COMBINED STAGE 1/STAGE 2

GEO-ENVIRONMENTAL REPORT

AT

FORMER HOYLE ING DYE WORKS
MANCHESTER ROAD
LINTHWAITE

ON BEHALF OF

HIGHSTONE BUILDING SERVICES LTD

AND

REDWATERS DEVELOPMENTS

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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 Development	Mixed residential properties with gardens and landscaping.
Existing Site Description	Rough ground with two dilapidated former mill buildings and a chimney. Site is stepped, with large retaining walls.
Site History	Dye works from 1890s. Most buildings demolished by 2016.
Geology	Sandstone of the Midgley Grit Formation. No superficial deposits. Northwest southeast trending fault across southern tip of the site.
Coal Mining	The site is not in a coal mine reporting area – considered stable.
Radon	No radon protection required.
Landfill Gas	No landfills within 250m of the site, only a quarry 100m away upslope. No gas protection measures considered to be required, subject to regulatory agreement.
Ground Conditions	Up to 3m of made ground, generally less than 1m, over cohesive and granular residual soils. Bedrock shallow as 0.1m locally.
Contamination	Elevated lead, PAH and chrysotile asbestos fibres. Localised naphthalene (which can migrate as vapours).
Remediation Strategy	Some limited topsoil to remove. 0.6m clean soil cover to soft areas, retention below hard areas. Exclude made ground at TP2 and TP11 from below building footprints, unless further testing demonstrates this is not required.
Foundations	Piles likely to be required in Area B due to impact on proposed retaining wall. Tree survey required. Strip/trench foundation in Area A, with exception of any foundations in backfilled basement – alternatives such as piles or reduced level excavation required.
Excavations	Liable to collapses within localised areas of deep made ground.
Concrete	FND2z designation for unreinforced foundations. For any reinforced concrete, other design-specific mixes will apply.
Soakaways	Not considered to be suitable.

Road Pavement	Design CBR of 2.5% is considered applicable, below any obvious soft spots, and at equilibrium moisture content. On granular material or rock, CBRs in excess of 15% are anticipated.

2.0 TERMS OF REFERENCE

2.1 Highstone Homes Ltd and Redwaters Developments are considering developing the site at Manchester Road, Linthwaite with a mixed residential development. It was considered appropriate to implement a desk study and ground investigation to provide information to aid the planning process, viability assessment, and design of any subsequent development.

2.2 ARP Geotechnical Ltd was appointed by Highstone Building Services Ltd and Redwaters Developments to carry out the investigation, which involved a desk study assessment of the geological and coal mining aspects, Ordnance Survey archive maps, radon gas, indicative flood risk, 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.

2.3 The investigation was implemented generally in accordance with BS 5930:2015 +A1:2020 "Code of practice for site investigations", NHBC Standard Chapter 4.1 "Land quality - managing ground conditions", Environment Agency LCRM “Land Contamination Risk Management" 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.

2.8 The report refers to, and includes, a copy of an indicative proposed layout. This is only for the purposes of generating a conceptual site model for the contamination risk assessment. Unless the proposed layout changes significantly, such that the conceptual model and risk assessment is affected, there is no requirement to re-issue this report when the layout is revised.

3.0 SITE DESCRIPTION

Site Location

3.1 The site, which is centred on Ordnance Survey Grid Reference 409810, 414530, is located at the corner of Manchester Road and Hoyle Ing in Linthwaite.

3.2 A site location plan and aerial photograph are presented in Appendix A.

3.3 A walkover survey was conducted on 9th February 2021. Details obtained from the walkover are discussed below. Photographs taken during the site walkover are presented in Appendix B.

On-Site Features

3.4 The site has overall dimensions of approximately 56m (northwest - southeast) by 70m (northeast -southwest).

3.5 The site can be split into two distinct areas due to the significant level differences present across the site. Area A, the northwestern two thirds, comprises rough ground with two dilapidated buildings and a 160m high chimney. Area B, the southeastern third of the site, comprises rough ground with dense vegetation.

3.6 Area A slopes gently from southeast to northwest, from 131m AOD down to 130m AOD at the boundary with Manchester Road. Area B is between 4m and 6m higher than Area A, with the difference in level accommodated by an approximately 6m high sandstone retaining wall along the northeastern third of the division and a brick retaining wall of approximately 4m height along the southwestern two thirds. The existing buildings in Area A also form part of the retaining wall. The northeastern end of Area B is generally level at approximately 136.3m AOD. The southwestern end of Area B is split across two levels, with a second brick retaining wall of approximately 3m high present, parallel with the lower brick retaining wall. Cross sections are included in Appendix H.

3.7 The northwestern face of the brick retaining wall near the middle of the site is visibly damaged, with the wall bowing outwards.

Site Boundaries and Surrounding Land Use

3.8 The site is bounded by Manchester Road to the northwest, commercial and residential buildings to the northeast, residential to the southeast, and Hoyle Ing along the southwest with a business and woodland beyond.

3.9 A retaining wall, at between 4m and 8m high is present along the northeastern and southeastern boundaries of the site, retaining higher ground off site.

Site History

3.10 Ordnance Survey archive maps were obtained for the site. Copies of the maps are included in Appendix C, and a summary of the findings is given below.

Map Date	**On-Site**	**Off-Site**
1851	No development on site.	Quarry approximately 200m southwest. Woollen mill approximately 100m northwest.
1892	Area A - Hoyle Ing Dye works with a tank and a chimney. Area B - Small building.	Quarry has expanded to within approximately 50m of the site boundary. Brick works across the road to the southwest.
1906	No significant change.	No significant change.
1916	Club labelled in southwestern corner of Area B.	No significant change.

1962	Dye Works occupies the majority of Area A. More buildings in Area B.	Quarry to the southwest now disused. Partially infilled with houses within southern end of former quarry. Royd House Tip annotated towards the centre of the quarry at approximately 150m from site.
1985	Buildings cover the whole site.	Two garages at approximately 100m to the west.
1992	No significant change.	Quarry now wooded. Business park at western boundary (former brick works). Garages at approximately 100m to the west now labelled works. Garage at approximately 250m to the southwest.
2016 (Aerial Image)	Majority of the buildings in Area A have been demolished with only two buildings and the chimney remaining. All buildings in Area B.	No significant change.
2021	No significant change	No significant change.

3.11 In summary, a dye works with a tank and a chimney occupied most of the site from the 1890s, with a club and several other buildings in Area B. The majority of the buildings were demolished by 2016. There will be the legacy of buried structures, foundations, services, and possibly basements, from the existing and previous development. A large quarry extended to within 100m of the southwestern boundary of the site from the 1850s until the 1960s. The quarry was partially filled by the 1960s, with houses constructed at the southern end of the quarry. A tip was noted towards the centre of the quarry, approximately 100m from the site boundary, on historical OS plans between 1960s and 1980s. The quarry is now a predominantly wooded area with houses to the south.

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 sandstone of the Midgley Grit Formation, with no superficial deposits.

4.2 The maps indicate a northwest southeast trending fault across the southern tip of the main site.

Coal Mining and Mineral Extraction

4.3 The site is not in a coal mine reporting area.

4.4 There are three BGS recorded mineral sites within 250m of the site at 125m southwest (Hoyle House), 204m south (Linthwaite brick works) and 216m southwest (Hollywell) all associated with the opencast mining of sandstone.

Hydrogeology

4.5 The Landmark Envirocheck Report, included in Appendix E, indicates the Bedrock Aquifer Designation to be a "Secondary A" Aquifer. These Aquifers comprise "permeable layers capable of supporting water supplies at a local rather than strategic scale, and in some cases forming an important source of base flow to rivers".

4.6 There are fifteen recorded groundwater abstractions within 1km of the site, with the nearest at 33m to the north and the furthest 970m to the west. The abstractions are generally for textiles with others for general cooling and general farming and domestic. However, only two are down hydraulic gradient of the site (to the northeast) and these are for non-sensitive uses.

4.7 The site is within groundwater Source Protection Zone II (Outer Zone).

Hydrology

4.8 The site lies on the southeastern flank of the valley of the River Colne, which flows from southwest to northeast. The nearest downslope surface water is the River Colne, 36m northwest of the site.

4.9 The site is not in an area at risk from river flooding. The risks of flooding from other causes such as adverse topography or insufficient surface water drainage, are not considered here. If such risk needs to be quantified, a separate specialist Flood Risk and Drainage Report should be commissioned, if not already available. BGS data indicates "limited potential for groundwater flooding of property to occur.

4.10 There are two active surface water abstractions within 1km down gradient of the site, at approximately 648m and 928m to the northeast. However, the abstractions are for textiles - non-sensitive industrial purposes.

Other Environmental Data

4.11 The Landmark Envirocheck Report, included in Appendix E, contains information on numerous environmental aspects. A summary of the pertinent findings, not already covered, with additional comments, is given below.

4.11.1 There are three Integrated Pollution Prevention and Control associated with the former Dye Works on site.

4.11.2 There is one Local Authority Pollution Prevention and Control within 250m of the site. The authorisation is located 5m to the north and is an Air pollution Control for wood coating.

4.11.3 There are no discharge consents relating to, or adjacent to, the site.

4.11.4 There are no closed or currently licenced landfills within 250m of the site. However, there is a potential infilled quarry which extended to within 100m of site boundary. A tip was noted towards the centre of the quarry, approximately 100m from the site boundary, on historical OS plans between 1960s and 1980s.

4.11.5 No radon protective measures are stated to be necessary for new dwellings or extensions on the site, and the site is within a “lower probability radon area”.

4.11.6 There are no contemporary trade directory entries relating to any activities which could have significant impact on the site.

4.11.7 There are no fuel station entries within 250m of the site.

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 The Environment Agency has published guidance on contaminated land, in the form of online documents referred to as LCRM “Land Contamination Risk Management". The documents are intended to provide the technical framework for structured decision making about land contamination, and to assist all those involved in "managing" the land, in particular landowners, developers, financial service providers, planners and regulators. As the documents currently provide 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 the site is proposed for a mixed residential development including potential private gardens, but also communal landscaping. An indicative proposed site layout is included in Appendix G. The site is shown to be underlain by sandstone of the Midgley Grit Formation, with no superficial deposits. The solid strata beneath the site are designated a

Secondary A Aquifer. There are no sensitive groundwater abstractions within 1km down hydraulic gradient of the site. There are no sensitive surface water abstractions within 1km downstream of the site.

5.9 The site has been occupied by a dye works since the 1890s. The most likely contamination sources are considered to be:

5.9.1 Possible made ground: – metals inorganics, total petroleum hydrocarbons (TPH), polyaromatic hydrocarbons (PAH), phenol and asbestos.

5.9.2 SVOCs and VOC associated with Dye works

5.9.2 Possible asbestos within existing buildings.

5.9.3 Possible harmful gases from infilled quarry within 250m: - methane, carbon dioxide. There are no landfills indicated to be present within 250m of the site, but historical maps indicate that a quarry, which extended to within 100m of the southwestern end of the site, was briefly used as a tip. However, the former quarry is at a significantly higher elevation than the site. Levels obtained from Google Earth indicate that the area of the former quarry is at approximately 159mAOD whilst the highest point on site is approximately 137mAOD. The risk of soil gas migrating 100m laterally and down a minimum 22m drop in level, through sandstones without any cap of drift deposits, is considered to be negligible. Therefore, the site is not considered to be at risk from gas generation associated with the potentially infilled quarry.

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: - metals, inorganics, TPH, PAH, phenol SVOCs and VOC associated with former use of the site as a Dye works	• Inhalation, ingestion and dermal contact with soil and dust	**Humans:-** • Future occupants • Maintenance workers • Adjacent residents and general public	**Medium**	**Low Likelihood**	**Moderate/ Low**
	• Fruit and vegetable intake, with soil	**Humans (as above)**	**Medium**	**Low Likelihood**	**Moderate/ Low**
	• Vapour inhalation outdoor	**Humans (as above)**	**Medium**	**Low Likelihood**	**Moderate/ Low**
	• Vapour inhalation indoor	**Humans (as above)**	**Medium**	**Low Likelihood**	**Moderate/ Low**
	• Migration in surface water	• Surface water (nearest downslope 36m northwest. There are no sensitive abstractions within 1km downstream.	**Mild**	**Unlikely**	**Very Low**
	• Migration in groundwater	• Groundwater (Secondary A Aquifer, no sensitive abstractions within 1km down gradient)	**Mild**	**Unlikely**	**Very Low**
	• Root uptake	**Vegetation:-** • Landscape areas • Private gardens	**Medium**	**Low Likelihood**	**Moderate/ Low**
	• Migration	**Services/Utilities:-** • Potable water supply	**Medium**	**Low Likelihood**	**Moderate/ Low**
Backfilled quarry 100m to the southwest:- methane and carbon dioxide	• Asphyxiation • Explosive risk	• Construction/de-molition workers • Future occupants • Buildings	**Negligible**		
Possible asbestos within existing buildings and possible 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 to 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 Trial pit excavations on a grid basis, preferably 25m maximum 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 VOCs, SVOCs and PCBs should also be tested for, due to the historical presence of a dye works on the site.

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 9th March 2021. 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 sampled on the grid, to satisfy the requirements of the British Standard, along with any targeted locations. Thirteen trial pits (TP1 to TP13) were excavated, to depths of between 0.4m and 3.9m. 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
TP2 and TP13	Inside existing building in Area A.
TP1, TP3,TP4, TP5 and TP12	General grid within Area A.
TP6 and TP7	Expose and inspect foundations of retaining walls. General grid within Area A.
TP8 and TP9	Establish ground conditions at the top of the retaining wall. General grid within Area B.
TP10 and TP11	General grid within Area B. Location of former club.

6.3 The trial pit logs are included in Appendix H, along with the location plan. 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 twelve soil samples for metals, inorganics, speciated PAH, TPH, phenols, and asbestos was undertaken by the UKAS accredited Chemtest Laboratory in Newmarket. Elevated determinands were tested further for leachability to determine the potential mobility of the contaminants. Selected samples were also tested for SVOCs/VOCs and PCBs due to the

historical land use as a dye works. Asbestos quantification was undertaken for samples that detected asbestos fibres. The test certificates are included in Appendix J.

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 Chemtech. The test certificates are included in Appendix J.

7.0 SUMMARY OF GROUND CONDITIONS

Strata and Groundwater

7.1 In Area A (average elevation of 130.5m AOD), the ground investigation revealed granular made ground from the surface to generally less than 1m depth, but up to a depth of 3m (127.5m AOD) in TP4. Sporadically, the made ground was only between 0.05m and 0.25m thick and comprised topsoil. The made ground in TP4 included many whole bricks, metal, concrete etc., and a brick wall was visible in the southwestern face. This is likely to be an infilled basement associated with the buildings which covered the whole footprint of the site. A 0.2m thick reinforced concrete slab was present within the main building (TP2), a concrete slab was also encountered at TP13, at between 0.4m and 0.7m depth and in TP12 at between 0.1m and 0.4m depth. In Area B, which is between approximately 4m and 6m higher than Area A, the ground investigation revealed granular made ground from the surface to depths of between 0.2m (136.1mAOD) and 1.8m depth (135.1mAOD).

7.2 In Area A, the made ground was underlain by natural granular and cohesive residual soils to depths of between 0.1m (130.80mAOD) and 3.0m depth (127.8mAOD), below which intact sandstone bedrock was present, interpreted to be the Midgely Grit Formation. Intact bedrock was encountered at less than 0.3m depth in TP5 and TP6. In Area B, the made ground was underlain by natural cohesive and granular soils to between 1.7m (130.4mAOD) and 3.9m depth (133.10mAOD). In TP8 the cohesive residual soil was soft down to 2.5m depth (134.4mAOD) and was noted as being wet. TP8 terminated at 3.9m depth (133mAOD) on hard strata interpreted to be sandstone bedrock. Intact bedrock was encountered at 0.2m depth in TP9.

7.3 Visual or olfactory signs of contamination were identified at two locations during the site investigation. In TP2, located within the larger building in Area A, a tarry residue with a slight odour was detected directly beneath the floor slab. In TP8, located at a higher level within Area B, ashy material was identified within the made ground.

7.4 The excavations into natural deposits generally remained stable for the short period of exposure and the pits were backfilled with the arisings on completion. However, instability was

observed during excavations within the made ground inTP3, TP4 and TP8. No noticeable groundwater was identified during the site investigation. However, the soils within TP8 were described as being moist between 2.5m (134.4mAOD) and 3.8m (133.1mAOD) depth.

Retaining walls

7.5 Excavations were undertaken to expose the foundations of the sandstone block retaining wall at TP6 and the brick retaining wall at TP7. Excavations were also undertaken at the higher level in Area B adjacent to the top of the retaining wall to establish ground conditions. The logs and foundations sketches are presented in Appendix H and the observations are summarised below;

- The foundations for the brick retaining wall near TP7 were found to be less than 250mm deep, and founded on granular residual soils of gravelly sand, with many angular cobbles and boulders. The ground conditions at TP8 at the higher level (not directly above TP7) comprised made ground to 1.8m depth overlying residual soils of soft clay to 2.5m and a mix of cohesive and granular residual soils to 3.9m. The soil was wet from 2.5m to 3.6m.
- The sandstone block retaining wall near TP6 was founded directly on intact sandstone bedrock at approximately 0.2m depth. Trial pit TP9, at the higher elevation above to the retaining wall, identified intact sandstone bedrock at 0.2m depth.

7.6 The northwestern face of the brick retaining wall, near the location of TP7 is visibly damaged, with the wall bowing outwards.

8.0 CONTAMINATION ASSESSMENT

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 issue, 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 exceedances of the S4UL, within the site specific context (including the use of benzo(a)pyrene as a surrogate marker for genotoxic PAH compounds, where appropriate). 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 J.

Screening Values - Leachability and Groundwater

8.4 In order of preference, the Environmental Quality Standards (EQS) annual averages for freshwater have been used as generic screening values for these results. Where no EQS is available, the stringent UK Drinking Water Standards (DWS) have been used, and other sources in the absence of EQS and DWS, as indicated on the groundwater screening values table in Appendix J.

Soils Analysis

8.5 Twelve soil samples were issued to the UKAS accredited Chemtest Laboratory in Newmarket for a 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). The testing comprised:

- Three samples of made ground topsoil from TP1, TP6, and TP7
- Eight samples of Made Ground from TP2, TP3, TP4, TP5, TP8, TP9, TP10 and TP11
- One natural sample from TP8

8.6 Due to the historical use of the site as a dye works, TP2, TP4, and TP8 were also tested for PCBs, VOCs and SVOCs.

8.7 For made ground, any determinands with exceedances of screening values were subjected to statistical analysis to determine the 95% Upper Confidence Level (UCL). Statistical analysis of the made ground topsoil results, and the sample of natural strata, was not possible given the small number of samples obtained, although appropriate for the site circumstances.

Topsoil

8.8 A results summary table for determinands within the topsoil found to be above screening values is given below

Location	Depth (m)	Lead	Asbestos
TP1	0.1-0.2	24	NAD
TP6	0.1-0.2	110	NAD
TP7	0-0.05	300	Chrysotile
Screening Values		**200**	-

Exceedance

Values are in mg/kg unless indicated otherwise

8.9 It can be seen from the table that elevated lead, at 300mg/kg, is present within the topsoil made ground at TP7. Asbestos fibres of chrysotile were also identified within TP7. Asbestos quantification was undertaken on this sample to confirm the volume of asbestos. The total percentage of asbestos was determined to be 0.002%. The elevated lead and asbestos fibres within the topsoil will need to be considered further in the risk assessment.

Made Ground

8.10 A results summary table for determinands within the made ground found to be above screening values is given on the following page. There were some exceedances of genotoxic PAH compounds, but the dataset supports the use of benzo(a)pyrene (BaP) as a surrogate marker. Therefore, the other genotoxic PAH compounds are not considered further individually, in accordance with C4SL guidance. A results summary table for the determinands found to be above screening values is given below. The organic matter (OM) contents were taken into account, with each sample checked against appropriate screening values for the OM content present within the sample, unless the OM content result was deemed to be inappropriate due to interference from coal, ash or petroleum hydrocarbons.

Made Ground – Determinands With Exceedances

Location	Depth	BaP	Naph	Lead	Arsenic	Asbestos	OM
TP2	0.4-0.5	36	52	520	27	ND	5.5
TP3	0.1-0.3	0.7	1.1	88	18	ND	4.3
TP4	1.3-1.4	0.95	0.51	250	12	ND	3.3
TP5	0.1-0.3	0.47	0.4	250	7.3	ND	1.2
TP8	1.1-1.2	0.1	0.4	85	200	Chrysotile	26
TP9	0.1-0.2	0.1	0.1	24	5	Chrysotile	0.91
TP11	0.3-0.4	17	11	29	26	ND	11
TP13	0.3-0.4	2.2	0.63	23	12	ND	3.3
Screening Values		**5**	**5.6**	**200**	**37**		
95% UCL		**47.0**	**71.8**	**477**	**139.8**		
95% UCL Minus Outliers			**8.6**		**21.7**		

Exceedance
Outlier

BaP – Benzo(a)Pyrene
Naph – Naphthalene
Values are in mg/kg unless indicated otherwise

8.11 It can be seen from the table that six out of eight samples of the made ground contained determinands elevated above screening values. The 95% UCL concentrations of benzo(a)pyrene and lead are above the screening values, with no outliers. Therefore, the made ground should be considered as a whole in terms of risks to human health, i.e. attempting to isolate areas of "cleaner" made ground from the results would be inappropriate.

8.12 Naphthalene is elevated at two locations: - TP2 within the larger building in Area A, and TP11 located at the higher level in Area B. The risk driver for this determinand is vapour migration to indoor air. This will need to be considered further in the risk assessment. The material within TP2 is potentially up to around 0.6m thick, directly beneath the floor slab, to a depth of 0.8m. A tarry odour was noted at this depth. The PAH double ratio plot for this sample indicates the source to be derived from combustion likely to be associated with the former land use as a dye works. The material within TP11 has marginally elevated concentration, and is potentially up to around 0.5m thick. There was no indication of any odour within the material at this location. The PAH double ratio plot for this sample indicates the source to be coal within the made ground. PAH double ratio plots are included in Appendix J.

8.13 PCBs and VOCs were found to be either below detection limits or below appropriate screening values. Detectable concentrations of 2 methylnapthalene, Dibenzofuran and Carbazole were detected within TP2 which are all derived from coal tar. This is consistent with the historical land use as a dye works. The concentrations are very low and the determinands are not significantly volatile.

Asbestos

8.14 Asbestos fibres as chrysotile were detected within made ground at TP8 and TP9, in Area B. Quantification analysis confirmed that the asbestos volume at both locations was below detection limit (<0.001%). This will need to be considered further in the assessment.

Water/Leachability Analysis

8.15 Leachability testing was carried out on the samples from TP2 and TP13 showing elevated PAH and lead respectively. The laboratory test certificates are presented in Appendix J. The analysis shows the determinands have negligible leachability. Therefore, if the contamination was to be retained on site below a cover material, the contamination would be effectively immobile with respect to water/groundwater transport.

Updated Risk Assessment and Conceptual Model

8.16 The updated source – pathway – receptor matrix is presented below, taking into account the findings of the investigation. Any pathways in italics are deemed not to be viable, and the reason given.

Viable Source - Pathway - Receptor Matrix (Finished Development)

Contamination Sources	Pathways	Receptors	Severity of Consequence	Probability of Event	Risk
Made ground - Elevated lead, PAH, arsenic Made Ground - Naphthalene at TP2 (high) and TP11 (marginal) Topsoil - elevated lead	• Inhalation, ingestion and dermal contact with soil and dust	**Humans:-** • Future occupants • Maintenance workers • Adjacent residents and general public	**Medium**	**Low Likelihood**	**Moderate/ Low**
	• Fruit and vegetable intake, with soil	**Humans (as above)**	**Medium**	**Low Likelihood**	**Moderate/ Low**
	• *Vapour inhalation outdoor (Negligible by this pathway)*	**Humans (as above)**	**Negligible**		
	• Vapour inhalation indoor – TP2 Only	**Humans (as above)**	**Medium**	**Low Likelihood**	**Moderate/ Low**
	• *Migration in surface water (Leachability found to be negligible)*	• Surface water (nearest downslope is 36m to northwest. No abstractions within 1km)	**Negligible**		
	• *Migration in groundwater (Leachability found to be negligible)*	• Groundwater (Secondary A Aquifer, no abstractions within 1km)	**Negligible**		
	• Root uptake	**Vegetation:-** • Landscape areas • Private gardens	**Medium**	**Low Likelihood**	**Moderate/ Low**
	• Migration	**Services/Utilities:-** • Potable water supply	**Medium**	**Low Likelihood**	**Moderate/ Low**
Asbestos fibres within the made ground and topsoil made ground.	• Inhalation	• Future occupants • Maintenance workers • Adjacent residents and general public	**Severe**	**Low Likelihood**	**Moderate**
Possible asbestos within existing buildings.	• Inhalation	• Future occupants • Maintenance workers • Adjacent residents and general public	**Severe**	**Low Likelihood**	**Moderate**

8.17 It can be seen from the above matrix that several pathways to receptors are operative, with moderate risk applicable and this may affect users of the finished development. Some form of remedial action is, therefore, considered necessary to allow residential development without excess risk.

Risk Based Assessment of Remedial Options

Asbestos Within Existing Buildings

8.18 Provided an asbestos survey is carried out prior to any work on, or demolition of, the existing buildings on the site, and any identified asbestos is removed and disposed to a licenced facility, then the risk to receptors is low. The work should be carried out by appropriately qualified Contractors.

Topsoil made ground (lead and asbestos) - Ingestion, Dust Inhalation, Dermal Contact, Root Uptake, and Fruit and Vegetable Intake With Soil

8.19 The minimal topsoil made ground present on site is not suitable for re-use on the site. As topsoil is a poor engineering material, and cannot be placed under a cover blanket system due to the potential for gas generation, the material should be removed from site.

Made Ground (lead, asbestos and PAH, excluding naphthalene) - Ingestion, Dust Inhalation, Dermal Contact, Root Uptake, and Fruit and Vegetable Intake With Soil.

8.20 This pathway is automatically blocked where buildings or hardstanding are present above the material. However, in garden and landscaped areas, provision of a cover blanket of a minimum 0.6m thickness will be required, to reduce the risk to future users of the site to acceptable levels from these pathways. This assumes a worst case double dig scenario (i.e. 2 x spade depths). However, to prevent inadvertent future exposure due to other forms of excavation such as tree planting or construction of ponds, a hard break layer or robust geogrid/geotextile should be provided below the base of the cover blanket.). Alteration of ground levels directly adjacent to the base of any existing retaining walls or the top of retaining walls will need to be considered carefully to avoid adverse impact on these structures.

Made Ground - Vapour Inhalation Pathways to Indoor and Outdoor Air (naphthalene at TP2 and TP11).

8.21 The vapour pathways are not significant for the made ground on the vast majority of the site. The exceptions are TP2 (within the larger building in Area A) and TP11 (at the higher level in Area B), where naphthalene concentration of 52mg/kg and 11mg/kg respectively were detected. At these locations, the concentrations detected will pose excessive risk if present below building footprints, and should, therefore, be excluded from proposed and existing building footprints. The risk via the outdoor air pathway is negligible and, therefore, provided the material remains in garden or landscape areas only, below 0.6m thickness of cover blanket, the risks will be acceptable.

8.22 It is possible that the exceedances may not represent the bulk concentration present within the made ground at these locations. Additional testing could be undertaken in the vicinity of TP2 (following demolition of the building and removal of the floor slab) and TP11, to confirm the extent of the naphthalene contamination. It is possible that, if results are favourable, the general naphthalene concentration at these locations may be sufficiently low as to allow it remain below building footprints. This is particularly the case in the vicinity of TP11 where the concentration of naphthalene is considerably lower (marginally above screening values) and no odours were detected.

Migration to Utilities

8.23 Any migration to utilities is unlikely to be significant. However, the local water company are likely to require details of the contaminants present on the site, to make a judgment on any requirement for protection of buried water supply pipes from chemical attack/ingress.

Risks During Construction Period

8.24 It is also necessary to consider the effects of the contamination present on the site in relation to the risks to adjacent residents, construction workers and the general public during construction. This is assessed in the following matrix.

Source	Pathway	Potential risk	Risk after employing suitable Health and Safety plan.
Existing made ground	Inhalation	Moderate	Damping down of the site during dry periods and timely placement of the existing made ground below barriers should block this pathway and reduce the risk to negligible.
Existing made ground	Ingestion	Moderate	Site fencing will exclude access to members of the public. Existing made ground will be contained within the site boundary, and placed below barriers as soon as possible. Washing facilities and a clean mess room from which work boots and overalls are excluded should be provided. These measures should block this pathway and reduce the risk to negligible.
Existing made ground	Contact	Moderate	Education of workers to use adequate hygiene and PPE should block this pathway and reduce the risk to negligible.
Existing made ground	Surface water	Moderate	Preventing surface water run off by minimising open exposure times of the existing made ground, and using bunds or cut off trenches as necessary should block this pathway and reduce the risk to negligible.
Asbestos in existing buildings	Inhalation	High	Provided an asbestos survey is carried out, and any identified asbestos is removed from site prior to any other works commencing, the pathway is blocked and the risk is negligible.

8.25 Provision of all the above measures will ensure that all the identified pathways for the contamination will be blocked.

Summary of Contamination Assessment and Remedial Options

8.26 The site is underlain by up to 3m thickness of made ground, generally less than 1m thick, overlying cohesive and granular natural residual soils. The topsoil made ground was found to contain elevated lead, with a maximum concentration of 300mg/kg, and fibres of chrysotile asbestos. The made ground was found to contain elevated concentrations of BaP, Naphthalene

and lead, at maximum concentrations of 36mg/kg, 52mg/kg and 520mg/kg respectively. Localised chrysotile asbestos fibres were also identified within the made ground in Area B. The volume of asbestos was found to be between <0.001% and 0.002%. Leachability was found to be negligible.

8.27 The contamination risk assessment, and assessment of remedial options, has indicated that, provided that the following remedial measures are adopted then the risks to the identified receptors are deemed acceptable for the proposed development of residential properties with private gardens and apartments.

8.27.1 An asbestos survey should be carried out prior to any work on, or demolition of, the existing buildings on the site, and any identified asbestos should be removed and disposed to a licenced facility. The work should be carried out by appropriately qualified Contractors.

8.27.2 Only minimal topsoil is present on the site and, where present, all the existing topsoil should be removed from the site. The receiving tip may require Waste Acceptance Criteria testing. Independent validation inspection will be required, to verify removal of all the affected topsoil. The disposal/transfer documents should be retained for inclusion in the Validation Report.

8.27.3 Where any garden or landscape areas overlie the existing made ground, a minimum 0.6m thickness of uncontaminated soils (topsoil and subsoil) should be provided. As chrysotile fibres have been identified, it is recommended that the cover blanket be underlain by a minimum 0.1m thick hard break layer of coarse stone, or a robust geotextile. In areas of hardstanding or building footprints, the cover blanket is not required. Made ground can be moved to other areas of the site in order to suit proposed levels and achieve the required cover.

8.27.4 Made ground from TP2 and TP11 should be excluded from footprints. However, additional testing at/around these locations (TP2 following demolition of the building

and removal of floor slab) could, if the general concentrations are sufficiently low, allow the exclusion measures to be waived, or at least confirm the extent of the naphthalene contamination.

8.27.5 Any imported soils used within the cover blanket will need to be verified as suitable by inspection and testing, in accordance with guidance supplied in the document produced by the Yorkshire and Lincolnshire Pollution Advisory Group (YALPAG): "Guidance on the Verification Requirements for Cover Systems".

8.28 The local water company are likely to require details of the contaminants present on the site, to make a judgment on any requirement for protection of buried water supply pipes from chemical attack/ingress.

8.29 A Contamination Remediation Statement is included in Appendix K.

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 J and a summary of the results, including Modified Plasticity Indices, is given below.

Location	Depth (m)	MC	LL	PL	PI	<425µm	I'p
TP1	0.8 - 1.0	14	30	16	14	87	12.2
TP2	2.9-3.0	34	54	33	21	92	19.3
TP8	2.8-3.0	22	43	21	22	84	18.5
							3
Min.		14	30	16	14	84	12.2
Max.		34	54	33	22	92	19.3

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 show clays of low to high plasticity, in accordance with BS 5930:2015 +A1:2020 "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 19.3. 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 Chemtech and Chemtest, comprising five 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	8.2	1,450
Natural Strata	4.6	208

SO_4 = 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 an acidic pH. The Aggressive Chemical Environment for Concrete (ACEC) class is AC-2z. Testing on the made ground indicates class AC-2. Therefore, the use of FND2Z designated concrete will be necessary for unreinforced buried concrete, in accordance with BS 8500-1:2015+A2:2019, if the existing made ground is to be retained. For any reinforced buried concrete, other design-specific mixes will apply.

10.0 GEOTECHNICAL ASSESSMENT

Coal Mining and Coal Recovery

10.1 The site is not in a coal mine reporting area and can be considered stable in this regard.

Foundations

Area A

10.2 The made ground on the site is not considered suitable for support of foundation loads. In Area A, the underlying natural soils are considered suitable, for the use of strip/trench fill foundations. An allowable bearing pressure of 100kN/m^2 is considered applicable. A higher bearing capacity can be achieved if founded on intact bedrock, which was present as shallow as 0.1m depth on Area A. As the existing site platforms are formed by terraces constructed into the hillside, with the exception of the basement at TP4, rock is likely to be shallower towards the rear (southeast) of the platforms and deeper towards the northwest.

10.3 Any foundation excavations into basement areas, such as encountered at TP4, are likely to be unstable, with the faces comprising demolition rubble. An alternative solution to trench fill would be required, such as piles, or the material could be excavated and replaced/compacted to a lower level by material that could remain stable and allow a trench less than 2.5m deep to be excavated. General levels could then be built back up once the foundations have been formed.

10.4 Where rock is present at shallow depth, foundations should be taken to at least a depth of 0.45m, to prevent potential adverse effects from frost. This may require the use of a hydraulic breaker.

Area B

10.5 In Area B, piled foundations may be required for proposed buildings towards the entrance of Hoyle Ing and adjacent to TP8, to avoid imposing additional loading on existing/proposed retaining walls. Piles should be well socketed into bedrock. As intact bedrock is encountered at shallow depth in TP9, any building in this vicinity is unlikely to require piling.

10.6 The clays, where present, were shown to be of Medium Volume Change Potential. Therefore, in accordance with NHBC Standard Chapter 4.2 "Building Near Trees", in the absence of trees, a minimum foundation depth of 0.9m below existing or proposed ground level is applicable, whichever is the lower. However, in the presence of any proposed, existing or removed trees, the foundation may need to be deepened, depending on the type of tree and its distance from the face of the foundation. If not already available, a tree survey may be required to enable a foundation schedule to be prepared. The tree survey will also need to consider trees on third party properties.

10.7 Where the founding strata are non-plastic, the minimum foundation depths given in NHBC Standard Chapter 4.2 "Building Near Trees" do not apply. However, to protect against fines washing subsidence in the event of a burst water supply pipe, it is recommended that a foundation depth of 0.9m is adopted in proximity to any such pipes. Where intact bedrock is present, a minimum foundation depth of 0.45m is required.

10.8 It is recommended that the guidance contained within NHBC Standard Chapter 4.2 "Building Near Trees" is observed in relation to any requirement for heave protection. A tree survey may be required for this, if not already available.

10.9 The foundations in Area A 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. Foundations should be reinforced where it is necessary to transition from suitable granular to suitable cohesive strata within a proposed building footprint.

10.10 If bedrock is encountered on part of a foundation excavation, the rest of the plot should be deepened to ensure founding on similar material. However, if rock is not encountered by 2.5m depth on the remainder of the plot, then the Engineer should be contacted for further advice.

10.11 Foundations within 20m either side of the geological fault indicated to cross the site will need to be 300mm thick and reinforced with two layers of B503 mesh – one near the bottom and one near the top, to mitigate any potential differential settlement associated with more deeply weathered zones or tilted/stepped strata.

Excavations

10.12 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 can be anticipated within the made ground, for example the demolition rubble filled basement at TP4.

10.13 No noticeable groundwater was detected during the site investigation. However, the soil within TP8 was wet between 2.5 and 3.5m depth. Any such encounters should be controllable by pumping from an artificial sump.

10.14 Excavations into made ground and residual subsoils should be readily achieved using conventional hydraulic plant. However, excavations into intact bedrock (present as shallow as 0.1m (TP6)) or any buried foundations and structures, are likely to require a hydraulic breaker.

Chemical Precautions

10.15 The Aggressive Chemical Environment for Concrete (ACEC) class is AC-2z for natural strata and AC-2 for made ground. Therefore, the use of FND2z designated concrete will be satisfactory for unreinforced buried concrete, in accordance with BS 8500-1:2015+A2:2019. For any reinforced buried concrete, other design-specific mixes will apply.

Road Pavement Construction

10.16 For any areas of road pavement, including parking areas, the formation will likely comprise granular residual soils in Area A, possibly localised rock, and cohesive residual soils in Area B. Based on the observed characteristics of the cohesive soils, and the results of the plasticity testing, a design California Bearing Ratio (CBR) value of 2.5% is considered applicable on the cohesive soils, below any obvious soft spots, and at equilibrium moisture content. If considered necessary, this should be confirmed by testing at proposed subgrade level before construction. Formation of roads on the existing made ground will not be acceptable. A higher CBR value, well above 15%, is considered to be applicable where granular residual soils, or rock, are present at formation level.

Flooding and Soakaways

10.17 The site is not at risk from river flooding. The risks of flooding from other causes such as adverse topography or insufficient surface water drainage, are not considered here. If such risk needs to be quantified, a separate specialist Flood Risk and Drainage Report should be commissioned, if not already available.

10.18 The disposal of surface water using soakaways is not considered to be practical on the site due to the presence of retaining structures on the site.

Gas Protection

10.19 No radon protective measures are required for properties constructed on the site.

10.20 There are no landfills indicated to be present within 250m of the site, but archive maps indicate that a quarry which extended to within 100m of the southwestern end of the site was briefly used as a tip. However, the area of the former tip is at least 22m higher than the highest point on site. The risk of soil gas migrating 100m laterally and down a minimum 22m drop in level, through sandstones without any cap of drift deposits, is considered to be negligible. Therefore,

the site is not considered to be at risk from gas generation associated with the potentially infilled quarry. No gas protection measures are considered necessary. This conclusion will be subject to the agreement of the regulatory authorities.

Retaining walls

10.21 Possible issues associated with the development of the upper level in Area B are summarised below;

- Piled foundations may be required for proposed buildings towards the entrance of Hoyle Ing and adjacent to TP8 to avoid imposing additional loading on existing/proposed retaining walls. As intact bedrock is encountered at shallow depth in TP9, any building in this vicinity is unlikely to require piling.
- The larger existing building to be demolished forms part of the existing retaining wall. Therefore, temporary retention will be required during the demolition of this building and the retaining wall that is to be replaced (brown dash on the proposed layout plan).
- Suitable drainage will be required to the rear of any proposed retaining walls.
- Surface water sewer and electricity cable are present on site near the entrance with Hoyle Ings.
- Foundations to the proposed retaining wall between TP8 and TP10 are likely to require reinforcement due to the presence of a geological fault.
- The brick retaining wall requires structural assessment before removal, for safety reasons.

Additional works:

10.22 The following additional works are recommended;

- To assess the structural integrity of the existing sandstone retaining wall that is to remain, it is recommended that a structural survey is undertaken together with associated structural calculations.
- Structural surveys may also be required for the existing chimney and the retaining walls along the site boundary.

- A supplementary investigation in the blue zone on the site investigation plan in Appendix H to confirm ground conditions between the two brick retaining walls. Safe access to this area is an issue, it is likely that a hand auguring process would be most beneficial, however a small hand held windowless sampling borehole rig may be able to gain access to part of this area.
- Supplementary testing in the vicinity of TP2 following the demolition of the existing building and removal of floor slab and in the vicinity of TP11 to delineate the extent of the naphthalene contamination.

Party Wall Aspects

10.23 The proposed layout indicates properties are in close proximity to the site boundaries. The requirements of The Party Wall Act 1996 should be observed, and it is possible that a Party Wall Surveyor may need to be appointed.

APPENDIX A

SITE LOCATION PLAN AND AERIAL PHOTOGRAPH

ARP GEOTECHNICAL LTD
CHARTERED CONSULTING ENGINEERS
Northwest House: 5-6 Northwest Business Park: Sevyla Hill: Leeds LS6 2QH
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Project
FORMER HOYLE ING
DYE WORKS, MANCHESTER RD,
LINTHWAITE

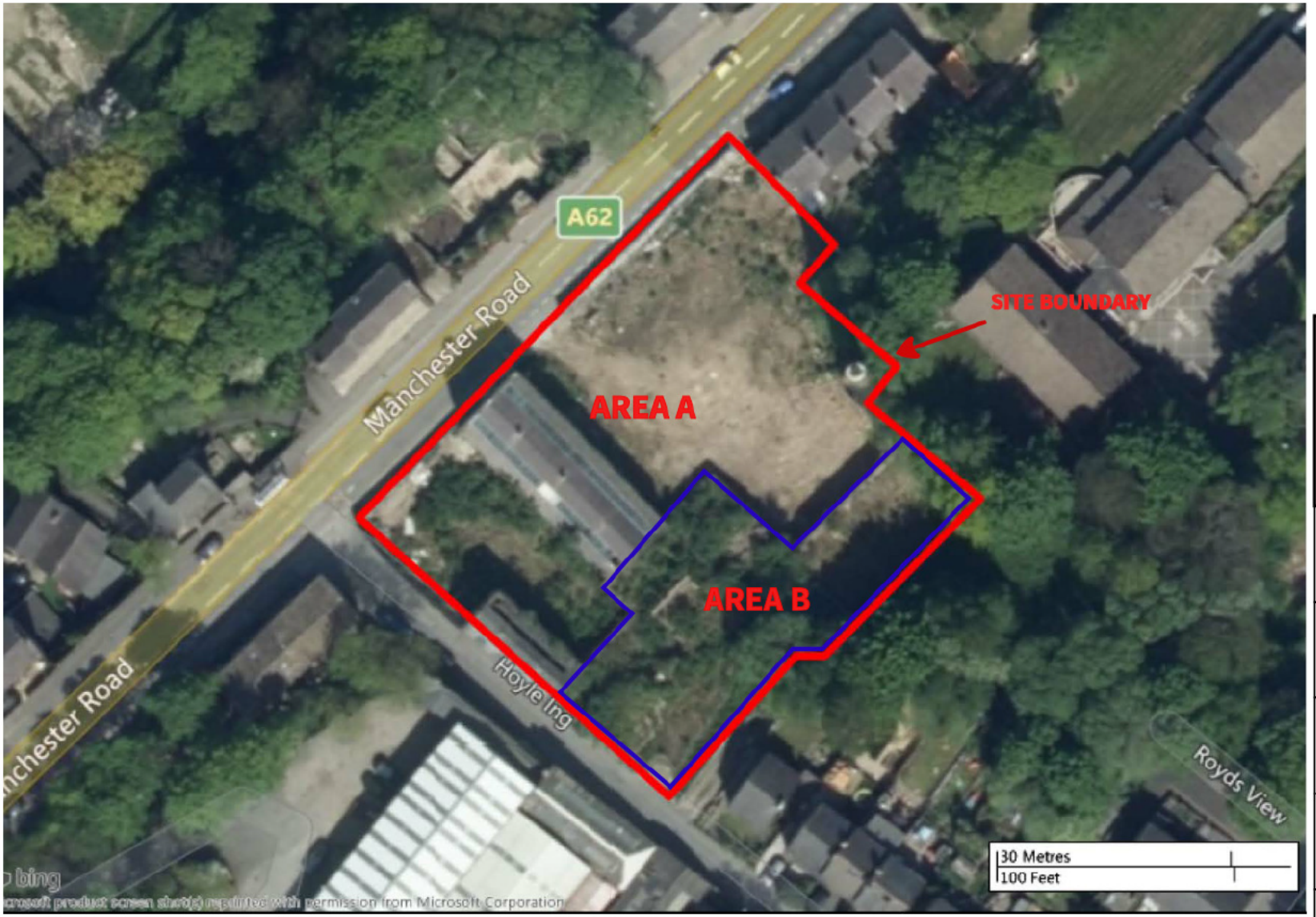
Client
HIGHSTONE BUILDING
SERVICES LTD

Title
SITE LOCATION PLAN

Date
MARCH 2021

Drawn	Scale
OG	AS SHOWN

Job No.
HIG/01



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Project
FORMER HOYLE ING DYE WORKS, MANCHESTER RD, LINTHWAITE

Client
HIGHSTONE BUILDING SERVICES LTD

Title
AERIAL PHOTOGRAPH

Date
MARCH 2021

Drawn	Scale
OG	AS SHOWN

Job No.
HIG/01

APPENDIX B

SITE WALKOVER PHOTOGRAPHS

Retaining wall

Photograph 1: Sandstone retaining wall in background, brick retaining wall to the right. Photograph facing south.

Photograph 2: Higher plateau above the retaining wall in photograph 1. Photograph facing northwest.

Photograph 3: Exposed foundation of the sandstone retaining wall in TP6.

Photograph 4: Close-up of exposed foundation in TP6

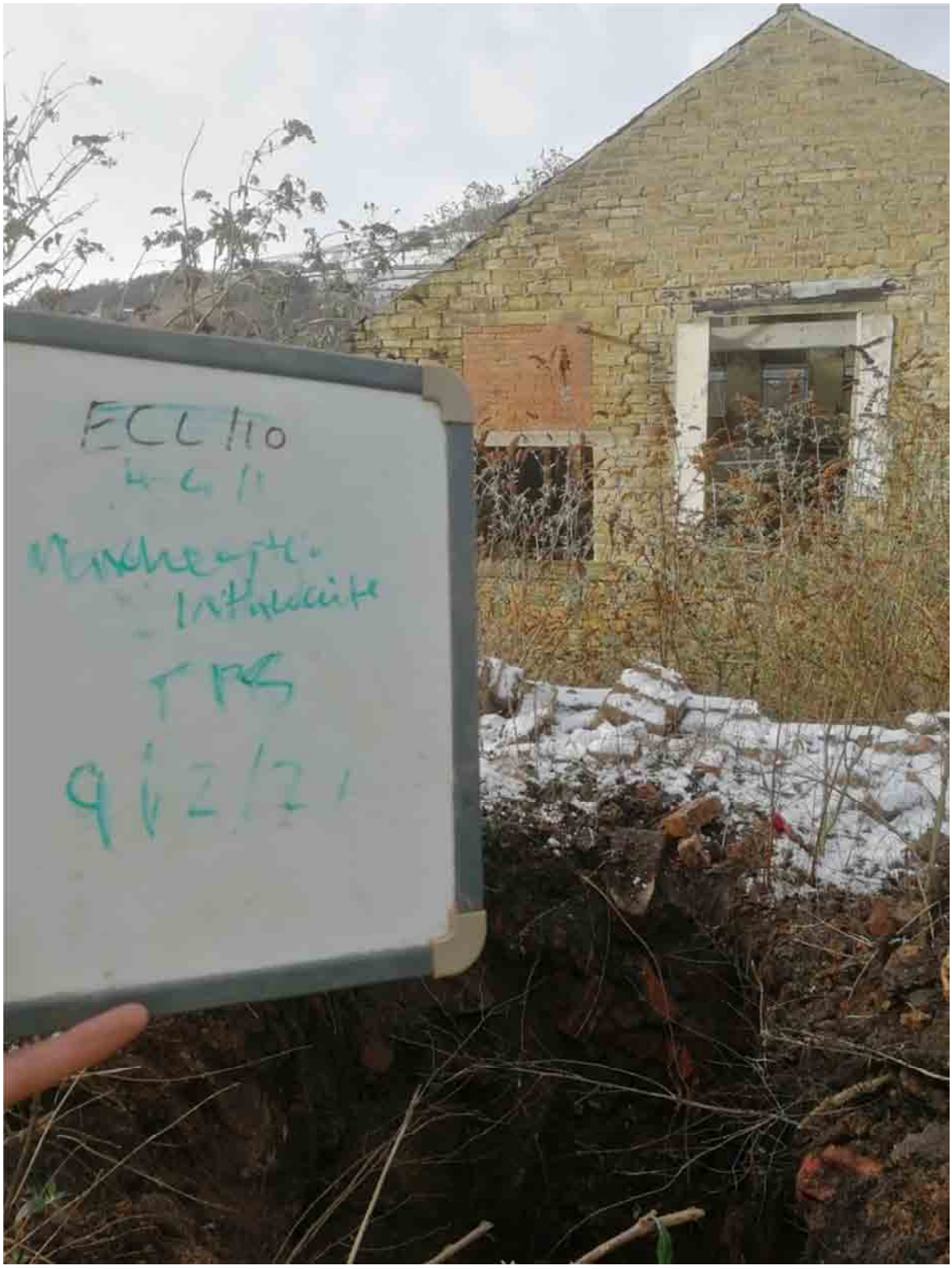
Photograph 5: Base of TP9 positioned at the top of the retaining wall in photograph 1.

Photograph 6: Damage to the brick retaining wall. Photograph taken facing south.

Photograph 7: Location of TP7 undertaken to expose foundations of brick retaining wall in photograph 6.

Photograph 8: Exposed foundations in TP7

Photograph 9: Close-up of exposed foundations in TP7



Photograph 10: Location of TP8 at the higher ground to the rear of the main building.

Photograph 11: Base of trial pit TP8.

AREA A

Photograph 11: Entrance to Area A off Manchester Road, facing northwest.

Photograph 12: Northern end of Area A , facing north

Photograph 13: Chimney at northern end of Area A.

Photograph 14: Large dilapidated building in Area A.

Photograph 15: Inside the dilapidated building in photograph 14.

Photograph 16: Area of rough ground between the two dilapidated buildings in Area A, facing southeast.

Photograph 17: View from opening in larger building looking towards the smaller building.

AREA B

Photograph 18: Retaining wall at northern boundary of Area B (above sandstone retaining wall in photograph 1).

Photograph 19: Retaining wall along eastern boundary of Area B.

Photograph 20: At the top of the sandstone retaining wall in photograph 1, facing southwest.

Photograph 21: Dense vegetation in Area B, looking down to Area A.

Photograph 22: Central part of Area B looking northwest towards the larger building in Area A.

APPENDIX C

ORDNANCE SURVEY ARCHIVE MAPS