



**BROWNFIELD
SOLUTIONS LTD**

GEO-ENVIRONMENTAL ENGINEERING EXCELLENCE

DOMIS CONSTRUCTION LTD

Castle Irwell, Salford (Phase 3)

Phase II Geo-Environmental Assessment Report

AN/C4334/11432

September 2022

EXECUTIVE SUMMARY	
Location and Brief Site Description	The site is located in the area of the former Castle Irwell student village, off Cromwell Road, Salford. The Phase 3 area is currently an open field surfaced in made ground.
Ground Conditions	Generalised ground conditions from the ground investigation comprise (top down): • Made ground encountered from ground level to between 1.00m and 2.20m bgl. • Natural superficial deposits comprising clayey sand with varying amounts of clay and gravel proven to depths between 1.80m and 4.29m bgl. • Solid geology was encountered during the initial site investigation in 2018, comprising of extremely weak sandstone from 2.50m bgl. • Groundwater was encountered at 4.40m bgl at one borehole drilled in 2018 however no groundwater was encountered during the 2018 and 2020 monitoring.
Human Health - Soils Contamination	• No elevated concentrations of contaminants.
Controlled Waters – Surface and Groundwater Contamination	• The risk to controlled waters have been assessed as low.
Ground Gas	Based on the monitoring, the site is classified as Amber 2 under the NHBC traffic light classification system.
Outline Remedial Strategy	Subject to regulatory approval, the following outline remedial strategy is recommended: • A nominal cover layer of clean subsoil/topsoil should be placed in any new areas of soft landscaping. • Ground gas protection measures are required to comply with Amber 2 Classification. • Site specific plan for the management of UXO risk.
Waste	Based on the waste classification database assessment, the made ground and natural soils have been classified as non-hazardous.
Foundations and Floor Slabs	Vibro piled foundations are considered the most suitable foundation option. Estimated axial loads for a single pile of 300mm diameter and 5.00m length are 230kPa.
Concrete Classification	DS1 AC1 conditions prevail.
Highways Design	Superficial Strata CBR – cohesive/fine soils– 2% Superficial Strata CBR – granular/coarse soils– 5% The above should be confirmed by in-situ testing at formation level by a specialist geotechnical engineer during construction.
Sustainable Drainage Systems (SUDS)	Indicative soil infiltration rates range from 2.43*10 ⁻⁶ m/s to 5.33*10 ⁻⁶ m/s.
Further Work	The following further works will be required to progress to the construction phase: • Detailed foundation design by a structural engineer, including foundation zonation plan and depth schedule. • Design of Remedial Strategy and confirmation with the Local Authority /EA / NHBC • Production of Ground Gas Protection Measures Verification Plan. • Production of Materials Management Plan (MMP) under the CL:AIRE DoWCoP, if required. Implementation of the Remedial Strategy and verification of the remedial works.

This executive summary should be read in conjunction with the full report, reference AN/C4334/11432 and not as a standalone document.

PROJECT QUALITY CONTROL DATA SHEET

Site Name:	Castle Irwell, Salford (Phase 3)		
Document Name:	Phase II Geo-Environmental Assessment Report		
Reference:	AN/C4334/11432		
Status:	-	18/10/2022	Final.

Issued By:	Client:	Engineer:
Brownfield Solutions Ltd William Smith House 173 – 183 Witton Street Northwich Cheshire CW9 5LP Tel: 01606 334 844 brownfield-solutions.com	Domis Construction Ltd Unit 2 Block C 14 Hulme Street Salford M5 4ZG	Renaissance Associated Ltd Carvers Warehouse 77 Dale Street Manchester M1 2HG
	Contact: Geoff Danby	Contact: Joe Bullough

Written by:



A Nagi
BSc (Hons)
Graduate Project Engineer

Checked by:



J Mather
BSc (Hons) FGS
Senior Project Engineer

Approved by:



J Jacob
BSc (Hons) CGeol, FGS
Director



CONTENTS

1.0	INTRODUCTION	6
1.1	CONTEXT	6
1.2	PROPOSED DEVELOPMENT	6
1.3	PREVIOUS REPORTS	6
1.4	OBJECTIVES AND SCOPE.....	6
1.5	LIMITATIONS	7
2.0	THE SITE	9
2.1	LOCATION.....	9
2.2	SITE DESCRIPTION	9
3.0	SUMMARY OF PREVIOUS REPORTS	10
3.1	IAN FARMER ASSOCIATES (REF: 42071, APRIL 2017)	10
3.2	DETAILED UXO DESK STUDY	11
4.0	METHOD OF INVESTIGATION	12
4.1	OBJECTIVES.....	12
4.2	SITE WORKS.....	12
4.3	SAMPLING	13
4.4	LABORATORY TESTING.....	13
4.5	MONITORING	14
5.0	GROUND CONDITIONS	16
5.1	SUMMARY	16
5.2	MADE GROUND.....	16
5.3	NATURAL SUPERFICIAL STRATA	16
5.4	OBSERVATIONS	16
6.0	TEST RESULTS	18
6.1	AGGRESSIVE GROUND CONDITIONS – GEOTECHNICAL CHEMICAL TESTING	18
6.2	IN SITU GEOTECHNICAL TESTING	18
6.3	GEO-ENVIRONMENTAL TESTING.....	19
7.0	GEOTECHNICAL ASSESSMENT.....	20
7.1	GROUND MODEL SUMMARY	20
7.2	DESIGN SOIL PARAMETERS.....	20
7.3	FOUNDATIONS.....	21
7.4	BUILDING NEAR TREES	24
7.5	FLOOR SLABS.....	24
7.6	SITE PREPARATION AND CONSTRUCTION	24
7.7	CONCRETE CLASSIFICATION	25
7.8	HIGHWAYS.....	25
7.9	SUSTAINABLE DRAINAGE SYSTEMS (SUDS)	25
7.10	EARTHWORKS.....	26
8.0	GEO-ENVIRONMENTAL RISK ASSESSMENT	27
8.1	INTRODUCTION	27
8.2	SOILS TEST RESULTS AND RISK ASSESSMENT – HUMAN HEALTH	27
8.3	SUMMARY – HUMAN HEALTH RISK ASSESSMENT	27
8.4	WATERS AND LEACHATE TEST RESULTS – CONTROLLED WATERS.....	27
8.5	PERMANENT GROUND GAS AND VAPOURS RESULTS	28
8.6	GROUND GAS RISK ASSESSMENT.....	29
8.7	POTABLE WATER SUPPLY.....	30
8.8	QUALITATIVE RISK ASSESSMENT.....	30

CONTENTS	
8.9	OUTLINE REMEDIAL MEASURES 33
8.10	HEALTH AND SAFETY ISSUES 34
8.11	ASBESTOS 34
9.0	WASTE SOIL CLASSIFICATION & ASSESSMENT 36
9.1	SUMMARY 36
9.2	WASTE CLASSIFICATION PROCEDURE 36
9.3	WASTE CLASSIFICATION AND WASTE ACCEPTANCE CRITERIA (WAC) 37
9.4	OPTIONS ASSESSMENT 38
9.5	RE-USE OF SOILS 38
10.0	CONCLUSIONS 41
10.1	GEO-ENVIRONMENTAL 41
10.2	GEOTECHNICAL 41
10.3	FURTHER WORK 42
11.0	ABBREVIATIONS AND DEFINITIONS 43
12.0	REFERENCES 46

DRAWINGS		
Drawing Number	Rev	Title
21070 (PL) 010 K	K	Proposed Masterplan
C4334/01	-	Site Location Plan
C4334/02	-	Site Features Plan
C4334/03	G	Exploratory Hole Location Plan

APPENDICES	
Appendix	Title
Appendix A	BSL Methodology and Guidance
Appendix B	UXO Preliminary Report
Appendix C	Chemical Testing Results
Appendix D	Geotechnical Testing Results
Appendix E	Monitoring Results
Appendix F	Waste Assessment Report
Appendix G	Exploratory Hole Logs
Appendix H	Soil infiltration Test Results
Appendix I	Water Pipe Risk Assessment

1.0 INTRODUCTION

1.1 Context

This report describes a Phase II Geo-Environmental Assessment carried out by Brownfield Solutions Limited (BSL) for Domis Construction Ltd on a site off Castle Irwell, Salford (for Phase 3) and has been completed in general accordance with the following guidance:

-
- Environment Agency guidance - Land Contamination: Risk Management (LCRM).
 - BS 10175:2011+A2:2017 Investigation of Potentially Contaminated Sites.
 - BS5930: 2015+A1:2020 Code of Practice for Ground Investigations.
 - BS EN 1997-1:2004+A1:2013 Eurocode 7. Geotechnical design. General rules plus UK National Annex.
 - BS EN 1997-2:2007 Eurocode 7 Geotechnical design. Ground investigation and testing plus UK National Annex.
 - NHBC Standards. Chapter 4.1: Land Quality - Managing Ground Conditions.
-

Definitions of terms and acronyms used within this report is presented in Section 11.0.

1.2 Proposed Development

This report relates to Phase 3 of the development which is for residential end use comprising 104 low rise residential dwellings, associated private gardens, highways and areas of POS as shown on the proposed site plan ref. 21070 (PL) 010 Rev K provided to BSL by the client. Separate environmental and geotechnical reports have been produced for previous phases.

The overall proposed development is for a residential end use comprising 367 low rise dwellings with associated private gardens, highways and public open space (POS) areas.

1.3 Previous Reports

The following reports have been produced for the site and should be read in conjunction with this assessment (in date order):

-
- Ian Farmer Associates Ltd, Report on Preliminary Risk Assessment, Contract No. 42071 dated April 2017.
 - BSL, Geo-Environmental Assessment Report, reference DI/C3830/7569, dated July 2018.
 - BSL, Gas Risk Assessment, reference MS/C3830/8016 dated November 2018.
 - 1st Line Defence, Detailed UXO Risk Assessment Report Ref: DA10348-00, January 2020).
 - BSL, Environmental Assessment Report, reference SM/C4334/9117, February 2020.
 - BSL, Geotechnical Assessment Report, reference SM/C4334/9153, March 2020.
 - BSL, Ground Gas Risk Assessment, reference TM/C4334/9316, July 2020.
-

1.4 Objectives and Scope

The objectives of this report are to determine the geo-environmental setting and ground conditions of the site, highlighting potential risks and areas of concern that may govern the development under the current planning regime.

This report has been produced in general accordance with the recommendations for a Tier 2 Generic Quantitative Risk Assessment as described in LCRM guidance. This assessment is also intended to fulfil the requirements of a Ground Investigation Report (GIR) as detailed in BS EN 1997-2:2007.

Following the Phase II Desk Study referenced above, a supplementary intrusive investigation was undertaken to confirm the findings of the preliminary CSM and risk assessment and meet any objectives that had not been satisfied. The supplementary investigation was undertaken using trial pitting, window sampling gas and groundwater monitoring, laboratory chemical and geotechnical testing, with reporting on the findings.

1.5 Limitations

This assessment has been prepared in accordance with the relevant current legislative framework, guidance and risk assessment methodology as outlined in Appendix A. BSL is not liable for any subsequent changes in the guidance and legislation.

The findings and opinions conveyed via this report are based on information obtained from a number of sources as detailed within this report, BSL have assumed this information is correct and reliable. Nevertheless, BSL cannot and does not guarantee the authenticity or reliability of the information it has relied upon.

BSL have used reasonable skill, care and diligence for the investigation of the site and the production of this report. There may be other conditions prevailing on the site which are outside the scope of work and have not been highlighted by this assessment and therefore have not been considered by this report. Responsibility cannot be accepted for such site conditions not revealed by the assessment.

This report has been prepared for the sole use and reliance of the Client, Domis Construction Ltd. No other third parties may rely upon or reproduce the contents of this report without the written permission of Brownfield Solutions Ltd (BSL). If any unauthorised third party comes into possession of this report, they rely on it at their own risk and BSL do not owe them any Duty of Care.

The investigation carried out on the site has been conducted to provide the best information on the ground conditions within site access and budgetary constraints. The inherent variation of ground conditions allows only for definition of the actual conditions at the locations and depths of exploratory locations at the time of the investigation. Different ground conditions may exist that have not been identified within this investigation.

The recommendations in this report assume that ground levels will remain as existing, unless stated otherwise within the report. If there is to be any re-profiling (e.g. to create development platforms or flood defences) then the recommendations may not apply.

The groundwater results described are only representative of the dates on which they were recorded, and levels may vary seasonally (e.g. due to changes in weather).

This assessment has been based on the proposed planning layouts provided. Any subsequent change to the planning layout may have an impact on the validity of recommendations made within this report. Furthermore, new information, changed practices or new legislation may necessitate revised interpretation of the report after the date of its submission.

Although every effort has been made to position exploratory holes in the least sensitive areas of the site, exploratory hole positions were located approximately as part of this investigation and no guarantee can be given as to their accuracy. Consideration should be given to the possibility that exploratory holes excavated as part of this investigation and indeed any previous ground investigation work by others may be encountered beneath or within the influence of individual foundations. BSL cannot be held responsible for structural failures caused by the location of foundations of any form of structure within the influence of exploratory holes.

Where it has not been possible to reasonably use an EC7 compliant investigation technique, a practical alternative has been adopted to obtain indicative soil parameters and any interpretation is based upon engineering experience, local precedent where applicable and relevant published information.

The chemical testing carried out for this report was not scoped to comply with the requirements of the water supply company and further work may be required, unless otherwise stated.

Notwithstanding site observations concerning the presence or otherwise of archaeological issues, asbestos-containing materials (ACM) or invasive weeds (e.g. Japanese knotweed), this report does not constitute a formal survey of these potential issues.

The site plans enclosed in this report should not be scaled off. Any site boundary line depicted on plans does not imply legal ownership of land.

Any recommendations made in this report should be confirmed with the Regulatory Authorities prior to implementation to ensure compliance.

2.0 THE SITE

2.1 Location

The points below relate to the wider development area. The site is located in the area of the former Castle Irwell student village, off Cromwell Road, Salford. It is situated approximately 1.40km north-east of Salford City Centre, centred on National Grid Reference 381880, 400380 as shown on the Site Location Plan, Drawing No. C4334/01.

2.2 Site Description

The main site features and potential issues identified are detailed below and are shown on the Site Features Plan, Drawing No. C4334/02.

Feature	Description
Site Area	The wider site covers approximately 13.9 hectares. The Phase 3 area covers circa 2.2 hectares.
Site Access	Access to the site is gained off Cromwell Street (A576) to the south-east.
Current Land Use and Site Features	The Phase 3 area is currently an open field surfaced in made ground. Previously, the south-west of the phase 3 area was occupied by mature trees, with sporadic overgrown vegetation across the remainder of the area. Hardstanding in the form asphalt and concrete was present across the majority of the Phase 3 area associated with the former student village. Soft landscaping was also present between the concrete slabs associated with the former student village.
Potential Sources of Gross Contamination	• Made ground associated with the previous developments. • Ground gas from Alluvium.
Vegetation	There are sporadic mature/semi-mature trees across the site, including silver birch and ash. A previous report has also identified shrubs, including Buddleia.
Topography	The site is generally flat.
Site Boundaries	The site was surrounded to the south and west by a 2.00m to 2.50m high red brick wall, while palisade fencing was located along the northern and eastern boundaries.
Surrounding Area	The majority of the Phase 3 area is surrounded by Phase 1 of the residential development including the central area of POS, except for the southern boundary that lies adjacent to the Turnstiles Building. The area adjacent to the north-west of the site comprises the site compound for the wider development, and to the north is the Castle Irwell Flood Basin.

3.0 SUMMARY OF PREVIOUS REPORTS

3.1 Ian Farmer Associates (Ref: 42071, April 2017)

This report was commissioned by Renaissance Ltd to assess the former Castle Irwell Student Village. A summary of the relevant points from the above report is presented below:

- A site walkover was undertaken by IFA on 11th April 2017 during the demolition of the site. The site has remained relatively unchanged since the time of the walkover, however BSL's site works has undertaken post demolition and most of the waste described by IFA had been removed by this time.
- Historic mapping indicates that the site remained as agricultural fields up until 1908 where the site comprised the southern half of the Manchester Race Course. The associated stands, judges box and ancillary buildings were located in the west and south of the site, with the remainder comprising the track. Between 1968 and 1980 the site was redeveloped into a student village with associated car parks, pavilion, and playing fields. Further expansion of the student village took place in the west of the site between 1992 and 1994. By 2017 some of the student housing in the west of the site had been demolished.
- The possible sources of contamination identified by the desk study were:
 - Made ground associated with the previous developments.
 - Above ground storage tanks.
 - On-site sub stations.
 - Pollution incident of leaking tank in 1994.
 - Ground gas from Alluvium.
 - Japanese Knotweed, located to the south and south-east adjacent to the existing building.
 - Off-site fuel station.
- The geological map indicates the majority of the site to be underlain by superficial deposits of River Terrace Deposit 1, comprising sand and gravel (Secondary A Aquifer). In the east of the site along the boundary, Alluvium is indicated as present possibly comprising silt, clay and sand with gravel and peat lenses. The superficial deposits are underlain by Chester Pebble Beds Formation, from Sherwood Sandstone Group of Triassic age indicated to be a Principle Aquifer.
- The Envirocheck vulnerability map indicates the soil to be of high leaching potential. Soils of high leaching potential are soils that readily transmit liquid discharges because they are either shallow or susceptible to rapid by-pass flow directly to rock, gravel or groundwater.
- The site is not located within a groundwater source protection zone.
- There are four groundwater abstraction wells within 1km of the site. The nearest is 260m to the west, used for cooling, however the licence is revoked. There are no surface water abstractions within 1km of the site.
- The nearest surface watercourse is the River Irwell, located approximately 8m to the northwest of the site at its closest point.
- The risk from flooding on the site is considered by the Environment Agency to be moderate. The northern boundary comprised flood defence constructed by Environment Agency comprising a series of large reservoirs.
- The site is located within an area designated as a nitrate vulnerable zone.
- A Non-Residential Mining report (ref. 5100140261600) has been obtained from the Coal Authority. Five seams of coal are indicated to have been worked in the past between 420m and 1060m depth. Movements should have ceased and further extraction is unlikely. However, BSL believe the risk associated with previous coal mining is low and no further action is required.
- An electrical substation was located within the central grassed area of the site. The substation comprised brick structure. There was evidence of vandalism of the wiring and transformers. Several shallow trenches were located around the substation possibly indicating theft of underground cables. A strong hydrocarbon odour was noted in this area and there was evidence of damage to the transformers and leakage from them.

3.2 Detailed UXO Desk Study

This report was commissioned to assess the risk from Unexploded Ordnance (UXO) at the former Castle Irwell Student Village. A summary of the relevant points from the above referenced report is presented below:

-
- Records indicate the presence of UXO and UXB on site.
 - The majority of the northern, southern and western areas of the site, as well as two small areas in the eastern sector have been assessed as Medium Risk.
 - The remaining areas are assessed as low risk.
 - The following risk mitigation measures are recommended to support the proposed works on site:
 - UXO Risk Management Plan
 - UXO Specialist on-site support
 - Intrusive Magnetometer Survey of all boreholes and pile locations/cluster down to maximum bomb penetration depth.
 - Site Specific UXO Awareness Briefing to all personal conducting intrusive works.
-

The full UXO preliminary report is presented in Appendix B.

4.0 METHOD OF INVESTIGATION

4.1 Objectives

To confirm the risks to the identified receptors and confirm the ground conditions in respect to the identified geotechnical and geo-environmental risks, an appropriate intrusive investigation was undertaken as per the recommendations of the Phase I Desk Study Assessment.

The aim of the fieldwork was to:

- Further ground conditions on the site and the potential need for detailed investigation.
- Install standpipes to allow future monitoring.
- Assess the potential contamination on the site and obtain samples for contamination screening.
- Assess the potential impact of any contamination on controlled waters.
- Obtain geotechnical information on the ground conditions at the site for preliminary foundation design and preliminary pavement design purposes.
- Give an assessment of the geo-environmental risks associated with redevelopment of the site.

4.2 Site Works

The following site works have been undertaken as part of the initial intrusive investigation within the Phase 3 area between the dates of 23rd to 27th April 2018.

Method	No.	Range Depths (m bgl)	Purpose
Trial pits – JCB 3CX	11	1.50 – 3.30	Establish general ground conditions and gain good coverage.
Window sample boreholes – Tracked WS rig / Rotary rig	2	4.90 – 5.00	Establish general ground conditions on site. Allow Standard Penetration Tests (SPTs) to be carried out and obtain samples for contamination and geotechnical and testing. Installation of ground gas and water monitoring wells.
Infiltration tests	1	1.66 - 2.29	Obtain infiltration rates for drainage design.

The following site works have been undertaken as part of the supplementary intrusive investigation between the dates 17th to 19th August 2022.

Method	No.	Range Depths (m bgl)	Purpose
Trial pits – JCB 3CX	14	0.70 – 4.30	Establish general ground conditions and gain good coverage.
Window sample boreholes – Tracked WS rig	5	2.96 – 4.29	Establish general ground conditions on site. Allow Standard Penetration Tests (SPTs) to be carried out and obtain samples for contamination and geotechnical and testing. Installation of ground gas and water monitoring wells.
Infiltration tests	6	2.40 – 3.20	Obtain infiltration rates for drainage design.

The approximate locations of the exploratory holes are indicated on the Exploratory Hole Location Plan, Drawing No C4334/03 (Rev G). The exploratory hole logs are presented in Appendix G.

The exploratory holes were logged by an experienced geo-environmental engineer in general accordance with the following guidance:

- BS 5930:2015+A1:2020 Code of Practice for Site Investigations.
- BS EN 14688-1:2018 Geotechnical Investigation and Testing – Identification and classification of soil.

As a specialist UXO study, commissioned as part of the 2022 intrusive site investigation, identified a low-medium risk of UXO and order to minimise the risk to operatives during the ground investigation works, all borehole and trial pit locations were scanned with a hand-held magnetometer and all trial pit excavations were supervised by a specialist UXO surveyor.

4.3 Sampling

During the drilling and excavation of the exploratory holes, representative samples were taken at regular intervals to assist in the identification of the soils and to allow subsequent laboratory testing. They were stored and transported in general accordance with BS 10175:2011+A2:2017.

The type of sample was dependent upon the stratum and the purpose of analysis in accordance with current environmental and geotechnical guidance.

The distribution of samples taken across the site as part of the initial intrusive investigation between the dates of 23rd to 27th April 2018 is recorded on the exploratory logs and a summary of the samples taken is presented in the table below:

Type	Number
Environmental (ES)	24
Disturbed (D)	39

The distribution of samples taken across the site as part of the supplementary investigation between the dates of 17th to 19th August 2022 is recorded on the exploratory logs and a summary of the samples taken is presented in the table below:

Type	Number
Environmental (ES)	20
Disturbed (D)	25

4.4 Laboratory Testing

As part of the further assessment for potential contamination of the site, selected samples were taken for the purpose of chemical contamination testing.

The potential contaminative process on site were made ground associated with the previous developments, above ground storage tanks, on-site sub stations and off-site fuel station. Therefore, for the samples taken between the dates of 23rd to 27th April 2018, the following suite of determinands were chosen to screen for potential site impacts at a UKAS approved laboratory:

Determinand	No of Samples
BSL Default Soil Suite: Arsenic, Cadmium, Chromium (III), Chromium (VI), Copper, Nickel, Mercury, Lead, Zinc, Selenium, speciated polycyclic hydrocarbons (PAH 16), water soluble sulphate (2:1 Extract), soil organic matter (SOM) and pH.	6
Asbestos Screen.	5
Waste Acceptance Criteria (WAC).	1

The potential contaminative process on site were made ground associated with the previous developments. Therefore, for the samples taken between the dates of 17th to 19th August 2022, the following suite of determinands were chosen to screen for potential site impacts at a UKAS approved laboratory:

Determinand	No of Samples
BSL Default Soil Suite: Arsenic, Cadmium, Chromium (III), Chromium (VI), Copper, Nickel, Mercury, Lead, Zinc, Selenium, speciated polycyclic hydrocarbons (PAH 16), water soluble sulphate (2:1 Extract), soil organic matter (SOM) and pH.	4
Soil Suite A: Arsenic, cadmium, chromium (total and hexavalent), copper, lead, mercury, nickel, selenium, zinc and pH.	6
Asbestos Screen.	10

The following tests were scheduled on prepared leachate samples at a UKAS approved laboratory:

Determinand	No of Samples
BSL Default Water Suite: Arsenic, Boron, Cadmium, Calcium, Chromium (III), Chromium (VI), Copper, Lead, Mercury, Nickel, Selenium, Zinc, total and free cyanide, speciated polycyclic hydrocarbons (PAH 16), total phenol, sulphate as SO ₄ , sulphide, sulphur, chloride, Ammonium as NH ₄ , Nitrate as N, Nitrate as NO ₃ , Nitrite as NO ₂ , pH, hardness, electrical conductivity, dissolved organic carbon (DOC).	6
NRA Leachate Preparation	6
Asbestos Screen.	6

The Chemical Laboratory Testing Results are presented in Appendix C.

Representative disturbed samples were obtained for all soil types encountered. Selected samples taken between the dates of 23rd to 27th April 2018 were scheduled for testing at an approved laboratory in accordance with BS 1377 'Method of Test for Soils for Civil Engineering Purposes' and BS EN ISO 17892-Parts 1-12:2018 'Geotechnical investigation and testing. Laboratory testing of soil'.

The following tests were scheduled for geotechnical purposes:

Description	No of Samples
Moisture Content	2
Atterberg Limits	2

Representative disturbed samples were obtained for all soil types encountered. Selected samples taken between the dates of 17th to 19th August 2022 were scheduled for testing at an approved laboratory in accordance with BS 1377 'Method of Test for Soils for Civil Engineering Purposes' and BS EN ISO 17892-Parts 1-12:2018 'Geotechnical investigation and testing. Laboratory testing of soil'.

The following tests were scheduled for geotechnical purposes:

Description	No of Samples
PH & Water Soluble Sulphate Content.	4

The Geotechnical Laboratory Testing Results are presented in Appendix D.

4.5 Monitoring

For the initial site investigation between the dates of 23rd to 27th April 2018, ground gas and ground water monitoring standpipes were installed in 2 boreholes in the phase 3 area and subsequently 6 monitoring visits were undertaken out of 6 proposed as part of the current scope between the dates of 17th May to 18th October 2018, in line with the recommendations of CIRIA C665. The same boreholes were also monitored 6 times out of the proposed 6 between dates of 4th February to 7th May 2020.

For the supplementary site investigation between the dates of 17th to 19th August 2022, continuous ground gas monitoring clams were installed in 3 boreholes and have subsequently monitored ground gas every hour from 23rd August to 15th September 2022 as part of the current scope in line with the recommendations of CIRIA C665.

The original gas monitoring was undertaken using a GFM 436 infrared gas meter with integral electronic flow analyser.

Flow measurements on each standpipe (l/hr) were taken. Measurements of the percentage volume in air (%v/v) of oxygen (O₂), carbon dioxide (CO₂) and methane (CH₄) were recorded in addition to the percentage Lower Explosive Limit (%LEL) of methane (Note: 100% LEL equates to 5% by volume), the atmospheric pressure (mb) and average temperature during the visit (°C).

Standpipes were constructed in general accordance with the relevant guidance. A summary of the installation construction is presented in the table below for the initial site investigation between the dates of 23rd to 27th April 2018:

Location	Internal Diameter Pipe	Response Zone (m bgl)	Targeted Strata	Purpose
WS106	35mm PVC	1.00 – 3.00	Natural Strata	Ground Gas and Ground Water
WS107	35mm PVC	0.50 – 1.00	Made Ground	Ground Gas and Ground Water

The gas monitoring visits recorded peak and steady state conditions. Peak results are those that occur on opening the valve on the borehole tap. Steady state conditions are those that occur a period of time afterwards when the initial (accumulated) gases have been purged from the borehole.

Standpipes were constructed in general accordance with the relevant guidance. A summary of the installation construction is presented in the table below for the supplementary site investigation between the dates of 17th to 19th September 2022:

Location	Internal Diameter Pipe	Response Zone (m bgl)	Targeted Strata	Purpose
WS401	50mm HDPE	2.00 – 2.96	Natural Strata	Ground Gas
WS403	50mm HDPE	1.83 – 3.83	Natural Strata	Ground Gas
WS404	50mm HDPE	1.00 – 2.00	Made Ground	Ground Gas

The full ground gas monitoring results are presented in Appendix E of this report.

5.0 GROUND CONDITIONS

5.1 Summary

A brief summary of the ground conditions encountered in the supplementary site investigation dated between the 17th and 19th August 2022 is presented in the table below:

Stratum	Range Depths - Top (m bgl)	Range Depths - Base (m bgl)	Range Thickness' (m)	Brief Description
Made Ground	0.00	1.00 – 2.20	1.00 – 2.20	Clayey gravelly SAND (with rootlets). Gravel of brick, chert and mudstone.
Natural Superficial Strata	1.00 – 2.20	1.80 - 4.29	1.80 - 4.29	Gravelly/ clayey SAND and locally soft to firm gravelly/ sandy CLAY

Details are provided in the logs in Appendix G and the individual strata are described in the sections below.

5.2 Made Ground

Made Ground – General

Made ground was encountered within all the exploratory holes across the site and was observed from ground level to depths between 1.00m and 2.20m bgl, generally comprising dark brown slightly clayey sand with occasional rootlets and varying proportions of gravel and clay.

Brick walls and concrete slabs associated with previous developments were encountered within the southern part of the site within the trial pits.

5.3 Natural Superficial Strata

The natural strata underlying the site was generally clayey sand with varying amounts of clay and gravel as minor constituents. This is interpreted to represent Alluvium and River Terrace Deposits.

Soft clay was encountered in discrete isolated areas at the following depths and locations within the clayey gravelly sand:

Location	Depth (m)	Strata
TP406	1.50-3.40	Soft slightly sandy gravelly CLAY
TP409	15.20-16.60	Soft sandy CLAY

5.4 Observations

Contamination

During the works undertaken by BSL, observations for both visual and olfactory evidence of contamination were undertaken.

With the exception of clinker observed as a minor constituent in the made ground soils, no other evidence of contamination was observed at the site.

Stability of Excavations/Boreholes

The sides of the trial pits were generally stable however spalling of the natural strata was observed in WS404 and TP407A.

Excavation was generally easy to moderate throughout the site with the exception of TP407 where a concrete slab was encountered at 0.70m bgl. A concrete slab was also encountered at SA408 at 1.20m bgl. These holes were terminated at these depths respectively.

The stiff nature of the clay across the site proved difficult to excavate at depth, giving the window sample rig refusal at depths between 2.96m and 4.29m bgl.

The borehole sidewalls were generally stable and window sampling progressed without the need to install casing.

6.0 TEST RESULTS

6.1 Aggressive Ground Conditions – Geotechnical Chemical Testing

Plasticity Index Analysis

Plasticity index results ranged between 10% and 21% indicating cohesive soils to be of low to medium plasticity. Associated liquid contents ranged between 33% and 42%.

After modification of particle size in accordance with NHBC Chapter 4.2 the modified plasticity indices are in the range 10% to 20.6% indicating the cohesive soils to be of low to medium volume change potential.

The test results for the assessment of aggressive ground conditions are presented in Appendix D. The results are summarised and assessed within Section 8.0 of this report.

6.2 In Situ Geotechnical Testing

In Situ Hand Shear Vane Tests

Three hand shear vane tests were carried out on suitable cohesive soils recovered from the trial pits. Each shear vane result recorded represents the mean value of three tests undertaken at the specified depth.

The results and distribution of the hand shear vane tests are recorded in kPa on the Exploratory Hole Logs which are presented in Appendix G.

In Situ Standard Penetration Tests

Standard Penetration Tests (SPTs) were carried out within the window sample and cable percussive boreholes at regular 1.0m to 1.5m intervals. The results of the individual blows and the N-values are recorded on the Exploratory Hole Logs in Appendix G.

All SPT N values are uncorrected. Density and strength descriptors are reported in accordance with the guidelines stated in BS 5930:2015+A1:2020, incorporating requirements of BS EN ISO 14688-1:2002, BS EN ISO 14688-2:2004 and BS EN ISO 14689-1:2003.

Soil Infiltration Test Results

Soil infiltration test tests were undertaken within trial pits at seven locations across site, a summary of the results is presented in the table below. These were carried out in general accordance with BRE Digest 365 (BRE 2016) where infiltration rates allow three test runs during a working day (or where there is no infiltration), but where low infiltration rates were encountered the available time may not have been sufficient to fully comply with the BRE test method.

Where less than three tests were possible in a particular location the results provided should be considered as indicative only. Further discussion concerning the suitability of infiltration testing at the site is provided in Section 7.0.

Location	Stratum Type	Depth (m)	Infiltration Rate (m/sec)
			Test 1
SA04	Silty Clayey SAND	2	3.73x10 ⁻⁶
SA401	Gravelly Clayey SAND	2.5	2.43x10 ⁻⁶
SA402	Gravelly Clayey SAND	2.4	3.90x10 ⁻⁶
SA403	Gravelly Clayey SAND	3	5.33x10 ⁻⁶
SA405	Gravelly Clayey SAND	2.2	4.77x10 ⁻⁶
SA407	Gravelly Clayey SAND	2.6	1.57x10 ⁻⁶
SA409	Gravelly Clayey SAND	2.4	7.93x10 ⁻⁶

The full test results are presented in Appendix H.

6.3 Geo-Environmental Testing

Chemical Laboratory Testing

The chemical test results for soils and leachates are presented in Appendix C. The results are summarised and assessed within Section 8.0 of this report.

Photo-Ionisation Detection (PID) Monitoring - Soils

PID head space monitoring was undertaken on all environmental soil samples taken during the ground investigation at the site, the results are recorded on the exploratory hole logs.

All of the samples tested recorded PID results of between 0.0ppm and 0.1ppm, indicating that no significant volatile vapour contamination was present.

Ground Gas Monitoring

Gas clam installations have recorded the ground gas levels every hour from 23rd August to 15th September 2022 in three boreholes.

Two boreholes from the original ground investigation were installed within the phase 3 area to monitor ground gas and ground water and subsequently 6 out of 6 monitoring visits were completed between the dates of 17th May and 18th October 2018 and 4th February to 7th May 2020. The results are presented in Appendix E and are summarised and assessed within Section 8.0 of this report.

7.0 GEOTECHNICAL ASSESSMENT

7.1 Ground Model Summary

The site is currently an unoccupied area of the wider Castle Irwell construction site.

The ground conditions can be summarised as below (top down):

-
- Made ground generally comprising dark brown slightly clayey sand with occasional rootlets and varying proportions of gravel from ground level to between 1.00m and 2.20m bgl.
 - Natural superficial deposits comprising clayey sand with varying amounts of clay and gravel proven to depths between 1.80m and 4.29m bgl.
-

Obstructions were found in some soakaway pits, making them unsuitable for infiltration testing. An old water pipe was found in SA404. Concrete slabs were encountered in SA408 and TP407. A brick footing was encountered in SA404A and SA406.

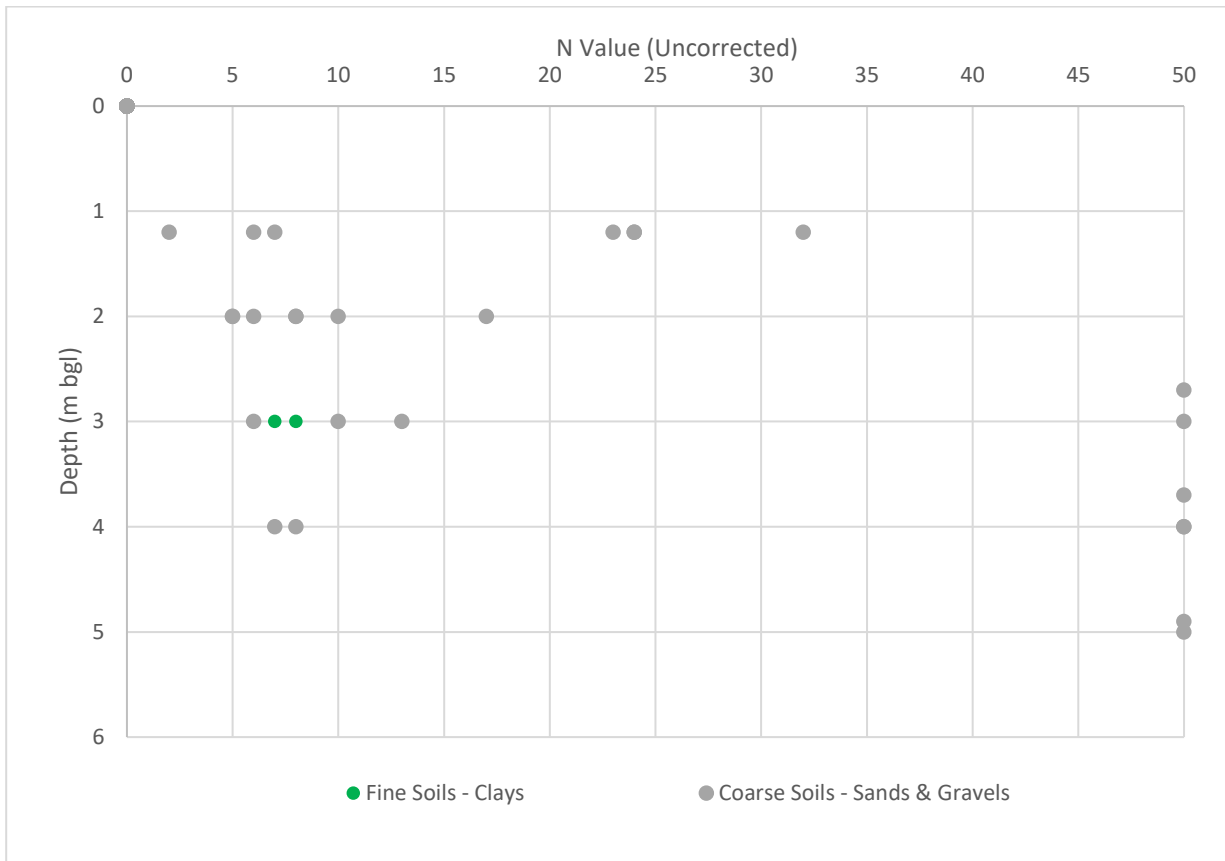
7.2 Design Soil Parameters

The relevant test results from the prior section have been evaluated to derive geotechnical soil parameters for the site in the following section.

For cohesive (fine) soils, the equivalent approximate undrained shear strengths (C_u) and equivalent approximate coefficients of volume compressibility (m_v) have been calculated from the recorded SPT N values, adopting f_1 and f_2 values respectively, based on the correlation of Stroud (1975) and the 'average' plasticity.

The angle of shearing resistance (ϕ') of the granular (coarse) soils has been derived from the uncorrected SPT N value data and the correlation of Peck (1967).

A depth vs SPT N value graph is provided separately for the granular soils, which was encountered across the whole phase 3 area.



The above graph indicates a more consistent profile of granular soils' density with depth; soils are mostly loose with dense soils at lower depths.

7.3 Foundations

The development is of residential end use comprising 104 low rise residential dwellings, associated private gardens, highways and areas of POS and is considered to be classed as Geotechnical Category 2 in accordance with Eurocode 7.

Based on the proposed development, the presence of made ground in typical shallow foundation depths, and the relatively loose nature of the shallow natural granular soils, the use of shallow foundations is not be considered suitable.

A possible suitable option is considered to be piles extending through the made ground and superficial deposits end bearing on the dense sands and weathered sandstone which was observed to depths of between 2.60m and 5.60m bgl from the initial investigation in 2018, and depths of 2.96m to 4.29m bgl during the supplementary investigation of 2022.

Driven pre-cast concrete piles, bored piles with the use of casing or continuous flight auger (CFA) piles are all considered potentially suitable piling solutions for this site.

Piles should be extended through the made ground and the superficial deposits. Depending on the structural loadings and design requirements, piles will likely utilise a combination of skin friction and end bearing resistance, transferring the majority of the load to the underlying competent sandstone bedrock. Piles should extend a minimum of five pile diameters into the bearing stratum to fully mobilise end-bearing resistance and shaft resistance.

The choice of piling system and the detailed design of piles are beyond the scope of this report and should be undertaken by a piling specialist.

Based on the available information at the site, preliminary calculations were undertaken for a single 300mm wide square concrete pile approximately 5.00m in length would give an allowable load of 230kN. Higher allowable loads could be achieved by increasing the diameter of the piles or by using pile groups. Where bedrock is shallow, it may be such that piles would need to be 'socketed' into bedrock, which will likely also pre-determine the method of pile installation.

Information gained from this ground investigation should be assessed by an experienced piling contractor such that appropriate piles are selected and designed given the site conditions that have been encountered.

In accordance with Eurocode 7 it would be prudent to verify the compressive resistance of the strata and the pile design should be by static load testing on working piles 1.5 times the characteristic load on more than 1% of working piles. This will provide an accurate strength of the end bearing stratum.

Discussions should be made with the piling contractor regarding the suitability of driven piles due to the levels of disruption to any adjacent residential and commercial properties, particularly given the phased nature of the development. CFA piles are likely to be a suitable alternative to driven piles to reduce noise levels, although there will be additional costs associated with disposal of excess soils.

The piling work should be undertaken in accordance with BS EN 12699:2015 'Execution of Special Geotechnical Work - Displacement piles', and also relevant standards associated with manufacturing the piles.

Prior to the commencement of piling works, a working platform will be required for tracked plant. This should be designed and installed in accordance with BR470 (BRE 2004) based on the plant requirements, data and rig loadings.

Whilst detailed design is beyond the scope of this report, the following should be taken into consideration during the detailed design stage by a suitably competent contractor/engineer:

- Piles should extend a minimum of five pile diameters into the bearing stratum to fully mobilise end-bearing resistance and shaft resistance.
- Higher allowable loads than those listed in the table above could be achieved by increasing the diameter of the piles or by using pile groups.
- Obstructions in the ground (e.g. relict foundations) could cause piles to stop shallower than their anticipated design depth, or deviate from the vertical, therefore reducing their capacity.
- As groundwater was observed during the boring of the intrusive holes and monitoring, temporary casing may be required for bored piles.
- Bored piles through coarse soils will likely result in loosening, with resultant reduced shaft friction.
- The potential effects of negative skin friction on piles due to recently placed made ground/fill / deposits should be considered.
- Discussions should be made with the piling contractor regarding the suitability of driven piles due to the levels of disruption to the adjacent residential and commercial properties.
- CFA piles are likely to be a suitable alternative to driven piles to reduce noise levels, although there will be additional costs associated with disposal of excess soils.
- The piling work should be undertaken in accordance with BS EN 12699:2015 'Execution of Special Geotechnical Work - Displacement piles', and also relevant standards associated with manufacturing the piles.
- In accordance with Eurocode 7 it would be prudent to verify the compressive resistance of the strata and the pile design should be by static load testing on working piles 1.5 times the characteristic load on more than 1% of working piles. This will provide an accurate strength of the end bearing stratum.

Ground improvement

Alternatively, a ground improvement foundation option can be utilised for the proposed development.

After the removal of former structures and in order to restrict the potential for differential settlement of the proposed structure, ground improvement by vibro stone columns (VSCs) could be considered to provide a suitable platform for the development. This will create a stiffened layer which will help to spread the building loads and thus minimise differential settlement. Further guidance is provided in BRE 391 "Specifying vibro stone columns".

The vibro stone columns would need to penetrate through the made ground and underlying any soft cohesive natural strata, down to a competent horizon.

Following ground improvement, pad foundations could be used bearing onto the improved ground over the VSCs. Typically, allowable bearing capacities of the order of 150kN/m² – 200kN/m² can be achieved, keeping total and differential settlements within tolerable limits, although this should be discussed with specialist VSC contractors. Alternatively, a raft foundation could be used to distribute the structural loads across a stiffened granular layer, with installed columns acting as "rigid inclusions".

Other forms of ground improvement may be possible, such as surcharging, although this would require detailed specification, design of a suitable monitoring programme and careful analysis.

UXO

Based on the available information to date, specialist UXO advice and/or supervision will be required for all groundworks, including piling.

Piling Risk Assessment

A risk assessment is likely to be necessary for piling and/or the installation of VSCs, as there is a possibility that this could lead to creation of new pathways for migration of contamination.

7.4 Building Near Trees

The clay soils on site are of low to medium volume change potential. Where foundation excavations (or piles if adopted) encounter cohesive strata in the vicinity of existing, proposed or recently removed trees, foundations should be adjusted in full accordance with NHBC Standards Chapter 4.2 and BRE 298. All foundations should be deepened below roots of greater than 5mm diameter during excavations for footings.

A survey of all trees and hedges on the site and within influencing distance of the site boundary should be undertaken to identify tree species and heights by a qualified arboriculturist in accordance with BS 5837:2012. This information will be required in order to assess the effects of trees on the cohesive strata.

Where foundation depths due to trees already present or recently removed exceeds 1.50m there is a possibility for heave to occur on removal of the tree and guidance states that compressible material or void former is required against the inside face of the foundation.

Where foundations are constructed on clay soils within the influencing distance of trees including proposed planting, the upper section of the pile (to the recommended minimum founding depth) should be sleeved or overbored to allow for clay volume change. Bored, cast-in-place piles are well suited to counteracting heave. Driven piles are less well suited to counteracting heave and are difficult to install in stiff desiccated clay without excessive noise and vibration.

7.5 Floor Slabs

Given the thickness of made ground and the presence of ground gas at the site, suspended floor slabs should be adopted at the site in accordance with NHBC standards.

Where foundation depths due to trees already present exceeds 1.50m there is a possibility for heave to occur on removal of the tree. NHBC Guidance states that either a precast concrete floor, a suspended timber or in-situ concrete floor must be used. We recommend the former, the required void size for beneath floor slabs on this site is 200mm.

7.6 Site Preparation and Construction

Topsoil and subsoil should be removed from beneath all buildings and hardstanding areas.

It is understood that all services will have been disconnected and any suspected dead services should be confirmed as dead by testing.

Collapsing of the trial pit and window samples sides was observed in the natural strata and temporary shoring maybe required. Otherwise the foundation excavations will be significantly wider than anticipated and costs will be incurred for additional volumes of concrete.

Excavation depths should generally be readily achieved using conventional plant (JCB or similar) although high specification plant (tracked 360o or similar) is recommended to maintain the build programme. Breaking equipment will also be required locally to penetrate old foundations associated with former construction, cobbles and boulders in the made ground strata, hardstanding and intact rock quality strata.

Based on the available information to date, specialist UXO advice and/or supervision will be required for all groundworks.

Groundwater was encountered only in one borehole during the 2018 initial site investigation in WS107 at 4.40m bgl. The majority of the exploratory holes did not encounter groundwater during the site

investigations, therefore are unlikely to be encountered within likely excavation depths. Further guidance is provided in CIRIA C750 "Groundwater Control: Design and Practice". It should be noted that groundwater levels will vary seasonally and the timing of construction may influence requirements.

7.7 Concrete Classification

The soluble sulphate and Ph test results have been assessed in accordance with BRE Special Digest 1 "Concrete in aggressive ground" 2005.

For the purposes of this assessment, the natural strata is considered to be relatively permeable, therefore the groundwater has been classed as mobile. Made ground was encountered during the investigation, therefore the characteristic values are based on the available testing which has been carried out in both the natural soils and made ground.

The characteristic value for water soluble sulphate is 51.5 mg/l and the characteristic pH is 6.9, indicating relatively neutral conditions.

Based on the above, the results of laboratory pH and sulphate content, alongside the BRE full suite tests, indicate that sulphate class DS-1 and ACEC Class AC-1 conditions prevail in accordance with BRE Special Digest 1 "Concrete in aggressive ground" 2005.

The specific concrete mixes (the Design Concrete Class) to be used on site will be determined by the site-specific concrete requirements in terms of the durability and structural performance. These are assessed in terms of the Structural Performance Level (SPL) and any need for Additional Protective Measures (APM) detailed in Part D of BRE Special Digest 1 with further guidance in Pt E and F.

7.8 Highways

Based on Table 5.1 from DMRB IAN 73/06 Rev 1 equilibrium CBR values of 5% are likely to be achieved in undisturbed natural granular soils and 2% for natural clays soils for pavement design purposes, unless proven otherwise by in-situ testing at formation level by a specialist geotechnical engineer. Equilibrium CBR values are likely to be 2% within the made ground.

Where the CBR is found to be less than 2%, the sub-grade is unlikely to be suitable for both the trafficking of site plant and as a permanent highway foundation without improvement of the soils.

To achieve the required design CBR value, improvement works should be carried out in accordance with DMRB IAN 73/06 Rev 1 Chapter 5 and may include proof rolling, excavation and re-engineering / replacement of weaker soils, the inclusion of a geogrid or use of stabilisation techniques such as the addition of hydraulic binders (e.g. cement/lime).

Based on the fines content of the soils, they are considered to be frost susceptible, therefore highway construction should be a minimum thickness of 450mm to mitigate against the risk.

Care should be taken to ensure the stratum at formation level is protected against inclement weather, as this is likely to lead to surface deterioration and a decrease in soils strengths.

7.9 Sustainable Drainage Systems (SUDS)

In accordance with CIRIA C753 "The SUDS Manual", infiltration viability should be given full consideration where rates of 10^{-6} m/s or greater exist on the site. Where rates are less than this value, the soils can still usefully be used for interception delivery, but disposal of significant volumes of run-off may not be appropriate unless a large area is available, or some form of attenuation can be incorporated.

Therefore, based on the rates obtained, SUDS are potentially suitable at the site. However, none of the tests were BRE 365 compliant. We recommend the design of infiltration drainage is carried out in accordance with BRE 365 and CIRIA C753. Consideration should also be given to future maintenance, where infiltration capacity can be reduced as a result of blinding through ingress of fines.

If drainage to soakaways is to be considered, it is suggested that this is discussed with the Local Authority at the earliest opportunity, to confirm the adequacy of proposed testing and to allow their inspection of any test results.

7.10 Earthworks

Given the variability of existing site levels and development layout requirements, earthworks will be required in order to achieve the desired development platform levels. In addition, the risk from flooding on the site is considered to be moderate. The northern boundary comprises a flood defence constructed by the Environment Agency and flood risk will need to be taken into consideration when setting final levels.

Any fill should be placed in accordance with an appropriate specification, discussed further below. Designs should allow for incorporation of suitable drainage to prevent the build-up of pore water pressure which could lead to instability.

An initial assessment reveals spoil resulting from excavations within the made ground and superficial deposits should generally be suitable for re-use as general fill subject to further testing and specification or may be disposed offsite. Grossly contaminated soils (e.g. hydrocarbon impacted soils) may require extensive treatment before they become geotechnically suitable. Alternatively, they could be disposed offsite to a suitably licenced facility.

Where it is proposed to re-use site won materials as an engineered fill, it will be necessary to develop an appropriate Earthworks Specification. The basis for the Specification should be BS 6031:2009 and the latest version of the SHW, Series 600 Earthworks. Note testing for earthworks was not within the scope of the investigation, but is recommended.

If site-won material is to be re-used on site, it is recommended this is carried out under the CL:AIRE Development Industry Code of Practice (DoWCoP CL:AIRE March 2011).

8.0 GEO-ENVIRONMENTAL RISK ASSESSMENT

8.1 Introduction

The samples were tested for an assessment of the chemical contamination that may pose a risk to human health. The results were examined with reference to a selection of guidance documents as detailed in Appendix A. In this case the LQM/CIEH S4ULs and DEFRA C4SLs for a residential end use with homegrown produce as Tier 1 generic screening values.

The apparent exceedance of the relevant screening value is taken as indicating further detailed assessment or remedial action is required.

A summary assessment sheet is presented in Appendix C alongside the chemical test results. Results are discussed in detail in the sections below.

8.2 Soils Test Results and Risk Assessment – Human Health

Metals

No metals have been detected above the adopted screening criteria.

Asbestos

No asbestos has been detected in any of the ten samples screened.

Poly Aromatic Hydrocarbons (PAHs)

No PAHs have been detected above the adopted screening criteria.

Total Petroleum Hydrocarbons (TPH CWG)

No petroleum hydrocarbons have been identified above the adopted screening criteria.

BTEX and MTBE

No BTEX or MTBE compounds have been identified above the adopted screening criteria.

Volatile Organic Compounds (VOCs)

No VOCs have been identified above the adopted screening criteria.

Semi - Volatile Organic Compounds (SVOCs)

No SVOCs have been identified above the adopted screening criteria.

8.3 Summary – Human Health Risk Assessment

Based on the testing and assessment undertaken, there are no determinands above the relevant assessment criteria and mitigation measures will not be required in respect to soils.

8.4 Waters and Leachate Test Results – Controlled Waters

No groundwater was encountered in the borehole installations; therefore leachate tests were undertaken as an alternative.

Six samples were scheduled for leachate analysis. They were then compared to Environmental Quality Standard (EQS) values where no EQS is given then UK drinking water standards (DWS) have been used.

All the metals were below the relevant EQS value or DWS.

8.5 Permanent Ground Gas and Vapours Results

Results of the previous gas monitoring done in the phase 3 area in 2018 and 2020 are summarised in the table below:

	CH ₄ (%)		CO ₂ (%)		O ₂ (%)		CO (ppm)		H ₂ S (ppm)		Steady Flow (l/hr)	
	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max
Peak	0.1	0.2	0.2	5.9	12.3	23.1	0.1	0.1	0.1	0.1	0.1	0.2
Steady	0.1	0.2	0.1	5.5	12.5	23.9					0.1	0.1

Gas clams continuously recorded the ground gas hourly from the 23rd of August to 15th September 2022. Results are summarised in the table below:

WS401	CH ₄ (%)	CO ₂ (%)	O ₂ (%)	CO (ppm)	H ₂ S (ppm)	TVOC (ppm)
	Max	Max	Max	Max	Max	Max
Steady	0.3	7.2	20.4	0	0	0

WS403	CH ₄ (%)	CO ₂ (%)	O ₂ (%)	CO (ppm)	H ₂ S (ppm)	TVOC (ppm)
	Max	Max	Max	Max	Max	Max
Steady	0.1	4.8	21.1	1	0	2

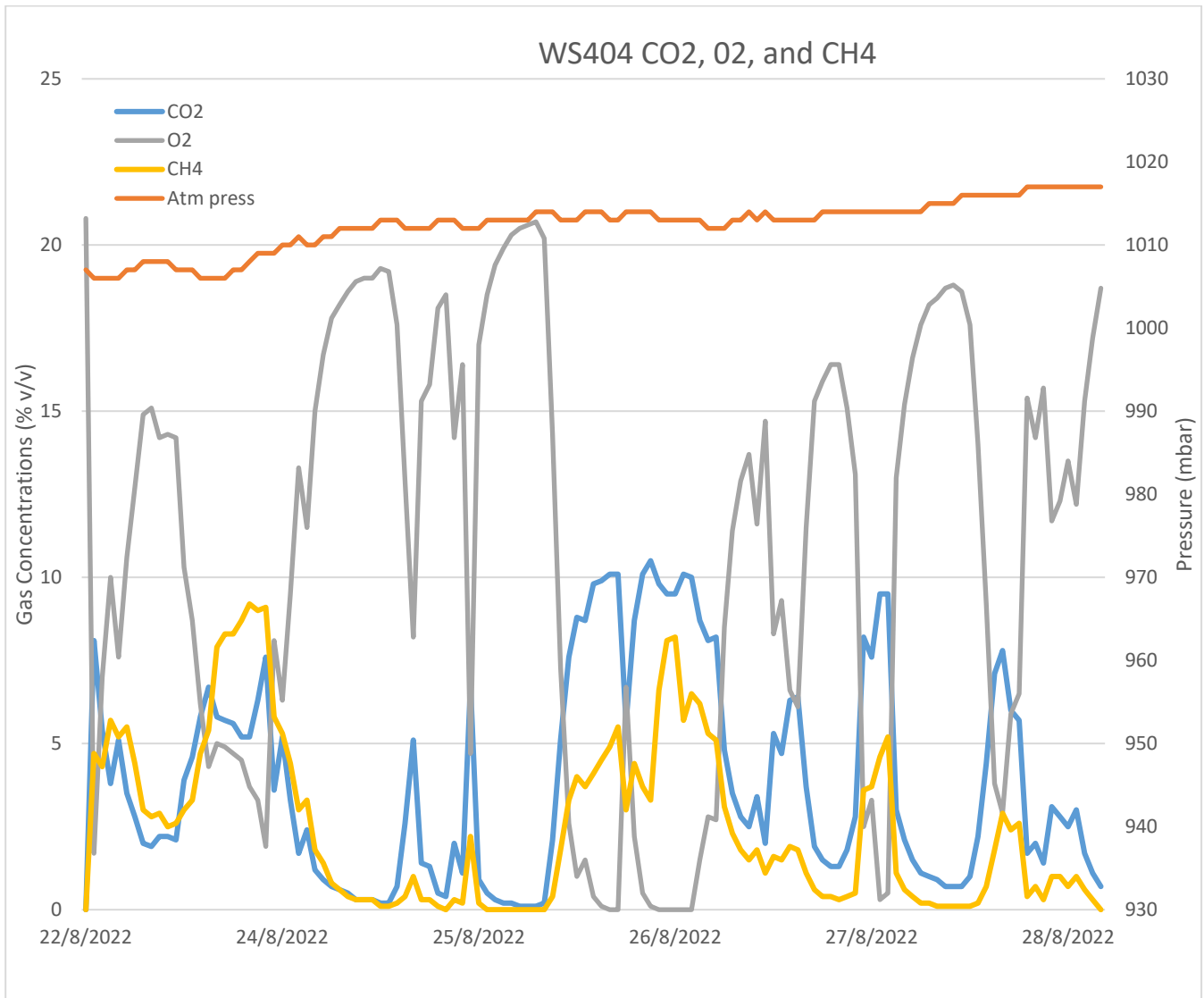
WS404	CH ₄ (%)	CO ₂ (%)	O ₂ (%)	CO (ppm)	H ₂ S (ppm)	TVOC (ppm)
	Max	Max	Max	Max	Max	Max
Steady	9.2	10.5	20.7	4	0	0

Notes: CH₄ = Methane; CO₂= Carbon dioxide; O₂= Oxygen; CO= Carbon Monoxide; H₂S= Hydrogen Sulphide; TVOC (PID)= Total Volatile Organic Compounds (as measured with Photo Ionisation Detector); ppm= Parts Per Million.

The highest methane concentrations were recorded within WS404 (9.2% v/v) on the gas clams on the 24th August 2022 at 9:53am, whilst the highest carbon dioxide concentrations were recorded in W404 (10.5% v/v) on the gas clams. The maximum flow of 0.2 l/hr was recorded in WS107 on the second visit of the gas monitoring period in 2018.

The atmospheric pressure ranged between 990mb and 1030mb over all the monitoring period, of which visits were conducted over a range of falling, steady and rising pressure trends.

The graph below displays the elevated methane and carbon dioxide levels in WS404.



There was no ground water in any of the boreholes.

All of the samples tested recorded PID results of between 0.0ppm and 2ppm, indicating that no significant volatile vapour contamination was present.

8.6 Ground Gas Risk Assessment

In order to assess the ground gas situation and the requirement for ground gas precautionary measures at the site, guidance was taken from CIRIA C665 'Assessing risks posed by hazardous ground gases to buildings' and BS8485:2015+A1:2019 'Code of Practice for the design of protective measures for methane and carbon dioxide ground gases for new buildings'.

As the proposed end-use is for low rise residential development, guidance dictates that the gas monitoring results should be assessed in accordance with the Boyle and Witherington.

The Boyle and Witherington uses the concept of a Gas Screening Value (GSV) which is derived using the following equation: $(\text{max gas concentration} / 100) \times \text{maximum flow}$.

A maximum positive flow of 0.2l/hr has been used to derive the GSVs. The GSV's for the site are presented below.

Gas	GSV (l/h)	Typical Threshold Concentration Exceeded	Classification
Methane	0.018	Yes	NHBC Amber 2
Carbon Dioxide	0.021	Yes	NHBC Amber 2

The GSV for carbon dioxide and methane place the site the site into Amber 2 classification of the Boyle and Witherington Traffic Light System as outlined in CIRIA C665. However due to concentrations of carbon dioxide greater than 10% v/v and methane over 5% v/v, guidance that's that consideration should be given to increasing the characteristic situation however it is classified as Amber 2 due to the very low flow rate.

Confirmation of the Characterisation Situation will be made following completion of the current monitoring period.

The highest methane concentrations were recorded within WS404 on the gas clams and is considered to represent 'worst case' conditions. Made ground was encountered at depths to 2.10m bgl however no putrescible material was encountered during the site investigation. Despite this, the made ground was targeted in the installs of WS404, making the made ground the primary source of the elevated methane levels.

No other borehole exhibits any elevated levels of methane to this degree, suggesting that WS404 is classified as a localised area of NHBC Amber 2 precautions based on the underlying made ground and alluvium. Despite this, made ground and alluvium are the only known gas sources on site and previous ground investigations shows that the entire phase 3 area is underlain by the made ground and alluvium. This suggests that the entire site should be classified as Amber 2, applying the 'worst case' conditions on the whole site.

WS401 shows elevated levels of carbon dioxide above 5% v/v in the alluvium. WS404 and WS401 are at opposite ends of the site, suggesting that the gas source covers the entire site, supporting the statement above. Other boreholes not displaying elevated levels of methane and carbon dioxide may be due to difference in strata thicknesses, strength, gas generation potential and gas migration.

8.7 Potable Water Supply

The level of protection for the clean potable water supply pipes should be determined using the local water company risk assessment criteria in accordance with UKWIR.

As the site is brownfield, there is the assumption that barrier pipe would be utilised, although requirements should be confirmed by risk assessment and with the water supply company.

8.8 Qualitative Risk Assessment

The CSM has been revised based on the findings of the site investigation and laboratory testing results and these are presented overleaf.

Human Health						
Potential Source	Potential Pathway	Potential Receptor	Likelihood	Severity	Level of Risk	Justification
On-site Alluvium Ground Gas (carbon dioxide and methane)	Migration into confined spaces, inhalation and asphyxiation/explosion	End-users / property / structures	Low likelihood	Severe	Moderate	Alluvium is known to be underlying the entire site from previous ground investigations and reports. Gas monitoring data reveals carbon dioxide concentrations of 7.2% in the alluvium (WS401). WS03 also has a peak carbon dioxide value of 4.8% in the alluvium.
On site Made Ground Ground Gas (carbon dioxide and methane)	Migration into confined spaces, inhalation and asphyxiation/explosion	End-users / property / structures	Likely	Severe	High	Made ground is known to be underlying the entire site from previous ground investigations and reports. Any made ground likely represents demolition materials and therefore is unlikely to have significant organic material however gas monitoring data reveals carbon dioxide concentrations above 5.0% in the made ground (WS107, WS404). Methane levels above 5% were recorded in WS404. Therefore, gas protection measures will be required and must comply with NHBC Amber 2.
On site Made Ground Metals, PAHs and petroleum hydrocarbons	Migration into/chemical attack of water supply pipelines.	Water Pipelines	Unlikely	Medium	Low	Contaminants within the soil/groundwater could potentially attack the clean potable water supply pipe. Contaminants should be assessed to determine the correct pipe material and level of precautions required though a risk assessment and with the supply water company.
On site Made Ground Metals, PAH's, Petroleum hydrocarbon, asbestos	Root uptake, ingestion, direct contact, inhalation of dusts	End-users	Unlikely	Medium	Low	Made ground was present across the entire site. Chemical testing within various made ground strata in the phase 3 area from the site investigations in 2022 and 2018 revealed no contaminants exceeding the GAC limit.

Controlled Waters						
Potential Source	Potential Pathway	Potential Receptor	Likelihood	Severity	Level of Risk	Justification
Made Ground PAH's, Metals, Petroleum Hydrocarbons	Overland flow, / migration through saturated zone	River Irwell 10m away (Surface waters)	Low likelihood	Mild	Low	It is considered that contaminants potentially associated with the made ground could possibly impact River Irwell. The chemical lab results showed no contaminants within the made ground. Also, despite the close proximity and low permeability of the underlying geology, the development of the site into residential housing will likely contain a new drainage system. The risk is considered low.
	Leaching through unsaturated zone / Migration through saturated zone	Principal Aquifer – Superficial deposits and bedrock (Ground-water)	Low likelihood	Mild	Low	Made ground was present on the entire site however visual or olfactory evidence of contamination was not observed. Significant concentrations of contaminants are not present in soils. The proposed development will likely have a new surface water drainage system installed which will further reduce the risk to controlled waters. In addition, no groundwater was encountered during the 2018, 2020 and 2022 monitoring visits. The risk is considered low that the made ground poses a risk to the superficial aquifer.

8.9 Outline Remedial Measures

The level of protection for the clean potable water supply pipes should be determined using the local water company risk assessment criteria in accordance with UKWIR.

Made Ground

Made ground underlies the entire site. Chemical testing undertaken on soils to date in Phase 3 has not identified any significant contamination elevated above residential with plant uptake screening values. Therefore no clean cover system is required for the Phase 3 site. However, a nominal thickness of topsoil (150mm) will be required to act as a suitable growing medium.

Ground Gas

Based on the ground gas monitoring results to date, mitigation measures are required in the form of NHBC Amber 2.

Amber 2 is a low to intermediate gas regime, which requires low-level gas protection measures, comprising a carbon dioxide and methane resistant membrane and ventilated sub-floor void to create a permeability contrast to limit the ingress of gas into buildings. Gas protection measures should be as prescribed in BRE Report 414 (Johnson, 2001). For Amber 2 classification, the membrane should be fitted by a specialist contractor. Ventilation of the sub-floor void should facilitate a minimum of one complete volume change per 24 hours.

Utilities

Given the absence of any considerable contamination in areas where pipes will be placed, it is considered that barrier pipe would not be required for new water supply pipelines which has been confirmed via UKWIR Risk Assessment, with standard PE pipe able to be used. The Risk Assessment for Water Pipes is presented in Appendix I.

Further advice is contained in UKWIR Report 10/WM/03/21 – ‘Guidance for the Selection of Water Supply Pipes to be used in Brownfield Sites’.

UXO

The UXO desk study indicates the majority of the site is medium risk with a portion towards the east classed as a low risk.

It is recommended that a site-specific plan for the management of UXO risk is written for this site. This plan should be kept on site and be referred to in the event that a suspect item of UXO is encountered at any stage of the project. It should detail the steps to be taken in the event of such a discovery, considering elements such as communication, raising the alarm, nominated responsible persons etc.

As a minimum precaution, all personnel working on the site should be briefed on the basic identification of UXO and what to do in the event of encountering a suspect item. This should in the first instance be undertaken by a UXO Specialist. Posters and information on the risk of UXO can be held in the site office for reference.

It is recommended within the UXO report that there should be an Unexploded Ordnance (UXO) Specialist Presence on Site to support shallow intrusive works.

Watching Brief

A watching brief is recommended during groundworks for any unidentified sources of contamination. If any gross contaminated material is encountered works should cease in that area and BSL consulted.

8.10 Health and Safety Issues

During the reclamation and construction phases of the site development it will be necessary to protect the health and safety of site personnel. The risk to construction and ground workers is assessed in the table below:

Potential Source	Potential Pathway	Potential Receptor	Likelihood	Severity	Level of Risk
Made Ground (heavy metals, PAHs, petroleum hydrocarbons)	Ingestion, direct contact, inhalation of dusts.	Construction Workers	Likely	Medium	Moderate
Asbestos	Ingestion, direct contact, inhalation of dusts.	Construction Workers	Unlikely	Medium	Low
Ground gas	Inhalation in confined spaces/trenches	Construction Workers	Low likelihood	Severe	Moderate

No asbestos has been identified in the test results of phase 3 however the presence of asbestos cannot be ruled out due to the areas of phase 1 and phase 2 having traces of asbestos. The risk from asbestos should be highlighted in the method statements and site induction. If further evidence of asbestos is encountered in the soils, work should cease until asbestos control measures have been agreed and put in place. Asbestos is further discussed in Section 8.11 below.

The risk from made ground will be mitigated by standard PPE including gloves. Welfare facilities should be made available to wash before hand to mouth activities.

It is noted that concentrations of carbon dioxide (an asphyxiant) in the soil exceed HSE Workplace Exposure Limits for personnel in the working environment of 1.5% for short term (15 minutes) exposure and/or 0.5% for long term exposure. Furthermore, soil concentrations of oxygen are below the HSE recommendations of 18%.

Soil gas concentrations are not necessarily reflected by those in the breathing zone, all contractors and maintenance workers should be made aware of the possible presence of carbon dioxide and should take all necessary health and safety precautions when working in trenches or confined spaces.

General guidance on these matters is given in the Health and Safety Executive (HSE) document "Protection of Workers and the General Public during the Redevelopment of Contaminated Land". In summary, the following measures are suggested to provide a minimum level of protection:

- All ground workers should be issued with the relevant protective clothing, footwear and gloves. These protective items should not be removed from the site and personnel should be instructed as to why and how they are to be used.
- Hand-washing and boot-washing facilities should be provided.
- Care should be taken to minimise the potential for off-site migration of contamination by the provision of dust suppression control and wheel cleaning equipment during the construction works.
- Good practices relating to personal hygiene should be adopted on the site.
- The contractor shall satisfy the Health and Safety Executive with regard to any other matters concerning the health, safety and welfare of persons on the site.

8.11 Asbestos

The investigation of asbestos issues within structures was beyond the scope of this report. However, guidance from UK Government indicates that asbestos should be assumed to be present in buildings unless proven otherwise.

Any asbestos within structures will require removal prior to re-development. This will need to be done by a suitably qualified experienced and licensed contractor, who ensures that adequate PPE is provided to operatives, and that all the relevant legislation is adhered to.

Additional guidance is provided within the BSL methodology Guidance Note in Appendix A.

9.0 WASTE SOIL CLASSIFICATION & ASSESSMENT

9.1 Summary

BSL have undertaken a preliminary assessment of potential excavation waste to arise from the site during redevelopment to:

- Classify the excavation waste to arise as either hazardous or non-hazardous.
- Identify the most sustainable options for the wastes to arise in accordance with the waste hierarchy.
- Provide a written description of the waste required as part of the Duty of Care.
- Provide details of “hazardous properties” to complete hazardous waste consignment note (where applicable).
- Be able to provide a basic classification report to a landfill operator (where waste is destined for landfill disposal).

9.2 Waste Classification Procedure

As described in the ‘Waste Duty of Care Code of Practice (2016)’ any substance or object that the holder discards, intends to discard or is required to discard is a waste. It is the responsibility of the waste producer to classify this waste. The classification process is described in the ‘Guidance on the classification and assessment of waste’ WM3 and aims to determine whether the waste is Hazardous or Non-Hazardous to human health and the environment.

Hazardous wastes are signified by entries where the code is followed by an asterisk, where some wastes are deemed hazardous without further assessment, which are termed “Absolute Entries” e.g. most waste oils. Alternatively, waste entries are termed “Mirror” entries that require further assessment of hazardous properties, in order to determine whether they are hazardous waste or not (e.g. soil and stones). The EWC codes relevant to excavation wastes are:

- 17 05 03* - soil and stones containing dangerous substances.
- 17 05 04 – soil and stones other than those mentioned in 17 05 03.

The Landfill Directive (Directive 1999/31/EC on the landfilling of waste, Decision 2003/33/EC and Landfill Regulations 2005) led to the establishment of a methodology for classifying wastes.

Wastes first need to be classified based on their total concentrations and classified as either hazardous or non-hazardous waste. WAC testing is only required if the end disposal route is a landfill and WAC analysis must not be used for waste classification.

Wastes can only be accepted at a landfill if they meet the relevant Waste Acceptance Criteria (WAC) for that type of landfill. A waste must comply with the WAC limits for the relevant landfill, otherwise the soil will need to be pre-treated. There are three different WAC criteria, these are:

- Inert waste.
- Stable Non-Reactive Hazardous Waste (SNRHW).
- Hazardous waste.

There are no standard set of WAC limits for non-hazardous landfill sites and each non-hazardous landfill will have its own set of criteria under which it is licenced to accept non-hazardous waste. These will need to be determined through the selected waste receiver prior to disposal.

A non-hazardous waste should not be compared with WAC limits for hazardous or SNRHW waste sites and the WAC test should only be used to determine if the waste is suitable for disposal at an inert waste landfill site. Likewise, wastes classified as hazardous based on their total concentrations should not be compared with WAC limits for inert waste landfill sites, as these will not be accepted.

Details of how material should be classified for waste disposal are presented in the BSL Methodology and Guidance in Appendix A and are summarised in the table below:

Classification based on Total Concentrations ¹	PRIOR TO LEAVING SITE			
	Non-Hazardous Waste		Hazardous Waste	
	IF SOILS CANNOT BE RE-USED ELSEWHERE AND MUST GO TO LANDFILL			
WAC testing	Below inert WAC limit values	Above inert WAC limit values	Below hazardous WAC limit values ⁴	> WAC limit values
Landfill requirements	INERT landfill	NON-HAZARDOUS landfill ²	HAZARDOUS landfill	PRE-TREATMENT ³

1 Total concentrations are defined as tests results on solids as opposed to leachate (i.e. a liquid).

2 Individual sites may have certain limit values pre-determined in their licence.

3 After pre-treatment the material characteristics may have changed to an extent that allow the soil to be re-classified.

4 Possibility that wastes could be classified as stable Nonreactive HAZARDOUS waste in non-hazardous Landfill (e.g. soils containing low concentrations of asbestos, gypsum or sulphate bearing soils).

Waste classified as non-hazardous can be accepted into a non-hazardous landfill without having to pass any numerical WAC.

Soils above hazardous WAC limit values require pre-treatment prior to disposal. The effective pre-treatment, typically involving separation, sorting and screening, can offer cost savings through reducing the hazardous nature and volumes of soil. Costs for disposal of non-hazardous/hazardous soils are significant compared to the disposal of inert material.

Inert Waste

The possibility of automatic inert classification of the naturally occurring “clean” soils should be explored in accordance with Section 4.3 of the EA guidance document. The Council Decision includes a list of wastes in Section 2.1.1 of the document that are assumed to be inert and therefore acceptable at a landfill for inert waste without testing. This is the case if:

- They are single stream waste of a single waste type (although different waste types from the list may be accepted together if they are from a single source); and
- There is no suspicion of material or substances such as metals, asbestos, plastics, chemicals, etc to an extent which increases the risk associated with the waste sufficiently to justify contamination and they do not contain other classes of landfill.

9.3 Waste Classification and Waste Acceptance Criteria (WAC)

We have reviewed the testing results and assessed them through a waste classification database which allows users to code and classify waste as defined in the EWC (European Waste Catalogue) based on EC Regulation 1272/2008 on the Classification, Labelling and Packaging of Substances and Mixtures (CLP) and latest Environment Agency guidance (WM3 “Guidance on the classification and assessment of waste - Technical Guidance”).

11 samples were tested to assess whether they contained any contaminants in the hazardous range when screened against assessment criteria within WM3 using the HazWasteOnline tool.

Based on the waste classification database assessment, the made ground and natural soils have been classified as **non-hazardous**. The Waste Classification Report are presented in Appendix F.

9.4 Options Assessment

Following the classification of waste materials, the options available for the waste can be considered in the context of the waste hierarchy as below:

- Onsite re-use (with or without prior treatment) under suitable exceptions/permits.
- Offsite processing for recycling or recovery e.g. screening.
- Offsite disposal (with or without prior treatment) i.e. landfill.

Where feasible, efforts should be made to retain soils for onsite re-use to minimise costs and maximise the sustainability of projects.

Based on the above, the possible options for the generation of waste soils at the site are described in the table below:

Waste Generation Source	Comments
Made Ground from site levelling/foundations excavations/services excavations	Samples of made ground from across the site have been classified as non-hazardous and hazardous for off-site disposal purposes, although should be suitable for re-use on site if required under suitable exemptions/permits.
Natural ground from site levelling/foundations excavations/services excavations	Natural soils may be considered suitable for re-use onsite as fill where the criteria of the WFD exception for re-use of naturally occurring soils can be met. Naturally occurring clean materials could also be exported to another site under the direct transfer scenario of the DoWCoP. Classified as non-hazardous and below inert WAC testing criteria for off-site disposal purposes.

General

If any gross hydrocarbon contaminated material is encountered during the construction phase, it is possible that this may be classified as hazardous and testing should be undertaken at that time.

Where it is necessary to dispose material off site it is recommended that materials are segregated and sufficient time is allowed to further classify the actual soil arisings that constitute the waste, including discussion with landfill sites and waste transfer stations to find the best disposal route. It is illegal to dilute and mix soils without a suitable permit.

9.5 Re-use of Soils

By definition in law, any material excavated from the ground becomes waste at the moment of excavation. If that soil (now a “waste”) is then placed on another part of the development site (or used on another development site) without an appropriate materials management plan, permit or exemption being in place, by law this material is defined as “illegally deposited waste”.

Landfill tax rules allow HM Revenue & Customs (HMRC) to recover landfill tax on illegally deposited waste on construction sites. This could lead to excessive costs without the correct documentation in place. In addition, a person who makes, knowingly causes or knowingly facilitates a disposal to be made at an unauthorised site is also liable to pay Landfill Tax.

In order to comply with UK legislation and avoid excessive costs, if the re-use of soils is proposed on site, this should be done in accordance with the relevant exemptions or permits in place.

Soils Re-use Under DoWCoP

One of the main industry mechanisms for allowing the re-use of soils in construction is the CL:AIRE “Development Industry Code of Practice for the Definition of Waste” (CL:AIRE DoWCoP) also known as a Materials Management Plan (MMP). Further guidance is provided in the BSL Methodology and Guidance in Appendix A.

To implement the DoWCoP (for Route A), there is a requirement to notify the Environment Agency and Local Authority of the intention to use the code of practice in principal, after which there is a 21-day notice period for their response.

In order to re-use soils under the DoWCoP, there are four key criteria that need to be met:

-
- The aims and objectives of the project meet the requirements of the Waste Framework Directive (does not harm human health or the environment).
 - The soils can be demonstrated to be suitable for use (backed up by chemical/geotechnical testing and assessment).
 - There is certainty of use (planning consents are in place alongside materials tracking, which should be in place as part of good site practice in any case).
 - Quantity (the quantity of materials used should be known).
-

Information on existing site levels, proposed levels, volumes generated (e.g. foundation / drainage excavation arisings) would need to be known in order to complete the MMP.

If the DoWCoP is the chosen route, the MMP should be in place and declared by a Qualified Persons (QP) before works commence, otherwise excavated soils could constitute an illegal deposit of waste and enforcement action could be taken by the EA and HMRC.

The declared MMP should be amended as new import sources are added.

Once the project is complete, a verification report detailing soils re-use/import will need to be produced and submitted to CL:AIRE, which may be subject to a random audit process. Sites found to be non-compliant with the CoP can be referred to the EA for further investigation.

Regardless of implementing re-use under the code of practice or not, all sites should have some form of materials tracking in place in compliance with current legislation. Any re-use scheme should also be designed to minimise disposal costs.

Re-use of soils containing asbestos should comply with the CL:AIRE publication ‘Interpretation for Managing and working with Asbestos in Soil and Construction and Demolition Materials’ (CAR-SOIL™) and CAR 2012.

In terms of the re-use of brick/concrete crush materials, the DoWCoP does cover aggregates, but only on the site of origin, and the EA WRAP aggregate Quality Protocol might best apply to ensure quality standards, which are discussed further below.

Soils Re-use under Exemptions and Permits

Other potentially suitable options to allow the re-use and/or import of soils and aggregates on site are provided in the table below:

Re-use Mechanism	Description
U1 Exemption	Can be applied to re-use/import of soils and stones, but only up to 1000 tonnes or for brick and concrete up to 5000 tonnes. This is usually an efficient way to re-use small volumes of waste materials. However, only one U1 can be filled in per site in any 3-year period. Quick and free via online registration.
WRAP Quality Protocols	Describes how processed demolition arisings can be removed from regulatory waste regime. Requires a demonstration of appropriateness by: • Factory Production Control Manual. • Facility Permit (or Exemption). • Grading Analysis.
Waste Framework Directive (WFD) exclusion	In regard to “clean” naturally occurring soils only that are to be re-used on their site of origin, these are covered by a Waste Framework Directive (WFD) exclusion which is an EA regulatory position statement. So long as the project can prove the four criteria listed above for the DoWCoP, then permits or the DoWCoP are not required. However, many projects still use the CoP to ensure compliance.
T5 Screening and blending of waste	The T5 exemption allows you to temporarily treat waste on a small scale to produce aggregate or soil at a particular location, such as a construction or demolition site. The limit is 5,000 tonnes. This applies to: • Screening soil on a demolition site to remove wood and rubble. • Blending soil and compost that has been produced under an exemption on a construction site to produce better soil for landscaping on that site (e.g. peaty deposits). • Crushing waste (except bricks, tiles and concrete) before screening or blending • Grading waste concrete after it has been crushed to produce a certain type of aggregate.
T7 Exemption	The T7 allows treatment of waste bricks, tiles and concrete by crushing, grinding or reducing in size. This needs to be registered with the Local Authority.
Other Permitting Routes	Other options include use under an Environmental Permit (Standard or Bespoke Rules), however these may be a time consuming and costly route, where use of the other above options (if applicable) are likely to be more feasible in construction.

10.0 CONCLUSIONS

10.1 Geo-Environmental

Geo-Environmental – Human Health

Based on the chemical testing completed and additional assessment of the previous testing carried out at site, the overall risk from soils contaminations is considered to be low.

Ground gas monitoring has revealed a maximum peak carbon dioxide concentration of 10.5%v/v and methane concentrations of 9.2%v/v. Based on the gas monitoring the site is classified as NHBC Amber 2 and ground gas protection measures are required.

Geo-Environmental – Controlled Waters

The overall risk to controlled waters is considered to be low and no further action is required.

Waste

Based on the waste classification database assessment, the made ground and natural soils have been classified as non-hazardous.

10.2 Geotechnical

Foundations

The ground conditions are relatively similar throughout the site with made ground up to 2.2m bgl, underlain by medium dense alluvium sand. Soft clay is present along the eastern side of the site.

The use of vibro ground improvement or piles is likely to be suitable across the site. Piles should extend through the made ground and superficial deposits end bearing on sandstone. Piles should extend a minimum of five pile diameters into the bearing stratum to fully mobilise end-bearing resistance and shaft resistance. Preliminary calculations were undertaken for a single 300mm wide square concrete pile approximately 5.00m in length would give an allowance load of 230kN.

Floor slabs

Suspended floor slabs are recommended.

Concrete classification

DS-1 and ACEC Class AC-1 conditions prevail.

Drainage (SUDS)

SUDS are potentially suitable at the site. We recommend the design of infiltration drainage is carried out in accordance with BRE 365 and CIRIA C753. Consideration should also be given to future maintenance, where infiltration capacity can be reduced as a result of blinding through ingress of fines.

Earthworks

Earthworks will be required in order to achieve the desired development platform levels. In addition, the risk from flooding on the site is considered to be moderate. The northern boundary comprises a flood defence constructed by the Environment Agency and flood risk will need to be taken into consideration when setting final levels.

10.3 Further Work

The following further work is considered necessary to progress the site to construction phase:

- Detailed foundation design by a structural engineer, including foundation zonation plan and depth schedule.
- Design of Remedial Strategy and confirmation with the Local Authority / EA / NHBC
- Production of Ground Gas Protection Measures Verification Plan.
- Production of Materials Management Plan (MMP) under the CL:AIRE DoWCoP, if required.
- Implementation of the Remedial Strategy and verification of the remedial works.

11.0 ABBREVIATIONS AND DEFINITIONS

GLOSSARY	
Term / Abbreviation	Definition
AST	Above Ground Storage Tank.
B(a)P	Benzo (a) Pyrene.
BGS	British Geological Survey.
BRE	Building Research Establishment.
BS	British Standard.
BSL	Brownfield Solutions Ltd.
BTEX	Benzene, Toluene, Ethylbenzene, Xylenes.
CBR	California Bearing Ratio (used in pavement/highways design).
CAR 2012	Control of Asbestos Regulations (2012).
CBCB	Cheshire Brine Compensation Board.
CBCD	Cheshire Brine Compensation District.
CBR	California Bearing Ratio.
CIEH	Chartered Institute of Environmental Health.
CIRIA	Construction Industry Research Association.
CL:AIRE	Contaminated Land: Applications in Real Environments.
CLEA	Contaminated Land Exposure Assessment.
CLO	Contaminated Land Officer.
COMAH	Control of Major Accident Hazards.
Contamination	Presence of a substance which is in, on or under land, and which has the potential to cause significant harm or to cause significant pollution of controlled water. There is no assumption in this definition that harm results from the presence of the contamination. Naturally enhanced concentrations of harmful substances can fall within this definition of contamination. Contamination may relate to soils, surface water, groundwater or ground gas.
Controlled Waters	Inland freshwater (any lake, pond or watercourse above the freshwater limit), water contained in underground strata and any coastal water between the limit of highest tide or the freshwater line to the three-mile limit of territorial waters.
CPT	Cone Penetration Test.
CSM	Conceptual Site Model. A schematic hypothesis of the nature and sources of contamination, potential migration pathways (including description of the ground and groundwater) and potential receptors, developed on the basis of the information from the preliminary investigation and refined during subsequent phases of investigation and which is an essential part of the risk assessment process. The conceptual site model is initially derived from the information obtained by the preliminary investigation (i.e. the Phase I Desk Study). This conceptual model is used to focus subsequent investigations, where these are considered to be necessary, in order to meet the objectives of the investigations and the risk assessment. The results of intrusive investigations can provide additional data that can be used to further refine the conceptual site model.
DCP	Dynamic Cone Penetrometer.
DNAPL	Dense Non-Aqueous Phase Liquid.
DoWCoP	Definition of Waste Code of Practice.
DWS	Drinking Water Standard.
EA	Environment Agency.
EHO	Environmental health Officer.
EQS	Environmental Quality Standard.
GAC	Generic Assessment Criteria.

GLOSSARY	
Term / Abbreviation	Definition
GDR	Geotechnical Design Report.
GFR	Geotechnical Feedback Report.
GIR	Ground Investigation Report.
GSV	Gas Screening Value.
Harm	Adverse effect on the health of living organisms, or other interference with ecological systems of which they form part, and, in the case of human health, including property/structures and water supply pipelines.
Hazard	Inherently dangerous quality of a substance, procedure or event.
HDPE	High Density Polyethylene.
HSV	Hand Shear Vane.
K	Modulus of Subgrade Reaction.
LCRM	Land Contamination: Risk Management (EA guidance).
LNAPL	Light Non-Aqueous Phase Liquid (petrol, diesel, kerosene).
LOD	Limit of Detection (for particular method adopted).
MMP	Materials Management Plan.
Mv	Modulus of Volume of Compressibility.
ND	Not Detected.
NHBC	National House Building Council.
NR	Not Recorded.
OS	Ordnance Survey.
PAH	Polycyclic Aromatic Hydrocarbon.
Pathway	Mechanism or route by which a contaminant comes into contact with, or otherwise affects, a receptor.
PCB	Poly-Chlorinated Biphenyl.
PCSM	Preliminary Conceptual Site Model.
pH	Scale used to specify how acidic or basic a water-based solution is.
PHC	Petroleum Hydrocarbons.
PID	Photo Ionisation Detector.
PNEC	Predicted No-Effect Concentration.
Precision	Level of agreement within a series of measurements of a parameter.
PSD	Particle Size Distribution.
PVC	Polyvinyl Chloride.
Receptor	Human health, living organisms, ecological systems, controlled waters (surface waters and groundwater within aquifers), atmosphere, structures and utilities that could potentially be adversely affected by contaminant(s).
Risk	Probability of the occurrence, magnitude and consequences of an unwanted adverse effect on a receptor.
Risk Assessment	Process of establishing, to the extent possible, the existence, nature and significance of risk.
Sampling	Methods and techniques used to obtain a representative sample of the material under investigation.
SOM	Soil Organic Matter.
Source	Location from which contamination is, or was, derived. This could possibly be the location of the highest soil, groundwater or gas concentration of the contaminant(s).
SPT	Standard Penetration Test.
SVOCs	Semi Volatile Organic Compounds.
TOC	Total Organic Carbon.
TPH CWG	Total Petroleum Hydrocarbon (Criteria Working Group).

GLOSSARY	
Term / Abbreviation	Definition
TVOCs	Total volatile organic compounds.
UCS	Unconfined Compressive Strength.
Uncertainty	Parameter, associated with the result of a measurement that characterises the dispersion of the values that could reasonably be attributed to the measurement.
UST	Underground Storage Tank.
UXO	Unexploded Ordnance.
VCCs	Vibro Concrete Columns.
VSCs	Vibro Stone Columns
VOCs	Volatile Organic Compounds.
WAC	Waste Assessment Criteria.
WFD (in waste context)	Waste Framework Directive.
WFD (in water context)	Water Framework Directive.
Units	Definition
°	Degrees
Φ	Phi angle (in degrees)
g/l	Grams per Litre
Km	Kilometres
kPa	Kilo Pascal (Equivalent to kN/m ²)
KN/m ² /mm	Kilo Newton per metered squared per millimeter
kN/m ²	Kilo Newtons per metre squared
kPa	Kilo Pascal (Equivalent to kN/m ²)
l/hr	Litres per hour
MJ/kg	Mega joule per kilogram
MN	Mega Newton
M ² /MN	Mega Newton per metre squared
M	Metres
m bgl	Metres Below Ground Level
m OD	Metres Ordnance Datum (sea level)
µg/l	Micrograms per Litre (parts per billion)
µm	Micrometre
mb	Millibars (atmospheric pressure)
mg/kg	Milligrams per kilogram (parts per million)
mg/m ³	Milligram per metre cubed
mm	Millimetre
ppb	Parts Per Billion
Ppm	Parts Per Million

12.0 REFERENCES

- Association of Ground Investigation Specialists. 'Guidelines for Good Practice in Site Investigation'. Issue 2, March 2006.
- Black, W.P.M. & Lister, N.W. The strength of clay fill subgrades, its prediction in relation to road performance Report LR889, TRRL. 1979.
- BRE Special Digest 1: 'Concrete in Aggressive Ground' 3rd Ed 2005.
- BRE Report BR211, Scivyer, C. 'Radon – Guidance on protective measures for new buildings' 2015 Edition.
- BRE Digest, vols. 240 and 241 'Low-rise buildings on shrinkable clay soils'. 1993.
- BRE Digest 298 'The influence of trees on house foundations in clay soils'. 1999.
- BRE Digest 365 'Soakaway Design'. 2016.
- BRE Report 391 "Specifying vibro stone columns". 2000.
- BRE Report 414. 'Protective measures for housing on gas contaminated land. Building Research Establishment Report'. 2011.
- BRE Report 465 'Cover Systems for Land Regeneration'. 2004.
- BRE Report 470 'Working platforms for tracked plant: good practice guide to the design, installation, maintenance and repair of ground-supported working platforms'. 2004.
- British Geological Survey Technical Report WD/97/34. 312pp. Environment Agency R&D Publication 8. 'The physical properties of major aquifers in England and Wales'. 1997.
- British Geological Survey Technical Report WD/00/04. 234pp. Environment Agency R&D Publication 68 'The physical properties of minor aquifers in England and Wales'.
- British Geological Survey 'The advanced soil geochemical atlas of England and Wales'. 2012.
- BS 1377 'Method of Test for Soils for Civil Engineering Purposes'. 1990.
- BS EN 1997-1. 'Eurocode 7 – Geotechnical design - Part 1: General rules'. Plus associated UK National Annex. 2004.
- BS EN 1997-2. 'Eurocode 7 – Geotechnical design - Part 2: 'Geotechnical investigation and testing'. Plus associated UK National Annex. 2007.
- BS 3882: 'Specification for topsoil'. 2015.
- BS 5837: 'Trees in relation to design, demolition and construction Recommendations'. 2012.
- BS 5930+A1:2020: 'Code of Practice for Site Investigations'. 2020.
- BS 6031: 'Code of practice for earthworks'. 2009.
- BS 8004: 'Code of practice for foundations'. 2015.
- BS 8485+A1: 'Code of practise for the design of protective measures for methane and carbon dioxide ground gases for new buildings'. 2019.
- BS 8500-1 AMD 2. Concrete. Complementary BS to BS EN 206. Part 1. 'Method of specifying and guidance for the specifier'. 2018.
- BS 8576 'Guidance on investigations for ground gas – Permanent gases and Volatile Organic Compounds (VOCs)'. 2013.
- BS 10175:2011+A2 'Investigation of Potentially Contaminated sites - code of practice'. 2017.

- BS 10176:2020 'Taking soil samples for determination of volatile organic compounds (VOCs)'. 2020.
- BS EN ISO 14688 'Geotechnical investigation and testing – Identification and classification of soil'. 2018.
- BS EN ISO 14689 'Geotechnical investigation and testing – Identification and classification of rock'. 2018.
- BS EN ISO 17892 'Geotechnical investigation and testing. Laboratory testing of soil.' Parts 1-12 :2018.
- BULL ET AL. Promoting the Use of B(a)P as a Marker for PAH Exposure in UK Soils. February 2013.
- CIRIA Special Publication SP32, PSA Civil Engineering Technical Guide 34, 'Construction over abandoned mine workings'. 1984.
- CIRIA Special Publications 101-112, 'Remedial Treatment for Contaminated Land'. 1998.
- CIRIA Special Publication 124, 'Barriers, liners and cover systems for containment and control of land contamination'. 1996.
- CIRIA R143, 'The Standard Penetration Test (SPT): methods and use'. 1995.
- CIRIA 149 'Protecting Development from Methane'. 1995.
- CIRIA 150 'Methane Investigation Strategies'. 1995.
- CIRIA 151 'Interpreting Measurements of Gas in the Ground'. 1995.
- CIRIA 152 'Risk assessment for Methane and Other Gases from the Ground'. 1995.
- CIRIA 552 'Contaminated Land Risk Assessment – A guide to good practice'. 2001.
- CIRIA C659 'Assessing risks posed by hazardous ground gases to buildings.' 2006.
- CIRIA C665 'Assessing Risks Posed by Hazardous Ground Gases to Buildings'. 2007.
- CIRIA C681 'Unexploded Ordnance (UXO) A guide for the construction industry'. 2009.
- CIRIA C716 'Remediating and mitigating risks from volatile organic compound (VOC) vapours from land affected by contamination'. 2012.
- CIRIA C733 'Asbestos in Soil And Made Ground: A Guide To Understanding And Managing Risks'. 2014.
- CIRIA C735 'Good Practice on The Testing and Verification of Protection Systems for Buildings Against Hazardous Ground Gases'. 2014.
- CIRIA C748 'Guidance on the Use of Plastic Membranes as VOC Vapour Barriers'. 2014.
- CIRIA C750 'Groundwater control: design and practice, second edition". 2016.
- CIRIA C753 'The SuDS Manual'. 2015.
- CIRIA C758 'Abandoned Mine Workings Manual'. 2019.
- CL:AIRE and CIEH. 'Guidance on Comparing Soil Contamination Data with a Critical Concentration'. May 2008.
- CL:AIRE 'The Definition of Waste: Development Industry Code of Practice'. Version 2. March 2011.
- CL:AIRE RB17 'A Pragmatic Approach to Ground Gas Risk Assessment'. 2012.
- CL:AIRE SP1010 'Development of Category 4 Screening Levels for Assessment of Land Affected by Contamination'. Rev 2 2014.
- CL:AIRE 'Interpretation for Managing and Working with Asbestos in Soil and Construction and Demolition Materials – CAR-SOILTM'. 2016.
- CL:AIRE 'Petroleum Hydrocarbons in Groundwater: Guidance on assessing petroleum hydrocarbons using existing hydrogeological risk assessment methodologies' Version 1. March 2017.

- CULP, S.J., ET AL., A comparison of the tumours induced by coal tar and benzo[a]pyrene in a 2-year bioassay. Carcinogenesis. 1998.
- DEFRA and the Environment Agency, CLR10 'Soil Guideline Value Reports for Individual Soil Contaminants'. 2002-2004.
- DEFRA and the Environment Agency, CLR Report No 11 'Model Procedures for the Management of Contaminated Land'. 2004. [Withdrawn 2019.]
- Department of the Environment, CLR Report No 1 'A framework for assessing the impact of contaminated land on groundwater and surface water'. 1994.
- Department of the Environment, CLR Report No 2 'Guidance on Preliminary Site Inspection of Contaminated Land'. 1994.
- Department of the Environment, CLR Report No 3 'Documentary research on Industrial Sites'. 1994.
- Department of the Environment, CLR Report No 4 'Sampling Strategies for Contaminated Land'. 1994.
- Department of the Environment Waste Management Paper No. 27. 'Landfill Gas: A Technical Memorandum Providing Guidance on the Monitoring and Control of Landfill Gas'. 1992.
- Department of the Environment. 'Industry Profiles' - 48 separate publications available from The Stationery Office, London. 1995.
- DETR. Circular: Contaminated Land. 2006.
- EC Regulation 1272/2008 'The Classification, labelling and packaging of substances and mixtures (CLP)' 2008.
- Environment Agency guidance - Land Contamination: Risk Management (LCRM). 2019.
- Environment Agency 'Using Soil Guideline Values'. 2009.
- Environment Agency, 'Updated Technical Background to the CLEA model'. 2009.
- Environment Agency, 'Human health toxicological assessment of contaminants in soil'. 2009.
- Environment Agency Hazardous Waste: 'Guidance on the classification and assessment of waste' WM3 ver 1.1 May 2018.
- Environment Agency. 'Remedial Targets Methodology. Hydrogeological Risk Assessment for Land Contamination'. 2006.
- Environment Agency & NHBC. R&D Publication 66. 'Guidance for the Safe Development of Housing on Land Affected by Contamination'. 2008.
- Environment Agency. R&D Publication 20. 'Methodology for the Derivation of Remedial Targets for Soil and Groundwater to Protect Water Resources'. 1999.
- Environment Agency Technical Guidance Note 01. Hydrogeological Risk Assessment for Landfills. [Withdrawn Feb 2016. Replaced with below].
- Environment Agency and DEFRA 'Landfill developments: groundwater risk assessment for leachate'. 2016.
- Environment Agency Petroleum Hydrocarbons in Groundwater 'Supplementary Guidance for Hydrogeological Risk Assessment'. 2009.
- Environment Agency 'Groundwater protection: Principles and practice (GP3)'. 2013. [Superseded 2017 by www.gov.uk online guidance].
- Environmental Permitting Guidance: version 3.1 'The Landfill Directive for the Environmental Permitting (England and Wales) Regulations'. 2010.

Environmental Quality Standards. 2008.

European Parliament Directive 2008/98/EC of the Council of 19 November 2008 on waste and repealing certain Directives. 2008.

European Parliament. Directive 2014/955/EU: Commission Decision of 18 December 2014 amending Decision 2000/532/EC on the list of waste pursuant to Directive 2008/98/EC.

Ground Engineering. Wilson & Card 'Proposed method classifying gassing sites' /1999.

Hazardous Waste (England and Wales) Regulations. 2005.

Health & Safety Executive (HSE). 'Protection of Workers & the General Public during the Development of Contaminated Land'. 1991.

Health and Safety Executive (HSE). Control of Asbestos Regulations (CAR). 2012.

Highways Agency. Design Guidance for Road Pavement Foundations (Draft HD25). Interim Advice Note 73/06. Rev 1. Highway Agency, London. 2009. [Withdrawn 30th May 2017].

ICE Thomas Telford 'Applications of Dynamic Cone Penetrometer testing in East Anglia'. 1989.

Land Quality Press, Nathanail, C. P., McCaffrey, C., Gillett, A., Ogden, R. C. and Nathanail, J.F. 'The LQM/CIEH S4ULs for Human Health Risk Assessment.' 2015.

Landfill Directive 'Directive 1999/31/EC on the landfilling of waste'. 1999.

Japanese Geotechnical Society. Hatanaka and Uchida 'Empirical correlation between penetration resistance and effective friction of sandy soil'. Soils & Foundations, 36 (4), 1-9. 1996.

Manual of Contract Documents for Highway Works, Specification for Highway Works: Volume 1, Amendment August 2014. [Withdrawn 30th May 2017].

Manual of Contract Documents for Highway Works, Specification for Highways Works – Series 600 Earthworks November 2006. [Withdrawn 30th May 2017, Replacement unknown].

National Planning Policy Framework (NPPF). July 2018.

National Planning Policy Framework - Technical Guidance. March 2012.

NHBC Standards 2020, Part 1 'Introduction and Technical Requirements.' 2020.

NHBC Standards, Part 4 'Foundations.' 2020.

NHBC Standards. Chapter 4.1: Land Quality - Managing Ground Conditions. 2020.

NHBC. Boyle and Witherington. 'Guidance on evaluation of development proposals on sites where methane and carbon dioxide are present.' Report No. 10627-R01(04). 2007.

Public Health England (PHE). Contaminated land information sheet: risk assessment approaches for polycyclic aromatic hydrocarbons (PAHs). September 2017.

Total Petroleum Hydrocarbon Criteria Working Group Volume 1 'Analysis of Petroleum Hydrocarbons in Environmental Media'. 1999.

Total Petroleum Hydrocarbon Criteria Working Group Volume 2 Composition of Petroleum Mixtures. May 1998.

Total Petroleum Hydrocarbon Criteria Working Group Volume 3 'Selection of Representative TPH Fractions Based on Fate and Transport Considerations'. July 1997.

Total Petroleum Hydrocarbon Criteria Working Group Volume 4 'Development of Fraction Specific Reference Doses (RfDs) and Reference Concentrations (RfCs) for Total Petroleum Hydrocarbons (TPH)'. 1997

Total Petroleum Hydrocarbon Criteria Working Group Volume 5 'Human Health Risk-Based Evaluation of Petroleum Release Sites: Implementing the Working Group Approach' June 1999.

SEPA 'Land remediation and waste management guidelines' publication date unknown.

UK Drinking Water Standards: Water Supply (Water Quality) Regulations 1989 (SI 1989/1147) and Water Supply (Water Quality) Regulations 2000 (SI 2000/3184).

UKTAG. Updated recommendations on environmental standards. River Basin Management (2015-21). UK Technical Advisory Group on the Water Framework Directive. November 2013 (updated January 2018).

UKTAG-WFD. UKTAG River & Lake Assessment Method, Specific Pollutants (Metals), Metal Bioavailability Assessment Tool (M-BAT). Water Framework Directive – United Kingdom Technical Advisory Group. 2014.-

UKWIR Report 10/WM/03/21 2010 'Guidance for the Selection of Water Supply Pipes to be used in Brownfield Sites' 2010.

Water Framework Directive, 2000.

Water UK HBF. Contaminated Land Assessment Guidance. Water UK and the Home Builders Federation.

DRAWINGS



LEGEND

Facing Brick Types (refer to spec for details):

- 1) Red facing brick
- 2) Buff facing brick
- 3) Grey facing brick

Proposed Cycle Routes (all min 3m wide)

NOTE: REFER TO LANDSCAPING PROPOSALS FOR ALL HARD AND SOFT LANDSCAPING, AND ALL BOUNDARY TREATMENTS. REFER TO CIVIL / HIGHWAYS ENGINEER FOR ALL LEVELS / ROAD WORKS INFORMATION.

CALDERPEEL.COM

© CALDERPEEL PARTNERSHIP LTD

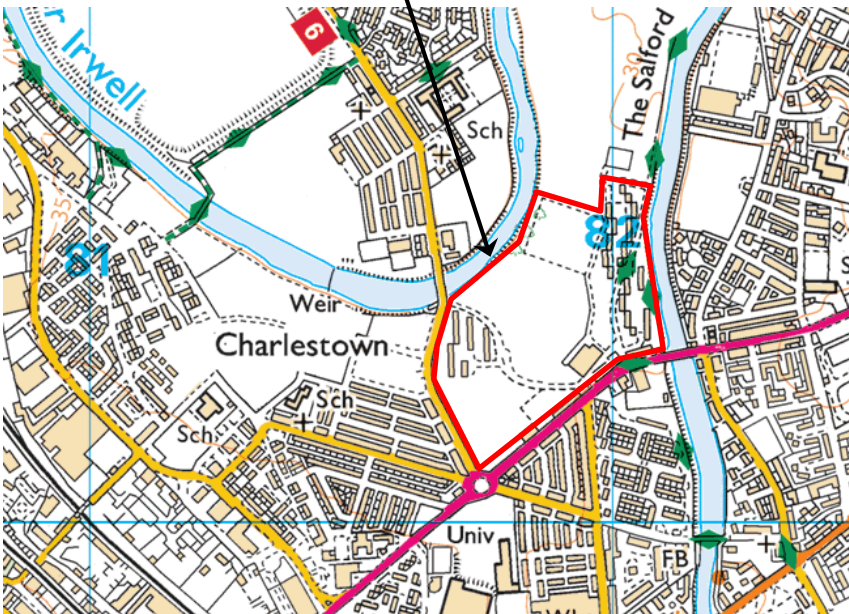
NOTE: DO NOT SCALE FROM THIS DRAWING

REV	DESCRIPTION	DATE	DRAWN
1	Issue to client / final & present	01/08/21	AG
2	Issue to client / present	01/08/21	AG
3	Issue to client / present	01/08/21	AG
4	Issue to client / present	01/08/21	AG
5	Issue to client / present	01/08/21	AG
6	Issue to client / present	01/08/21	AG
7	Issue to client / present	01/08/21	AG
8	Issue to client / present	01/08/21	AG
9	Issue to client / present	01/08/21	AG
10	Issue to client / present	01/08/21	AG
11	Issue to client / present	01/08/21	AG
12	Issue to client / present	01/08/21	AG
13	Issue to client / present	01/08/21	AG
14	Issue to client / present	01/08/21	AG
15	Issue to client / present	01/08/21	AG
16	Issue to client / present	01/08/21	AG
17	Issue to client / present	01/08/21	AG
18	Issue to client / present	01/08/21	AG
19	Issue to client / present	01/08/21	AG
20	Issue to client / present	01/08/21	AG
21	Issue to client / present	01/08/21	AG
22	Issue to client / present	01/08/21	AG
23	Issue to client / present	01/08/21	AG
24	Issue to client / present	01/08/21	AG
25	Issue to client / present	01/08/21	AG
26	Issue to client / present	01/08/21	AG
27	Issue to client / present	01/08/21	AG
28	Issue to client / present	01/08/21	AG
29	Issue to client / present	01/08/21	AG
30	Issue to client / present	01/08/21	AG
31	Issue to client / present	01/08/21	AG
32	Issue to client / present	01/08/21	AG
33	Issue to client / present	01/08/21	AG
34	Issue to client / present	01/08/21	AG
35	Issue to client / present	01/08/21	AG
36	Issue to client / present	01/08/21	AG
37	Issue to client / present	01/08/21	AG
38	Issue to client / present	01/08/21	AG
39	Issue to client / present	01/08/21	AG
40	Issue to client / present	01/08/21	AG
41	Issue to client / present	01/08/21	AG
42	Issue to client / present	01/08/21	AG
43	Issue to client / present	01/08/21	AG
44	Issue to client / present	01/08/21	AG
45	Issue to client / present	01/08/21	AG
46	Issue to client / present	01/08/21	AG
47	Issue to client / present	01/08/21	AG
48	Issue to client / present	01/08/21	AG
49	Issue to client / present	01/08/21	AG
50	Issue to client / present	01/08/21	AG
51	Issue to client / present	01/08/21	AG
52	Issue to client / present	01/08/21	AG
53	Issue to client / present	01/08/21	AG
54	Issue to client / present	01/08/21	AG
55	Issue to client / present	01/08/21	AG
56	Issue to client / present	01/08/21	AG
57	Issue to client / present	01/08/21	AG
58	Issue to client / present	01/08/21	AG
59	Issue to client / present	01/08/21	AG
60	Issue to client / present	01/08/21	AG
61	Issue to client / present	01/08/21	AG
62	Issue to client / present	01/08/21	AG
63	Issue to client / present	01/08/21	AG
64	Issue to client / present	01/08/21	AG
65	Issue to client / present	01/08/21	AG
66	Issue to client / present	01/08/21	AG
67	Issue to client / present	01/08/21	AG
68	Issue to client / present	01/08/21	AG
69	Issue to client / present	01/08/21	AG
70	Issue to client / present	01/08/21	AG
71	Issue to client / present	01/08/21	AG
72	Issue to client / present	01/08/21	AG
73	Issue to client / present	01/08/21	AG
74	Issue to client / present	01/08/21	AG
75	Issue to client / present	01/08/21	AG
76	Issue to client / present	01/08/21	AG
77	Issue to client / present	01/08/21	AG
78	Issue to client / present	01/08/21	AG
79	Issue to client / present	01/08/21	AG
80	Issue to client / present	01/08/21	AG
81	Issue to client / present	01/08/21	AG
82	Issue to client / present	01/08/21	AG
83	Issue to client / present	01/08/21	AG
84	Issue to client / present	01/08/21	AG
85	Issue to client / present	01/08/21	AG
86	Issue to client / present	01/08/21	AG
87	Issue to client / present	01/08/21	AG
88	Issue to client / present	01/08/21	AG
89	Issue to client / present	01/08/21	AG
90	Issue to client / present	01/08/21	AG
91	Issue to client / present	01/08/21	AG
92	Issue to client / present	01/08/21	AG
93	Issue to client / present	01/08/21	AG
94	Issue to client / present	01/08/21	AG
95	Issue to client / present	01/08/21	AG
96	Issue to client / present	01/08/21	AG
97	Issue to client / present	01/08/21	AG
98	Issue to client / present	01/08/21	AG
99	Issue to client / present	01/08/21	AG
100	Issue to client / present	01/08/21	AG

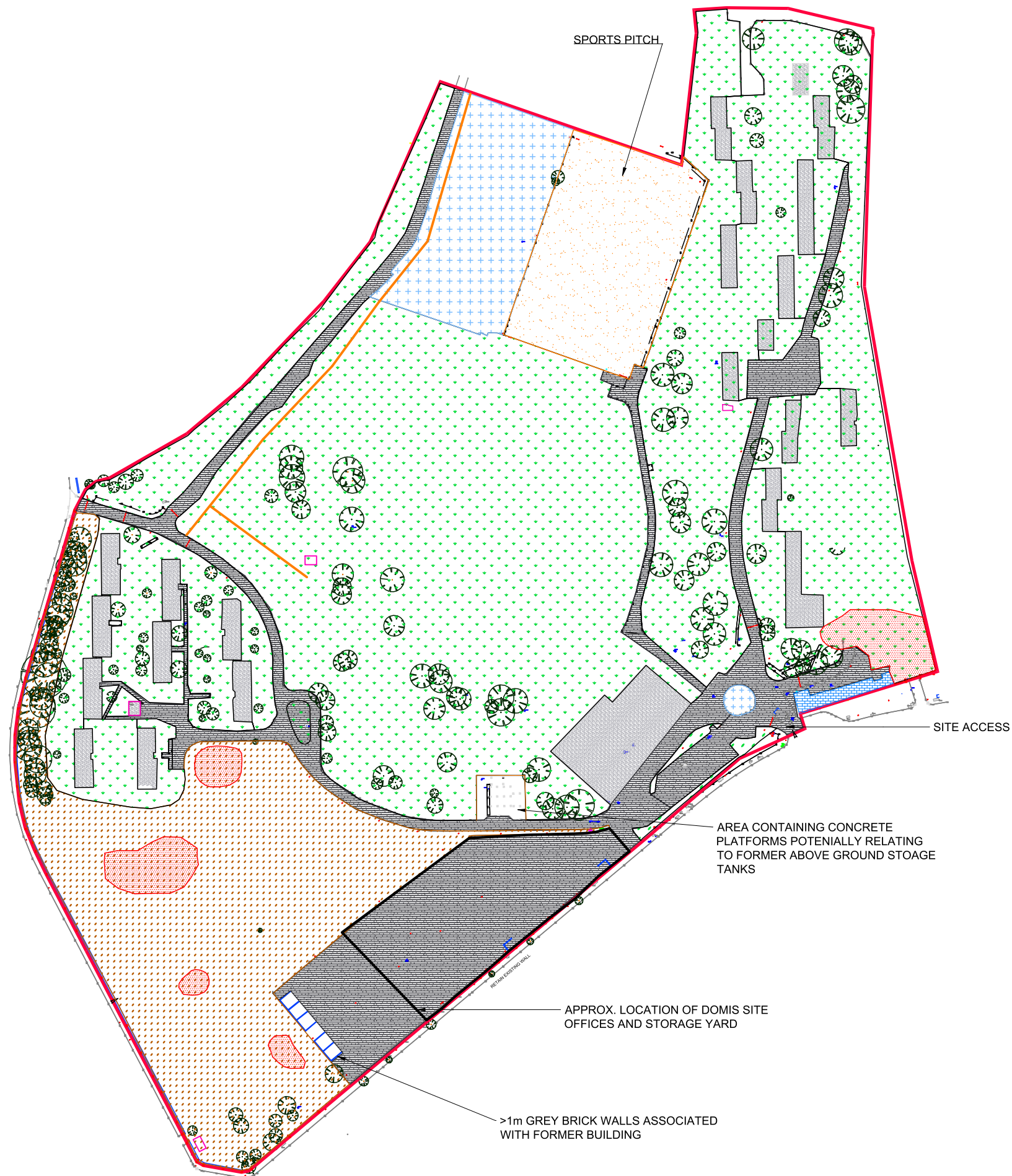


SITE LOCATION

NEAREST POSTCODE: M6 6DA



REV	DATE	DESCRIPTION	BY	CKD
 BROWNFIELD SOLUTIONS LTD GEO-ENVIRONMENTAL ENGINEERING EXCELLENCE				
CLIENT				
DOMIS CONSTRUCTION LTD				
PROJECT TITLE				
CASTLE IRWELL, SALFORD				
DRAWING TITLE				
SITE LOCATION PLAN				
DRAWING No. C4334/01	REVISION -	SCALE NTS	DATE 09/12/19	
DRAWN BY JM		CHECKED BY JMC		



KEY

- CONCRETE
- ASPHALT
- FORMER WOODLAND
- SOFT-STANDING
- GRAVEL SURFACE
- ASTRO-TURF
- APPROX. LOCATION OF JAPANESE KNOTWEED
- BRICK BUILDING
- DISUSED ELETRICAL SUBSTATIONS
- METAL FENCE
- SITE OFFICE / STORAGE YARD

NOTES

- ALL DIMENSIONS TO BE CHECKED ON SITE BEFORE COMMENCING WORKS. ANY DISCREPANCIES ARE TO BE REPORTED TO THE ARCHITECT & ENGINEER FOR VERIFICATION. FIGURED DIMENSIONS ONLY ARE TO BE TAKEN FROM THIS DRAWING.
- THIS DRAWING IS TO BE READ IN CONJUNCTION WITH ALL RELEVANT ENGINEERS REPORTS. THIS DRAWING IS COPYRIGHT OF BSL.
- DRAWING NOT FOR CONSTRUCTION PURPOSES.

REV	DATE	DESCRIPTION	BY	CKD

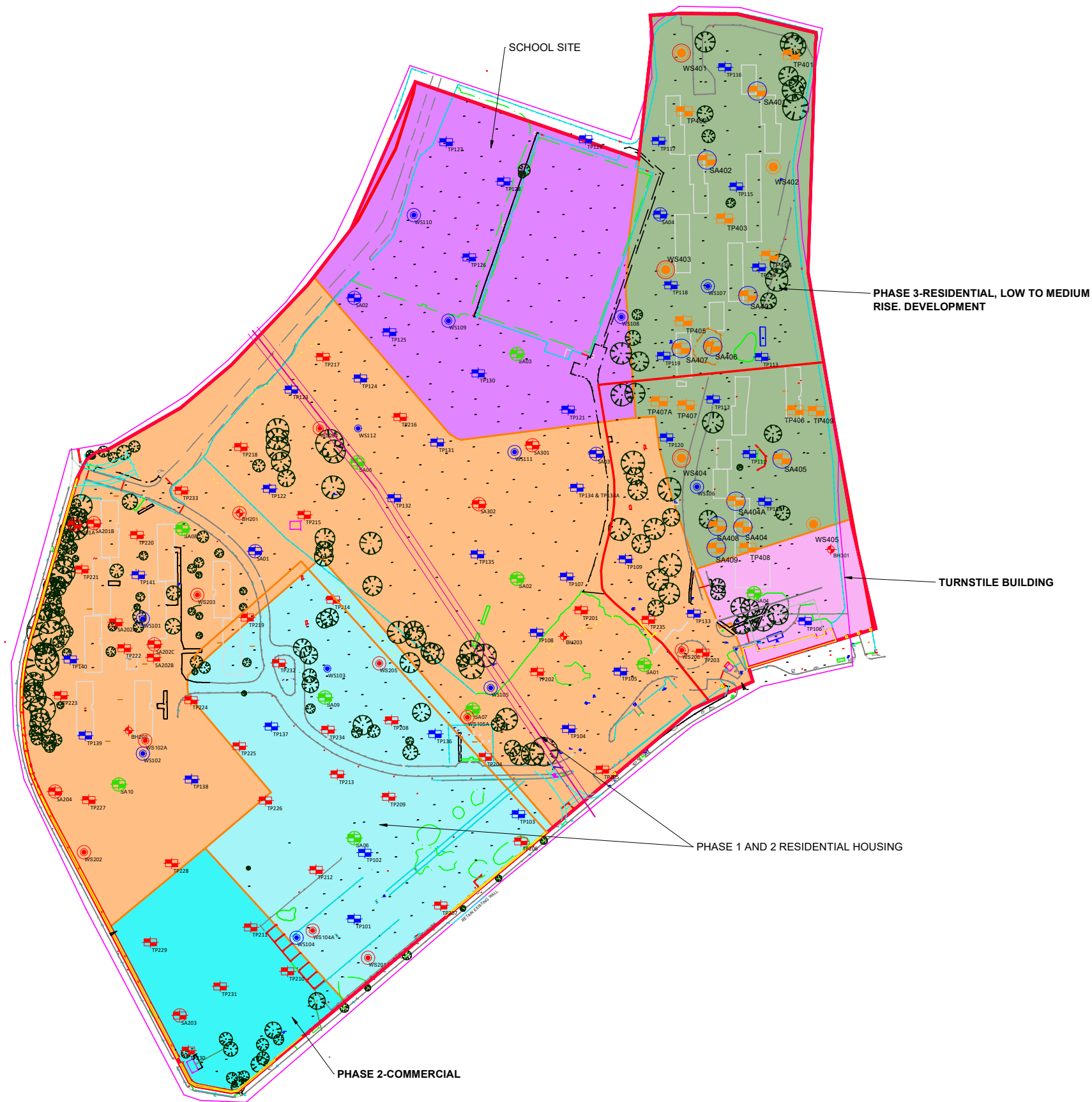


CLIENT
DOMIS CONSTRUCTION LTD

PROJECT TITLE
CASTLE IRWELL, SALFORD

DRAWING TITLE
SITE FEATURE PLAN

DRAWING No.	REVISION	SCALE	DATE
C4334/02	-	NTS	20/02/20
DRAWN BY SM		CHECKED BY JMC	



KEY

BROWNFIELD SOLUTIONS INVESTIGATION, 2022

- TPXX TRIAL PIT
- WSXX WINDOW SAMPLE BOREHOLE
- SAXX SOAKAWAY INFILTRATION TEST
- BHXX BOREHOLE INSTALLATION

BROWNFIELD SOLUTIONS INVESTIGATION, 2020

- BHXX CABLE PERCUSSIVE BOREHOLE
- WSXX WINDOW SAMPLE BOREHOLE
- SAXX SOAKAWAY INFILTRATION TEST
- BHXX BOREHOLE INSTALLATION

BROWNFIELD SOLUTIONS INVESTIGATION, 2019

- SAXX SOAKAWAY INFILTRATION TEST

BROWNFIELD SOLUTIONS INVESTIGATION, 2018

- TPXX TRIAL PIT
- WSXX WINDOW SAMPLE BOREHOLE
- SAXX SOAKAWAY INFILTRATION TEST
- BHXX BOREHOLE INSTALLATION

NOTES

- ALL DIMENSIONS TO BE CHECKED ON SITE BEFORE COMMENCING WORKS. ANY DISCREPANCIES ARE TO BE REPORTED TO THE ARCHITECT & ENGINEER FOR VERIFICATION. FIGURED DIMENSIONS ONLY ARE TO BE TAKEN FROM THIS DRAWING.
- THIS DRAWING IS TO BE READ IN CONJUNCTION WITH ALL RELEVANT ENGINEERS REPORTS. THIS DRAWING IS COPYRIGHT OF BSL.
- DRAWING NOT FOR CONSTRUCTION PURPOSES.

REV	DATE	DESCRIPTION	BY	CKD
C	13-05-20	ADDITION OF BOREHOLES WITH GAS SENTINEL INSTALLATIONS (WS102A, WS104A & WS105A)	SR	
G	06-09-22	INVESTIGATION OF PHASE 3 AREA	AN	JM



CLIENT
DOMIS CONSTRUCTION LTD

PROJECT TITLE
CASTLE IRWELL, SALFORD

DRAWING TITLE
EXPLORATORY HOLE LOCATION PLAN

DRAWING No.	REVISION	SCALE	DATE
C4334/03	G	NTS	06/09/2022
DRAWN BY JM		CHECKED BY AJS	

APPENDIX A

BSL Methodology and Guidance

BSL Phase I & II Geo-Environmental Assessment Reports - Methodology and Guidance

This Appendix provides information on the approaches, methods and guidance used by Brownfield Solutions Ltd in the preparation of this report.

The term 'geo-environmental' is used to describe aspects relating to ground-related environmental issues (such as potential soils and groundwater contamination). The term 'geotechnical' is used to describe aspects relating to the physical nature of the site (such as foundation requirements). It should be noted that this is an integrated investigation and these two main aspects are related, unless otherwise specified within the report.

Phase I reports are written in general accordance with the description of a Preliminary Investigation as defined in BS10175:2011+A2:2017 and are also produced in general accordance with the recommendations for a Tier 1 Preliminary Risk Assessment as described in LCRM guidance

The first stage of the investigation and assessment of a site is the Preliminary Investigation/Tier 1 Preliminary Risk Assessment, often referred to as a Phase 1 Desk Study, comprising a desk study and walk-over survey and collation of desk-based searches, which culminates in the Preliminary Risk Assessment and the development of a preliminary/initial Conceptual Site Model (CSM). From this are identified any potential geotechnical and geo-environmental hazards and the qualitative degree of risk associated with them.

From the geo-environmental perspective, the hazard Identification process uses professional judgement to evaluate all the hazards in terms of possible contaminant linkages (of source-pathway-receptor). Possible contaminant linkages are potentially unacceptable risks in terms of the current contaminated land regime legal framework and require either remediation or further assessment. These are normally addressed via intrusive ground investigation and generic risk assessment as part of Phase II investigations and reports.

The second stage is the Ground Investigation, Generic Risk Assessment and Geotechnical Interpretation. This represents the further assessment mentioned above. The Ground Investigation comprises field work and laboratory testing based on the findings of the Preliminary Risk Assessment, to reduce uncertainty in the geotechnical and geo-environmental hazard identification. This may include an exploratory, a detailed or/and supplementary Investigations as described in BS 10175:2011+A2:2017. Phase II Assessments are produced in general accordance with the recommendations for a Tier 2 Generic Quantitative Risk Assessment as described in LCRM guidance and are also intended to fulfil the requirements of a Ground Investigation Report (GIR) as detailed in BS EN 1997-2:2007.

Contaminated Land - Legislative Background

Land contamination can be addressed in several ways, e.g. during planning, under Part 2A, following an incident, during an investigation into environmental damages, or during the application of an environmental permit, or its surrender.

For the planning process the key test is **as a minimum the site cannot be determined as contaminated land**, e.g. there is not significant harm, significant possibility of significant harm to human health or that there is not significant harm to, or the significant possibility that the pollution of controlled waters will occur.

Environmental liabilities and risks have been evaluated in terms of a source -pathway - target relationship in accordance with the approach set out in:

- The 1995 Environment Act.
- The Contaminated Land Statutory Guidance, DEFRA – April 2012.
- The Contaminated Land (England) Regulations 2006.
- The Contaminated Land (England) Amendment Regulations 2012.
- Water Resources Act.
- Water Framework Directive.
- Environmental Damage Regulations.
- Environment Agency (EA) - Land Contamination Risk Management (LCRM) 2019.

Contaminated land is defined within the legislative framework as land which is in such condition by reason of substances in, on or under the land that:

- 1) Significant harm is being caused or there is a significant possibility of such harm being caused.
- 2) Significant pollution of controlled waters is being or is likely to be caused.

The potential for harm is based on the presence of three factors:

Source - substances that are potential contaminants or pollutants that may cause harm.

Pathway - a potential route by which contaminants can move from the source to the receptor, and the impact of that migration on the source e.g. attenuation.

Receptor - a receptor that may be harmed, for example the water environment, humans and water, considering the sensitivity of the receptor

Where a source, pathway and target are all present a pollutant linkage exists and there is potential for harm to be caused. The presence of a source does not automatically imply that a contamination problem exists, since contamination must be defined in terms of pollutant linkages and unacceptable risk of harm. The nature and importance of both pathways and receptors are site specific and will vary according to the intended end use of the site, its characteristics and its surroundings.

The key principle which supports the S-P-R approach is 'suitable for use' criteria. This requires remedial action only where contamination is considered to pose unacceptable actual or potential risks to health or the environment and, taking into account the proposed use of the site.

Relevant Guidance Documents

This report has been prepared in accordance with the list of guidance below, however the list is not exhaustive:

- DETR: Circular 02/2000: Environmental Protection Act 1990: Part IIA: Contaminated land. 2012.
 - Environment Agency technical advice to third parties on Pollution of Controlled Waters for Part IIA of the EPA1990, May 2002.
 - BS 10175:2011+A2:2017.
 - Environment Agency (EA) - Land Contamination Risk Management (LCRM). 2019.
-

- Groundwater Protection - <https://www.gov.uk/government/collections/groundwater-protection>.
- UK Technical Advisory Group (UKTAG) - - Water Framework Directive
- Incidents and their classification: the Common Incident Classification Scheme (CICS) – Used by the Environment Agency to classify pollution incidents.

Relevant Legislative Documents

The following is a non-exhaustive list of legislative framework documents that has been considered in the production of this report:

- The Environmental Protection Act 1990: Part 2A Contaminated Land Statutory Guidance (2012).
- The Environment Protection Act (1990).
- The Water Resources Act (1991).
- The Environment Act (1995).
- The Contaminated Land (England) Act (2000).
- The Pollution Prevention and Control (England and Wales) Regulations (2000).
- The Landfill Regulations (England and Wales) Regulations (2002).
- The Landfill (England and Wales) (Amendment) Regulations (2004).
- Contaminated Land (England) Regulations (2012).
- The Environmental Damage (Prevention and Remediation) Regulations (2009).
- Environmental Permitting Regulations (England and Wales) Regulations (2010).
- The Water Environment (Water Framework Directive) (England and Wales) Regulations 2017
- Health and Safety at Work Act.
- National Planning Policy Framework (NPPF)(2021).

Contaminated Land Risk Assessment Approach

Contaminated Land Risk Assessment is a technique that identifies and considers the associated risk, determines whether the risks are significant and whether action needs to be taken. The four main stages of risk assessment are:

Hazard Identification ➡ Hazard Assessment ➡ Risk Estimation ➡ Risk Evaluation.

LCRM outlines the framework to be followed for risk assessment in the UK. The framework is designed to be consistent with UK legislation and policies including planning. The starting point of the risk assessment is to identify the context of the problem and the objectives of the process. Under LCRM, three tiers of risk assessment exist – Stage/Tier Preliminary Risk Assessment, Stage 2 Generic Quantitative and Stage 3 Detailed Quantitative.

Further information can be found at the below site:

<https://www.gov.uk/government/publications/land-contamination-risk-management-lcrm>

Formulating and developing a conceptual model for the site is an important requirement of risk assessment, this supports the identification and assessment of pollutant linkages. Development of the conceptual model forms the main part of preliminary risk assessment, and the model is subsequently refined or revised as more information and understanding is obtained through the risk assessment process.

Risk is a combination of the likelihood of an event occurring and the magnitude of its consequences. Therefore, both the likelihood and the consequences of an event must be taken into account when assessing risk.

The risk assessment process needs to take into account the degree of confidence required in decisions. Identification of uncertainties is an essential step in risk assessment.

The likelihood of an event is classified on a four-point system using the following terms and definitions from CIRIA C552, with reference to Incidents and their classification: the Common Incident Classification Scheme

(CICS), Environmental Protection Act 1990: Part 2A – Contaminated Land Statutory Guidance 2012 and other guidance as appropriate which will be detailed within the main body of the report if applied.

The likelihood of a given receptor being impacted is related to a number of factors, e.g. the geology which could inhibit contaminant migration. For example, a site with a significant thickness of clay between it and a receptor may reduce migration of contamination via the subsurface, which will reduce the likelihood of a given receptor being impacted. The geology or drainage for example could offer a preferential pathway e.g. mines shafts/faults increasing the likelihood and potential magnitude of an impact. The depth of contamination will also affect the exposure pathway, for example petroleum hydrocarbons at depth are unlikely to reach a receptor via dermal contact but could via vapour pathways which will influence the likelihood of an impact being felt e.g. if there are no buildings on site.

The terms and definitions used for the assessment of the likelihood are provided below:

High likelihood: There is a pollution linkage and an event appears very likely in the short term and almost inevitable over the long term, or there is evidence at the receptor of harm or pollution.

Examples - Extensive areas with concentrations above saturation limits for mobile contamination e.g. petroleum hydrocarbons within the water table.

Likely: There is a pollution linkage and all the elements are present and in the right place, which means it is probable that an event will occur. Circumstances are such that the event is not inevitable, but possible in the short term and likely over the long term.

Examples – Localised areas of contaminants with concentrations above saturation limits for mobile contamination e.g. localised petroleum hydrocarbons within the water table; shallow contamination above relevant human health generic assessment criteria is present with little or no hardstanding,

Low likelihood: There is a pollution linkage and circumstances are possible under which an event could occur. However, it is by no means certain even over a longer period such event would take place, and is less likely in the short term.

Examples - A thickness/distance of low permeability deposits preventing contaminant migration to a receptor is present; a site is mostly covered hard standing preventing exposure to soil contamination.

Unlikely: There is a pollution linkage but circumstances are such that it is improbable the event would occur even in the long term.

Examples – A site is underlain by a substantial thickness of low permeability clays, between the source and potential receptors which will inhibit significantly, but not completely rule out migration to sensitive receptors.

The severity is also classified using a system based on CIRIA C552, with reference to Incidents and their classification: the Common Incident Classification Scheme (CICS), Environmental Protection Act 1990: Part 2A – Contaminated Land Statutory Guidance 2012 and other guidance as appropriate which will be detailed within the main body of the report, if applied. The terms and definitions are:

Severe: Short term (acute) risk to human health likely to result in ‘significant harm’ as defined by the Environment Protection Act 1990, Part IIA. Short-term risk of pollution of sensitive water resources. Catastrophic damage to buildings or property. A short-term risk to a particular ecosystem or organism forming part of that ecosystem (note definition of ecosystem in ‘Draft Circular on Contaminated Land’, DETR 2000);

Examples – High concentrations of contaminant on surface of recreation area, major spillage of contaminants from site into controlled waters, explosion causing building to collapse.

Medium: Chronic damage to human health (‘significant harm’ as defined in DETR 2000). Pollution of sensitive water resources. A significant change in a particular ecosystem or organism forming part of that ecosystem (note definition of ecosystem in ‘Draft Circular on Contaminated Land’, DETR 2000);

Examples - Concentrations of contaminants exceed the generic assessment criteria, leaching of contaminants from a site to a Principal or Secondary Aquifer, death of species within a designated nature reserve.

Mild: Pollution of non-sensitive water resources. Significant damage to crops, buildings, structures and services ('significant harm' as defined in 'Draft Circular on Contaminated Land', DETR 2000). Damage to sensitive buildings, structures, services or the environment.

Examples – Pollution of non-classified groundwater or damage to buildings rendering it unsafe to occupy.

Minor: harm, not necessarily significant harm, which may result in financial loss or expenditure to resolve. Non-permanent health effects to human health (easily prevented by use of personal protective clothing etc). Easily repairable effects of damage to buildings, structures and services.

Examples – Presence of contaminants at such concentrations PPE is required during site work, loss of plants in landscaping scheme or discolouration of concrete.

Once the likelihood and severity have been determined, a risk category can be assigned using the table below.

		Consequences			
		Severe	Medium	Mild	Minor
Probability	Highly likely	Very high	High	Moderate	Moderate/low
	Likely	High	Moderate	Moderate/low	Low
	Low likelihood	Moderate	Moderate/low	Low	Very low
	Unlikely	Moderate/low	Low	Very Low	Very low
	No Linkage	Negligible			

Definitions of the risk categories obtained from the above table are as follows together with an assessment of the further work that might be required:

Very high: There is a high probability that severe harm could arise to a designated receptor from an identified hazard or there is evidence that severe harm is currently happening. This risk, if realised, could result in substantial liability. Urgent investigation and remediation are likely to be required.

High: Harm is likely to arise to a designated receptor from an identified hazard. Realisation of the risk is likely to present a substantial liability. Urgent investigation is required and remedial works may be necessary in the short term and are likely over the longer term.

Moderate: It is possible that harm could arise to a designated receptor from an identified hazard. However, it is either relatively unlikely that any such harm would be severe, or if any harm were to occur it would be more likely to be relatively mild. Investigation is normally required to clarify the risk and determine the liability. Some remedial works may be required in the longer term.

Low: It is possible that harm could arise to a designated receptor from an identified hazard, but it is likely that this harm, if realised, would at worst normally be mild.

Very Low: There is a low possibility that harm could arise to a receptor. In the event of such harm being realised, it is not likely to be severe.

Some linkages may be identified which constitutes a theoretical connection between a source and a receptor, but professional judgement shows them not to be possible for some reason. These are labelled 'no linkage' in the summary table, which give rise to a **negligible** risk category and no further action is required.

Ground Gas Risk Assessment Guidance

BS8485:2015+A1:2019, BS 8576:2013, CIRIA C665 and CL:AIRE RB17 are the current guidance which gives up-to-date advice on all aspects of ground gas. They outline good practice in investigation, the collection of relevant data and monitoring programmes in a risk-based approach to ground gas contamination.

Within BS8485:2015+A1:2019, BS 8576:2013 and CIRIA C665, two semi-quantitative methods are set out for the assessment of risk:

- 1 For low rise housing with a ventilated under floor void at minimum 150 mm (Boyle and Witherington).
- 2 For all other development types (Wilson and Card).

Both methods use the concept of Gas Screening Values (GSVs) to identify levels of risk. The mitigation and management of potentially unacceptable risk is described with reference to both passive and active systems of gas. Source removal is also discussed as an option. A separate approach is discussed under the RB17 header further below.

The aim of the guidance is for a consistent approach to decision making, particularly relating to the scope of protective design measures on a site-specific basis.

Legislative Framework

BS8485:2015+A1:2019, BS 8576:2013 and CIRIA C665 provides technical guidance, however they also recognise the context into which the guidance has to be employed. Government policy is based upon a “suitable for use approach”, which is relevant to both the current and proposed future use of land. When considering the current use of land, Part IIA of the Environment Protection Act 1990 provides the regulatory regime. The presence of hazardous ground gases could provide the “source” in a “pollutant linkage” which could lead the regulator to determine that considerable harm or there is a significant possibility of such harm being caused. Under such circumstances, the regulator would determine the land to be “contaminated land” under the provisions of the Act, setting out the process of remediation as described in the DETR Circular 02/2000 *Statutory guidance on contaminated land*.

Generation Potential of Sources

BS 8576:2013 Figure 6 provides a basis for assessing the generation potential from sources identified as part of the Phase I Assessment. These are summarised below:

Generation Potential	Typical Sources
Very Low	- Natural carbonate soil and strata, e.g. chalk and limestone. - Natural soil strata with a low degradable organic content, e.g. alluvium, peat. - In-filled pond less than 15 m diameter, in-filled before 1930s to 1940s. - Made ground with low degradable organic content (e.g. up to 5% organic material such as pieces of wood, pieces of paper, rags, etc. with a high proportion of ash and no food or other easily degradable waste). - Mine workings shallow or shaft (where there is clear evidence that they are flooded). - Inert landfill sites.
Low	- Natural soil strata with a high degradable organic content (DOC). - Made ground with total organic carbon (TOC) up to 6% (e.g. dock silt, no food or other easily degradable waste). - Foundry sand (includes phenolic binders, rags and wood that decay, albeit at low rates). - Landfill 1945 to mid 1960s (see also Moderate below).
Moderate	- Sewage sludge. - Mine workings – unflooded, more than 50 years since last worked (gas is liberated from coal when mine workings are excavated; this continues for up to about 50 years). - Landfill 1945 to mid 1960s (this could also be “low” or, if disturbed, “high”).

Generation Potential	Typical Sources
High	- Landfill mid 1960s to early 1990s. - Mine workings – unflooded – less than 50 years since last worked.
Very High	- Municipal landfill sites. - Landfill early 1990s onward.

Frequency and Duration of Monitoring

The monitoring period for a specific site covers the “worst case” scenario. A “worst case” scenario will typically occur during falling atmospheric pressure and, in particular, weather conditions such as rainfall, frost and dry weather.

The benefits of the additional information and whether it is likely to change the scope of gas protection should be considered, as are the consequences of failing to characterise adequately pollutant linkages. Investigations concerned with soil gas are required to provide monitoring data sufficient to allow prediction of worst case conditions enabling the confident assessment of risk and subsequent design of appropriate gas protection schemes. Monitoring programmes should not be an academic exercise in data collection. CL:AIRE publication TB17 “Ground Gas Monitoring and ‘Worst-Case’ Conditions” provides further guidance.

Below are matrices that will aid in determining an appropriate number of gas monitoring visits and the length of monitoring period.

Typical/idealised periods of monitoring

		Generation of Potential Source				
		Very Low	Low	Moderate	High	Very High
Sensitivity of Development	Low (Commercial)	1 month	2 months	3 months	6 months	12 months
	Moderate (Apartments)	2 months	3 months	6 months	12 months	24 months
	High (Low rise Residential)	3 months	6 months	6 months	12 months	24 months

Typical/idealised frequency of monitoring/Number of Visits Required

		Gas Generation of Potential Source				
		Very Low	Low	Moderate	High	Very High
Sensitivity of Development	Low (Commercial)	4	6	6	12	12
	Moderate (Apartments)	6	6	9	12	24
	High (Low rise Residential)	6	9	12	24	24

Note

- NHBC guidance also recommends this period of monitoring (Boyle and Witherington, 2007).
- Generation potential of sources based on descriptions within BS 8576:2013.
- At least two sets of readings should be at low and falling atmospheric pressure (but not restricted to periods below <1000 mb) known as worst case conditions. Historical data can be used as part of the data set (Table 5.5b).

It is recommended that newly installed monitoring wells are left for 24 hours to allow the soil gas to reach equilibrium. It should be recognised, however, that some soil gas regimes could take considerably longer (up to seven days). Interpretation of any initial readings should take this equilibrium process into account.

RB17 Approach

CL:AIRE RB17 (Card et al 2012) is a pragmatic approach to ground gas risk assessment and was developed because gas concentration, pressure and flow rate measured in a well headspace may not be representative of the conditions in the surrounding formation.

In these low-risk situations, the approach is to use the conceptual site model and the estimation of the likely gas generation from a source to identify where or if gas monitoring is required to better define the risks.

Under this approach, for sites with natural soils only with no credible methane source, then no action is required (no monitoring or gas protection measures) as this represents Characteristic Situation 1 (CS1).

Unexploded Ordnance (UXO) Guidance

Clients have a legal duty under the CDM 2015 Regulations to provide designers and contractors with project-specific health and safety information needed to identify hazards and risks. This includes the possibility of unexploded ordnance (UXO) being encountered on the site. Further details are given in CIRIA report C681.

BSL carry out non-specialist UXO screening exercises by considering any evidence of UK defence activities on or near the site evident from gathered desk study information and the unexploded aerial delivered bomb (UXB) online risk maps produced by Zetica. Other data sources are available, but as a first stage screening exercise the freely available online Zetica maps have been used. The level of risk stated is that determined by Zetica, a company experienced and considered competent in the assessment of UXO.

Contaminated Land Screening Values

In assessing the potential for contamination Brownfield Solutions Limited (BSL) follows UK guidance and current best practice.

General

The current recommended method for assessing contamination is on the basis of:

Source-Pathway-Receptor

Where any one of these “pollution linkages” is absent there is deemed to be no risk.

Fundamentally, receptors can be considered as humans (human health) and controlled waters (surface and ground waters).

The purpose of using generic Tier 1 screening levels is to have a simple means of assessing the potential contamination of a site and to inform decisions on whether further investigation is warranted or whether an option to undertake clean up based on the data to hand is cost effective.

Human Health

Current UK guidance is provided by DEFRA and the Environment Agency (EA). Publications forming part of the guidance include the CLEA Model and toxicological reports collectively referred to as the CLEA Guidance. The CLEA Guidance has included a number of publications which have provided initial screening values for soil contamination based on standard land uses and soil assumptions.

CLEA guidance has gone through a number of revisions over time. Tier 1 generic S4UL values have been published using the CLEA 1.06 Model by CIEH/LQM. These are the third set of generic assessment criteria generated by CIEH and replace the previous two sets of GACs (Generic Assessment Criteria). The revised S4UL values are based on greater knowledge of relevant toxicology and further consideration of exposure frequencies.

C4SL values for six determinands including lead was published by DEFRA/CL:AIRE in December 2014 and they represent a low risk as opposed to minimal risk. These screening values were published by DEFRA for Part 2A use, although with the dual purpose for use under planning. However, S4ULs remain the first reference due to the broader range of end uses and soil organic content.

The preference from the EA is that site specific screening levels are used wherever possible. Due to numerous factors it is not always possible to utilise site specific values. In these instances the following data sources are used in the order of preference given below:

- CIEH S4UL values (derived by CIEH/LQM).
- DEFRA/CL:AIRE C4SL's.
- CL:AIRE GAC values.
- Guidance from other European countries.
- Guidance from the outside Europe.

Controlled Waters

The European Water Framework Directive (WFD) became UK law in December 2003. It was created to ensure that European countries manage their rivers, groundwater and lakes so that they stay healthy for people and for wildlife.

This is achieved by the use of chemical standards for surface waters and groundwater. These values describe concentrations of chemicals that are not expected to cause harm to environmental organisms or human health, provided they are not exceeded. The same chemical may have several standards for different environmental regimes, and for different protection objectives.

Statutory Standards are set in legislation and if exceeded, this constitutes non-compliance with statutory obligations. European Directives are implemented in England and Wales by corresponding statutory instruments (i.e. regulations). The statutory instruments can be the exact same standards as they appear in the Directive or be more stringent.

A number of non-statutory standards also exist, these are set by various organisations (including the EA) for chemicals that are considered to be of concern, but are not covered by any specific legislation.

The chemical standards used in the UK to control impaction of contamination on controlled waters are Environmental Quality Standards (EQS). The EQS's cover a large number of compounds.

Where certain compounds are not covered by the EQS these are commonly compared to the UK Drinking Water Standards (DWS).

Further Assessment

When screening values are exceeded then further consideration is required. This could include the use of simple measures to break the pollution pathway and mitigate the risk, further additional detailed investigation, including the deriving of site-specific values to better define the risk, and to design appropriate remedial measures.

Re-Use Of Waste - Guidance Note

Definition of Waste

The Environment Agency considers waste to be “...any material that is discarded, or intended to be discarded...” This includes any soil from trenches, footing, site strip etc. It is no longer required in its original location, therefore it is considered to be waste.

CL:AIRE: Code of Practice

Where materials are excavated for construction purposes, wherever possible these should be retained on site for engineering purposes if they are suitable for use. This can be implemented under the CL:AIRE “Development Industry Code of Practice for the Definition of Waste” (CL:AIRE DoWCoP), also commonly referred to as a “Materials Management Plan”.

The developer/contractor is advised to complete all works under the DoWCoP.

Potential scenarios where soils may be able to be re-used:

- Material capable of being used in another place on the same site without treatment.
- Material capable of being used in another place on the same site following ex-situ treatment on site.
- Material capable of being used in another development site without treatment (Direct Transfer).
- Material capable of being used in another development site following ex-situ treatment on another site eg Hub site.

The Code of Practice requires 4 No. Factors to be addressed:

- 1) Protection of human health and protection of the environment.
- 2) Suitability of use, without further treatment.
- 3) Certainty of use.
- 4) Quantity of material.

In order to satisfy these requirements the following are required:

- i) Consultation/approval with Local Authority & Environment Agency to confirm they have no objections to the proposed re-use of waste soils, or the risk assessments for the site.
- ii) Risk Assessments to demonstrate that the site does not present an Environmental Hazard.
- iii) Remediation Strategy for contaminated sites (or Design Statement for non-contaminated sites).
- iv) Materials Management Plan (MMP) which details material generated stockpiles and the end use.
- v) Volume calculations.
- vi) Planning permission for the development.
- vii) Contractual details to be clear, regarding who steps in if a contractor goes into administration/liquidation.

The use of the CoP is effectively industry regulated, there is a requirement to appoint an independent Qualified Person (QP) who checks all the requirements have been met and registers the documentation with the Environment Agency. This person must not have had any involvement with the preparing of the risk assessments or remedial strategy on the site.

Soils which require treatment on site (eg bioremediation, stabilisation) will require an Environmental Permit for treatment, together with justification and validation to prove, once treated, this material is suitable for use. Site management procedures need to be in place to ensure that material is tracked through from excavation stockpiling, treatment and remediation processes. Should the process of material tracking be considered non-robust, or not adhered to, this may fail the test whether excavated materials may be considered non-waste.

Waste Classification for Soils

Introduction

Waste producers have a duty of care to classify the waste they are producing:

- Before it is collected, disposed of or recovered.
- To identify the controls that apply to the movement of the waste.
- To complete waste documents and records.
- To identify suitably authorised waste management options.
- To prevent harm to people and the environment.

The most sustainable and economic method of dealing with waste soil is usually the retention and re-use on site. Where this is not possible there are three main options for the disposal of soils:

1. Disposal to a permitted waste recycling facility.
2. Re-use on another site (subject to the suitability).
3. Disposal to a landfill site.

The disposal to a permitted facility will be subject to the **specific conditions of the permits for each individual facility** and will vary dependent on location and environmental sensitivity of the receiving site. Re-use on another site will also be subject to the acceptability criteria of that site.

The guidance below relates to disposal to **landfill sites only**.

Background for Landfill Disposal

In July 2005 the United Kingdom implemented the European Directive 1999/31/EC (The Landfill Directive), this introduced the current regime for waste and waste disposal to landfill. The Landfill Directive places controls on waste disposal. These controls include requirements to follow the waste acceptance procedures and criteria that have been agreed by the Council of the European Union and are laid out in Council Decision 2003/33/EC.

Before a waste can be accepted at a landfill site, the landfill **operator** must be satisfied that the waste meets his permit conditions, the waste acceptance procedures (WAP) and waste acceptance criteria (WAC).

If disposal to landfill is the best management option for the waste soils, these procedures **must** be followed or the operator may refuse to accept the waste.

Key Points:

- Not all waste can be landfilled
- Landfills are classified according to whether they can accept hazardous, non-hazardous or inert wastes.
- Wastes can only be accepted at a landfill if they meet the waste acceptance criteria (WAC) for that class of landfill.
- Most wastes must be treated before you can send them to landfill.
- There are formal processes for identifying and checking wastes that must be followed before wastes can be accepted at a landfill site.

Classification

Wastes are listed in the European Waste Catalogue (EWC 2002) and grouped according to generic industry, process or waste types. Wastes within the EWC are either hazardous or non-hazardous. Some of these wastes are hazardous without further assessment (absolute entries) or are 'mirror' entries that require further assessment of their hazardous properties in order to determine whether they are hazardous waste.

Waste soil has mirror entries on the EWC and as such the first phase of the waste classification process is that of determining if the waste is hazardous or not i.e the hazard assessment. The most common EWC waste codes related to soil are:

17 05	soil (including excavated soil from contaminated sites), stones and dredging spoil
17 05 03*	soil and stones containing dangerous substances
17 05 04	soil and stones other than those mentioned in 17 05 03

Soils may contain certain contaminants (eg asbestos, oil,) which have prescribed concentration thresholds, that if breached will render the material hazardous waste. These are based on specific “hazardous properties” which include hazards such as carcinogenicity, flammability and toxicity.

In the first instance the concentrations of plausible contaminants within the soil should be identified and wastes should be **classified based on their total concentrations**.

Waste Definitions

Inert	- Will not undergo any significant physical, chemical or biological transformations. - Will not dissolve. - Will not burn. - Will not physically or chemically react. - Will not biodegrade. - Will not adversely affect other matter with which it comes into contact in a way likely to give rise to environmental pollution or harm to human health. - Has insignificant total leachability and pollutant content. - Produces a leachate with an ecotoxicity that is insignificant (if it produces leachate).
Non-Hazardous	Is not inert (see above) Is not hazardous (see below)
Hazardous	Soil has hazardous properties as defined in WM3 (Guidance on the classification and assessment of waste (1st edition 2015)- Technical Guidance)
Stable Non-reactive hazardous waste#	Hazardous waste, the leaching behaviour of which will not change adversely in the long-term, under landfill design conditions or foreseeable accidents either: in the waste alone (for example, by biodegradation), under the impact of long-term ambient conditions (for example, water, air, temperature or mechanical constraints) or by the impact of other wastes (including waste products such as leachate and gas).

This option allows hazardous waste that is stable and thus has a low leaching potential to be deposited in cells with a standard of containment consistent with non-hazardous wastes.

WAC Testing

The purpose of WAC analysis is to confirm that the waste complies with the relevant WAC for the receiving landfill. If the waste has any disposal route other than a landfill site (e.g. recycling facility, incineration etc) the WAC is not relevant. Furthermore, the WAC limits **cannot** be used to make an assessment of whether a waste is hazardous. WAC testing does however define if a non-hazardous waste is suitable for an inert landfill.

Classification based on Total Concentrations ¹	Non-Hazardous Waste		Hazardous Waste	
	Below inert WAC limit values:	Above inert WAC limit values:	Below hazardous WAC limit values	Above hazardous WAC limit values
WAC testing				
Landfill requirements	INERT landfill	NON-HAZARDOUS landfill ²	HAZARDOUS landfill	PRE-TREATMENT ³

1 Total concentrations are defined as tests results on solids as opposed to leachate (i.e. a liquid).

2 Individual sites may have certain limit values pre-determined in their licence.

3 After pre-treatment the material characteristics may have changed to an extent that allow the soil to be re-classified.

Hydrocarbons in Soils

WM3 uses the term Oil or Waste Oil to cover hydrocarbons products such as fuel oil, petrol or diesel. These are defined by WM3 as hazardous under an absolute entry in the List of Wastes. However, hydrocarbons in soils are a mixture rather than a pure product and are therefore not absolute entries.

Known Oils

The simplest scenario is where the identity of the contaminating oil is known or can be identified. If the oil is known the manufacturer's or supplier's REACH compliant safety data sheet for the specific oil can be obtained and the hazard statement codes on that Safety Data Sheet can be used for the hazardous waste assessment.

Where the identity of the oil can only be identified down to a petroleum group level (i.e. the contaminating oil is known to be diesel, but the specific type/brand is unknown), then the classification of that petroleum group should be used in the assessment. The marker compounds associated with that petroleum group may be used to confirm carcinogenicity.

Oils may contain a range of hydrocarbons, so the presence of for instance Diesel Range Organics (DRO) does not enable the assessor to conclude that diesel is present. These hydrocarbons may have arisen from other oils, the laboratory needs to provide an interpretation of the chromatograph to determine if it is consistent with diesel or weathered diesel as a whole.

The concentration of known oils should be determined using a method that as a minimum spans the range in which the carbon numbers for that known oil fall.

Unknown Oils

Where hydrocarbons are contaminating soils, it is likely that the oil will be unknown or cannot be determined.

WM3 states that:

For contaminated land specific consideration must be given to the following before proceeding;

- The presence of other organic contaminants, for example solvents or coal tar that could be detected as hydrocarbons. Coal Tar is not an oil and is considered separately in WM3 example 2. Where the site history or investigation indicates the presence of hydrocarbons from oil and other sources (e.g. coal tar), and the origin of the hydrocarbons cannot reliably be assigned to either, then a worst case approach of considering the hydrocarbons both as waste oil (in accordance with this example) and from other sources, for example coal tar should be taken.
- The presence of diesel, or weathered diesel, should be specifically considered by the laboratory and where this is confirmed by the hydrocarbon profile the oil should be assessed as a known or identified oil (diesel).

The use of marker compounds is optional; however, it is recommended that where possible the marker compounds should be used. WM3 states:

If the identity of the oil is unknown, and the petroleum group cannot be established, then the oil contaminating the waste can be classified as non-carcinogenic/mutagenic due to the presence of oil if all three of the following criteria are met:

- The waste contains benzo[a]pyrene (BaP) at a concentration of less than 0.01% (1/10,000th) of the TPH concentration (This is the carcinogenic limit specified in table 3.1 of the CLP for BaP)
- This has been determined by an appropriate and representative sampling approach in accordance with the principles set out in Appendix D of WM3, and
- The analysis clearly demonstrates, for example by carbon bands or chromatograph, and the laboratory has reasonably concluded that the hydrocarbons present have not arisen from petrol or diesel.

For example:

TPH Concentration (mg/kg)	Petrol or Diesel	BaP (mg/kg)	Classification
10,000	No	0.9	Non- Hazardous
1,000	No	Not available	Hazardous
1,000	Yes	Not relevant	Hazardous

References

1. Environmental Permitting (England and Wales) Regulations 2010 (as amended) (EP Regulations), the Landfill Directive (1999/31/EC) and the subsequent Council Decisions.
2. Environment Agency Environmental Permitting Regulations: "Inert Waste Guidance- Standards and Measures for the Deposit of Inert Waste on Land" 2009.
3. Environment Agency "Waste acceptance at landfills - Guidance on waste acceptance procedures and criteria" Nov 2010.
4. Environment Agency "Guidance on the classification and assessment of waste (Technical Guidance WM3)".
5. Classification, Labelling and Packaging of Substances Regulation (EC 1272/2008) (CLP).
6. Directive 2008/98/EC of the European Parliament and of the Council of 19 November 2008 on waste and repealing certain Directives
7. 2014/955/EU: Commission Decision of 18 December 2014 amending Decision 2000/532/EC on the list of waste pursuant to Directive 2008/98/EC of the European Parliament
8. Environmental Permitting Guidance The Landfill Directive For the Environmental Permitting (England and Wales) Regulations 2010 Updated March 2010 Version 3.1
9. Classification, Labelling and Packaging of Substances Regulation (EC 1272/2008) (CLP).

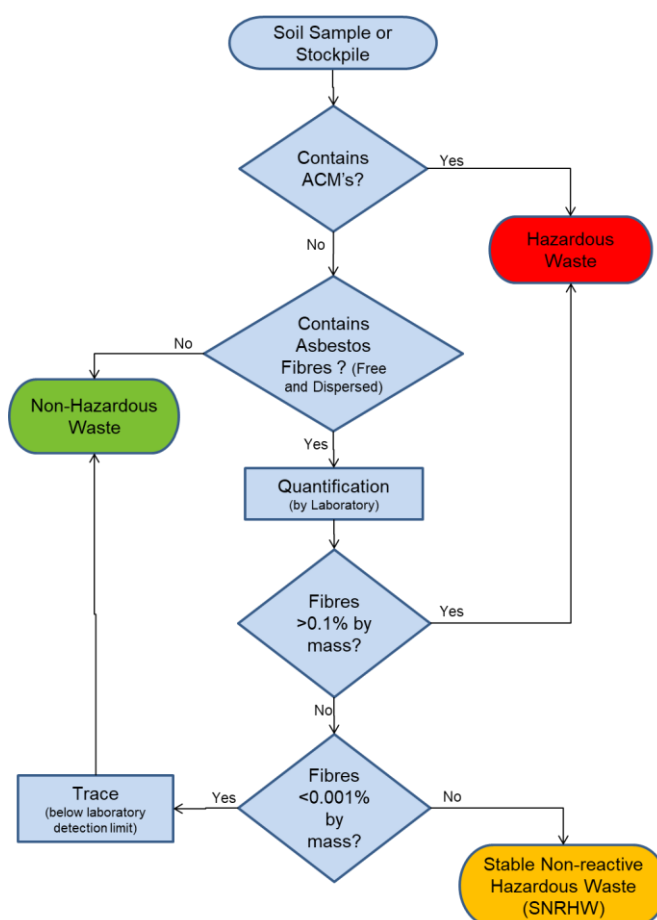
Additional Asbestos Guidance Notes

Disposal

The 1st Edition of WM3 "Guidance on the classification and assessment of waste", details the way in which Asbestos is assessed within soils.

The assessment of asbestos containing waste is dependent on whether the asbestos is present as:

- Fibres that are free and dispersed, or
- Identifiable pieces of asbestos containing materials (ACM's)



Identifiable pieces of asbestos are any particle of a size that can be identified as potentially being asbestos by a competent person if examined by the naked eye. The result is that commonly soils with visible ACM's are sorted and the ACM's removed by hand picking and separate disposal.

Asbestos concentrations below 0.001% by mass are below standard laboratory detection limits and are not currently regarded as containing asbestos for the purposes of disposal and may be disposed of to an inert landfill site¹. These levels are often termed "trace" by laboratories.

Asbestos concentrations between 0.001% and 0.1% are stable non-reactive hazardous waste (SNRHW)¹. Waste transfer stations where soil recycling takes place may be able to take SNRHW, but are unlikely to take soils containing asbestos above trace concentrations.

The following codes should be assigned to the asbestos waste as appropriate:

17 06	Insulation materials and asbestos-containing construction materials
17 06 01	Insulation materials containing asbestos
17 06 03	Other insulation materials consisting of or containing hazardous substances
17 06 04	Insulation materials other than those mentioned in 17 06 01 and 17 06 03
17 06 05	Construction material containing asbestos

WM3 indicates that 17 06 05 would normally be used in preference to 17 06 01 for the asbestos in asbestos contaminated soil and stones.

Construction materials containing asbestos and "*other suitable materials*" may be landfilled at landfills for non-hazardous waste in accordance with the Landfill Directive without testing.

This means that wastes that are only hazardous because of their asbestos content can be disposed of at landfills for non-hazardous waste in separate landfill cells that only accept asbestos wastes and other suitable materials. The Landfill Directive requires that stable non-reactive hazardous waste shall not be deposited with biodegradable waste (for example organic material, household waste, paper etc..) and must meet the waste acceptance criteria set out in accordance with Annex II.

Construction

Health and Safety Executive (HSE) guidance on asbestos is not directly related to soil and much of the guidance focuses on the removal of asbestos from buildings. The overarching legislation is the Control of Asbestos Regulation (CAR 2012). However, where work involves (or is likely to involve) contact with asbestos then CAR 2012 requires a risk assessment including whether or not the work is licensed or notifiable non-licensed work and may require an Asbestos Management Plan. Work becomes notifiable if it is considered that the control limit could be exceeded.

Brownfield sites frequently have soils that contain asbestos and the presence of asbestos needs to be considered within the context of construction, particularly in relation to groundworks. The exposure of soils and the use of excavators and plant to move soil around increases the possibility of fibres becoming airborne. However, it is good site practice to not generate dusts and to employ dust suppression on all sites regardless of the presence of asbestos.

The legal control limit for asbestos is 0.1f/ml over a continuous four-hour period. The control limit is not a 'safe' level and exposure from work activities involving asbestos must be reduced to as far below the control limit as possible.

Clearly the higher the concentrations in the soil the greater potential there is for fibres to be released, however IOM publication TM/88/14 "the release of dispersed asbestos fibres from soil" 1988 concludes that:

- Mixtures of asbestos in dry soils with asbestos content as low as 0.001% can produce airborne respirable asbestos concentrations greater than 0.1f/ml in dust clouds where the respirable dust concentrations are less than 5mg/m³.
- An action limit is recommended of no higher than 0.001% asbestos in soils above which steps should be taken to minimise exposure to airborne fibres (e.g. by wetting).
- The addition of relatively small quantities (10%) of water can reduce the airborne fibre concentrations by an order of magnitude.

Where asbestos has been identified at concentrations above 0.001% as free and dispersed fibres in the soil precautions need to be adopted. Concentrations below this are considered to be normal background, although good site practice dictates that the generation of dusts should be avoided and therefore any fugitive fibre release from minor concentrations should be kept to a practical minimum.

End Use

The use of materials containing asbestos and material containing asbestos is prohibited under EU legislation. There is currently a Joint Industry Working Group (JIWG) tasked with producing a Code of Practice for Asbestos in Soil, Made Ground and Construction & Demolition Material that will clarify in due course the position of the various government agencies.

Asbestos containing materials can remain in situ under a suitable cover system which may be hardsurfacing or soft landscaping (with or without hard dig layers and markers).

There is a risk that future maintenance may compromise such systems and details of the presence of asbestos should be kept in the Health and Safety File.

Preliminary publications from JIWG (April 2015) provide guides for decision making in relation to construction.

The re-use of waste soils should be undertaken in accordance with the CL:AIRE Code of Practice and is subject to suitable risk assessments demonstrating low risk. There is nothing that specifically excludes the re-use of soils containing asbestos as fill to raise levels. However, the movement of materials increases the risk of fibres becoming airborne and suitable precautions will be required.

The re-use of soils containing asbestos at concentrations above hazardous waste levels is likely to meet with regulatory opposition. Assuming a suitable strategy could be agreed this would take a considerable amount of time and is only likely to be feasible where there is a long program for implementation.

Asbestos in Soil as Free Fibres

Concentration (by weight)	Waste Disposal				Construction Issues	End Use	
	Recyc	Inert	SNR	Hazardo		Suitable for re-use on site	Precautions
Not detected	√	√			No precautions necessary, however on a brownfield site asbestos not previously identified may be found during works and a statement within the contractors method statement for how they will deal with this unforeseen asbestos would be good practice to ensure compliance with CAR2012.	Yes	None
Trace (<0.001%)		√ ²			Precautions are unlikely to be required, however a detailed method statement may be required to ensure compliance with CAR2012. Basic asbestos management good practice will be required. Typically precautions would include: - Ensuring soils do not dry out to become dusty. - Site personnel have the risk communicated at induction stage.	Yes Soils can be re-used under CL:AIRE CoP with the correct precautions in place.	Generally clean cover or hardstanding cover required.
0.001% – 0.099%			√		Contractor needs to produce an Asbestos Management Plan in accordance with CAR2012 as part of their method statement. Typical precautions would include: - Site personnel have the risk communicated at induction stage. - Ensuring personnel have suitable training. - Task monitoring to inform PPE requirements. - Ensuring soils do not dry out to become dusty and that misting is available during groundworks. - Separate stockpiling. - Clean haulage routes.	Possibly Soils may be able to be re-used under CL:AIRE CoP, subject to a satisfactory Risk Assessment and regulatory agreement with the correct precautions in place.	Clean cover or hardstanding cover required.
0.1+%				√	Contractor needs to produce an Asbestos Management Plan in accordance with CAR2012 as part of their method statement. Typical precautions would include: - Site personnel have the risk communicated at induction stage. - Ensuring personnel have suitable training. - Task monitoring to inform PPE requirements. - Site wide and or perimeter monitoring. - Ensuring soils do not dry out to become dusty and that misting is available during groundworks. - Separate stockpiling. - Clean haulage routes. - Decontamination unit	Unlikely ³ Re-use of soils containing asbestos within an earthworks scheme will involve significant engineering and the Risk for generating dusts will be significantly increased with	Clean cover and a hard dig layer. A plan should be in place for future excavations as part of the Health and Safety File.

Concentration (by weight)	Waste Disposal				Construction Issues	End Use	
	Recyc	Inert	SNR	Hazardo		Suitable for re-use on site	Precautions
						repeated handling and compaction.	

1. The standard laboratory detection limit is normally 0.001%. Below 0.001% is trace and currently regarded as not containing asbestos for the purposes of disposal off site. However the waste producer has a duty to fully classify the waste and the presence of trace asbestos should be declared. Consequently it is unlikely that a waste treatment site will take this soil and an inert landfill may make a commercial decision to only take it under some circumstances.
2. The re-use of soils containing asbestos at concentrations above hazardous waste is likely to meet with regulatory opposition. Assuming a suitable strategy could be agreed this would take a considerable amount of time and is only likely to be warranted where there a long program for implementation.

APPENDIX B

UXO Preliminary Report



Express Preliminary UXO Risk Assessment

Client	Brownfield Solutions
Project	Castle Irwell, Salford
Site Address	Castle Irwell Student Village, Salford, M6 6DA
Report Reference	EP10348-00
Date	10/12/19
Originator	HW

Assessment Objective

This preliminary risk assessment is a qualitative screening exercise to assess the likely potential of encountering unexploded ordnance (UXO) at the Castle Irwell, Salford site. The assessment involves the consideration of the basic factors that affect the potential for UXO to be present at a site as outlined in Stage One of the UXO risk management process.

Background

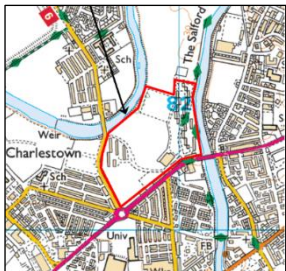
This assessment uses the sources of information available in-house to 1st Line Defence Ltd to enable the placement of a development site in context with events that may have led to the presence of German air-delivered or Allied military UXO. The report will identify any immediate necessity for risk mitigation or additional research in the form of a Detailed UXO Risk Assessment. It makes use of 1st Line Defence's extensive historical archives, library and unique geo-databases, as well as internet resources, and is researched and compiled by UXO specialists and graduate researchers.

The assessment directly follows CIRIA C681 guidelines "Unexploded Ordnance, a Guide for the Construction Industry". The document will therefore assess the following factors:

- Basic Site Data
- Previous Military Use
- Indicators of potential aerial delivered UXO threat
- Consideration of any Mitigating Factors
- Extent of Proposed Intrusive Works
- Any requirement for Further Work

It should be noted that the vast majority of construction sites in the UK will have a low or negligible risk of encountering UXO and should be able to be screened out at this preliminary stage. The report is meant as a common sense 'first step' in the UXO risk management process. The content of the report and conclusions drawn are based on basic, preliminary research using the information available to 1st Line Defence at the time this report was produced. It should be noted that the only way to entirely negate risk from UXO to a project would be to support the works proposed with appropriate UXO risk mitigation measures. It is rarely possible to state that there is absolutely 'no' risk from UXO to a project.



Risk Assessment Considerations	
Site location and description/current use	The site is located in Salford, Greater Manchester. The site is occupied by grassland and woodland with small areas of clearance and development dispersed throughout. It is bordered to the north by open grassland while the eastern boundary is formed by the River Irwell. A combination of Cromwell Road and Littleton Road represents the southern perimeter and the western margin is again denoted by the River Irwell. The site is approximately centred on the OS grid reference: SD 8192300433. 
Are there any indicators of current/historical military activity on/close to the site?	Anecdotal evidence suggests that the racecourse may have been used as a prisoner of war camp during WWII.¹ The racecourse does appear to have been open for at least the first two years of the war, so this use would have to have occurred after this point.² Other racecourses were used as prisoner of war camps across the UK, so the use of the site as a prisoner of war camp is a possibility. If so, it is not thought likely that this use of the site area would result in ordnance being burnt, buried or discarded within the site, although this would be worth clarifying.
What was the pre- and post-WWII history of the site?	Pre-war OS mapping dated 1922 recorded the site as being occupied by the southern sector of the Manchester Racecourse; comprised primarily of the race track itself with several small structures observable in the eastern and south-eastern sectors including <i>Member's Stand</i> and <i>Tottersall's Stand</i>. Anecdotal records indicate the racecourse was initially transferred to the Castle Irwell site in 1847, having moved from Kersal Moor. In 1888 the racecourse moved to New Barnes before returning to the Castle Irwell location in 1898. The Manchester Racecourse would remain here in operation until November 1963 whereupon a combination of financial difficulties and deteriorating stadia necessitated its closure³. The wider vicinity was semi-developed with further expanses of race track to the north and housing developments to the east, south and west. Post-war OS mapping dated 1953 indicated little on-site change beyond minor structural developments in the southern sector. Greater examples of development were visible in the wider vicinity wherein a number of previously open parcels of land had since been replaced with housing developments.
Was the area subject to bombing during WWII?	During WWII the site was situated in the County Borough of Salford which sustained an overall moderate-high bombing density with an average of 86.7 items of ordnance falling per 1,000 acres according to Home Office bombing statistics. This was comprised of 408 high explosive (H.E.) bombs, 29 parachute mines, and 16 oil bombs culminating in 451 incidents across 5,202 acres. A Salford Local Air-Raid map held in-house recorded three on-site H.E. incidents: one each in the north, south-eastern, and south-western sectors.

¹ <http://www.salfordstar.com/article.asp?id=3311>
² <http://www.greyhoundderby.com/Manchester%20Racecourse.html>
³ <https://www.bbc.co.uk/news/uk-england-32796143>



Is there any evidence of bomb damage on/close to the site?	Due to the lack of local bomb damage mapping or post-war aerial photography, it has not proven possible to accurately discern bomb damage at this preliminary stage.
To what degree would the site have been subject to access?	Areas affected by bombing incidents were typically subjected to a limited frequency of access due to the unsafe conditions and subsequent evacuations that were commonplace of such incidents.
To what degree has the site been developed post-WWII?	Post-war OS mapping indicated the deconstruction of the Manchester Racecourse in the mid-1960s before the central and western sectors were redeveloped with multiple rows of terraced structures labelled as <i>Castle Irwell Student Village</i> . The development was expanded throughout the 1970s to include a sports court in the northern sector and a pavilion in the eastern counterpart. The central buildings were demolished and replaced with grassland in the mid-2000s before the rest of the site was similarly redeveloped in the mid-2010s.
What is the nature and extent of the intrusive works proposed?	Information provided by the client indicates the nature and extent of works proposed is to include ten shallow trial pits to a depth of no more than two meters.

Summary and Conclusions

During WWII the site was situated in the County Borough of Salford which sustained an overall moderate-high bombing density with an average of 86.7 items of ordnance falling per 1,000 acres according to Home Office bombing statistics. Salford Local Air-Raids mapping held in-house recorded three on-site H.E. incidents: one each in the north, south-eastern, and south-western sectors. Due to the lack of information regarding the nature and aftermath of these bomb strikes available at this preliminary stage, it has not proven possible to mitigate the likelihood of on-site UXO contamination.

Anecdotal evidence suggests the racecourse on site was used as a prisoner of war camp; no further information could be found at this preliminary stage to prove or disprove this.

Recommendations

Given the findings of this preliminary report and in accordance with CIRIA guidelines, it is recommended that a **Detailed UXO Risk Assessment** should be undertaken. This would allow for the cross examination of the exact locations and any damage caused by the bomb strikes, as well as to confirm the exact wartime conditions present on site and in the locality. Further investigation would entail the analysis of data such as WWII-era aerial imagery and any available written records. The report would also outline work-specific risk mitigation measures.

Prior to or in lieu of a Detailed Assessment, it is recommended that appropriate UXO Risk Mitigation Measures are provided for intrusive works proposed.

If the client has any anecdotal or empirical evidence of UXO risk on site, please contact 1st Line Defence.



APPENDIX C

Chemical Testing Results

Abdulla Nagi
Brownfield Solutions Ltd
William Smith House
173 - 183 Witton Street
Northwich
Cheshire
CW9 5LP

i2 Analytical Ltd.
7 Woodshots Meadow,
Croxley Green
Business Park,
Watford,
Herts,
WD18 8YS

t: 01923 225404
f: 01923 237404
e: reception@i2analytical.com

e: a.nagi@brownfield-solutions.co.uk

Analytical Report Number : 22-79914

Project / Site name:	Castle Irwell Salford	Samples received on:	23/08/2022
Your job number:	C4334	Samples instructed on/ Analysis started on:	23/08/2022
Your order number:	C4334 3411 DM	Analysis completed by:	31/08/2022
Report Issue Number:	1	Report issued on:	31/08/2022
Samples Analysed:	6 leachate samples - 10 soil samples		


Signed:

Adam Fenwick
Technical Reviewer
For & on behalf of i2 Analytical Ltd.

Standard Geotechnical, Asbestos and Chemical Testing Laboratory located at: ul. Pionierów 39, 41 -711 Ruda Śląska, Poland.

Accredited tests are defined within the report, opinions and interpretations expressed herein are outside the scope of accreditation.

Standard sample disposal times, unless otherwise agreed with the laboratory, are :

soils	- 4 weeks from reporting
leachates	- 2 weeks from reporting
waters	- 2 weeks from reporting
asbestos	- 6 months from reporting

Excel copies of reports are only valid when accompanied by this PDF certificate.

Any assessments of compliance with specifications are based on actual analytical results with no contribution from uncertainty of measurement.
Application of uncertainty of measurement would provide a range within which the true result lies.
An estimate of measurement uncertainty can be provided on request.

Analytical Report Number: 22-79914
Project / Site name: Castle Irwell Salford
Your Order No: C4334 3411 DM

Lab Sample Number				2400762	2400763	2400764	2400765	2400766
Sample Reference				WS05	WS03	WS01	TP09	SA03
Sample Number				None Supplied	None Supplied	None Supplied	None Supplied	None Supplied
Depth (m)				0.60	1.00	0.50	0.70	0.40
Date Sampled				17/08/2022	18/08/2022	17/08/2000	18/08/2022	17/08/2022
Time Taken				None Supplied	None Supplied	None Supplied	None Supplied	None Supplied
Analytical Parameter (Soil Analysis)	Units	Limit of detection	Accreditation Status					
Stone Content	%	0.1	NONE	-	-	-	-	-
Moisture Content	%	0.01	NONE	-	-	-	-	-
Total mass of sample received	kg	0.001	NONE	-	-	-	-	-

Asbestos in Soil	Type	N/A	ISO 17025	Not-detected	Not-detected	Not-detected	Not-detected	Not-detected
Asbestos Analyst ID	N/A	N/A	N/A	JSW	JSW	JSW	JSW	JSW

General Inorganics

pH - Automated	pH Units	N/A	MCERTS	-	-	-	-	-
Water Soluble Sulphate as SO ₄ 16hr extraction (2:1)	mg/kg	2.5	MCERTS	-	-	-	-	-
Water Soluble SO ₄ 16hr extraction (2:1 Leachate Equivalent)	g/l	0.00125	MCERTS	-	-	-	-	-
Water Soluble SO ₄ 16hr extraction (2:1 Leachate Equivalent)	mg/l	1.25	MCERTS	-	-	-	-	-
Organic Matter (automated)	%	0.1	MCERTS	-	-	-	-	-

Speciated PAHs

Naphthalene	mg/kg	0.05	MCERTS	-	-	-	-	-
Acenaphthylene	mg/kg	0.05	MCERTS	-	-	-	-	-
Acenaphthene	mg/kg	0.05	MCERTS	-	-	-	-	-
Fluorene	mg/kg	0.05	MCERTS	-	-	-	-	-
Phenanthrene	mg/kg	0.05	MCERTS	-	-	-	-	-
Anthracene	mg/kg	0.05	MCERTS	-	-	-	-	-
Fluoranthene	mg/kg	0.05	MCERTS	-	-	-	-	-
Pyrene	mg/kg	0.05	MCERTS	-	-	-	-	-
Benzo(a)anthracene	mg/kg	0.05	MCERTS	-	-	-	-	-
Chrysene	mg/kg	0.05	MCERTS	-	-	-	-	-
Benzo(b)fluoranthene	mg/kg	0.05	MCERTS	-	-	-	-	-
Benzo(k)fluoranthene	mg/kg	0.05	MCERTS	-	-	-	-	-
Benzo(a)pyrene	mg/kg	0.05	MCERTS	-	-	-	-	-
Indeno(1,2,3-cd)pyrene	mg/kg	0.05	MCERTS	-	-	-	-	-
Dibenz(a,h)anthracene	mg/kg	0.05	MCERTS	-	-	-	-	-
Benzo(ghi)perylene	mg/kg	0.05	MCERTS	-	-	-	-	-

Total PAH

Speciated Total EPA-16 PAHs	mg/kg	0.8	MCERTS	-	-	-	-	-
-----------------------------	-------	-----	--------	---	---	---	---	---

Heavy Metals / Metalloids

Arsenic (aqua regia extractable)	mg/kg	1	MCERTS	-	-	-	-	-
Cadmium (aqua regia extractable)	mg/kg	0.2	MCERTS	-	-	-	-	-
Chromium (hexavalent)	mg/kg	1.2	NONE	-	-	-	-	-
Chromium (III)	mg/kg	1	NONE	-	-	-	-	-
Chromium (aqua regia extractable)	mg/kg	1	MCERTS	-	-	-	-	-
Copper (aqua regia extractable)	mg/kg	1	MCERTS	-	-	-	-	-
Lead (aqua regia extractable)	mg/kg	1	MCERTS	-	-	-	-	-
Mercury (aqua regia extractable)	mg/kg	0.3	MCERTS	-	-	-	-	-
Nickel (aqua regia extractable)	mg/kg	1	MCERTS	-	-	-	-	-
Selenium (aqua regia extractable)	mg/kg	1	MCERTS	-	-	-	-	-
Zinc (aqua regia extractable)	mg/kg	1	MCERTS	-	-	-	-	-

U/S = Unsuitable Sample I/S = Insufficient Sample

Analytical Report Number: 22-79914
Project / Site name: Castle Irwell Salford
Your Order No: C4334 3411 DM

Lab Sample Number				2400767	2400768	2400769	2400770	2400771
Sample Reference				TP7A	TP04	TP02	SA05	WS04
Sample Number				None Supplied	None Supplied	None Supplied	None Supplied	None Supplied
Depth (m)				0.30	0.50	0.50	2.00	2.30
Date Sampled				18/08/2022	18/08/2022	18/08/2022	19/08/2022	17/08/2022
Time Taken				None Supplied	None Supplied	None Supplied	None Supplied	None Supplied
Analytical Parameter (Soil Analysis)	Units	Limit of detection	Accreditation Status					
Stone Content	%	0.1	NONE	-	40	47	38	< 0.1
Moisture Content	%	0.01	NONE	-	6.7	7.1	11	18
Total mass of sample received	kg	0.001	NONE	-	0.8	0.8	0.8	0.8

Asbestos in Soil	Type	N/A	ISO 17025	Not-detected	Not-detected	Not-detected	Not-detected	Not-detected
Asbestos Analyst ID	N/A	N/A	N/A	JSW	JSW	JSW	JSW	JSW

General Inorganics

pH - Automated	pH Units	N/A	MCERTS	-	9.0	8.8	8.1	7.4
Water Soluble Sulphate as SO ₄ 16hr extraction (2:1)	mg/kg	2.5	MCERTS	-	190	220	52	71
Water Soluble SO ₄ 16hr extraction (2:1 Leachate Equivalent)	g/l	0.00125	MCERTS	-	0.094	0.11	0.026	0.035
Water Soluble SO ₄ 16hr extraction (2:1 Leachate Equivalent)	mg/l	1.25	MCERTS	-	93.9	112	25.8	35.4
Organic Matter (automated)	%	0.1	MCERTS	-	2	1.9	1.3	3.1

Speciated PAHs

Naphthalene	mg/kg	0.05	MCERTS	-	< 0.05	< 0.05	< 0.05	0.28
Acenaphthylene	mg/kg	0.05	MCERTS	-	< 0.05	< 0.05	< 0.05	< 0.05
Acenaphthene	mg/kg	0.05	MCERTS	-	< 0.05	0.27	0.32	1.2
Fluorene	mg/kg	0.05	MCERTS	-	< 0.05	< 0.05	0.24	0.7
Phenanthrene	mg/kg	0.05	MCERTS	-	0.99	1.6	2.6	5.2
Anthracene	mg/kg	0.05	MCERTS	-	0.27	0.37	0.79	0.98
Fluoranthene	mg/kg	0.05	MCERTS	-	2.2	2.4	6.9	6
Pyrene	mg/kg	0.05	MCERTS	-	1.9	2.2	6.2	6
Benzo(a)anthracene	mg/kg	0.05	MCERTS	-	1.2	1.1	3.3	3.1
Chrysene	mg/kg	0.05	MCERTS	-	1.1	1.1	3.1	2.8
Benzo(b)fluoranthene	mg/kg	0.05	MCERTS	-	1	0.88	2.7	2.2
Benzo(k)fluoranthene	mg/kg	0.05	MCERTS	-	0.77	0.66	1.8	1.3
Benzo(a)pyrene	mg/kg	0.05	MCERTS	-	0.93	0.79	2.5	2
Indeno(1,2,3-cd)pyrene	mg/kg	0.05	MCERTS	-	0.51	0.41	1.2	0.86
Dibenz(a,h)anthracene	mg/kg	0.05	MCERTS	-	< 0.05	< 0.05	0.26	0.24
Benzo(ghi)perylene	mg/kg	0.05	MCERTS	-	0.7	0.58	1.7	1.4

Total PAH

Speciated Total EPA-16 PAHs	mg/kg	0.8	MCERTS	-	11.6	12.3	33.5	34.2
-----------------------------	-------	-----	--------	---	------	------	------	------

Heavy Metals / Metalloids

Arsenic (aqua regia extractable)	mg/kg	1	MCERTS	-	11	8.7	9.2	21
Cadmium (aqua regia extractable)	mg/kg	0.2	MCERTS	-	< 0.2	< 0.2	0.5	< 0.2
Chromium (hexavalent)	mg/kg	1.2	NONE	-	< 1.2	< 1.2	< 1.2	< 1.2
Chromium (III)	mg/kg	1	NONE	-	14	13	19	18
Chromium (aqua regia extractable)	mg/kg	1	MCERTS	-	14	13	19	19
Copper (aqua regia extractable)	mg/kg	1	MCERTS	-	42	21	25	47
Lead (aqua regia extractable)	mg/kg	1	MCERTS	-	84	48	32	94
Mercury (aqua regia extractable)	mg/kg	0.3	MCERTS	-	0.3	< 0.3	< 0.3	< 0.3
Nickel (aqua regia extractable)	mg/kg	1	MCERTS	-	17	13	22	21
Selenium (aqua regia extractable)	mg/kg	1	MCERTS	-	< 1.0	< 1.0	< 1.0	< 1.0
Zinc (aqua regia extractable)	mg/kg	1	MCERTS	-	68	60	57	84

U/S = Unsuitable Sample I/S = Insufficient Sample

Analytical Report Number: 22-79914
Project / Site name: Castle Irwell Salford

Your Order No: C4334 3411 DM

Lab Sample Number	2400772	2400773	2400774	2400775	2400776
Sample Reference	WS05	WS03	WS01	TP09	SA03
Sample Number	None Supplied	None Supplied	None Supplied	None Supplied	None Supplied
Depth (m)	0.60	1.00	0.50	0.70	0.40
Date Sampled	17/08/2022	18/08/2022	17/08/2022	18/08/2022	17/08/2022
Time Taken	None Supplied	None Supplied	None Supplied	None Supplied	None Supplied
Analytical Parameter (Leachate Analysis)	Units	Limit of detection	Accreditation Status		

General Inorganics

pH (automated)	pH Units	N/A	ISO 17025	7.9	8.7	8.0	7.8	11.7
Electrical Conductivity	µS/cm	10	ISO 17025	160	140	130	100	1000
Total Cyanide	µg/l	10	ISO 17025	< 10	< 10	< 10	< 10	< 10
Free Cyanide	µg/l	10	ISO 17025	< 10	< 10	< 10	< 10	< 10
Sulphate as SO ₄	µg/l	100	ISO 17025	36100	25100	12500	10500	19400
Sulphate as SO ₄	mg/l	0.1	ISO 17025	36.1	25.1	12.5	10.5	19.4
Total Sulphur	µg/l	15	NONE	12000	8400	4200	3500	6500
Sulphide	µg/l	5	NONE	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0
Chloride	mg/l	0.15	ISO 17025	1.4	1.7	0.8	0.76	3.2
Ammoniacal Nitrogen as NH ₄	µg/l	15	NONE	34	35	24	32	92
Nitrate as N	mg/l	0.01	NONE	0.5	0.85	0.64	0.18	0.05
Nitrate as NO ₃	mg/l	0.05	NONE	2.21	3.78	2.84	0.81	0.23
Nitrite as N	µg/l	1	NONE	< 1.0	< 1.0	6.3	1.7	150
Nitrite as NO ₂	µg/l	5	NONE	< 5.0	< 5.0	21	5.6	500
Hardness - Total	mg/L	1	NONE	68.7	59.9	61.2	40.9	287

Speciated PAHs

Naphthalene	µg/l	0.01	ISO 17025	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01
Acenaphthylene	µg/l	0.01	ISO 17025	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01
Acenaphthene	µg/l	0.01	ISO 17025	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01
Fluorene	µg/l	0.01	ISO 17025	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01
Phenanthrene	µg/l	0.01	ISO 17025	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01
Anthracene	µg/l	0.01	ISO 17025	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01
Fluoranthene	µg/l	0.01	ISO 17025	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01
Pyrene	µg/l	0.01	ISO 17025	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01
Benzo(a)anthracene	µg/l	0.01	ISO 17025	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01
Chrysene	µg/l	0.01	ISO 17025	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01
Benzo(b)fluoranthene	µg/l	0.01	ISO 17025	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01
Benzo(k)fluoranthene	µg/l	0.01	ISO 17025	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01
Benzo(a)pyrene	µg/l	0.01	ISO 17025	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01
Indeno(1,2,3-cd)pyrene	µg/l	0.01	NONE	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01
Dibenz(a,h)anthracene	µg/l	0.01	NONE	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01
Benzo(ghi)perylene	µg/l	0.01	NONE	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01

Total PAH

Total EPA-16 PAHs	µg/l	0.2	NONE	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2
-------------------	------	-----	------	-------	-------	-------	-------	-------

Analytical Report Number: 22-79914
Project / Site name: Castle Irwell Salford

Your Order No: C4334 3411 DM

Lab Sample Number				2400772	2400773	2400774	2400775	2400776
Sample Reference				WS05	WS03	WS01	TP09	SA03
Sample Number				None Supplied	None Supplied	None Supplied	None Supplied	None Supplied
Depth (m)				0.60	1.00	0.50	0.70	0.40
Date Sampled				17/08/2022	18/08/2022	17/08/2022	18/08/2022	17/08/2022
Time Taken				None Supplied	None Supplied	None Supplied	None Supplied	None Supplied
Analytical Parameter (Leachate Analysis)				Units	Limit of detection	Accreditation Status		

Heavy Metals / Metalloids

Arsenic (dissolved)	µg/l	1	ISO 17025	3.2	8.9	8.4	3	3.8
Boron (dissolved)	µg/l	10	ISO 17025	37	25	31	19	15
Cadmium (dissolved)	µg/l	0.08	ISO 17025	< 0.08	< 0.08	< 0.08	< 0.08	< 0.08
Chromium (hexavalent)	µg/l	5	ISO 17025	< 5.0	< 5.0	< 5.0	< 5.0	9.2
Chromium (III)	µg/l	5	NONE	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0
Chromium (dissolved)	µg/l	0.4	ISO 17025	2.4	4.7	3.1	1.6	10
Copper (dissolved)	µg/l	0.7	ISO 17025	18	29	31	20	26
Lead (dissolved)	µg/l	1	ISO 17025	1.6	1.6	2.8	2.3	< 1.0
Mercury (dissolved)	µg/l	0.5	ISO 17025	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5
Nickel (dissolved)	µg/l	0.3	ISO 17025	< 0.3	1.6	1.4	0.9	4.9
Selenium (dissolved)	µg/l	4	ISO 17025	< 4.0	< 4.0	< 4.0	< 4.0	< 4.0
Zinc (dissolved)	µg/l	0.4	ISO 17025	9.3	6.1	10	8	6.8

Calcium (dissolved)	mg/l	0.012	ISO 17025	26	23	23	15	110
Magnesium (dissolved)	mg/l	0.005	ISO 17025	0.77	0.34	0.95	0.62	0.098

U/S = Unsuitable Sample I/S = Insufficient Sample



4041



Analytical Report Number: 22-79914
Project / Site name: Castle Irwell Salford

Your Order No: C4334 3411 DM

Lab Sample Number				2400777
Sample Reference				TP07A
Sample Number				None Supplied
Depth (m)				0.30
Date Sampled				18/08/2022
Time Taken				None Supplied
Analytical Parameter (Leachate Analysis)	Units	Limit of detection	Accreditation Status	

General Inorganics

pH (automated)	pH Units	N/A	ISO 17025	8.3
Electrical Conductivity	µS/cm	10	ISO 17025	120
Total Cyanide	µg/l	10	ISO 17025	< 10
Free Cyanide	µg/l	10	ISO 17025	< 10
Sulphate as SO ₄	µg/l	100	ISO 17025	13800
Sulphate as SO ₄	mg/l	0.1	ISO 17025	13.8
Total Sulphur	µg/l	15	NONE	4600
Sulphide	µg/l	5	NONE	< 5.0
Chloride	mg/l	0.15	ISO 17025	1
Ammoniacal Nitrogen as NH ₄	µg/l	15	NONE	26
Nitrate as N	mg/l	0.01	NONE	0.28
Nitrate as NO ₃	mg/l	0.05	NONE	1.24
Nitrite as N	µg/l	1	NONE	< 1.0
Nitrite as NO ₂	µg/l	5	NONE	< 5.0
Hardness - Total	mg CaCO ₃ /l	1	NONE	50.3

Speciated PAHs

Naphthalene	µg/l	0.01	ISO 17025	< 0.01
Acenaphthylene	µg/l	0.01	ISO 17025	< 0.01
Acenaphthene	µg/l	0.01	ISO 17025	< 0.01
Fluorene	µg/l	0.01	ISO 17025	< 0.01
Phenanthrene	µg/l	0.01	ISO 17025	< 0.01
Anthracene	µg/l	0.01	ISO 17025	< 0.01
Fluoranthene	µg/l	0.01	ISO 17025	< 0.01
Pyrene	µg/l	0.01	ISO 17025	< 0.01
Benzo(a)anthracene	µg/l	0.01	ISO 17025	< 0.01
Chrysene	µg/l	0.01	ISO 17025	< 0.01
Benzo(b)fluoranthene	µg/l	0.01	ISO 17025	< 0.01
Benzo(k)fluoranthene	µg/l	0.01	ISO 17025	< 0.01
Benzo(a)pyrene	µg/l	0.01	ISO 17025	< 0.01
Indeno(1,2,3-cd)pyrene	µg/l	0.01	NONE	< 0.01
Dibenz(a,h)anthracene	µg/l	0.01	NONE	< 0.01
Benzo(ghi)perylene	µg/l	0.01	NONE	< 0.01

Total PAH

Total EPA-16 PAHs	µg/l	0.2	NONE	< 0.2
-------------------	------	-----	------	-------



4041



Analytical Report Number: 22-79914
Project / Site name: Castle Irwell Salford

Your Order No: C4334 3411 DM

Lab Sample Number				2400777
Sample Reference				TP07A
Sample Number				None Supplied
Depth (m)				0.30
Date Sampled				18/08/2022
Time Taken				None Supplied
Analytical Parameter (Leachate Analysis)	Units	Limit of detection	Accreditation Status	

Heavy Metals / Metalloids

Arsenic (dissolved)	µg/l	1	ISO 17025	5.9
Boron (dissolved)	µg/l	10	ISO 17025	40
Cadmium (dissolved)	µg/l	0.08	ISO 17025	< 0.08
Chromium (hexavalent)	µg/l	5	ISO 17025	< 5.0
Chromium (III)	µg/l	5	NONE	< 5.0
Chromium (dissolved)	µg/l	0.4	ISO 17025	3.1
Copper (dissolved)	µg/l	0.7	ISO 17025	30
Lead (dissolved)	µg/l	1	ISO 17025	2.3
Mercury (dissolved)	µg/l	0.5	ISO 17025	< 0.5
Nickel (dissolved)	µg/l	0.3	ISO 17025	0.6
Selenium (dissolved)	µg/l	4	ISO 17025	< 4.0
Zinc (dissolved)	µg/l	0.4	ISO 17025	9.3

Calcium (dissolved)	mg/l	0.012	ISO 17025	19
Magnesium (dissolved)	mg/l	0.005	ISO 17025	0.54

U/S = Unsuitable Sample I/S = Insufficient Sample

Analytical Report Number : 22-79914

Project / Site name: Castle Irwell Salford

* These descriptions are only intended to act as a cross check if sample identities are questioned. The major constituent of the sample is intended to act with respect to MCERTS validation. The laboratory is accredited for sand, clay and loam (MCERTS) soil types. Data for unaccredited types of solid should be interpreted with care.

Stone content of a sample is calculated as the % weight of the stones not passing a 10 mm sieve. Results are not corrected for stone content.

Lab Sample Number	Sample Reference	Sample Number	Depth (m)	Sample Description *
2400768	TP04	None Supplied	0.5	Brown loam and sand with gravel and stones.
2400769	TP02	None Supplied	0.5	Brown loam and sand with gravel and stones.
2400770	SA05	None Supplied	2	Brown loam and sand with gravel and stones.
2400771	WS04	None Supplied	2.3	Brown clay and sand with gravel.

Analytical Report Number : 22-79914
Project / Site name: Castle Irwell Salford

Water matrix abbreviations:

Surface Water (SW) Potable Water (PW) Ground Water (GW) Process Waters (PrW) Final Sewage Effluent (FSE) Landfill Leachate (LL)

Analytical Test Name	Analytical Method Description	Analytical Method Reference	Method number	Wet / Dry Analysis	Accreditation Status
Metals in soil by ICP-OES	Determination of metals in soil by aqua-regia digestion followed by ICP-OES.	In-house method based on MEWAM 2006 Methods for the Determination of Metals in Soil.	L038-PL	D	MCERTS
Sulphate, water soluble, in soil (16hr extraction)	Determination of water soluble sulphate by ICP-OES. Results reported directly (leachate equivalent) and corrected for extraction ratio (soil equivalent).	In house method.	L038-PL	D	MCERTS
NRA Leachate Prep	10:1 extract with de-ionised water shaken for 24 hours then filtered.	In-house method based on National Rivers Authority	L020-PL	W	NONE
Asbestos identification in soil	Asbestos Identification with the use of polarised light microscopy in conjunction with dispersion staining techniques.	In house method based on HSG 248	A001-PL	D	ISO 17025
Metals by ICP-OES in leachate	Determination of metals in leachate by acidification followed by ICP-OES.	In-house method based on MEWAM 2006 Methods for the Determination of Metals in Soil.	L039-PL	W	ISO 17025
Boron in leachate	Determination of boron in leachate. Sample acidified and followed by ICP-OES.	In-house method based on MEWAM	L039-PL	W	ISO 17025
Hexavalent chromium in leachate	Determination of hexavalent chromium in leachate by acidification, addition of 1,5 diphenylcarbazide followed by colorimetry.	In-house method	L080-PL	W	ISO 17025
Electrical conductivity at 20oC of leachate	Determination of electrical conductivity in leachate by electrometric measurement.	In-house method based on Examination of Water and Wastewater 20th Edition: Clesceri, Greenberg & Eaton	L031-PL	W	ISO 17025
Free cyanide in leachate	Determination of free cyanide by distillation followed by colorimetry.	In-house method	L080-PL	W	ISO 17025
Total Hardness of leachates	Determination of hardness in leachates by calculation from calcium and magnesium.	In-house method based on Examination of Water and Wastewater 20th Edition: Clesceri, Greenberg & Eaton	L045-PL	W	NONE
Moisture Content	Moisture content, determined gravimetrically. (30 oC)	In house method.	L019-UK/PL	W	NONE
Nitrite, leachate soluble, in leachate	In-house method based on Examination of Water and Wastewater 20th Edition: Clesceri, Greenberg & Eaton & Polish Standard Method PN-82/C-04579.08	In-house method based on Examination of Water and Wastewater 20th Edition: Clesceri, Greenberg & Eaton & Polish Standard Method PN-82/C-04579.08	L077-PL	W	NONE
Nitrate, leachate soluble, in leachate	Determination of nitrate by reaction with sodium salicylate and colorimetry.	In-house method based on Examination of Water and Wastewater & Polish Standard Method PN-82/C-04579.08,	L078-PL	W	NONE
Speciated EPA-16 PAHs in leachate	Determination of PAH compounds in leachate by extraction in dichloromethane followed by GC-MS with the use of surrogate and internal standards.	In-house method based on USEPA 8270	L1028-PL	W	ISO 17025
Speciated EPA-16 PAHs in soil	Determination of PAH compounds in soil by extraction in dichloromethane and hexane followed by GC-MS with the use of surrogate and internal standards.	In-house method based on USEPA 8270	L064-PL	D	MCERTS
pH in soil (automated)	Determination of pH in soil by addition of water followed by automated electrometric measurement.	In house method.	L099-PL	D	MCERTS
pH at 20oC in leachate (automated)	Determination of pH in leachate by electrometric measurement.	In house method.	L099B	W	ISO 17025

Analytical Report Number : 22-79914
Project / Site name: Castle Irwell Salford

Water matrix abbreviations:

Surface Water (SW) Potable Water (PW) Ground Water (GW) Process Waters (PrW) Final Sewage Effluent (FSE) Landfill Leachate (LL)

Analytical Test Name	Analytical Method Description	Analytical Method Reference	Method number	Wet / Dry Analysis	Accreditation Status
Sulphide in leachate	Determination of sulphide in leachate by ion selective electrode.	In-house method	L010-PL	W	NONE
Sulphate in leachates	Determination of sulphate in leachate by acidification followed by ICP-OES.	In-house method based on MEWAM 1986 Methods for the Determination of Metals in Soil ¹	L039-PL	W	ISO 17025
Stones content of soil	Standard preparation for all samples unless otherwise detailed. Gravimetric determination of stone > 10 mm as % dry weight.	In-house method based on British Standard Methods and MCERTS requirements.	L019-UK/PL	D	NONE
Total Sulphur in leachates	Determination of total sulphur in leachates by acidification followed by ICP-OES.	In-house method based on MEWAM 2006 Methods for the Determination of Metals in Soil.	L039-PL	W	NONE
Total cyanide in leachate	Determination of total cyanide by distillation followed by colorimetry.	In-house method based on Examination of Water and Wastewater 20th Edition: Clesceri, Greenberg & Eaton (Skalar)	L080-PL	W	ISO 17025
Ammonium as NH ₄ in leachate	Determination of Ammonium/Ammonia/ Ammoniacal Nitrogen by the colorimetric salicylate/nitroprusside method.	In-house method based on Examination of Water and Wastewater 20th Edition: Clesceri, Greenberg & Eaton	L082-PL	W	NONE
Nitrite as N in leachate	Determination of nitrite in leachate by addition of sulphanilamide and NED followed by discrete analyser (colorimetry).	In-house method based on Examination of Water and Wastewater 20th Edition: Clesceri, Greenberg & Eaton & Polish Standard Method PN-82/C-04579.08	L082-PL	W	NONE
Nitrate as N in leachate	Determination of nitrate by reaction with sodium salicylate and colorimetry.	In-house method based on Examination of Water and Wastewater & Polish Standard Method PN-82/C-04579.08,	L078-PL	W	NONE
Cr (III) in soil	In-house method by calculation from total Cr and Cr VI.	In-house method by calculation	L080-PL	W	NONE
Cr (III) in leachate	In-house method by calculation from total Cr and Cr VI.	In-house method by calculation	L080-PL	W	NONE
Chloride in leachate	Determination of Chloride colorimetrically by discrete analyser.	In house based on MEWAM Method ISBN 0117516260.	L082-PL	W	ISO 17025
Organic matter (Automated) in soil	Determination of organic matter in soil by oxidising with potassium dichromate followed by titration with iron (II) sulphate.	In house method.	L009-PL	D	MCERTS
Hexavalent chromium in soil (Lower Level)	Determination of hexavalent chromium in soil by extraction in water then by acidification, addition of 1,5 diphenylcarbazide followed by colorimetry.	In-house method	L080-PL	W	NONE
Sulphate, water soluble, in soil	Determination of water soluble sulphate by ICP-OES. Results reported directly (leachate equivalent) and corrected for extraction ratio (soil equivalent).	In house method.	L038-PL	D	MCERTS

For method numbers ending in 'UK' analysis have been carried out in our laboratory in the United Kingdom.

For method numbers ending in 'PL' analysis have been carried out in our laboratory in Poland.

Soil analytical results are expressed on a dry weight basis. Where analysis is carried out on as-received the results obtained are multiplied by a moisture correction factor that is determined gravimetrically using the moisture content which is carried out at a maximum of 30°C.

Unless otherwise indicated, site information, order number, project number, sampling date, time, sample reference and depth are provided by the client. The instructed on date indicates the date on which this information was provided to the laboratory.



Jack Mather
Brownfield Solutions Ltd
William Smith House
173 - 183 Witton Street
Northwich
Cheshire
CW9 5LP

i2 Analytical Ltd.
7 Woodshots Meadow,
Croxley Green
Business Park,
Watford,
Herts,
WD18 8YS

t: 01923 225404

f: 01923 237404

e: reception@i2analytical.com

e: j.mather@brownfield-solutions.co.uk

Analytical Report Number : 22-88385

Project / Site name:	Castle Irwell, Salford	Samples received on:	05/10/2022
Your job number:	C4334	Samples instructed on/ Analysis started on:	05/10/2022
Your order number:	C4334 3411 JM	Analysis completed by:	10/10/2022
Report Issue Number:	1	Report issued on:	10/10/2022
Samples Analysed:	6 soil samples		

Signed:

Adam Fenwick
Technical Reviewer
For & on behalf of i2 Analytical Ltd.

Standard Geotechnical, Asbestos and Chemical Testing Laboratory located at: ul. Pionierów 39, 41 -711 Ruda Śląska, Poland.

Accredited tests are defined within the report, opinions and interpretations expressed herein are outside the scope of accreditation.

Standard sample disposal times, unless otherwise agreed with the laboratory, are :

soils - 4 weeks from reporting
leachates - 2 weeks from reporting
waters - 2 weeks from reporting
asbestos - 6 months from reporting

Excel copies of reports are only valid when accompanied by this PDF certificate.

Any assessments of compliance with specifications are based on actual analytical results with no contribution from uncertainty of measurement.
Application of uncertainty of measurement would provide a range within which the true result lies.
An estimate of measurement uncertainty can be provided on request.

Analytical Report Number: 22-88385
Project / Site name: Castle Irwell, Salford
Your Order No: C4334 3411 JM

Lab Sample Number				2450287	2450288	2450289	2450290	2450291
Sample Reference				TP406	TP408	TP409	WS402	SA407
Sample Number				None Supplied	None Supplied	None Supplied	None Supplied	None Supplied
Depth (m)				2.00	0.30	3.50	2.00	0.50
Date Sampled				18/08/2022	19/08/2022	18/08/2022	17/08/2022	19/08/2022
Time Taken				None Supplied	None Supplied	None Supplied	None Supplied	None Supplied
Analytical Parameter (Soil Analysis)	Units	Limit of detection	Accreditation Status					
Stone Content	%	0.1	NONE	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
Moisture Content	%	0.01	NONE	18	9	8.6	11	6.8
Total mass of sample received	kg	0.001	NONE	0.9	0.9	0.9	0.9	0.9

Asbestos in Soil	Type	N/A	ISO 17025	Not-detected	Not-detected	Not-detected	Not-detected	Not-detected
Asbestos Analyst ID	N/A	N/A	N/A	SPU	SPU	SPU	SPU	SPU

General Inorganics

pH - Automated	pH Units	N/A	MCERTS	8.2	8.8	8.4	8.6	8.8
----------------	----------	-----	--------	-----	-----	-----	-----	-----

Heavy Metals / Metalloids

Arsenic (aqua regia extractable)	mg/kg	1	MCERTS	16	8.2	5.9	13	6.4
Cadmium (aqua regia extractable)	mg/kg	0.2	MCERTS	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2
Chromium (hexavalent)	mg/kg	1.2	NONE	< 1.2	< 1.2	< 1.2	< 1.2	< 1.2
Chromium (III)	mg/kg	1	NONE	21	17	9.7	16	13
Chromium (aqua regia extractable)	mg/kg	1	MCERTS	21	17	9.7	16	13
Copper (aqua regia extractable)	mg/kg	1	MCERTS	53	21	9.5	30	15
Lead (aqua regia extractable)	mg/kg	1	MCERTS	63	36	13	42	36
Mercury (aqua regia extractable)	mg/kg	0.3	MCERTS	0.5	< 0.3	< 0.3	< 0.3	< 0.3
Nickel (aqua regia extractable)	mg/kg	1	MCERTS	21	15	11	23	12
Selenium (aqua regia extractable)	mg/kg	1	MCERTS	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Zinc (aqua regia extractable)	mg/kg	1	MCERTS	66	49	33	72	42

U/S = Unsuitable Sample I/S = Insufficient Sample

Analytical Report Number: 22-88385
Project / Site name: Castle Irwell, Salford
Your Order No: C4334 3411 JM

Lab Sample Number				2450292
Sample Reference				SA409
Sample Number				None Supplied
Depth (m)				2.20
Date Sampled				19/08/2022
Time Taken				None Supplied
Analytical Parameter (Soil Analysis)	Units	Limit of detection	Accreditation Status	
Stone Content	%	0.1	NONE	< 0.1
Moisture Content	%	0.01	NONE	8
Total mass of sample received	kg	0.001	NONE	0.9

Asbestos in Soil	Type	N/A	ISO 17025	Not-detected
Asbestos Analyst ID	N/A	N/A	N/A	SPU

General Inorganics

pH - Automated	pH Units	N/A	MCERTS	9.1
----------------	----------	-----	--------	-----

Heavy Metals / Metalloids

Arsenic (aqua regia extractable)	mg/kg	1	MCERTS	5.6
Cadmium (aqua regia extractable)	mg/kg	0.2	MCERTS	< 0.2
Chromium (hexavalent)	mg/kg	1.2	NONE	< 1.2
Chromium (III)	mg/kg	1	NONE	12
Chromium (aqua regia extractable)	mg/kg	1	MCERTS	12
Copper (aqua regia extractable)	mg/kg	1	MCERTS	10
Lead (aqua regia extractable)	mg/kg	1	MCERTS	39
Mercury (aqua regia extractable)	mg/kg	0.3	MCERTS	< 0.3
Nickel (aqua regia extractable)	mg/kg	1	MCERTS	16
Selenium (aqua regia extractable)	mg/kg	1	MCERTS	< 1.0
Zinc (aqua regia extractable)	mg/kg	1	MCERTS	37

U/S = Unsuitable Sample I/S = Insufficient Sample

Analytical Report Number : 22-88385

Project / Site name: Castle Irwell, Salford

* These descriptions are only intended to act as a cross check if sample identities are questioned. The major constituent of the sample is intended to act with respect to MCERTS validation. The laboratory is accredited for sand, clay and loam (MCERTS) soil types. Data for unaccredited types of solid should be interpreted with care.

Stone content of a sample is calculated as the % weight of the stones not passing a 10 mm sieve. Results are not corrected for stone content.

Lab Sample Number	Sample Reference	Sample Number	Depth (m)	Sample Description *
2450287	TP406	None Supplied	2	Brown clay and sand with gravel.
2450288	TP408	None Supplied	0.3	Brown loam and sand with gravel and brick.
2450289	TP409	None Supplied	3.5	Brown sand with gravel.
2450290	WS402	None Supplied	2	Brown clay and sand with gravel.
2450291	SA407	None Supplied	0.5	Brown loam and sand with gravel and brick.
2450292	SA409	None Supplied	2.2	Brown sand with gravel.

Analytical Report Number : 22-88385

Project / Site name: Castle Irwell, Salford

Water matrix abbreviations:

Surface Water (SW) Potable Water (PW) Ground Water (GW) Process Waters (PrW) Final Sewage Effluent (FSE) Landfill Leachate (LL)

Analytical Test Name	Analytical Method Description	Analytical Method Reference	Method number	Wet / Dry Analysis	Accreditation Status
Metals in soil by ICP-OES	Determination of metals in soil by aqua-regia digestion followed by ICP-OES.	In-house method based on MEWAM 2006 Methods for the Determination of Metals in Soil.	L038-PL	D	MCERTS
Asbestos identification in soil	Asbestos Identification with the use of polarised light microscopy in conjunction with dispersion staining techniques.	In house method based on HSG 248	A001-PL	D	ISO 17025
Moisture Content	Moisture content, determined gravimetrically. (30 oC)	In house method.	L019-UK/PL	W	NONE
pH in soil (automated)	Determination of pH in soil by addition of water followed by automated electrometric measurement.	In house method.	L099-PL	D	MCERTS
Stones content of soil	Standard preparation for all samples unless otherwise detailed. Gravimetric determination of stone > 10 mm as % dry weight.	In-house method based on British Standard Methods and MCERTS requirements.	L019-UK/PL	D	NONE
Cr (III) in soil	In-house method by calculation from total Cr and Cr VI.	In-house method by calculation	L080-PL	W	NONE
Hexavalent chromium in soil (Lower Level)	Determination of hexavalent chromium in soil by extraction in water then by acidification, addition of 1,5 diphenylcarbazide followed by colorimetry.	In-house method	L080-PL	W	NONE

For method numbers ending in 'UK or A' analysis have been carried out in our laboratory in the United Kingdom (WATFORD).

For method numbers ending in 'F' analysis have been carried out in our laboratory in the United Kingdom (East Kilbride).

For method numbers ending in 'PL or B' analysis have been carried out in our laboratory in Poland.

Soil analytical results are expressed on a dry weight basis. Where analysis is carried out on as-received the results obtained are multiplied by a moisture correction factor that is determined gravimetrically using the moisture content which is carried out at a maximum of 30oC.

Unless otherwise indicated, site information, order number, project number, sampling date, time, sample reference and depth are provided by the client. The instructed on date indicates the date on which this information was provided to the laboratory.

Sample Deviation Report



Analytical Report Number : 22-88385

Project / Site name: Castle Irwell, Salford

This deviation report indicates the sample and test deviations that apply to the samples submitted for analysis. Please note that the associated result(s) may be unreliable and should be interpreted with care.

Sample ID	Other ID	Sample Type	Lab Sample Number	Sample Deviation	Test Name	Test Ref	Test Deviation
SA407	None Supplied	S	2450291	c	Hexavalent chromium in soil (Lower Level)	L080-PL	c
SA407	None Supplied	S	2450291	c	Cr (III) in soil	L080-PL	c
SA407	None Supplied	S	2450291	c	pH in soil (automated)	L099-PL	c
SA409	None Supplied	S	2450292	c	Hexavalent chromium in soil (Lower Level)	L080-PL	c
SA409	None Supplied	S	2450292	c	Cr (III) in soil	L080-PL	c
SA409	None Supplied	S	2450292	c	pH in soil (automated)	L099-PL	c
TP406	None Supplied	S	2450287	c	Hexavalent chromium in soil (Lower Level)	L080-PL	c
TP406	None Supplied	S	2450287	c	Cr (III) in soil	L080-PL	c
TP406	None Supplied	S	2450287	c	pH in soil (automated)	L099-PL	c
TP408	None Supplied	S	2450288	c	Hexavalent chromium in soil (Lower Level)	L080-PL	c
TP408	None Supplied	S	2450288	c	Cr (III) in soil	L080-PL	c
TP408	None Supplied	S	2450288	c	pH in soil (automated)	L099-PL	c
TP409	None Supplied	S	2450289	c	Hexavalent chromium in soil (Lower Level)	L080-PL	c
TP409	None Supplied	S	2450289	c	Cr (III) in soil	L080-PL	c
TP409	None Supplied	S	2450289	c	pH in soil (automated)	L099-PL	c
WS402	None Supplied	S	2450290	c	Hexavalent chromium in soil (Lower Level)	L080-PL	c
WS402	None Supplied	S	2450290	c	Cr (III) in soil	L080-PL	c
WS402	None Supplied	S	2450290	c	pH in soil (automated)	L099-PL	c

Human Health Assessment Summary			Soil Type: Location: Depth:			Units	TP04 0.5	TP02 0.5	SA05 2	WS04 2.3	TP406 2	TP408 0.3	TP409 3.5	WS402 2	SA407 0.5	SA409 2.2
Contaminant	GAC (mg/kg)	No. Samples	Min. Value	Max. Value	No. Samples ≥GAC											
Moisture Content	-	11	6.70	18.00	-	%	7	7	11	18	18	9	9	11	7	8
Soil Organic Matter	-	5	1.30	3.10	-	%	2.0	1.9	1.3	3.1						
pH	-	11	7.40	9.10	-	pH Units	9.0	8.8	8.1	7.4	8.2	8.8	8.4	8.6	8.8	9.1
Water Soluble Sulphate (2:1 Leachate Equivalent)	-	0	0.00	<LOD	-											
Arsenic	37	11	5.60	21.00	0	mg/kg	11	9	9	21	16	8	6	13	6	6
Cadmium	11	11	< LOD	0.50	0	mg/kg	< 0.2	< 0.2	0.50	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2
Chromium (III)	910	11	9.70	21.00	0	mg/kg	14	13	19	18	21	17	10	16	13	12
Hexavalent Chromium (VI)	6	11	< LOD	0.00	0	mg/kg	< 1.2	< 1.2	< 1.2	< 1.2	< 1.2	< 1.2	< 1.2	< 1.2	< 1.2	< 1.2
Copper	2400	11	9.50	53.00	0	mg/kg	42	21	25	47	53	21	10	30	15	10
Lead	200	11	13.00	94.00	0	mg/kg	84	48	32	94	63	36	13	42	36	39
Mercury	1.2	11	< LOD	0.50	0	mg/kg	0.3	< 0.3	< 0.3	< 0.3	0.5	< 0.3	< 0.3	< 0.3	< 0.3	< 0.3
Nickel	130	11	11.00	23.00	0	mg/kg	17	13	22	21	21	15	11	23	12	16
Selenium	250	11	< LOD	0.00	0	mg/kg	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Zinc	3700	11	33.00	84.00	0	mg/kg	68	60	57	84	66	49	33	72	42	37
Cyanide (free)	26	1	0.00	0.00	0	mg/kg										
Phenol (total)	550	1	0.00	0.00	0	mg/kg										
Naphthalene	5.6	5	< LOD	0.28	0	mg/kg	< 0.05	< 0.05	< 0.05	0.28						
Acenaphthylene	420	5	< LOD	0.00	0	mg/kg	< 0.05	< 0.05	< 0.05	< 0.05						
Acenaphthene	510	5	< LOD	1.20	0	mg/kg	< 0.05	0.27	0.32	1.20						
Fluorene	400	5	< LOD	0.70	0	mg/kg	< 0.05	< 0.05	0.24	0.70						
Phenanthrene	220	5	0.99	5.20	0	mg/kg	1.0	1.6	2.6	5.2						
Anthracene	5400	5	0.27	0.98	0	mg/kg	0.27	0.37	0.79	0.98						
Fluoranthene	560	5	2.20	6.90	0	mg/kg	2.2	2.4	6.9	6.0						
Pyrene	1200	5	1.90	6.20	0	mg/kg	1.9	2.2	6.2	6.0						
Benzo(a)anthracene	11.0	5	1.10	3.30	0	mg/kg	1.2	1.1	3.3	3.1						
Chrysene	22	5	1.10	3.10	0	mg/kg	1.1	1.1	3.1	2.8						
Benzo(b)fluoranthene	3.3	5	0.88	2.70	0	mg/kg	1.0	0.9	2.7	2.2						
Benzo(k)fluoranthene	93	5	0.66	1.80	0	mg/kg	0.77	0.66	1.80	1.30						
Benzo(a)pyrene	2.7	5	0.79	2.50	0	mg/kg	0.9	0.8	2.5	2.0						
Indeno(1,2,3-cd)pyrene	36	5	0.41	1.20	0	mg/kg	0.51	0.41	1.20	0.86						
Dibenz(a,h)anthracene	0.28	5	< LOD	0.26	0	mg/kg	< 0.05	< 0.05	0.26	0.24						
Benzo(ghi)perylene	340	5	0.58	1.70	0	mg/kg	0.70	0.58	1.70	1.40						
Asbestos Detected (Detected or Not-Detected)	Y	11	-	0.00	0	N	N	N	N	N	N	N	N	N	N	N
Asbestos Quantification (% w/w)	0	1	0.58	0.00	0	N										
Mean Average SOM			2.1													
Mean Average pH			8.5													
			Residential with Homegrown Produce 2.5% SOM			Values in RED are > the relevant GAC (Generic Assessment Criteria).										
Job Number: C4334																
Client: DOMIS CONSTRUCTION																
Site: Castle Irwell																
Soil Group Type Combined Results																

APPENDIX D

Geotechnical Testing Results

Abdulla Nagi
Brownfield Solutions Ltd
William Smith House
173 - 183 Witton Street
Northwich
Cheshire
CW9 5LP

i2 Analytical Ltd.
7 Woodshots Meadow,
Croxley Green
Business Park,
Watford,
Herts,
WD18 8YS

t: 01923 225404
f: 01923 237404
e: reception@i2analytical.com

e: a.nagi@brownfield-solutions.co.uk

Analytical Report Number : 22-79619

Project / Site name:	Castle Irwell Salford	Samples received on:	23/08/2022
Your job number:	C4334	Samples instructed on/ Analysis started on:	23/08/2022
Your order number:	C4334 3412 JM	Analysis completed by:	07/09/2022
Report Issue Number:	1	Report issued on:	07/09/2022
Samples Analysed:	4 soil samples		


Signed:

Anna Goc
Junior Reporting Specialist
For & on behalf of i2 Analytical Ltd.

Standard Geotechnical, Asbestos and Chemical Testing Laboratory located at: ul. Pionierów 39, 41 -711 Ruda Śląska, Poland.

Accredited tests are defined within the report, opinions and interpretations expressed herein are outside the scope of accreditation.

Standard sample disposal times, unless otherwise agreed with the laboratory, are :

soils	- 4 weeks from reporting
leachates	- 2 weeks from reporting
waters	- 2 weeks from reporting
asbestos	- 6 months from reporting

Excel copies of reports are only valid when accompanied by this PDF certificate.

Any assessments of compliance with specifications are based on actual analytical results with no contribution from uncertainty of measurement. Application of uncertainty of measurement would provide a range within which the true result lies. An estimate of measurement uncertainty can be provided on request.

Analytical Report Number: 22-79619
 Project / Site name: Castle Irwell Salford
 Your Order No: C4334 3412 JM

Lab Sample Number				2398870	2398871	2398872	2398873
Sample Reference				TP01	TP03	TP08	WS04
Sample Number				None Supplied	None Supplied	None Supplied	None Supplied
Depth (m)				1.50	2.50	4.00	2.30
Date Sampled				18/08/2022	18/08/2022	18/08/2022	17/08/2022
Time Taken				None Supplied	None Supplied	None Supplied	None Supplied
Analytical Parameter (Soil Analysis)	Units	Limit of detection	Accreditation Status				
Stone Content	%	0.1	NONE	< 0.1	< 0.1	< 0.1	< 0.1
Moisture Content	%	0.01	NONE	12	15	11	14
Total mass of sample received	kg	0.001	NONE	0.6	0.6	0.6	0.6

General Inorganics

pH - Automated	pH Units	N/A	MCERTS	7.8	8.1	8.3	7.7
Water Soluble SO ₄ 10ml extraction (2:1 Leachate Equivalent)	g/l	0.00125	MCERTS	0.087	0.023	0.21	0.024

U/S = Unsuitable Sample I/S = Insufficient Sample

Analytical Report Number : 22-79619

Project / Site name: Castle Irwell Salford

* These descriptions are only intended to act as a cross check if sample identities are questioned. The major constituent of the sample is intended to act with respect to MCERTS validation. The laboratory is accredited for sand, clay and loam (MCERTS) soil types. Data for unaccredited types of solid should be interpreted with care.

Stone content of a sample is calculated as the % weight of the stones not passing a 10 mm sieve. Results are not corrected for stone content.

Lab Sample Number	Sample Reference	Sample Number	Depth (m)	Sample Description *
2398870	TP01	None Supplied	1.5	Brown clay and sand with gravel.
2398871	TP03	None Supplied	2.5	Brown clay and sand.
2398872	TP08	None Supplied	4	Brown clay and sand with plastic.
2398873	WS04	None Supplied	2.3	Brown clay and sand.

Analytical Report Number : 22-79619

Project / Site name: Castle Irwell Salford

Water matrix abbreviations:

Surface Water (SW) Potable Water (PW) Ground Water (GW) Process Waters (PrW) Final Sewage Effluent (FSE) Landfill Leachate (LL)

Analytical Test Name	Analytical Method Description	Analytical Method Reference	Method number	Wet / Dry Analysis	Accreditation Status
Sulphate, water soluble, in soil (16hr extraction)	Determination of water soluble sulphate by ICP-OES. Results reported directly (leachate equivalent) and corrected for extraction ratio (soil equivalent).	In house method.	L038-PL	D	MCERTS
Moisture Content	Moisture content, determined gravimetrically. (30 oC)	In house method.	L019-UK/PL	W	NONE
pH in soil (automated)	Determination of pH in soil by addition of water followed by automated electrometric measurement.	In house method.	L099-PL	D	MCERTS
Stones content of soil	Standard preparation for all samples unless otherwise detailed. Gravimetric determination of stone > 10 mm as % dry weight.	In-house method based on British Standard Methods and MCERTS requirements.	L019-UK/PL	D	NONE

For method numbers ending in 'UK' analysis have been carried out in our laboratory in the United Kingdom.

For method numbers ending in 'PL' analysis have been carried out in our laboratory in Poland.

Soil analytical results are expressed on a dry weight basis. Where analysis is carried out on as-received the results obtained are multiplied by a moisture correction factor that is determined gravimetrically using the moisture content which is carried out at a maximum of 30oC.

Unless otherwise indicated, site information, order number, project number, sampling date, time, sample reference and depth are provided by the client. The instructed on date indicates the date on which this information was provided to the laboratory.

APPENDIX E

Monitoring Results

Ground Gas Monitoring Results



CLIENT:	Date	Operator	Analysar	Weather Observations			Temp (°C)	Pressure Trend	Notes
DOMIS CONSTRUCTION	04/02/2020	JM	GFM436	Light rain	Windy	Cold	5	Rising	
JOB NO.	19/02/2020	PG	GFM436	Light Rain	Windy	Cold	5	Falling	
C4334	12/03/2020	PG	GFM436	Sunny	No wind	Cool	5	Steady	
SITE:	18/03/2020	GRP	GFM436	Light rain	No wind	Cool	7	Rising	
CASTLE IRWELL, SALFORD	24/04/2020	JM	GFM436	Sunny	No wind	Warm	20	Falling	
	07/05/2020	JM	GFM436	Sunny	No wind	Warm	20	Rising	

Notes: mb = milibars; CH₄ = methane; LEL = lower explosive limit = 5%v/v; CO₂ = carbon dioxide; O₂ = oxygen; CO=carbon monoxide; H₂S = hydrogen sulphide; TVOC= Total volatile organic compounds; PPM = parts per million. Where the flow is less than the limit of detection of the instrument, the detection limit is reported (Highlighted in green). Gas Screening Values (GSVs) are rounded to 3 decimal places. Calibration Records for analysers used available on request.

Date	Time	Location	Response zone (m)	Pressures (mb)		Gas flows (l/hr)		CH ₄ (%v/v)		CH ₄ (%LEL)		CO ₂ (%v/v)		O ₂ (%v/v)		Other Gases (PPM)			Depth to Water (m)	Well Base (m)	Gas Screening Value (CH ₄) (l/hr)	Gas Screening Value (CO ₂) (l/hr)	Notes	
				Atmospheric Pressure	Relative Well Pressure	Initial	Steady	Peak	Steady	Peak	Steady	Peak	Steady	Peak	Steady	CO	H ₂ S	TVOC (PID)						
				Summary Statistics																				
Max. values:				1018	4.0	1.4	1.4	0.1	0.1	2.0	2.0	7.8	7.8	21.0	21.0	10.0	0.0	0.0	4.6	4.9	0.001	0.109		
Min. values:				995	-1.0	-0.4	-0.4	0.0	0.0	0.0	0.0	0.0	0.0	9.8	9.8	0.0	0.0	0.0	1.6	0.9	0.000	0.000		
				Worst-case GSVs based on maximum recorded steady flow and maximum individual peak concentrations:																		0.001	0.109	
04/02/2020	AM	Ambient		1009	-	-	-	0.1	-	2.0	-	0.1	-	20.8	-	0.0	0.0	-	-	-	-	-		
		WS201	0.50-1.50		0.1	1.4	1.4	0.1	0.1	2.0	2.0	7.8	7.8	20.0	20.1	0.0	0.0	NA	NGW	1.50	0.001	0.109		
		WS202	0.50-2.00		0.0	0.1	0.1	0.1	0.1	2.0	2.0	0.2	0.2	20.2	20.5	0.0	0.0	NA	NGW	1.95	0.000	0.000		
		WS203	1.00-4.00		0.0	0.1	0.1	0.1	0.1	2.0	2.0	1.0	0.8	19.5	20.0	0.0	0.0	NA	NGW	3.85	0.000	0.001		
		WS204	1.50-3.00		0.0	0.1	0.1	0.1	0.1	2.0	2.0	0.2	0.1	20.2	20.6	0.0	0.0	NA	NGW	3.50	0.000	0.000		
		WS205	1.50-3.00		0.1	0.1	0.1	0.1	0.1	2.0	2.0	0.1	0.1	20.3	20.6	0.0	0.0	NA	NGW	3.95	0.000	0.000		
		WS206	0.50-2.00		0.1	0.1	0.1	0.1	0.1	2.0	2.0	0.5	0.4	19.6	19.9	0.0	0.0	NA	NGW	2.48	0.000	0.001		
		BH201	1.00-5.60		0.1	0.1	0.1	0.1	0.1	2.0	0.0	0.1	0.1	20.2	20.4	0.0	0.0	NA	NGW	4.85	0.000	0.000		
		WS101	1.00-3.00		0.0	0.1	0.1	0.1	0.1	0.0	0.0	2.0	1.7	18.8	19.3	0.0	0.0	NA	NGW	2.25	0.000	0.002		
		WS105	2.00-3.00		0.0	0.1	0.1	0.1	0.1	0.0	0.0	3.2	2.9	17.0	18.8	0.0	0.0	NA	NGW	2.55	0.000	0.003		
		WS106	1.00-3.00		0.1	0.1	0.1	0.1	0.1	0.0	0.0	1.0	0.9	19.6	20.3	0.0	0.0	NA	NGW	2.34	0.000	0.001		
		WS107	0.50-1.00		0.0	0.1	0.1	0.1	0.1	0.0	0.0	2.6	0.9	17.6	19.8	0.0	0.0	NA	NGW	0.98	0.000	0.003		
		WS108	0.50-1.00		0.0	0.1	0.1	0.1	0.1	0.0	0.0	0.3	0.1	20.0	20.2	0.0	0.0	NA	NGW	0.96	0.000	0.000		
		WS109	1.00-3.00		0.0	0.1	0.1	0.1	0.1	0.0	0.0	1.3	1.0	19.7	20.2	0.0	0.0	NA	NGW	2.85	0.000	0.001		
		WS110	1.00-2.50		0.0	0.1	0.1	0.1	0.1	0.0	0.0	3.0	1.6	16.0	19.1	0.0	0.0	NA	NGW	2.50	0.000	0.003		
		WS111	1.00-3.00		0.0	0.1	0.1	0.1	0.1	0.0	0.0	0.3	0.2	20.3	20.5	0.0	0.0	NA	NGW	2.90	0.000	0.000		
		AM	Ambient		1012	-	-	-	0.1	-	2.0	-	0.1	-	20.7	-	0.0	0.0	-	-	-	-	-	
19/02/2020	PM	Ambient		1007	-	-	-	0.0	-	0.0	-	0.0	-	20.8	-	0.0	0.0	-	-	-	-	-		
		WS201	0.50-1.50		0.0	0.0	0.0	0.0	0.0	0.0	0.0	3.9	3.9	11.9	11.9	0.0	0.0	NA	NGW	1.42	0.000	0.000		
		WS202	0.50-2.00		0.0	0.0	0.0	0.0	0.0	0.0	0.0	3.9	3.9	11.9	11.9	0.0	0.0	NA	NGW	1.90	0.000	0.000		
		WS203	1.00-4.00		1.0	0.0	0.0	0.0	0.0	0.0	0.0	2.2	2.2	15.6	11.9	0.0	0.0	NA	3.48	3.71	0.000	0.000		
		WS204	1.50-3.00		4.0	0.9	0.7	0.0	0.0	0.0	0.0	1.3	1.3	9.8	9.8	0.0	0.0	NA	NGW	2.90	0.000	0.009		
		WS205	1.50-3.00		4.0	0.7	0.7	0.0	0.0	0.0	0.0	2.7	1.7	18.4	18.4	0.0	0.0	NA	NGW	2.92	0.000	0.019		
		WS206	0.50-2.00		1.0	0.1	0.0	0.0	0.0	0.0	0.0	0.6	0.6	19.3	19.3	0.0	0.0	NA	NGW	2.47	0.000	0.000		
		BH201	1.00-5.60		3.0	0.7	0.7	0.0	0.0	0.0	0.0	4.9	4.9	12.3	12.3	0.0	0.0	NA	3.76	4.67	0.000	0.034		
		WS101	1.00-3.00		0.0	0.1	0.1	0.1	0.1	0.0	0.0	1.9	1.7	18.9	19.2	0.0	0.0	NA	NGW	2.25	0.0001	0.002		
		WS105	2.00-3.00		0.0	0.1	0.1	0.1	0.1	0.0	0.0	3.3	2.8	17.1	18.5	0.0	0.0	NA	NGW	2.55	0.0001	0.003		
		WS106	1.00-3.00		0.0	0.1	0.1	0.1	0.1	0.0	0.0	1.0	0.9	19.5	20.1	0.0	0.0	NA	NGW	2.34	0.0001	0.001		
		WS107	0.50-1.00		2.0	0.1	0.1	0.0	0.0	0.0	0.0	2.6	2.2	16.2	15.6	0.0	0.0	NA	NGW	0.96	0.0000	0.0026		
		WS108	0.50-1.00		0.0	0.1	0.1	0.1	0.1	0.0	0.0	0.4	0.2	20.1	20.2	0.0	0.0	NA	NGW	0.96	0.0001	0.0003		
		WS109	1.00-3.00		0.0	0.1	0.1	0.1	0.1	0.0	0.0	1.2	1.2	19.6	20.2	0.0	0.0	NA	NGW	2.85	0.0001	0.0013		
		WS110	1.00-2.50		0.0	0.1	0.1	0.1	0.1	0.0	0.0	3.2	1.7	16.0	19.1	0.0	0.0	NA	NGW	2.5	0.0001	0.003		
		WS111	1.00-3.00		0.0	0.1	0.1	0.1	0.1	0.0	0.0	0.4	0.3	20.2	20.2	0.0	0.0	NA	NGW	2.9	0.0001	0.0003		
		PM	Ambient		1005	-	-	-	0.1	-	2.0	-	0.1	-	20.7	-	0.0	0.0	-	-	-	-	-	

Ground Gas Monitoring Results



Date	Time	Location	Response zone (m)	Pressures (mb)		Gas flows (l/hr)		CH ₄ (%v/v)		CH ₄ (%LEL)		CO ₂ (%v/v)		O ₂ (%v/v)		Other Gases (PPM)			Depth to Water (m)	Well Base (m)	Gas Screening Value (CH ₄) (l/hr)	Gas Screening Value (CO ₂) (l/hr)	Notes
				Atmospheric Pressure	Relative Well Pressure	Initial	Steady	Peak	Steady	Peak	Steady	Peak	Steady	Peak	Steady	CO	H ₂ S	TVOC (PID)					
12/03/2020	PM	Ambient		999																			
		WS201	0.50-1.50		0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.4	1.3	19.7	17.7	0.0	0.0	NA	NG	1.40	0.000	0.000	
		WS202	0.50-2.00		-1.0	-0.4	-0.4	0.0	0.0	0.0	0.0	0.8	0.0	19.8	20.5	0.0	0.0	NA	NG	1.90	0.000	0.003	
		WS203	1.00-4.00		1.0	0.0	0.0	0.0	0.0	0.0	0.0	6.4	0.6	11.8	17.7	0.0	0.0	NA	3.29	3.73	0.000	0.000	
		WS204	1.50-3.00		3.0	0.3	0.0	0.0	0.0	0.0	0.0	1.6	0.8	10.2	18.2	0.0	0.0	NA	NG	2.87	0.000	0.000	
		WS205	1.50-3.00		0.1	0.1	0.1	0.1	0.1	2.0	2.0	0.1	0.1	20.3	20.6	0.0	0.0	NA	NGW	3.95	0.000	0.000	
		WS206	0.50-2.00		2.0	NA	0.0	NA	0.0	NA	0.0	NA	0.6	NA	17.7	0.0	0.0	NA	NG	2.47	NA	NA	Well head flooded.
		BH201	1.00-5.60		0.1	0.1	0.1	0.1	0.1	2.0	0.0	0.1	0.1	20.2	20.4	0.0	0.0	NA	NGW	4.85	0.000	0.000	
		WS101	1.00-3.00		1.0	0.0	0.0	0.0	0.0	0.0	0.0	6.4	0.6	11.8	17.7	0.0	0.0	NA	3.29	3.73	0.000	0.000	
		WS105	2.00-3.00		0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.5	0.0	18.2	20.2	0.0	0.0	NA	NG	2.92	0.000	0.000	
		WS106	1.00-3.00		0.1	0.1	0.1	0.1	0.1	0.0	0.0	1.0	0.9	19.6	20.3	0.0	0.0	NA	NGW	2.34	0.000	0.001	
		WS107	0.50-1.00		0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.8	1.8	17.7	17.6	0.0	0.0	NA	NG	0.92	0.000	0.000	
		WS108	0.50-1.00		0.0	0.1	0.1	0.1	0.1	0.0	0.0	0.3	0.1	20.0	20.2	0.0	0.0	NA	NGW	0.96	0.000	0.000	
		WS109	1.00-3.00		0.0	0.1	0.1	0.1	0.1	0.0	0.0	1.3	1.0	19.7	20.2	0.0	0.0	NA	NGW	2.85	0.000	0.001	
		WS110	1.00-2.50		0.0	0.1	0.1	0.1	0.1	0.0	0.0	3.0	1.6	16.0	19.1	0.0	0.0	NA	NGW	2.50	0.000	0.003	
		WS111	1.00-3.00		0.0	0.1	0.1	0.1	0.1	0.0	0.0	0.3	0.2	20.3	20.5	0.0	0.0	NA	NGW	2.90	0.000	0.000	
18/03/2020	AM	Ambient		1018																			
		WS201	0.50-1.50		0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.2	0.0	20.3	20.4	0.0	0.0	NA	NGW	1.39	0.000	0.000	
		WS202	0.50-2.00		2.0	0.3	0.0	0.0	0.0	0.0	0.0	0.8	0.2	19.8	20.2	0.0	0.0	NA	NGW	1.92	0.000	0.000	
		WS203	1.00-4.00		1.0	0.3	0.1	0.0	0.0	0.0	0.0	0.1	0.0	20.4	20.6	0.0	0.0	NA	3.48	3.76	0.000	0.000	
		WS204	1.50-3.00		1.0	0.1	0.0	0.0	0.0	0.0	0.0	1.7	0.7	12.6	20.0	0.0	0.0	NA	1.61	2.93	0.000	0.000	
		WS205	1.50-3.00		0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.5	0.3	19.3	19.9	0.0	0.0	NA	NGW	2.96	0.000	0.000	
		WS206	0.50-2.00		0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.4	0.1	20.0	20.5	0.0	0.0	NA	NGW	2.50	0.000	0.000	
		BH201	1.00-5.60		0.0	0.0	0.0	0.0	0.0	0.0	0.0	3.2	0.6	15.1	18.5	10.0	0.0	NA	3.74	4.78	0.000	0.000	
		WS101	1.00-3.00		NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	0.000	0.000	Not found.
		WS105	2.00-3.00		NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	0.000	0.000	Not found.
		WS106	1.00-3.00		NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	0.000	0.000	Not found.
		WS107	0.50-1.00		0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.2	0.1	20.2	20.4	0.0	0.0	NA	NGW	0.98	0.000	0.000	
		WS108	0.50-1.00		NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	0.000	0.000	Not found.
		WS109	1.00-3.00		0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.6	0.3	18.3	19.9	0.0	0.0	NA	NGW	2.87	0.000	0.000	
		WS110	1.00-2.50		NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	0.000	0.000	Hole destroyed, underwater.
		WS111	1.00-3.00		NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	0.000	0.000	Not found.
24/04/2020	AM	Ambient		1009	-	-	-	0.0	-	0.0	-	0.0	-	21.0	-	0.0	0.0	-	-	-	-	-	-
		WS201	0.50-1.50		-	1.0	0.1	0.1	0.0	0.0	0.0	1.1	1.0	18.6	19.3	0.0	0.0	NA	NGW	1.39	0.000	0.001	
		WS202	0.50-2.00		-	2.0	0.1	0.1	0.0	0.0	0.0	0.7	0.5	20.2	20.3	0.0	0.0	NA	NGW	1.92	0.000	0.001	
		WS203	1.00-4.00		-	0.0	0.1	0.1	0.0	0.0	0.0	0.6	0.4	20.1	20.5	0.0	0.0	NA	NGW	3.76	0.000	0.001	
		WS204	1.50-3.00		-	3.0	0.1	0.1	0.0	0.0	0.0	0.1	0.1	20.9	21.0	0.0	0.0	NA	NGW	2.93	0.000	0.000	
		WS205	1.50-3.00		-	1.0	0.1	0.1	0.0	0.0	0.0	2.5	2.2	17.5	18.6	0.0	0.0	NA	NGW	2.96	0.000	0.003	
		WS206	0.50-2.00		-	2.0	0.1	0.1	0.0	0.0	0.0	1.8	1.5	17.3	17.9	0.0	0.0	NA	NGW	2.50	0.000	0.002	
		BH201	1.00-5.60		-	1.0	0.1	0.1	0.0	0.0	0.0	4.5	4.0	15.3	17.4	0.0	0.0	NA	4.63	4.78	0.000	0.005	
		WS101	1.00-3.00		-	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	Not found.
		WS105	2.00-3.00		-	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	Not found.
		WS106	1.00-3.00		-	0.0	0.1	0.1	0.0	0.0	0.0	0.5	0.2	19.8	20.3	0.0	0.0	NA	NGW	2.7	0.000	0.001	
		WS107	0.50-1.00		-	0.0	0.1	0.1	0.0	0.0	0.0	2.4	2.1	18.9	19.3	0.0	0.0	NA	NGW	0.98	0.000	0.002	
		WS108	0.50-1.00		-	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	Not found.
		WS109	1.00-3.00		-	1.0	0.1	0.1	0.0	0.0	0.0	2.6	2.2	19.8	20.2	0.0	0.0	NA	NGW	2.85			
		WS110	1.00-2.50		-	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	Not found.
		WS111	1.00-3.00		-	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	Not found.
24/04/2020	PM	Ambient		1009	-	-	-	0.0	-	0.0	-	0.0	-	21.0	-	0.0	0.0	-	-	-	-	-	-

Ground Gas Monitoring Results



Date	Time	Location	Response zone (m)	Pressures (mb)		Gas flows (l/hr)		CH ₄ (%v/v)		CH ₄ (%LEL)		CO ₂ (%v/v)		O ₂ (%v/v)		Other Gases (PPM)			Depth to Water (m)	Well Base (m)	Gas Screening Value (CH ₄) (l/hr)	Gas Screening Value (CO ₂) (l/hr)	Notes
				Atmospheric Pressure	Relative Well Pressure	Initial	Steady	Peak	Steady	Peak	Steady	Peak	Steady	Peak	Steady	CO	H ₂ S	TVOC (PID)					
07/05/2020	AM	Ambient		1018	-	-	-	0.0	-	0.0	-	0.0	-	21.0	-	0.0	0.0	-	-	-	-	-	
		WS201	0.50-1.50	-	1.0	0.1	0.1	0.0	0.0	0.0	0.0	0.7	0.5	19.9	20.3	0.0	0.0	NA	NGW	1.35	0.000	0.001	
		WS202	0.50-2.00	-	1.0	0.1	0.1	0.0	0.0	0.0	0.0	0.9	0.6	19.9	20.1	0.0	0.0	NA	NGW	1.90	0.000	0.001	
		WS203	1.00-4.00	-	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	Well destroyed by onsite contractors
		WS204	1.50-3.00	-	0.0	0.1	0.1	0.0	0.0	0.0	0.0	2.3	2.3	15.6	16.6	0.0	0.0	NA	NGW	2.91	0.000	0.002	
		WS205	1.50-3.00	-	0.0	0.1	0.1	0.0	0.0	0.0	0.0	0.1	0.1	20.5	20.8	0.0	0.0	NA	NGW	2.95	0.000	0.000	
		WS206	0.50-2.00	-	1.0	0.1	0.1	0.0	0.0	0.0	0.0	2.0	0.8	17.4	18.9	0.0	0.0	NA	NGW	2.50	0.000	0.002	
		BH201	1.00-5.60	-	1.0	0.1	0.1	0.0	0.0	0.0	0.0	3.2	2.5	16.9	18.3	0.0	0.0	NA	NGW	4.77	0.000	0.003	
		WS101	1.00-3.00	-	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	Not found.
		WS105	2.00-3.00	-	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	Not found.
		WS106	1.00-3.00	-	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	Well destroyed by onsite contractors
		WS107	0.50-1.00	-	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	Well destroyed by onsite contractors
		WS108	0.50-1.00	-	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	Not found.
		WS109	1.00-3.00	-	1.0	0.1	0.1	0.0	0.0	0.0	0.0	1.5	1.1	20.0	20.3	0.0	0.0	NA	NGW	2.85	0.000	0.002	
		WS110	1.00-2.50	-	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	Not found.
		WS111	1.00-3.00	-	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	Not found.
	AM	Ambient		1018	-	-	-	0.0	-	0.0	-	0.0	-	21.0	-	0.0	0.0	-	-	-	-	-	

APPENDIX F

Waste Assessment Report



Waste Classification Report

HazWasteOnline™ classifies waste as either **hazardous** or **non-hazardous** based on its chemical composition, related legislation and the rules and data defined in the current UK or EU technical guidance (Appendix C) (note that HP 9 Infectious is not assessed). It is the responsibility of the classifier named below to:

- understand the origin of the waste
- select the correct List of Waste code(s)
- confirm that the list of determinands, results and sampling plan are fit for purpose
- select and justify the chosen metal species (Appendix B)
- correctly apply moisture correction and other available corrections
- add the meta data for their user-defined substances (Appendix A)
- check that the classification engine is suitable with respect to the national destination of the waste (Appendix C)



O3S0I-MC7X9-5IFYO

To aid the reviewer, the laboratory results, assumptions and justifications managed by the classifier are highlighted in **pale yellow**.

Job name

Castle Irwell, Salford

Description/Comments

Project

C4334

Site

Castle Irwell, Salford

Classified by

Name:
Matthew ShoreDate:
06 Sep 2022 07:22 GMT
Telephone:
01606334844Company:
Brownfield Solutions Limited
Brownfield Solutions Ltd
173-183 Witton Street
Northwich
CW9 5LP

HazWasteOnline™ provides a two day, hazardous waste classification course that covers the use of the software and both basic and advanced waste classification techniques. Certification has to be renewed every 3 years.

HazWasteOnline™ Certification:

CERTIFIED

Course

Hazardous Waste Classification

Date

07 Oct 2021

Next 3 year Refresher due by Oct 2024

Job summary

#	Sample name	Depth [m]	Classification Result	Hazard properties	Page
1	TP04	0.5	Non Hazardous		2
2	TP02	0.5	Non Hazardous		4
3	SA05	2	Non Hazardous		6
4	WS04	2.3	Non Hazardous		8

Related documents

#	Name	Description
1	BSL Suite	waste stream template used to create this Job

Report

Created by: Matthew Shore

Created date: 06 Sep 2022 07:22 GMT

Appendices	Page
Appendix A: Classifier defined and non GB MCL determinands	10
Appendix B: Rationale for selection of metal species	11
Appendix C: Version	11



Classification of sample: TP04



Non Hazardous Waste
Classified as **17 05 04**
in the List of Waste

Sample details

Sample name:	LoW Code:
TP04	Chapter: 17: Construction and Demolition Wastes (including excavated soil from contaminated sites)
Sample Depth:	Entry: 17 05 04 (Soil and stones other than those mentioned in 17 05 03)
0.5 m	
Moisture content:	
6.7%	
(wet weight correction)	

Hazard properties

None identified

Determinands

Moisture content: 6.7% Wet Weight Moisture Correction applied (MC)

#	Determinand			CLP Note	User entered data	Conv. Factor	Compound conc.		Classification value	MC Applied	Conc. Not Used
	EU CLP index number	EC Number	CAS Number								
1	pH				9 pH		9	pH	9pH		
2	arsenic { arsenic trioxide }				11 mg/kg	1.32	13.55	mg/kg	0.00136 %	✓	
	033-003-00-0	215-481-4	1327-53-3								
3	cadmium { cadmium sulfide }			1	<0.2 mg/kg	1.285	<0.257	mg/kg	<0.00002 %		<LOD
	048-010-00-4	215-147-8	1306-23-6								
4	chromium in chromium(VI) compounds { chromium(VI) oxide }				<1.2 mg/kg	1.923	<2.308	mg/kg	<0.000231 %		<LOD
	024-001-00-0	215-607-8	1333-82-0								
5	chromium in chromium(III) compounds { chromium(III) oxide (worst case) }				14 mg/kg	1.462	19.091	mg/kg	0.00191 %	✓	
		215-160-9	1308-38-9								
6	copper { dicopper oxide; copper (I) oxide }				42 mg/kg	1.126	44.119	mg/kg	0.00441 %	✓	
	029-002-00-X	215-270-7	1317-39-1								
7	lead { lead chromate }			1	84 mg/kg	1.56	122.246	mg/kg	0.00784 %	✓	
	082-004-00-2	231-846-0	7758-97-6								
8	mercury { mercury dichloride }				0.3 mg/kg	1.353	0.379	mg/kg	0.0000379 %	✓	
	080-010-00-X	231-299-8	7487-94-7								
9	nickel { nickel dihydroxide }				17 mg/kg	1.579	25.052	mg/kg	0.00251 %	✓	
	028-008-00-X	235-008-5 [1] 234-348-1 [2]	12054-48-7 [1] 11113-74-9 [2]								
10	selenium { selenium compounds with the exception of cadmium selenide and those specified elsewhere in this Annex }				<1 mg/kg	1.405	<1.405	mg/kg	<0.000141 %		<LOD
	034-002-00-8										
11	zinc { zinc chromate }				68 mg/kg	2.774	176.003	mg/kg	0.0176 %	✓	
	024-007-00-3	236-878-9	13530-65-9								
12	naphthalene				<0.005 mg/kg		<0.005	mg/kg	<0.0000005 %		<LOD
	601-052-00-2	202-049-5	91-20-3								
13	acenaphthylene				<0.05 mg/kg		<0.05	mg/kg	<0.000005 %		<LOD
		205-917-1	208-96-8								
14	acenaphthene				<0.05 mg/kg		<0.05	mg/kg	<0.000005 %		<LOD
		201-469-6	83-32-9								
15	fluorene				<0.05 mg/kg		<0.05	mg/kg	<0.000005 %		<LOD
		201-695-5	86-73-7								



#	Determinand			CLP Note	User entered data	Conv. Factor	Compound conc.	Classification value	MC Applied	Conc. Not Used
	EU CLP index number	EC Number	CAS Number							
16	phenanthrene	201-581-5	85-01-8		0.99 mg/kg		0.924 mg/kg	0.0000924 %	✓	
17	anthracene	204-371-1	120-12-7		0.27 mg/kg		0.252 mg/kg	0.0000252 %	✓	
18	fluoranthene	205-912-4	206-44-0		2.2 mg/kg		2.053 mg/kg	0.000205 %	✓	
19	pyrene	204-927-3	129-00-0		1.9 mg/kg		1.773 mg/kg	0.000177 %	✓	
20	benzo[a]anthracene	601-033-00-9	200-280-6		1.2 mg/kg		1.12 mg/kg	0.000112 %	✓	
21	chrysene	601-048-00-0	205-923-4		1.1 mg/kg		1.026 mg/kg	0.000103 %	✓	
22	benzo[b]fluoranthene	601-034-00-4	205-911-9		1 mg/kg		0.933 mg/kg	0.0000933 %	✓	
23	benzo[k]fluoranthene	601-036-00-5	205-916-6		0.77 mg/kg		0.718 mg/kg	0.0000718 %	✓	
24	benzo[a]pyrene; benzo[def]chrysene	601-032-00-3	200-028-5		0.93 mg/kg		0.868 mg/kg	0.0000868 %	✓	
25	indeno[123-cd]pyrene	205-893-2	193-39-5		0.51 mg/kg		0.476 mg/kg	0.0000476 %	✓	
26	dibenz[a,h]anthracene	601-041-00-2	200-181-8		<0.05 mg/kg		<0.05 mg/kg	<0.000005 %		<LOD
27	benzo[ghi]perylene	205-883-8	191-24-2		0.7 mg/kg		0.653 mg/kg	0.0000653 %	✓	
Total:								0.0371 %		

Key

- User supplied data
- Determinand values ignored for classification, see column 'Conc. Not Used' for reason
- Determinand defined or amended by HazWasteOnline (see Appendix A)
- Speciated Determinand - Unless the Determinand is Note 1, the Conversion Factor is used to calculate the compound concentration
- <LOD** Below limit of detection
- ND** Not detected
- CLP: Note 1 Only the metal concentration has been used for classification

Classification of sample: TP02

 **Non Hazardous Waste**
 Classified as **17 05 04**
 in the List of Waste

Sample details

Sample name:	LoW Code:
TP02	Chapter: 17: Construction and Demolition Wastes (including excavated soil from contaminated sites)
Sample Depth:	Entry: 17 05 04 (Soil and stones other than those mentioned in 17 05 03)
0.5 m	
Moisture content:	
7.1%	
(wet weight correction)	

Hazard properties

None identified

Determinands

Moisture content: 7.1% Wet Weight Moisture Correction applied (MC)

#	Determinand			CLP Note	User entered data	Conv. Factor	Compound conc.	Classification value	MC Applied	Conc. Not Used
	EU CLP index number	EC Number	CAS Number							
1	pH				8.8 pH		8.8 pH	8.8 pH		
2	arsenic { arsenic trioxide }				8.7 mg/kg	1.32	10.671 mg/kg	0.00107 %	✓	
	033-003-00-0	215-481-4	1327-53-3							
3	cadmium { cadmium sulfide }			1	<0.2 mg/kg	1.285	<0.257 mg/kg	<0.00002 %		<LOD
	048-010-00-4	215-147-8	1306-23-6							
4	chromium in chromium(VI) compounds { chromium(VI) oxide }				<1.2 mg/kg	1.923	<2.308 mg/kg	<0.000231 %		<LOD
	024-001-00-0	215-607-8	1333-82-0							
5	chromium in chromium(III) compounds { chromium(III) oxide (worst case) }				13 mg/kg	1.462	17.651 mg/kg	0.00177 %	✓	
		215-160-9	1308-38-9							
6	copper { dicopper oxide; copper (I) oxide }				21 mg/kg	1.126	21.965 mg/kg	0.0022 %	✓	
	029-002-00-X	215-270-7	1317-39-1							
7	lead { lead chromate }			1	48 mg/kg	1.56	69.555 mg/kg	0.00446 %	✓	
	082-004-00-2	231-846-0	7758-97-6							
8	mercury { mercury dichloride }				<0.3 mg/kg	1.353	<0.406 mg/kg	<0.0000406 %		<LOD
	080-010-00-X	231-299-8	7487-94-7							
9	nickel { nickel dihydroxide }				13 mg/kg	1.579	19.076 mg/kg	0.00191 %	✓	
	028-008-00-X	235-008-5 [1] 234-348-1 [2]	12054-48-7 [1] 11113-74-9 [2]							
10	selenium { selenium compounds with the exception of cadmium selenosulfide and those specified elsewhere in this Annex }				<1 mg/kg	1.405	<1.405 mg/kg	<0.000141 %		<LOD
	034-002-00-8									
11	zinc { zinc chromate }				60 mg/kg	2.774	154.631 mg/kg	0.0155 %	✓	
	024-007-00-3	236-878-9	13530-65-9							
12	naphthalene				<0.005 mg/kg		<0.005 mg/kg	<0.0000005 %		<LOD
	601-052-00-2	202-049-5	91-20-3							
13	acenaphthylene				<0.05 mg/kg		<0.05 mg/kg	<0.000005 %		<LOD
		205-917-1	208-96-8							
14	acenaphthene				0.27 mg/kg		0.251 mg/kg	0.0000251 %	✓	
		201-469-6	83-32-9							
15	fluorene				<0.05 mg/kg		<0.05 mg/kg	<0.000005 %		<LOD
		201-695-5	86-73-7							



#	Determinand			CLP Note	User entered data	Conv. Factor	Compound conc.	Classification value	MC Applied	Conc. Not Used
	EU CLP index number	EC Number	CAS Number							
16	phenanthrene	201-581-5	85-01-8		1.6 mg/kg		1.486 mg/kg	0.000149 %	✓	
17	anthracene	204-371-1	120-12-7		0.37 mg/kg		0.344 mg/kg	0.0000344 %	✓	
18	fluoranthene	205-912-4	206-44-0		2.4 mg/kg		2.23 mg/kg	0.000223 %	✓	
19	pyrene	204-927-3	129-00-0		2.2 mg/kg		2.044 mg/kg	0.000204 %	✓	
20	benzo[a]anthracene	601-033-00-9	200-280-6		1.1 mg/kg		1.022 mg/kg	0.000102 %	✓	
21	chrysene	601-048-00-0	205-923-4		1.1 mg/kg		1.022 mg/kg	0.000102 %	✓	
22	benzo[b]fluoranthene	601-034-00-4	205-911-9		0.88 mg/kg		0.818 mg/kg	0.0000818 %	✓	
23	benzo[k]fluoranthene	601-036-00-5	205-916-6		0.66 mg/kg		0.613 mg/kg	0.0000613 %	✓	
24	benzo[a]pyrene; benzo[def]chrysene	601-032-00-3	200-028-5		0.79 mg/kg		0.734 mg/kg	0.0000734 %	✓	
25	indeno[123-cd]pyrene	205-893-2	193-39-5		0.41 mg/kg		0.381 mg/kg	0.0000381 %	✓	
26	dibenz[a,h]anthracene	601-041-00-2	200-181-8		<0.05 mg/kg		<0.05 mg/kg	<0.000005 %		<LOD
27	benzo[ghi]perylene	205-883-8	191-24-2		0.58 mg/kg		0.539 mg/kg	0.0000539 %	✓	
Total:								0.0285 %		

Key

- User supplied data
- Determinand values ignored for classification, see column 'Conc. Not Used' for reason
- Determinand defined or amended by HazWasteOnline (see Appendix A)
- Speciated Determinand - Unless the Determinand is Note 1, the Conversion Factor is used to calculate the compound concentration
- <LOD** Below limit of detection
- ND** Not detected
- CLP: Note 1 Only the metal concentration has been used for classification



Classification of sample: SA05



Non Hazardous Waste
Classified as **17 05 04**
in the List of Waste

Sample details

Sample name:	LoW Code:
SA05	Chapter: 17: Construction and Demolition Wastes (including excavated soil from contaminated sites)
Sample Depth:	Entry: 17 05 04 (Soil and stones other than those mentioned in 17 05 03)
2 m	
Moisture content:	
11%	
(wet weight correction)	

Hazard properties

None identified

Determinands

Moisture content: 11% Wet Weight Moisture Correction applied (MC)

#	Determinand			CLP Note	User entered data		Conv. Factor	Compound conc.		Classification value	MC Applied	Conc. Not Used
	EU CLP index number	EC Number	CAS Number									
1	pH				8.1	pH		8.1	pH	8.1 pH		
2	arsenic { arsenic trioxide }				9.2	mg/kg	1.32	10.811	mg/kg	0.00108 %	✓	
	033-003-00-0	215-481-4	1327-53-3									
3	cadmium { cadmium sulfide }			1	0.5	mg/kg	1.285	0.572	mg/kg	0.0000445 %	✓	
	048-010-00-4	215-147-8	1306-23-6									
4	chromium in chromium(VI) compounds { chromium(VI) oxide }				<1.2	mg/kg	1.923	<2.308	mg/kg	<0.000231 %		<LOD
	024-001-00-0	215-607-8	1333-82-0									
5	chromium in chromium(III) compounds { chromium(III) oxide (worst case) }				19	mg/kg	1.462	24.715	mg/kg	0.00247 %	✓	
		215-160-9	1308-38-9									
6	copper { dicopper oxide; copper (I) oxide }				25	mg/kg	1.126	25.051	mg/kg	0.00251 %	✓	
	029-002-00-X	215-270-7	1317-39-1									
7	lead { lead chromate }			1	32	mg/kg	1.56	44.424	mg/kg	0.00285 %	✓	
	082-004-00-2	231-846-0	7758-97-6									
8	mercury { mercury dichloride }				<0.3	mg/kg	1.353	<0.406	mg/kg	<0.0000406 %		<LOD
	080-010-00-X	231-299-8	7487-94-7									
9	nickel { nickel dihydroxide }				22	mg/kg	1.579	30.927	mg/kg	0.00309 %	✓	
	028-008-00-X	235-008-5 [1] 234-348-1 [2]	12054-48-7 [1] 11113-74-9 [2]									
10	selenium { selenium compounds with the exception of cadmium selenide and those specified elsewhere in this Annex }				<1	mg/kg	1.405	<1.405	mg/kg	<0.000141 %		<LOD
	034-002-00-8											
11	zinc { zinc chromate }				57	mg/kg	2.774	140.732	mg/kg	0.0141 %	✓	
	024-007-00-3	236-878-9	13530-65-9									
12	naphthalene				<0.05	mg/kg		<0.05	mg/kg	<0.000005 %		<LOD
	601-052-00-2	202-049-5	91-20-3									
13	acenaphthylene				<0.05	mg/kg		<0.05	mg/kg	<0.000005 %		<LOD
		205-917-1	208-96-8									
14	acenaphthene				0.32	mg/kg		0.285	mg/kg	0.0000285 %	✓	
		201-469-6	83-32-9									
15	fluorene				0.24	mg/kg		0.214	mg/kg	0.0000214 %	✓	
		201-695-5	86-73-7									



#	Determinand			CLP Note	User entered data	Conv. Factor	Compound conc.	Classification value	MC Applied	Conc. Not Used
	EU CLP index number	EC Number	CAS Number							
16	phenanthrene	201-581-5	85-01-8		2.6 mg/kg		2.314 mg/kg	0.000231 %	✓	
17	anthracene	204-371-1	120-12-7		0.79 mg/kg		0.703 mg/kg	0.0000703 %	✓	
18	fluoranthene	205-912-4	206-44-0		6.9 mg/kg		6.141 mg/kg	0.000614 %	✓	
19	pyrene	204-927-3	129-00-0		6.2 mg/kg		5.518 mg/kg	0.000552 %	✓	
20	benzo[a]anthracene	601-033-00-9	200-280-6		3.3 mg/kg		2.937 mg/kg	0.000294 %	✓	
21	chrysene	601-048-00-0	205-923-4		3.1 mg/kg		2.759 mg/kg	0.000276 %	✓	
22	benzo[b]fluoranthene	601-034-00-4	205-911-9		2.7 mg/kg		2.403 mg/kg	0.00024 %	✓	
23	benzo[k]fluoranthene	601-036-00-5	205-916-6		1.8 mg/kg		1.602 mg/kg	0.00016 %	✓	
24	benzo[a]pyrene; benzo[def]chrysene	601-032-00-3	200-028-5		2.5 mg/kg		2.225 mg/kg	0.000223 %	✓	
25	indeno[123-cd]pyrene	205-893-2	193-39-5		1.2 mg/kg		1.068 mg/kg	0.000107 %	✓	
26	dibenz[a,h]anthracene	601-041-00-2	200-181-8		0.26 mg/kg		0.231 mg/kg	0.0000231 %	✓	
27	benzo[ghi]perylene	205-883-8	191-24-2		1.7 mg/kg		1.513 mg/kg	0.000151 %	✓	
Total:								0.0295 %		

Key

- User supplied data
- Determinand values ignored for classification, see column 'Conc. Not Used' for reason
- Determinand defined or amended by HazWasteOnline (see Appendix A)
- Speciated Determinand - Unless the Determinand is Note 1, the Conversion Factor is used to calculate the compound concentration
- <LOD** Below limit of detection
- ND** Not detected
- CLP: Note 1 Only the metal concentration has been used for classification

Classification of sample: WS04

 **Non Hazardous Waste**
 Classified as **17 05 04**
 in the List of Waste

Sample details

Sample name:	LoW Code:
WS04	Chapter: 17: Construction and Demolition Wastes (including excavated soil from contaminated sites)
Sample Depth:	Entry: 17 05 04 (Soil and stones other than those mentioned in 17 05 03)
2.3 m	
Moisture content:	
18%	
(wet weight correction)	

Hazard properties

None identified

Determinands

Moisture content: 18% Wet Weight Moisture Correction applied (MC)

#	Determinand			CLP Note	User entered data	Conv. Factor	Compound conc.	Classification value	MC Applied	Conc. Not Used
	EU CLP index number	EC Number	CAS Number							
1	pH				7.4 pH		7.4 pH	7.4 pH		
2	arsenic { arsenic trioxide }				21 mg/kg	1.32	22.736 mg/kg	0.00227 %	✓	
	033-003-00-0	215-481-4	1327-53-3							
3	cadmium { cadmium sulfide }			1	<0.2 mg/kg	1.285	<0.257 mg/kg	<0.00002 %		<LOD
	048-010-00-4	215-147-8	1306-23-6							
4	chromium in chromium(VI) compounds { chromium(VI) oxide }				<1.2 mg/kg	1.923	<2.308 mg/kg	<0.000231 %		<LOD
	024-001-00-0	215-607-8	1333-82-0							
5	chromium in chromium(III) compounds { chromium(III) oxide (worst case) }				18 mg/kg	1.462	21.573 mg/kg	0.00216 %	✓	
		215-160-9	1308-38-9							
6	copper { dicopper oxide; copper (I) oxide }				47 mg/kg	1.126	43.392 mg/kg	0.00434 %	✓	
	029-002-00-X	215-270-7	1317-39-1							
7	lead { lead chromate }			1	94 mg/kg	1.56	120.231 mg/kg	0.00771 %	✓	
	082-004-00-2	231-846-0	7758-97-6							
8	mercury { mercury dichloride }				<0.3 mg/kg	1.353	<0.406 mg/kg	<0.0000406 %		<LOD
	080-010-00-X	231-299-8	7487-94-7							
9	nickel { nickel dihydroxide }				21 mg/kg	1.579	27.199 mg/kg	0.00272 %	✓	
	028-008-00-X	235-008-5 [1] 234-348-1 [2]	12054-48-7 [1] 11113-74-9 [2]							
10	selenium { selenium compounds with the exception of cadmium sulphoselenide and those specified elsewhere in this Annex }				<1 mg/kg	1.405	<1.405 mg/kg	<0.000141 %		<LOD
	034-002-00-8									
11	zinc { zinc chromate }				84 mg/kg	2.774	191.083 mg/kg	0.0191 %	✓	
	024-007-00-3	236-878-9	13530-65-9							
12	naphthalene				0.28 mg/kg		0.23 mg/kg	0.000023 %	✓	
	601-052-00-2	202-049-5	91-20-3							
13	acenaphthylene				<0.05 mg/kg		<0.05 mg/kg	<0.000005 %		<LOD
		205-917-1	208-96-8							
14	acenaphthene				1.2 mg/kg		0.984 mg/kg	0.0000984 %	✓	
		201-469-6	83-32-9							
15	fluorene				0.7 mg/kg		0.574 mg/kg	0.0000574 %	✓	
		201-695-5	86-73-7							



#	Determinand			CLP Note	User entered data	Conv. Factor	Compound conc.	Classification value	MC Applied	Conc. Not Used
	EU CLP index number	EC Number	CAS Number							
16	phenanthrene	201-581-5	85-01-8		5.2 mg/kg		4.264 mg/kg	0.000426 %	✓	
17	anthracene	204-371-1	120-12-7		0.98 mg/kg		0.804 mg/kg	0.0000804 %	✓	
18	fluoranthene	205-912-4	206-44-0		6 mg/kg		4.92 mg/kg	0.000492 %	✓	
19	pyrene	204-927-3	129-00-0		6 mg/kg		4.92 mg/kg	0.000492 %	✓	
20	benzo[a]anthracene	601-033-00-9	200-280-6		3.1 mg/kg		2.542 mg/kg	0.000254 %	✓	
21	chrysene	601-048-00-0	205-923-4		2.8 mg/kg		2.296 mg/kg	0.00023 %	✓	
22	benzo[b]fluoranthene	601-034-00-4	205-911-9		2.2 mg/kg		1.804 mg/kg	0.00018 %	✓	
23	benzo[k]fluoranthene	601-036-00-5	205-916-6		1.3 mg/kg		1.066 mg/kg	0.000107 %	✓	
24	benzo[a]pyrene; benzo[def]chrysene	601-032-00-3	200-028-5		2 mg/kg		1.64 mg/kg	0.000164 %	✓	
25	indeno[123-cd]pyrene	205-893-2	193-39-5		0.86 mg/kg		0.705 mg/kg	0.0000705 %	✓	
26	dibenz[a,h]anthracene	601-041-00-2	200-181-8		0.24 mg/kg		0.197 mg/kg	0.0000197 %	✓	
27	benzo[ghi]perylene	205-883-8	191-24-2		1.4 mg/kg		1.148 mg/kg	0.000115 %	✓	
Total:								0.0416 %		

Key

- User supplied data
- Determinand values ignored for classification, see column 'Conc. Not Used' for reason
- Determinand defined or amended by HazWasteOnline (see Appendix A)
- Speciated Determinand - Unless the Determinand is Note 1, the Conversion Factor is used to calculate the compound concentration
- <LOD** Below limit of detection
- ND** Not detected
- CLP: Note 1 Only the metal concentration has been used for classification

Appendix A: Classifier defined and non GB MCL determinands

■ pH (CAS Number: PH)

Description/Comments: Appendix C4
Data source: WM3 1st Edition 2015
Data source date: 25 May 2015
Hazard Statements: None.

■ chromium(III) oxide (worst case) (EC Number: 215-160-9, CAS Number: 1308-38-9)

Description/Comments: Data from C&L Inventory Database
Data source: <https://echa.europa.eu/information-on-chemicals/cl-inventory-database/-/discli/details/33806>
Data source date: 17 Jul 2015
Hazard Statements: Acute Tox. 4; H332 , Acute Tox. 4; H302 , Eye Irrit. 2; H319 , STOT SE 3; H335 , Skin Irrit. 2; H315 , Resp. Sens. 1; H334 , Skin Sens. 1; H317 , Repr. 1B; H360FD , Aquatic Acute 1; H400 , Aquatic Chronic 1; H410

■ acenaphthylene (EC Number: 205-917-1, CAS Number: 208-96-8)

Description/Comments: Data from C&L Inventory Database
Data source: <http://echa.europa.eu/web/guest/information-on-chemicals/cl-inventory-database>
Data source date: 17 Jul 2015
Hazard Statements: Acute Tox. 4; H302 , Acute Tox. 1; H330 , Acute Tox. 1; H310 , Eye Irrit. 2; H319 , STOT SE 3; H335 , Skin Irrit. 2; H315

■ acenaphthene (EC Number: 201-469-6, CAS Number: 83-32-9)

Description/Comments: Data from C&L Inventory Database
Data source: <http://echa.europa.eu/web/guest/information-on-chemicals/cl-inventory-database>
Data source date: 17 Jul 2015
Hazard Statements: Eye Irrit. 2; H319 , STOT SE 3; H335 , Skin Irrit. 2; H315 , Aquatic Acute 1; H400 , Aquatic Chronic 1; H410 , Aquatic Chronic 2; H411

■ fluorene (EC Number: 201-695-5, CAS Number: 86-73-7)

Description/Comments: Data from C&L Inventory Database
Data source: <http://echa.europa.eu/web/guest/information-on-chemicals/cl-inventory-database>
Data source date: 06 Aug 2015
Hazard Statements: Aquatic Acute 1; H400 , Aquatic Chronic 1; H410

■ phenanthrene (EC Number: 201-581-5, CAS Number: 85-01-8)

Description/Comments: Data from C&L Inventory Database
Data source: <http://echa.europa.eu/web/guest/information-on-chemicals/cl-inventory-database>
Data source date: 06 Aug 2015
Hazard Statements: Acute Tox. 4; H302 , Eye Irrit. 2; H319 , STOT SE 3; H335 , Carc. 2; H351 , Skin Sens. 1; H317 , Aquatic Acute 1; H400 , Aquatic Chronic 1; H410 , Skin Irrit. 2; H315

■ anthracene (EC Number: 204-371-1, CAS Number: 120-12-7)

Description/Comments: Data from C&L Inventory Database
Data source: <http://echa.europa.eu/web/guest/information-on-chemicals/cl-inventory-database>
Data source date: 17 Jul 2015
Hazard Statements: Eye Irrit. 2; H319 , STOT SE 3; H335 , Skin Irrit. 2; H315 , Skin Sens. 1; H317 , Aquatic Acute 1; H400 , Aquatic Chronic 1; H410

■ fluoranthene (EC Number: 205-912-4, CAS Number: 206-44-0)

Description/Comments: Data from C&L Inventory Database
Data source: <http://echa.europa.eu/web/guest/information-on-chemicals/cl-inventory-database>
Data source date: 21 Aug 2015
Hazard Statements: Acute Tox. 4; H302 , Aquatic Acute 1; H400 , Aquatic Chronic 1; H410

■ pyrene (EC Number: 204-927-3, CAS Number: 129-00-0)

Description/Comments: Data from C&L Inventory Database; SDS Sigma Aldrich 2014
Data source: <http://echa.europa.eu/web/guest/information-on-chemicals/cl-inventory-database>
Data source date: 21 Aug 2015
Hazard Statements: Skin Irrit. 2; H315 , Eye Irrit. 2; H319 , STOT SE 3; H335 , Aquatic Acute 1; H400 , Aquatic Chronic 1; H410

■ indeno[123-cd]pyrene (EC Number: 205-893-2, CAS Number: 193-39-5)

Description/Comments: Data from C&L Inventory Database
Data source: <http://echa.europa.eu/web/guest/information-on-chemicals/cl-inventory-database>
Data source date: 06 Aug 2015
Hazard Statements: Carc. 2; H351



▪ **benzo[ghi]perylene** (EC Number: 205-883-8, CAS Number: 191-24-2)

Description/Comments: Data from C&L Inventory Database; SDS Sigma Aldrich 28/02/2015
Data source: <http://echa.europa.eu/web/guest/information-on-chemicals/cl-inventory-database>
Data source date: 23 Jul 2015
Hazard Statements: Aquatic Acute 1; H400 , Aquatic Chronic 1; H410

Appendix B: Rationale for selection of metal species

arsenic {arsenic trioxide}

Worst case species based on hazard statements

cadmium {cadmium sulfide}

Worst case species based on hazard statements

chromium in chromium(VI) compounds {chromium(VI) oxide}

Worst case species based on hazard statements

chromium in chromium(III) compounds {chromium(III) oxide (worst case)}

Worst case species based on hazard statements

copper {dicopper oxide; copper (I) oxide}

Most likely common species

lead {lead chromate}

Worst case species based on hazard statements

mercury {mercury dichloride}

Worst case species based on hazard statements

nickel {nickel dihydroxide}

Worst case species based on hazard statements

selenium {selenium compounds with the exception of cadmium selenide and those specified elsewhere in this Annex}

Worst case species based on hazard statements

zinc {zinc chromate}

Worst case species based on hazard statements

Appendix C: Version

HazWasteOnline Classification Engine: **WM3 1st Edition v1.2.GB - Oct 2021**

HazWasteOnline Classification Engine Version: 2022.245.5317.9942 (02 Sep 2022)

HazWasteOnline Database: 2022.245.5317.9942 (02 Sep 2022)

This classification utilises the following guidance and legislation:

WM3 v1.2.GB - Waste Classification - 1st Edition v1.2.GB - Oct 2021

CLP Regulation - Regulation 1272/2008/EC of 16 December 2008

1st ATP - Regulation 790/2009/EC of 10 August 2009

2nd ATP - Regulation 286/2011/EC of 10 March 2011

3rd ATP - Regulation 618/2012/EU of 10 July 2012

4th ATP - Regulation 487/2013/EU of 8 May 2013

Correction to 1st ATP - Regulation 758/2013/EU of 7 August 2013

5th ATP - Regulation 944/2013/EU of 2 October 2013

6th ATP - Regulation 605/2014/EU of 5 June 2014

WFD Annex III replacement - Regulation 1357/2014/EU of 18 December 2014

Revised List of Waste 2014 - Decision 2014/955/EU of 18 December 2014

7th ATP - Regulation 2015/1221/EU of 24 July 2015

8th ATP - Regulation (EU) 2016/918 of 19 May 2016

9th ATP - Regulation (EU) 2016/1179 of 19 July 2016

10th ATP - Regulation (EU) 2017/776 of 4 May 2017

HP14 amendment - Regulation (EU) 2017/997 of 8 June 2017

13th ATP - Regulation (EU) 2018/1480 of 4 October 2018

14th ATP - Regulation (EU) 2020/217 of 4 October 2019

15th ATP - Regulation (EU) 2020/1182 of 19 May 2020

The Chemicals (Health and Safety) and Genetically Modified Organisms (Contained Use)(Amendment etc.) (EU Exit)

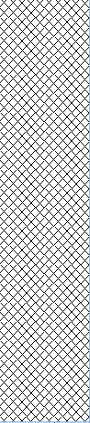
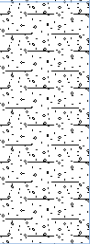
Regulations 2020 - UK: 2020 No. 1567 of 16th December 2020

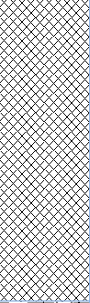
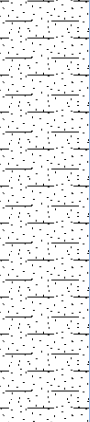
The Waste and Environmental Permitting etc. (Legislative Functions and Amendment etc.) (EU Exit) Regulations 2020 - UK: 2020 No. 1540 of 16th December 2020

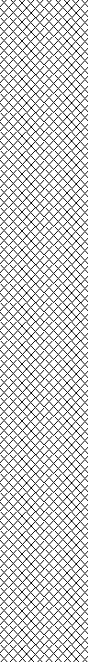
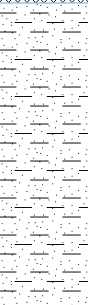
GB MCL List - version 1.1 of 09 June 2021

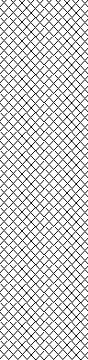
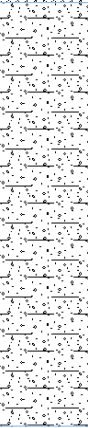
APPENDIX G

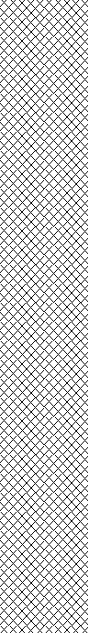
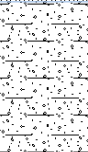
Exploratory Hole Logs

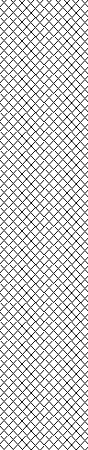
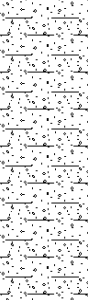
 BROWNFIELD SOLUTIONS LTD						Trial Pit Log		No. SA401 Sheet 1 of 1 Hole Type TP Scale 1:25 Logged AN Checked JM	
PROJECT NO: C4334B						CO-ORDS:			
PROJECT NAME: CASTLE IRWELL, SALFORD						LEVEL:			
CLIENT: DOMIS CONSTRUCTION						DATES: 18/08/22			
Water Strikes	Sample and In Situ Testing			Depth (m)	Level (m OD)	Legend	Stratum Description		
	Depth (m)	Type	Results						
	0.70	D ES					MADE GROUND: Dark brown slightly clayey gravelly fine to coarse sand. Gravel is sub-angular to sub-rounded fine to coarse of brick, mudstone, clinker and rare glass. Occasional cobbles of brick up to 0.24m in diameter.		1.0
				1.40			Reddish brown slightly clayey gravelly fine to coarse SAND. Gravel is sub-angular to sub-rounded fine to coarse of flint and mudstone.		
				1.70			Brown slightly clayey gravelly fine to coarse SAND with medium cobble content. Gravel is sub-angular to sub-rounded fine to coarse of flint, mudstone and sandstone. Cobbles are sub-angular of sandstone up to 0.22m in diameter.		2.0
				2.50			End of Trial Pit at 2.50m		
									3.0
									4.0
									5.0
Remarks		1. Service clearance using CAT and GENNY. 2. Mechanically dug to 2.50m bgl. 3. No groundwater encountered. 4. Sides stable during infiltration testing. 5. Excavation easy. 6. Hole was backfilled with arisings upon completion.						ES = Environmental Sample D = Disturbed Sample B = Bulk Sample LB = Large Bulk Sample U = Undisturbed Sample UT = Undisturbed Thin Wall Sample SPT = Standard Penetration Test PID = Photoionization Detector (ppm) PPM = Part Per Million HSV = Hand Shear Vane	

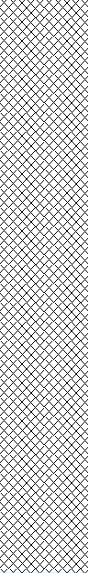
 BROWNFIELD SOLUTIONS LTD						Trial Pit Log		No. SA402 Sheet 1 of 1 Hole Type TP Scale 1:25 Logged AN Checked JM	
PROJECT NO: C4334B						CO-ORDS:			
PROJECT NAME: CASTLE IRWELL, SALFORD						LEVEL:			
CLIENT: DOMIS CONSTRUCTION						DATES: 18/08/22			
Water Strikes	Sample and In Situ Testing			Depth (m)	Level (m OD)	Legend	Stratum Description		
	Depth (m)	Type	Results						
				1.00			MADE GROUND: Dark brown gravelly slightly clayey fine to coarse sand. Gravel is sub-angular to sub-rounded fine to coarse of brick, mudstone, clinker and rare glass. Rare cobbles of brick up to 0.24m in diameter.	1.0	
	2.00	D ES		2.40			Light brown clayey fine to coarse SAND.	2.0	
							End of Trial Pit at 2.40m	3.0	
								4.0	
								5.0	
Remarks		1. Service clearance using CAT and GENNY. 2. Mechanically dug to 2.40m bgl. 3. No groundwater encountered. 4. Sides stable during infiltration testing. 5. Excavation easy. 6. Hole was backfilled with arisings upon completion.						ES = Environmental Sample D = Disturbed Sample B = Bulk Sample LB = Large Bulk Sample U = Undisturbed Sample UT = Undisturbed Thin Wall Sample SPT = Standard Penetration Test PID = Photoionization Detector (ppm) PPM = Part Per Million HSV = Hand Shear Vane	

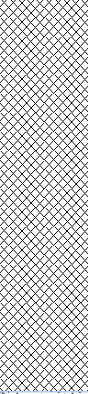
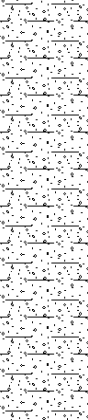
 BROWNFIELD SOLUTIONS LTD						Trial Pit Log		No.	
SA403									
Sheet 1 of 1									
PROJECT NO: C4334B						CO-ORDS:		Hole Type	
PROJECT NAME: CASTLE IRWELL, SALFORD						LEVEL:		TP	
CLIENT: DOMIS CONSTRUCTION						DATES: 18/08/22		Scale	
								1:25	
								Logged	
								AN	
								Checked	
								JM	
Water Strikes	Sample and In Situ Testing			Depth (m)	Level (m OD)	Legend	Stratum Description		
	Depth (m)	Type	Results						
	0.40	D ES					MADE GROUND: Dark brown slightly clayey gravelly fine to coarse sand. Gravel is sub-angular to sub-rounded fine to coarse of brick, mudstone, clinker and rare glass. Rare cobbles of brick up to 0.24m in diameter.	1.0	
				2.20			Firm brown sandy CLAY. Sand is fine to coarse.	2.0	
				3.20			End of Trial Pit at 3.20m	3.0	
								4.0	
								5.0	
Remarks		1. Service clearance using CAT and GENNY. 2. Mechanically dug to 3.20m bgl. 3. No groundwater encountered. 4. Sides stable during infiltration testing. 5. Excavation easy. 6. Hole was backfilled with arisings upon completion.						ES = Environmental Sample D = Disturbed Sample B = Bulk Sample LB = Large Bulk Sample U = Undisturbed Sample UT = Undisturbed Thin Wall Sample SPT = Standard Penetration Test PID = Photoionization Detector (ppm) PPM = Part Per Million HSV = Hand Shear Vane	

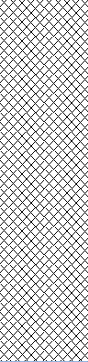
 BROWNFIELD SOLUTIONS LTD						Trial Pit Log		No. SA404 Sheet 1 of 1	
PROJECT NO: C4334B						CO-ORDS:		Hole Type TP	
PROJECT NAME: CASTLE IRWELL, SALFORD						LEVEL:		Scale 1:25	
CLIENT: DOMIS CONSTRUCTION						DATES: 19/08/22		Logged AN	Checked JM
Water Strikes	Sample and In Situ Testing			Depth (m)	Level (m OD)	Legend	Stratum Description		
	Depth (m)	Type	Results						
				1.20			MADE GROUND: Dark brown gravelly slightly clayey fine to coarse sand. Gravel is sub-angular to sub-rounded fine to coarse of brick, mudstone, clinker, asphalt, rare glass and occasional rootlets. Occasional cobbles of brick up to 0.24m in diameter.	1.0	
				2.60			Red slightly gravelly clayey fine to coarse SAND. Gravel is sub-angular to sub-rounded fine to coarse of mudstone and sandstone.	2.0	
							End of Trial Pit at 2.60m	3.0	
								4.0	
								5.0	
Remarks		1. Service clearance using CAT and GENNY. 2. Mechanically dug to 2.60m bgl. 3. No groundwater encountered. 4. Sides stable during excavation. 5. Old water pipe encountered at 2.40m bgl. 6. Excavation easy. 7. Hole was backfilled with arisings upon completion.						ES = Environmental Sample D = Disturbed Sample B = Bulk Sample LB = Large Bulk Sample U = Undisturbed Sample UT = Undisturbed Thin Wall Sample SPT = Standard Penetration Test PID = Photoionization Detector (ppm) PPM = Part Per Million HSV = Hand Shear Vane	

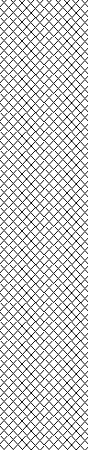
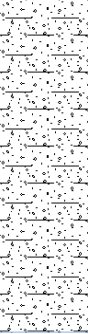
 BROWNFIELD SOLUTIONS LTD						Trial Pit Log		No. SA404A Sheet 1 of 1 Hole Type TP Scale 1:25 Logged AN Checked JM	
PROJECT NO: C4334B						CO-ORDS:			
PROJECT NAME: CASTLE IRWELL, SALFORD						LEVEL:			
CLIENT: DOMIS CONSTRUCTION						DATES: 19/08/22			
Water Strikes	Sample and In Situ Testing			Depth (m)	Level (m OD)	Legend	Stratum Description		
	Depth (m)	Type	Results						
				2.10			MADE GROUND: Dark brown slightly clayey gravelly fine to coarse sand. Gravel is sub-angular to sub-rounded fine to coarse of brick, mudstone, clinker, asphalt, rare glass and occasional rootlets. Occasional cobbles of brick up to 0.24m in diameter.	1.0	
				2.60			Reddish brown slightly gravelly clayey fine to coarse SAND. Gravel is sub-angular to sub-rounded fine to coarse of flint and mudstone.	2.0	
							End of Trial Pit at 2.60m	3.0	
								4.0	
								5.0	
Remarks		1. Service clearance using CAT and GENNY. 2. Mechanically dug to 2.60m bgl. 3. No groundwater encountered. 4. Brick footing encountered from 1.30m bgl. 5. Sides stable during excavation. 6. Excavation easy. 7. Hole was backfilled with arisings upon completion.						ES = Environmental Sample D = Disturbed Sample B = Bulk Sample LB = Large Bulk Sample U = Undisturbed Sample UT = Undisturbed Thin Wall Sample SPT = Standard Penetration Test PID = Photoionization Detector (ppm) PPM = Part Per Million HSV = Hand Shear Vane	

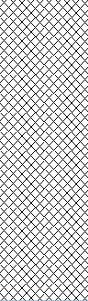
 BROWNFIELD SOLUTIONS LTD						Trial Pit Log		No. SA405 Sheet 1 of 1	
PROJECT NO: C4334B						CO-ORDS:		Hole Type TP	
PROJECT NAME: CASTLE IRWELL, SALFORD						LEVEL:		Scale 1:25	
CLIENT: DOMIS CONSTRUCTION						DATES: 19/08/22		Logged AN	Checked JM
Water Strikes	Sample and In Situ Testing			Depth (m)	Level (m OD)	Legend	Stratum Description		
	Depth (m)	Type	Results						
							MADE GROUND: Dark brown slightly clayey gravelly fine to coarse sand. Gravel is sub-angular to sub-rounded fine to coarse of brick, mudstone, clinker, asphalt, rare glass and occasional rootlets. Occasional cobbles of brick up to 0.24m in diameter.	1.0	
	2.00	D ES		1.50			Brown slightly gravelly clayey fine to coarse SAND with medium cobble content. Gravel is sub-angular to sub-rounded fine to coarse of mudstone and sandstone. Cobbles are sub-angular of sandstone up to 0.18m in diameter.	2.0	
				2.50			End of Trial Pit at 2.50m	3.0	
								4.0	
								5.0	
Remarks		1. Service clearance using CAT and GENNY. 2. Mechanically dug to 2.50m bgl. 3. No groundwater encountered. 4. Sides stable during infiltration testing. 5. Excavation easy to moderate. 6. Hole was backfilled with arisings upon completion.						ES = Environmental Sample D = Disturbed Sample B = Bulk Sample LB = Large Bulk Sample U = Undisturbed Sample UT = Undisturbed Thin Wall Sample SPT = Standard Penetration Test PID = Photoionization Detector (ppm) PPM = Part Per Million HSV = Hand Shear Vane	

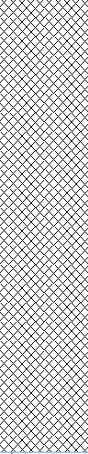
 BROWNFIELD SOLUTIONS LTD						Trial Pit Log		No. SA406 Sheet 1 of 1 Hole Type TP Scale 1:25 Logged AN Checked JM	
PROJECT NO: C4334B						CO-ORDS:			
PROJECT NAME: CASTLE IRWELL, SALFORD						LEVEL:			
CLIENT: DOMIS CONSTRUCTION						DATES: 19/08/22			
Water Strikes	Sample and In Situ Testing			Depth (m)	Level (m OD)	Legend	Stratum Description		
	Depth (m)	Type	Results						
				1.90			MADE GROUND: Dark brown slightly clayey gravelly fine to coarse sand. Gravel is sub-angular to sub-rounded fine to coarse of brick, mudstone, clinker, asphalt, concrete, rare glass, and occasional rootlets. Occasional cobbles of brick up to 0.24m in diameter.	1.0	
							End of Trial Pit at 1.90m	2.0	
								3.0	
								4.0	
								5.0	
Remarks		1. Service clearance using CAT and GENNY. 2. Mechanically dug to 1.90m bgl. 3. No groundwater encountered. 4. Brick footing encountered from 1.80m bgl. 5. Excavation easy to moderate. 6. Hole was backfilled with arisings upon completion.						ES = Environmental Sample D = Disturbed Sample B = Bulk Sample LB = Large Bulk Sample U = Undisturbed Sample UT = Undisturbed Thin Wall Sample SPT = Standard Penetration Test PID = Photoionization Detector (ppm) PPM = Part Per Million HSV = Hand Shear Vane	

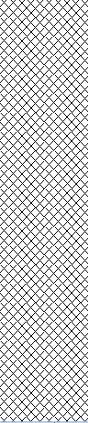
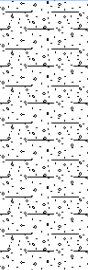
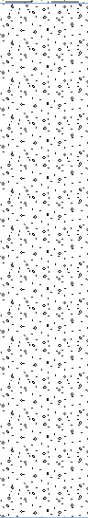
 BROWNFIELD SOLUTIONS LTD						Trial Pit Log		No. SA407 Sheet 1 of 1 Hole Type TP Scale 1:25 Logged AN Checked JM	
PROJECT NO: C4334B						CO-ORDS:			
PROJECT NAME: CASTLE IRWELL, SALFORD						LEVEL:			
CLIENT: DOMIS CONSTRUCTION						DATES: 19/08/22			
Water Strikes	Sample and In Situ Testing			Depth (m)	Level (m OD)	Legend	Stratum Description		
	Depth (m)	Type	Results						
	0.50	D ES					MADE GROUND: Dark brown slightly clayey gravelly fine to coarse sand. Gravel is sub-angular to sub-rounded fine to coarse of brick, mudstone, clinker, asphalt, concrete, rare glass, and occasional rootlets. Occasional cobbles of brick up to 0.24m in diameter.	1.0	
				1.30			Brown slightly gravelly clayey fine to coarse SAND. Gravel is sub-angular to sub-rounded fine to coarse of sandstone and mudstone.	2.0	
				2.70			End of Trial Pit at 2.70m	3.0	
								4.0	
								5.0	
Remarks		1. Service clearance using CAT and GENNY. 2. Mechanically dug to 2.70m bgl. 3. No groundwater encountered. 4. Sides stable during infiltration testing. 5. Excavation easy to moderate. 6. Hole was backfilled with arisings upon completion.						ES = Environmental Sample D = Disturbed Sample B = Bulk Sample LB = Large Bulk Sample U = Undisturbed Sample UT = Undisturbed Thin Wall Sample SPT = Standard Penetration Test PID = Photoionization Detector (ppm) PPM = Part Per Million HSV = Hand Shear Vane	

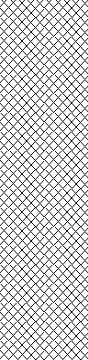
 BROWNFIELD SOLUTIONS LTD						Trial Pit Log		No. SA408 Sheet 1 of 1	
PROJECT NO: C4334B						CO-ORDS:		Hole Type TP	
PROJECT NAME: CASTLE IRWELL, SALFORD						LEVEL:		Scale 1:25	
CLIENT: DOMIS CONSTRUCTION						DATES: 19/08/22		Logged AN	Checked JM
Water Strikes	Sample and In Situ Testing			Depth (m)	Level (m OD)	Legend	Stratum Description		
	Depth (m)	Type	Results						
				1.20			MADE GROUND: Dark brown slightly clayey gravelly fine to coarse sand. Gravel is sub-angular to sub-rounded fine to coarse of brick, mudstone, clinker, asphalt, concrete, rare glass, and occasional rootlets. Occasional cobbles of brick up to 0.24m in diameter.		1.0
							End of Trial Pit at 1.20m		2.0
									3.0
									4.0
									5.0
Remarks		1. Service clearance using CAT and GENNY. 2. Mechanically dug to 1.20m bgl. 3. No groundwater encountered. 4. Concrete slabs encountered at 1.20m bgl. 5. Sides stable during excavation. 6. Excavation easy to moderate. 7. Hole was backfilled with arisings upon completion.						ES = Environmental Sample D = Disturbed Sample B = Bulk Sample LB = Large Bulk Sample U = Undisturbed Sample UT = Undisturbed Thin Wall Sample SPT = Standard Penetration Test PID = Photoionization Detector (ppm) PPM = Part Per Million HSV = Hand Shear Vane	

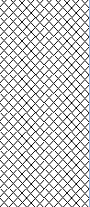
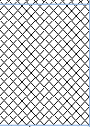
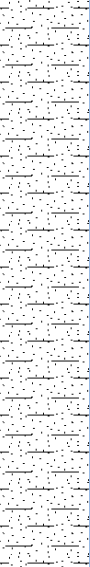
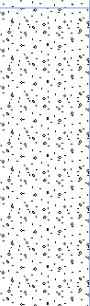
 BROWNFIELD SOLUTIONS LTD						Trial Pit Log		No. SA409 Sheet 1 of 1 Hole Type TP Scale 1:25 Logged AN Checked JM	
PROJECT NO: C4334B						CO-ORDS:			
PROJECT NAME: CASTLE IRWELL, SALFORD						LEVEL:			
CLIENT: DOMIS CONSTRUCTION						DATES: 19/08/22			
Water Strikes	Sample and In Situ Testing			Depth (m)	Level (m OD)	Legend	Stratum Description		
	Depth (m)	Type	Results						
							MADE GROUND: Dark brown slightly clayey gravelly fine to coarse sand. Gravel is sub-angular to sub-rounded fine to coarse of brick, mudstone, clinker, asphalt, concrete, rare glass, and occasional rootlets. Occasional cobbles of brick up to 0.24m in diameter.		1.0
	2.20	D ES					Reddish brown slightly clayey gravelly fine to coarse SAND with low cobble content. Gravel is sub-angular to sub-rounded fine to coarse of sandstone and mudstone. Cobbles are sub-angular of sandstone up to 0.20m in diameter.		2.0
				2.60			End of Trial Pit at 2.60m		3.0
									4.0
									5.0
Remarks		1. Service clearance using CAT and GENNY. 2. Mechanically dug to 2.60m bgl. 3. No groundwater encountered. 4. Sides stable during infiltration testing. 5. Excavation easy to moderate. 6. Hole was backfilled with arisings upon completion.						ES = Environmental Sample D = Disturbed Sample B = Bulk Sample LB = Large Bulk Sample U = Undisturbed Sample UT = Undisturbed Thin Wall Sample SPT = Standard Penetration Test PID = Photoionization Detector (ppm) PPM = Part Per Million HSV = Hand Shear Vane	

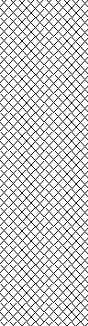
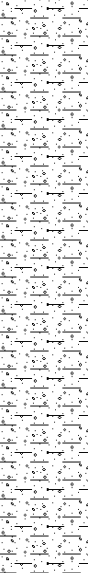
 BROWNFIELD SOLUTIONS LTD						Trial Pit Log		No. TP401 Sheet 1 of 1	
PROJECT NO: C4334B						CO-ORDS:		Hole Type TP	
PROJECT NAME: CASTLE IRWELL, SALFORD						LEVEL:		Scale 1:25	
CLIENT: DOMIS CONSTRUCTION						DATES: 18/08/22		Logged AN	Checked JM
Water Strikes	Sample and In Situ Testing			Depth (m)	Level (m OD)	Legend	Stratum Description		
	Depth (m)	Type	Results						
				1.00			MADE GROUND: Dark brown gravelly slightly clayey fine to coarse sand. Gravel is sub-angular to sub-rounded fine to coarse of brick, mudstone, clinker, asphalt, concrete, rare glass, and occasional rootlets. Occasional cobbles of brick up to 0.24m in diameter.		1.0
	1.50	D ES					Yellowish brown fine to coarse SAND.		2.0
				3.00			Yellowish brown gravelly fine to coarse SAND. Gravel is sub-rounded to rounded fine to coarse of sandstone.		3.0
				4.10			End of Trial Pit at 4.10m		4.0
									5.0
Remarks		1. Service clearance using CAT and GENNY. 2. Mechanically dug to 4.10m bgl. 3. No groundwater encountered. 4. Sides stable during excavation. 5. Excavation easy. 6. Hole was backfilled with arisings upon completion.						ES = Environmental Sample D = Disturbed Sample B = Bulk Sample LB = Large Bulk Sample U = Undisturbed Sample UT = Undisturbed Thin Wall Sample SPT = Standard Penetration Test PID = Photoionization Detector (ppm) PPM = Part Per Million HSV = Hand Shear Vane	

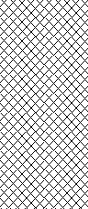
 BROWNFIELD SOLUTIONS LTD						Trial Pit Log		No. TP402 Sheet 1 of 1	
PROJECT NO: C4334B						CO-ORDS:		Hole Type TP	
PROJECT NAME: CASTLE IRWELL, SALFORD						LEVEL:		Scale 1:25	
CLIENT: DOMIS CONSTRUCTION						DATES: 18/08/22		Logged AN	Checked JM
Water Strikes	Sample and In Situ Testing			Depth (m)	Level (m OD)	Legend	Stratum Description		
	Depth (m)	Type	Results						
	0.50	D ES					MADE GROUND: Dark brown slightly clayey gravelly fine to coarse sand. Gravel is sub-angular to sub-rounded fine to coarse of brick, mudstone, clinker, asphalt, concrete, rare glass, and occasional rootlets. Occasional cobbles of brick up to 0.24m in diameter.	1.0	
				1.50			Brown fine to coarse SAND.		
				2.00			Brown gravelly fine to coarse SAND with low cobble content. Gravel is sub-rounded to rounded fine to coarse of sandstone. Cobbles are sub-angular of sandstone up to 0.18m in diameter.	2.0	
				3.20			End of Trial Pit at 3.20m	3.0	
								4.0	
								5.0	
Remarks		1. Service clearance using CAT and GENNY. 2. Mechanically dug to 3.20m bgl. 3. No groundwater encountered. 4. Sides collapsing from 3.20m bgl. 5. Excavation easy. 6. Hole was backfilled with arisings upon completion.						ES = Environmental Sample D = Disturbed Sample B = Bulk Sample LB = Large Bulk Sample U = Undisturbed Sample UT = Undisturbed Thin Wall Sample SPT = Standard Penetration Test PID = Photoionization Detector (ppm) PPM = Part Per Million HSV = Hand Shear Vane	

BROWNFIELD SOLUTIONS LTD						Trial Pit Log		No.
PROJECT NO: C4334B						CO-ORDS:		TP403
PROJECT NAME: CASTLE IRWELL, SALFORD						LEVEL:		Sheet 1 of 1
CLIENT: DOMIS CONSTRUCTION						DATES: 18/08/22		Hole Type
								TP
								Scale
								1:25
						Logged	Checked	
						AN	JM	
Water Strikes	Sample and In Situ Testing			Depth (m)	Level (m OD)	Legend	Stratum Description	
	Depth (m)	Type	Results					
				1.40			MADE GROUND: Dark brown slightly clayey gravelly fine to coarse sand. Gravel is sub-angular to sub-rounded fine to coarse of brick, mudstone, sandstone and flint. Occasional cobbles of brick up to 0.24m in diameter.	1.0
				2.30			Brown slightly gravelly clayey fine to coarse SAND. Gravel is sub-angular to sub-rounded fine to coarse of sandstone.	2.0
	2.50	D ES					Yellowish slightly gravelly fine to coarse SAND. Gravel is sub-rounded to rounded fine to coarse of sandstone.	3.0
				4.00			End of Trial Pit at 4.00m	4.0
								5.0
Remarks		1. Service clearance using CAT and GENNY. 2. Mechanically dug to 4.00m bgl. 3. No groundwater encountered. 4. Sides stable during excavation. 5. Excavation easy. 6. Hole was backfilled with arisings upon completion.					ES = Environmental Sample D = Disturbed Sample B = Bulk Sample LB = Large Bulk Sample U = Undisturbed Sample UT = Undisturbed Thin Wall Sample SPT = Standard Penetration Test PID = Photoionization Detector (ppm) PPM = Part Per Million HSV = Hand Shear Vane	

 BROWNFIELD SOLUTIONS LTD						Trial Pit Log		No. TP404 Sheet 1 of 1	
PROJECT NO: C4334B						CO-ORDS:		Hole Type TP	
PROJECT NAME: CASTLE IRWELL, SALFORD						LEVEL:		Scale 1:25	
CLIENT: DOMIS CONSTRUCTION						DATES: 18/08/22		Logged AN	Checked JM
Water Strikes	Sample and In Situ Testing			Depth (m)	Level (m OD)	Legend	Stratum Description		
	Depth (m)	Type	Results						
	0.50	D ES					MADE GROUND: Dark brown slightly clayey gravelly fine to coarse sand. Gravel is sub-angular to sub-rounded fine to coarse of brick, mudstone, sandstone and flint. Occasional cobbles of brick up to 0.24m in diameter.		
				1.20			Gravelly fine to coarse SAND. Gravel is sub-angular to sub-rounded fine to coarse of mudstone and sandstone.	1.0	
				1.80			End of Trial Pit at 1.80m	2.0	
								3.0	
								4.0	
								5.0	
Remarks		1. Service clearance using CAT and GENNY. 2. Mechanically dug to 1.80m bgl. 3. No groundwater encountered. 4. Sides stable during excavation. 5. Excavation easy. 6. Hole was backfilled with arisings upon completion.						ES = Environmental Sample D = Disturbed Sample B = Bulk Sample LB = Large Bulk Sample U = Undisturbed Sample UT = Undisturbed Thin Wall Sample SPT = Standard Penetration Test PID = Photoionization Detector (ppm) PPM = Part Per Million HSV = Hand Shear Vane	

 BROWNFIELD SOLUTIONS LTD						Trial Pit Log		No. TP405 Sheet 1 of 1	
PROJECT NO: C4334B						CO-ORDS:		Hole Type TP	
PROJECT NAME: CASTLE IRWELL, SALFORD						LEVEL:		Scale 1:25	
CLIENT: DOMIS CONSTRUCTION						DATES: 18/08/22		Logged AN	Checked JM
Water Strikes	Sample and In Situ Testing			Depth (m)	Level (m OD)	Legend	Stratum Description		
	Depth (m)	Type	Results						
				0.70			MADE GROUND: Brown slightly clayey gravelly fine to coarse sand. Gravel is sub-angular to sub-rounded fine to coarse of brick, concrete, mudstone and chert. Rare cobbles of brick up to 0.24m in diameter.		
				1.10			MADE GROUND: Dark brown slightly clayey gravelly fine to coarse sand. Gravel is angular to sub-rounded of concrete, flint, brick and concrete. Occasional cobbles of concrete up to 0.21m in diameter.	1.0	
				3.00			Brown clayey fine to coarse SAND. Gravel is sub-angular to sub-rounded fine to coarse of mudstone and sandstone.	2.0	
	3.50	D ES		4.00			Brown slightly gravelly fine to coarse SAND. Gravel is sub-rounded to rounded fine to coarse of sandstone.	3.0	
							End of Trial Pit at 4.00m	4.0	
								5.0	
Remarks		1. Service clearance using CAT and GENNY. 2. Mechanically dug to 4.00m bgl. 3. No groundwater encountered. 4. Sides stable during excavation. 5. Excavation easy. 6. Hole was backfilled with arisings upon completion.						ES = Environmental Sample D = Disturbed Sample B = Bulk Sample LB = Large Bulk Sample U = Undisturbed Sample UT = Undisturbed Thin Wall Sample SPT = Standard Penetration Test PID = Photoionization Detector (ppm) PPM = Part Per Million HSV = Hand Shear Vane	

 BROWNFIELD SOLUTIONS LTD						Trial Pit Log		No. TP406 Sheet 1 of 1	
PROJECT NO: C4334B						CO-ORDS:		Hole Type TP	
PROJECT NAME: CASTLE IRWELL, SALFORD						LEVEL:		Scale 1:25	
CLIENT: DOMIS CONSTRUCTION						DATES: 18/08/22		Logged AN	Checked JM
Water Strikes	Sample and In Situ Testing			Depth (m)	Level (m OD)	Legend	Stratum Description		
	Depth (m)	Type	Results						
				1.10			MADE GROUND: Dark brown slightly clayey gravelly fine to coarse sand. Gravel is angular to sub-rounded fine to coarse of brick, mudstone, sandstone and flint. Occasional cobbles of brick up to 0.24m in diameter.	1.0	
				1.50			MADE GROUND: Black and red gravellyfine to coarse sand. Gravel is sub-angular to sub-rounded fine to coarse of charcoal, flint, brick and asphalt.		
	2.00	D ES HSV	38kPa				Soft red slightly sandy gravelly CLAY. Sand is fine to coarse. Gravel is sub-angular to sub-rounded fine to coarse of mudstone and sandstone.	2.0	
				3.40			End of Trial Pit at 3.40m	3.0	
								4.0	
								5.0	
Remarks		1. Service clearance using CAT and GENNY. 2. Mechanically dug to 3.40m bgl. 3. No groundwater encountered. 4. Sides stable during excavation. 5. Excavation moderate. 6. Hole was backfilled with arisings upon completion.						ES = Environmental Sample D = Disturbed Sample B = Bulk Sample LB = Large Bulk Sample U = Undisturbed Sample UT = Undisturbed Thin Wall Sample SPT = Standard Penetration Test PID = Photoionization Detector (ppm) PPM = Part Per Million HSV = Hand Shear Vane	

 BROWNFIELD SOLUTIONS LTD						Trial Pit Log		No. TP407 Sheet 1 of 1	
PROJECT NO: C4334B						CO-ORDS:		Hole Type TP	
PROJECT NAME: CASTLE IRWELL, SALFORD						LEVEL:		Scale 1:25	
CLIENT: DOMIS CONSTRUCTION						DATES: 18/08/22		Logged AN	Checked JM
Water Strikes	Sample and In Situ Testing			Depth (m)	Level (m OD)	Legend	Stratum Description		
	Depth (m)	Type	Results						
				0.70			MADE GROUND: Dark brown slightly clayey gravelly fine to coarse sand. Gravel is angular to sub-rounded fine to coarse of brick, mudstone, sandstone and flint. Occasional cobbles of brick up to 0.24m in diameter.		
							End of Trial Pit at 0.70m		1.0
									2.0
									3.0
									4.0
									5.0
Remarks		1. Service clearance using CAT and GENNY. 2. Mechanically dug to 0.70m bgl. 3. No groundwater encountered. 4. Concrete slabs encountered at 0.70m bgl. 5. Excavation hard. 6. Sides stable during excavation. 7. Hole was backfilled with arisings upon completion.						ES = Environmental Sample D = Disturbed Sample B = Bulk Sample LB = Large Bulk Sample U = Undisturbed Sample UT = Undisturbed Thin Wall Sample SPT = Standard Penetration Test PID = Photoionization Detector (ppm) PPM = Part Per Million HSV = Hand Shear Vane	



No.

TP407A

Sheet 1 of 1

CO-ORDS:

Hole Type

LEVEL:

Hole Type

TP

Scale

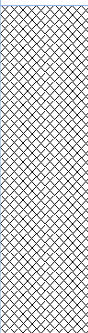
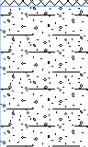
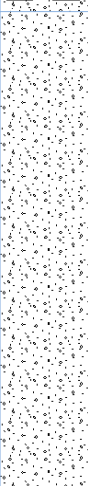
DATES: 18/08/22

Logged

Checked

AN

JM

Water Strikes	Sample and In Situ Testing			Depth (m)	Level (m OD)	Legend	Stratum Description	
	Depth (m)	Type	Results					
	0.30	DES		1.10			MADE GROUND: Dark brown slightly clayey gravelly fine to coarse sand. Gravel is angular to sub-rounded fine to coarse of brick, mudstone, sandstone, plastic pipes, and flint. Occasional cobbles of brick up to 0.24m in diameter.	1.0
							Brown slightly gravelly clayey fine to coarse SAND. Gravel is angular to sub-rounded fine to coarse of flint, mudstone and sandstone.	
							Orangeish brown gravelly fine to coarse SAND with medium cobble content. Gravel is sub-rounded to rounded fine to coarse of sandstone. Cobbles are sub-angular of sandstone up to 0.21m in diameter.	2.0
							3.20	
								4.0
								5.0

1. Service clearance using CAT and GENNY.
2. Mechanically dug to 3.20m bgl.
3. No groundwater encountered.
4. Sides starting to collapse at 1.60m bgl during excavation.
5. Excavation easy.
6. Hole was backfilled with arisings upon completion.

ES = Environmental Sample
D = Disturbed Sample
B = Bulk Sample
LB = Large Bulk Sample
U = Undisturbed Sample
UT = Undisturbed Thin Wall Sample
SPT = Standard Penetration Test
PID = Photoionization Detector (ppm)
PPM = Part Per Million
HSV = Hand Shear Vane



No.

TP408

Sheet 1 of 1

PROJECT NO: C4334B

CO-ORDS:

Hole Type

Hole Type

PROJECT NAME: CASTLE IRWELL, SALFORD

LEVEL:

Scale

1:25

CLIENT: DOMIS CONSTRUCTION

DATES:

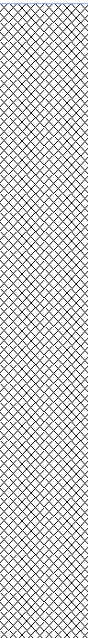
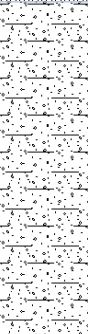
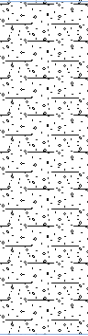
19/08/22

Logged

Checked

AN

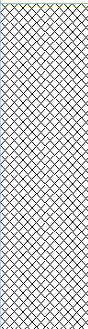
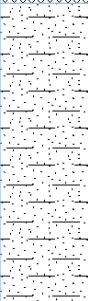
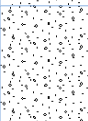
JM

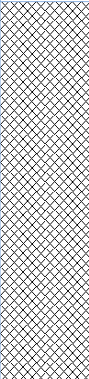
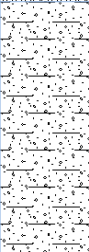
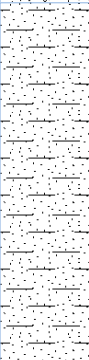
Water Strikes	Sample and In Situ Testing			Depth (m)	Level (m OD)	Legend	Stratum Description	
	Depth (m)	Type	Results					
	0.30	D ES		2.10			MADE GROUND: Dark brown slightly clayey gravelly fine to coarse sand. Gravel is angular to sub-rounded fine to coarse of brick, mudstone, sandstone, and flint. Occasional cobbles of brick up to 0.24m in diameter.	1.0
							Brown slightly gravelly clayey fine to coarse SAND with low cobble content. Gravel is sub-angular to sub-rounded fine to coarse of mudstone and sandstone. Cobbles are sub-angular of mudstone up to 0.16m in diameter.	3.0
							Reddish brown slightly gravelly clayey fine to coarse SAND. Gravel is sub-angular to rounded fine to coarse of sandstone and mudstone.	4.0
	4.00	D		4.30			End of Trial Pit at 4.30m	5.0

1. Service clearance using CAT and GENNY.
2. Mechanically dug to 4.30m bgl.
3. No groundwater encountered.
4. Sides stable during excavation.
5. Excavation easy.
6. Hole was backfilled with arisings upon completion.

ES = Environmental Sample
D = Disturbed Sample
B = Bulk Sample
LB = Large Bulk Sample
U = Undisturbed Sample
UT = Undisturbed Thin Wall Sample
SPT = Standard Penetration Test
PID = Photoionization Detector (ppm)
PPM = Part Per Million
HSV = Hand Shear Vane

 BROWNFIELD SOLUTIONS LTD						Trial Pit Log		No. TP409 Sheet 1 of 1 Hole Type TP Scale 1:25 Logged AN Checked JM	
PROJECT NO: C4334B						CO-ORDS:			
PROJECT NAME: CASTLE IRWELL, SALFORD						LEVEL:			
CLIENT: DOMIS CONSTRUCTION						DATES: 18/08/22			
Water Strikes	Sample and In Situ Testing			Depth (m)	Level (m OD)	Legend	Stratum Description		0.0 0.5 1.0 1.5 2.0 2.5 3.0 3.5 4.0 4.5 5.0
	Depth (m)	Type	Results						
	0.70	D ES					MADE GROUND: Dark brown slightly clayey gravelly fine to coarse sand. Gravel is angular to sub-rounded fine to coarse of brick, mudstone, sandstone, and flint. Occasional cobbles of brick up to 0.24m in diameter.		
							MADE GROUND: Asphalt.		
							Reddish brown slightly clayey gravelly fine to coarse sand. Gravel is sub-angular to sub-rounded fine to coarse of mudstone.		
	2.20	D		2.10		Soft brown sandy CLAY. Sand is fine to coarse.			
	3.00	HSV	28kPa	3.30		End of Trial Pit at 3.30m			
Remarks		1. Service clearance using CAT and GENNY. 2. Mechanically dug to 3.30m bgl. 3. No groundwater encountered. 4. Sides stable during excavation. 5. Excavation easy to moderate. 6. Hole was backfilled with arisings upon completion.						ES = Environmental Sample D = Disturbed Sample B = Bulk Sample LB = Large Bulk Sample U = Undisturbed Sample UT = Undisturbed Thin Wall Sample SPT = Standard Penetration Test PID = Photoionization Detector (ppm) PPM = Part Per Million HSV = Hand Shear Vane	

 BROWNFIELD SOLUTIONS LTD							Borehole Log		Window Sampler No.	
									WS401	
									Sheet 1 of 1	
PROJECT NO: C4334B							CO-ORDS:		Hole Type	
									WS	
PROJECT NAME: CASTLE IRWELL, SALFORD							LEVEL:		Scale	
									1:30	
CLIENT: DOMIS CONSTRUCTION							DATES: 17/08/22		Logged	Checked
									AN	JM
Well	Water Strikes	Sample and In Situ Testing			Depth (m)	Level (m OD)	Legend	Stratum Description		
		Depth (m)	Type	Results						
		0.50	D ES					MADE GROUND: Dark brown slightly gravelly sandy clay. Sand is fine to coarse. Gravel is sub-angular to sub-rounded fine to coarse of brick, chert, mudstone and rare glass. Occasional cobbles of brick up to 0.24m in diameter.	1.0	
		1.20	SPT	N=24 (10,12/6,7,6,5)	1.30					Loose brown clayey fine to coarse SAND.
		2.00	SPT	N=8 (1,1/1,2,2,3)					Dense light brown gravelly fine to coarse SAND. Gravel is sub-angular to sub-rounded fine to coarse of mudstone and sandstone. <i>Becoming very dense from 2.70m bgl.</i>	2.0
		2.70	D SPT	N≥50 (12,12/50 for 265mm)	2.50				End of Borehole at 2.96m	
					2.96				4.0	
									5.0	
									6.0	
Remarks		1. Service clearance using CAT and GENNY. 2. Handpitting to 1.20m bgl. 3. No groundwater encountered. 4. Refusal at 2.96m bgl. 5. Installation of 1.96m plain and 1.00m slotted PVC.							ES = Environmental Sample D = Disturbed Sample B = Bulk Sample LB = Large Bulk Sample U = Undisturbed Sample UT = Undisturbed Thin Wall Sample SPT = Standard Penetration Test PID = Photoionization Detector (ppm) PPM = Part Per Million HSV = Hand Shear Vane	

 BROWNFIELD SOLUTIONS LTD							Borehole Log		Window Sampler No.
									WS402
									Sheet 1 of 1
PROJECT NO: C4334B							CO-ORDS:		Hole Type
									WS
PROJECT NAME: CASTLE IRWELL, SALFORD							LEVEL:		Scale
									1:30
CLIENT: DOMIS CONSTRUCTION							DATES: 17/08/22		Logged
									AN
									Checked
									JM
Well	Water Strikes	Sample and In Situ Testing			Depth (m)	Level (m OD)	Legend	Stratum Description	
		Depth (m)	Type	Results					
		1.20	SPT	N=7 (7,5/2,1,2,2)	1.50			MADE GROUND: Dark brown gravelly slightly clayey fine to coarse sand. Gravel is sub-angular to sub-rounded fine to coarse of brick, chert, mudstone and rare glass.	1.0
		2.00	D ES SPT	N=5 (1,1/1,1,1,2)	2.50			Loose dark brown slightly clayey gravelly fine to coarse SAND. Gravel is sub-angular to sub-rounded fine to medium of mudstone and sandstone. <i>Pockets of clay encountered from 2.00m to 2.20m bgl.</i>	2.0
		3.00	SPT	N=10 (2,2/2,2,3,3)					Medium dense brown clayey fine to coarse SAND. <i>Becoming gravelly from 3.50m bgl.</i>
		4.00	SPT	N≥50 (2,2/50 for 190mm)	4.19				<i>Becoming very dense from 4.00m bgl.</i>
								End of Borehole at 4.19m	5.0
									6.0
Remarks		1. Service clearance using CAT and GENNY. 2. Handpitting to 1.20m bgl. 3. Refusal at 4.19m bgl. 4. Hole was backfilled with arisings upon completion.							ES = Environmental Sample D = Disturbed Sample B = Bulk Sample LB = Large Bulk Sample U = Undisturbed Sample UT = Undisturbed Thin Wall Sample SPT = Standard Penetration Test PID = Photoionization Detector (ppm) PPM = Part Per Million HSV = Hand Shear Vane



Window Sampler No.

WS403

Sheet 1 of 1

CO-ORDS:

LEVEL:

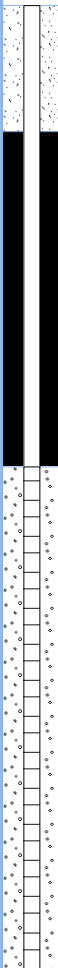
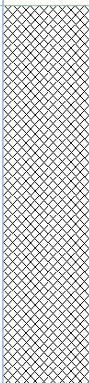
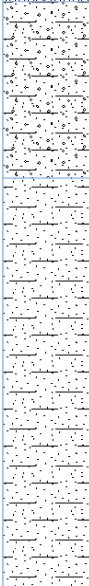
DATES: 17/08/22

Logged

Checked

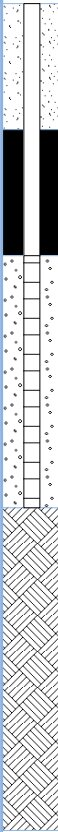
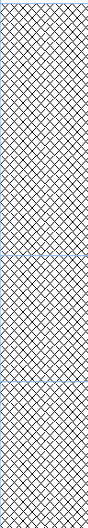
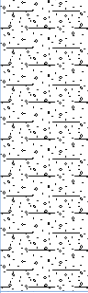
AN

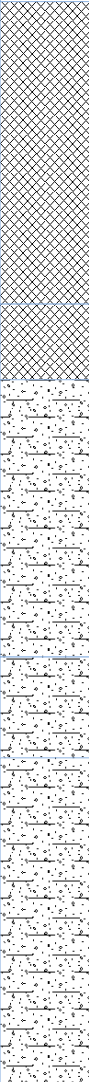
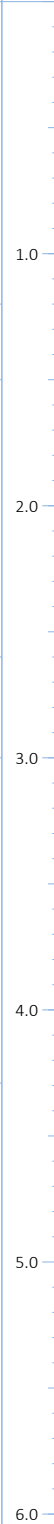
JM

Well	Water Strikes	Sample and In Situ Testing			Depth (m)	Level (m OD)	Legend	Stratum Description	
		Depth (m)	Type	Results					
		1.00	D ES	N=32 (12,11/10,10,6,6)	1.50		MADE GROUND: Dark brown gravelly slightly clayey fine to coarse sand. Gravel is sub-angular to sub-rounded fine to coarse of brick, chert, mudstone and rare glass. Occasional cobbles of brick up to 0.24m in diameter.	1.0	
		1.20	SPT						
		2.00	SPT	N=6 (1,1/1,1,2,2)	2.20		Loose dark brown slightly clayey gravelly fine to coarse SAND. Gravel is sub-angular to sub-rounded fine to medium of mudstone, sandstone and flint.	2.0	
		2.50	D	N=13 (2,3/3,3,3,4)	3.00		Medium dense brown clayey fine to coarse SAND.		3.0
		3.70	SPT			N≥50 (11,13/50 for 135mm)		3.83	
									End of Borehole at 3.83m
								5.0	
								6.0	

1. Service clearance using CAT and GENNY.
2. Handpitting to 1.20m bgl.
3. No groundwater encountered.
4. Refusal at 3.70m bgl.
5. Installation of 1.83m plain and 2.00m slotted PVC.

ES = Environmental Sample
D = Disturbed Sample
B = Bulk Sample
LB = Large Bulk Sample
U = Undisturbed Sample
UT = Undisturbed Thin Wall Sample
SPT = Standard Penetration Test
PID = Photoionization Detector (ppm)
PPM = Part Per Million
HSV = Hand Shear Vane

BROWNFIELD SOLUTIONS LTD							Borehole Log		Window Sampler No.	
									WS404	
									Sheet 1 of 1	
PROJECT NO: C4334B							CO-ORDS:		Hole Type	
									WS	
PROJECT NAME: CASTLE IRWELL, SALFORD							LEVEL:		Scale	
									1:30	
CLIENT: DOMIS CONSTRUCTION							DATES: 17/08/22		Logged	
									Checked	
									AN JM	
Well	Water Strikes	Sample and In Situ Testing			Depth (m)	Level (m OD)	Legend	Stratum Description		
		Depth (m)	Type	Results						
								MADE GROUND: Dark brown slightly clayey gravelly fine to coarse sand. Gravel is sub-angular to sub-rounded fine to coarse of brick, chert, mudstone and rare glass. Occasional cobbles of brick up to 0.24m in diameter.	1.0	
		1.20	SPT	N=23 (7,10/10,7,4,2)	1.00			MADE GROUND: Light brown slightly clayey gravelly fine to coarse sand. Gravel is sub-angular to sub-rounded fine to coarse of brick and mudstone. Rare cobbles of brick up to 0.24m in diameter.		
					1.50			MADE GROUND: Dark brown gravelly fine to coarse sand. Gravel is sub-angular to sub-rounded fine to coarse of brick and mudstone. Rare cobbles of brick up to 0.24m in diameter.		
		2.00	SPT	N=17 (8,8/3,5,7,2)	2.10		Medium dense brown slightly slightly gravelly clayey SAND. Gravel is sub-angular to rounded fine to coarse of mudstone and flint.	2.0		
		2.30	D ES							
		3.00	SPT	N≥50 (6,5/50 for 285mm)			Becoming very dense from 3.00m bgl.	3.0		
					3.28			End of Borehole at 3.28m		
										4.0
										5.0
										6.0
Remarks		1. Service clearance using CAT and GENNY. 2. Handpitting to 1.20m bgl. 3. No groundwater encountered. 4. Refusal at 3.28m bgl. 5. Collapsed to 2.00m bgl. 6. Installation of 1.30m plain and 1.00m slotted PVC.							ES = Environmental Sample D = Disturbed Sample B = Bulk Sample LB = Large Bulk Sample U = Undisturbed Sample UT = Undisturbed Thin Wall Sample SPT = Standard Penetration Test PID = Photoionization Detector (ppm) PPM = Part Per Million HSV = Hand Shear Vane	

 BROWNFIELD SOLUTIONS LTD							Borehole Log		Window Sampler No.	
									WS405	
									Sheet 1 of 1	
PROJECT NO: C4334B							CO-ORDS:		Hole Type	
									WS	
PROJECT NAME: CASTLE IRWELL, SALFORD							LEVEL:		Scale	
									1:30	
CLIENT: DOMIS CONSTRUCTION							DATES: 17/08/22		Logged	Checked
									AN	JM
Well	Water Strikes	Sample and In Situ Testing			Depth (m)	Level (m OD)	Legend	Stratum Description		
		Depth (m)	Type	Results						
		0.60	D ES					MADE GROUND: Dark brown slightly clayey gravelly fine to coarse sand. Gravel is sub-angular to sub-rounded fine to coarse of brick, flint, charcoal and mudstone with occasional rootlets.		
		1.20	SPT	N=24 (7,6/5,7,6,6)	1.20			MADE GROUND: Black gravelly fine to coarse sand. Gravel is sub-angular to sub-rounded fine to medium of brick and mudstone.		
					1.50			Medium dense red brown slightly clayey gravelly fine to coarse SAND. Gravel is sub-angular to sub-rounded fine to coarse of mudstone and sandstone.		
		2.00	SPT	N=8 (3,2/2,2,2,2)				Firm dark brown slightly gravelly sandy CLAY. Sand is fine to coarse. Gravel is sub-angular to sub-rounded fine to medium of mudstone and flint.		
					2.60			Medium dense slightly gravelly clayey fine to coarse SAND. Gravel is sub-rounded to rounded fine to medium of mudstone and sandstone.		
		3.00	SPT	N=8 (2,2/2,2,2,2)	3.00					
		3.30	D							
		4.00	SPT	N≥50 (6,9/50 for 290mm)				Becoming very dense from 4.00m bgl.		
					4.29			End of Borehole at 4.29m		
Remarks								ES = Environmental Sample D = Disturbed Sample B = Bulk Sample LB = Large Bulk Sample U = Undisturbed Sample UT = Undisturbed Thin Wall Sample SPT = Standard Penetration Test PID = Photoionization Detector (ppm) PPM = Part Per Million HSV = Hand Shear Vane		
1. Service clearance using CAT and GENNY. 2. Handpitting to 1.20m bgl. 3. No groundwater encountered. 4. Refusal at 4.29m bgl. 5. Hole was backfilled with arisings upon completion.										

APPENDIX H

Soil Infiltration Test Results

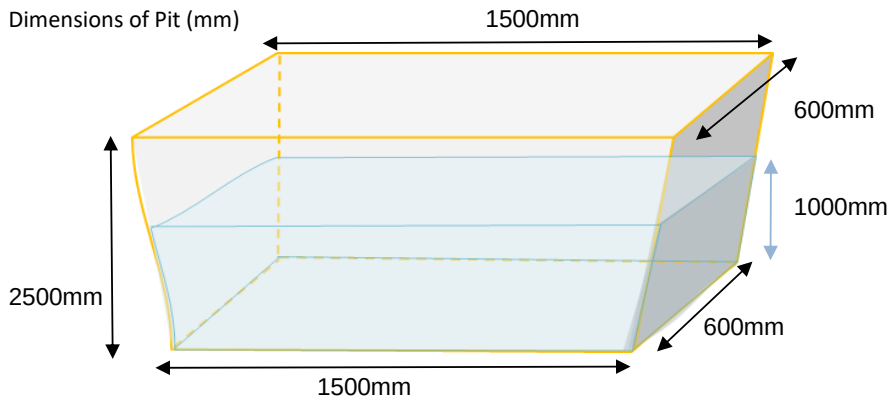
Percolation Test

DOMIS CONSTRUCTION**SA401**

Test 1

CASTLE IRWELL, SALFORD

C4334


**BROWNFIELD
SOLUTIONS LTD**
GEO-ENVIRONMENTAL ENGINEERING EXCELLENCE
Test Pit Construction

Date of Test:

18/08/2022

Logged By:

AN

Checked By:

JM

Strata Description	Gravelly Clayey Sand (Check log descriptions)		
Depth of Pit	2500mm		
Depth of Water (start)	1000mm		
Pit Details	Open with no stone filling See Associated Log for Stratum Details		
Void Ratio	1	Volume of Pit (m ³)	0.900
Infill Volume (m ³)	N/A	Water Volume (m ³)	0.900

Site Recorded Data

Time (mins)	Depth to water (mm)	Depth of water (mm)	Time (mins)	Depth to water (mm)	Depth of water (mm)
0.17	1500	1000	90.0	1600	900
0.33	1500	1000	120.0	1620	880
0.50	1500	1000	180.0	1640	860
0.67	1500	1000	End of Test	End of Test	End of Test
0.83	1500	1000			
1.00	1500	1000			
2.00	1500	1000			
3.00	1500	1000			
4.00	1505	995			
5.00	1510	990			
10.00	1515	985			
15.00	1530	970			
20.00	1535	965			
25.00	1540	960			
30.00	1545	955			
40.00	1555	945			
50.00	1585	915			
60.00	1600	900			

Percolation Test

DOMIS CONSTRUCTION

SA401

CASTLE IRWELL, SALFORD

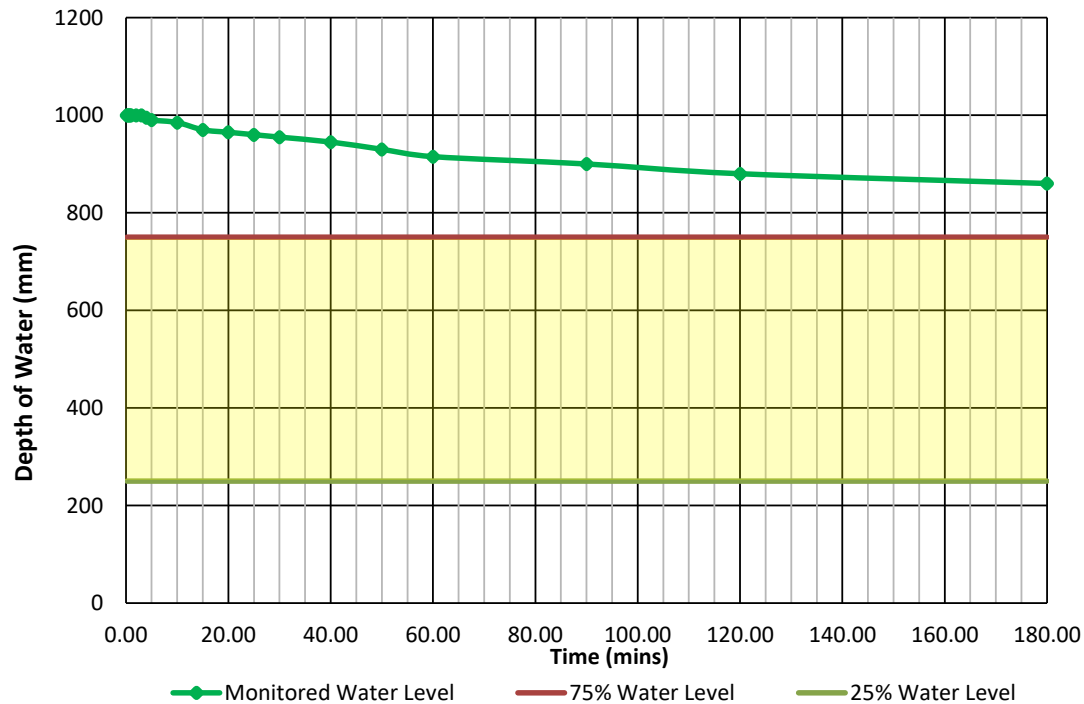
Test 1

C4334


**BROWNFIELD
SOLUTIONS LTD**
GEO-ENVIRONMENTAL ENGINEERING EXCELLENCE

Data Analysis

Graph of Depth vs Time



Soil Infiltration Rate Calculation

Water Level 1 (mm)	1000
Water Level 2 (mm)	860
Time to Drain from Level 1 to Level 2 (mins)	180
Volume of water discharged (m ³)	0.126
Discharge Area (m ²)	4.806
Soil Infiltration Rate (m/min)	0.000145651

Soil Infiltration Rate (m/sec)	2.43E-06
--------------------------------	----------

Compliance Check

Water Level at 75% effective depth (mm)	750
Water Level at 25% effective depth (mm)	250

Test not BRE 365 compliant - insufficient time to drain past 25% effective depth

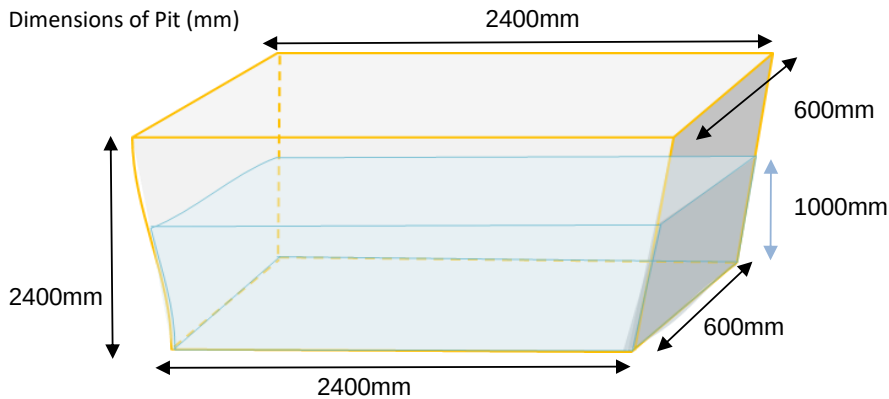
Percolation Test

DOMIS CONSTRUCTION**SA402**

Test 1

CASTLE IRWELL, SALFORD

C4334


**BROWNFIELD
SOLUTIONS LTD**
GEO-ENVIRONMENTAL ENGINEERING EXCELLENCE
Test Pit Construction

Date of Test:

18/08/2022

Logged By:

AN

Checked By:

JM

Strata Description	Gravelly Clayey Sand (Check log descriptions)		
Depth of Pit	2400mm		
Depth of Water (start)	1000mm		
Pit Details	Open with no stone filling See Associated Log for Stratum Details		
Void Ratio	1	Volume of Pit (m ³)	1.440
Infill Volume (m ³)	N/A	Water Volume (m ³)	1.440

Site Recorded Data

Time (mins)	Depth to water (mm)	Depth of water (mm)	Time (mins)	Depth to water (mm)	Depth of water (mm)
0.17	1400	1000	90.0	1560	840
0.33	1415	985	120.0	1580	820
0.50	1420	980	180.0	1600	800
0.67	1420	980	End of Test	End of Test	End of Test
0.83	1420	980			
1.00	1430	970			
2.00	1435	965			
3.00	1445	955			
4.00	1460	940			
5.00	1460	940			
10.00	1465	935			
15.00	1475	925			
20.00	1480	920			
25.00	1490	910			
30.00	1500	900			
40.00	1525	875			
50.00	1535	865			
60.00	1560	840			

Percolation Test

DOMIS CONSTRUCTION

SA402

CASTLE IRWELL, SALFORD

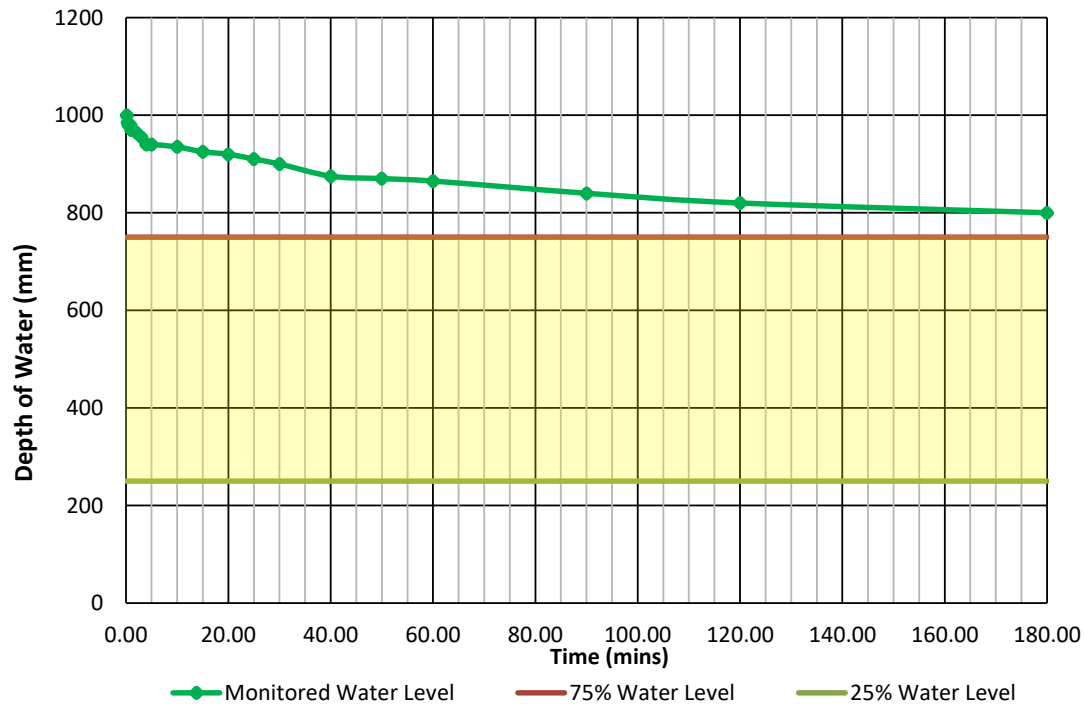
Test 1

C4334


**BROWNFIELD
SOLUTIONS LTD**
GEO-ENVIRONMENTAL ENGINEERING EXCELLENCE

Data Analysis

Graph of Depth vs Time



Soil Infiltration Rate Calculation

Water Level 1 (mm)	1000
Water Level 2 (mm)	800
Time to Drain from Level 1 to Level 2 (mins)	180
Volume of water discharged (m ³)	0.288
Discharge Area (m ²)	6.84
Soil Infiltration Rate (m/min)	0.000233918

Soil Infiltration Rate (m/sec)	3.90E-06
--------------------------------	----------

Compliance Check

Water Level at 75% effective depth (mm)	750
Water Level at 25% effective depth (mm)	250

Test not BRE 365 compliant - insufficient time to drain past 25% effective depth

Percolation Test

DOMIS CONSTRUCTION

SA403

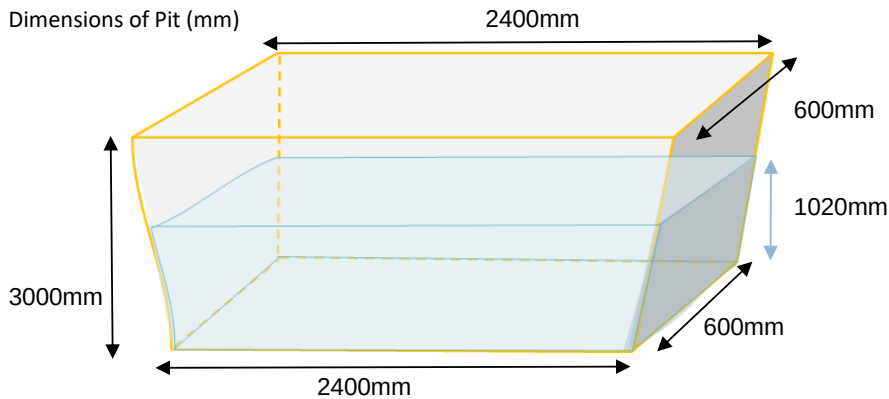
Test 1

CASTLE IRWELL, SALFORD

C4334


**BROWNFIELD
SOLUTIONS LTD**
GEO-ENVIRONMENTAL ENGINEERING EXCELLENCE

Test Pit Construction



Date of Test:

18/08/2022

Logged By:

AN

Checked By:

JM

Strata Description	Gravelly Clayey Sand (Check log descriptions)		
Depth of Pit	3000mm		
Depth of Water (start)	1020mm		
Pit Details	Open with no stone filling See Associated Log for Stratum Details		
Void Ratio	1	Volume of Pit (m ³)	1.469
Infill Volume (m ³)	N/A	Water Volume (m ³)	1.469

Site Recorded Data

Time (mins)	Depth to water (mm)	Depth of water (mm)	Time (mins)	Depth to water (mm)	Depth of water (mm)
0.17	1980	1020	90.0	2100	900
0.33	1980	1020	120.0	2180	820
0.50	1985	1015	180.0	2250	750
0.67	1985	1015	End of Test	End of Test	End of Test
0.83	1985	1015			
1.00	1990	1010			
2.00	1990	1010			
3.00	2000	1000			
4.00	2005	995			
5.00	2005	995			
10.00	2005	995			
15.00	2010	990			
20.00	2010	990			
25.00	2020	980			
30.00	2025	975			
40.00	2040	960			
50.00	2080	920			
60.00	2100	900			

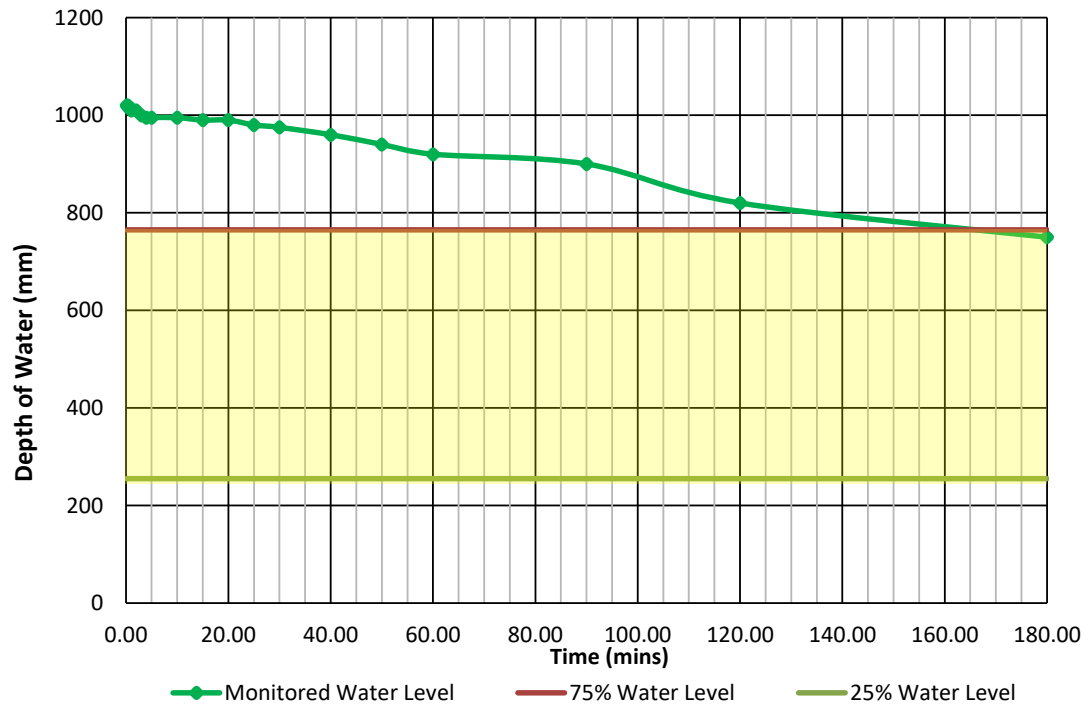
Percolation Test

DOMIS CONSTRUCTION**SA403**

CASTLE IRWELL, SALFORD

Test 1

C4334


**BROWNFIELD
SOLUTIONS LTD**
GEO-ENVIRONMENTAL ENGINEERING EXCELLENCE
Data Analysis**Graph of Depth vs Time****Soil Infiltration Rate Calculation**

Water Level 1 (mm)	1020
Water Level 2 (mm)	750
Time to Drain from Level 1 to Level 2 (mins)	180
Volume of water discharged (m ³)	0.3888
Discharge Area (m ²)	6.75
Soil Infiltration Rate (m/min)	0.00032

Soil Infiltration Rate (m/sec)	5.33E-06
--------------------------------	----------

Compliance Check

Water Level at 75% effective depth (mm)	765
Water Level at 25% effective depth (mm)	255

Test not BRE 365 compliant - insufficient time to drain past 25% effective depth

Percolation Test

DOMIS CONSTRUCTION**SA405**

Test 1

CASTLE IRWELL, SALFORD

C4334


**BROWNFIELD
SOLUTIONS LTD**
GEO-ENVIRONMENTAL ENGINEERING EXCELLENCE
Test Pit Construction

Date of Test:

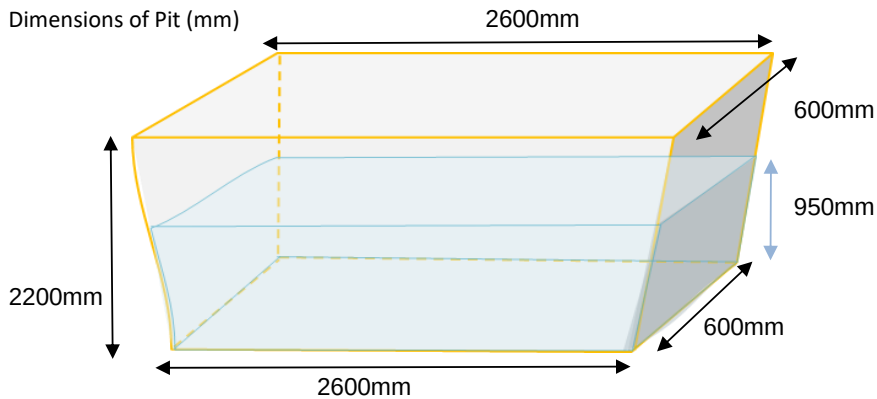
19/08/2022

Logged By:

AN

Checked By:

JM



Strata Description	Gravelly Clayey Sand (Check log descriptions)		
Depth of Pit	2200mm		
Depth of Water (start)	950mm		
Pit Details	Open with no stone filling See Associated Log for Stratum Details		
Void Ratio	1	Volume of Pit (m ³)	1.482
Infill Volume (m ³)	N/A	Water Volume (m ³)	1.482

Site Recorded Data

Time (mins)	Depth to water (mm)	Depth of water (mm)	Time (mins)	Depth to water (mm)	Depth of water (mm)
0.17	1250	950	8.0	1310	890
0.25	1270	930	10.0	1310	890
0.33	1270	930	15.0	1330	870
0.42	1270	930	25.0	1360	840
0.50	1270	930	30.0	1370	830
0.58	1270	930	50.0	1395	805
0.67	1270	930	60.0	1410	790
0.75	1270	930	80.0	1440	760
0.83	1270	930	90.0	1450	750
1.00	1270	930	110.0	1460	740
1.50	1270	930	120.0	1480	720
2.00	1280	920	130.0	1490	710
2.50	1280	920	150.0	1510	690
3.00	1280	920	160.0	1510	690
3.50	1280	920	170.0	1520	680
4.00	1290	910	180.0	1530	670
5.00	1300	900	210.0	1540	660
7.00	1310	890	240.0	1545	655

Percolation Test

DOMIS CONSTRUCTION

SA405

CASTLE IRWELL, SALFORD

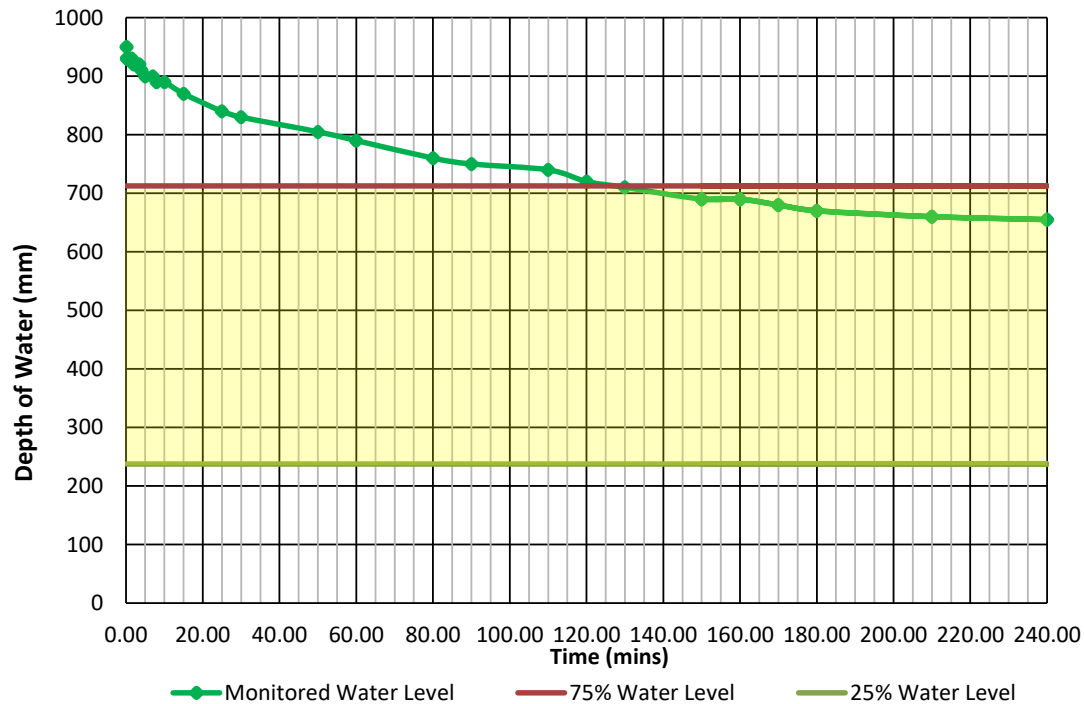
Test 1

C4334


**BROWNFIELD
SOLUTIONS LTD**
GEO-ENVIRONMENTAL ENGINEERING EXCELLENCE

Data Analysis

Graph of Depth vs Time



Soil Infiltration Rate Calculation

Water Level 1 (mm)	950
Water Level 2 (mm)	655
Time to Drain from Level 1 to Level 2 (mins)	240
Volume of water discharged (m ³)	0.4602
Discharge Area (m ²)	6.696
Soil Infiltration Rate (m/min)	0.000286365
Soil Infiltration Rate (m/sec)	4.77E-06

Compliance Check

Water Level at 75% effective depth (mm)	712.5
Water Level at 25% effective depth (mm)	237.5

Test not BRE 365 compliant - insufficient time to drain past 25% effective depth

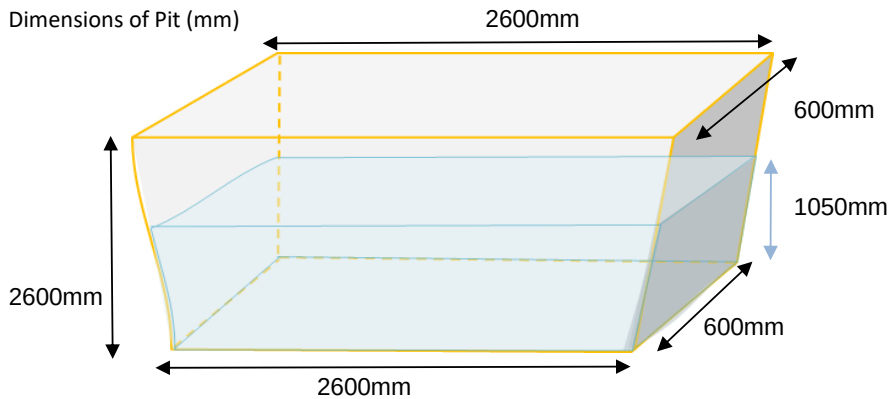
Percolation Test

DOMIS CONSTRUCTION**SA407**

Test 1

CASTLE IRWELL, SALFORD

C4334


**BROWNFIELD
SOLUTIONS LTD**
GEO-ENVIRONMENTAL ENGINEERING EXCELLENCE
Test Pit Construction

Date of Test:

19/08/2022

Logged By:

AN

Checked By:

JM

Strata Description	Gravelly Clayey Sand (Check log descriptions)		
Depth of Pit	2600mm		
Depth of Water (start)	1050mm		
Pit Details	Open with no stone filling See Associated Log for Stratum Details		
Void Ratio	1	Volume of Pit (m ³)	1.638
Infill Volume (m ³)	N/A	Water Volume (m ³)	1.638

Site Recorded Data

Time (mins)	Depth to water (mm)	Depth of water (mm)	Time (mins)	Depth to water (mm)	Depth of water (mm)
0.17	1550	1050	6.0	1580	1020
0.25	1560	1040	7.0	1580	1020
0.33	1560	1040	8.0	1580	1020
0.42	1560	1040	9.0	1585	1015
0.50	1560	1040	10.0	1585	1015
0.58	1560	1040	20.0	1590	1010
0.67	1560	1040	30.0	1600	1000
0.75	1560	1040	40.0	1610	990
0.83	1560	1040	50.0	1620	980
1.00	1560	1040	60.0	1620	980
1.50	1560	1040	90.0	1620	980
2.00	1570	1030	120.0	1625	975
2.50	1580	1020	140.0	1635	965
3.00	1580	1020	150.0	1640	960
3.50	1580	1020	170.0	1660	940
4.00	1580	1020	180.0	1665	935
4.50	1580	1020	240.0	1665	935
5.00	1580	1020	End of Test	End of Test	End of Test

Percolation Test

DOMIS CONSTRUCTION

SA407

CASTLE IRWELL, SALFORD

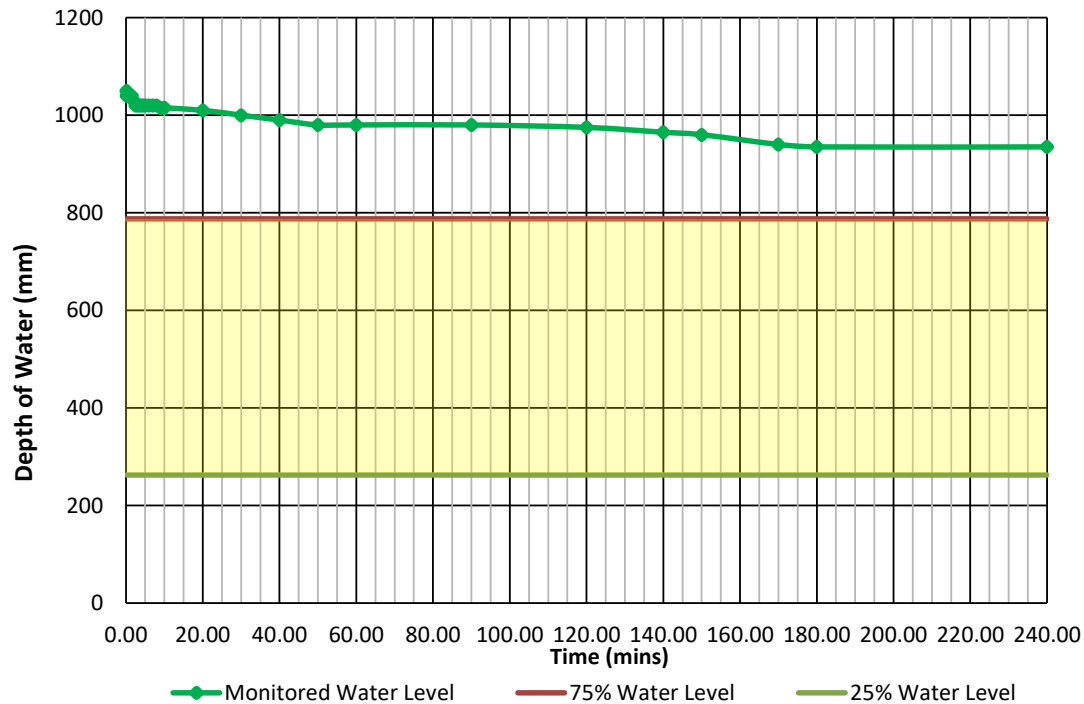
Test 1

C4334


**BROWNFIELD
SOLUTIONS LTD**
GEO-ENVIRONMENTAL ENGINEERING EXCELLENCE

Data Analysis

Graph of Depth vs Time



Soil Infiltration Rate Calculation

Water Level 1 (mm)	1050
Water Level 2 (mm)	935
Time to Drain from Level 1 to Level 2 (mins)	240
Volume of water discharged (m ³)	0.1794
Discharge Area (m ²)	7.912
Soil Infiltration Rate (m/min)	9.44767E-05

Soil Infiltration Rate (m/sec)	1.57E-06
--------------------------------	----------

Compliance Check

Water Level at 75% effective depth (mm)	787.5
Water Level at 25% effective depth (mm)	262.5

Test not BRE 365 compliant - insufficient time to drain past 25% effective depth

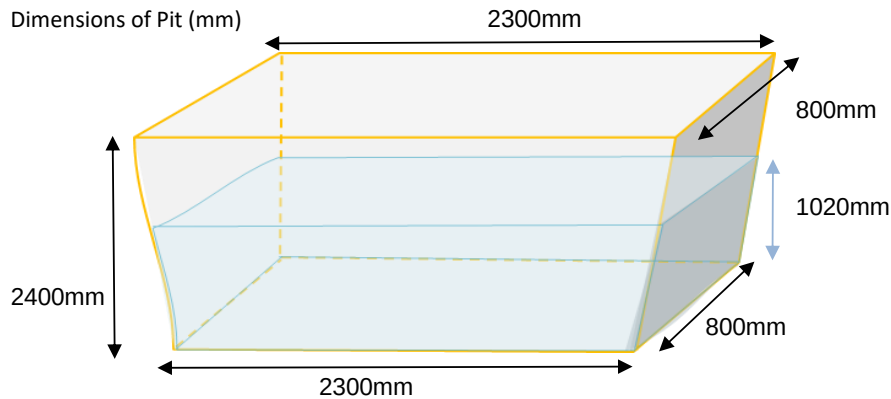
Percolation Test

DOMIS CONSTRUCTION**SA409**

Test 1

CASTLE IRWELL, SALFORD

C4334


**BROWNFIELD
SOLUTIONS LTD**
GEO-ENVIRONMENTAL ENGINEERING EXCELLENCE
Test Pit Construction

Date of Test:

19/08/2022

Logged By:

AN

Checked By:

JM

Strata Description	Clayey Sand (Check log descriptions)		
Depth of Pit	2400mm		
Depth of Water (start)	1020mm		
Pit Details	Open with no stone filling See Associated Log for Stratum Details		
Void Ratio	1	Volume of Pit (m ³)	1.877
Infill Volume (m ³)	N/A	Water Volume (m ³)	1.877

Site Recorded Data

Time (mins)	Depth to water (mm)	Depth of water (mm)	Time (mins)	Depth to water (mm)	Depth of water (mm)
0.17	1380	1020	20.0	1530	870
0.25	1380	1020	30.0	1570	830
0.33	1380	1020	40.0	1580	820
0.42	1400	1000	60.0	1600	800
0.50	1400	1000	70.0	1640	760
0.58	1400	1000	90.0	1670	730
0.67	1410	990	100.0	1675	725
0.75	1410	990	120.0	1700	700
0.83	1410	990	130.0	1720	680
1.00	1415	985	140.0	1740	660
1.50	1420	980	150.0	1745	655
2.00	1420	980	160.0	1760	640
3.00	1445	955	170.0	1770	630
4.00	1450	950	180.0	1780	620
5.00	1460	940	210.0	1795	605
7.00	1470	930	240.0	1805	595
8.00	1490	910	End of Test	End of Test	End of Test
10.00	1530	870			

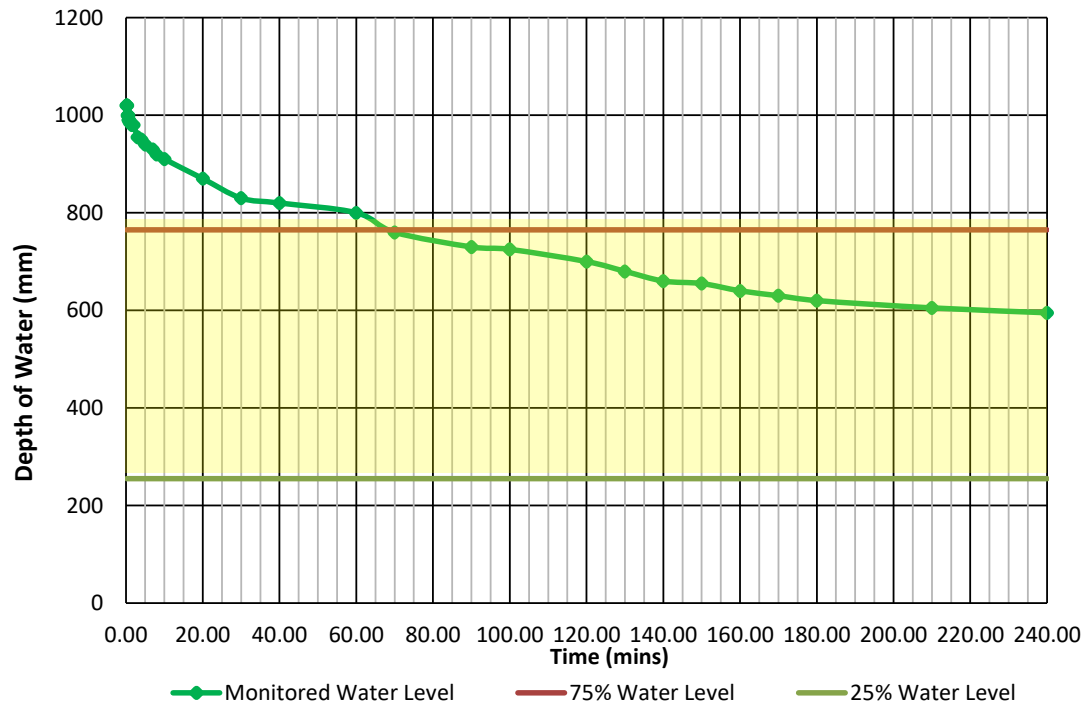
Percolation Test

DOMIS CONSTRUCTION**SA409**

CASTLE IRWELL, SALFORD

Test 1

C4334


**BROWNFIELD
SOLUTIONS LTD**
GEO-ENVIRONMENTAL ENGINEERING EXCELLENCE
Data Analysis**Graph of Depth vs Time****Soil Infiltration Rate Calculation**

Water Level 1 (mm)	1020
Water Level 2 (mm)	595
Time to Drain from Level 1 to Level 2 (mins)	240
Volume of water discharged (m ³)	0.782
Discharge Area (m ²)	6.8465
Soil Infiltration Rate (m/min)	0.000475912
Soil Infiltration Rate (m/sec)	7.93E-06

Compliance Check

Water Level at 75% effective depth (mm)	765
Water Level at 25% effective depth (mm)	255

Test not BRE 365 compliant - insufficient time to drain past 25% effective depth

APPENDIX I

Water Pipe Risk Assessment

Supplementary guidance for the selection of water pipes in land potentially affected by contamination



Introduction

In January 2011, UK Water Industry Research (UKWIR) published "Guidance for the Selection of Water Supply Pipes to be used in Brownfield Sites" (Ref 10/WM/03/21; the 'UKWIR Guidance'). Its aim is to ensure that the correct materials are selected for water pipes and components to be used below ground in brownfield sites to protect the quality of drinking water whilst taking into account the service life of the water distribution system. It supersedes the Water Regulations Advisory Scheme (WRAS) Information and Guidance Note 9-04-03 "Laying Pipes in Contaminated Land" which has been withdrawn.

The UKWIR Guidance is for use by developers, self-lay organisations, water companies and consultants when planning, designing and constructing water mains and/or services in brownfield sites. It defines brownfield sites as "land or premises that have previously been used or developed. They may also be vacant or derelict. However, they are not necessarily contaminated." The UKWIR Guidance states that it does not apply to greenfield sites; however, we consider this supplementary guidance and the relevant sections of the UKWIR guidance as being equally suitable for application to those greenfield sites considered to be potentially affected by contamination. Where greenfield sites are not affected by contamination a preliminary risk assessment (see below) will suffice.

The UKWIR Guidance also states that there should be no departure from its provisions "*except where formally approved by the Water Company, such departure being technically justifiable or representing advances in knowledge or product development*".

We have adopted the UKWIR Guidance in principle and produced this company specific supplementary guidance (the 'UUW Guidance') which includes the Risk Assessment for Water Pipes (the 'RA').

This guidance does not cover operative safety, health exposure modelling or accidental pipe damage.

Risk Assessment for Water Pipes in Land Potentially Affected by Contamination

Any application for new water supplies to a development (construction of new properties, or renovation or conversion of existing buildings) in land potentially affected by contamination shall include a completed RA.

As a minimum a desk study (preliminary risk assessment) shall be provided with the RA in accordance with the framework in Environment Agency publication "Model Procedures for the Management of Land Contamination" (ref: CLR11) that sets out whether the land through which the pipes are to be laid may be affected by contamination. The application of the source, pathway, receptor concept will be an integral part of any pipeline risk assessment. For each potential source (the contamination) and each potential receptor (the water pipe), consideration shall be given to whether a potential pathway between source and receptor exists, or may exist in the future, linking the two. There are normally only three pathways by which contamination may come into contact with water pipes. These are direct contact with the soil or backfill, an excessive vapour phase or a contaminated groundwater regime. If none of these conditions exist on site (adopting the source, pathway, receptor concept) then it is likely that extended and/or targeted soil testing will not be required and a simple risk assessment will suffice. For those sites where land may be affected by contamination appropriate testing shall be undertaken on the materials within which the pipes are to be laid, whether that be existing ground materials, remediated materials or imported capping materials. The testing requirements are as described in the following section.

The signatories of the Water Supply Application Form and the RA must ensure that all assessments of land condition have been carried out in accordance with applicable current standards and guidelines by or under the direction of a suitably qualified competent person.

We require the competent person to be a) a chartered member of an appropriate professional body (such as the Institution of Civil Engineers, the Geological Society of London or the Royal Institution of Chartered Surveyors) with relevant experience of investigating contaminated sites or b) a Specialist in Land Condition (SiLC) with appropriate geo-environmental experience.

Testing Requirements

The soil, rock and if appropriate groundwater tests that are required on all sites where the potential for organic contamination has been identified in the desk study and where water pipes are proposed to be laid must be accredited by United Kingdom Accreditation Service (UKAS) as a minimum and where commercially available the Environment Agency's Monitoring Certification Service (MCERTS). These accredited tests should be undertaken for:

Banded hydrocarbons EC5-EC10, EC10-EC16, EC16-EC40 (Total aliphatic and aromatic hydrocarbons for each banding may be summed). Aliphatic/aromatic fractionation and subsequent banding may be required should a more detailed site specific risk assessment be undertaken. The bandings have been amended to take into account readily available laboratory tests. The equivalent carbon number (EC) is used to assess petroleum hydrocarbon mixtures rather than the actual number of carbon atoms in the molecule in line with guidance issued by the Environment Agency (2005).

Volatile organic compounds (VOCs) (method by head space or purge & trap GCMS) with tentative identification of compounds greater than 20µg/kg. The method used should be capable of detecting a wide range of compounds listed in US EPA Method 8260C or similar. The method should include analysis of naphthalene.

BTEX (Benzene, toluene, ethyl benzene and xylenes) plus MTBE (Methyl-tertiary butyl ether) (by head space GCMS)

Semi-Volatile Organic Compounds (SVOCs) (method by GCMS) with tentative identification of compounds greater than 20µg/kg. The method used should be capable of detecting the compounds listed in US EPA Method 8270D or similar. The total concentration of SVOCs excludes polycyclic aromatic hydrocarbons, ethers, nitrobenzene, ketones, aldehydes, phenols, cresols and chlorinated phenols. Phenols, cresols and chlorinated phenols which are detected by the SVOC analysis are given their own assessment criteria.

We do not consider Table G1 and Table 3.1 of the UKWIR Guidance to be a definitive guide for assessing total concentrations. Table 1 in the RA below replaces Table 3.1 of the UKWIR Guidance.

Where previous site uses include the use, storage, treatment, disposal or manufacture of any of the following, appropriate testing for these substances will be required:

Ethers, nitrobenzene, ketones, aldehydes and amines. Note that the presence of amines on any site at the proposed pipe depth +/- 1.0m precludes the use of polyethylene. The methods of analysis and method of calculation of total concentrations of these compounds will need to be agreed with UUW.

To comply with the testing requirements, the suites of tests that are required on all brownfield sites where wrapped steel, wrapped ductile iron or copper pipes are to be laid as minimum must include:

pH, Conductivity and redox potential

Sufficiency of Testing

Water pipes are normally laid at between 0.75 and 1.35m from finished ground level to crown of pipe. Samples taken and tested must represent both a) the soil in which the water pipes are to be laid and b) the soil down to at least 500mm below the underside of the proposed pipe. Where the proposed depth of the pipes is unknown at the time of application, soil samples representative of the ground condition between surface level and 1.5m below finished ground level shall be taken as a minimum. Where appropriate (see UKWIR Guidance) groundwater sampling and groundwater monitoring will also be

necessary. Photo-ionisation detection (PID) monitoring along the proposed route of the pipeline may be employed, though this does not provide a definitive guide to the suitability of water pipe materials.

Where required a sufficient number of test results should be obtained from the material in which the pipes are to be laid. CLAIRE/CIEH 2008 "Guidance on comparing soil contamination data with a critical concentration" may be used, where appropriate, to justify the number of soil samples tested; however, this statistical model should not be used on heterogeneous materials or used to average test results from different types of materials.

Further guidance on representative sampling is contained within BS10175:2011 Code of Practice for the Investigation of Potentially Contaminated Sites, the Department of the Environment's Contaminated Land Research Report "Sampling strategies for contaminated land" prepared by The Centre for Research into the Built Environment, Nottingham Trent University (Ref: CLR 4; 1994) and the Environment Agency's "Secondary Model Procedure for the Development of Appropriate Soil Sampling Strategies for Land Contamination" (ref: R&D Technical Report P5-066/TR; 2000).

Where remediation has been carried out on the site, the test results obtained from validation samples will be used in the assessment. Where a horizontal capping system has been or will be employed using materials spread across a site, sufficient samples will need to be taken to characterise the capping material used and the results presented to UUW. However, the sufficiency of sampling on the horizontal capping system, in which the pipeline will be placed, may be assessed on the basis of the source, quantity and type of materials used.

Detection Limits

Only positive concentrations, ie those above the limit of detection should be used in summation of VOC and SVOC (or other test groups of compounds ie phenols, cresols and chlorinated phenols). Laboratory methods shall provide a minimum limit of detection of 10µg/kg for each individual VOC or SVOC (or other test groups of compounds) quantitatively detected in accordance with the methods described above. For tentatively identified compounds (TICs), only those compounds with a concentration of 20µg/kg or greater shall be used in the summation of VOC and SVOC (or other test groups of compounds).

Protective Measures

Where polyethylene, ductile iron, steel or copper pipes are to be laid on a brownfield site or other land potentially affected by contamination (whether or not it has been remediated) and where the concentrations exceed the generic guideline values set out in Table 1 of the RA, the developer shall provide either:

- a) a robust risk assessment to show how any contaminants will not significantly impact on proposed water supplies or buried assets over the lifetime of the assets; or
- b) more suitable pipe materials; or
- c) an engineering solution to protect the pipe work backed up by an adequate assessment of the risk.

Liquid free phase product (e.g. oil or free solvent layers) shall not remain in the ground or groundwater in the vicinity of water pipes, whether barrier pipe or any other pipe materials are used.

When designing pipe routes on land potentially affected by contamination, new preferential contamination pathways along the route of new water pipes shall not be created. Particular measures may be required to prevent the possible migration of contamination through pipe bedding and into controlled waters.

References

BS10175:2011 "Investigation of Potentially Contaminated Sites Code of Practice"

CLAIRE/CIEH "Guidance on comparing soil contamination data with a critical concentration" 2008

Department of the Environment Contaminated Land Research Report "Sampling strategies for contaminated land" prepared by The Centre for Research into the Built Environment, Nottingham Trent University (Ref: CLR 4) 1994

Environment Agency "Secondary Model Procedure for the Development of Appropriate Soil Sampling Strategies for Land Contamination" (ref: R&D Technical Report P5-066/TR) 2000

Environment Agency "Model Procedures for the Management of Land Contamination" (ref: CLR11), 2004

Environment Agency P5-080/TR3 "The UK Approach for Evaluating Human Health Risks from Petroleum Hydrocarbons in Soils", 2005

UK Water Industry Research (UKWIR) "Guidance for the Selection of Water Supply Pipes to be used in Brownfield Sites" (Ref 10/WM/03/21)" January 2011

Water Regulations Advisory Scheme (WRAS) Information and Guidance Note 9-04-03 "Laying Pipes in Contaminated Land" 2002



About us

United Utilities is the North West's water company. We keep the taps flowing and toilets flushing for seven million customers every day. From Crewe to Carlisle, we work hard behind the scenes to help your life flow smoothly.

United Utilities Water PLC, Haweswater House, Lingley Mere Business Park, Lingley Green Avenue, Warrington WA5 3LP.
Registered in England and Wales. Registered Number 2366678.

Risk Assessment for Water Pipes (RA)



The risk assessment for water pipes will help you choose appropriate materials for your development. We are happy to deal with a risk assessment for water pipes in advance of any formal application for a new water supply.

If you need any help completing the form please call us on 0845 026 4296.

When completing this form electronically, the larger text boxes will expand in height if required.

Section 1: Development Details	
Development Name (<i>if it has one</i>)	Former Student Village, Castle Irwell, Salford Irwell, Salford
Development Address	Former Castle Irwell Student Village, off Cromwell Road, Salford, M6 6DB
OS Grid Reference (<i>mid point</i>)	381880, 400380
Developers Name	Domis Construction Limited.
UW reference number (<i>for UW use only</i>)	
Please provide details below of the current and historical use of the site and adjacent sites.	
<i>If your supporting information has details of the current and historical site use, please reference below the relevant sections of your report.</i>	
Historic mapping indicates that the site remained as agricultural fields up until 1908 where the site comprised the southern half of the Manchester Racecourse. The associated stands, judges' box and ancillary buildings were located in the west and south of the site, with the remainder comprising the track. Between 1968 and 1980 the site was redeveloped into a student village with associated car parks, pavilion, and playing fields. Further expansion of the student village took place in the west of the site between 1992 and 1994. By 2017 some of the student housing in the west of the site had been demolished. The River Irwell bounds the site to the east and west. To the east approximately 20m off-site is a fuel station. The north of the site is occupied by an Environment Agency maintained flood plain. Directly north of the site is a flood defence in the form of an embankment. The area to the south of the site comprises residential properties which is separated from the site by a brick wall. An active fuel station is present adjacent to the western corner of the site..	

Section 2: Preliminary Risk Assessment	
Has your desk study and site walkover identified any land potentially affected by contamination?	☒ Yes ☐ No
If the site is potentially affected by contamination but you have not completed any intrusive site investigation please provide details below of the rationale behind the intended pipe selection.	
<i>If your supporting information has details of the rationale behind the intended pipe selection, please reference below the relevant sections of your report.</i>	
Detailed Site Investigation with chemical testing undertaken and further information is available in the following report: BSL, Environmental Assessment Report, reference SM/C4334/9117, dated February 2020.	

Section 3: Intrusive Site Investigation	
Have you completed any intrusive site investigation?	☒ Yes ☐ No
Date(s) when the site investigation(s) undertaken	23-27/04/2018, 11-12/12/2018, 27-31/01/2020, 04/06/2020
At what level has groundwater been encountered?	>3.48 metres below ground level or ☐ Not encountered
Table 1 (Pipeline Selection Risk Assessment Summary (PSRAS)) below classifies testing required where the preliminary risk assessment has identified land potentially affected by contamination. Please provide details below of any test groups which have not been tested and the rationale for not testing. <i>If your supporting information has details of the rationale behind not testing any particular test groups, please reference below the relevant sections of your report.</i>	
VOCs and SVOCs (other than those tested for in PAHs), ethers, Nitrobenzene, Ketones, Aldehydes and Amines were not tested for as no source of contamination pertaining to these was identified in the desk study or site investigations. Further details are provided within the Environmental Assessment Report (ref. SM/C4334/9117, dated February 2020).	
If the intrusive site investigation has identified concentrations above the PE threshold (see PSRAS) and your intended pipe selection is PE please provide details below of the rationale behind the intended pipe selection. <i>If your supporting information has details of the rationale behind the intended pipe selection, please reference below the relevant sections of your report.</i>	
Chemical testing during the site investigations did reveal levels of contaminants in isolated areas which were noted to be above the thresholds at proposed pipeline depth. However, in line with the remediation strategy (ref. JMC/C4334/9067 Rev B, dated July 2020), as part of the enabling works currently underway at the site, made ground is to be stripped from the site to provide a 'clean' development platform. Area of limited mild hydrocarbon impaction will be excavated with soils screened and testing prior to re-use. The made ground will be screened / sorted for re-use in suitable areas. Screened site won natural sands and imported quarried material will be used within service trenches present within natural soils which are present at the proposed pipeline depth. A validation report will be produced upon completion of the works to document the above.	
Section 4: Site Remediation	
Please provide details below of any site remediation (which may include a change in site levels) already completed. <i>If your supporting information has details of the site remediation already completed, please reference below the relevant sections of your report.</i>	
As above.	
Has the PSRAS (Table 1) been completed using appropriate data after remediation?	☐ Yes ☒ No ☐ N/A
Please provide details below of any proposed site remediation and an analysis of whether this will affect your intended pipe selection. <i>If your supporting information has details of any proposed site remediation and whether this will affect your intended pipe selection, please reference below the relevant sections of your report.</i>	

Note the completed table refers to existing levels prior to earthworks/remedial measures at the site. The clean topsoil / subsoil that is to be installed in garden and soft landscaping areas in the proposed development has not been completed at the time of writing. However, this is not anticipated to have any effect on the intended pipe selection. Soils to be used/imported will be below residential screening assessment criteria.

Section 5: Final Use of Site

Please provide details below of any chemicals (including fuel) to be stored on site and any other future contamination risks which may affect your intended pipe selection.

If your supporting information has details of potential contamination risks which may affect your intended pipe selection, please reference below the relevant sections of your report.

The residential development will not be subject to storage of any chemicals onsite.

What water pipe materials are intended to be used on site?

☒ PE ☐ PE Barrier Pipe Type A ☐ PE Barrier Pipe Type B
Other (please specify):

Section 6: Additional Information

Please use the section below to provide any additional details to support your intended pipe selection.

If your supporting information has additional information to support your intended pipe selection, please reference below the relevant sections of your report.

N/A

Section 7: Risk Assessor

Name and relevant qualifications of person directing the risk assessment for water pipes	Nicola Swallow BSc (Hons) MSc MEnvSc Checked By: Aaron Stokoe BSc (Hons) CSci MEnvSc FGS
Name and address of risk assessor's company	Brownfield Solutions Ltd, William Smith House, 173-183 Witton Street, Northwich, CW9 5LP
Date risk assessment performed	04/09/2020

Section 8: Declaration

I confirm I have completed this form and provided supporting information in accordance with 'UKWIR Guidance for the Selection of Water Supply Pipes to be used in Brownfield Sites' and UUW's Supplementary Guidance. I also confirm that if any further site investigation is needed and carried out, I will be required to submit an additional Risk Assessment for Water Pipes with the relevant supporting information. I understand that failure to supply any of the required information may delay my application being processed.

Name	Nicola Swallow	Company	Brownfield Solutions Ltd
Phone Number	01606 334 844	Date	04/09/2020

Please e-mail the completed form and supporting information to water.connections@uuplc.co.uk. Alternatively you can fax a paper version to 01925 678926 or post to us at United Utilities Water, Metering and Connections, Ullswater House, Lingley Mere, Warrington, WA5 3LP.



About us

United Utilities is the North West's water company. We keep the taps flowing and toilets flushing for seven million customers every day. From Crewe to Carlisle, we work hard behind the scenes to help your life flow smoothly.

United Utilities Water PLC, Haweswater House, Lingley Mere Business Park, Lingley Green Avenue, Warrington WA5 3LP.
Registered in England and Wales. Registered Number 2366678.

02/12/2019/1995

Table 1 - Pipe Selection Risk Assessment Summary (PSRAS)

- 1) Testing must be undertaken on the materials within which the pipes are to be laid, whether that be existing ground materials, remediated materials or imported capping materials. Please use the appropriate testing data to complete Table 1 below.
- 2) If more than one pipe selection is being made, for example, for pipes in different areas of a large site, a completed PSRAS is required for each selection.

What materials have been tested to populate Table 1 below?

☒ Existing ground materials ☐ Remediated materials ☐ Imported capping materials

All concentrations in mg/kg								
Test Group	Testing Required?	PE threshold	Metal Pipes/ Barrier Pipe	Laboratory Detection Limit	Testing UKAS accredited Y/N	Maximum concentration at proposed pipeline depth See Note [2]	Maximum site concentration See Note [3]	Locations and depths where concentrations exceed proposed pipeline threshold
Total VOCs	Where Preliminary Risk Assessment (PRA) has identified land potentially affected by contamination	0.5	Pass	0.05	Y	<LOD	6.0	TP106 (0.05) TP107 (0.10) TP133 (0.30) WS108 (0.30)
Total BTEX & MTBE		0.1	Pass	0.001	Y	<LOD	<LOD	
Total SVOCs (excluding PAHs and those substances marked with an *)		2	Pass	NA	-	-	-	-
EC5-EC10 aliphatic and aromatic hydrocarbons		2	Pass	0.006	Y	<LOD	<LOD	
EC10-EC16 aliphatic and aromatic hydrocarbons		10	Pass	6	Y	15.6	117.6	TP222 (1.00) WS206 (0.60) TP204 (0.20) TP103 (0.30) TP104 (0.10) TP106 (0.05) TP136 (0.20)
EC16-EC40 aliphatic and aromatic hydrocarbons		500	Pass	36	Y	143	5043	WS201 (0.30) TP101 (0.10)
Phenols* (from SVOC analysis)		2	Pass	0.3	N	<LOD	<LOD	
Cresols and chlorinated phenols* (from SVOC analysis)		2	Pass	NA	-	-	-	-
Ethers*	Only where identified	0.5	Pass	NA	-	-	-	-
Nitrobenzene*		0.5	Pass	NA	-	-	-	-
Ketones*		0.5	Pass	NA	-	-	-	-
Aldehydes*		0.5	Pass	NA	-	-	-	-
Amines		Fail	Pass	NA	-	-	-	-
Corrosive	Conductivity, Redox and pH	Pass	See Note [1]	NA	Y	-	-	-

Note [1] Threshold: For wrapped steel, corrosive if pH<7 and conductivity > 400µS/cm. For wrapped ductile iron corrosive if pH<5, Eh not neutral and conductivity > 400µS/cm. For copper, corrosive if pH<5 or >8 and Eh positive.

Note [2] Water pipes are normally laid at 0.75-1.35m below finished ground level.

Note [3] Also state if liquid free product is present in soil or groundwater.

North West

**William Smith House
173 – 183 Witton Street
Northwich
Cheshire
CW9 5LP**

Tel: 01606 334 844

Midlands

**Unit 5, Alfred Court
Saxon Business Park
Stoke Prior
Bromsgrove
Worcestershire
B60 4AD**

Tel: 01215 729 014

www.brownfield-solutions.com

