



STAGE 2 ENVIRONMENTAL REPORT

AT

LEEDS ROAD, HUDDERSFIELD

ON BEHALF OF

CARS 2 LIMITED

ARP GEOTECHNICAL LTD

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CLIENT: CARS 2 LIMITED

JOB NUMBER: C2L/03

PROJECT: LEEDS ROAD, HUDDERSFIELD

REPORT TYPE: STAGE 2 ENVIRONMENTAL REPORT

REPORT REFERENCE: C2L/03r1

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ISSUE	DATE	STATUS
1	3 RD OCTOBER 2019	V1 FINAL

CONTENTS

	Page
1.0 Executive Summary	4
2.0 Terms of Reference	5 - 6
3.0 The Site	7 - 8
4.0 Environmental Setting	9 - 10
5.0 Preliminary Risk Assessment and Conceptual Model	11 - 15
6.0 Site Investigation	16 - 17
7.0 Summary of Ground Conditions	18
8.0 Contamination Analysis	19 - 20
9.0 Geotechnical Testing	21 - 22
10.0 Comments and Conclusions	23 - 26

APPENDICES

Appendix A	Site Location Plan and Aerial Photograph
Appendix B	Site Walkover Photographs
Appendix C	Ordnance Survey Archive Maps
Appendix D	Geological Maps
Appendix E	Envirocheck Report
Appendix F	Risk Categorisation Tables
Appendix G	Borehole and Trial Pit Location Plan and Logs
Appendix H	Laboratory Test Certificates and Screening Values

1.0 EXECUTIVE SUMMARY

The pertinent conclusions of the report are tabulated below. However, the information below is not exhaustive, and it is recommended the report is read in its entirety.

Proposed land use	The site is to remain as a car dealership.
Existing Site Description	Car dealership with associated car parking and car wash facilities.
Site History	Small foundry in the northeast, houses along Leeds Road in the northwest. Remainder of the site undeveloped until construction of existing buildings.
Geology	Pennine Lower Coal Measures. No drift. No faults.
Coal Mining	Mine shaft located 13m from site boundary, 65m from existing building. Not considered a risk to existing building. May need further assessment for any future new development proposal.
Radon	No protection measures required.
Landfill Gas	No landfills within 250m.
Ground Conditions	Generally up to 0.6m of made ground, locally up to at least 1.65m deep in the northeast, overlying generally cohesive, locally granular residual soils.
Contamination Risk Assessment	No contamination identified. Therefore, the risk to future site users (assuming land use remains as a car dealership) is considered to be Very Low.
Foundations	Strips/trench fill/pad foundations likely to be viable for future development, if any is proposed.
Excavations	Excavations likely to remain stable within the natural soil.
Concrete	GEN1 designation for any unreinforced new foundations. For any reinforced concrete, other design-specific mixes will apply.

2.0 TERMS OF REFERENCE

- 2.1 Cars 2 Limited is considering purchasing a former car dealership at Leeds Road, Huddersfield. Following the purchase the site will remain in operation as a car dealership. It was considered appropriate to provide information to aid viability assessment prior to purchase.
- 2.2 ARP Geotechnical Ltd was appointed by Cars 2 Limited to carry out the investigation, which involved a desk study assessment of the geological and an overview of coal mining aspects, Ordnance Survey archive maps, radon gas, hydrogeology, landfill, and other environmental issues, primarily by assessment of a Landmark Envirocheck Report. This was supplemented by an intrusive investigation to assess the ground conditions and to provide an environmental risk assessment.
- 2.3 The investigation was implemented generally in accordance with BS 5930 : 2015 "Code of practice for site investigations", NHBC Standard Chapter 4.1 "Land quality - managing ground conditions", Environment Agency CLR 11 "Model Procedures for the Management of Land Contamination" and BS10175 : 2011 + A2 : 2017 "Investigation of potentially contaminated sites - Code of practice". This report is limited to the data obtained as part of this investigation. It should be noted that there is a possibility of variation in ground conditions between test locations and interpretation of strata is given for guidance only. No liability is accepted for changes to site conditions, including groundwater levels, after the preparation of this report.
- 2.4 The general observation and assessment of the ground surface, and the identification/classification of vegetation is made in general terms only. It would be prudent for a specialist to undertake a more detailed survey, including for any invasive/harmful weeds.
- 2.5 The assessment of any topsoil is carried out in terms of potential chemical effects on human health only, and no account is taken of aesthetic or horticultural properties. Such considerations should be referred to a horticulturist or landscape architect.

- 2.6 The report has been prepared for the use and reliance of the Client only. The report shall not be relied upon or transferred to any other parties without the written agreement of ARP Geotechnical Ltd. For the avoidance of any doubt, where ARP Geotechnical Ltd enters into a letter of reliance for the benefit of a third party, that third party will be permitted to rely on the report. No responsibility will be accepted where this report is used, either in its entirety or in part, by any other party without ARP Geotechnical Ltd.'s consent.
- 2.7 Attention is drawn to the requirements of the Construction Design and Management Regulations 2015, and in particular the duties and obligation of the Client.

3.0 THE SITE

Site Location

- 3.1 The site, which is centred on Ordnance Survey Grid Reference 417550,420540, is located off Leeds Road, Huddersfield.
- 3.2 A site location plan and aerial photograph are presented in Appendix A.

Site Description

- 3.3 The site currently comprises a recently vacated car showroom, surrounded by hardstanding. Lockup storage garages are present just inside the western boundary with a car washing bay adjacent. A rectangular open sided metal canopy structure is present in the northwest. High voltage overhead power cables cross the eastern end of the site. The site is predominantly under hardstanding of bituminous surfacing (“bitmac”) with localised crushed slate surfacing in the northern corner and dense vegetation along the southern and eastern perimeter. Numerous manholes are present on site, associated with the below ground services. A gas governor station is present at the boundary with Leeds Road. Photographs taken during the site walkover are presented in Appendix B.
- 3.4 At the western boundary, the site slopes steeply down to the east, towards the main building. The ground immediately surrounding the building is generally level, with a steep slope along the eastern boundary sloping down to the east towards the canal.
- 3.5 The site is bounded to the northwest by Leeds Road, to the south by a bowling green and a car park to a warehouse, a canal to the northeast, and commercial properties to the southwest.
- 3.6 During the site walkover, three above ground oil storage tanks were identified to the rear of the main building. Visual evidence of suspected oil staining was identified on the surface of

the hardstanding in front of the tanks. A large above ground tank, understood to contain Adblue, was also present nearby.

Site History

- 3.7 Ordnance Survey archive maps, presented in Appendix C, show that a small foundry was located in the northern corner from the 1950s until the 1990s and a row of houses was present along the boundary of Leeds Road from the 1880s until the 2000s. There is no indication of development across the remainder of the site until the construction of the existing building configuration in the 2000s. Off site land uses include a large sewage works with filter beds approximately 50m to the northeast, a quarry approximately 150m to the northwest, and a cotton mill 150m to the north.

4.0 ENVIRONMENTAL SETTING

Geology

- 4.1 Extracts from the British Geological Survey 1:50,000 Series Geology Maps are included within the Envirocheck Geology Report in Appendix D. The maps show the site to be underlain by Pennine Lower Coal Measures with no drift deposits. There are no faults shown to affect the site.

Coal Mining

- 4.2 A coal risk assessment does not form the scope of this report. However, Envirocheck records indicate that the Upper Staith Coal pit/shaft is located approximately 13m southwest of the site (at least 65m from the existing building). Therefore, any collapse of the fill within the shaft would not affect the existing building. However, if any future buildings are proposed in this area, further assessment would probably be required.

Hydrogeology

- 4.3 The Landmark Envirocheck Report indicates the Bedrock Aquifer Designation to be “Secondary A”.
- 4.4 There are no groundwater abstractions within 1km of the site.
- 4.5 The site is not within a groundwater Source Protection Zone.

Hydrology

- 4.6 There are no watercourses on site. However, the Calder and Hebble Navigation Huddersfield Broad Canal is present immediately east of the site, and the River Calder 55m to the east. Any

surface water run-off, which is not intercepted by drainage, is likely to eventually reach the canal.

- 4.7 There are four active surface water abstractions within 1km down gradient of the site, at approximately 98m to the east. These abstractions are associated with the chemical industry and are not considered to be sensitive.

Other Relevant Environmental Data

- 4.8 There are no closed or currently licensed landfills within 250m of the site.
- 4.9 There are two Pollution Control Authorisations within 250m of the site associated with a petrol filling station 9m north of the site (across Leeds Road) and a sewage works and a sewage sludge incinerator 165m to the northeast.
- 4.10 There is one Notification of Installations Handling Hazardous Substances (NIHHS) located within 250m of the site, associated with Zeneca PLC located 87m southwest of the site.
- 4.11 No radon protective measures are stated to be necessary for new buildings on the site, and the site is within a “lower probability radon area”.

5.0 PRELIMINARY RISK ASSESSMENT AND CONCEPTUAL MODEL

5.1 Part II A of the Environmental Protection Act (EPA) 1990 became effective from 1st April 2000. The Regime was introduced by the Contaminated Land (England) Regulations 2000 (SI 2000, No. 227) along with the associated DEFRA Circular February 2000.

5.2 Section 78A (2) of the Act defines "Contaminated land is any land in such a condition, by reason of substances in, on or under that land that –

(a) significant harm is being caused or there is a significant possibility of such harm being caused; or

(b) pollution of controlled waters is being caused, or there is a significant possibility of such pollution being caused".

From S78A (4) "Harm" : means harm to the health of living organisms or other interference with the ecological systems of which they form part and, in the case of man, includes harm to his property.

Controlled waters are defined as "...the waters in any relevant lake or pond, or of so much of any relevant river or watercourse as is above the freshwater limit, and ground waters, that is to say, any waters contained in underground strata". From the 1st October 2004, the definition of groundwater in relation to Part IIA was amended, by the Second Water Act Commencement Order SI 2004 No 2528. This makes clear that "ground waters" does not include waters above the saturation zone, i.e. does not include any soil water and pore water present in the unsaturated zone.

5.3 The objectives of the regime are to ensure that risks associated with contaminated land are reduced to an acceptable level, having regard to the costs of doing so. The costs should be proportionate, manageable and economically sustainable.

- 5.4 In assessing risk, it is necessary to consider the probability, or frequency, of occurrence of the hazard and the magnitude/seriousness of the consequences. Consequently, for land to be classified as contaminated, it must have, or be very likely to have, a detrimental effect on humans or the environment before it can be classified as contaminated land.
- 5.5 In establishing risk, the concept of the pollutant source/pathway/receptor linkage model, based on current and proposed site use, is to be considered. Therefore for a site to be deemed contaminated under the Regime, all three linkages must be in place i.e. the site must not only contain harmful substances, but the substances must have a pathway by which to leak out and cause significant harm to a receptor.
- 5.6 In September 2004, the Environment Agency published the Contaminated Land Report (CLR) 11, "Model Procedures for the Management of Land Contamination". The document is intended to provide the technical framework for structured decision making about land contamination, and is intended to assist all those involved in "managing" the land, in particular landowners, developers, financial service providers, planners and regulators. As the document currently provides the framework for best practice, the general principles are, therefore, followed in conducting the assessment below.
- 5.7 The categorisations of risk adopted in this report are adapted from CIRIA Report C552 (Contaminated Land Risk Assessment: A Guide to Good Practice, 2001). This approach assesses the potential severity of any pollution event and the probability of the event occurring, to arrive at a risk category, for the various potential source - pathway - receptor linkages. The relevant tables used, with the definitions, are presented in Appendix F.

Conceptual Site Model

- 5.8 It is known that, once the purchase of the site is complete, it shall remain as a car dealership. The site is shown to be underlain by Pennine Lower Coal Measures with no drift deposits. The solid strata beneath the site are designated a Secondary A Aquifer. There are no groundwater abstractions within 1km of the site. The nearest surface water is a canal located immediately

east of the site. There are no sensitive surface water abstractions within 1km downstream of the site.

- 5.9 The site has previously been occupied by a foundry in the northern corner, houses to the northwest, and latterly a car dealership, since the 2000s. Three above ground oil storage tanks were present during the site walk over. The most likely contamination sources are considered to be:

5.9.1 Possible made ground associated with historical foundry in the northeast: – metals inorganics, total petroleum hydrocarbons (TPH), polyaromatic hydrocarbons (PAH), phenol and asbestos.

5.9.2 Possible localised hydrocarbon contamination associated with above ground oil tanks: – total petroleum hydrocarbons (TPH), BTEX and MTBE.

5.9.3 Possible asbestos within existing buildings. However, as the building was built post-2000, the presence of asbestos within the building is considered to be unlikely.

- 5.10 The conceptual model needs to consider sources of contamination, pathways along which contaminants could migrate and the receptors, which may become exposed. Guidance published by the Environment Agency has been consulted with regard to pathways and receptors. The potential sources, pathways, and receptors, applicable to the proposed development are identified on the table below. Any pathways in italics are deemed not to be viable, and the reason given.

Potential Source - Pathway - Receptor Matrix (Finished Development)

Contamination Sources	Pathways	Receptors	Severity of Consequence	Probability of Event	Risk
Possible made ground associated with historical land use as a foundry and housing: - metals, inorganics, TPH, PAH, phenol	- Inhalation, ingestion and dermal contact with soil and dust <i>Fruit and vegetable intake, with soil (not applicable)</i> - Vapour inhalation outdoor - Vapour inhalation indoor	Humans:- - Future site users - Maintenance workers - Adjacent residents and general public	Medium	Low Likelihood	Moderate/Low
	Migration in surface water	Surface water (nearest immediately east. There are no abstractions within 1km).	Medium	Low Likelihood	Moderate/Low
	Migration in groundwater	Groundwater (Secondary A Aquifer, no abstractions within 1km)	Medium	Low Likelihood	Moderate/Low
	<i>Root uptake (minimal landscaping)</i>	Vegetation:- <i>Landscape areas</i> <i>Private gardens</i>	Mild	Unlikely	Very low
	Migration	Services/Utilities:- Potable water supply	Mild	Low Likelihood	Low
Localised hydrocarbon contamination associated with existing above ground oil tanks.	- Inhalation, ingestion and dermal contact with soil and dust <i>Fruit and vegetable intake, with soil (not applicable)</i> - Vapour inhalation outdoor - Vapour inhalation indoor	Humans:- - Future occupants - Maintenance workers - Adjacent residents and general public	Medium	Low Likelihood	Moderate/Low
	Migration in surface water	Surface water (nearest immediately east. There are no abstractions within 1km)	Medium	Low Likelihood	Moderate/Low
	Migration in groundwater	Groundwater (Secondary A Aquifer, no abstractions within 1km)	Medium	Low Likelihood	Moderate/Low
Possible asbestos within existing buildings and made ground	Inhalation	- Future occupants - Maintenance workers - Adjacent residents and general public	Severe	Low Likelihood	Moderate

- 5.11 The above matrix indicates there are several potential source – pathway – receptor linkages applicable to the proposed development, ranging from moderate/low to very low risk.
- 5.12 The assessment was used to inform the design of the subsequent ground investigation. To fully characterise the site, in accordance with BS10175 : 2011 + A2 : 2017 "Investigation of potentially contaminated sites - Code of practice", and to address the above concerns, it was decided that, in addition to geotechnical information required, the site investigation should include:
- 5.12.1 Windowless sample boreholes on a grid basis, preferably 25m spacing.
 - 5.12.2 Samples of the made ground issued for testing for a broad suite of determinands, including metals, inorganics, asbestos, phenols, speciated PAH, and TPH. It was determined that for selected samples MTBE and BTEX should also be tested for, due to the presence of above ground oil tanks.
 - 5.12.3 Upon receipt of contamination test results, any elevated TPH would be speciated to allow further risk assessment, and leachability testing undertaken on all elevated determinands, to give indication of mobility.

6.0 SITE INVESTIGATION

6.1 A site investigation was undertaken by ARP Geotechnical Ltd on 30th August 2019. The purpose of the investigation was to produce an assessment of the site in accordance with BS10175 : 2011 + A2 : 2017 "Investigation of potentially contaminated sites - Code of practice", and to provide geotechnical information to aid design of the development.

6.2 The site was gridded on a maximum 25m spacing and trial pits were excavated and sampled on the grid, to satisfy the requirements of the British Standard, along with any targeted locations. Eight windowless sample boreholes (WS1 to WS8) were excavated, to depths of between 1.65m and 5.45m and one hand pit (HP01) to 0.6m. The trial pits were organised, supervised and logged by an Engineer from ARP Geotechnical Ltd. Justifications for the trial pit locations are given below.

LOCATION	REASON
WS1	Target former foundry in the northern corner.
WS2 and WS8	General site coverage
WS3	Target above ground Adblue tank
WS4 and HP1	Target oil tanks with suspected oil staining at surface.
WS5 and WS6	Target carwash/valeting area.
WS7	Target former houses.

6.3 The borehole location plan and logs are included in Appendix G. It should be noted that the co-ordinates on the logs have not been surveyed in, but are automatically determined by the logging software (which incorporates mapping) following positioning of each location by the Engineer.

6.4 Chemical analysis of eight soil samples for metals, inorganics, speciated PAH, TPH, phenols, and asbestos was undertaken by the UKAS accredited Chemtech laboratory in County Durham. Elevated determinands were tested further for leachability to determine the potential mobility of the contaminants. The test certificates are included in Appendix H.

- 6.5 Analysis for Atterberg Limits and moisture content was undertaken by the UKAS accredited Professional Soils Laboratory (PSL) in Doncaster. Geochemical testing comprising pH and water soluble sulphate was undertaken by DETS. The test certificates are included in Appendix H.

7.0 SUMMARY OF GROUND CONDITIONS

Strata and Groundwater

- 7.1 The deposits present beneath the site, and the variation in the distribution of the strata, have been analysed with reference to the windowless boreholes (WS).
- 7.2 The ground investigation revealed bitmac cover across the majority of the site to between 0.08m and 0.18m depth, with localised crushed slate surfacing in the northwest to 0.15m depth. This was underlain by limestone hardcore to depths of between 0.2m and 0.35m.
- 7.3 The bitmac/hardcore was underlain by made ground comprising brown sandy gravel, with occasional clay including rare brick and concrete, to a maximum depth of 0.6m across the majority of the site, but down to at least 1.65m depth in the northwestern corner. Windowless sample WS1, located in the northern corner of the site, terminated on an obstruction within the made ground and hand pit HP01 was terminated within the made ground at 0.55m, due to an obstruction.
- 7.4 The made ground was underlain by residual soils derived from weathering of bedrock, comprising clay and occasionally sand, and proven to the maximum borehole depth of 5.45m.
- 7.5 Water ingress was observed within WS2, between 3m and 4m depth, WS5 from 4m depth, and WS7 from 4m depth.
- 7.6 No visual or olfactory signs of contamination were identified within the soil samples.

8.0 CONTAMINATION ANALYSIS

Screening Values - Soils

- 8.1 There is presently conflicting opinion with regard to the appropriate generic assessment criteria, or screening values, for soils which should be used in contamination assessment for proposed development. In March 2014, DEFRA published Category 4 Screening Levels (C4SLs) for six contaminants: arsenic, benzene, benzo(a)pyrene, cadmium, chromium VI and lead. The values are based on the toxicological benchmark of a "low level of toxicological concern" (LLTC) rather than the previous regulatory approach of "minimal or tolerable level of risk". As the C4SLs are less protective of health than the previous approach, the Chartered Institute of Environmental Health (CIEH) has advocated an alternative approach based on minimal risk, but with some adjustment of exposure parameters to more realistic scenarios than those previously used. To this end, the CIEH has collaborated with Land Quality Management to publish "Suitable 4 Use Levels" (S4ULs) "The LQM/CIEH S4ULs for Human Health Risk Assessment", November 2014 (LQM/CIEH). However, DEFRA has reiterated its intention that the C4SLs should be used in generic risk assessment for proposed development, and there is indication that other parties will collaborate, in the near future, to extend the range of C4SL determinands beyond the six published so far.
- 8.2 In the absence of a final resolution to the debate, soil contamination test results in this report have been compared first against the more conservative S4UL, and where a C4SL exists for the same determinand, consideration given to the use of the C4SL for any exceedences of the S4UL, within the site specific context. Where no S4UL exists for a determinand, for example lead, the C4SL has been used. The LQM/CIEH screening values have been calculated for soil organic matter contents of 1% and 2.5%, as well as 6%, and the appropriate screening value is used for the organic matter content of the soil. All the C4SL values published are for a soil organic matter content of 6%.
- 8.3 A table showing the screening values utilised is included in Appendix H.

Soils Analysis

- 8.4 Eight samples of Made Ground (from HP1, WS1, WS2, WS3, WS4, WS6, WS7 and WS8) were issued to Chemtech for the suite of testing (As, Cd, Cr (VI), Cr(III), Cu, Hg, Ni, Pb, Se, Zn, Total Sulphate, Water Soluble Sulphate, pH, Phenol-monohydric, Speciated PAH, Total TPH, Asbestos, and Organic Matter). It was not considered necessary to test any samples for BTEX or MTBE, as there was no visual or olfactory evidence of any oil/fuel contamination.
- 8.5 The results show all determinands to be below the screening values for commercial sites, indicating the soils are compatible with this use, and no remediation is required.

Updated Risk Assessment and Conceptual Model

- 8.6 The conceptual model can be updated to take account of the findings of the site investigation and laboratory tests. The main refinements are given below.
- 8.6.1 Contamination testing of made ground revealed all determinands to be below current best practice screening values for commercial use. There was no visual or olfactory evidence of any oil or fuel contamination of the ground samples inspected. Therefore, the risk to future site users (assuming land use remains as a car dealership) is considered to be Very Low.
- 8.6.2 Based on the absence of contamination identified within the made ground the risk to offsite groundwaters is considered to be Very Low.
- 8.6.3 Although sufficient investigation has been carried out to characterise the site, there is a slight residual risk that localised contamination may be present between investigation locations, as with any previously developed sites. If any future works encounter suspected contamination, a Geo-environmental Engineer should be contacted for advice.

9.0 GEOTECHNICAL TESTING

- 9.1 Selected samples of the natural strata were delivered to PSL in Doncaster for testing with regard to plasticity indices and moisture content. Test certificates are presented in Appendix H and a summary of the results, including Modified Plasticity Indices, is given below.

Location	Depth (m)	MC	LL	PL	PI	<425µm	I'p
WS7	1.3	19	37	18	19	95	18.1
WS8	1.6	11	38	18	20	100	20.0
Number of results		2	2	2	2	2	2
Min.		11	37	18	19	95	18.1
Max.		19	38	18	20	100	20.0

I'p	VCP
>40%	High
20% - <40%	Medium
10% - <20%	Low

MC= Moisture Content (%) LL= Liquid Limit (%) PL= Plastic Limit (%)
 PI= Plasticity Index (%) I'p= Modified PI (%) VCP= NHBC Standard Chapter 4.2 Volume Change Potential

- 9.2 The plasticity test data shows the clay strata to be of intermediate plasticity, in accordance with BS 5930 : 2015 "Code of Practice for Site Investigations". When the percentage retained on the 425 micron BS sieve is considered, the Modified Plasticity Index, in accordance with NHBC Standard Chapter 4.2 "Building Near Trees" is a maximum of 20. In accordance with the Standard, this equates to Medium Volume Change Potential.
- 9.3 Geochemical testing (water soluble sulphate and pH) was undertaken on selected samples by DETS, comprising two samples of natural strata and eight samples of made ground. In accordance with the BRE Special Digest 1 "Concrete in aggressive ground", the characteristic values for the two materials are given below:

Characteristic Values

Material	pH	SO ₄
Made Ground	8.7	90.5
Natural Strata	7.4	65

SO₄ = Sulphate content in mg/l on a 2:1 water : soil extract pH = Acidity

- 9.4 The geochemical analyses show the natural strata to have low water soluble sulphate content and near neutral pH. The Aggressive Chemical Environment for Concrete (ACEC) class is AC-1. Therefore, the use of GEN1 designated concrete will be satisfactory for unreinforced buried concrete. For any reinforced buried concrete, other design-specific mixes will apply.

10.0 COMMENTS AND CONCLUSIONS

Site Description

- 10.1 The site currently comprises a recently vacated car dealership surrounded by hardstanding with garages and car washing bay in the west and a rectangular open sided metal canopy structure in the northwest. Overhead high voltage power cables cross the eastern end of the site. The site is predominantly under hardstanding of bitmac, with localised crushed slate surfacing in the northern corner and dense vegetation along the southern and eastern perimeter. Numerous manholes are present on site associated with the below ground services. Three above ground oil storage tanks were identified to the rear of the main building.

Site History

- 10.2 Ordnance Survey archive maps show that a small foundry was located in the northern corner from the 1950s until the 1990s, and a row of houses was present along the boundary of Leeds Road from the 1880s until the 2000s. The remainder of the site was undeveloped until the construction of the existing buildings in the 2000s.

Geology

- 10.3 The geological map shows the site to be underlain by Pennine Lower Coal Measures with no drift deposits. No coal seams are conjectured to outcrop near the site. There are no faults shown to affect the site.

Coal Mining and Coal Recovery

- 10.4 A coal risk assessment does not form the scope of this report. However, Envirocheck records indicate that the Upper Staith Coal pit/shaft is located approximately 13m southwest of the site. The shaft is at least 65m from the existing building. Therefore, any collapse of the fill

within the shaft would not affect the existing building. However, if any future buildings are proposed in this area, further assessment would probably be required.

Environmental Data

- 10.5 The strata beneath the site are classed as a Secondary A Aquifer. There are no groundwater abstractions within 1km of the site.
- 10.6 There are no watercourses on site. However, the Calder and Hebble Navigation Huddersfield Broad Canal is present immediately east of the site, and the River Calder 55m to the east. There are no surface water abstractions within 1km of the site.
- 10.7 No radon protective measures are required for any future proposed development on the site.
- 10.8 There are no landfills within 250m of the site. Therefore, it is unlikely that landfill gas protection measures would be required for any future proposed development.

Ground Conditions Encountered

- 10.9 The ground investigation revealed bitmac cover across the majority of the site, to depths between 0.08m and 0.18m, with localised crushed slate surfacing in the northwest to 0.15m depth. This was underlain by limestone hardcore to depths of between 0.2m and 0.35m. The bitmac/hardcore was underlain by made ground of sandy gravel, with occasional clay including rare brick and concrete, to a maximum depth of 0.6m across the majority of the site, but down to at least 1.65m depth in the northwestern corner. No visual or olfactory signs of contamination were identified.
- 10.10 The made ground was underlain by residual soils derived from weathering of bedrock, comprising clay and occasionally sand, and proven to the maximum borehole depth of 5.45m.

Contamination Assessment

- 10.11 The results show all determinands to be below the screening values for commercial sites, indicating the soils are compatible with this use, and no remediation is required.
- 10.12 Although sufficient investigation has been carried out to characterise the site, there is a slight residual risk that localised contamination may be present between investigation locations, as with any previously developed site. If any future works encounter suspected contamination, a Geo-environmental Engineer should be contacted for advice.

Foundations

- 10.13 It is understood that no development work is proposed at this stage. However, should any development be undertaken in the future, then the following advice on foundations is provided.
- 10.14 The natural residual soils are considered suitable to provide support for strip/trench fill or pad foundations. An allowable bearing pressure of 100kN/m² is considered acceptable.
- 10.15 The clays were shown to be of medium volume change potential. Therefore, shrinkability of soils will need to be considered in relation to foundation depth and any existing or proposed trees and hedges.
- 10.16 The foundation should be taken below the depth of any existing foundations or obstructions, onto natural ground. The whole plan area of the foundation should be placed on similar natural material.
- 10.17 As the ground slopes away from the site at the eastern boundary, slope stability should be taken into account for any development proposal in this area.

Excavations

- 10.18 If excavation works are required for any future development, it is likely that excavations into the natural strata will remain stable in the short term, requiring minimal trench support, in accordance with the prevailing statutory guidance. However, instability may be anticipated within any made ground present on the site.
- 10.19 Water ingress was observed within WS2 between 3m and 4m depth, WS5 from 4m and WS7 from 4m depth. Any such encounters should be controllable by pumping from an artificial sump.
- 10.20 Excavations should be readily achieved using conventional hydraulic plant. However, excavations into intact any buried foundations and structures are likely to require a hydraulic breaker. The requirements of the Party Wall Act should be observed in relation to excavations in the vicinity of adjacent property.

Chemical Precautions

- 10.21 The Aggressive Chemical Environment for Concrete (ACEC) class is AC-1 for both the natural strata and made ground. Therefore, the use of GEN1 designated concrete will be satisfactory for unreinforced buried concrete for any future constructions, in accordance with BS 8500-1:2006. For any reinforced buried concrete, other design-specific mixes will apply.