



Prologis UK Limited

PROLOGIS PARK WEST LONDON: EXPANSION LAND

Remediation Strategy



Prologis UK Limited

PROLOGIS PARK WEST LONDON: EXPANSION LAND

Remediation Strategy

TYPE OF DOCUMENT (VERSION) CONFIDENTIAL

PROJECT NO. 70077417

OUR REF. NO. 70077417-REM

DATE: JULY 2021

WSP

4th Floor
6 Devonshire Square
London
EC2M 4YE

Phone: +44 20 7337 1700

Fax: +44 20 7337 1701

WSP.com



QUALITY CONTROL

Issue/revision	First issue	Revision 1	Revision 2
Remarks	For Information	Final	Final
Date	March 2021	April 2021	July 2021
Prepared by	Reena Gohel	Reena Gohel	Reena Gohel
Signature			Hares, Rob (UKRJH005) Digitally signed by Hares, Rob (UKRJH005) DN: cn=Hares, Rob (UKRJH005), ou=Active, email=Rob.Hares@wsp.com Reason: pp. R. Gohel Date: 2021.10.12 14:27:45 +01'00'
Checked by	Dr Rob Hares	Dr Rob Hares	Dr Rob Hares
Signature			Hares, Rob (UKRJH005) Digitally signed by Hares, Rob (UKRJH005) DN: cn=Hares, Rob (UKRJH005), ou=Active, email=Rob.Hares@wsp.com Reason: pp. R. Gohel Date: 2021.10.12 14:28:12 +01'00'
Authorised by	Dr Rob Hares	Dr Rob Hares	Dr Rob Hares
Signature			Hares, Rob (UKRJH005) Digitally signed by Hares, Rob (UKRJH005) DN: cn=Hares, Rob (UKRJH005), ou=Active, email=Rob.Hares@wsp.com Date: 2021.10.12 14:28:36 +01'00'
Project number	70077417	70077417	70077417
Report number	70077417-REM	70077417-REM	70077417-REM
File reference	\\uk.wspgroup.com\central data\Projects\70077xxx\70077417 - GSK Stockley Park\02 WIP\GW Ground & Water\6) Reporting\Rem Strat	\\uk.wspgroup.com\central data\Projects\70077xxx\70077417 - GSK Stockley Park\02 WIP\GW Ground & Water\6) Reporting\Rem Strat	\\uk.wspgroup.com\central data\Projects\70077xxx\70077417 - GSK Stockley Park\02 WIP\GW Ground & Water\6) Reporting\Rem Strat

CONTENTS

1	INTRODUCTION	1
1.1	AUTHORISATION AND PURPOSE OF THE ASSESSMENT	1
1.2	PROPOSED DEVELOPMENT	1
1.3	OBJECTIVES	1
1.4	SOURCES OF INFORMATION	2
1.5	CONFIDENTIALITY & LIMITATIONS	3
2	SUMMARY OF SITE INFORMATION	4
2.1	SITE LOCATION & SITE DESCRIPTION	4
2.2	SITE HISTORY	5
2.3	GROUND INVESTIGATION	6
2.4	GEOLOGY	9
2.5	HYDROGEOLOGICAL MODEL	10
2.6	OTHER INFORMATION	11
2.7	RISK ASSESSMENTS	11
2.7.1	HUMAN HEALTH RISK ASSESSMENT FROM SOILS	11
2.7.2	CONTROLLED WATERS RISK ASSESSMENT	12
2.8	GROUND/VAPOUR GAS RISK ASSESSMENT	12
2.9	PRELIMINARY WASTE ASSESSMENT	13
3	CONCEPTUAL SITE MODEL	14
3.1	INTRODUCTION	14
3.2	POTENTIAL CONTAMINATION SOURCES	14
3.3	POTENTIAL RECEPTORS	14
3.4	RELEVANT CONTAMINANT LINKAGES	14

4 REMEDIATION OBJECTIVES, CONSTRAINTS AND OPTIONS APPRAISAL 17

4.1	REMEDATION OBJECTIVES	17
4.2	CONSTRAINTS AND CONSIDERATIONS	18

5 REMEDIATION OPTIONS APPRAISAL 20

5.1	EXCAVATE AND DISPOSE (CIVIL ENGINEERING BASED SOLUTION)	20
5.2	EXCAVATE AND REMOVAL TO SOIL TREATMENT FACILITY (CIVIL ENGINEERING BASED SOLUTION)	20
5.3	EXCAVATE AND RE-USE UNDER MATERIALS MANAGEMENT PLAN (CIVIL ENGINEERING BASED SOLUTION)	20
5.4	EX-SITU BIO-REMEDIATION (PROCESS BASED SOLUTION)	21
5.5	MATERIALS MANAGEMENT AND COVER SYSTEMS / BARRIERS (CIVIL ENGINEERING BASED SOLUTION)	21
5.6	PREFERRED REMEDIATION OPTIONS	21
5.6.1	HUMAN HEALTH	21
5.6.1.1	Metal and Asbestos Contamination	21
5.6.1.2	Hydrocarbons	22
5.6.2	BUILDINGS	22
5.6.2.1	Ground Gases	22
5.6.2.2	Foundations	22
5.6.2.3	Services	22

6 REMEDIATION STRATEGY 23

6.1	PROPOSED DEVELOPMENT	23
6.2	DEMOLITION AND REMOVAL OF HARDSTANDING	23
6.2.1	DEMOLITION WORKS	23
6.2.2	REMOVAL OF HARDSTANDING	23
6.3	EARTHWORKS	24
6.3.1	CUT	25
6.3.2	FILL	26

6.4	VISUAL INSPECTION AND ANALYSIS	26
6.5	VALIDATION OF EXCAVATED VOIDS (UNDERGROUND FUEL TANKS)	27
6.6	WASTE MANAGEMENT	28
6.7	MANAGEMENT OF ARISING FROM INFRASTRUCTURE AND FOUNDATION WORKS	28
6.8	SAMPLING AND TESTING FOR SUITABILITY OF USE	29
6.9	CLEAN COVER SYSTEMS	31
6.10	OTHER CONSIDERATIONS	32
6.10.1	MANAGEMENT OF ASBESTOS RISKS	32
6.10.2	MANAGING UNEXPECTED CONTAMINATION AND WATCHING BRIEF	33
6.10.3	WATER SUPPLY PIPES	34
6.10.4	DRAINAGE	34
6.10.5	GAS AND VAPOUR PROTECTION	35
7	ENVIRONMENTAL MONITORING AND CONTROL MEASURES	36
7.1	DUST AND PARTICULATES	36
7.2	VAPOURS AND ODOURS	36
7.3	WATER INGRESS AND CONTROL	36
8	HEALTH, SAFETY AND ENVIRONMENTAL CONSIDERATIONS	37
8.1	CONTAMINATION	37
8.2	ENVIRONMENTAL CONTROLS	37
8.3	DECOMMISSIONING OF BOREHOLES	38
9	VERIFICATION REPORTING	39

APPENDICES

APPENDIX A

FIGURES & DRAWINGS

APPENDIX B



GENERAL LIMITATIONS

1 INTRODUCTION

1.1 AUTHORISATION AND PURPOSE OF THE ASSESSMENT

WSP was commissioned by Prologis UK limited (the 'Client') to prepare a Remediation Strategy for the proposed development at the Prologis Park West London Expansion Land at 1-3 Ironbridge Road, Stockley Park West, West Drayton, Uxbridge, UB11 1BT (the Site).

The Site location and current layout are presented as **Figures 1 and 2 in Appendix A**.

A Generic Quantitative Risk Assessment (GQRA) was prepared for the Site in March 2021 (Ref. 70077417-001). This report identified the presence of contamination across the site at unacceptable levels which would require remedial measures. This Remediation Strategy has been prepared to assess the risks identified within the GQRA and provide mitigation measures for the proposed development of the Site.

This work has been conducted in line with current practice, including that detailed in the Environment Agency (EA) document Land Contamination Risk Management (LCRM) Published 8th October 2020.

It is understood that this report will be submitted as part of a planning application to the London Borough of Hillingdon.

This Remediation strategy includes for the chemical suitability of the soils as a part of the proposed development. It is understood that the geotechnical suitability for the re-use of soils is being undertaken by others.

This report has been compiled for information only. On confirmation of the programming, logistics and the final design of the proposed development, the Remediation Implementation Plan for the proposed works should be prepared by the Contractor prior to commencing works.

1.2 PROPOSED DEVELOPMENT

The proposed development includes the construction of two warehouse buildings with ancillary office space and external hardstanding for parking and vehicular access. Areas of soft landscaping will mainly be present at the Site's perimeter with a wider strip of soft landscaping and the expansion of the existing attenuation pond located to the east of the warehouse along with attenuation tanks in the south-east and north-western parts of the Site.

A copy of the current Masterplan is provided as Drawing Number **30928-PL-201B** in **Appendix A**.

The current proposal is to demolish all existing buildings on the Site followed by reprofiling of existing Site levels via a cut and fill balance. It is anticipated that any required remediation of the Site will also be carried out during this phase of works.

Details of the cut and fill detail is shown on Drawing Number **PPWLE-RPS-SI-XX-DR-C-1201** in **Appendix A**.

1.3 OBJECTIVES

Based on the findings of the GQRA, the following objectives have been identified:

Prepare a Remediation Strategy in accordance with LCRM to address the pollutant linkages identified across the Site. The Remediation Strategy will include:

- Review of background information;
- Summary of relevant pollutant linkages as identified through development of a Conceptual Site Model (CSM) and the GQRA;
- Remediation Objectives and Requirements;
- Options Appraisal,
- Remedial Strategy; and,
- Remediation Validation Requirements.

1.4 SOURCES OF INFORMATION

The following relevant sources of information were used in the production of this report and should be read in conjunction with the environmental setting information summarised below.

Table 1-1 – Sources of information

Source	Report
WSP reports	'1-3 Ironbridge Road, Stockley Park, Ground Conditions - Preliminary Risk Assessment', ref 70055718-PRA, dated February 2019; GSK Site, Stockley Park, Hillingdon. Geo-environmental - Preliminary Risk Assessment', ref 70062215-PRA, dated June 2020; Prologis Park West London: Expansion Land – Phase 2 Geo-environmental and Geotechnical Assessment – Prologis UK Limited, Ref 70055718-P2, dated April 2019; GSK Site, Stockley Park, Hillingdon, Phase 2 Geo-environmental and Geotechnical Assessment. Dated June 2020, Ref 70062215-P2; and, Prologis Park West London: Expansion Land, Generic Quantitative Risk Assessment. Dated April 2021, Ref 70077417-001.
Third party reports	Ramboll Environ 'Glaxosmithkline UK Ltd, 1-3 Iron Bridge Road, Stockley Park, Uxbridge, Middlesex, Phase 1 Environmental Review', ref UK11-22552, dated 15 February 2016.
Public information	Landmark Envirocheck report, dated 7 February 2019, Order Ref: 193335617_1_1 British Geological Society (BGS) 1:50,000 Series Geological Map Sheet 269 'Windsor' and 255 'Beaconsfield' (Solid & Drift ed.) BGS 'Geology of Britain' online viewer accessed 8 February 2021 <https://www.bgs.ac.uk/discoveringGeology/geologyOfBritain/viewer.html> Zetica 'Regional unexploded bomb risk map' website accessed 18 February 2021 <https://zeticauxo.com/downloads-and-resources/risk-maps/> MAGIC website, accessed 8 February 2021 <https://magic.defra.gov.uk/MagicMap.aspx> London Borough of Hillingdon planning portal accessed 8 February 2021 <http://planning.hillingdon.gov.uk/OcellaWeb/planningSearch>
Notes:	The report contains British Geological Survey materials ©NERC 2021 and Environment Agency information ©Environment Agency and database right.



1.5 CONFIDENTIALITY & LIMITATIONS

This report is addressed to and may be relied upon by Prologis UK Limited.

This assessment has been prepared for the sole use and reliance of the above named parties. This report has been prepared in line with the WSP proposal and associated notes. This report shall not be relied upon or transferred to any other parties without the express written authorisation of WSP. No responsibility will be accepted where this report is used, either in its entirety or in part, by any other party.

This report needs to be read and used in full. General limitations of the assessment are included in **Appendix B**.

2 SUMMARY OF SITE INFORMATION

2.1 SITE LOCATION & SITE DESCRIPTION

Site Location Plan and Site Layout Plans are provided as **Appendix A**.

Table 1 provides details of the site obtained from a review of Ordnance Survey (OS) mapping, online aerial photography and key observations made during a walkover for the 2019 Desk Study and 2019 and 2021 ground investigation works.

Table 2-1 – Summary of Site details

Detail	Comment
Name of Site	GSK Stockley Park
Address of Site	1-3 Ironbridge Road, Stockley Park West, Iron Bridge Road North, West Drayton, Uxbridge, UB11 1BT.
Location and National Grid Reference (NGR)	Approximate NGR: 507560, 180120. The Site can be accessed via Ironbridge Road North, adjacent to the west of the Site.
Site Area and Topography	The Site is broadly rectangular in shape and covers approximately 5.4 hectares (ha). The topography of the Site raises by approximately 1.5 m from the southern section towards the centre of the Site. The ground level in the north-west section of the Site reduces by approximately 1.5 m towards the northern Site boundary.
Site Description and Current Use	The Site was previously owned and occupied by GSK, a pharmaceutical company. But at the time of writing this report, the Site is now owned by Prologis UK Limited. The Site comprises the former GSK offices, which includes four large buildings on-site; one in the north (Building B9), one in the centre (B10), one in the south-west (B11) and a multi-storey car park in the south-east corner. The remainder of the Site is covered in hardstanding (used as car parking) with limited landscaped areas. Two large surface water features are present; one located in the north of the Site and one in the east. The surface water feature to the north is for aesthetic purposes. It is understood the water feature in the east of the Site is a surface water balancing pond used to attenuate surface water car park discharge, prior to its discharge to the Grand Union Canal. 3 x 30,000 litre underground diesel storage tanks (USTs) are present on-site; one associated with each building to power back-up generators (located on the roofs). The USTs were linked via underground fuel lines to fuel risers that were installed up the external side of the buildings. The fill points are located adjacent to the USTs. The USTs were reportedly installed in the early 1990s and decommissioned in 2014, which comprised emptying the tanks of fuel and filling each with foam. Each backup generator was served by a dedicated above ground tank (AGTs), approximately 500 litres in capacity. Reportedly the AGTs were emptied at the same time as the USTs were decommissioned. It is unknown whether the ancillary fuel pipes have been decommissioned or foam filled.

Detail	Comment
	Three electrical substations present on-site; located in the north-west, east and south. It is not known whether these substations contained polychlorinated biphenyls (PCBs). Waste storage areas are present to the east of Building 10, to the east of Building 11 and to the west of Building 9.
Ground Cover	The Site is predominantly covered by block paving with soft landscaping and trees between the parking bays. The block paving is generally in good condition.
Surrounding Area	The following land uses were observed in the area surrounding the Site: North – A408 junction with Horton Road and Bennetsfield Road with Stockley Park golf course beyond. East – A408 with further industrial units of Stockley Park beyond. South – Grand Union Canal, Iron Bridge Road South, railway line and residential properties. West – Iron Bridge Road North and industrial units of Prologis Park: West London beyond.
Observations of Impact	No external staining of the ground was observed. No evidence of vegetation stress was noted.

2.2 SITE HISTORY

The earliest available historical maps from 1868 indicate most of the Site to be undeveloped, comprising three fields. By 1895 a gravel pit is present in the south-east corner of Site. The central field is shown as an orchard with three small buildings constructed; one in the centre and two on the eastern boundary. An additional building is present in the south-east corner of Site.

By 1914, the southern two thirds of the Site are a gravel pit with a flooded excavation in the west. By 1934, further excavation has occurred along the western half of the Site. The previously flooded section of the gravel pit in the west of the Site has been extended north and formed into a navigable channel connected to the canal to the south.

Historical reports indicate that the gravel extraction was followed by progressive filling in the 1930s to 1940s and again in the 1960s. In 1960 the channel is no longer connected to the canal and the building at the northern end is no longer present. The Site is marked as rough pasture. The northern ends of two long buildings cross the western boundary.

By the mid-1960s, the channel had been backfilled and a depot had been constructed in the south of the Site. The long building that crossed the western boundary is part of a piggery with additional related buildings present in the eastern half of the Site. By 1975 a plant hire works has been built cross boundary to the south of the piggery.

By the early 1990s, the Site is redeveloped into its current day configuration except for the multi-story carpark in the south-east corner (constructed in the late 1990s).

The Envirocheck report indicates most of the Site to be infilled land with a small area of landfill in the north-west.

Council records obtained by Ramboll Environ suggest remediation occurred on-site and the wider adjacent site from 1987 to 1988 involving the removal of 1,116,000 m³ of landfill material and the construction of in-ground clay barriers and leachate drainage.

Further information is provided in the Ramboll Environ Phase 1 report and the WSP PRA/GQRA.

The Ramboll Environ report indicates that one of the tanks (associated with Building 10 in the centre of the Site) was identified to be leaking in 2007 resulting in impact to the surrounding soil. The tank and the surrounding soils were removed and a new tank, and 'clean' soil placed. No documentation regarding the works was available.

2.3 GROUND INVESTIGATION

The Phase 1 GI was completed between 23 February and 10 March 2019. Four monitoring rounds, including the development of monitoring wells, were carried out between the 20 March and 2 April 2019.

The Phase 2 GI was completed between 13 January to 25 January 2021. The first four monitoring rounds, including the development of monitoring wells, were carried out between the 26 January to 19 February 2021. The final two monitoring rounds are to be completed between the 22 February and 5 March 2021.

The completed scope of works is listed in **Table 2-1** below:

Table 2-1 – Completed Scope of Works

Hole ID	Hole type	Proposed depth	Finished depth	Well installation
BH01	Dynamic / Rotary	15.00 m	14.95 m	Installed into MG (3.00 to 6.00 m bgl)
BH02	Dynamic / Rotary	15.00 m	14.95 m	Installed into LHGR (3.00 to 5.50 m bgl)
BH03	Dynamic / Rotary	15.00 m	14.95 m	Installed into MG (3.00 to 4.00 m bgl)
BH04	Dynamic / Rotary	15.00 m	14.95 m	Installed into MG / LASI (1.50 to 2.50 m bgl)
WS01	Windowless sampler	6.00 m	6.45 m	Installed into MG / LC (3.00 to 6.00 m bgl)
WS02	Windowless sampler	6.00 m	1.20 m	Installed into MG (0.50 to 1.20 m bgl)
WS03	Windowless sampler	6.00 m	0.83 m	None
WS04	Windowless sampler	6.00 m	5.00 m	Installed into MG (1.00 to 4.00 m bgl)

Hole ID	Hole type	Proposed depth	Finished depth	Well installation
WS06	Windowless sampler	6.00 m	6.45 m	Installed into MG (1.00 to 6.00 m bgl)
WS07	Windowless sampler	6.00 m	4.45 m	None
WS08	Windowless sampler	6.00 m	6.45 m	Installed into MG (3.00 to 6.00 m bgl)
WS09	Windowless sampler	6.00 m	5.45 m	Installed into MG (2.00 to 2.80 m bgl)
WS10 / WS10A	Windowless sampler	6.00 m	0.75 m 0.35 m	Installed into MG (0.45 to 0.75 m bgl)
WS11	Windowless sampler	6.00 m	5.45 m	Installed into MG (1.00 to 3.90 m bgl)
WS12	Windowless sampler	6.00 m	4.00 m	Installed into MG (1.00 to 2.00 m bgl)
WS13 / WS13A	Windowless sampler	6.00 m	0.65 m 0.67 m	None
WS14	Windowless sampler	6.00 m	1.30 m	Installed into MG (0.50 to 1.00 mbgl)
WS15	Windowless sampler	6.00 m	2.90 m	None
CPT01	CPT	15.00 m	1.65 m	None
CPT02	CPT	15.00 m	5.41 m	None
CPT03	CPT	15.00 m	3.58 m	None
CPT04	CPT	15.00 m	15.32 m	None
CPT05	CPT	15.00 m	14.96 m	None
CPT06	CPT	15.00 m	13.81 m	None
CPT07	CPT	15.00 m	15.01 m	None
CPT08	CPT	15.00 m	15.08 m	None
CPT09	CPT	15.00 m	1.97 m	None
CPT10	CPT	15.00 m	6.89 m	None

Hole ID	Hole type	Proposed depth	Finished depth	Well installation
BH201 \ BH201A \ BH201B	Cable percussion	20.00 m	1.60 m 1.30 m 3.50 m	Installed into MG (1.00 to 3.50 m bgl)
BH202	Cable percussion	20.00 m	20.00 m	Installed into LC (5.00 to 20.00 m bgl)
BH203	Cable percussion	20.00 m	3.50 m	Installed into MG (1.00 to 3.50 m bgl)
BH204 \ BH204A	Cable percussion	20.00 m	1.00 m 1.00 m	None
BH205	Cable percussion	20.00 m	6.45 m	Installed into MG (1.00 to 5.50 m bgl)
HDP201	Windowless sampler	1.50 m	4.00 m	Installed into MG (1.00 to 2.50 m bgl)
HDP202	Hand dug pit	1.50 m	1.50 m	None
HDP203	Hand dug pit	1.50 m	1.20 m	None
HDP204	Hand dug pit	1.50 m	0.90 m	None
HDP205	Hand dug pit	1.50 m	1.50 m	None
TP201	Trial pit	3.50 m	3.50 m	None
TP202	Trial pit	3.50 m	3.50 m	None
TP203	Trial pit	3.50 m	3.50 m	None
TP204	Trial pit	3.50 m	3.00 m	None
VW201	Vapour well	0.10 m	0.10 m	Installed into MG (0.05 to 0.10 m bgl)
VW202	Vapour well	0.10 m	0.10 m	Installed into MG (0.05 to 0.10 m bgl)
VW203	Vapour well	0.10 m	0.10 m	Installed into MG (0.05 to 0.10 m bgl)
VW204	Vapour well	0.10 m	0.10 m	Installed into MG (0.05 to 0.10 m bgl)
VW205	Vapour well	0.10 m	0.10 m	Installed into MG (0.05 to 0.10 m bgl)
VW206	Vapour well	0.10 m	0.10 m	Installed into MG (0.05 to 0.10 m bgl)
VW207	Vapour well	0.10 m	0.10 m	Installed into MG (0.05 to 0.10 m bgl)
VW208	Vapour well	0.10 m	0.10 m	Installed into MG (0.05 to 0.10 m bgl)

Hole ID	Hole type	Proposed depth	Finished depth	Well installation
VW209	Vapour well	0.10 m	0.10 m	Installed into MG (0.05 to 0.10 m bgl)
VW210	Vapour well	0.10 m	0.10 m	Installed into MG (0.05 to 0.10 m bgl)
VW211	Vapour well	0.10 m	0.10 m	Installed into MG (0.05 to 0.10 m bgl)
VW212	Vapour well	0.10 m	0.10 m	Installed into MG (0.05 to 0.10 m bgl)
WS201 \ WS201A	Windowless sampler	6.00 m	0.60 m 5.00 m	Installed into LHGR (3.00 to 4.00 m bgl)
WS202	Windowless sampler	6.00 m	6.45 m	Installed into MG (2.00 to 5.00 m bgl)
WS203	Windowless sampler	6.00 m	4.38 m	Installed into MG (2.00 to 3.50 m bgl)
WS204	Windowless sampler	6.00 m	6.00 m	Installed into MG (1.00 to 4.00 m bgl)
WS205 \ WS205A	Windowless sampler	6.00 m	2.00 m 5.00 m	None
WS206	Windowless sampler	6.00 m	5.00 m	Installed into MG (1.00 to 4.00 m bgl)
WS207	Windowless sampler	6.00 m	2.00 m	None

Notes: CPT – Cone penetration test, MG – Made Ground, LASI – Langley Silt Member, LHGR – Lynch Hill Gravel Member & LC – London Clay Formation.

2.4 GEOLOGY

The information in the table below has been compiled from the British Geological Survey (BGS) and exploratory hole logs from the two phases of ground investigation works undertaken across the Site. A summary of the encountered ground conditions is presented in **Table 2-2**.

Geological cross sections across the Site are presented within **Figures 4 to 8** within **Appendix A**.

Table 2-2 – Summary of Ground Conditions

Group	Stratum	Depth to Base of Strata (m bgl)	Level at Base of Strata (mAOD)	Thickness (m)
Hardstanding	Block paving / Concrete	0.06 to 2.50 (3.50)	36.34 to 31.76 (31.46)	0.06 to 1.08
Made Ground	Engineered Fill	0.22 to 0.52 (1.65)	36.12 to 31.54	0.14 to 0.44
	Made Ground	0.80 to 6.39	35.14 to 28.26	0.40 to 6.09
	Infilled Ground (possible Landfill)	1.30 to 4.70	34.19 to 29.01	0.80 to 2.70
	Worked Ground (Reworked Natural)	3.00 to 6.30 (6.45)	30.54 to 28.22 (27.91)	0.10 to 4.38 (5.05)
Superficial Deposits	Langley Silt Member	2.65 to 3.00 (3.50)	32.84 to 29.10	0.40 to 1.00 (1.30)
	Lynch Hill Gravel Member	2.50 to 8.36	29.83 to 26.17	0.30 to 2.20
Bedrock	London Clay Formation	Not proven (20.00)	Not proven (13.68)	Not proven (15.50)

2.5 HYDROGEOLOGICAL MODEL

The Lynch Hill Gravel Member is classified as a Principal Aquifer and the Langley Silt Member and London Clay Formation are designated as Unproductive Strata. The Site is not situated within a groundwater Source Protection Zone (SPZ) and there are no operational groundwater abstraction licences for potable water supply within 1 km of the Site. The closest abstraction is approximately 42 m north-west of the Site and relates to abstracting groundwater for make-up or top-up water (i.e. to make up water levels in ponds, canals, boilers, lagoons). It is understood this abstraction was used to maintain water levels in the surface water features located to the west of Ironbridge Road North.

Two surface water ponds are present on-site; located in the north and east. The nearest off-site surface water feature is the Grand Union Canal, which lies adjacent to the southern boundary. The section of the canal between Iron Bridge and Brent was given a General Quality Assessment (GQA) Grade of D (i.e. Fair) in 2000. No recent water quality data for the canal is available from the

Environment Agency. The River Crane is located approximately 3 km east of the Site and has an overall water body quality classification of poor (2016).

The closest surface water abstraction point (for process water) is located approximately 156 m south-east of the Site.

2.6 OTHER INFORMATION

The Zetica unexploded ordnance (UXO) map indicates the Site to lie within an area of low risk from UXO.

2.7 RISK ASSESSMENTS

A summary of the risk assessment undertaken within the GQRA is outlined below. This should be read in conjunction with the full risk assessments included within the March 2021 GQRA Report.

2.7.1 HUMAN HEALTH RISK ASSESSMENT FROM SOILS

Lead concentrations were recorded above the commercial GAC in three Made Ground samples and asbestos was detected in six Made Ground samples.

The presence of hardstanding across the Site post development will restrict direct exposure pathways, therefore, the risk to future Site users is considered to be **Low**.

The risk from vapours from shallow groundwater and soil is also considered to be **Low**.

The risk to future construction workers is considered to be **Low to Moderate** due to the greater potential for direct contact to occur with potentially contaminated soils, however these health and safety risks should be mitigated under CDM regulations.

The risk to occupants of neighbouring land will be managed under the project's Construction Environmental Management Plan.

Notwithstanding the above, it is noted that significant earthworks are to be undertaken as part of the project's construction hence, the spatial distribution of contaminants recorded to date will change.

In addition, it is understood that the proposed construction detail allows for a minimum of 450 mm clean building material beneath external hardstanding and 775 mm beneath the new building, including a 350 mm thick concrete slab, resulting in an overall reduction in risk from ground contamination to future site users.

Asbestos fibres were identified by the testing laboratory within soil samples BH01, BH201B, CPT03, TP201, TP202 and WS02 at depths of between 0.40 to 2.00 m BGL. All positive samples were further scheduled for asbestos quantification with all results reported predominantly as <0.001 % except for WS02 which reported a result of 0.0123 %.

The proposed development will likely have limited soft landscaping with buildings and hardstanding occupying most of the Site. Therefore, the ingestion pathway linkage associated with respirable asbestos fibres will likely be severed.

An Asbestos Management Plan will be required setting out how asbestos impacted soils will be managed during the construction works to protect construction workers and occupants of neighbouring land. The plan will set out control measures that will be implemented e.g. dust suppression, ambient air monitoring. Any removal of licensable asbestos activities will be undertaken in accordance with Control of Asbestos Regulations 2015 and by a Licenced Asbestos Contractor.

2.7.2 CONTROLLED WATERS RISK ASSESSMENT

Exceedances of the DWS for ammoniacal nitrogen recorded in soil leachate and exceedances of ammoniacal nitrogen and PAHs recorded in groundwater samples suggest a potential risk to the underlying Principal Aquifer. However, the Site is not located within a Source Protection Zone, there are no potable groundwater abstraction licences within 1 km of the Site and the majority of the Lynch Hill Gravel has been excavated from the Site and surrounding area. The risk to groundwater is therefore considered to be **Low**.

The exceedances of EQSs for ammoniacal nitrogen, TPH fractions and PAHs indicate a potential risk to surface waters. Based on the groundwater level monitoring undertaken, groundwater within Made Ground appears to flow to the south, towards the Grand Union Canal. However, given the cohesive Made Ground and the presence of sheet piling, lateral migration would be limited; the risk to surface waters is therefore considered to be **Low**.

No remediation to address risk to controlled waters is recommended based on the findings of this assessment.

2.8 GROUND/VAPOUR GAS RISK ASSESSMENT

Methane and carbon dioxide were recorded above trigger values (1% v/v and 5% v/v, respectively) at several locations on-site. Although flow rates were typically 0.1 l/hr or below, CIRIA C665 suggests considering an increase to Characteristic Situation 2, which is considered appropriate given the infilling history of the Site and the surrounding area. Based on the ground gas monitoring undertaken to date, it is recommended that ground gas protection measures in accordance with a CS2 gas regime and Type D commercial building as per BS8485 are incorporated into the proposed warehouse building detail.

Laboratory analysis of soil and groundwater samples along with low PID readings recorded during the ground investigation indicates the absence of a significant source of volatile organic compounds beneath the Site.

Reference has been made to BS8485:2015+A1:2019 to determine the likely gas protection measures required for the proposed development. In accordance with Tables F.7 and F.8, the following combination of measures to provide a gas protection solution of 1.5 for a 'large floor plan commercial building (Type D building) based on a CS2 scenario are showing in Table 2-3.

Table 2-3 – Required Gas Protection Measures

Type and use of building	Minimum Score	Structural Barrier (score)	Ventilation / dilution (score)	Gas membrane (score)	Total achieved score
Large floor plan retail/ commercial/industrial building (no basement) (Building Type D)	1.5	Cast in-situ ground-bearing slab (1)	6F2 sub-base + geocomposite dispersal layer to low level vents (preferential pathway only) (0.5)	DPM (0)	1.5

Type and use of building	Minimum Score	Structural Barrier (score)	Ventilation / dilution (score)	Gas membrane (score)	Total achieved score
		Suspended floor slab (1.5)	Well graded subbase (not pressure relief pathway) (0)	DPM (0)	1.5

The gas protection measures should be agreed with Building Control and the London Borough of Hillingdon.

2.9 PRELIMINARY WASTE ASSESSMENT

The preliminary waste classification indicates that 4 of the 81 soil samples would be classified as 'Hazardous' for disposal and the remaining 77 soil samples are classified as non-hazardous for disposal.

Asbestos was detected in seven soil samples at a maximum concentration of 0.0123% (WS02 at 1.00 m BGL) which is below the hazardous threshold of 0.1%. Asbestos was either not detected or recorded below the laboratory limit of quantification in the remaining soil samples analysed and no fragments of asbestos containing materials (ACM) were observed during the ground investigation.

The site will be subjected to significant earthworks and as such a Materials Management Plan (MMP), in accordance with CL:AIRE Definition of Waste: Code of Practice or similar, should be implemented should site won material be required for reuse on-site and to minimise the quantity of material requiring off-site disposal.

It is recommended that if disposal of Site materials is required, laboratory data should be provided to the waste receiver to confirm the final classification. The responsibility for classification of waste for disposal lies with the 'waste producer' and it will be their responsibility to agree the final classification and acceptability of the material for disposal with the receiving landfill.

If materials cannot be retained on-site due to material balance or geotechnical suitability, it is suggested that 'non-hazardous' and 'hazardous' materials are retained on-site (assuming they present no ongoing or future risk to controlled water or human health) and 'inert' materials are removed from the Site to achieve a more cost-effective materials management solution.

3 CONCEPTUAL SITE MODEL

3.1 INTRODUCTION

This section summarises the findings of the GQRA and the key receptors identified in the CSM and provides the plausible linkages identified at the generic assessment level.

3.2 POTENTIAL CONTAMINATION SOURCES

Based on the site conditions and potential contaminant linkages, potential sources of contamination that may affect the development have been identified as follows:

- Three underground storage tanks within the three office buildings on Site;
- Metals and asbestos in Made Ground;
- Dissolved phase PAHs in the groundwater; and
- Ground gases.

3.3 POTENTIAL RECEPTORS

Relevant potential receptors are considered to include the following in the context of the proposed development:

Human Health

- Site users and visitors
- Construction Workers,
- Future site users, and
- Adjacent site users.

Future development

- Built structures and underground services.

Controlled Waters have been excluded as the Generic Quantitative Risk Assessment Report concludes that there is a low risk to controlled waters based on the minor exceedances of contaminants on the Site.

3.4 RELEVANT CONTAMINANT LINKAGES

Table 3-1 presents the relevant pollutant linkages that were considered to be plausible following the site investigation, based on an evaluation of the potential sources and future receptors and the current hydrogeological model.

Table 3-1 - Relevant Contaminant Linkages (RCL)

RCL	Contaminants	Pathways	Receptors	Comments
RCL1	Free asbestos fibres in soil	Inhalation of asbestos fibres.	Site users and visitors. Construction/maintenance workers and adjacent site users.	Asbestos fibres and Asbestos Containing Materials were noted at several locations across the site. Consideration of appropriate control measures must be undertaken if this material is to be re-used on site or disposed of off-site to a suitably licenced facility (refer to Section 6.10.1).
RCL2	Metals in the Made Ground Soils	Dermal contact, ingestion and inhalation of impacted Made Ground and soil particles. Inhalation of vapours derived from impacted soil and groundwater.	Site users and visitors, and adjacent site users. Construction / maintenance workers.	Three exceedances of the lead commercial GAC were noted and may pose a risk in areas of soft landscaping. The presence of hardstanding will restrict exposure in future and current Site users. A capping layer comprising 'clean' independently validated topsoil is likely to be required in areas of soft landscaping where Made Ground remains on-site. Construction and maintenance workers are at a greater risk of exposure via direct contact with potentially contaminated soil and groundwater. Appropriate health and safety management practices on-site will limit exposure of site operatives to contamination.
RCL3	Hydrocarbons associated with the 3 x USTs and other hydrocarbon hotspots on the Site	Dermal contact, ingestion and inhalation of impacted Made Ground and inhalation of vapours	Site users and visitors, and adjacent site users. Construction / maintenance workers.	Three USTs are noted as being present on the Site associated with the three office buildings. There was also visual / olfactory evidence of contamination noted at several locations on the Site. Further assessment and mitigation through either further characterisation of soils if identified during the earthworks or remedial measures are likely to be required within these areas. Construction and maintenance workers are at a greater risk of exposure via direct contact with potentially contaminated soil and groundwater. Appropriate health and safety management practices on-site will limit exposure of site operatives to contamination.

RCL	Contaminants	Pathways	Receptors	Comments
RCL4	Soil and vapour gases generated from Made Ground and infilled material on-site and off-site	Ingress into confined spaces within proposed structures	Future and Current Site users New structures	Elevated concentrations of methane and carbon dioxide have been noted on the Site therefore, remedial measures are considered necessary to mitigate the risk. There is considered to be a risk to future site users in all areas of the building footprint. It is understood that some earthworks are proposed on the Site, therefore, further ground gas and vapour monitoring is recommended post earthworks in order to confirm the ground and vapour gas protection measures required.
RCL5	Aggressive contaminants (i.e. sulphate and hydrocarbons)	Direct contact with impacted soils and groundwater	Below ground construction materials including concrete and plastic water pipes	Based on UKWIR, due to elevated pH concentrations (>8) in several locations, copper water pipes are unlikely to be suitable due to potential corrosive soil conditions. Polyethylene (PE) and polyvinyl chloride (PVC) are also unlikely to be suitable due to elevated concentrations of PAHs (>0.5 mg/kg), TPH (>500 mg/kg) and BTEX (>0.03 mg/kg) in some samples. Protectaline pipes should be considered and agreed with Thames Water.

Risks associated with potable water supply have not been assessed within this report. The suitability of materials surrounding portable water supplies should be assessed post earthworks and confirmed with the water supply company when the design plans are finalised.

4 REMEDIATION OBJECTIVES, CONSTRAINTS AND OPTIONS APPRAISAL

This section defines the remediation objectives and constraints and sets out the basis for selecting the most appropriate overall remediation option for the Site.

4.1 REMEDIATION OBJECTIVES

The objectives of the proposed remediation are as follows:

- Protection of human health and the environment;
- To provide a site suitable for the proposed end-use;
- Contributing to a sustainable development;
- Minimising adverse environmental impact on off-site locations; and,
- Best practical remediation measure.

The protection of human health from soil contamination will need to address;

- Unacceptable risks to human health

The remediation objectives of this strategy are set out below. These are required to address the potential risks to human health, services and buildings for the future development. Only the relevant contaminant linkages have been brought forward within this section. The risk to controlled waters have been addressed within the Generic Quantitative Risk Assessment Report the findings of which show that there is no risk to controlled waters.

Table 4-1 – Summary of Remediation Objectives per Relevant Pollutant Linkage

RCL	Source	Aim / Requirements	Comments
RCL1	Free asbestos fibres in soil	Protection of construction works, future site users and adjacent site users	Control measures during excavation works associated with drainage. Source removal of arisings generated. During groundworks appropriate PPE/RPE and mitigation methods against the release of airborne asbestos fibres (including air monitoring) are recommended. Provision of pathway break in soft landscaped areas.
RCL2	Metals in the Made Ground Soils	Protection of construction works, future site users and adjacent site users	Control measures in line with CDM Regulations during localised earthworks and any other excavation works such as the installation of infrastructure. Provision of a pathway break in soft landscaped areas.

RCL	Source	Aim / Requirements	Comments
RCL3	Hydrocarbons associated with the 3 x USTs and other hydrocarbon hotspots on the Site	Protection of construction works, future site users and adjacent site users	Control measures in line with CDM regulations during excavation works. Decommissioning and removal of USTs in line with good practice. A watching brief by a suitably qualified person within the areas of the USTs during excavation. This includes validation of the sides and base of the areas once the contaminated soils have been removed. Some of the excavated soils may require treatment or removal off-site. This can be undertaken during demolition and / or earthworks.
RCL4	Soil gases generated from Made Ground and infilled material on-site and off-site	Future and Current Site users New structures	Control measures during excavation works and prevention of gas migration through the use of suitable gas protection measures as a part of the proposed development. It is understood that earthworks are proposed on the Site, therefore, further ground gas and vapour monitoring is recommended post earthworks in order to confirm the ground and vapour gas protection measures required.
RCL5	Aggressive contaminants (i.e. sulphate and hydrocarbons)	Protection of below ground construction materials including concrete and drainage pipes.	Assessment of concrete in aggressive ground and potential requirement for barrier pipes (subject to agreement with relevant statutory authority).

4.2 CONSTRAINTS AND CONSIDERATIONS

The following Site-specific factors are likely to affect the choice of remediation solution:

- The assessment undertaken is based on the masterplan available at the time of writing this report. If subject to change assessment and strategy should be re-assessed.
- At this stage, design plans for locations of portable water supply have not been finalised. Some of the soils in close proximity to the USTs may record elevated concentrations of hydrocarbons that may pose a risk to below ground portable water pipes constructed from polyethylene.
- The building is likely to be piled through the Made Ground and Langley Silt Member and Lynch Hill Gravels. Consideration of the environmental impacts associated with the piling works should be considered in a piling risk assessment that should be conducted in accordance with NC/99/73 Piling and penetrative ground improvement methods on land affected by contamination: guidance on pollution prevention dated 2001.

- Localised earthworks are proposed across the Site as shown on Drawing No. **PPWLE-RPS-SI-XX-DR-C-1201, Appendix A**. The material generated could potentially be re-used subject to chemical and geotechnical suitability. Chemical suitability should be assessed in accordance with this strategy.
- It is understood that groundwater strikes were encountered between 0.55 m and 4.30 m bgl. The deepest area of cut is understood to be 3.50 m bgl in the north-western part of the Site therefore, perched groundwater may be encountered during the earthworks. If dewatering is required during the construction process it will be undertaken by a Design and Build Contractor. It is understood that they would be responsible for specific discharge consents, abstraction licence (if required), and ensure the works are in line with appropriate legislative frameworks (the Water Act 2003, for example) and guidance. Based on the groundwater monitoring results obtained during the ground investigation works, it is considered possible that the water within excavations may require treatment prior to discharge. This should be considered as a part of the proposed development. If visual / olfactory evidence of contamination is identified during the works, the environmental consultant shall be informed and a sample will be obtained for testing in order to assess the risks associated with contamination within the groundwater.
- It is understood that the USTs were decommissioned in 2014, however there is no documentary evidence. The decommissioning status should be confirmed prior to commencing works, the tanks should be emptied (if required) and removed followed by the removal of impacted soils or free product around former tanks and decommissioning of ancillary fuel pipes and removal of impacted soils around pipes.
- It is understood that attenuation drainage features are proposed as a part of the proposed development. This will include attenuation tanks in the north-western part of the Site and in the south-eastern part of the Site which will combine into one drain which will then flow into an existing Thames Water Manhole before it is discharged into the Grand Union Canal. The cut and fill assessment has only made an approximate allowance of 5000 m³ at this stage and should be updated prior to development.
- There is also an enlargement of the existing balancing pond proposed in the eastern part of the Site. This has been excluded from the cut and fill calculations for the Site and should be considered prior to earthworks.
- The volume of materials generated from the proposed foundations is estimated as 3,400 m³ at this stage. This should be confirmed following the final design.
- Infilled ground / landfill material was noted within the north-western part of the Site. This material encountered did not contain any landfill type materials however, the Made Ground in this area did contain anthropogenic materials such as wood and occasional plastic, glass, clinker, metal, bone, ceramic and ash. And infilled / landfill material generated is considered like to require sorted prior to re-use. If more bio-degradable material is encountered within areas not investigated during the Phase 1 and 2 ground investigation works, an assessment should be made on whether the material is suitable for use and an allowance should be made for off-site disposal, if required.

5 REMEDIATION OPTIONS APPRAISAL

An appraisal has been undertaken taking into consideration technical, logistical and financial aspects of the remediation technology/options and incorporates the staged approach as defined in LCRM (2020).

The remedial options available to manage unacceptable risks will either:

- Manage (remove, destroy, modify or immobilise) the source,
- Interrupt the pathway; or
- Modify the receptor or the behaviour of the receptor.

The proposed options are designed to manage the source of contamination or interrupt the pathway. Modifying receptor or receptor behaviour has not been considered in this instance. Source management may involve the removal, destruction, stabilisation, or transformation of the source. Pathway interruption may involve either the blocking of the pathway or the destruction or removal of contaminants moving along a pathway.

Remedial technologies are therefore assessed on design methods that can be incorporated into engineering works, such as a source removal and segregation in order to minimise costs associated with off-site disposal.

5.1 EXCAVATE AND DISPOSE (CIVIL ENGINEERING BASED SOLUTION)

This technique simply involves excavating the source of contaminated material. It has the advantage that it is an observational technique and contaminated material identified by visual and olfactory means may be removed with some confidence. The disposal option is an expensive and environmentally unsustainable solution, requiring disposal of the contaminated material to a suitable disposal facility, a source of chemically suitable material to backfill the excavation and transport of the waste and fill materials. Any excavation and disposal works should be undertaken in line with materials management of the soils in accordance with waste management guidance as outlined within **Section 6.6**.

5.2 EXCAVATE AND REMOVAL TO SOIL TREATMENT FACILITY (CIVIL ENGINEERING BASED SOLUTION)

This technique involves excavating the source of contaminated material. This is an observational technique based on visual / olfactory evidence of contamination which will be confirmed by validation testing. This material will then be disposed of off-site to a registered Soil Treatment Facility (STF) for treatment and re-use off-site. Based upon the volume of contaminated material, this may prove to be a more cost-effective approach than treatment on site, however, segregation should be undertaken to ensure that this is cost effective.

5.3 EXCAVATE AND RE-USE UNDER MATERIALS MANAGEMENT PLAN (CIVIL ENGINEERING BASED SOLUTION)

It is anticipated that the re-use of on-site soils will be carried out under the CL:AIRE Code of Practice to facilitate the re-use and treatment of on-site material that might otherwise be classified as waste. This technique involves excavating the source of contaminated material. This is an observational

technique based on visual / olfactory evidence of contamination which will be confirmed by validation testing. This material will then be re-used by the management of soils within areas of lower risk such as areas of proposed hardstanding where infiltration of water will be minimal. It should be noted that some material may be unsuitable for re-use in any of the likely land-use scenarios and require further remediation or removal from site.

5.4 EX-SITU BIO-REMEDIATION (PROCESS BASED SOLUTION)

This technique is suitable for organic contamination and ranges in complexity from simply placing and turning over excavated contaminated source material in windrows, to adding spent compost or seeding with bacteria and allowing biological degradation of the contaminants. It has the advantage that treatment progress can be observed and visual and olfactory contaminated material may be removed with confidence. Once treated and validated the material can be placed back into the excavation and compacted to an engineering specification. However, it is a time based solution and requires a temporary impermeable working area to store material during treatment. Surface water runoff and leachate are collected for treatment. The remediation end-points also have to be sufficiently low to meet assessment criteria, which for some PAHs and residential use, can be technically challenging.

5.5 MATERIALS MANAGEMENT AND COVER SYSTEMS / BARRIERS (CIVIL ENGINEERING BASED SOLUTION)

This technique introduces an appropriate barrier, removing the pathway to the receptor. Import of clean materials or onsite management of appropriate materials is required for construction of the barrier. Systems range from simple cover layers to provide a reduction of the hazard to human health and to provide a suitable medium for plant growth; through to engineered systems designed to provide a complete separation of the receptor from the hazard and to perform a number of functions including limiting upward migration of contaminants due to capillary rise and controlling the downward infiltration of water.

5.6 PREFERRED REMEDIATION OPTIONS

Based upon literature review, consultation with a number of specialist contractors, and from direct experience on sites of similar complexity, it is considered that an appropriate and cost-effective approach that can be adopted is a mixture of ex-situ remediation or off-site treatment at a Soils Treatment Facility, along with selective re-use under a Materials Management Plan and construction of cover systems / barriers.

The use of off-site or on-site treatment will be dependent on the volume of contaminated soils encountered when decommissioning the USTs on the Site, space on the Site and timescales for the development of the Site.

5.6.1 HUMAN HEALTH

5.6.1.1 Metal and Asbestos Contamination

It is understood that the Site levels will be reduced by up to 3.50 m bgl in the northern and north-western part of the Site and filled by up to 3.00 m in the southern part of the Site. Residual risks to human health associated with contaminated soils within any remaining Made Ground within the upper 600 mm (following the earthworks) will be mitigated for metals and asbestos contaminants, through the covering of the site with buildings and hardstanding. In areas of proposed soft landscaping any

residual human health risks following the earthworks will be mitigated for metal contaminants, through the import or re-use of between 300 to 600-mm clean cover system which is chemically compliant with the end-use of the Site.

The re-use criteria for asbestos is 'below the analytical limit of detection' following quantification. If above the limit of detection but below 0.1%vv, a risk based approach should be adopted for the re-use of the material, if not notifiable. This should include re-deposit under proposed buildings or hardstandings and cover with a marker layer (Orange Terram or similar). The area should be surveyed and detailed provided in the Health and Safety file that will accompany the future development.

5.6.1.2 Hydrocarbons

Risks associated with potentially contaminated with hydrocarbons have been identified in close proximity to the three USTs associated with the former office buildings on the Site. There were also a number of locations where there was visual / olfactory evidence of hydrocarbons on the Site. The depth and extent of any potential hydrocarbon contamination associated with the tanks is unknown.

Decommissioning and removal of USTs in line with good practice and further investigation, assessment and potential remediation surrounding impacted soils identified on the Site is required.

A watching brief by a suitably qualified person within the areas of the USTs during excavation. This includes validation of the sides and base of the areas once the contaminated soils have been removed. Some of the excavated soils may require treatment or removal off-site.

5.6.2 BUILDINGS

5.6.2.1 Ground Gases

Elevated ground borne gas recorded during the ground investigation works indicates a CS₂ classification should be considered as a part of the proposed development.

5.6.2.2 Foundations

Elevated concentrations of sulphate have been identified in the soils Site. The concrete foundations for the buildings will require an appropriate design of concrete classification.

Further detail on the appropriate concrete classification for the Site is included within the WSP Generic Quantitative Risk Assessment Report dated March 2021, Ref. 70077417-001.

5.6.2.3 Services

Based on UK Water Industry Research 'Guidance for the Selection of Water Supply Pipes to be used in Brownfield Sites' and the available data, an indicative assessment has been undertaken on the type of water supply pipes that may be suitable for the Site. The assessment suggests that barrier pipes may be required. Once the proposed locations of the potable water supply pipes have been confirmed; appropriate soil testing should be agreed with the relevant statutory authority.

It should be noted that the water supply company's bespoke threshold concentrations take precedence over the UKWIR guidance, therefore, this should be confirmed prior to construction.

6 REMEDIATION STRATEGY

6.1 PROPOSED DEVELOPMENT

The proposed development includes the construction of a single warehouse building with ancillary office space, a multi storey van car park and external hardstanding for parking and vehicular access. Areas of soft landscaping will mainly be present at the Site's perimeter with a wider strip of soft landscaping and an attenuation pond located to the north of the warehouse. A copy of the current Masterplan is provided as Drawing Number **31538-FE-002B** in **Appendix A**.

The current proposal is to demolish all existing buildings on the Site followed by reprofiling of existing Site levels via a cut and fill balance which generally shows cut in the north and north-western part of the Site and fill within the southern part of the Site. The proposed cut and fill is shown on Drawing Number **PPWLE-RPS-SI-XX-DR-C-1201** in **Appendix A** and is further discussed in Section 6.3.

It is anticipated that any required remediation of the Site will also be carried out during this phase of works.

6.2 DEMOLITION AND REMOVAL OF HARDSTANDING

6.2.1 DEMOLITION WORKS

It is assumed that the demolition of the existing buildings will be undertaken prior to commencing earthworks and remediation works on the Site. There are presently four buildings present on the Site. Three of these are former office buildings and one is a multi-storey car park.

Based on the age of the buildings, an asbestos survey should be undertaken along with removal of potential asbestos containing materials by a specialist prior to demolition.

There are three USTs associated with the former office buildings on the Site which will require decommissioning and removal. Residual contamination may be present within the soils surrounding these former USTs. Removal of tanks and remediation of impacted soils should be undertaken in line subsequent sections of this report.

6.2.2 REMOVAL OF HARDSTANDING

The majority of the Site is covered in block paving and there are also some areas of concrete hardstanding present around the buildings present on the Site.

When breaking out the hardstanding, these materials should be segregated and records will be kept of the volumes of recycled material, including volumes of concrete. The block paving is considered likely to be unsuitable for re-use therefore, waste tickets should be provided for any materials being taken off-site for disposal or recycling.

Locations of material stockpiles will also be recorded on a live site plan, which will be revised during the course of the works in line with Material Management requirements. Reinforcing bar and other recovered metals will also be logged prior to being conveyed to a licensed metal recycling facility.

As part of the hardstanding removal works, sub-base materials, where present, will be stockpiled for verification testing and potential re-use.

Excavated structures that are determined to be potentially suitable for re-use (free of visual or olfactory signs of contamination) will be transferred to designated crushing areas on site. Steel reinforcement bar liberated during crushing will be stockpiled separately prior to off-site disposal.

All crushed material will be sampled at the specified frequency outlined in **Section 6.8** and given a unique sample reference linking them to a specific stockpile.

Areas designated for crushing will be segregated and subject to Environmental Compliance monitoring in accordance with the Mobile Plant Environmental Permit. Methods including damping materials prior to crushing should be employed.

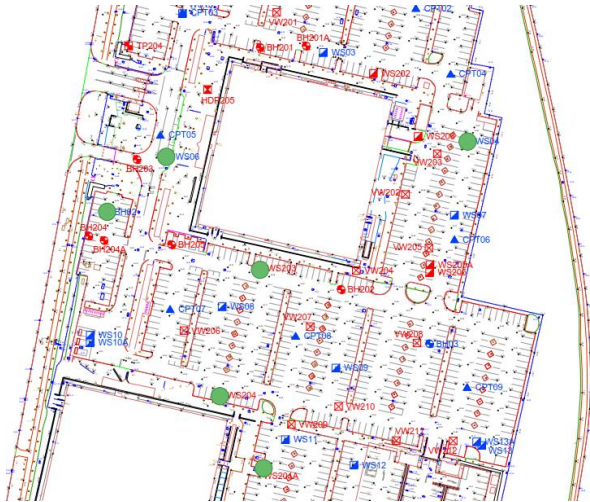
6.3 EARTHWORKS

Cut and fill works are proposed across the Site prior to development the details of which are shown on Drawing Number **PPWLE-RPS-SI-XX-DR-C-1201** in **Appendix A**. In general, there is a volume of approximately 26,291 m³ of material that will be cut and approximately 24,386 m³ of fill leaving a net surplus of 1,905 m³.

There are a number of assumptions made as a part of the cut and fill analysis which should be confirmed as a part of the detailed design. These are listed below:

- The construction depths of the building footprint, service yard and access and car parks and access.
- The piling matt is excluded from the calculations.
- The impact on the volumes from the removal of the hardstanding across the Site.
- An assumption of 3,400 m³ has been made for the proposed foundations. This should be confirmed during detailed design.
- An assumption of 5,000 m³ has been made for the drainage such as the attenuation tanks in the north-west. This should be confirmed during detailed design.
- No bulking factors have been applied to the cut and fill calculations at this stage.
- No allowance has been made for the enlargement of the existing balancing pond in the eastern part of the Site.

There are a number of areas on the site where visual / olfactory evidence of contamination was noted during the ground investigation works as shown by the green circles on the drawing below:

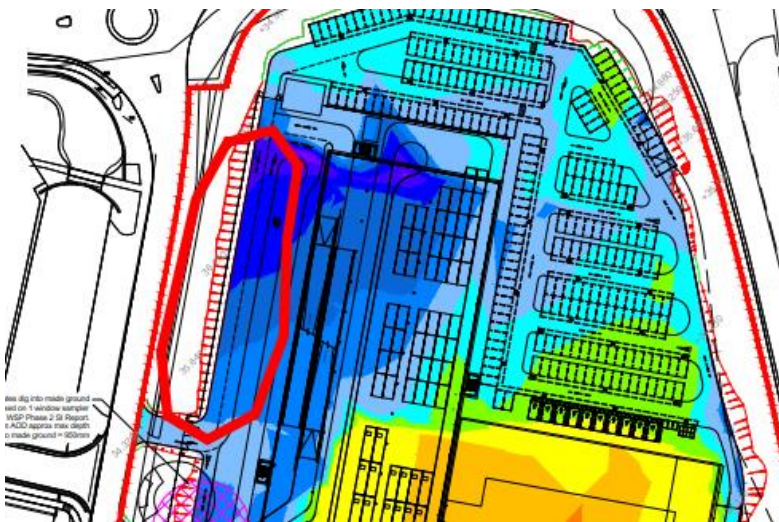


Although there were no elevated concentrations of contaminants at these locations, during earthworks a watching brief should be undertaken to ensure that any free-product / unsuitable material is not identified.

6.3.1 CUT

In general, the bulk of the cut will be undertaken from the northern and north-western part of the Site which will then be filled in the eastern and southern parts of the Site to produce a development platform. The deepest part of the cut is in the north-west where there is a 3.50 m reduction in site levels.

Based on the ground investigation data obtained during the Phase 1 and Phase 2 ground investigation works, the bulk of the cut material is considered likely to be Made Ground / reworked natural. There is an area of infilled ground / landfill material situated in the north-western part of the Site as shown in red on the image below:



The reline boundary provided is indicative and based on the data available from the ground investigation works. The full extent of this infilled / landfill material may extend up to the site boundary, however, this will need to be confirmed during earthworks.

Although the infilled ground / landfill material contains anthropogenic material such as frequent inclusions of wood and occasional fragments of plastic, glass, clinker, metal, bone, ceramic and ash, there are no other biodegradable items noted at the ground investigation locations with the exception of the wood. It is recommended that the cut and fill works are undertaken under the supervision of a suitably qualified environmental engineer full time so that the different types of Made Ground can be suitably segregated and complex sorted during the earthworks. This infilled / landfill material could potentially be re-used following some complex sorting of the anthropogenic materials within the soils generated however this will be subject to chemical and geotechnical suitability.

The frequency of testing and suitability of the soils should be assessed in line with the requirements outlined in **Section 6.8**. The geotechnical suitability of the soils will be assessed by others.

6.3.2 FILL

The bulk of the filling is proposed in the eastern and southern parts of the Site. This appears to exclude the area of the proposed balancing pond along the eastern boundary of the Site. The proposed balancing pond should be considered prior to earthworks.

The ground within the fill areas should be compacted in line with good practice prior to the placement of any materials. Any visual / olfactory evidence of contamination encountered underneath the hardstanding should be further investigated and validated in line criteria provided in Section 6.8 prior to the placement and compaction of chemically and geotechnically suitable soils. The geotechnical suitability of the soils will be assessed by others.

Excess soil that is generated from construction works (including any Topsoil strip) can potentially be retained and re-used beneath hardstand areas, provided that it is classified as suitable for use (Refer to **Table 6-2**). During the construction works this material must be chemically characterised for potential re-use on site or for offsite disposal. The frequency of the testing is outlined in **Section 6.8**.

During groundworks appropriate PPE/RPE and mitigation methods against the release of airborne asbestos fibres (including air monitoring) are recommended.

6.4 VISUAL INSPECTION AND ANALYSIS

It is proposed that a system of appropriate inspection and assessment is implemented during the excavation of all Made Ground and natural material as part of the planned earthworks. This role will be performed full time by a suitably experienced Environmental Engineer / Scientist who is able to provide an appropriate level of specialist technical advice in relation to the presence of contamination or otherwise. The Environmental Engineer / Scientist shall ensure that all material is correctly inspected, stockpiled, tested and classified. The Engineer will have primary responsibility for the inspection of arisings and excavation of any suspected contaminated material.

In addition, during the excavation works and disposal of the asbestos impacted soils not suitable for re-use, the chosen contractor should ensure that an Engineer suitably qualified in dealing with asbestos provides guidance on works, to include methodologies for mitigating fibre release, providing tool box talks to staff and undertaking personnel and verification monitoring.

In order to maximise the quantity of material that can be retained on site for re-use, the segregation of different material types should be completed in accordance with the ground conditions encountered and a Materials Management Plan. For example, Made Ground deposits; Infilled Made Ground;

Landfill; and natural material should be excavated separately and segregated at the point of excavation.

6.5 VALIDATION OF EXCAVATED VOIDS (UNDERGROUND FUEL TANKS)

Following decommissioning, removal of the USTs and visually impacted soils, sampling and verification testing is required to confirm the removal of impacted material has been suitably completed. This will comprise:

- Collection of one sample from each sidewall of the excavation and one sample from the base;
- Sidewall samples will be taken within the centre of the sidewall at a depth midway up the wall in Made Ground soil. For dimensions greater than 10 m, additional samples will be required at a rate of one sample per 10 m length;
- The base samples should be undertaken on a 10 m² x 10 m² grid across the base of the excavation;
- Dimension of the excavation and locations of the verification samples must be recorded including the approximate co-ordinates and elevation from surface;
- An annotated photographic record showing sides and base of the excavation is required prior to infilling. Photographs should include details of the location, date and a colour chart to allow for colour balancing;
- The samples will be chemically tested using an independent UKAS and MCERTS accredited laboratory and the results submitted to the Environmental Consultant for prior approval prior to backfilling the void;
- If the verification testing contains contaminants concentration in excess of the remediation guideline criteria, further excavation will be required to the following extent:
 - Excavation Base Failures – remove material to a vertical depth of 0.10 m
 - Excavation Sidewall Failures – remove material to the face for horizontal depth of 0.50 m and vertically the full depth of the excavation

Upon removal of the additional material further validation testing will be conducted in accordance with the sampling regime described above. Should the additional testing contain contaminant concentrations in excess of the remediation guideline criteria, further excavation will be required as described in the bullet points above. Sidewall and base verification shall include the testing requirements outlined in **Table 6-2** below.

This role will be performed by a suitably qualified person who is able to observe any visual / olfactory evidence of contamination during the enabling works and undertake further investigation, sampling, testing and subsequent assessment on receipt of the results.

The findings may indicate the requirement for further mitigation measures required as a part of the proposed development. This will require regulatory approval prior to implementation (if required).

6.6 WASTE MANAGEMENT

It should be noted by the Contractor that a small part of the north-western area of the Site lies within a registered landfill area. Prior to commencing any works on the Site, the Contractor should ensure that the necessary waste recovery permits or Material Management Plans are in place if deemed to be required by the Environment Agency. Agreement of the works will be required by the Environment Agency and the Local Planning Authority prior to excavation.

Site levels are proposed to be reduced by up to 3.50 m in the north and north-western part of the Site and material generated will be re-used to fill the eastern and southern parts of the Site, subject to chemical and geotechnical suitability. Therefore, a Materials Management Plan (MMP) will be required under the CL:AIRE Code of Practice.

A 'Qualified Person' as defined under the CoP will review the development of the Materials Management Plan, Risk Assessments and Remediation Strategy / Design Statement together with documentation relating to Planning and Regulatory issues will sign a Declaration which is forwarded to the Environment Agency and which confirms compliance with the CoP. Any need for the disposal of material off site will require appropriate pre-classification and pre-treatment to minimise the waste volume. It is the strategy of the site however to maximise re-use of materials where possible.

The Contractor should provide a works materials management statement that sets out the circumstances and criteria for which materials are to be classified as waste or non-wastes.

The Contractor is required to provide method statements illustrating how compliance with waste management legislation is to be achieved for those materials classified as waste, to include but not limited to:

- Use of imported material;
- Criteria for assessing of the suitability of imported materials;
- Management of material that arises during the works and is classified as waste;
- Waste streams are appropriately classified prior to offsite disposal;
- Audit process for the selection of waste management contractors to include the collection and assessment of licences, permits and registrations; and,
- Audit process and record keeping.

All excavation works should be undertaken under the full-time supervision of a suitably qualified Environmental Engineer in order to ensure that the different types of Made Ground generated is segregated, complex sorted and tested for suitability of re-use. Chemical re-use criteria has been included within this report however, geotechnical suitability will be assessed by others under a separate cover.

6.7 MANAGEMENT OF ARISING FROM INFRASTRUCTURE AND FOUNDATION WORKS

The development works will generate construction arising as part of the formation of foundations, and infrastructure for the proposed development together with the creation of new services and utilities corridors. In order to ensure that the remediation strategy is adhered to, it will be necessary firstly to

confirm whether these materials are required for re-use on the Site. If required, these would need to be tested for suitability in line with the frequency sent out in **Section 6.8** and the assessment criteria outlined within **Table 6-2**.

If materials fail the assessment criteria, a risk-based approach should be used to ensure that construction arisings are re-deposited on the site in non-sensitive areas such as beneath roads and hardstanding and beneath building slabs. If the materials generated pass the specified criteria, the materials can also be re-deposited within proposed landscaped areas subject to compliance with the re-use criteria and the clean cover requirements outlined within **Section 6.9** and geotechnical requirements of subsoil and topsoil as outlined within BS 8601:2013 and BS 3882:2015, respectively.

A record of where general construction arisings created by the development works should be maintained in line with an MMP.

6.8 SAMPLING AND TESTING FOR SUITABILITY OF USE

Sampling and testing of any backfill materials will be required in order to demonstrate suitability of use. Sampling frequency and strategy is detailed in **Table 6-1** below:

Table 6-1 – Proposed Sampling Strategy

Activity	Testing Frequency	Testing Suite
Stockpiled materials for disposal	Testing frequency as required by the receiver of the waste	Waste acceptable criteria (WAC) analysis if being taken to a landfill or a full testing suite for metals, inorganics and organics if being taken to another site or a Soil Treatment Facility (subject to the requirements of the receiver site).
Site won crushed concrete used to create site levels	One sample will be analysed per 500 m ³ of material	Asbestos and TPH – CWG
Site won soils used to create site levels	One sample will be analysed per 250 m ³ to 500 m ³ of material depending on the material type and olfactory and visual signs of contamination.	Suite of testing as outlined within Table 6-2 .
Imported materials	One sample every 500 m ³ below the cover layer (potential to reduce testing if consistent source)*	Suite of testing as outlined within Table 6-2 . Asbestos and TPH – CWG if crushed concrete.
Validation of clean cover materials for soft landscaped areas	One sample every 250 m ³ . This could rise to every 500 m ³ if a consistent source of	Suite including TPH – CWG, asbestos, metals and PAHs.

Activity	Testing Frequency	Testing Suite
	imported growth medium is used.	

* - Where imported material is a certified product or from a virgin source or the material has been demonstrated to have been produced in accordance with the WRAP Quality protocol and is used below the clean cover layer, the sampling and testing of the material would not be required. A visual/olfactory assessment of the material once imported onto Site would however be required.

The materials being used for backfilling within the areas of the proposed buildings and car parking would be assessed for suitability by comparison to the Generic Screening Criteria (GACs) for Commercial end-use for 6% SOM content. Residential Public Open Space for 1% soil organic matter (SOM) has been included for areas of proposed landscaping as this material is likely to be imported as presented within the table below.

Table 6-2 –Re-use Criteria

Determinands	Public Open Space (mg/kg)	Commercial (mg/kg)
Arsenic	79	635
Barium	2,680	
Beryllium	2,2	
Boron	20,500	207,000
Cadmium	120	223
Chromium (III)	2,140	9,550
Chromium (VI) (Hexavalent)	5.7	24
Copper	12,500	69,800
Lead	310	1,390
Mercury (Inorganic)	124	1,110
Nickel	305	1,710
Selenium	1,140	12,300
Vanadium	2,110	9,220
Zinc	80,700	N/A
Benzo[a]pyrene (as surrogate marker)	5,3	38
Naphthalene	4,890	1,080
Benzene	72	90
Toluene	500*	500*
Ethylbenzene	500*	500*
Total xylenes	500*	500*
Methyl tert-butyl ether	500*	500*
Iso-propylbenzene	500*	500*
Propylbenzene	500*	500*
Styrene	3,020	5,000*

Determinands	Public Open Space (mg/kg)	Commercial (mg/kg)
Trimethylbenzenes	248	208
Inorganic Cyanide	15	50
PCBs	1.3	9.5
Aliphatic EC >5-6	1,000*	1,000*
Aliphatic EC >6-8	1,000*	1,000*
Aliphatic EC >8-10	1,000*	1,000*
Aliphatic EC >10-12	1,000*	1,000*
Aliphatic EC >12-16	1,000*	1,000*
Aliphatic EC >16-35	1,000*	1,000*
Aliphatic EC >35-44	1,000*	1,000*
Aromatic EC >5-7	1,000*	1,000*
Aromatic EC >7-8	1,000*	1,000*
Aromatic EC >8-10	1,000*	1,000*
Aromatic EC >10-12	1,000*	1,000*
Aromatic EC >12-16	1,000*	1,000*
Aromatic EC >16-21	3770	5,000*
Aromatic EC >21-35	3770	5,000*
Aromatic EC >35-44	3770	5,000*
Carbon disulphide	5,000*	47
Phenol	760	3,200
Biphenyl	1,000*	1,000*
Total Cresols	1,000*	1,000*

* - NOTE – Values in bold have been reduced to a proxy value as the actual values of these contaminant are considered to be too high for re-use on the Site.

The re-use criteria for asbestos is ‘below the analytical limit of detection’ following quantification. If above the limit of detection but below 0.1%vv, a risk based approach should be adopted for the re-use of the material, if not notifiable. This should include re-deposit under proposed buildings or hardstandings and cover with a marker layer (orange Terram or similar). The area should be surveyed and detailed provided in the Health and Safety file that will accompany the future development.

6.9 CLEAN COVER SYSTEMS

The placement of clean cover systems will be the responsibility of the developer who should appoint a suitably qualified environmental consultant to independently verify that imported cover materials meet the required standard and the cover systems are constructed in accordance with the requirements set out below.

In areas of proposed soft landscaping, where Made Ground remains in place, there is the potential for residual contamination to be present which, although has been assessed as suitable to remain in place, may pose an increased risk to sensitive human receptors if it is brought to the surface due to

maintenance work. As such it is recommended that a minimum cover is designed to mitigate residual risks and a marker layer such as orange terram or similar is required. In addition, soft landscaping will require suitable growing medium for cultivation.

The capping thicknesses are shown in **Table 6-3** below. The clean cover layer will be placed in the sequence as shown below by the developer during the construction phase. It is considered that areas of soft landscaping will be managed by the building management who can take appropriate mitigation measures to limit exposure to their workforce.

Such a cover barrier would need to be agreed with the Contaminated Land Officer at the Local Authority and will be dependent on the final development layout and levels.

It is noted that the proposed capping of certain failures across the site will in a majority of cases exceed that set out below in **Table 6-3**.

Table 6-3 –Capping Thickness

Area on Site	Geotextile Marker Layer	Sub-Soil (mm)	Topsoil (mm)	Total Thickness (mm)
Public Open Space / landscaping areas	Yes	200 min 400 max	100 min 200 max	300 min 600 max

The chemical requirements for the landscaping areas are outlined within **Section 6.8** and geotechnical requirements of subsoil and topsoil are as outlined within BS 8601:2013 and BS 3882:2015, respectively.

Based on the depth of the groundwater table, the requirement for a capillary break layer has been excluded.

6.10 OTHER CONSIDERATIONS

6.10.1 MANAGEMENT OF ASBESTOS RISKS

Based on the findings of the ground investigation works and the age of the historical uses of the site, the presence of asbestos within the ground cannot be dismissed and should be considered as a part of the proposed development and an Asbestos Management Plan should be implemented as a part of the development works.

If asbestos is identified during the excavations on the site, this material will require careful management in accordance with Control of Asbestos Regulations 2012. Asbestos exposure risk assessment, mitigation such as dust suppression and air monitoring would be required.

It is considered that based upon the proposed development and the placement of clean cover and hardstanding across most of the site, any bound asbestos can be managed following a full assessment of the risks to human health.

As general Site Management good practice, earthworks operatives should be given a tool box talk on potential contaminated land risks in particular the possibility of encountering Asbestos Containing Material (ACM) prior to excavation.

If suspected ACM is identified then the following is required:

- i. Stop works in the vicinity of the suspected location;
- ii. Inform Site Manager;
- iii. Inform the environmental consultant;
- iv. Operatives to be provided with appropriate PPE;
- v. Damp and cover the location to prevent release of asbestos fibres;
- vi. Fence off the area to prevent tracking of fibres across the Site by vehicle / people movements; and,
- vii. Collection of soil sample for asbestos quantification testing.

The re-use criteria for asbestos is 'below the analytical limit of detection' following quantification. If above the limit of detection but below 0.1%vv, a risk based approach should be adopted for the re-use of the material, if not notifiable. This should include re-deposit under proposed buildings or hardstandings and cover with a marker layer (orange Terram or similar). The area should be surveyed and detailed provided in the Health and Safety file that will accompany the future development.

6.10.2 MANAGING UNEXPECTED CONTAMINATION AND WATCHING BRIEF

Excavations should be undertaken under the full-time supervision of a suitably qualified Environmental Engineer / Scientist overseeing excavation works. The Environmental Engineer / Scientist should be aware of the different types of material 'expected' and 'not expected' on this Site. In the event that unexpected contamination is encountered then the following action is proposed.

Immediately stop excavations to assess the immediate risks to the environment to include:

- Inhalation of hazardous dust such as asbestos;
- Inhalation of vapour or gas; and,
- Spread of liquid contamination such as liquids / oils leaking from pipes or tanks.

If there is an immediate risk to human health and construction workers then evacuate to a safe distance and follow site emergency procedures.

If no immediate risk to human health then undertake an assessment to determine:

- The source of contamination; and,
- Appropriate method of containment.

A specialist Environmental consultant must be appointed to further assess the risks and develop an appropriate remediation strategy. With assistance from the specialist consultant, a risk based assessment and strategy will be developed to assess the potential source / pathway / receptor pollutant linkages. If a significant pollutant linkage that requires supplementary remediation works is identified then notification will be made to the local planning authority along with the mitigation approach for managing the identified contamination risk.

In addition to the above, it is recommended that a watching brief by a suitably qualified person be carried out during all major earthworks including slab removal. All site personnel will be briefed on the potential areas of concern, contamination risks and observations to be made during the works. The engineer shall ensure:

- Observations of all excavations during the works and any potential contamination is noted and addressed in accordance with **Table 6-4**;
- A photographic record is kept during the key stages of the development and key occurrences of the works;
- All contamination observations are addressed in accordance with this Remediation Action Plan; and,
- All of the findings will be reported within the Verification Report.

The procedure for assessing unexpected contamination will be a risk based assessment and will follow the following the procedure outlined in **Table 6-4**. The level of risk assessment will dependant on the identified pollutant linkage and the severity of the unexpected contamination.

Table 6-4 – Flow Chart Showing Procedures for Assessing and Managing Unexpected Contamination



Step	Actions
Identify Pollutant Linkage	Review the Conceptual Site Model to identify any relevant Pollutant Linkages
Conduct Risk Assessment	Undertake a Quantitative Risk Assessment to determine if the level of risk is acceptable
Remediation Options Appraisal	If the level of risk is not acceptable then review the options to select the most cost effective option to either break or remove the pollutant linkage
Determine Remediation Strategy	Finalise and present the Strategy for regulatory approval
Submit to Regulator for approval	In the event that regulatory approval is not obtained then revisit the Remediation Options Appraisal and Remediation Strategy to meet regulatory requirements
Implement Strategy	Implement Remediation in accordance with the agreed strategy
Verification	Undertake verification works and report in a final Validation Report

6.10.3 WATER SUPPLY PIPES

Prior to commencement of the construction works, the statutory water authority should be consulted to determine the most suitable form of water supply pipes. Residual organic contamination is expected within site soils and on this basis ductile iron water supply pipes are likely to be required.

6.10.4 DRAINAGE

Based on the historical nature of the Site, it is understood that attenuation features are proposed in the north-western and south-eastern parts of the Site. In addition to this, the existing balancing pond in the eastern part of the Site will be enlarged as a part of the proposed development.

The Environment Agency should be consulted prior to finalisation of the proposed drainage strategy for the development.

6.10.5 GAS AND VAPOUR PROTECTION

Ground gas risks should be confirmed by subsequent contractors based on the earthworks undertaken on the Site and the final formation levels.

The vapour / gas protection measures should be confirmed with the regulators and this should include details and specification of the specifications, how they will be fitted and the locations in relation to the foundations.

Verification of the vapour / gas protection measures should be undertaken and provided to the regulators prior to the foundation works.

7 ENVIRONMENTAL MONITORING AND CONTROL MEASURES

As part of construction works at the Site there will be a requirement for environmental controls and monitoring.

Typical considerations will focus on perched groundwater, air, noise and vibration and odour. The requirement for detailed information on the methodologies and controls will be detailed in a Construction Environmental Management Plan (CEMP) or Construction Code of Practice document.

7.1 DUST AND PARTICULATES

Dust and particulates can potentially be generated during excavation and haulage activities. In addition, there may be potential asbestos fibres generated during the works.

Detailed information on the methodologies and controls for managing dust and particulates should be outlined within a CEMP prior to commencing works and managed in line with this document during the works.

7.2 VAPOURS AND ODOURS

Vapours and odours are expected to be released during the excavation, transport and treatment of hydrocarbon impacted soil.

An odour implementation plan should be agreed with the regulators prior to commencing works. This document should include the proposed approach to monitor the vapours and odours during the remediation works in order to ensure that risk is managed during the works.

The methodologies and controls for managing vapours and odours should be detailed in a CEMP prior to commencing works and managed in line with this document during the works.

7.3 WATER INGRESS AND CONTROL

It is anticipated that some of the excavations will encounter groundwater (perched or otherwise). Water ingress has the potential to be contaminated and will require management through either dewatering and/or disposal under Duty of Care or discharge via consent to foul sewer. Similarly, buried pipelines or underground structures may contain contaminated liquids. Measures should be taken to ensure that when emptying and/or excavating such structures, contaminated liquids do not contaminate the surrounding soil or other materials or enter groundwater or any surface water feature.

8 HEALTH, SAFETY AND ENVIRONMENTAL CONSIDERATIONS

The health and safety management scheme operated during remediation, earthworks and validation operations should take into account all relevant health and safety documentation, policy and methodology applicable to such works. The works should also comply with the Construction Design Management Regulations (CDM) 2015.

8.1 CONTAMINATION

Construction workers or maintenance staff involved in excavations at the Site will be exposed to concentrations of contamination in soils that are likely to present a low to moderate risk to human health. It will be necessary to ensure that construction workers are adequately protected and that a suitable health and safety management scheme is operated during construction and remediation activities.

As a minimum the health and safety plan should address the following potential health and safety issues:

- Potential for vapours in excavations;
- Dermal contact;
- Ingestion; and,
- Dust and (asbestos) fibre inhalation.

Asbestos was identified in seven sampling locations across the Site. Earthworks and construction contractors should be aware of the potential for asbestos containing materials in soils and be vigilant to its presence. If potential asbestos containing materials are identified during redevelopment professional advice should be sought.

8.2 ENVIRONMENTAL CONTROLS

The Contractor should be responsible for the provision of all necessary environmental controls during the remediation works. These measures will include:

- Protection of surface water drains and catchments of surface run-off to reduce the risk of contaminated run-off and high-suspended solids moving off-site;
- Management of stockpiles of recycled (crushed) construction aggregates and contaminated soils awaiting off-site disposal and/or on-site treatment to minimise the potential for generation of contaminated run-off and dust;
- Use of dust and odour suppression techniques during development to minimise off-site impacts; and,
- Storage of all fuels, oils and chemicals will be stored in appropriate containers within bunded compounds.

Guidelines presented within the Environment Agency document, “Pollution Prevention Guidance 6 – Working at Construction and Demolition Sites” should be adhered to and all relevant licences obtained.

8.3 DECOMMISSIONING OF BOREHOLES

Once the boreholes on the Site are no longer required, they should be decommissioned in line with good practice in order to ensure that no pollutant pathways are created as a part of the proposed development of the Site.

9 VERIFICATION REPORTING

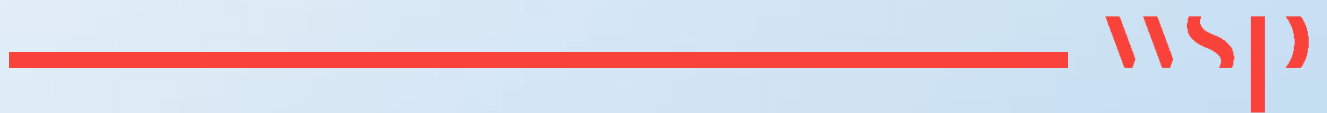
All relevant information shall be collected during the remediation works and a verification report compiled on completion. The report shall take account of the recommendations in LCRM (October 2020) and comprise as a minimum:

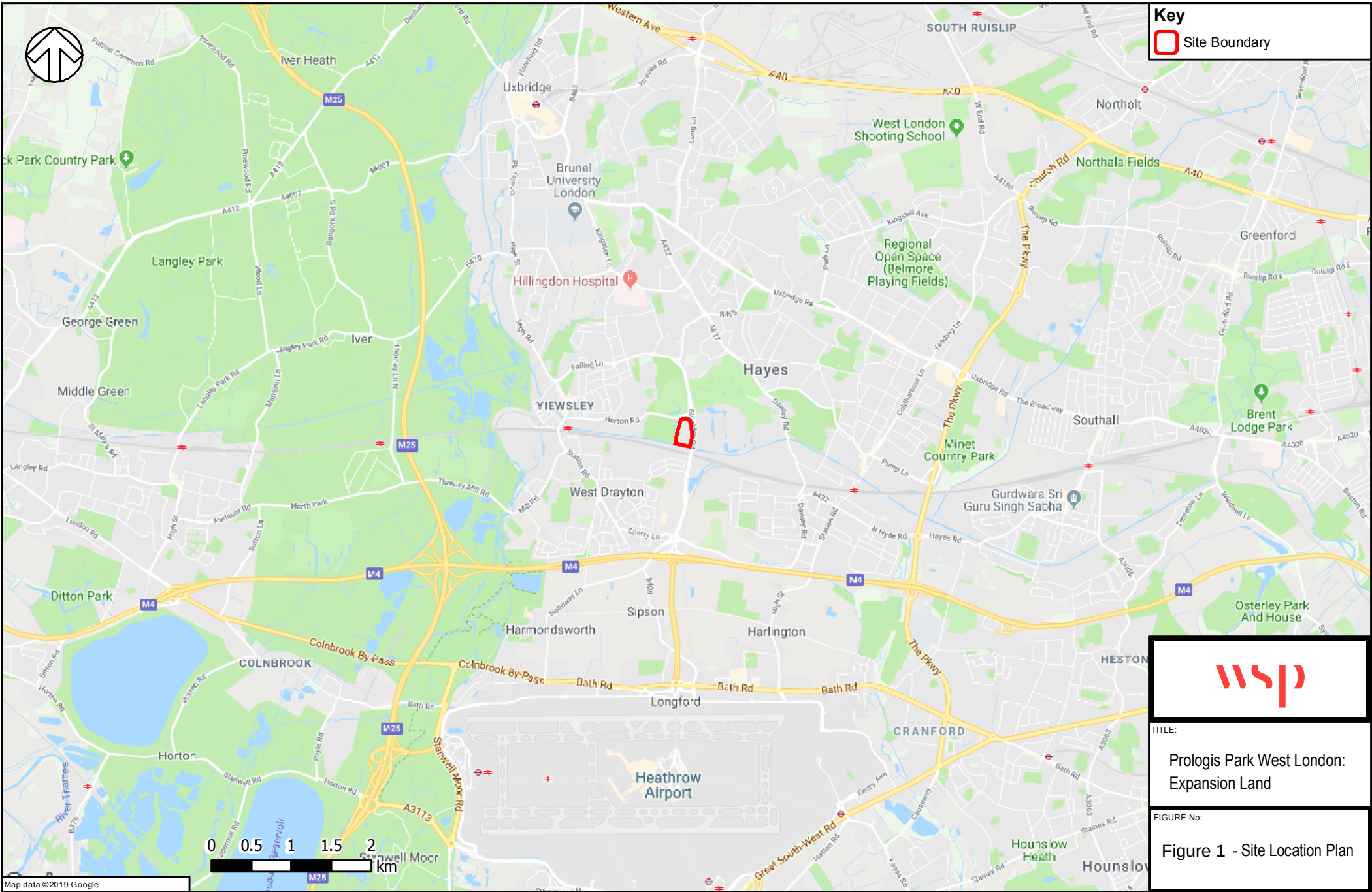
- A summary of the information contained in the risk assessment reports along with the agreed redevelopment strategy and objectives;
- Details of all parties involved in the works;
- Laboratory validation test certificates if unexpected contamination encountered;
- Details and quantities of excavated soils and soils re-used on site or disposed of off Site;
- Records of all earthworks, excavations and sorting including as built drawings, photographs, quantities of materials exported and imported;
- An annotated photographic record showing sides and base of the excavation during the drainage infrastructure works. Photographs should include details of the location and date and as built survey showing the base of excavation;
- Inclusion of information from an asbestos specialist providing a summary of the asbestos removal works completed which as minimum should include Consignment Notes, Air Monitoring Records and an account of the works completed;
- Verification of backfill materials on completion of the enabling works in order to confirm suitability of re-use;
- As built drawings; and,
- Waste classification and management documentation (including consignment note, waste carrier licenses and waste management licence).

It is envisaged that the site Health and Safety File will include all information pertaining to the areas affected by ground contamination.

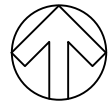
Appendix A

FIGURES & DRAWINGS





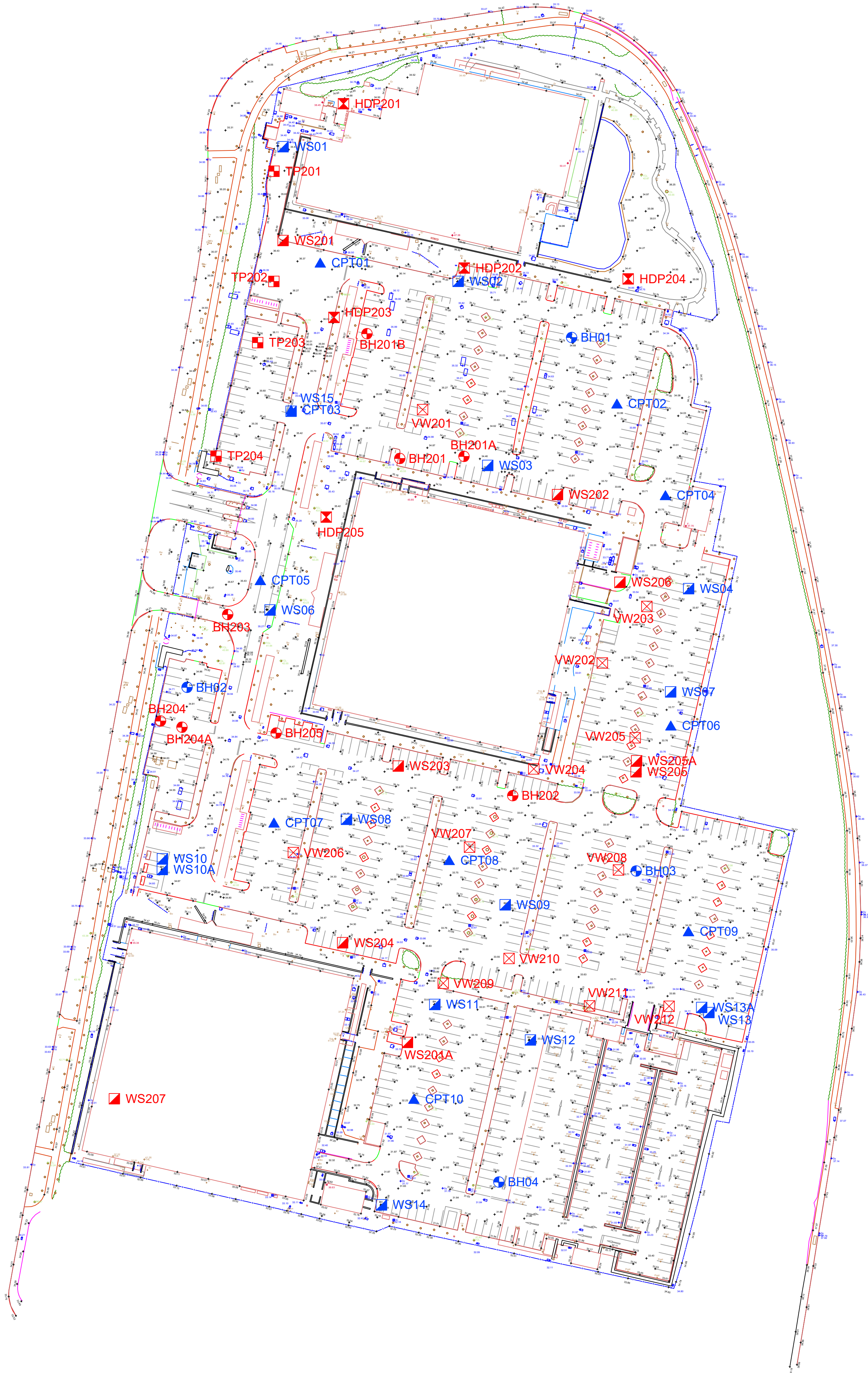




DO NOT SCALE

KEY:

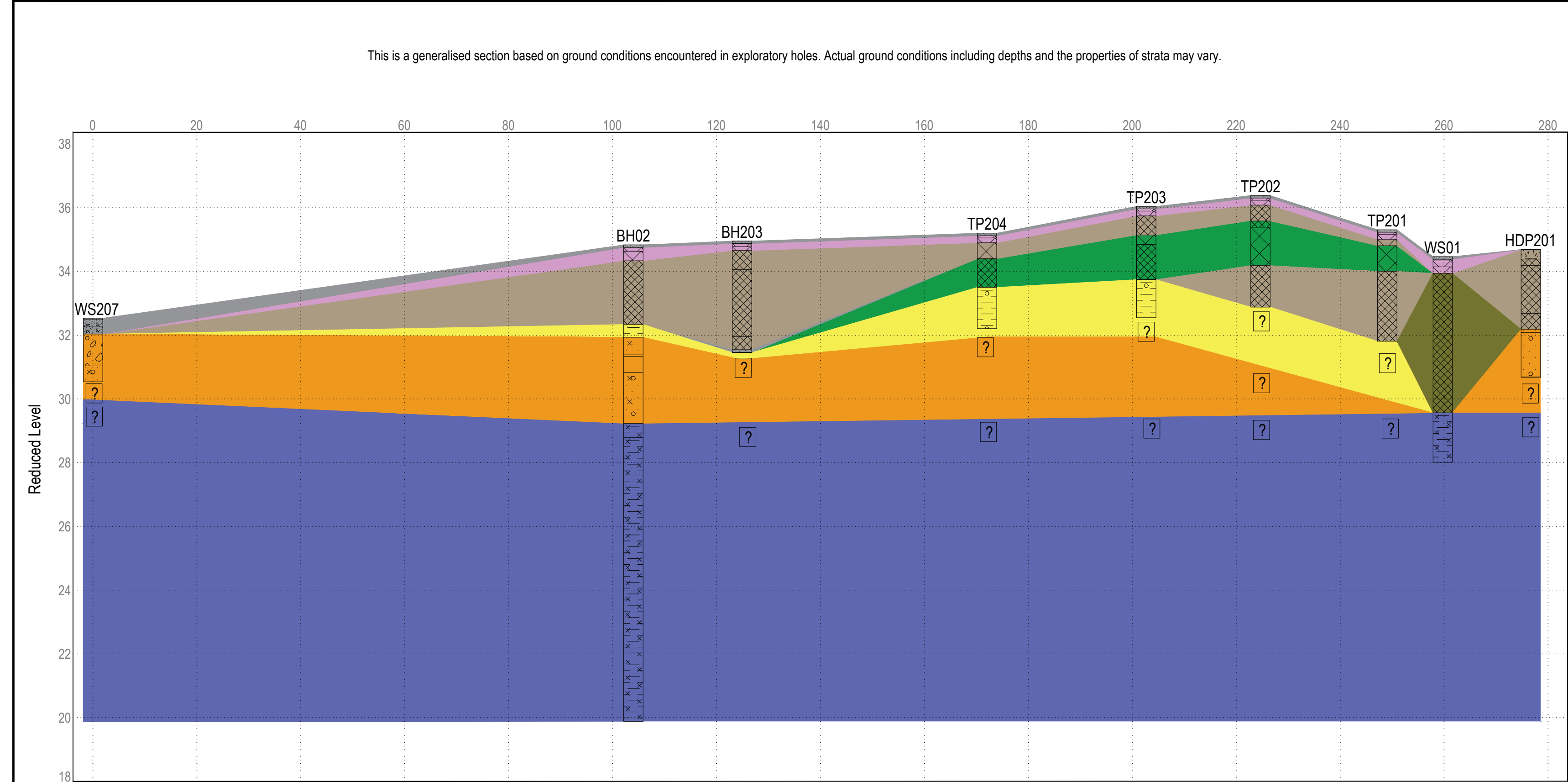
- BH201** 2021 Cable percussion BH
- HDP202** 2021 Hand dug trial pit
- TP201** 2021 Machine dug trial pit
- WS201** 2021 Window sample BH
- VW204** 2021 Vapour well
- BH01** 2019 Boreholes
- WS01** 2019 Window sample BHs
- CPT01** 2019 CPTs



P01	01/01/1901	XXX	FIRST ISSUE	XXX	XXX
VER	DATE	BY	DESCRIPTION	CHK	APP
					
CLIENT: PROLOGIS UK LIMITED					
PROJECT: PROLOGIS PARK WEST LONDON: EXPANSION LAND					
FIGURE TITLE: EXPLORATORY HOLE LOCATION PLAN					
SCALE @ A1: 1:1000	DRAWN: NB	CHECKED: AJ	APPROVED: AJ	PROJECT No: 70077417	OFFICE: Basingstoke
REPORT REF: 70077417-001			FIGURE No: 3		VERSION: DATE: March 21
© WSP UK Ltd					

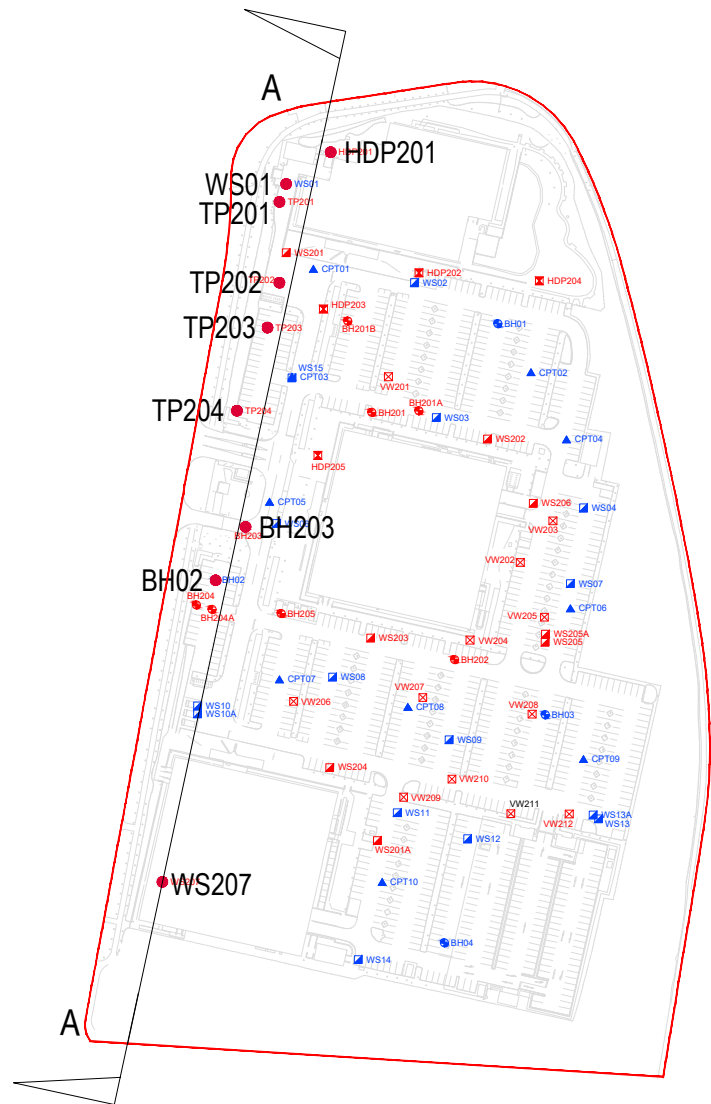
REPRODUCED FROM THE 'ORIGINAL' DRAWING AND WITH THE PERMISSION OF THE CONTROLLER OF HER MAJESTY'S STATIONERY OFFICE. LICENCE No. 100018037. CROWN COPYRIGHT RESERVED.

File name C:\USERS\INDT01667\DESKTOP\FIGURE 4.DWG, printed on Tuesday, March 9, 2021 5:21:22 PM by Tyagi, Devendra



SECTION A A
NTS

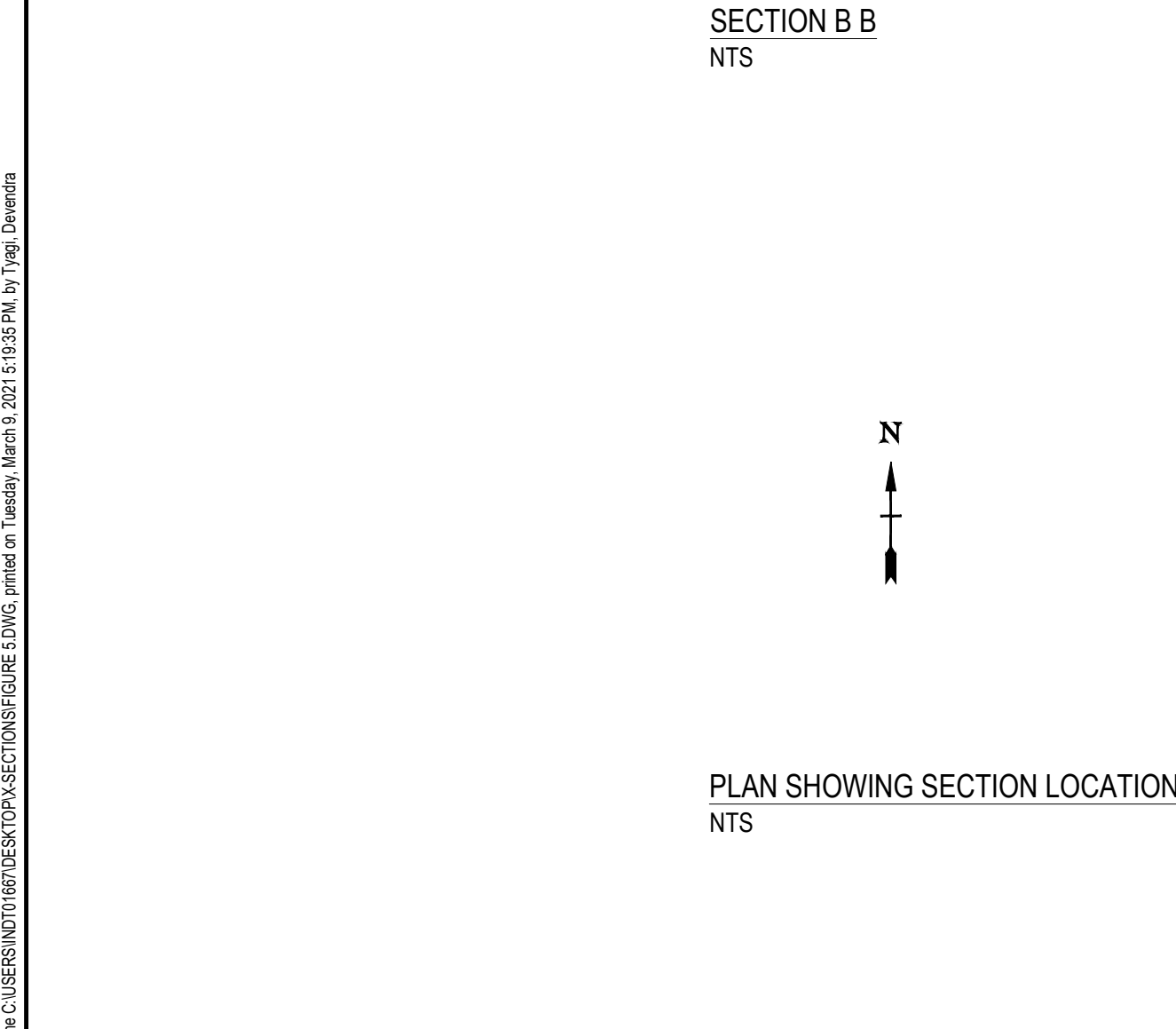
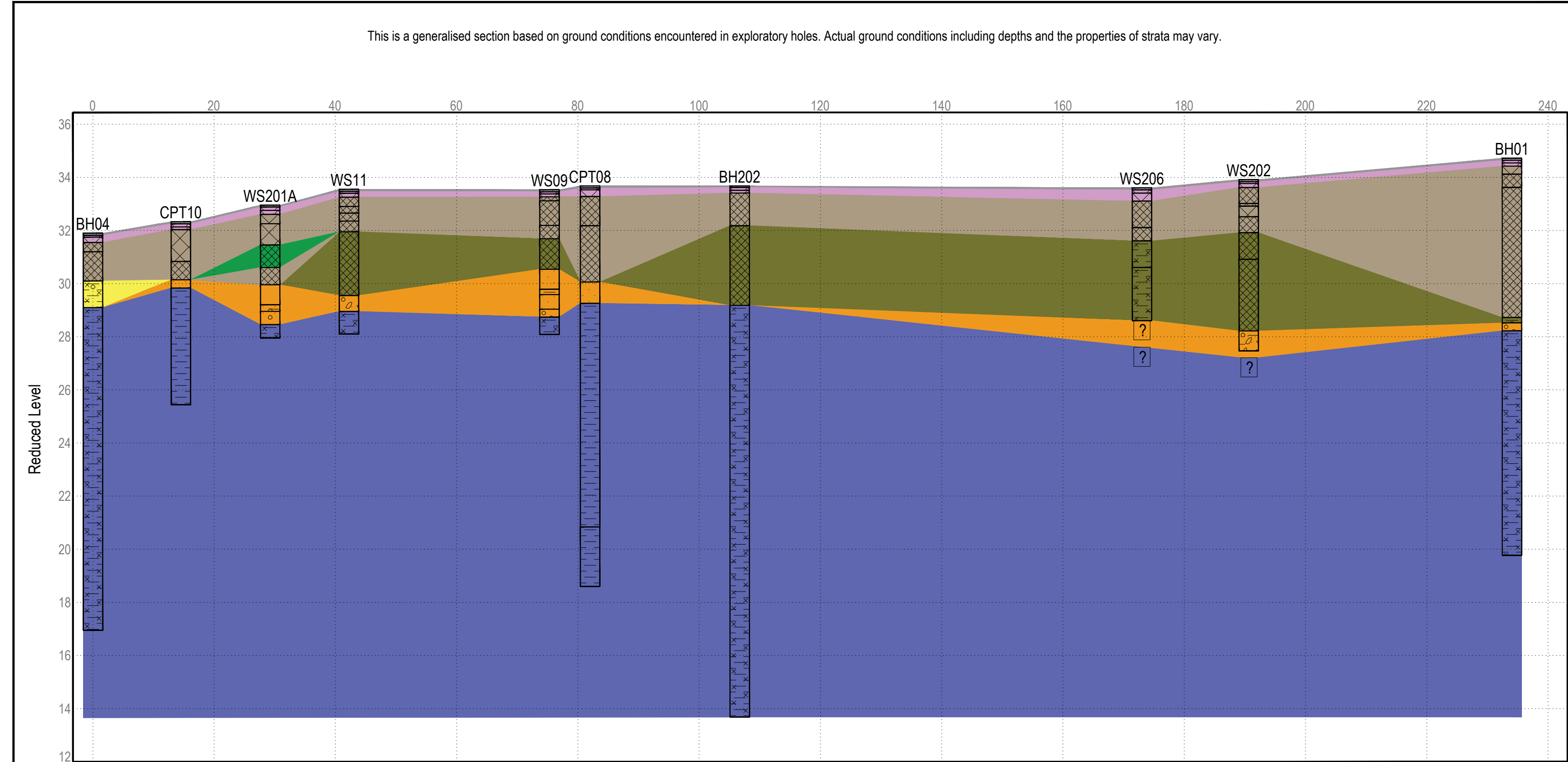
PLAN SHOWING SECTION LOCATION
NTS



Mountbatten House, Basing View, Basingstoke, RG21 4HJ, UK
T+ 44 (0) 1256 318 800, F+ 44 (0) 1256 318 700
wsp.com

CLIENT:				Prologis																											
ARCHITECT:																															
PROJECT:								GSK Stockley Park																							
TITLE:								Subsurface section																							
SCALE @ A2:				CHECKED:				APPROVED:																							
NTS				AJ				AJ																							
PROJECT No:				DESIGNED:				DRAWN:				DATE:																			
70077417								DKT				Mar-21																			
DRAWING No:												FIGURE 4												REV:				P01			
© WSP UK Ltd																															

File name C:\USERS\IND701667\DESKTOP\FIGURE 5.DWG, printed on Tuesday, March 9, 2021 5:19:35 PM, by Tyagi, Devendra



Legends

- Hardstanding
- Made Ground Sub-base
- Made Ground (MG)
- MG- Possible Landfill
- MG- Worked Ground
- Langley Silt Member
- Lynch Hill Gravel Member
- London Clay Formation
- Concrete
- Cohesive Made Ground
- Silty Sand
- Silty gravelly Sand
- Topsoil
- Gravelly Clay
- Granular Made Ground
- Sandy Clay
- No recovery
- Silty Clay
- Gravelly Sand
- Sandy Gravel

P01		XXX	FIRST ISSUE	XXX	XXX
REV	DATE	BY	DESCRIPTION	CHK	APP
DRAWING STATUS: S0 - WORK IN PROGRESS					

Mountbatten House, Basing View, Basingstoke, RG21 4HJ, UK
T+ 44 (0) 1256 318 800, F+ 44 (0) 1256 318 700
wsp.com

CLIENT: Prologis

ARCHITECT:

PROJECT: GSK Stockley Park

TITLE: Subsurface section

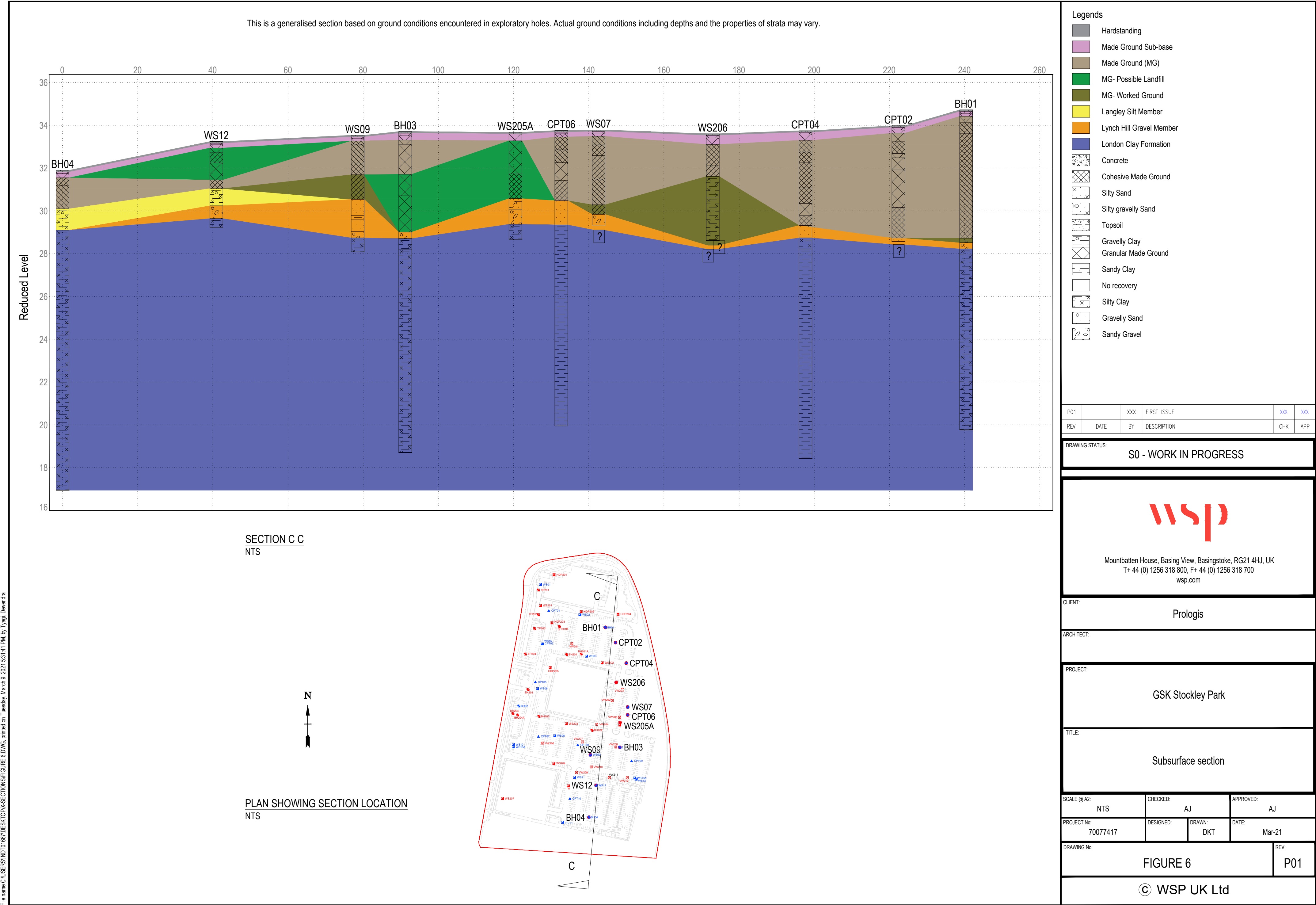
SCALE @ A2:	CHECKED:	APPROVED:
NTS	AJ	AJ

PROJECT No:	DESIGNED:	DRAWN:	DATE:
70077417		DKT	Mar-21

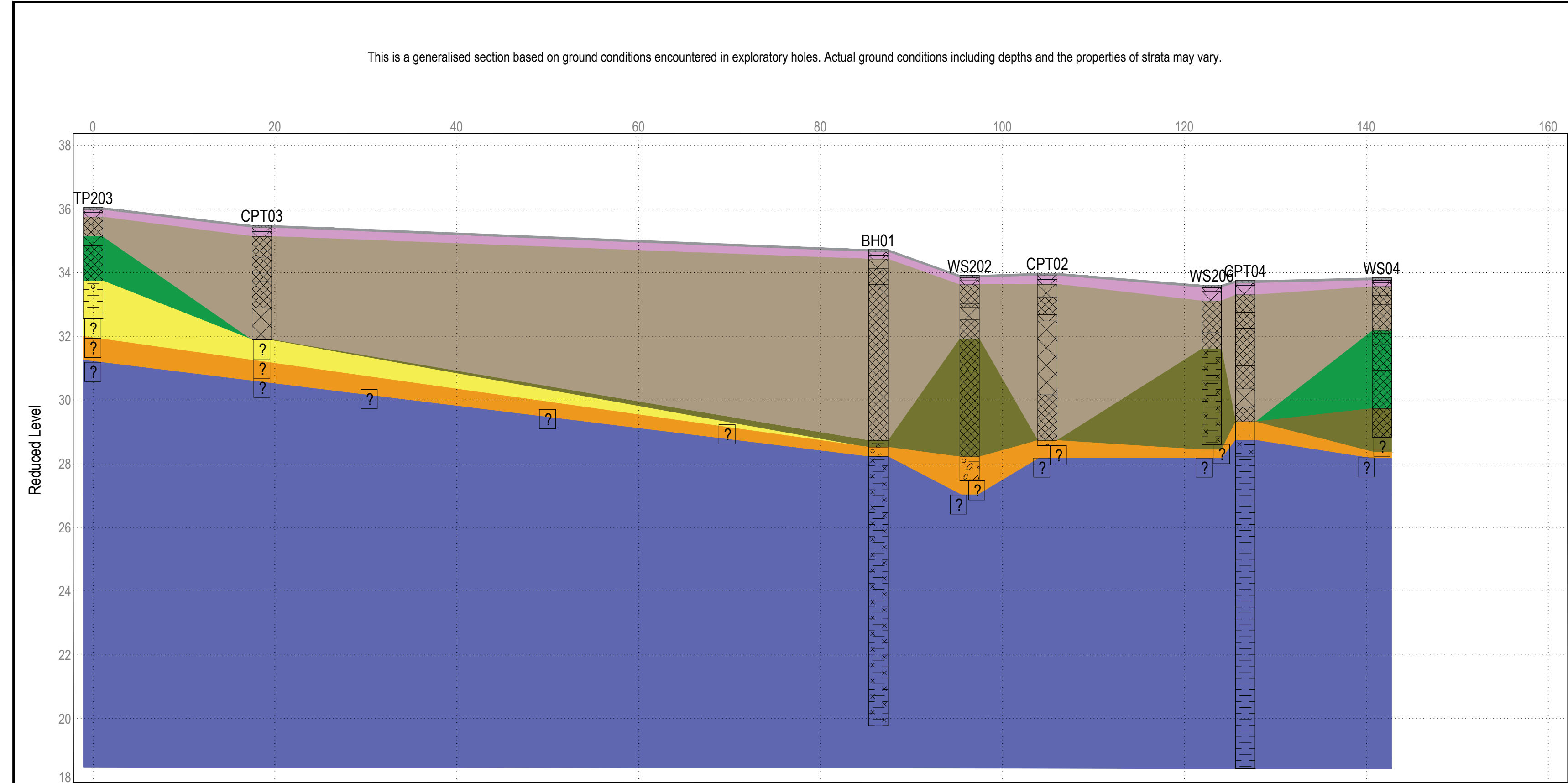
DRAWING No:	REV:
FIGURE 5	P01

© WSP UK Ltd

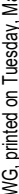
File name C:\USERS\INDT01667\DESKTOP\SECTIONS\FIGURE 6.DWG, printed on Tuesday, March 9, 2021 5:31:41 PM, by Tyagi, Devenendra



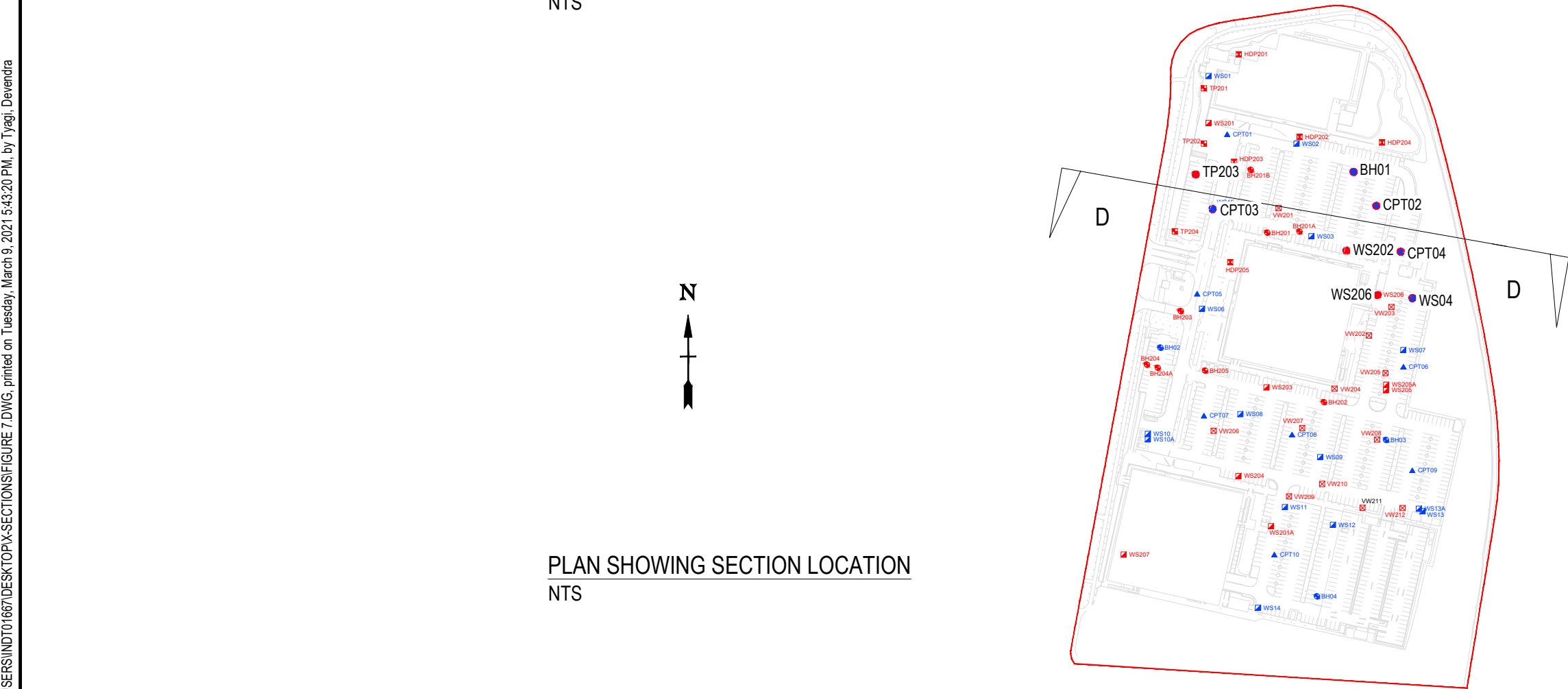
File name C:\USERS\INDT01667\DESKTOP\SECTIONS\FIGURE 7.DWG, printed on Tuesday, March 9, 2021 5:43:20 PM, by Tyagi, Devenendra



SECTION D D
NTS



PLAN SHOWING SECTION LOCATION
NTS



Legends

Hardstanding

Made Ground Sub-base

Made Ground (MG)

MG- Possible Landfill

MG- Worked Ground

Langley Silt Member

Lynch Hill Gravel Member

London Clay Formation

Concrete

Cohesive Made Ground

Silty Sand

Silty gravelly Sand

Topsoil

Gravelly Clay

Granular Made Ground

Sandy Clay

No recovery

Silty Clay

Gravelly Sand

Sandy Gravel

P01		XXX	FIRST ISSUE	XXX	XXX
REV	DATE	BY	DESCRIPTION	CHK	APP

DRAWING STATUS:

S0 - WORK IN PROGRESS

wsp

Mountbatten House, Basing View, Basingstoke, RG21 4HJ, UK
T+ 44 (0) 1256 318 800, F+ 44 (0) 1256 318 700
wsp.com

CLIENT:

Prologis

ARCHITECT:

PROJECT:

GSK Stockley Park

TITLE:

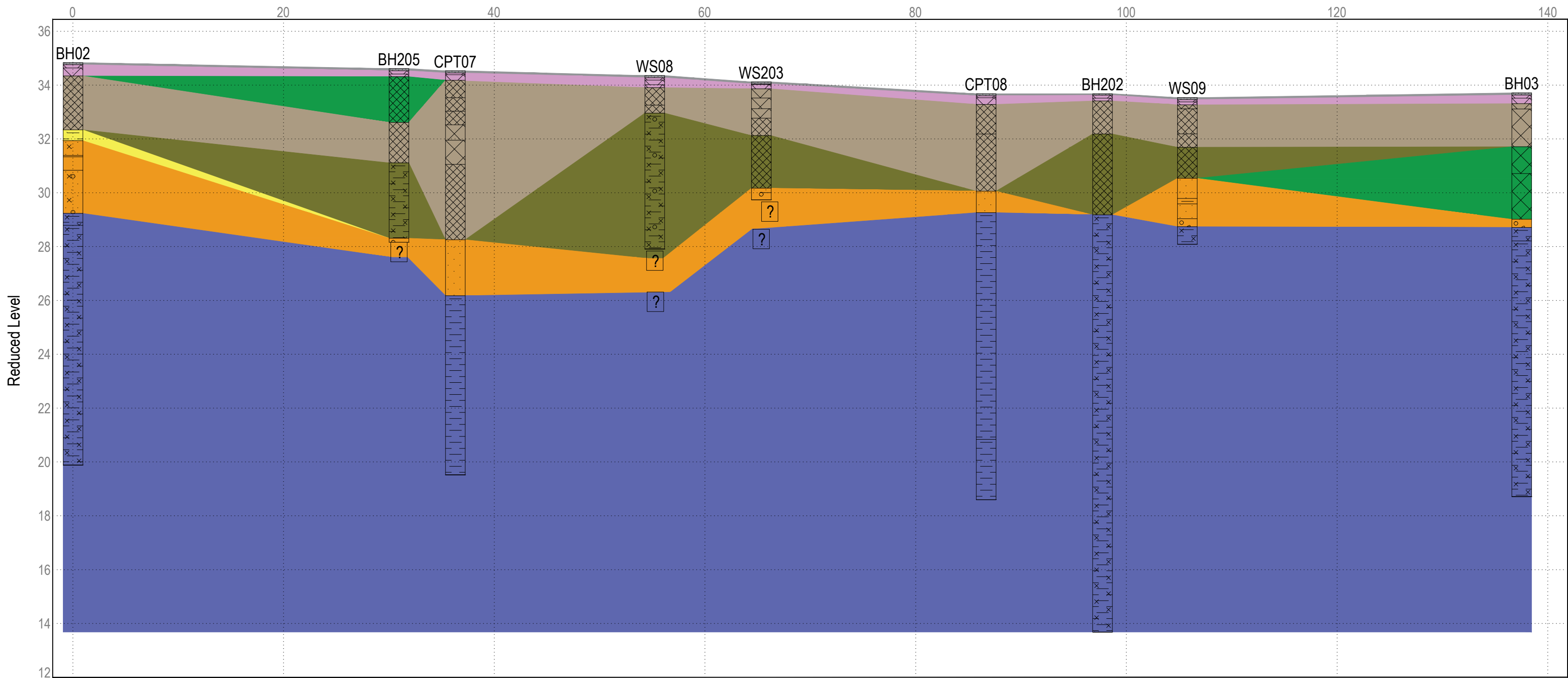
Subsurface section

SCALE @ A2:	CHECKED:	APPROVED:
NTS	AJ	AJ
PROJECT No:	DESIGNED:	DRAWN:
70077417		DKT
DRAWING No:	REV:	
FIGURE 7		
P01		

© WSP UK Ltd

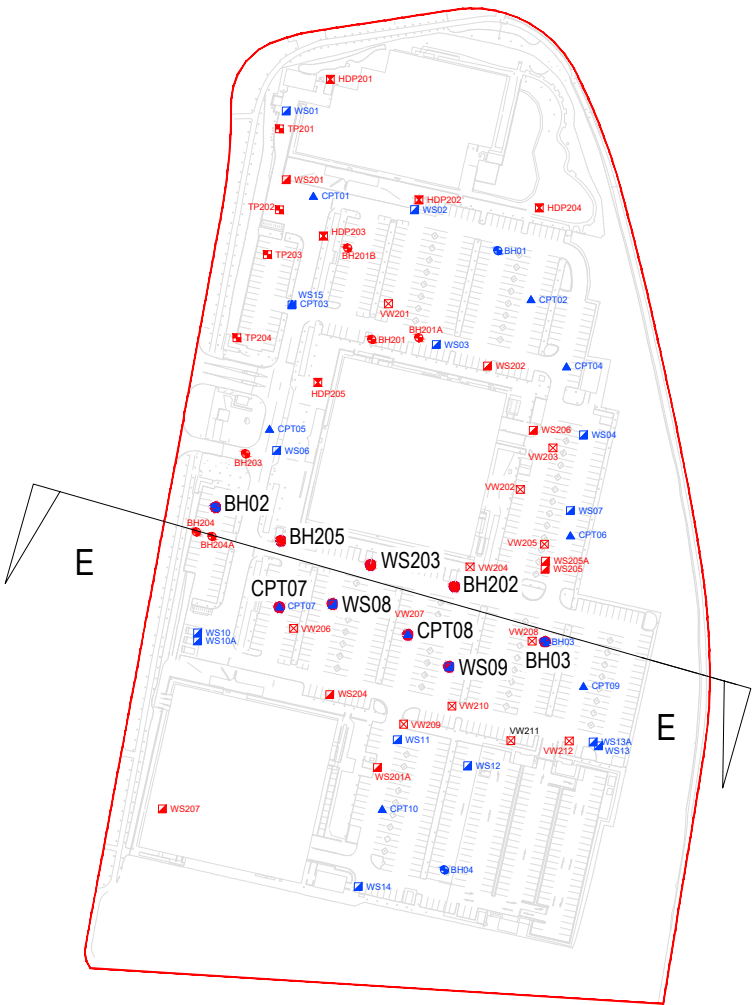
File name C:\USERS\IND701667\DESKTOP\FIGURE 8.DWG, printed on Tuesday, March 9, 2021 5:54:21 PM, by Tyagi, Devenendra

This is a generalised section based on ground conditions encountered in exploratory holes. Actual ground conditions including depths and the properties of strata may vary.



SECTION E E
NTS

PLAN SHOWING SECTION LOCATION
NTS



Legends

- Hardstanding
- Made Ground Sub-base
- Made Ground (MG)
- MG- Possible Landfill
- MG- Worked Ground
- Langley Silt Member
- Lynch Hill Gravel Member
- London Clay Formation
- Concrete
- Cohesive Made Ground
- Silty Sand
- Silty gravelly Sand
- Topsoil
- Gravelly Clay
- Granular Made Ground
- Sandy Clay
- No recovery
- Silty Clay
- Gravelly Sand
- Sandy Gravel

P01		XXX	FIRST ISSUE	XXX	XXX
REV	DATE	BY	DESCRIPTION	CHK	APP

DRAWING STATUS:	S0 - WORK IN PROGRESS
-----------------	-----------------------



Mountbatten House, Basing View, Basingstoke, RG21 4HJ, UK
T+ 44 (0) 1256 318 800, F+ 44 (0) 1256 318 700
wsp.com

CLIENT:	Prologis
---------	----------

ARCHITECT:	
------------	--

PROJECT:	GSK Stockley Park
----------	-------------------

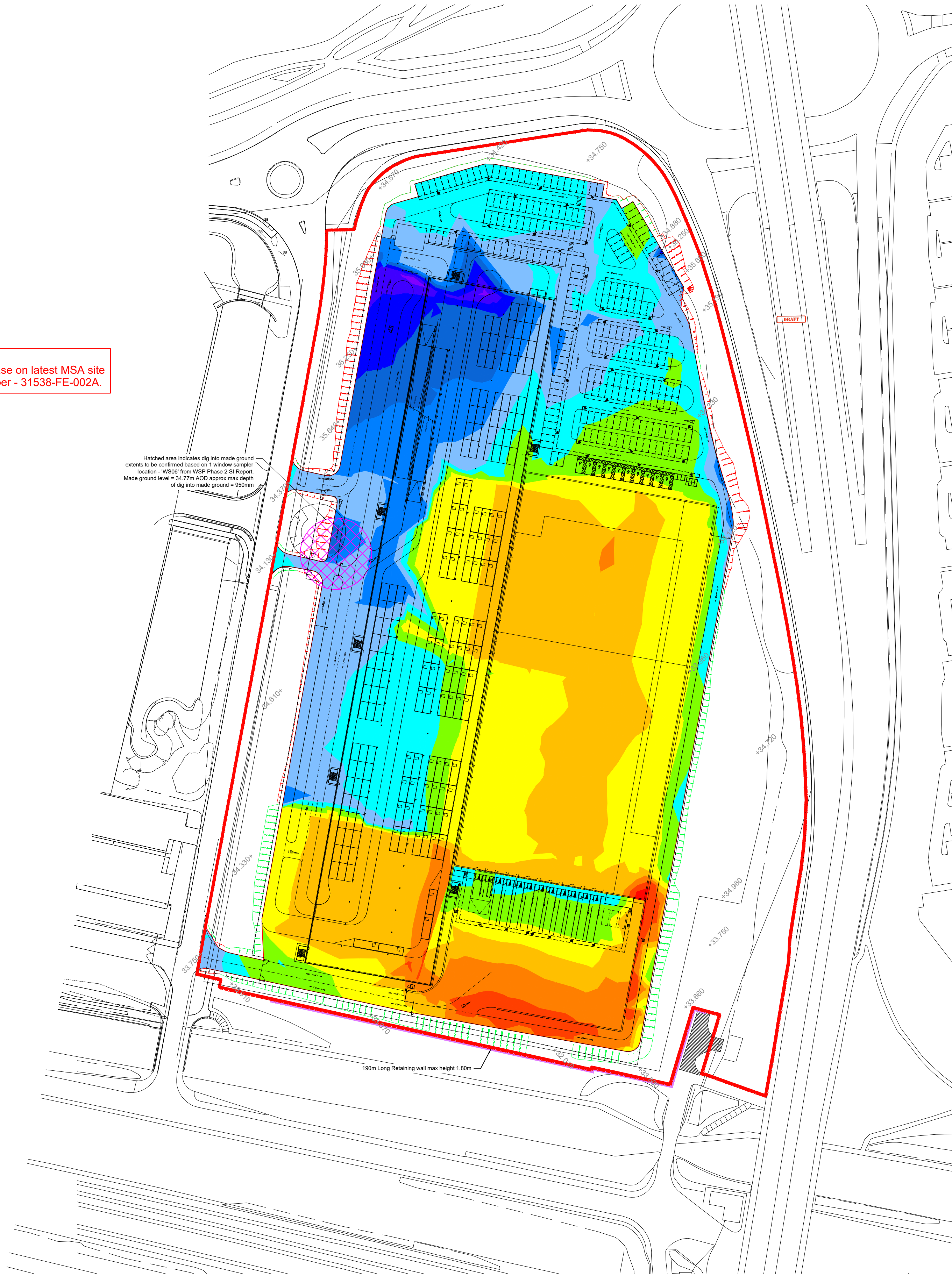
TITLE:	Subsurface section
--------	--------------------

SCALE @ A2:	NTS	CHECKED:	AJ	APPROVED:	AJ
-------------	-----	----------	----	-----------	----

PROJECT No:	70077417	DESIGNED:		DRAWN:	DKT	DATE:	Mar-21
-------------	----------	-----------	--	--------	-----	-------	--------

DRAWING No:	FIGURE 8	REV:	P01
-------------	----------	------	-----

© WSP UK Ltd



Note:
Earthwork analysis base on latest MSA site layout : drawing number - 31538-FE-002A.

Hatched area indicates dig into made ground extends to be confirmed based on 1 window sampler location - W5040 from WSP Phase 2 SI Report. Made ground level = 34.77m AOD, approx max depth of dig into made ground = 950mm

190m Long Retaining wall max height 1.80m

Key :
- Indicates Retaining Wall Max 1.8m High
- Indicates 1 in 3 cut gradient to existing level

SURFACE LEVEL DATA					
NUMBER	MINIMUM LEVEL	MAXIMUM LEVEL	COLOUR	AREA	VOLUME
1	-4.00	-3.50		0.000m2	0.000m3
2	-3.50	-3.00		20.626m2	1.710m3
3	-3.00	-2.50		258.312m2	57.383m3
4	-2.50	-2.00		757.701m2	303.408m3
5	-2.00	-1.50		1711.364m2	931.104m3
6	-1.50	-1.00		2720.435m2	1872.009m3
7	-1.00	-0.50		5978.970m2	4217.916m3
8	-0.50	0.00		7261.000m2	7407.951m3
9	0.00	0.50		4428.895m2	11862.342m3
10	0.50	1.00		9127.402m2	9028.511m3
11	1.00	1.50		10076.046m2	2635.221m3
12	1.50	2.00		1836.245m2	784.726m3
13	2.00	2.50		656.349m2	74.381m3
14	2.50	3.00		21.442m2	1.174m3

Cut

Fill

- © 2021 RPS Group
- Notes
- This drawing has been prepared in accordance with the scope of RPS's appointment with its client and is subject to the terms and conditions of that appointment. RPS accepts no liability for any use of this document other than by its client and only for the purposes for which it was prepared and provided.
 - If received electronically it is the recipient's responsibility to print to correct scale. Only written dimensions should be used.
 - This drawing should be read in conjunction with all other relevant drawings and specifications.

Design Assumptions

- This drawing is based on existing levels taken from GH - 33865_T rev 0. By Greenhatch.
- The Cut and Fill analysis on this drawing is based on the Proposed Finished Floor Levels indicated.
- The Cut and Fill analysis is based on a general construction depth of :
Building Footprint = 775mm**
Service Yard and Access = 515mm
Car Parks and Access = 450mm
** : 325mm Overall floor slab depth used within this earthworks analysis.
450mm piling matt crushed concrete derived from existing superstructure demolition works not included within this earthworks analysis. Total volume required = 12,875m³.
Volume of re-usable arisings from demolition works to be confirmed.
- No allowance has been made for a site strip.
- No bulking factors have been applied to the figures below.
- Maximum water table level (including seasonal variation) = 32.570m AOD, from WSP Phase 2 SI Report. Lowest level in service yard = 33.665 (0.515m construction depth).
- The following allowance has been made for Arising's from Foundations and Drainage for all plots:
Drainage = 5,000m³
Foundations = 3,400m³
- Dock height taken as 1.2m.
- Cut & Fill volumes:

Earthworks Cut = 14,791m³
Drainage Arisings = 5,000m³
Foundation Arisings = 6,500m³

Total cut = 26,291m³
Total Fill = 24,386m³
Net (Surplus) = 1,905m³

P01

First Issue

DRH

MH

08/02/21

Rev

Description

By

Ckd

Date

rps

MAKING
COMPLEX
EASY

Sherwood House, Sherwood Avenue,
Newark, Nottinghamshire, NG24 1QQ
T:01636 605 700 E: rpsnewark@rpsgroup.com

Client

PROLOGIS®

Prologis Park West London
Expansion

Earthwork Volumes
Single Unit

Status

Scale @ A1

Date Created

Preliminary

1:1000

05/08/21

Task Team
Manager

Information
Author

Task Information
Manager

MH

DRH

MH

Document Number

PPWLE-RPS-SI-XX-DR-C-1201

Project Code - Originator - Zone - Level - Type - Role - Drawing Number

RPS Project Number

Suitability

Revision

NK019749

S1

P01

rpsgroup.com

NOTES:

SUBJECT TO STATUTORY CONSENTS

SUBJECT TO SURVEY

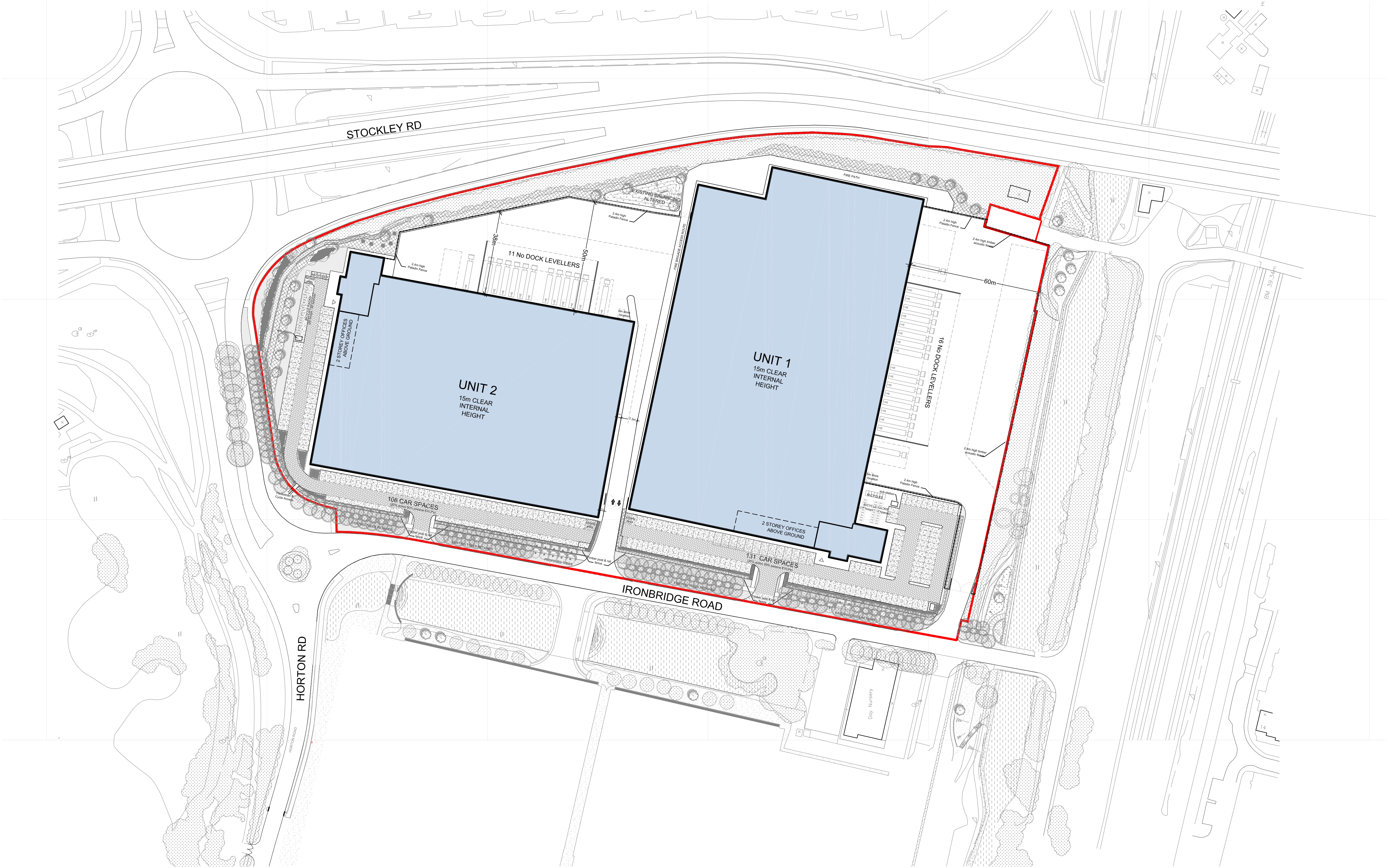
BASED ON OS MAP REPRODUCED BY PERMISSION OF
CONTROLLER OF HM STATIONARY OFFICE (c) CROWN
COPYRIGHT

COPYRIGHT RESERVED

DO NOT USE ELECTRONIC VERSIONS OF THIS DRAWING TO
DETERMINE DIMENSIONS UNLESS SPECIFICALLY
AUTHORISED BY MICHAEL SPARKS ASSOCIATES

IF USING AN ELECTRONIC VERSION OF THIS DRAWING
FIGURED DIMENSIONS TAKE PRECEDENCE AND NOTIFY
MICHAEL SPARKS ASSOCIATES OF ANY DISCREPANCIES

BASED ON GREENHATCH SURVEY
REF: 33865_T_REV 0
DATED: 24.06.19



01
201

SITE LAYOUT
1:1000

B	29.06.20	Landscaping, fencing & bin store locations added.	sd	ss/ms
A	23.06.20	Office areas amended.	sd	ss/ms
REV	DATE	NOTE	DRAW	CHK



CHARTERED ARCHITECTS

11 PLATO PLACE
ST. DIONIS ROAD
LONDON SW6 4TU

TELEPHONE 020 7736 6162
www.msa-architects.co.uk



TITLE

IRONBRIDGE ROAD, HAYES

DRAWING

SITE LAYOUT PLAN

CLIENT

PROLOGIS UK LTD

DATE	SCALE	DRAWN
JUNE 2020	1:1000@A1	PF
	STATUS	CHECKED
	PLANNING	MS/GZ/SD

DRAWING NUMBER

30928-PL-201B

Appendix B

GENERAL LIMITATIONS





REPORT LIMITATIONS - GROUND AND WATER

GENERAL

1. WSP UK Limited has prepared this report solely for the use of the Client and those parties with whom a warranty agreement has been executed, or with whom an assignment has been agreed and outlined in the body of the report.
2. Unless explicitly agreed otherwise, in writing, this report has been prepared under WSP UK Limited standard Terms and Conditions as included within our proposal to the Client.
3. Project specific appointment documents may be agreed at our discretion and a charge may be levied for both the time to review and finalise appointments documents and also for associated changes to the appointment terms. WSP UK Limited reserves the right to amend the fee should any changes to the appointment terms create an increase risk to WSP UK Limited.
4. The report needs to be considered in the light of the WSP UK Limited proposal and associated limitations of scope. The report needs to be read in full and isolated sections cannot be used without full reference to other elements of the report and any previous works referenced within the report.

INTRUSIVE INVESTIGATION REPORTS

Coverage: The following report titles (or combination) may cover this category of work: geo environmental site investigation; geotechnical assessment; GIR (Ground Investigation reports); preliminary environmental and geotechnical risk assessment; and, geotechnical risk register.

5. The investigation has been undertaken to provide information concerning either:
6. The type and degree of contamination present at the site in order to allow a generic quantitative risk assessment to be undertaken; or
7. Information on the soil properties present at the site to allow for geotechnical development constraints to be considered.
8. The scope of the investigation was selected on the basis of the specific development and land use scenario proposed by the Client and may be inappropriate to another form of development or scheme. If the development layout was not known at the time of the investigation the report findings may need revisiting once the development layout is confirmed.
9. For contamination purposes, the objectives of the investigation are limited to establishing the risks associated with potential contamination sources with the potential to cause harm to human health, building materials, the environment (including adjacent land), or controlled waters.
10. For geotechnical investigations the purpose is to broadly consider potential development constraints associated with the physical property of the soils underlying the site within the context of the proposed future or continued use of the site, as stated within the report.
11. The amount of exploratory work, soil property testing and chemical testing undertaken has necessarily been restricted by various factors which may include accessibility, the presence of services; existing buildings; current site usage or short timescales. The exploratory holes completed assess only a small percentage of the area in relation to the overall size of the Site, and as such can only provide a general indication of conditions.

12. The number of sampling points and the methods of sampling and testing do not preclude the possible existence of contamination where concentrations may be significantly higher than those actually encountered or ground conditions that vary from those identified. In addition, there may be exceptional ground conditions elsewhere on the site which have not been disclosed by this investigation and which have therefore not been taken into account in this report.
13. The inspection, testing and monitoring records relate specifically to the investigation points and the timeframe that the works were undertaken. They will also be limited by the techniques employed. As part of this assessment, WSP UK Limited has used reasonable skill and care to extrapolate conditions between these points based upon assumptions to develop our interpretation and conclusions. The assumption made in forming our conclusions is that the ground and groundwater conditions (both chemically and physically) are the same as have been encountered during the works undertaken at the specific points of investigation. Conditions can change between investigation points and these interpretations should be considered indicative.
14. The risk assessment and opinions provided are based on currently available guidance relating to acceptable contamination concentrations; no liability can be accepted for the retrospective effects of any future changes or amendments to these values. Specific assumptions associated with the WSP UK Limited risk assessment process have been outlined within the body or associated appendix of the report.
15. Additional investigations may be required in order to satisfy relevant planning conditions or to resolve any engineering and environmental issues.
16. Where soil contamination concentrations recorded as part of this investigation are used for commentary on potential waste classification of soils for disposal purposes, these should be classed as indicative only. Due consideration should be given to the variability of contaminant concentrations taken from targeted samples versus bulk excavated soils and the potential variability of contaminant concentrations between sampling locations. Where major waste disposal operations are considered, targeted waste classification investigations should be designed.
17. The results of the asbestos testing are factually reported and interpretation given as to how this relates to the previous use of the site, the types of ground encountered and site conceptualisation. This does not however constitute a formal asbestos assessment. These results should be treated cautiously and should not be relied upon to provide detailed and representative information on the delineation, type and extent of bulk ACMs and / or trace loose asbestos fibres within the soil matrix at the site.
18. If costs have been included in relation to additional site works, and / or site remediation works these must be considered as indicative only and must be confirmed by a qualified quantity surveyor.

EUROCODE 7: GEOTECHNICAL DESIGN

19. On 1st April 2010, BS EN 1997-1:2004 (Eurocode 7: Geotechnical Design – Part 1) became the mandatory baseline standard for geotechnical ground investigations.
20. In terms of geotechnical design for foundations, slopes, retaining walls and earthworks, EC7 sets guidance on design procedures including specific guidance on the numbers and spacings of boreholes for geotechnical design, there are limits to methods of ground investigation and the quality of data obtained and there are also prescriptive methods of assessing soil strengths and methods of design. Unless otherwise explicitly stated, the work has not been undertaken in accordance with EC7. A standard geotechnical interpretative report will not meet the requirements of the Geotechnical Design Report (GDR) under Eurocode 7. The GDR can only be prepared following confirmation of all structural loads and serviceability requirements. The report is likely to represent a Ground Investigation Report (GIR) under the Eurocode 7 guidance.



4th Floor
6 Devonshire Square
London
EC2M 4YE

wsp.com

CONFIDENTIAL