T J BOOTH ASSOCIATES

CONSULTING CIVIL & GEOTECHNICAL ENGINEERS

PHASE 1&2 ENVIRONMENTAL AUDIT.

Proposed Residential Development

Furness Avenue (former No.76)

Heywood

Rochdale

OL10 4UP

Author:	Daniel Slattery
Client:	Holmtree Developments
Reference:	rep-tjba-holmtree-furness ave-PHS1&2-111220.docx

Revision	Date	Reason
0	Dec 2020	Original for planning.

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1. INTRODUCTION.

T. J. Booth Associates have been appointed by Holmtree Developments to undertake a Phase 1 & 2 Environmental Audit to the former 76 Furness Avenue, Heywood.

The Application Site formerly comprised a commercial warehouse taking up much of the site area footprint, with an external yard/hardstanding wrapping around the north & east side, and some minor soft landscaping to the south boundary.

Planning permission (ref No: *19/00645/FUL*) was obtained in December 2019 for the: *"Erection of 5 no. dwellings and demolition of existing building – part retrospective".* Condition 3 on the permission notice concerned environmental assessment, specifically requesting the following:

PLANNING PERMISSION GRANTED

APPLICATION REFERENCE: 19/00645/FUL

Name and address for correspondence:	Applicant name:
Mrs Melanie Lawrenson ML Planning Consultancy Ltd 5 Bobbin Mill Cottages Stubbins Lane Claughton on Brock Preston PR3 0PL	Ms JUNE ELLICOT C/O ML PLANNING CONSULTANCY LTD

Part I - Particulars of Application

Date of Application: 14 August 2019

Proposal:	**Erection of 5 no. dwellings and demolition of existing building - part retrospective**
Location:	**Site Of Former 76 Furness Avenue, Heywood, OL10 4UP**

3 No further development or works of site preparation shall take place until an investigation and risk assessment (in addition to any assessment provided with the planning application) has been submitted to and approved in writing by the Local Planning Authority. The assessment shall investigate the nature and extent of any contamination on the site (whether or not it originates on the site). The assessment shall be undertaken by competent persons and a written report of the findings submitted to and approved in writing by the Local Planning Authority before any development takes place.

The submitted report shall include:
i) a survey of the extent, scale and nature of contamination
ii) an assessment of the potential risks to:
- human health,
- property (existing or proposed) including buildings, crops, livestock, pets, woodland, and service lines and pipes,
- adjoining land,
- groundwaters and surface waters,
- ecological systems,
- archaeological sites and ancient monuments;

iii) where unacceptable risks are identified, an appraisal of remedial options and proposal of the preferred option(s) to form a remediation strategy for the site.

The development shall thereafter be carried out in full accordance with the duly approved remediation strategy and a verification report submitted to and approved in writing by the Local Planning Authority before any of the building(s) hereby approved are first occupied.

Ultimately this report will support discharge of the pre-development environmental condition No.3 to the satisfaction of the LPA.

This report provides a desk-based study & intrusive ground investigation based on current UK guidance for environmental investigation within the construction industry. Principal to the assessment is the potential for contamination pollutant linkages via the CLR-11 source-pathway-receptor methodology. Assessment of potential pollution linkages is primarily undertaken in strict accordance with BS5930:2015; BS 10175:2011+A2:2017; CIRIA C665; and BS 8485:2015+A1:2019 et al.

2. PROPOSED DEVELOPMENT.

The proposal is for the demolition of the existing building and all current site features & structures.

In its place, 5No. residential 2 storey masonry dwellings will be constructed, with associated driveways and soft landscaped lawns and gardens to the rear. Three of the properties will be terrace/townhouse form fronting onto Kirkstall Ave, and the remaining 2 (semidetached) will front onto Furness Avenue. Refer to Existing & Proposed Plans in the Appendix.

3. HISTORIC MAPS.

DATE	ON-SITE	OFF-SITE/SURROUNDING AREA
c1851	Site is part of agricultural land.	Only immediate local feature is Back o'th Moss Lane approximately 30-40m south-east of the Site. Development lies approximately 200-250m distant to the north-east/north-west comprising some residential dwellings, cotton mills, and gas works adjacent the River Roch.
c1893	No change.	Gas works to the north noted as Heywood Corporation Gas Works. Some additional residential terraces in the wider area.
c1910	No change.	Some additional development in the wider area nominally 150-200m distant. No overall change.
c1929-30	No change.	No overall change.
c1937	Site remains part of agricultural land but is split by a field partition through the centre of the site.	Much terraced construction in the wider area, still over 150m from site boundaries. Some allotment land in the wider area but not particularly close to site. Some minor made ground horizons noted in the wider locale but are generally small in area and over 150-200m from site.
c1957	Building noted on site with access drive to the north corner, and what appears to be an enclosed external space to the east side of the building. Remainder of site is within the site curtilage but undeveloped.	The residential housing estate and road format are laid out as in the present day, however, some of the dwellings are in different layout to present - particularly along Kirkstall Avenue adjacent to the site, and Clay Bank Street.
c1973-81	Site is shown to be re-developed with the late warehouse now encompassing most of the site footprint.	The residential dwellings to Kirkstall Avenue to the east side of the Application Site have now been demolished and rebuilt as semidetached residential dwellings.
c1978-89	No change.	Gasworks site to the north nominally 200m distant is by now demolished.
c1992	No change.	Former gasworks site is now recorded as a scrap yard.
c2005	No change.	Many of the old terraced dwellings around Kirkstall Avenue and Clay Bank Street demolished, with the area now comprising vacant land.

4. PRESENT DAY MAPS.

Site Boundaries, Outlines of Structures and Buildings:	Present day map recorded the former outline of the commercial building on site as in the historic maps. The building was surrounded by concrete hardstanding and soft landscaping to the south side. The building was demolished in early 2020, ready for construction, which is now updated

	on current digital mapping platforms.
Ground Contours, Natural Drainage Features:	There is a fall in ground elevation to the south in the immediate local area. A drainage has indicated a site connection to the United Utilities mains combined sewerage located in Clay Bank Street.
Water Courses:	The closest watercourse is the River Roch approximately 280m north.
Below Ground Obstructions:	None noted.

5. GEOLOGY.

Bedrock Geology:	Undifferentiated sandstone/mudstone of the Carboniferous Lower Coal Measures.
Superficial Geology:	Site is underlain by glacial till (boulder clay).
Coal Seams/Faults.	The closest coal seam is the Arley approximately 60m north-east of the Application Site. The seam dips to the south west, so underlies the Site.

6. BOREHOLES RECORDS.

No relevant boreholes in the local area.

7. LANDMARK ENVIROCHECK

7.1. AGENCY & HYDROLOGICAL

Contaminated land register entries & notices:	No records within a 250m radius.
Discharge consents:	One record within a 250m radius – indicated to be a storm tank/CSO 247m distant.
Pollution incidents to controlled waters:	2No records within a 250m radius – the closest 190m distant.
Water abstractions:	None noted within a 500m radius.
Groundwater vulnerability:	Noted as high vulnerability.
Bedrock aquifer:	Secondary A aquifer.
Superficial aquifer:	Secondary aquifer undifferentiated.
Source protection zone:	Not within an SPZ.

7.2. WASTE

BGS recorded landfill sites:	No records within a 250m radius. Closest is 313m west.
Historical landfill sites:	1 record within a 250m radius, recorded as Hooley Bridge Works, 180m north.
Registered landfill sites:	No records within a 250m radius.

7.3. HAZARDOUS SUBSTANCES

Control of major accident hazards sites (COMAH):	No records within a 250m radius.
Planning hazardous substance consents:	No records within a 250m radius.

7.4. GEOLOGICAL

Mining Instability:	No records.
Potential for Collapsible Ground Stability Hazards:	Very low risk.
Potential for Compressible Ground Stability Hazards:	No hazard.
Potential for Ground Dissolution Stability Hazards:	No hazard.
Potential for Landslide Ground Stability Hazards:	Very low risk.
Potential for Running Sand Ground Stability Hazards:	Very low risk.
Potential for Shrinking or Swelling Clay Ground Stability Hazards:	Very low risk.
Radon Potential - Radon Affected Areas:	Within an area where less than 1% of homes at or above the action level.
Radon Potential - Radon Protection Measures:	None required.

8. COAL AUTHORITY

Entries, Adits, Shafts.	One shaft noted nominally 15m from the west Site boundary.
Past Recorded Underground Mining.	No workings noted at depth.
Potential Shallow Seams/Mining.	The CA maps show a coal seam which if the position is correctly recorded will be situated at relatively shallow depth beneath the site, and has the potential to be worked.
Shallow Recorded Mining.	No recorded workings noted beneath the site.
Development High Risk Area.	Site is within a Development High Risk Area.

9. LOCAL KNOWLEDGE & PLANNING SEARCH

N/A.

10. INDUSTRY PROFILES

N/A.

11. SITE RECONNAISSANCE

Site reconnaissance was undertaken on 13.11.2020.

Details of Existing Structures:	The Site was attended in July 2020, and a walkover completed. At the time of reconnaissance, the existing above ground structures had been demolished and the site cleared. There were some made ground/rubble stockpiles still to be removed. The foundation trenches for the plots fronting to Kirkstall Avenue were excavated and awaiting concrete pouring. The foundation depths were nominally 600-750mm deep and comprised nominally 200-300mm of clayey MADE GROUND above virgin CLAY. The foundations to the south side of the site were in the process of being excavated at the time, and comprised a deeper upper clayey MADE GROUND with some very ashy horizons to approximately 2500mm deep. Relict foundations of the former building were noted in the trial hole, and founded on what appeared to be virgin CLAY at depth. There was a small retaining wall between the Application Site and the dwellings fronting on to Kirkstall Road. A Leylandii nominally to the centre east boundary, which had been recently felled was noted to the top of the retaining wall. No other pertinent features were noted.
Adjacent Properties:	The local area is predominantly residential. The site is surrounded by residential estate roads on 3 sides, with neighbouring residential dwellings and associated gardens to the east side. Across Clay Bank Street to the south was some small former garages/outbuildings adjacent a car park with sport fields beyond.
Water Levels, Directions of Flow and Rates in Rivers:	None noted on reconnaissance.
Old Mine or Quarry Workings:	None features noted in the local area.
Obvious/Immediate Hazards to Health/Safety:	None noted.
Areas of Discoloured Soil, Polluted Water, Vegetation, and Significant Odours:	Ashy made ground noted, which is often a source of metals and PAH contamination.
Relevant Ground Levels, Ground Water Levels, Positions of Wells and Springs:	The site had a fall from the north boundary to the south in the order of approximately 3.5m.

12. ENVIRONMENTAL SITE SUMMARY

12.1. Summary

Mapping records indicate the Application Site, and immediate local area was part of agricultural land from c1850-c1940/50s when it along with the local area was developed. The Site was initially only partly developed to the north side, and later was extended c1970s. It remained this way until the present day when it was demolished c2020 for development.

The local area was developed c1940-50s. There was some demolition and redevelopment of the dwellings to the east side of the Application Site (along Kirkstall Avenue), whereby the dwellings erected in the 1940-50s were demolished, and replacement dwellings erected c1970s.

In the wider area, there was an historic landfill noted within 250m of the site which comprised a former gas works approximately 200m north. After the gas works was demolished c1970s, there was no evidence on historic maps to suggest this was ever a disposal site for putrescible material, and most likely comprises inert wastes from the site demolition. In addition, its recent use as a scrap yard/reprocessing facility has likely contributed to it being identified as a historic landfill site. It is also noted that within the boundary of the former gas works site, there are made ground stockpiles, but these are generally separated from the surrounding ground, and pose no significant risk. The local area is also underlain by impermeable clay subsoil, as proven on site, which would mitigate the risk of pathways and any subsequent pollutant linkage.

A former coal shaft was noted within 15m of the development although a separate Coal Mining Risk Assessment is being undertaken.

The site is within a Class 1 Radon Protection Area, where <1% of properties are affected. Locations in this area require no protection measures to new dwellings.

12.2. Potential Contaminants

CURRENT SOURCE/S	ORIGINAL ASSOCIATED USAGE	CONTAMINANT/S
Made ground noted on-site comprising ash/clinker.	General infilling, demolition wastes.	Metals, PAH, sulphates, inorganics, asbestos.

12.3. Potential Pathways

PATHWAY	MEDIA
Soil and dust ingestion	Soil and indoor dust
Consumption of home-grown fruit and vegetables	Produce
Skin contact (indoors)	Indoor dust
Skin contact (outdoors)	Soil
Inhalation of dust (indoors)	Air
Inhalation of dust (outdoors)	Air
Vapours (indoors)	Air
Vapours (outdoors)	Air

12.4. Potential Receptors

Receptors mainly comprise workers in the construction phase, and workers in the proposed end use.

13. CONCEPTUAL MODEL

CURRENT SOURCE/S	ORIGINAL ASSOCIATED USAGE	CONTAMINANT TYPE	PATHWAY	RECEPTOR	POLLUTION LINKAGE	CONSEQUENCE	PROBABILITY	RISK
Site surface /sub soil.	Brownfield site – past development & local filling.	Chemical contamination.	Direct ingestion, aerial ingestion, dermal contact, drinking water.	Site construction operatives & future inhabitants.	PRESENT – Site was noted to comprise MADE GROUND with ashy clearly identified. Ash and building rubble are a source of metal, PAH & asbestos contamination.	Medium.	Likely.	Moderate risk.
Geological ground gas.	Coal seams & radon sources. Peat and alluvial soil.	CH4, CO2, Rn, other trace gases.	Diffusion through soil, substructures, aerial inhalation.	Future occupants. Explosion, suffocation.	UNLIKELY – Site within a BGS/HPA Class 1 Radon Area. Shallow seams may underlie the site but there is no credible pathway.	Minor.	Unlikely.	Very low risk.
Anthropogenic ground gas.	Decomposing organic material in the ground.	CH4, CO2, other trace gases.	Diffusion through soil, substructures, aerial inhalation.	Future occupants. Explosion, suffocation.	NOT PRESENT – No credible source, and pathways mitigated by geology.	Minor.	Unlikely.	Very low risk.
Contaminated ground /surface water. Controlled Waters.	Brownfield site – past development.	Chemical contamination.	Permeation through soil into ground water, local watercourses, or aquatic habitats.	Water supplies, watercourses, aquatic habitats.	UNLIKELY – Shallow ground contamination if present is likely to be minor, & expected contaminants generally immobile. Site not within a Source Protection Zone & no watercourses or aquatic habitats immediately adjacent the site.	Minor.	Unlikely.	No risk.
Aerial contaminants.	Local industrial activity.	Chemical contamination.	Dermal contact & aerial inhalation.	All site users / occupants.	POTENTIALLY PRESENT – Potential minor polluting activities historically but these will now be recorded in pollutant linkage 1 in the upper ground profile. Current aerial contaminants are regulated and few.	Minor.	Unlikely.	Very low risk.

14. SITE INVESTIGATIONS

14.1. Investigation Design from Conceptual Model

The proposed site end use is for a residential usage with soft landscaping garden areas. Due to the proposed end use, and the potential for minor contamination noted within the conceptual model, a soil sampling regime is to be undertaken to ensure existing site soil is suitable for use, or any potential contaminated material is kept at a suitable depth from future site receptors.

BS10175:2011+A1:2013 & R&D TECHNICAL REPORT P5-066/TR considers the upper 500mm is sufficient to categorise the site soils with respect to:

- human/animal intake arising from ingestion and dermal contact
- potential for wind entrainment leading to inhalation (of contaminated soils and dusts)
- or deposition onto neighbouring land
- surface water run-off (e.g. due to flash flooding)
- uptake by shallow rooting plants (e.g. crops, ornamental and wild species)
- surface leaching to groundwater

There is no definitive guidance on the number of samples required for soil representation in current guidance. However, R&D TECHNICAL REPORT P5-066/TR indicates that sample spacing should be between 10-25m for residential applications.

Considering the Site area, nominally 3 soil samples representative of the upper 500mm of MADE GROUND would satisfy guidance criteria for sampling.

Soil samples should be tested for the following contaminant suites: metals, speciated PAH, inorganics & sulphates, SOM, and asbestos screening, and analysed against common threshold comparison data, specifically the Defra Category 4 Screening Levels (C4SLs) where available, then to the LQM/CIEH (S4ULs) thereafter.

14.2. Site Investigations

Soil sampling was undertaken on the 18.12.2020, and comprised 3No. samples (S1-3), located between & across the rear of the plots, nominally in the location of the garden areas, refer to Site Investigation Plan in appendix.

The masonry building shell and roofs were complete, with internal/external fixings & finishings to be completed. From the immediate rear of Plots 1-3 to the N side of the site, virgin clay was mostly exposed at or close to the surface. From the rear of Plots 1-3 to the south side of the site, made ground was encountered, becoming deeper to the south boundary. Much of access to the central and north part of the site had been covered with a thin layer of road planings.

Virgin clay is considered clean, and was not sampled. The soil samples were all taken in clayey made ground & were noted as a dark brown clayey MADE GROUND with abundant gravel sized fragments of brick, stone, cement/mortar, and occasional plaster.

Soil samples were sealed in 1kg white plastic snap top containers & amber jars, and sent to Chemtest Ltd to be tested for the following contaminant suites: metals, speciated PAH, inorganics & sulphates, SOM, and asbestos screening.

No visual or olfactory evidence of hydrocarbon contamination was noted on site.

14.3. Soil Sampling Assessment

On return the sample results were assessed by TJ Booth Associates to common threshold comparison data, specifically the Defra Category 4 Screening Levels (C4SLs) where available, then to the LQM/CIEH (S4ULs) thereafter.

Sample 1 recorded some minor elevation of genotoxic PAHs (benzo(b)fluoranthene & dibenz(ah)anthracene) only. Samples S2 & S3 recorded contaminants below threshold values.

However, current guidance allows for a simplified risk assessment of PAH using benzo(a)pyrene as a surrogate marker for the carcinogenic risk of PAHs noted in soil, based on the toxicological benchmarks of the coal tar mixtures tested by Culp et al. (1998).

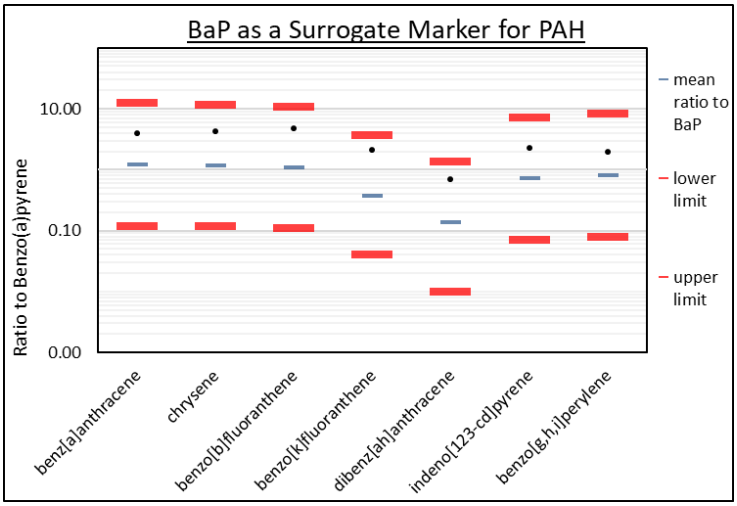
The simplified PAH risk assessment is subject to the ratios of genotoxic PAHs having a signature of not greater than an order of magnitude relative to benzo(a)pyrene in the coal tar mixtures used within the Culp et al. study.

If the risk assessment is adopted, and sample parameters fall within the coal tar PAH signature, benzo(a)pyrene may be used as

a surrogate marker of PAH risk for some or all samples noted from the Site.

The assessment may be used for individual or groups of samples, although any samples with either benzo(a)pyrene (in particular) or other genotoxic PAHs recorded at or below the detection method LOD, may lead to erroneous results in the assessment.

Samples S2 & S3 were removed from the assessment, although both of these samples recorded all contaminants below residential thresholds. Sample 1 which showed slightly elevated benzo(b)fluoranthene & dibenz(ah)anthracene, was plotted relative to benzo(a)pyrene and found to correspond with the Culp et al. coal tar signature, indicating that for the Application Site, benzo(a)pyrene could be used as a surrogate marker for PAH, see below graph:



Given the benzo(a)pyrene results for all samples are below the relative C4SLs, then PAH risk from the Site is considered low, and the risk from existing site soils mitigated with respect to a residential end use setting.

Refer to TJ Booth Associates Soil Analysis Table and Chemtest Ltd sample certification in the appendix.

14.4. Gas Monitoring Assessment

N/A – no risk.

15. REMEDIATION STRATEGY

15.1. Ground/Soil Contamination Risk

Existing site soils have been assessed and found to be suitable for the proposed end use.

However, topsoil will need to be imported into garden areas for finishes.

It should be noted that areas of road planings used as hardcore for access is considered contaminated and should be removed prior to import of topsoil & external works finishes. The road planings are not representative of the existing site soil and were only noted on the surface in access areas.

Imported soil should be clean/inert, and free from deleterious materials, and should be suitable for use in a residential end use setting. Imported soil should be able to pass testing of the following potential contaminant suites to current Defra Category 4 Screening Levels (C4SLs) where available, and then to the LQM/CIEH (S4ULs), for use in a residential end use setting:

- metals, inorganics, PAH USEPA16 speciated, and asbestos screening.

Should it be required by RMBC, imported soil should be validated by competent professional persons, see additional notes below.

15.2. Ground Gas Risk

No legitimate ground gas source or pathway has been noted within the risk assessment and thus the no pollutant linkage exists. No ground gas monitoring nor any protection measures required in the development.

15.3. Additional Notes

Should any suspected unidentified contamination be encountered throughout the groundworks or construction phase of the development: all works should cease, the relevant area isolated, and potential contamination assessed by professional & competent persons detailing further recommendations & remedial measures to be approved by RMBC.

Remedial measures should be validated if required by RMBC, and comprise the following:

- Soil import for gardens/soft landscaping areas should be sampled at the rate of 1:200m3 from a proven greenfield source, and 1:50m3 from an unknown/brownfield source; not less than 3 samples to be taken for each.
- Soil import should be tested for the following contamination suites: metals, inorganics, PAH USEPA16 speciated, and asbestos screening. Results will be analysed against Defra Category 4 Screening Levels (C4SLs) where available, and then to the LQM/CIEH (S4ULs), for use in a residential end use setting.
- Due to existing soils passing the contaminant testing, taped trial pits are not required and topsoil depths may be installed to suit finishes.

The above should be analysed by suitably qualified & competent persons, and reported upon accordingly in a site completion report detailing validation procedures, analysis, certification as required, and photographic evidence. A validation report should be undertaken following completion of remedial measures indicated above, which should include documentary/photographic evidence of all remediation, and any subsoil/topsoil import sample results if required.

Before any further work is undertaken, this report should be submitted to and agreed by the Local Planning Authority Contaminated Land Department.

We trust that the above clear, but should you require further advice please contact the undersigned.

Authored

D S Slattery BSc (Hons).

T J Booth Associates.

Approved

T J Booth BSc (Hons), C. Eng. C. Env. MICE.

T J Booth Associates.

16. REFERENCES

Environment Agency. 2005. Secondary model procedure for the development of appropriate soil sampling strategies for land contamination. R&D Technical Report P5-066/TR.

NHBC. 2007. Guidance on evaluation of development proposals on sites where methane and carbon dioxide are present.

CIRIA. 2007. Report C665.

CL:AIRE. 2012. Research Bulletin-RB17-A pragmatic approach to ground gas risk assessment.

BSI. 2013. BS 10175:2011+A2:2017. Investigation of potentially contaminated sites – code of practice.

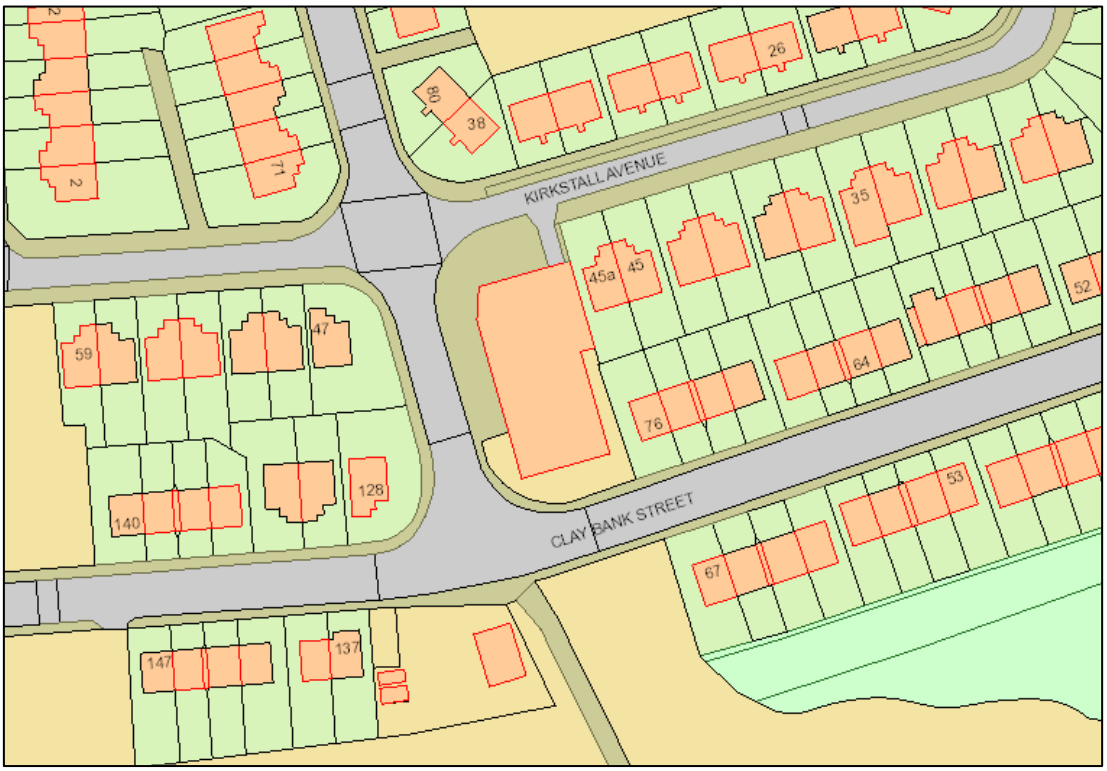
BSI. 2013. BS 8576:2013. Guidance on investigation for ground gas – permanent gases and volatile organic compounds (VOCs).

BSI. 2015. BS 5930:2015+A1:2020. Code of practice for ground investigations.

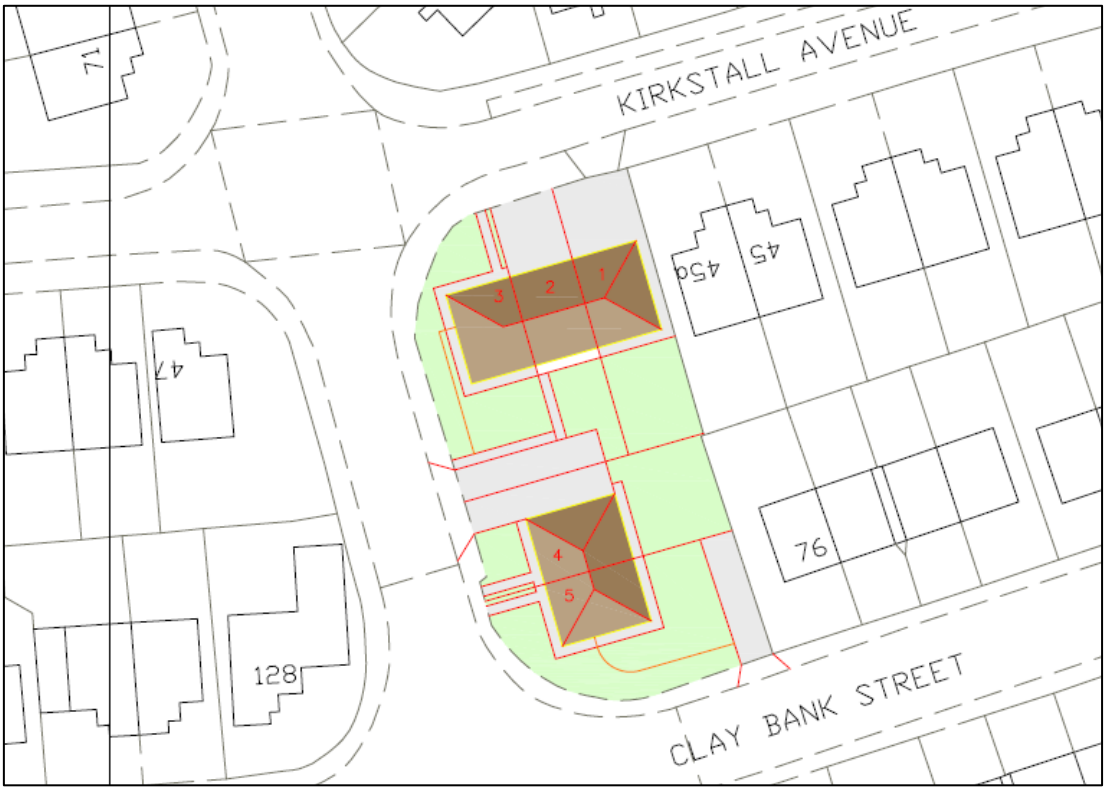
CIRIA. 2019. Report C758D. Abandoned mine workings manual.

17. APPENDIX A: PHOTOS & FIGURES.

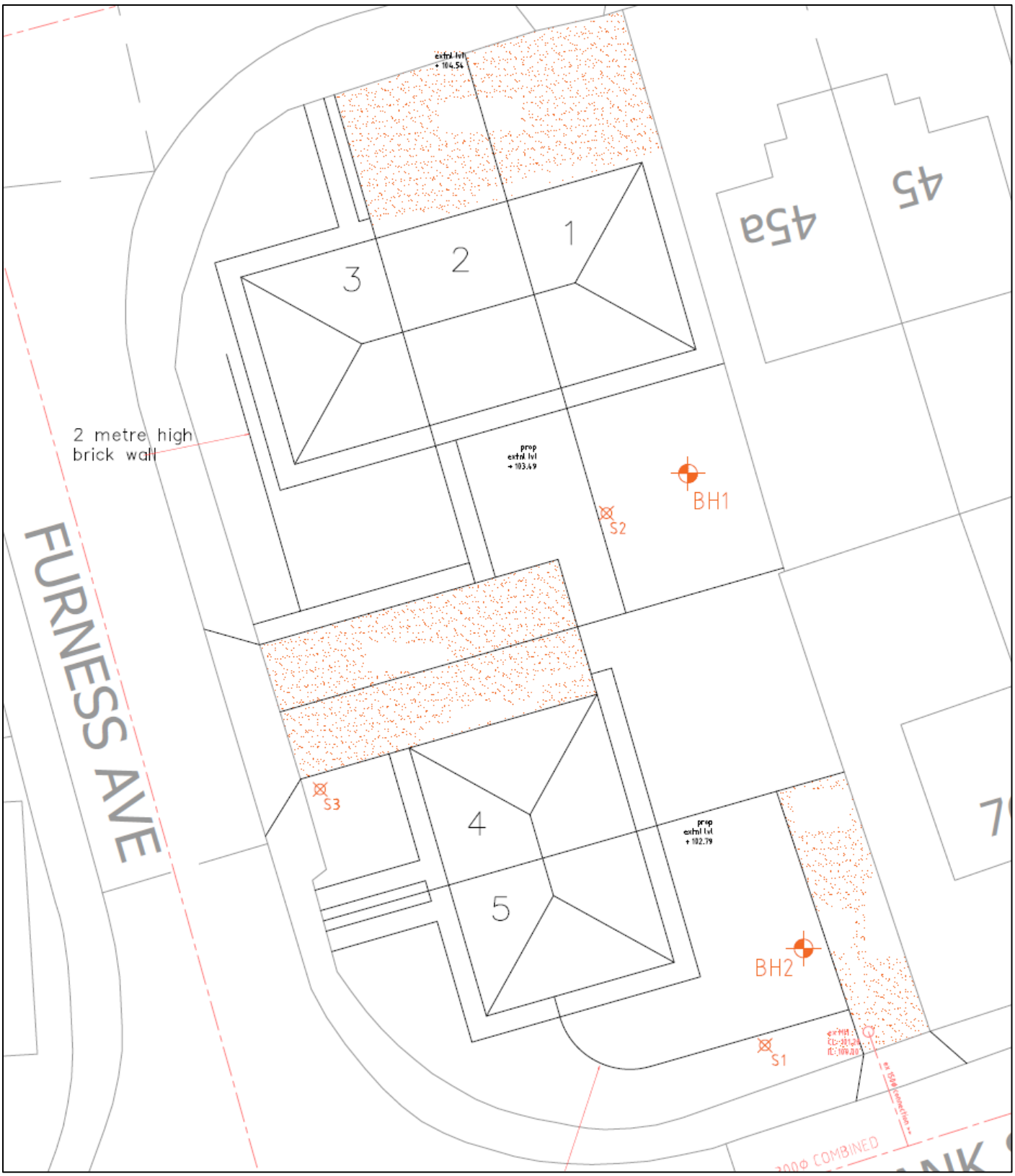
17.1. Location Plan/Existing Site Plan.



17.2. Proposed Site Plan.



17.3. Site Investigation Plan.



17.4. Existing Soil Sampling/Analysis.

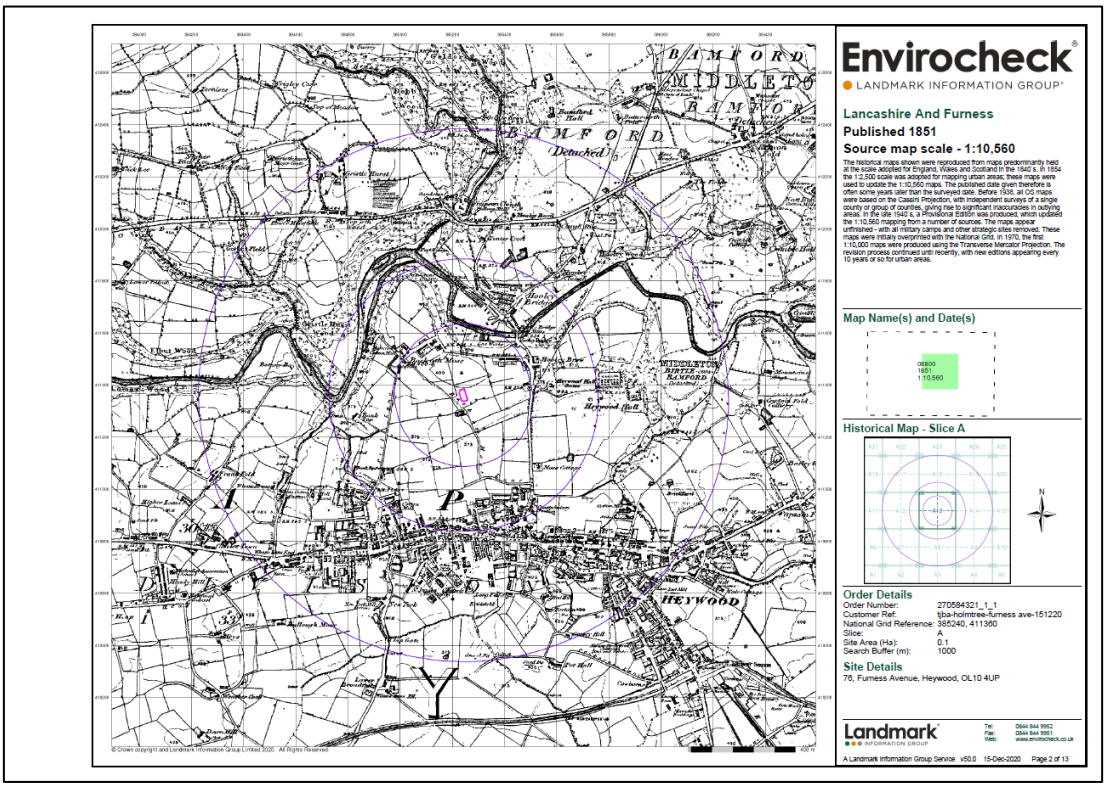
Client / Site	***Holmtree - Furness Avenue, Rochdale***
Sampling Date	***18.12.2020***

Comparison of Contamination Test Results with Thresholds (mg/kg)

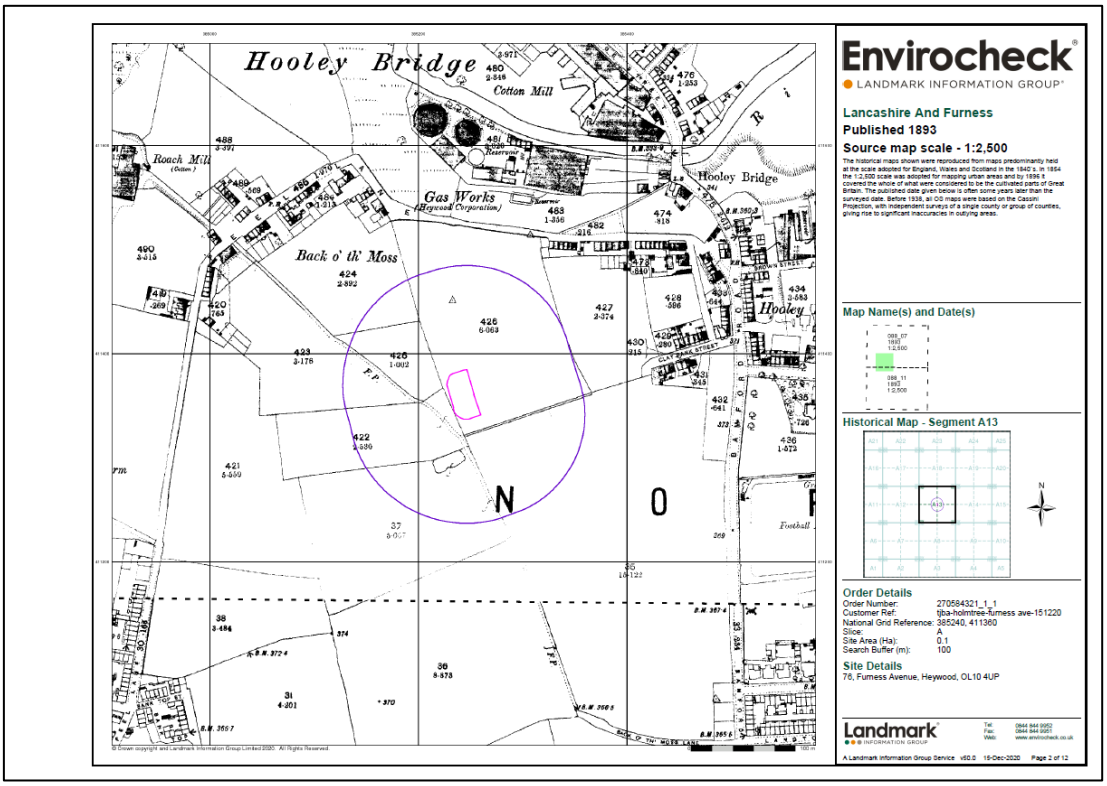
Contaminant		No	Max	Mean	t 95	RESIDENTIAL (with or without plant uptake)		
							Pass/Fail	Comment
METALS	Arsenic as As, dry weight	3	24	18	23.3	37	PASS	
	Boron as B, hot water sol dw	3	0.6	0.4767	0.583	290	PASS	
	Cadmium as Cd, dry weight	3	0.49	0.3567	0.477	22	PASS	
	chromium as Cr(III) dry weight	3	22	19.33	22.00	910	PASS	
	Chromium as Cr(VI), dry weight	3	0.5	0.5	0.5	21	PASS	
	Copper, as Dry Weight	3	46	38	45.2	2400	PASS	
	Lead, as Dry Weight	3	150	101	144.3	200	PASS	
	Mercury as Hg, dry weight	3	0.18	0.1467	0.178	1.2	PASS	
	Nickel as Ni, dry weight	3	28	22.667	27.4	130	PASS	
	Selenium as Se, dry weight	3	0.2	0.2	0.2	250	PASS	
	Zinc as Zn, dry weight	3	99	87	97.9	3700	PASS	
INORGANIC	Cyanide (Total)	3	0.5	0.5	0.5	2.5	PASS	
	Sulphate (Total) as SO4	3	0.17	0.116	0.162	0.24	PASS	
	Sulphide	3	46	18.833	41.95	250	PASS	
	pH	3	9.2	8.8667	9.17	6 to 8	ALKALINE	
	Sulphur (Elemental)	3	10	8.2333	9.79	100	PASS	
	Asbestos Identification	3	0	0	0	0	PASS	
ORGANIC	SOM	3	6	4.8333	6			
PAH	acenaphthene	3	1.5	0.5667	1.36	1100	PASS	
PAH	acenaphthylene	3	0.15	0.1167	0.145	920	PASS	
PAH	anthracene	3	1.7	0.85	1.592	11000	PASS	
PAH	benzo[a]anthracene	3	4	2.6333	3.88	13	PASS	
PAH	benzo[a]pyrene	3	3.8	2.3633	3.65	5	PASS	BaP ok to use as surrogate for PAH risk assessment
PAH	benzo[b]fluoranthene	3	4.8	2.7667	4.53	3.7	FAIL	S1 fail but pass using as BaP surrogate maker, S2 & S3 ok
PAH	benzo[g,h,i]perylene	3	2	0.7333	1.81	350	PASS	
PAH	benzo[k]fluoranthene	3	2.1	1.26	2	100	PASS	
PAH	chrysene	3	4.3	2.6667	4.11	27	PASS	
PAH	dibenz[ah]anthracene	3	0.7	0.3	0.64	0.3	FAIL	S1 fail but pass using as BaP surrogate maker, S2 & S3 ok
PAH	fluoranthene	3	9.3	5.3667	8.87	890	PASS	
PAH	fluorene	3	1.1	0.4333	1	860	PASS	
PAH	indeno[123-cd]pyrene	3	2.3	0.8333	2.08	41	PASS	
PAH	napthalene	3	0.71	0.3033	0.649	13	PASS	
PAH	phenanthrene	3	8.3	3.9667	7.71	440	PASS	
PAH	pyrene	3	9.2	5.5333	8.82	2000	PASS	
PAH	PAH (Total - SUM EPA16)	3	56	30.333	52.8	1	comment	
SVOC	phenol	3	0.3	0.3	0.3	380	PASS	

18. APPENDIX B: MAPS.

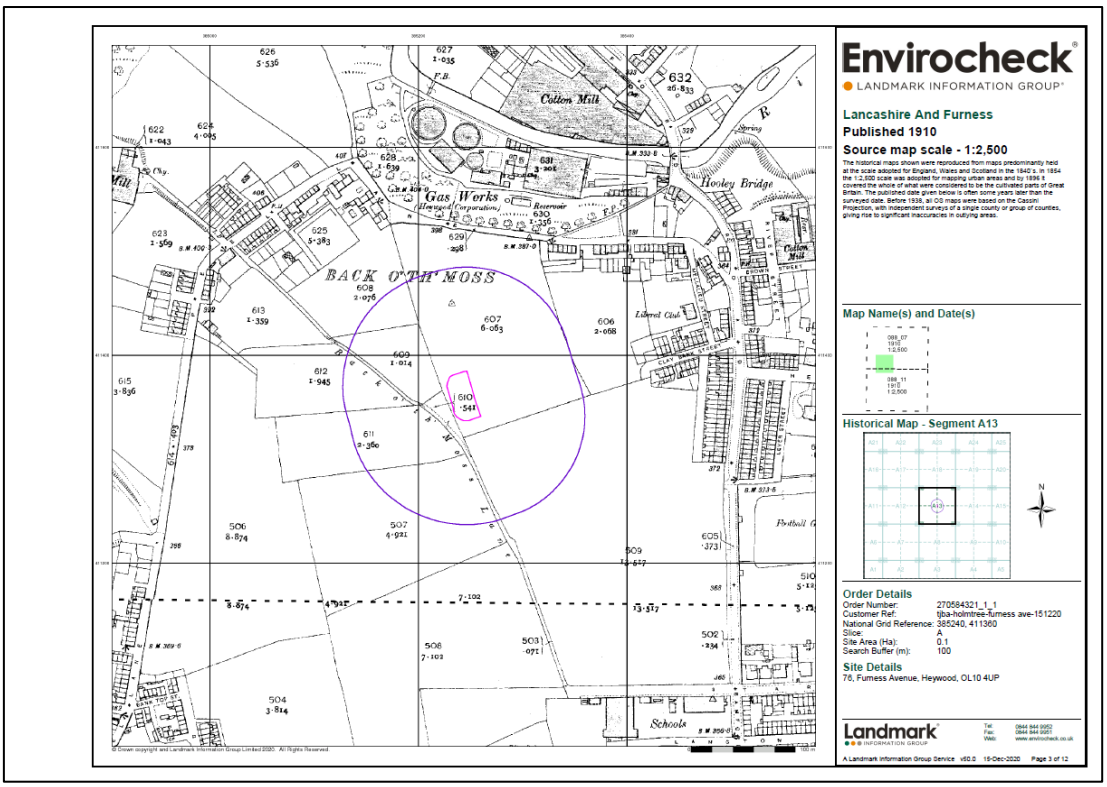
18.1. Ordnance Survey c1851



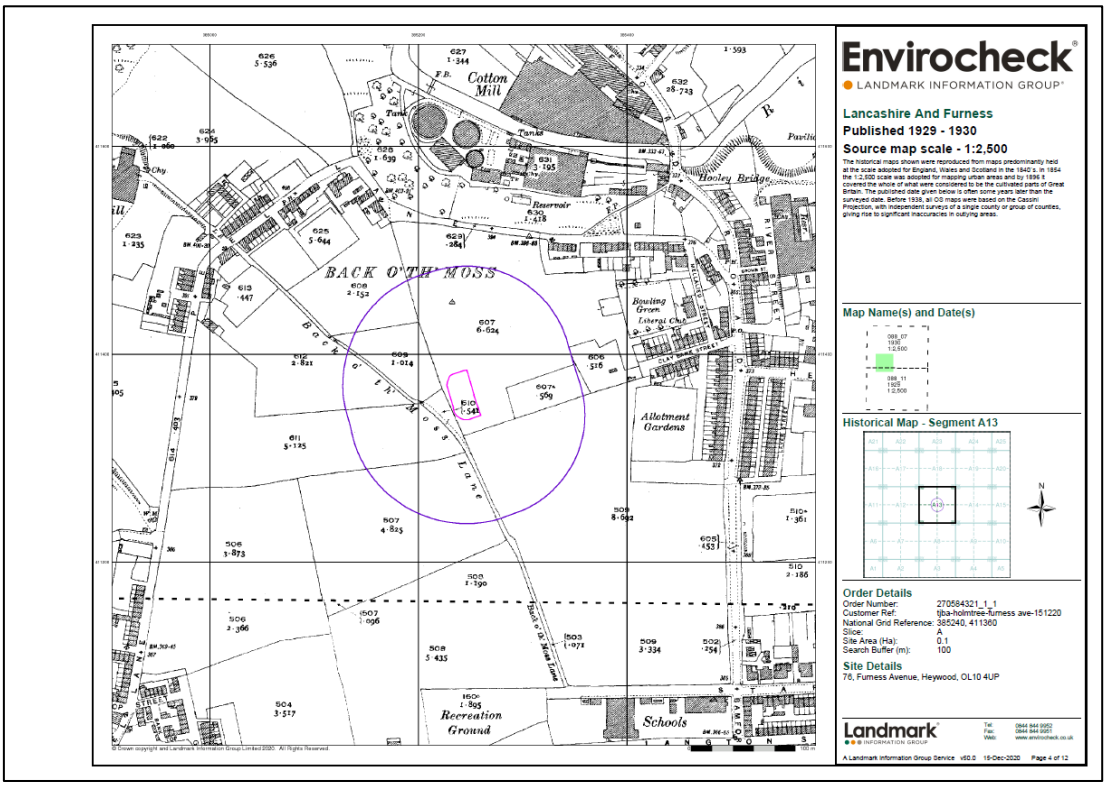
18.2. Ordnance Survey c1893



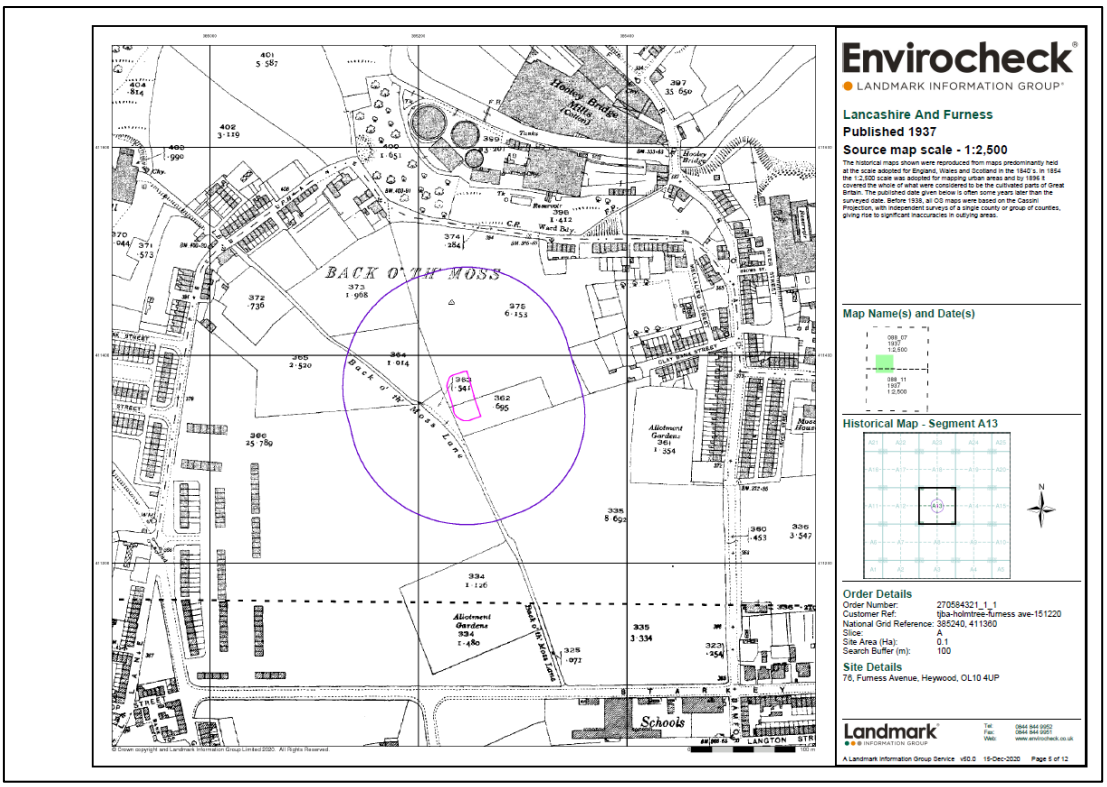
18.3. Ordnance Survey c1910



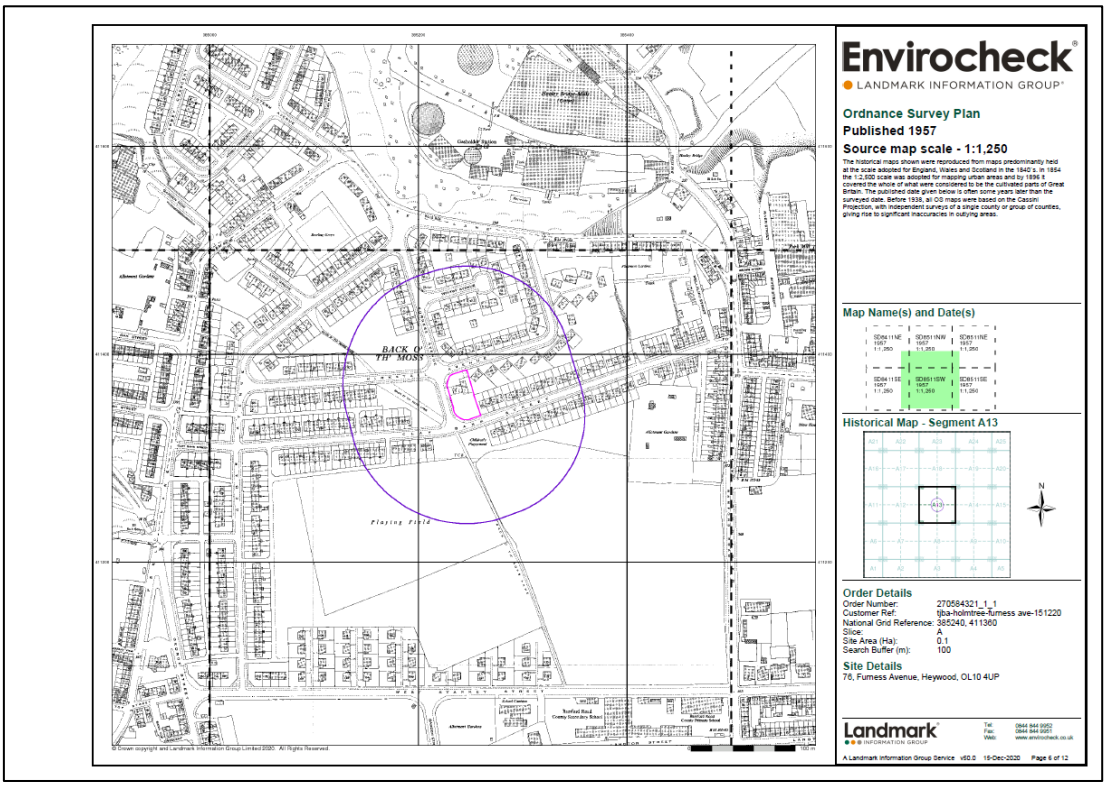
18.4. Ordnance Survey c1929-30



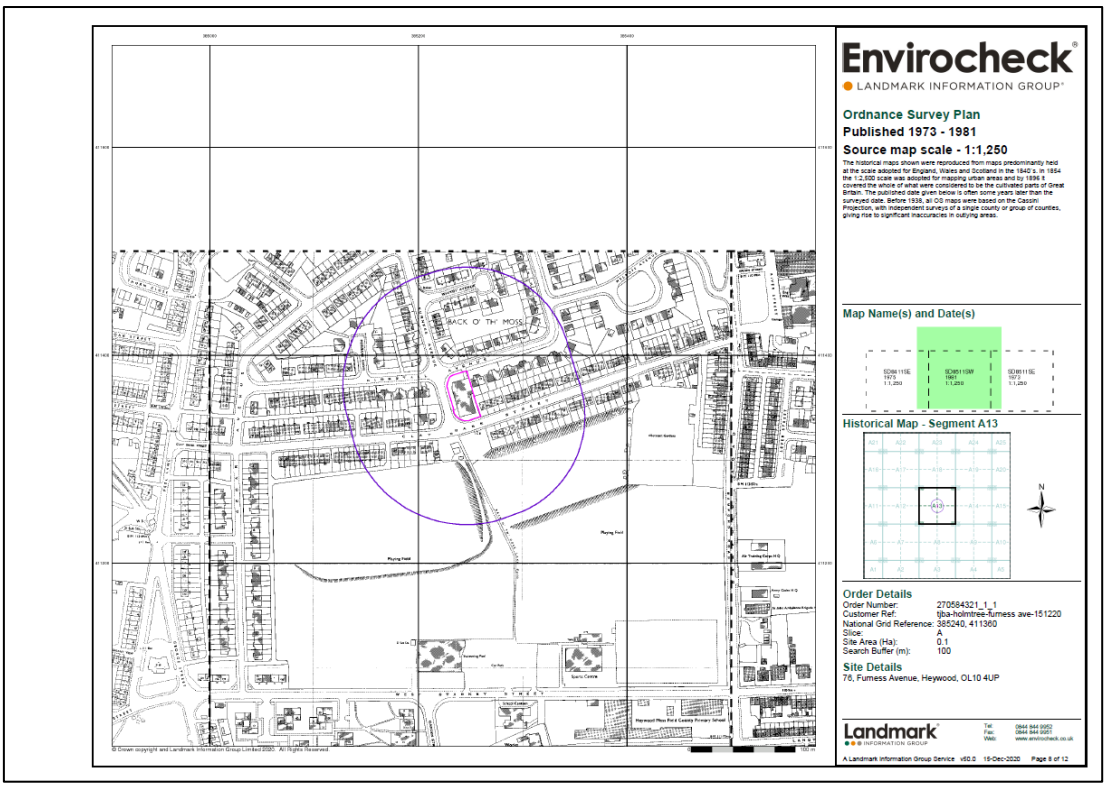
18.5. Ordnance Survey c1937



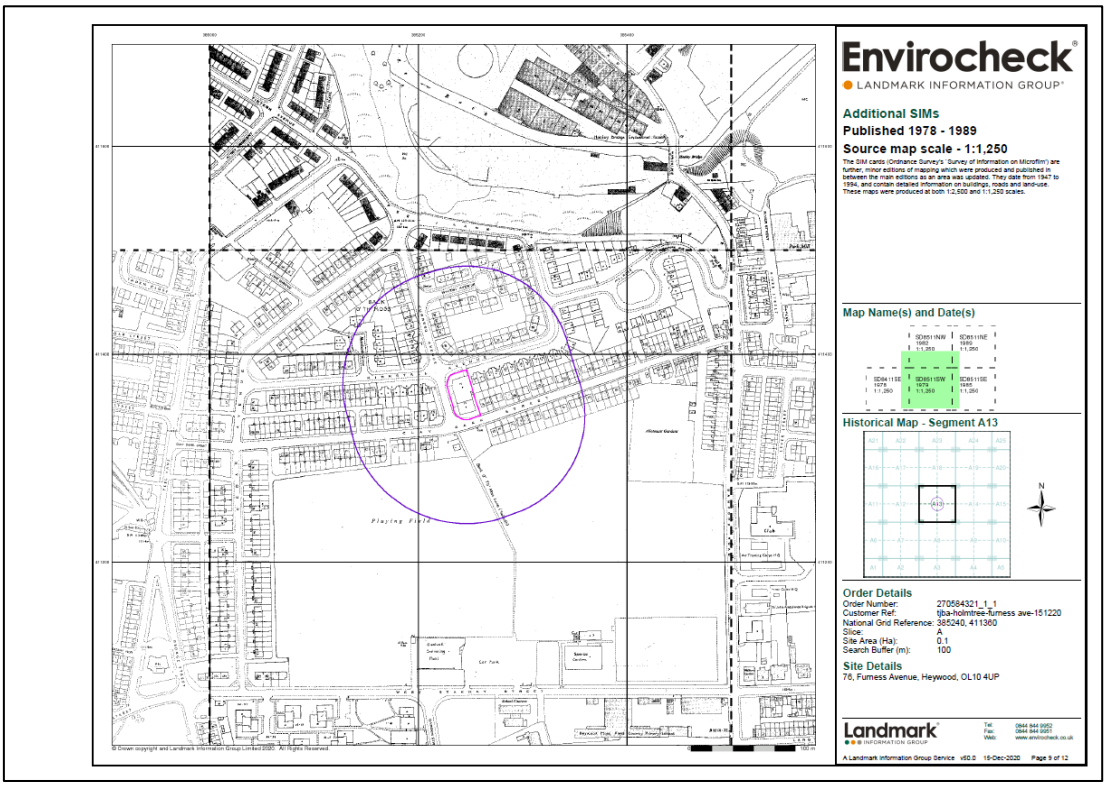
18.6. Ordnance Survey c1957



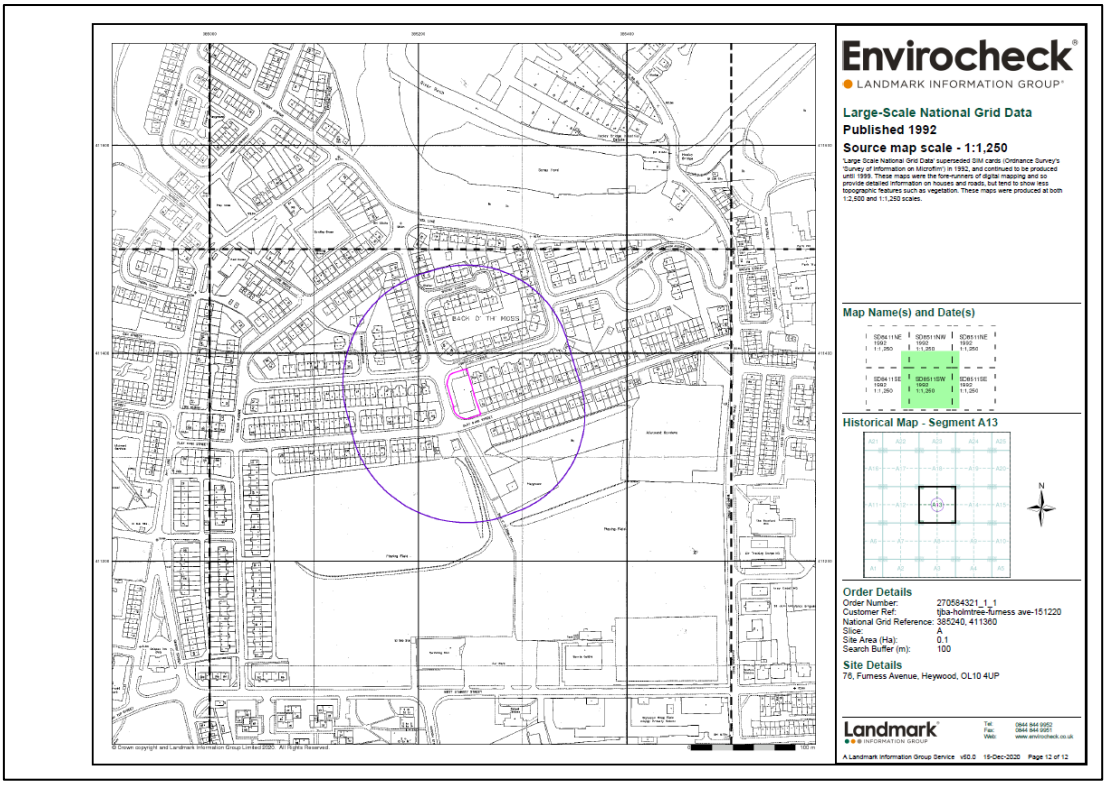
18.7. Ordnance Survey c1973-81



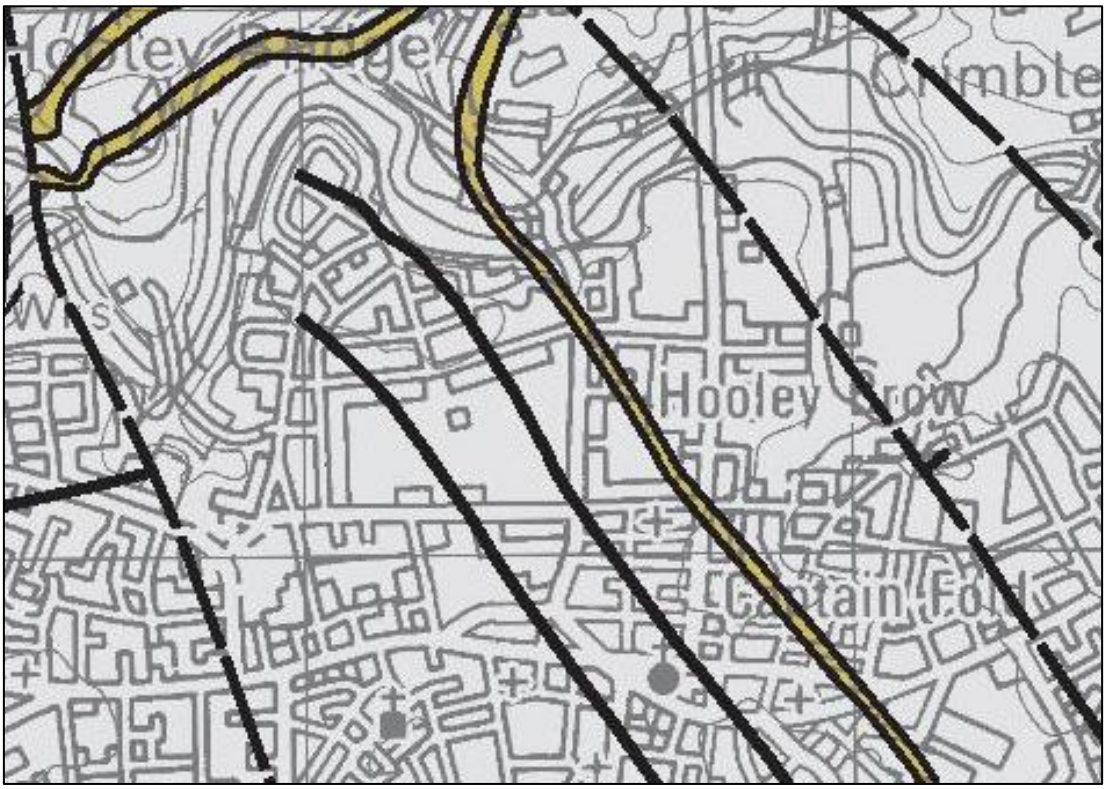
18.8. Ordnance Survey c1978-89



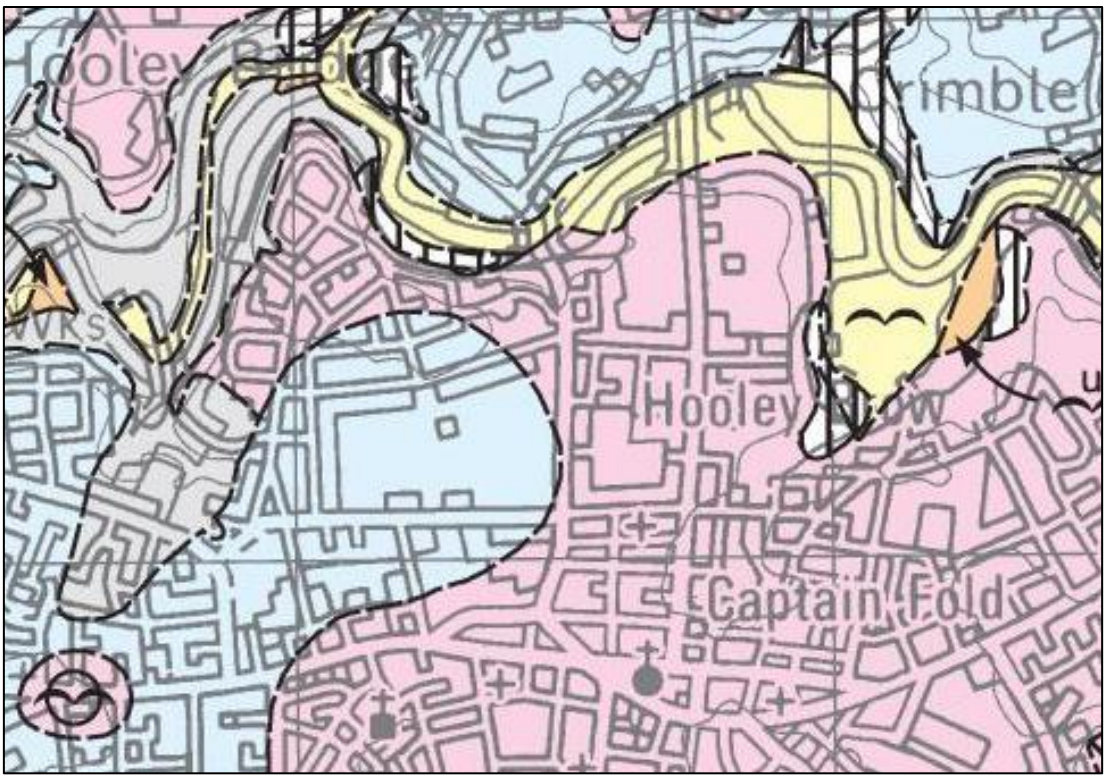
18.9. Ordnance Survey c1992



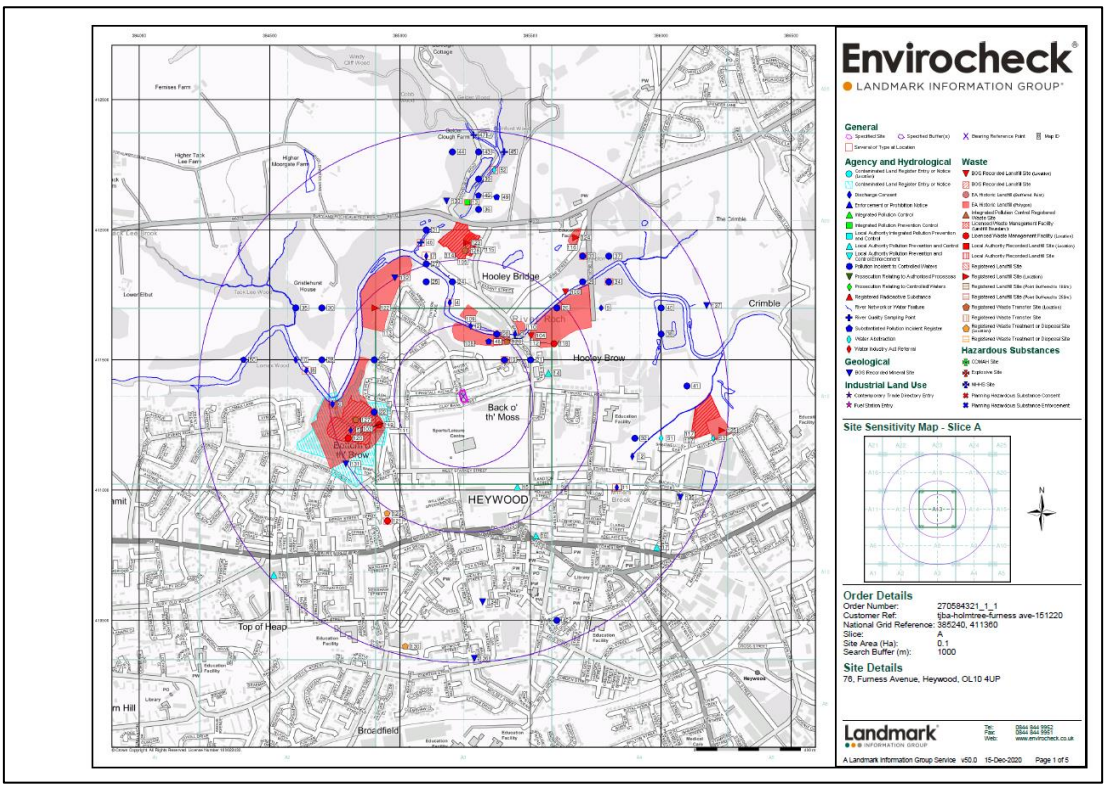
18.10. BGS Geological Map (Solid).



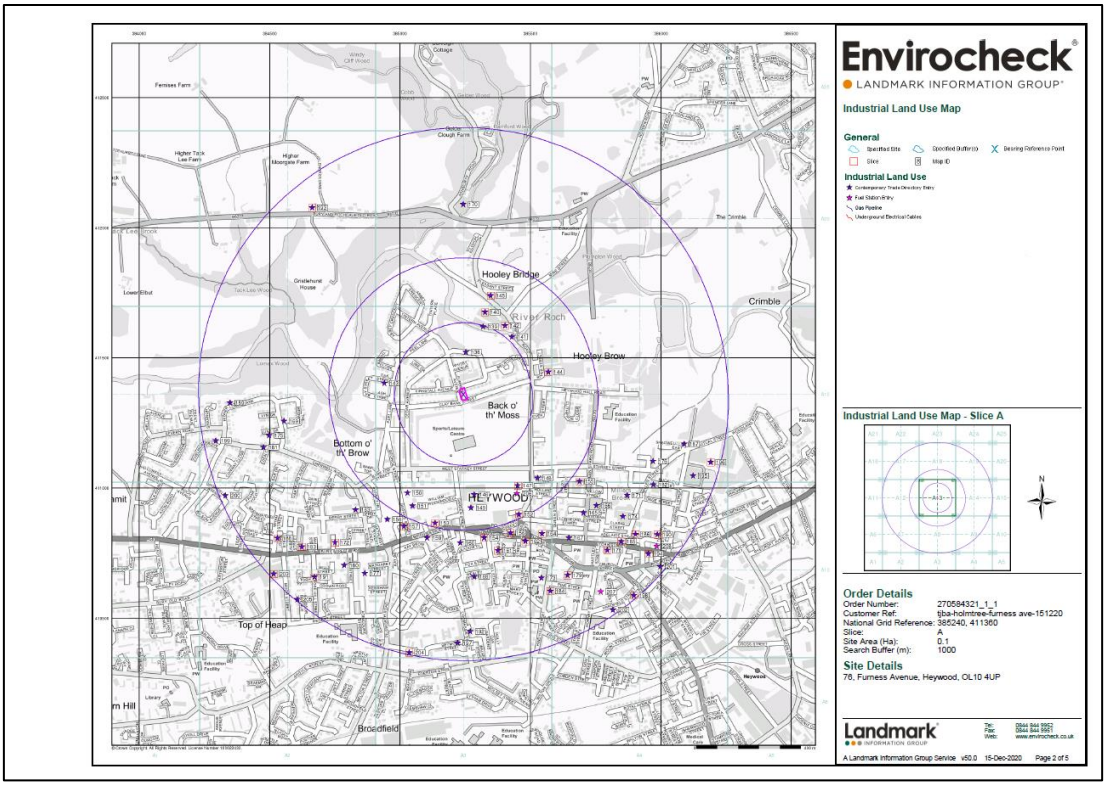
18.11. BGS Geological Map (Superficial).



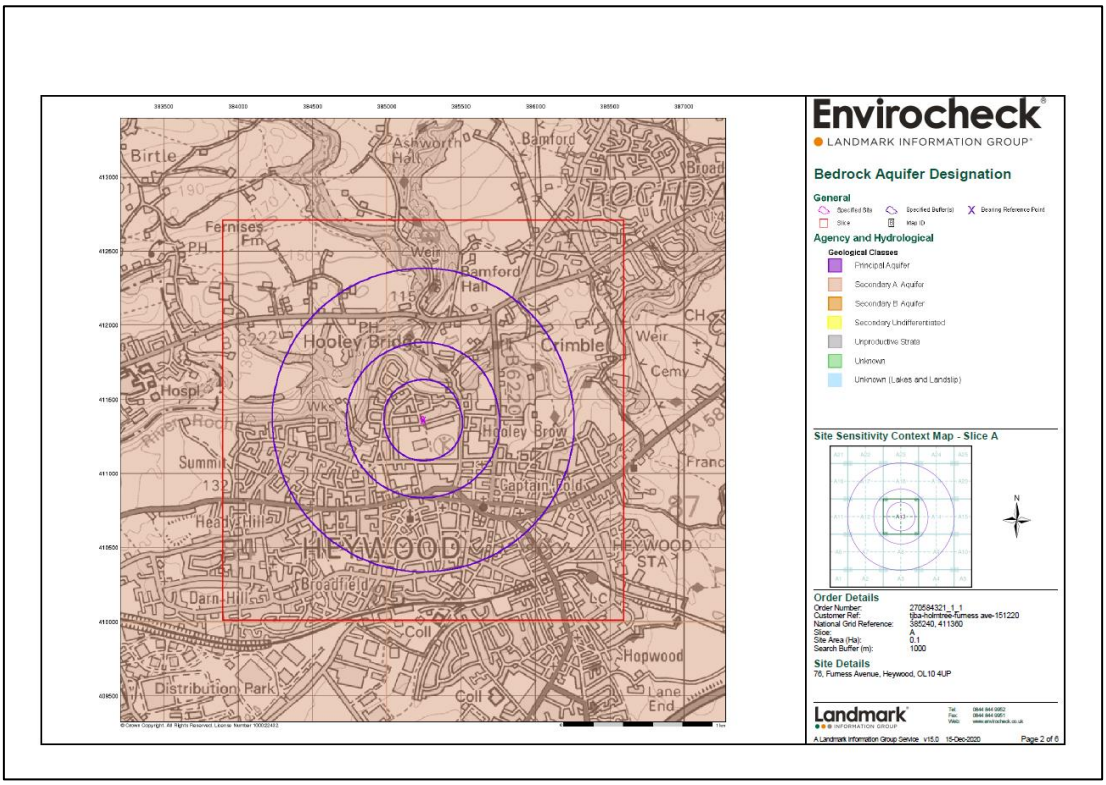
18.12. Landmark General Contaminants Map.



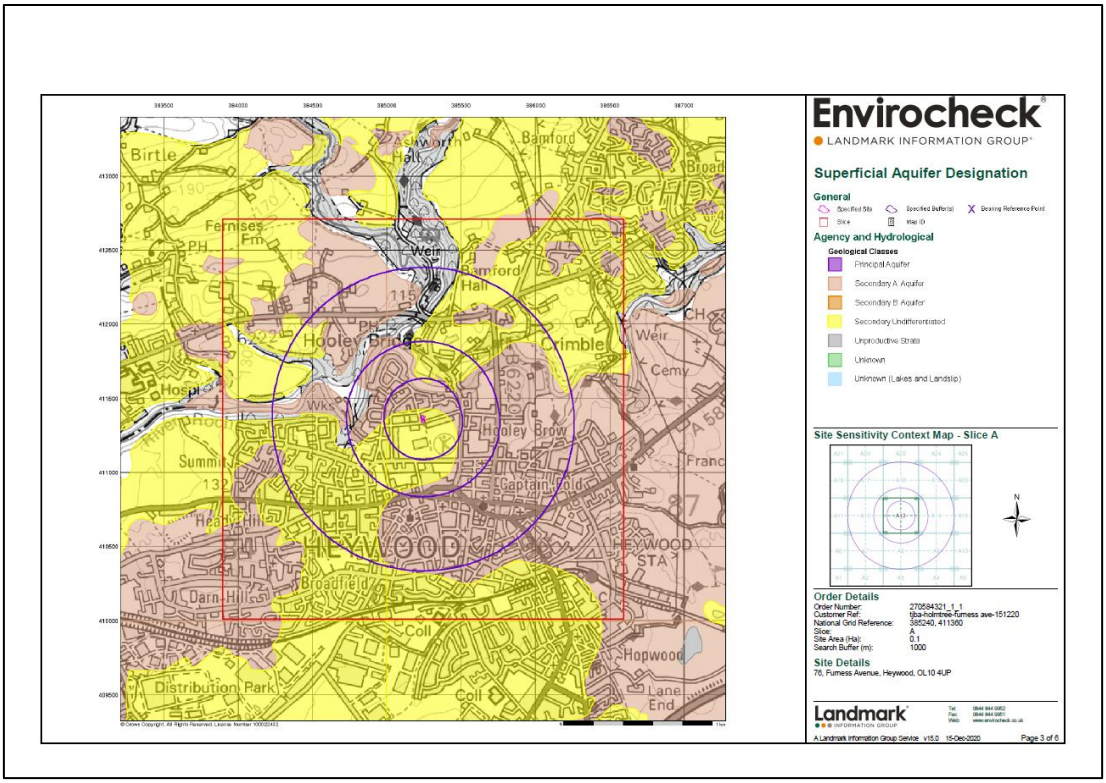
18.13. Landmark Industrial Land Use Map.



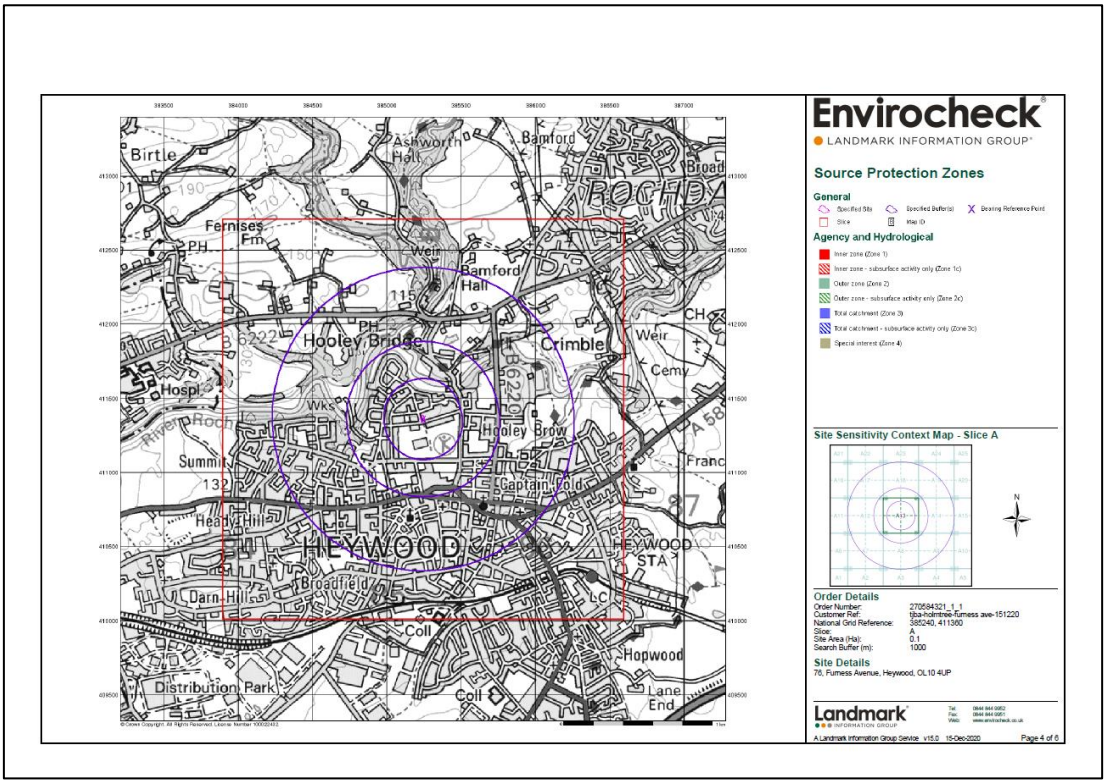
18.14. Landmark Bedrock Aquifer Map.



18.15. Landmark Superficial Aquifer Map.



18.16. Landmark Source Protection Zone Map.



19. APPENDIX C: REPORTS & CERTIFICATES.

eurofins | Chemtest
Eurofins Chemtest Ltd
Depot Road
Newmarket
CB8 0AL
Tel: 01638 606070
Email: info@chemtest.com

UKAS TESTING 2183

Final Report

Report No.:	20-35342-1		
Initial Date of Issue:	06-Jan-2021		
Client	TJ Booth Associates		
Client Address:	20a Eastgate Street Rochdale Lancs OL16 1DH		
Contact(s):	Daniel Slattery		
Project	Holmtree-Furness Ave, Heywood		
Quotation No.:	Q19-18321	**Date Received:**	22-Dec-2020
Order No.:		**Date Instructed:**	22-Dec-2020
No. of Samples:	3		
Turnaround (Wkdays):	10	**Results Due:**	07-Jan-2021
Date Approved:	06-Jan-2021		
Approved By:			
Details:	Glynn Harvey, Technical Manager		

Page 1 of 5

Results - Soil

Project: Holmtree-Furness Ave, Heywood

Client: TJ Booth Associates			Chemtest Job No.:		20-35342	20-35342	20-35342
Quotation No.: Q19-18321			Chemtest Sample ID.:		1118466	1118467	1118468
			Client Sample ID.:		S1	S2	S3
			Sample Type:		SOIL	SOIL	SOIL
			Top Depth (m):		4.00	2.00	3.00
			Date Sampled:		18-Dec-2020	18-Dec-2020	18-Dec-2020
			Asbestos Lab:		COVENTRY	COVENTRY	COVENTRY
Determinand	**Accred.**	**SOP**	**Units**	**LOD**			
ACM Type	U	2192		N/A	-	-	-
Asbestos Identification	U	2192		N/A	No Asbestos Detected	No Asbestos Detected	No Asbestos Detected
ACM Detection Stage	U	2192		N/A	-	-	-
Moisture	N	2030	%	0.020	15	12	13
pH	U	2010		4.0	8.5	9.2	8.9
Boron (Hot Water Soluble)	U	2120	mg/kg	0.40	0.60	0.43	< 0.40
Sulphur (Elemental)	U	2180	mg/kg	1.0	10	7.9	6.8
Cyanide (Total)	U	2300	mg/kg	0.50	< 0.50	< 0.50	< 0.50
Thiocyanate	U	2300	mg/kg	5.0	< 5.0	< 5.0	< 5.0
Sulphide (Easily Liberatable)	N	2325	mg/kg	0.50	5.5	5.0	46
Sulphate (Total)	U	2430	mg/kg	100	840	1700	940
Arsenic	U	2450	mg/kg	1.0	17	13	24
Cadmium	U	2450	mg/kg	0.10	0.22	0.49	0.36
Chromium	U	2450	mg/kg	1.0	14	22	22
Copper	U	2450	mg/kg	0.50	38	30	46
Mercury	U	2450	mg/kg	0.10	0.18	< 0.10	0.16
Nickel	U	2450	mg/kg	0.50	18	22	28
Lead	U	2450	mg/kg	0.50	150	60	93
Selenium	U	2450	mg/kg	0.20	< 0.20	< 0.20	< 0.20
Zinc	U	2450	mg/kg	0.50	74	88	99
Chromium (Hexavalent)	N	2490	mg/kg	0.50	< 0.50	< 0.50	< 0.50
Organic Matter	U	2625	%	0.40	4.5	6.0	2.9
Naphthalene	U	2700	mg/kg	0.10	0.71	< 0.10	< 0.10
Acenaphthylene	U	2700	mg/kg	0.10	0.15	< 0.10	< 0.10
Acenaphthene	U	2700	mg/kg	0.10	1.5	< 0.10	< 0.10
Fluorene	U	2700	mg/kg	0.10	1.1	< 0.10	< 0.10
Phenanthrene	U	2700	mg/kg	0.10	8.3	2.4	1.2
Anthracene	U	2700	mg/kg	0.10	1.7	0.62	0.23
Fluoranthene	U	2700	mg/kg	0.10	9.3	5.0	1.8
Pyrene	U	2700	mg/kg	0.10	9.2	5.4	2.0
Benzo[a]anthracene	U	2700	mg/kg	0.10	4.0	2.8	1.1
Chrysene	U	2700	mg/kg	0.10	4.3	2.4	1.3
Benzo[b]fluoranthene	U	2700	mg/kg	0.10	4.8	2.1	1.4
Benzo[k]fluoranthene	U	2700	mg/kg	0.10	2.1	1.1	0.58
Benzo[a]pyrene	U	2700	mg/kg	0.10	3.8	2.3	0.99
Indeno(1,2,3-c,d)Pyrene	U	2700	mg/kg	0.10	2.3	< 0.10	< 0.10
Dibenz(a,h)Anthracene	U	2700	mg/kg	0.10	0.70	< 0.10	< 0.10
Benzo[g,h,i]perylene	U	2700	mg/kg	0.10	2.0	< 0.10	< 0.10

Results - Soil

Project: Holmtree-Furness Ave, Heywood

Client: TJ Booth Associates			Chemtest Job No.:		20-35342	20-35342	20-35342
Quotation No.: Q19-18321			Chemtest Sample ID.:		1118466	1118467	1118468
			Client Sample ID.:		S1	S2	S3
			Sample Type:		SOIL	SOIL	SOIL
			Top Depth (m):		4.00	2.00	3.00
			Date Sampled:		18-Dec-2020	18-Dec-2020	18-Dec-2020
			Asbestos Lab:		COVENTRY	COVENTRY	COVENTRY
Determinand	**Accred.**	**SOP**	**Units**	**LOD**			
Total Of 16 PAH's	U	2700	mg/kg	2.0	56	24	11
Total Phenols	U	2920	mg/kg	0.30	< 0.30	< 0.30	< 0.30

20. APPENDIX D: PUBLICATIONS.

20.1. CIRIA SP 78, TABLE 15, Contaminant Hazards Related to End Use.

	Targets and associated hazards[1]						
	1	2	3	4	5	6	7
	Site works	Water resources	Buildings and services	Buildings and services	Garden amenities	Allotments, agriculture	Plant growing
Critical Contamination[2]	Harm to workers[3]	Leachate pollution[4]	Fire and explosion	Corrosion or expansion damage[4]	Harm to children[5]	Crop uptake of contaminant[4]	Phyto-toxicity[4]
Arsenic	O	O			●	O	
Cadmium		O			●	●[15]	
Lead		O		O[11]	●	●[15]	
Cyanide	O	●			●[14]		
PAH[6]	●		O		●		O
Phenols	●	●		●	●		O
Copper		O		O[11]	O		●[16]
Nickel		O		O[11]			●[16]
Zinc		O		O[11]			●[16]
Sulphate		●		●[12]	●		O
Sulphide		O		●			
Chloride		O		●			O
Mineral oils	●[8]	O	O	●	O		
Ammonium ion				●			
Methane	O[9]		●[9]				O
Sulphur			●	O[13]			
Combustibles	O		●[7]				
Oily, tarry substances	●	O	O	●			O
Asbestos	●	O[10]					
Radioactive materials	●	O			O	O	
Soluble metals		●		O	O		
pH	O	●		●		●	●
Solvents and organics	O	O	O				
Boron		O					O
Expansives				O[17]			

● Listed contamination hazards (from BS,DD 175 1988, and ICRCL Note 59/83 2nd edition 1987).

O Non-listed contamination hazards.

Notes.
1. Combinations of hazards may need investigation.
2. Local factors may involve other contaminants.
3. Workers at risk from contact, inhalation, explosion, fire and ground pH.
4. Soil pH affects incidence of these hazards.
5. Children at risk from inhalation, ingestion and contact.
6. PAH polynuclear aromatic hydrocarbons.
7. Combustibles include coal, oils, tars, refuse, rubber, etc Determine calorific value, loss on ignition, ash and volatile contents, total organic carbon.
8. Mineral oils are industrial hygiene problem, with or without PCB contamination.
9. Continuous on-site monitoring.
10. Hazard if run-off carries friable asbestos into streams.
11. Electrolytic action if free metal present.
12. Total and soluble sulphate (See also Section 1 1.4.4).
13. Corrosion induced by sulphur consuming bacteria.
14. Free' cyanide.
15. Total and 'plant-available' metals.
16. Total, 'plant-available' and 'zinc equivalent' values.
17. Expansives include: blast-furnace and steel slags, mining spoils and pyritic materials. Determine: total sulphur and acid soluble sulphate, calcite, and calcium as CaO.

20.2. CIRIA (Report c665) Wilson and Card Classification.

Modified Wilson and Card classification

	Characteristic situation (CIRIA R149)	Comparable classification in DETR *et al* (1999)	Risk classification	Gas screening value (GSV) (CH_4 or CO_2) (l/hr)[1] Threshold	Additional factors	Typical source of generation
	1	A	Very low risk	<0.07	Typically methane <1 % and/or carbon dioxide <5 %. Otherwise consider increase to Situation 2	Natural soils with low organic content "Typical" made ground
	2	B	Low risk	<0.7	Borehole air flow rate not to exceed 70l/hr. Otherwise consider increase to characteristic Situation 3	Natural soil, high peat/organic content. "Typical" made ground
	3	C	Moderate risk	<3.5		Old landfill, inert waste, mineworking flooded
	4	D	Moderate to high risk	<15	Quantitative risk assessment required to evaluate scope of protective measures.	Mineworking – susceptible to flooding, completed landfill (WMP 26B criteria)
	5	E	High risk	<70		Mineworking unflooded inactive with shallow workings near surface
	6	F	Very high risk	>70		Recent landfill site

Notes on the use of Table 8.5

1 Gas screening value: (Litres of gas/hour) is calculated by multiplying the maximum gas concentration (%) by the maximum measured borehole flow rate (l/hr) – see Glossary.

2 Site characterisation should be based on gas monitoring of concentrations and borehole flow rates for the minimum periods defined in Table 5.5.

3 Source of gas and generation potential/performance should be identified.

4 Soil gas investigation should be in accordance with guidance provided in Chapters 4 to 6.

5 If there is no detectable flow, use the limit of detection of the instrument.

6 The boundaries between the Partners in Technology classifications do not fit exactly with the boundaries for the CIRIA classification.

20.3. CIRIA (Report c665) Wilson and Card Protective Measures.

Typical scope of gas protective measures

Characteristic situation	Residential building (not those which belong to Situation B)[1]		Office/commercial/industrial development	
(From Table 8.5)	Number of levels of protection	Typical scope of protective measures	Number of levels of protection	Typical scope of protective measures
1	None	No special precautions	None	No special precautions
2	2	a. Reinforced concrete cast *in situ* floor slab (suspended, non-suspended or raft) with at least 1200 g DPM and underfloor venting. b. Beam and block or pre-cast concrete and 2000 g DPM/ reinforced gas membrane and underfloor venting. All joints and penetrations sealed.	1 to 2	a) Reinforced concrete cast *in situ* floor slab (suspended, non-suspended or raft) with at least 1200 g DPM. b) Beam and block or pre cast concrete slab and minimum 2000 g DPM/reinforced gas membrane. c) Possibly underfloor venting or pressurisation in combination with a) and b) depending on use. All joints and penetrations sealed.
3	2	All types of floor slab as above. All joints and penetrations sealed. Proprietary gas resistant membrane and passively ventilated or positively pressurised underfloor sub-space.	1 to 2	All types of floor slab as above. All joints and penetrations sealed. Minimum 2000 g/reinforced gas proof membrane and passively ventilated underfloor sub-space or positively pressurised underfloor sub-space
	3	All types of floor slab as above. All joints and penetrations sealed. Proprietary gas resistant membrane and passively ventilated underfloor subspace or positively pressurised underfloor sub-space, oversite capping or blinding and in-ground venting layer.	2 to 3	All types of floor slab as above. All joints and penetrations sealed. Proprietary gas resistant membrane and passively ventilated or positively pressurised underfloor sub-space with monitoring facility.
	4	Reinforced concrete cast *in situ* floor slab (suspended, non-suspended or raft). All joints and penetrations sealed. Proprietary gas resistant membrane and ventilated or positively pressurised underfloor sub-space, oversite capping and in-ground venting layer and in-ground venting wells or barriers.	3 to 4	Reinforced concrete cast in-situ floor slab (suspended, non-suspended or raft). All joints and penetrations sealed. Proprietary gas resistant membrane and passively ventilated or positively pressurised underfloor sub-space with monitoring facility. In ground venting wells or barriers.
	5	Not suitable unless gas regime is reduced first and quantitative risk assessment carried out to assess design of protection measures in conjunction with foundation design.	4 to 5	Reinforced concrete cast in-situ floor slab (suspended, non-suspended or raft). All joints and penetrations sealed. Proprietary gas resistant membrane and actively ventilated or positively pressurised underfloor sub-space with monitoring facility, with monitoring. In ground venting wells and reduction of gas regime.

Note:

1 For low rise traditional housing with ventilated clear underfloor void (ie Situation B. See Table 8.7, Box 8.4 and Section 8.3.2).

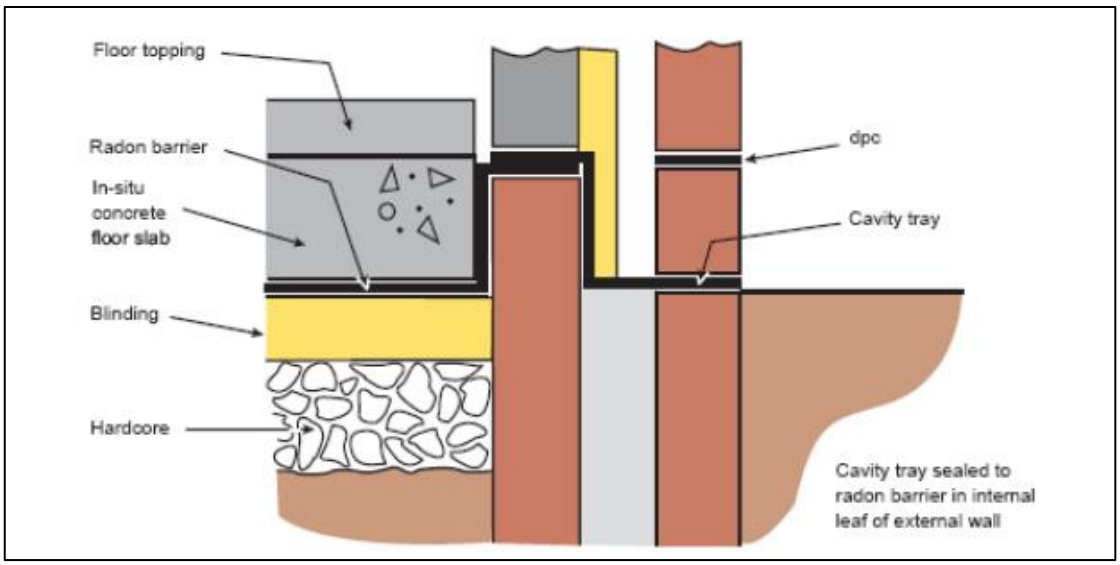
20.4. BGS/HPA report IR/11/044 – Radon Potential Class.

Radon Potential Class*	Is the property in a Radon Affected Area?	Additional information
1	No	The property is in a Lower probability radon area (less than 1% of homes are estimated to be at or above the Action Level). The property is not in a radon affected area.
2	Yes	The property is in an Intermediate probability radon area (1 to 3% of homes are estimated to be at or above the Action Level). The property is in a radon affected area.
3	Yes	The property is an Intermediate probability radon area (3 to 5% of homes are estimated to be at or above the Action Level). The property is in a radon affected area.
4	Yes	The property is in an Intermediate probability radon area (5 to 10% of homes are estimated to be at or above the Action Level). The property is in a radon affected area.
5	Yes	The property is in a Higher probability radon area (10 to 30% of homes are estimated to be at or above the Action Level). The property is in a radon affected area.
6	Yes	The property is in a Higher probability radon area (more than 30% of homes are estimated to be at or above the Action Level). The property is in a radon affected area.

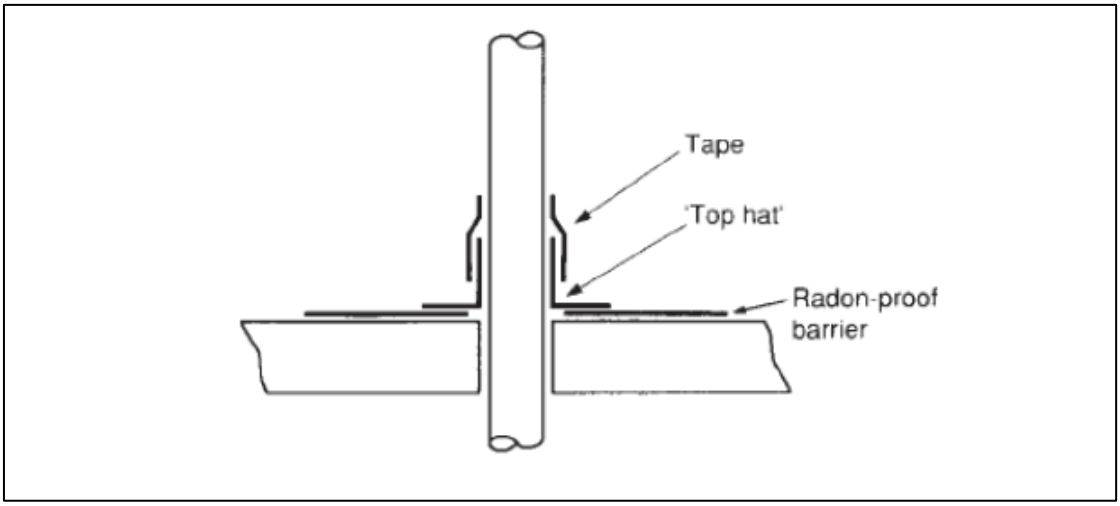
20.5. BGS/HPA report IR/11/044 – Radon Potential Class/Protection Measures.

Radon Potential Class*	What level of radon protective measures are required for new buildings in England and Wales?	What level of radon protective measures are required for new dwellings in Scotland?
1	None**	None**
2	None	Stage 1
3	Basic	Stage 1
4	Basic	Stage 1
5	Full	Stage 2
6	Full	Stage 2

20.6. BRE 211 – Typical Ground Bearing Slab, Membrane/Cavity Tray Detail.



20.7. BRE 211 – Typical Service Penetration Detail.



20.8. CIRIA C552, 2001 – Tables 6.3-6.6, Risk Matrices.

Table 6.3 *Classification of consequence*

Classification	Definition	Examples
Severe	Short-term (acute) risk to human health likely to result in "significant harm" as defined by the Environment Protection Act 1990, Part IIA. Short-term risk of pollution (note: Water Resources Act contains no scope for considering significance of pollution) of sensitive water resource. Catastrophic damage to buildings/property. A short-term risk to a particular ecosystem, or organism forming part of such ecosystem (note: the definitions of ecological systems within the Draft Circular on Contaminated Land, DETR, 2000).	High concentrations of cyanide on the surface of an informal recreation area. Major spillage of contaminants from site into controlled water. Explosion, causing building collapse (can also equate to a short-term human health risk if buildings are occupied.
Medium	Chronic damage to Human Health ("significant harm" as defined in DETR, 2000). Pollution of sensitive water resources (note: Water Resources Act contains no scope for considering significance of pollution). A significant change in a particular ecosystem, or organism forming part of such ecosystem. (note: the definitions of ecological systems within Draft Circular on Contaminated Land, DETR , 2000).	Concentrations of a contaminant from site exceed the generic, or site-specific assessment criteria. Leaching of contaminants from a site to a major or minor aquifer. Death of a species within a designated nature reserve.
Mild	Pollution of non-sensitive water resources. Significant damage to crops, buildings, structures and services ("significant harm" as defined in the *Draft Circular on Contaminated Land*, DETR, 2000). Damage to sensitive buildings/structures/services or the environment.	Pollution of non-classified groundwater. Damage to building rendering it unsafe to occupy (eg foundation damage resulting in instability).
Minor	Harm, although not necessarily significant harm, which may result in a financial loss, or expenditure to resolve. Non-permanent health effects to human health (easily prevented by means such as personal protective clothing etc). Easily repairable effects of damage to buildings, structures and services.	The presence of contaminants at such concentrations that protective equipment is required during site works. The loss of plants in a landscaping scheme. Discoloration of concrete.

Table 6.4 *Classification of probability*

Classification	Definition
High likelihood	There is a pollution linkage and an event that either appears very likely in the short term and almost inevitable over the long term, or there is evidence at the receptor of harm or pollution.
Likely	There is a pollution linkage and all the elements are present and in the right place, which means that it is probable that an event will occur. Circumstances are such that an event is not inevitable, but possible in the short term and likely over the long term.
Low likelihood	There is a pollution linkage and circumstances are possible under which an event could occur. However, it is by no means certain that even over a longer period such event would take place, and is less likely in the shorter term.
Unlikely	There is a pollution linkage but circumstances are such that it is improbable that an event would occur even in the very long term

Table 6.5 *Comparison of consequence against probability*

		Consequence			
		Severe	Medium	Mild	Minor
Probability	High likelihood	**Very high risk**	**High risk**	**Moderate risk**	Moderate/ low risk
	Likely	**High risk**	**Moderate risk**	Moderate/ low risk	Low risk
	Low likelihood	**Moderate risk**	Moderate/ low risk	Low risk	Very low risk
	Unlikely	Moderate/ low risk	Low risk	Very low risk	Very low risk

Table 6.6 *Description of the classified risks and likely action required*

Very high risk	There is a high probability that severe harm could arise to a designated receptor from an identified hazard, OR, there is evidence that severe harm to a designated receptor is currently happening. This risk, if realised, is likely to result in a substantial liability. Urgent investigation (if not undertaken already) and remediation are likely to be required.
High risk	Harm is likely to arise to a designated receptor from an identified hazard. Realisation of the risk is likely to present a substantial liability. Urgent investigation (if not undertaken already) is required and remedial works may be necessary in the short term and are likely over the longer term
Moderate risk	It is possible that harm could arise to a designated receptor from an identified hazard. However, if is either relatively unlikely that any such harm would be severe, or if any harm were to occur it is more likely that the harm would be relatively mild Investigation (if not already undertaken) is normally required to clarify the risk and to determine the potential liability. Some remedial works may be required in the longer term
Low risk	It is possible that harm could arise to a designated receptor from an identified hazard, but it is likely that this harm, if realised, would at worst normally be mild.
Very low risk	There is a low possibility that harm could arise to a receptor. In the event of such harm being realised it is not likely to be severe.