale: 1:500	A2	Sheet:		
Project Number: 70031882		Drawing Number: SUPP-006		Revision:	
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NOTES

CONSULTANTS

- Refer to highways consultant's drawings for details
- Refer to landscape consultant's drawings for details
- Landscaping layout is indicative only

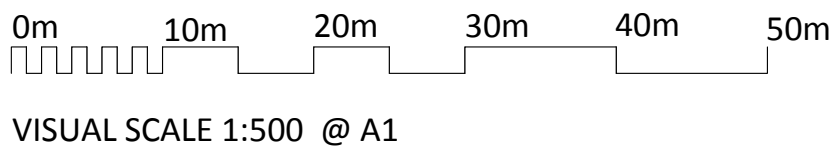
AREAS

- Refer to area schedule

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N

Rev	Notes	Date	By	Auth
P	Planning Application	28/03/19		



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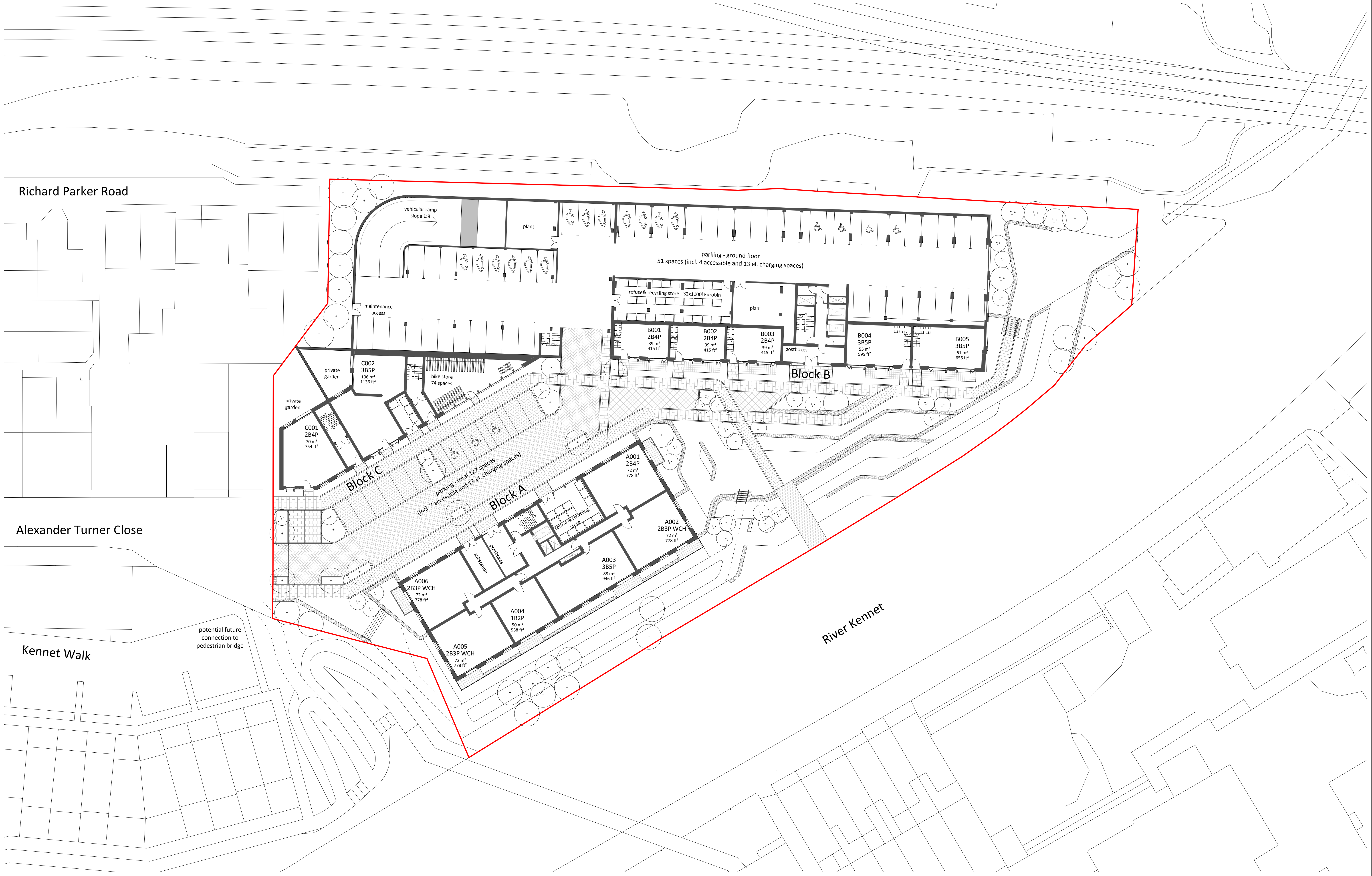
Date: 28/03/19
Drawn By: LK
Checked by: RC
Scale @ A1: 1 : 500
Scale @ A3: 1 : 1000
CAD File No:

Danescroft (KDPM) LLP
Gas Holder, Reading
Proposed Site Plan

PLANNING
16035

P0-010

Revision



NOTES

CONSULTANTS

- Refer to highways consultant's drawings for details

- Refer to landscape consultant's drawings for details

- Landscaping layout is indicative only

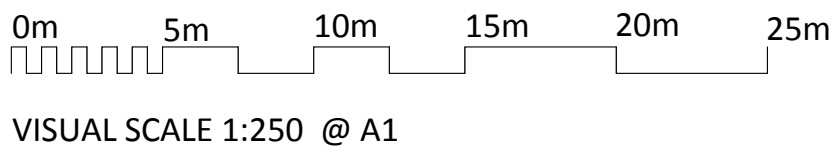
AREAS

- Refer to area schedule

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Rev	Notes	Date	By	Auth
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Date: 28/03/19

Drawn By: LK

Checked by: RC

Scale @ A1: 1 : 250

Scale @ A3: 1 : 500

CAD File No:

Danescroft (KDPM) LLP

Gas Holder, Reading

Proposed Plan - Ground Floor

PLANNING

16035

P0-100

Revision