T J BOOTH ASSOCIATES

CONSULTING CIVIL & GEOTECHNICAL ENGINEERS

PHASE 1 & 2 ENVIRONMENTAL AUDIT

Proposed Residential Development

C.D. Grieves

10-12 Broadhalgh Road

Bamford

Rochdale

OL11 5LY

Author: Daniel Slattery

Client: Hallmark Developments Ltd.

Reference: rep-tjba-hallmark-10-12 broadhalgh rd-phs1-260919.docx

Revision	Date	Reason
0	October 2019	Original for planning application.

T J Booth Associates.

20A Eastgate St,

Rochdale,

Lancs,

OL16 1DH.

Tel: 01706 868288.

Email: office@tjba.co.uk

T J BOOTH ASSOCIATES

CONSULTING CIVIL & GEOTECHNICAL ENGINEERS

PHASE 1 & 2 ENVIRONMENTAL AUDIT

Proposed Residential Development

C.D. Grieves

10-12 Broadhalgh Road

Bamford

Rochdale

OL11 5LY

CONTENTS:

1. Introduction. 3
2. Proposed Development. 3
3. Historic Maps. 3
4. Present Day Maps. 3
5. Geology. 4
6. Boreholes Records. 4
7. Landmark Envirosearch Residential Report. 4
8. Coal Authority. 5
9. Local knowledge & Planning Search. 5
10. Industry Profiles. 5
11. Site Reconnaissance. 5
12. Site Investigations. 7
13. Environmental Site Summary. 8
14. Conceptual Model. 9
15. Recommendations/Site Investigation Strategy. 10
16. References. 11
17. Appendix A: Figures. 12
18. Appendix B: Maps. 18
19. Appendix C: Publications. 23

1. INTRODUCTION.

T. J. Booth Associates have been appointed by C.D. Grieves to undertake a Phase 1 Environmental Audit to the above Development Site, to support a Town & Country planning application for development.

As the current status of the proposal is for a planning application, there are currently no environmental conditions imposed by the local planning authority on the Site, however, the LPA generally require a Phase 1 Environmental Report to validate planning applications.

The Application Site is part of the current rear garden areas to Nos. 10 & 12 Broadhalgh Road. Site coordinates are E: 387215, N: 412930. A location Plan of the development Site can be found in the appendix. The proposed development comprises a 2No. detached residential dwellings.

This report provides a desk based environmental study local to the Site on the potential for contamination via the source-pathway-receptor methodology using current environmental databases, in addition to a site walkover in line with current guidance. Recommendations in line with current best practice shall be put forward at the end of the report.

2. PROPOSED DEVELOPMENT.

The proposed development is for 2No. two storey detached residential dwellings.

The existing driveway to the N side of No 12 is to be retained and used as the access road/drive to the two new dwellings to the rear.

Each dwelling will have private parking/driveways to the front, and soft landscaping to the front & rear.

3. HISTORIC MAPS.

Historic maps were obtained from Landmark at nominally 1:2500 and 1:10560 scale of the Site and the surrounding area. They were reviewed, tabulated below & appended.

DATE	ON-SITE	OFF-SITE/SURROUNDING AREA
c1850	Site is in agricultural grazing fields adjacent to what is/will become Broadhalgh Road.	Sandstone quarry 240m W, Arthur Pits approx 250m NW, Meadocroft Colliery approx 350m W. Area predominantly rural.
c1890-93	No change.	Broadfield Mill noted approx 450m S. Above collieries and quarry closed and new colliery noted 350m NE.
c1910	No change.	Colliery demolished and infill noted 300m NE. Sewage works 450m SE.
c1929-30	No change.	Residential areas built approx 200m E & SE.
c1957-63	Garden areas in which the new dwellings are to be built enclosed as present day.	Part of current residential estate built to Nos. 10-12 & around the Site to the E, W, and S to Bury Road.
c1977-90	No change.	Further residential infill to the N and W of the Site with more modern 1970s type dwellings.

4. PRESENT DAY MAPS.

Paper & digital/online resources such as google maps, topographic surveys, OS etc.

Site Boundaries, Outlines of Structures and Buildings:	The site is situated between properties on Broadhalgh Road, Chester Avenue, and York Avenue, sharing a boundary with the associated rear gardens. The site is heavily vegetated with mature trees, and enclosed by close boarded timber fencing. There are some hardstandings such as garden paths/patios as well as lawn areas.

	There is currently a garage to the rear of the existing driveway to No.12, and an inspection chamber adjacent to this/to the rear of No 12. The local area is residential.
Ground Contours, Natural Drainage Features:	As noted above, an inspection chamber is located to the rear of No12. From the topographic spot levels, the ground elevation falls from the rear E side to the front W side. In the wider area, overall land elevation falls to the S to the River Roch approximately 450m distant.
Water Courses:	River Roch approximately 450m distant. None in the immediate local area.
Below Ground Obstructions:	None indicated on current maps.

5. GEOLOGY.

The local geology was accessed via the BGS digital online mapping data service, and paper copies of Derby Sheet Sheet 125, 1:50000 Series (solid & superficial), refer to appendix for Geological Maps.

Bedrock Geology:	Maps indicate solid geology comprises Westphalian Lower Coal Measures beneath the site and wider area. There is a fault trending NW-SE through the local area which runs through the site (fault dips to the SW).
Superficial Geology:	The majority of the area to the W and N comprises boulder clay, however there are some sand & gravel deposits locally to the E, SE as well as beneath the Site.
Coal Seams/Faults.	The Arley Mine seam subcrops approximately 750m NW, and 750m SE. Given the distance from Site and the local dip of the stratigraphy, it is estimated to underlie the Site at approx 130m not considering superficial cover.

6. BOREHOLES RECORDS.

No boreholes noted within close proximity to the Site.

7. LANDMARK ENVIROSEARCH RESIDENTIAL REPORT.

Due to a previous environmental report for the Site, a Landmark Residential Report was used as the environmental database, and was obtained c2010.

7.1. HISTORICAL LAND USE

Potentially Contaminative Uses	An historical potential contaminative industrial site search indicated 2 records within 25-250m of the site. These included a quarry 250m W, and mining of coal.
Potentially Infilled Land	There were some potentially infilled parcels of land and water, but all were minor in size, and relatively distant from site.
Storage of Hazardous Substances	No historical storage of hazardous substances were recorded within a 500m radius of the site.

7.2. CURRENT LAND USE

Waste & Landfill Sites	No waste or landfill sites were recorded within a 500m radius of the Site.
Statutory Authorisations	None noted in the search data.
Discharge Consents	There are no discharge consents within a 500m radius of the site.

Storage of Hazardous Substances	No storage of hazardous substances were recorded within a 500m radius of the site.
Contraventions	No contraventions were recorded within a 500m radius of the site.
Potentially Contaminative Uses	Some minor current uses, but none that pose a risk to the site.

7.3. MINING & RADON

Coal Mining Area	In an area that may be affected by coal mining.
Radon Areas	Site is within a Class 2 radon protection area.

8. COAL AUTHORITY.

Entires, Adits, Shafts.	No shafts within 20m of site boundaries, nor within close proximity to the site. Closest was 290m NE.
Past Recorded Underground Mining.	The Coal Authority map indicated that coal has been worked at depth beneath the site and local area.
Shallow Unrecorded Mining.	None noted beneath the Site.
Shallow Recorded Mining.	None noted beneath the Site.
Development High Risk Area.	Not 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 24th April 2019.

Details of Existing Structures:	The Site currently forms the rear garden area to Nos. 10 & 12 Broadhalgh Road. The rear garden areas which form the site have recently been stripped of most heavy vegetation and paving flags, leaving the soft landscaping exposed. To the NE part of the garden area in the place of the former flagged patio, ash used as a bedding material was noted on the topsoil surface. The fences to the Site perimeter remain. No other particular site features pertinent to the investigation to comment on. Drainage manhole noted to the rear of No.12. As of 10.10.19, the garage to the side of No.12 where the access is to be located has

	been demolished. There was formerly asbestos sheeting to the roof which had been dismantled, and bagged for removal from Site. There was also an asbestos sheet roof to the garage on the adjacent plot to the SE.
Adjacent Properties:	Site is within a residential housing estate and therefore surrounded on all sides by residential dwellings and associated gardens.
Water Levels, Directions of Flow and Rates in Rivers:	None noted.
Old Mine or Quarry Workings:	None noted.
Obvious/Immediate Hazards to Health/Safety:	None noted.
Areas of Discoloured Soil, Polluted Water, Vegetation, and Significant Odours:	TBC
Relevant Ground Levels, Ground Water Levels, Positions of Wells and Springs:	Site is relatively level.

12. SITE INVESTIGATIONS.

12.1. Summary

Due to the proposed end use, and the potential for minor contamination, a limited soil sampling regime was undertaken.

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 3/4 soil samples representative of the upper 500mm of MADE GROUND would satisfy guidance criteria for sampling.

Soil sampling was undertaken on the 04.10.19 by T J Booth Associates and comprised 4 samples of topsoil (S1-4), refer to SI plan in appendix. Virgin superficial deposits were noted below the topsoil (see below).

The topsoil samples were all noted as brown silty TOPSOIL.

Further trial hole investigations were undertaken on the 10.10.19 by T J Booth Associates, and comprised 3No. machine excavated trial holes (THs1-3), completed with a 5t back acting excavator. For trial hole locations refer to Site Investigation Plan in appendix.

The site generally comprised 300-600mm topsoil, over orange-brown firm to stiff becoming stiff to hard CLAY to max 2000mm depth. Below this was an orange/brown slightly clayey/silty GRAVEL with ocassional cobbles to approx 4m depth.

No ground water was noted.

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 (& quantification if required).

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

12.2. Soil Testing Analysis.

Sample results indicated that upper topsoil across the Site contained no minor chemical contamination above the threshold level for a residential end use. However, chrysotile asbestos was found in sample S2.

Sample S2 was then sent for further quantification analysis, which revealed a result of 0.002% asbestos fibre.

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

13. ENVIRONMENTAL SITE SUMMARY.

13.1. Summary.

The Site was part of agricultural land from earliest mapping data until c1950s-60s when it was developed with the local area for residential housing estates. It has remained as part of the garden areas for Nos. 10-12 Broadhalgh Road since, and although no major sources of contamination have been identified, previous development of the current housing estate could have contributed minor contaminants to upper soil.

On Site reconnaissance some minor made ground in the form of ash/clinker was noted to the NE part of the Site which had been used as a bedding material for paviours. But other than this natural ground was recorded.

Minor site investigations were undertaken including sampling of the upper soil profile. The sample noted low levels of minor contaminants in the soil, general below the threshold levels for action. Asbestos was identified in one sample (S2) but quantification noted low levels.

Although there have been some minor commercial activities in the local and wider area such as quarries or collieries, none were noted closer than 250m.

There is the possibility that the historical industry in the area could have contributed aerial contaminants to the Site, but it is thought that this will be minimal. No major industry has been noted close to the site.

There are no landfill Sites within influencing proximity of the Site.

Although there are workings of coal beneath the site and local area, these are thought to be at considerable depth and out of the zone of influence.

The site is within a Class 2 radon protection area, however, only 1-3% of properties in this zone are affected and no protection measures are required to new dwellings.

13.2. Potential Contaminants.

The desk study/site reconnaissance has revealed the following sources (not an exhaustive list but a summary of the main points):

CURRENT SOURCE/S	ORIGINAL ASSOCIATED USAGE	CONTAMINANT/S
Made ground/upper soil.	Brownfield Site.	Metals, PAH, sulphates, inorganics, asbestos.

13.3. Potential Pathways.

The potential pathways to/from the Development Site include (not an exhaustive list but a summary of the main points):

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

13.4. Potential Receptors.

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

14. 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.	Chemical contamination.	Direct ingestion, aerial ingestion, dermal contact, drinking water. Contact with potential hazards.	Site construction operatives & future occupants. Site buildings.	PRESENT – Potential for made ground to comprise shallow ground contamination which is likely to persist.	Minor.	Unlikely.	Very low risk.
Geological ground gas.	Coal seams & radon sources.	CH4, CO2, Rn, other trace gases.	Diffusion through soil, substructures, aerial inhalation.	Future occupants. Explosion, suffocation.	NOT PRESENT – Site within a BGS/HPA Class 1 Radon Area. No coal seams within shallow depth, no adits or shafts close by.	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 landfill site within 250m of the development, no evidence of infilling or organic material in the ground locally.	Minor.	Unlikely.	Very low risk.
Contaminated ground /surface water. Controlled Waters.	Brownfield site – past development & builders yard.	Chemical contamination.	Permeation through soil into ground water, local watercourses or aquatic habitats.	Watercourses, aquatic habitats & associated wildlife.	NOT PRESENT – 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 locally.	Minor.	Unlikely.	Very low risk.
	Slaughterhouse.	Pathogenic contamination.						
Aerial contaminants.	Local industrial activity.	Chemical contamination.	Dermal contact & aerial inhalation.	All site users / occupants.	NOT PRESENT – No heavy industry noted in Site history or in the present day locally.	Minor.	Unlikely.	Very low risk.

15. RECOMMENDATIONS/SITE INVESTIGATION STRATEGY.

15.1. Contamination Risk:

The proposed Site end use is for a residential usage with soft landscaping garden areas.

Made ground including ash/clinker was noted on Site reconnaissance/investigations and although relatively inert, is a known source of metal & PAH contamination; and should be removed from soft landscaping areas.

General site topsoil noted below the ash/clinker horizon was noted as being free from shallow contamination above thresholds for action, and is considered suitable for reuse on site in soft landscaping areas as appropriate. Although asbestos contamination was noted in sample S2, quantification revealed low results, especially when considered over the Site average.

15.2. Gas Risk:

No legitimate sources of ground gas were noted in the local area, and gas risk to the development is not considered a viable pollutant linkage. Gas protection measures are not required in the development.

15.3. Additional Notes:

Before any further work is undertaken, this report should be submitted to and agreed by the Rochdale MBC Contaminated Land Team.

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

Signed…….

D.S.Slattery BSc (Hons).

T J Booth Associates.

Authorised…….

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

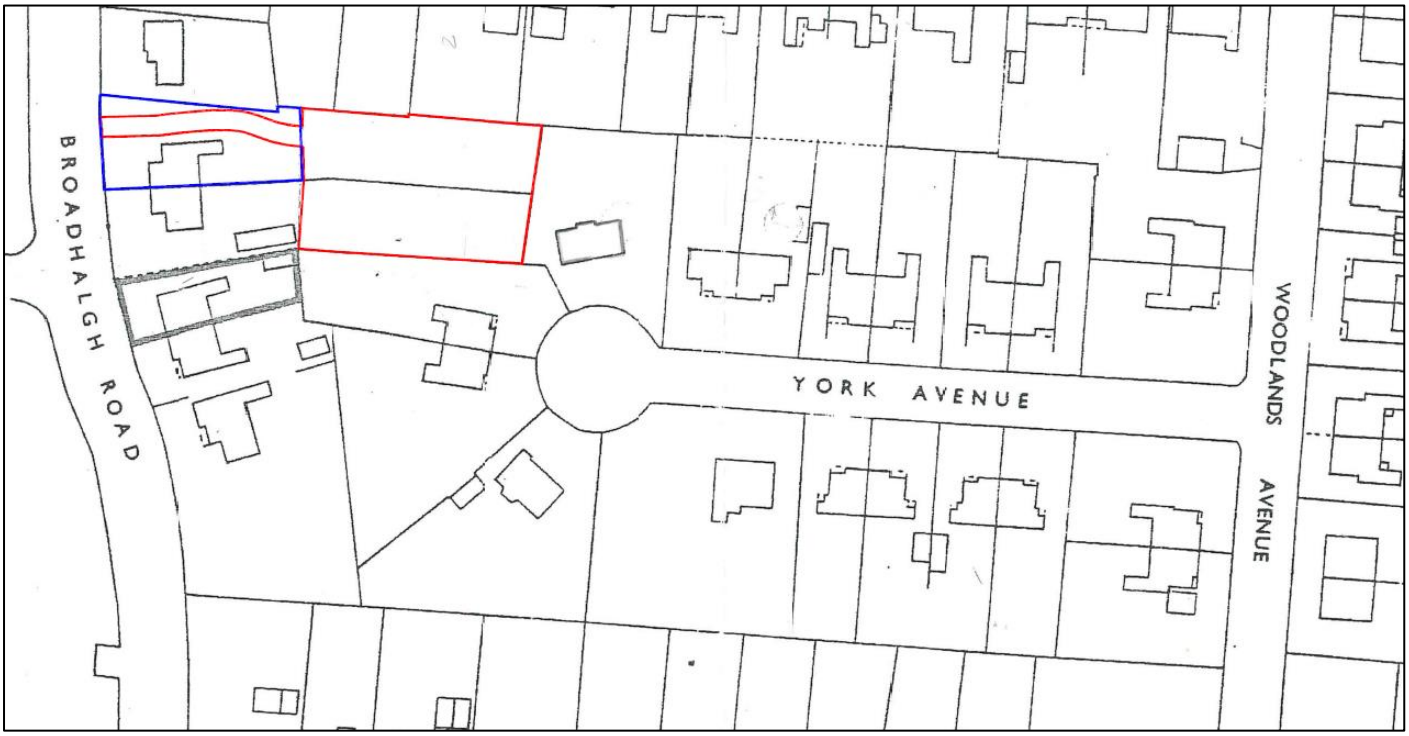
T J Booth Associates.

16. REFERENCES.

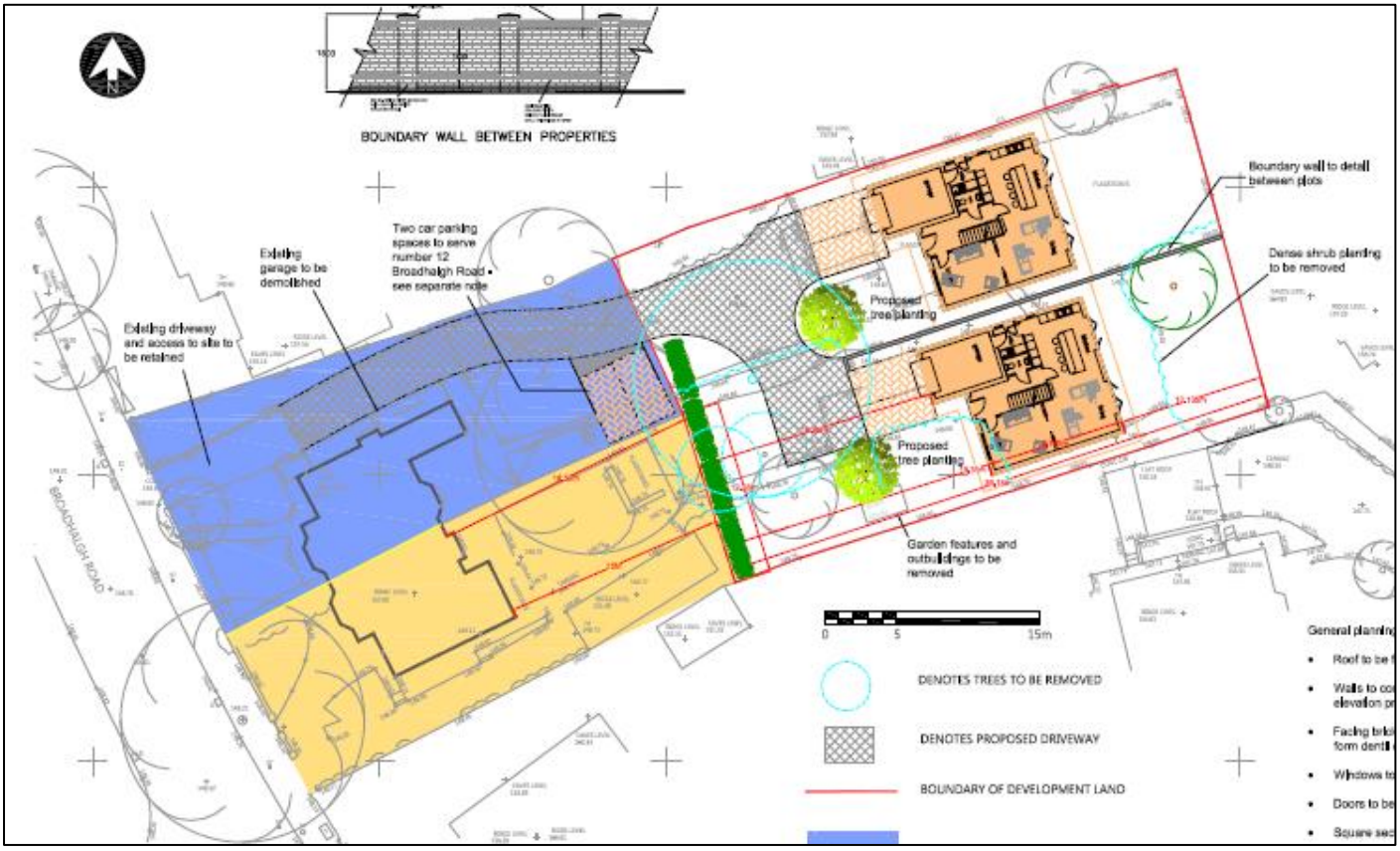
- BSI. 2013. BS 10175:2011+A1:2013. Investigation of Potentially Contaminated Sites – Code of Practice.
- Environment Agency. 2005. Secondary Model Procedure for the Development of Appropriate Soil Sampling Strategies for Land Contamination. R&D Technical Report P5-066/TR.
- CL:AIRE. 2012. Research Bulletin-RB17-A Pragmatic Approach to Ground Gas Risk Assessment.
- NHBC. 2007. Guidance on Evaluation of Development Proposals on Sites Where Methane and Carbon Dioxide are Present.
- CIRIA. Report C665.
- CIRIA. Report 130.
- CIRIA. Report SP32.
- BRE 414. 2001. Protective Measures for Housing on Gas Contaminated Land.
- ICE Manual of Geotechnical Engineering Volume I. 2012.

17. APPENDIX A: FIGURES.

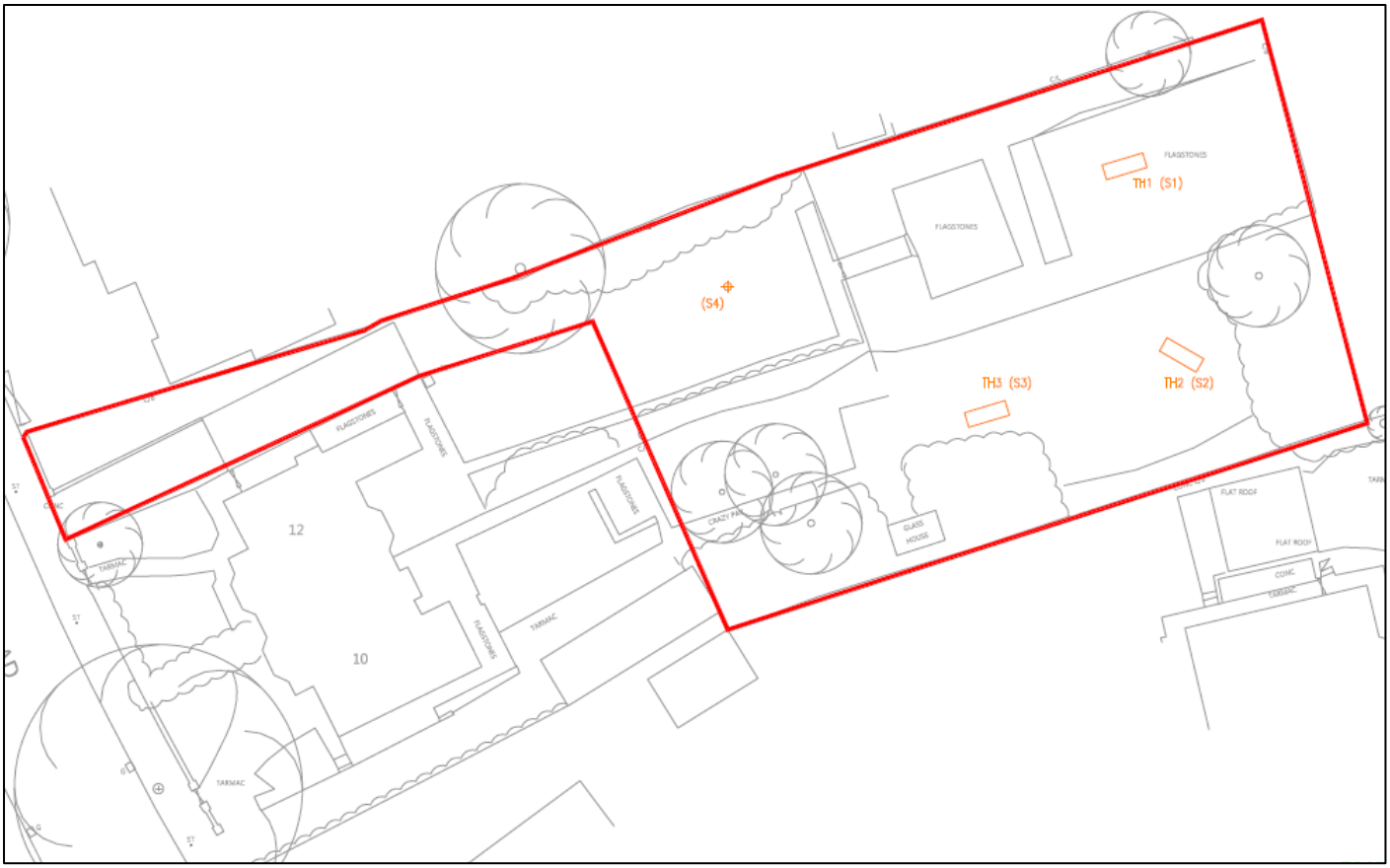
17.1. Location Plan.



17.2. Proposed Development.



17.3. Site Investigation Plan.



17.4. TJBA Soil Analysis.

Client / Site	***Grieves - 10-12 Broadhalgh Rd, Bamford***
Sampling Date	***03.10.19***

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	4	27	19.75	26.25	37	PASS	
	Boron as B, hot water sol dw	4	0.44	0.4125	0.436	290	PASS	
	Cadmium as Cd, dry weight	4	0.37	0.29	0.367	22	PASS	
	chromium as Cr(III) dry weight	4	23	21.75	22.85	910	PASS	
	Chromium as Cr(VI), dry weight	4	0.5	0.5	0.5	21	PASS	
	Copper, as Dry Weight	4	49	36.25	47.8	2400	PASS	
	Lead, as Dry Weight	4	110	91.75	108.1	200	PASS	
	Mercury as Hg, dry weight	4	0.43	0.255	0.405	1.2	PASS	
	Nickel as Ni, dry weight	4	20	19.25	20	130	PASS	
	Selenium as Se, dry weight	4	0.97	0.79	0.957	250	PASS	
	Zinc as Zn, dry weight	4	110	81	106.9	3700	PASS	
INORGANIC	Cyanide (Total)	4	0.9	0.6	0.84	2.5	PASS	
	Sulphate (Total) as SO4	4	0.17	0.09675	0.159	0.24	PASS	
	Sulphide	4	1.4	0.9425	1.339	250	PASS	
	pH	4	7.1	5.775	6.845	6 to 8	ACIDIC	
	Sulphur (Elemental)	4	6.1	3.775	5.785	100	PASS	
	Asbestos Identification	4	1	0.25	0.85	0	FAIL	sample S2 +ve chrysotile
	Asbestos quantification	4	0.002	0.0005	0.002	0.001	comment	low detection, site mean low
ORGANIC	SOM	4	6	5.125	6			
PAH	acenaphthene	4	0.44	0.225	0.413	1100	PASS	
PAH	acenaphthylene	4	0.19	0.1325	0.183	920	PASS	
PAH	anthracene	4	0.34	0.215	0.337	11000	PASS	
PAH	benz[a]anthracene	4	1.5	0.775	1.485	13	PASS	
PAH	benzo[a]pyrene	4	1.5	0.75	1.47	5	PASS	
PAH	benzo[b]flouranthene	4	2.3	1.2	2.3	3.7	PASS	
PAH	benzo[g,h,i]perylene	4	1.2	0.585	1.161	350	PASS	
PAH	benzo[k]flouranthene	4	1.1	0.575	1.085	100	PASS	
PAH	chrysene	4	1.6	0.85	1.6	27	PASS	
PAH	dibenz[ah]anthracene	4	0.3	0.155	0.273	0.3	PASS	
PAH	flouranthene	4	3	1.725	2.955	890	PASS	
PAH	flourene	4	0.29	0.17	0.275	860	PASS	
PAH	indeno[123-cd]pyrene	4	0.72	0.4025	0.716	41	PASS	
PAH	napthalene	4	0.46	0.205	0.415	13	PASS	
PAH	phenanthrene	4	2	1.125	1.94	440	PASS	
PAH	pyrene	4	3.2	1.89	3.14	2000	PASS	
PAH	PAH (Total - SUM EPA16)	4	19	10.55	18.85	1	comment	
SVOC	phenol	4	0.3	0.3	0.3	380	PASS	

GAC =LQM residential plant uptake & commercial 2009, BRE = Building Research Establishment, S = typ SNIFFER values, SOM=soil organic material, IC-ICRCL 87(withdrawn), LOD = limit of detection

17.5. Chemtest Ltd Soil Chemical Results & Certification.

UKAS TESTING 2183

Chemtest
The right chemistry to deliver results

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

Amended Report

Report No.:	19-33435-2		
Initial Date of Issue:	14-Oct-2019	**Date of Re-Issue:**	17-Oct-2019
Client	TJ Booth Associates		
Client Address:	20a Eastgate Street Rochdale Lancs OL16 1HD		
Contact(s):	Daniel Slattery		
Project	10-12 Broadhalgh Road, Bamford, Rochdale		
Quotation No.:	Q19-18321	**Date Received:**	07-Oct-2019
Order No.:		**Date Instructed:**	07-Oct-2019
No. of Samples:	4		
Turnaround (Wkdays):	9	**Results Due:**	17-Oct-2019
Date Approved:	17-Oct-2019		
Approved By:			
Details:	Glynn Harvey, Laboratory Manager Robert Monk, Technical Manager		

Page 1 of 5

Chemtest
The right chemistry to deliver results

Results - Soil

Project: 10-12 Broadhalgh Road, Bamford, Rochdale

Client: TJ Booth Associates			Chemtest Job No.:		19-33435	19-33435	19-33435	19-33435
Quotation No.: Q19-18321			Chemtest Sample ID.:		900962	900963	900964	900965
Order No.:			Client Sample Ref.:		n/a	n/a	n/a	n/a
			Client Sample ID.:		S1	S2	S3	S4
			Sample Location:		n/a	n/a	n/a	n/a
			Sample Type:		SOIL	SOIL	SOIL	SOIL
			Top Depth (m):		0.4	0.3	0.3	0.3
			Date Sampled ($):		03-Oct-2019	03-Oct-2019	03-Oct-2019	03-Oct-2019
			Asbestos Lab:		DURHAM	DURHAM	DURHAM	DURHAM
Determinand	**Accred.**	**SOP**	**Units**	**LOD**				
ACM Type	U	2192		N/A	-	Fibres/Clumps	-	-
Asbestos Identification	U	2192	%	0.001	No Asbestos Detected	Chrysotile	No Asbestos Detected	No Asbestos Detected
ACM Detection Stage	U	2192		N/A	-	Stereo Microscopy	-	-
Asbestos by Gravimetry	U	2192	%	0.001		0.002		
Total Asbestos	N	2192	%	0.001		0.002		
Moisture	N	2030	%	0.020	20	23	21	20
pH	U	2010		N/A	7.1	5.3	5.3	5.4
Boron (Hot Water Soluble)	U	2120	mg/kg	0.40	< 0.40	0.41	< 0.40	0.44
Sulphur (Elemental)	U	2180	mg/kg	1.0	6.1	4.0	4.0	< 1.0
Cyanide (Total)	U	2300	mg/kg	0.50	< 0.50	0.50	< 0.50	0.90
Thiocyanate	U	2300	mg/kg	5.0	< 5.0	< 5.0	< 5.0	< 5.0
Sulphide (Easily Liberatable)	N	2325	mg/kg	0.50	1.4	0.67	0.71	0.99
Sulphate (Total)	U	2430	mg/kg	100	480	950	740	1700
Arsenic	U	2450	mg/kg	1.0	11	22	19	27
Cadmium	U	2450	mg/kg	0.10	0.15	0.35	0.29	0.37
Chromium	U	2450	mg/kg	1.0	21	23	22	21
Copper	U	2450	mg/kg	0.50	20	41	35	49
Mercury	U	2450	mg/kg	0.10	< 0.10	0.43	0.23	0.26
Nickel	U	2450	mg/kg	0.50	18	20	20	19
Lead	U	2450	mg/kg	0.50	83	97	77	110
Selenium	U	2450	mg/kg	0.20	0.64	0.88	0.67	0.97
Zinc	U	2450	mg/kg	0.50	51	89	74	110
Chromium (Hexavalent)	N	2490	mg/kg	0.50	< 0.50	< 0.50	< 0.50	< 0.50
Organic Matter	U	2625	%	0.40	2.8	5.2	5.7	6.2
Naphthalene	U	2700	mg/kg	0.10	< 0.10	0.16	< 0.10	0.46
Acenaphthylene	U	2700	mg/kg	0.10	< 0.10	0.19	< 0.10	0.14
Acenaphthene	U	2700	mg/kg	0.10	< 0.10	0.26	< 0.10	0.44
Fluorene	U	2700	mg/kg	0.10	< 0.10	0.19	< 0.10	0.29
Phenanthrene	U	2700	mg/kg	0.10	< 0.10	1.6	0.80	2.0
Anthracene	U	2700	mg/kg	0.10	< 0.10	0.34	< 0.10	0.32
Fluoranthene	U	2700	mg/kg	0.10	< 0.10	3.0	1.1	2.7
Pyrene	U	2700	mg/kg	0.10	0.26	3.2	1.3	2.8
Benzo[a]anthracene	U	2700	mg/kg	0.10	< 0.10	1.4	< 0.10	1.5
Chrysene	U	2700	mg/kg	0.10	< 0.10	1.6	< 0.10	1.6

Chemtest
The right chemistry to deliver results

Results - Soil

Project: 10-12 Broadhalgh Road, Bamford, Rochdale

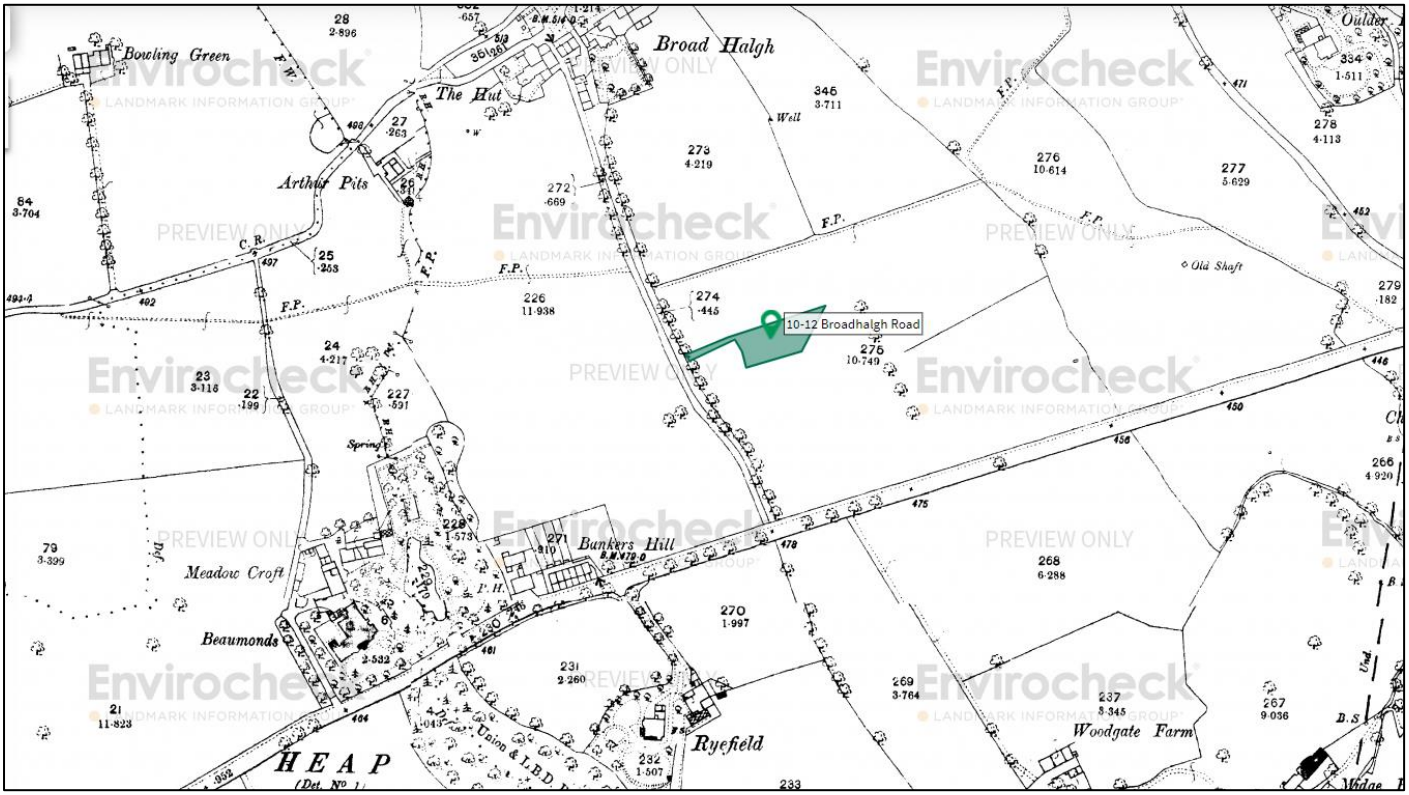
Client: TJ Booth Associates			Chemtest Job No.:		19-33435	19-33435	19-33435	19-33435
Quotation No.: Q19-18321			Chemtest Sample ID.:		900962	900963	900964	900965
Order No.:			Client Sample Ref.:		n/a	n/a	n/a	n/a
			Client Sample ID.:		S1	S2	S3	S4
			Sample Location:		n/a	n/a	n/a	n/a
			Sample Type:		SOIL	SOIL	SOIL	SOIL
			Top Depth (m):		0.4	0.3	0.3	0.3
			Date Sampled ($):		03-Oct-2019	03-Oct-2019	03-Oct-2019	03-Oct-2019
			Asbestos Lab:		DURHAM	DURHAM	DURHAM	DURHAM
Determinand	**Accred.**	**SOP**	**Units**	**LOD**				
Benzo[b]fluoranthene	U	2700	mg/kg	0.10	< 0.10	2.3	< 0.10	2.3
Benzo[k]fluoranthene	U	2700	mg/kg	0.10	< 0.10	1.0	< 0.10	1.1
Benzo[a]pyrene	U	2700	mg/kg	0.10	< 0.10	1.3	< 0.10	1.5
Indeno(1,2,3-c,d)Pyrene	U	2700	mg/kg	0.10	< 0.10	0.69	< 0.10	0.72
Dibenz(a,h)Anthracene	U	2700	mg/kg	0.10	< 0.10	0.12	< 0.10	0.30
Benzo[g,h,i]perylene	U	2700	mg/kg	0.10	< 0.10	0.94	< 0.10	1.2
Total Of 16 PAH's	U	2700	mg/kg	2.0	< 2.0	18	3.2	19
Total Phenols	U	2920	mg/kg	0.30	< 0.30	< 0.30	< 0.30	< 0.30

18. APPENDIX B: MAPS.

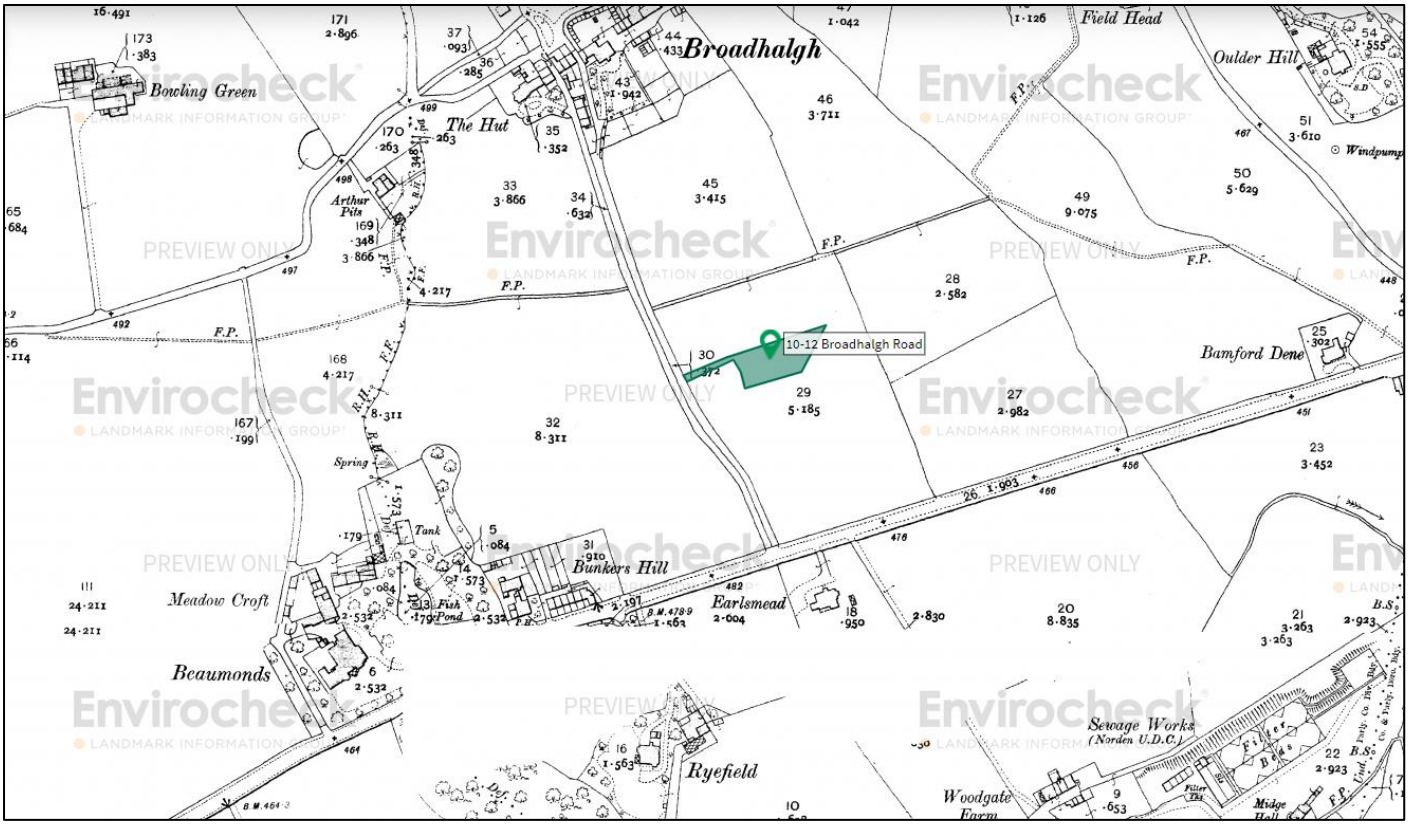
18.1. Ordnance Survey c1850



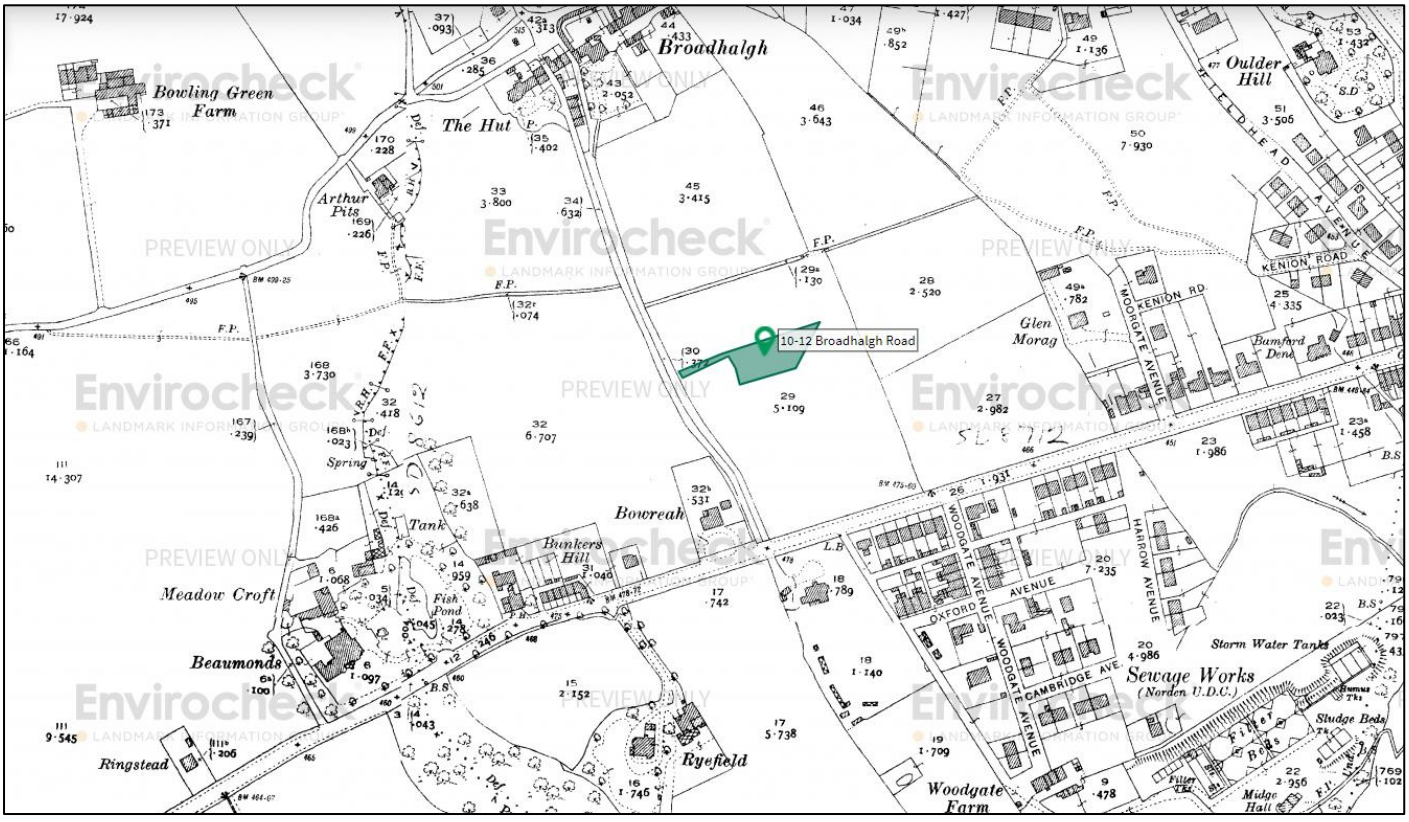
18.2. Ordnance Survey c1890-93



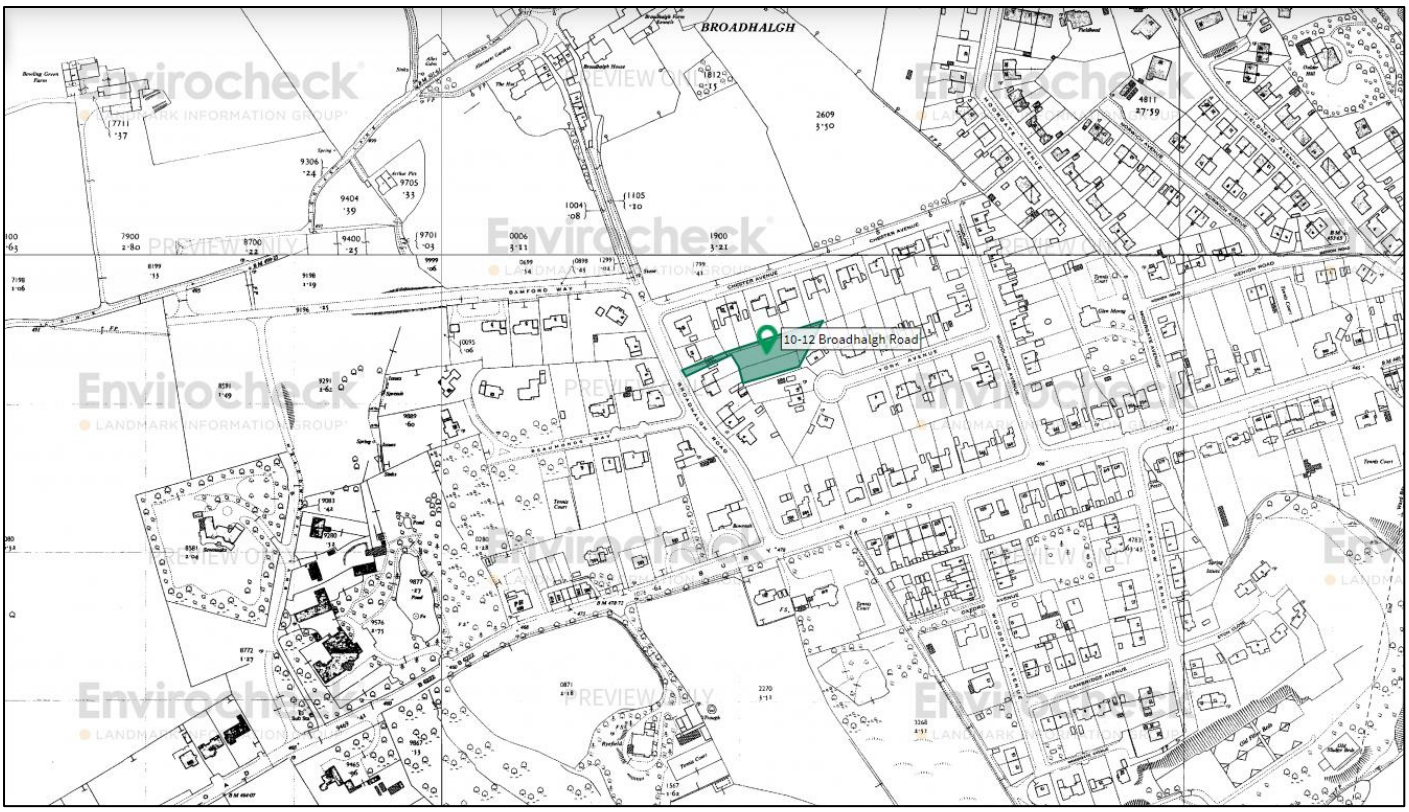
18.3. Ordnance Survey c1910



18.4. Ordnance Survey c1929-30



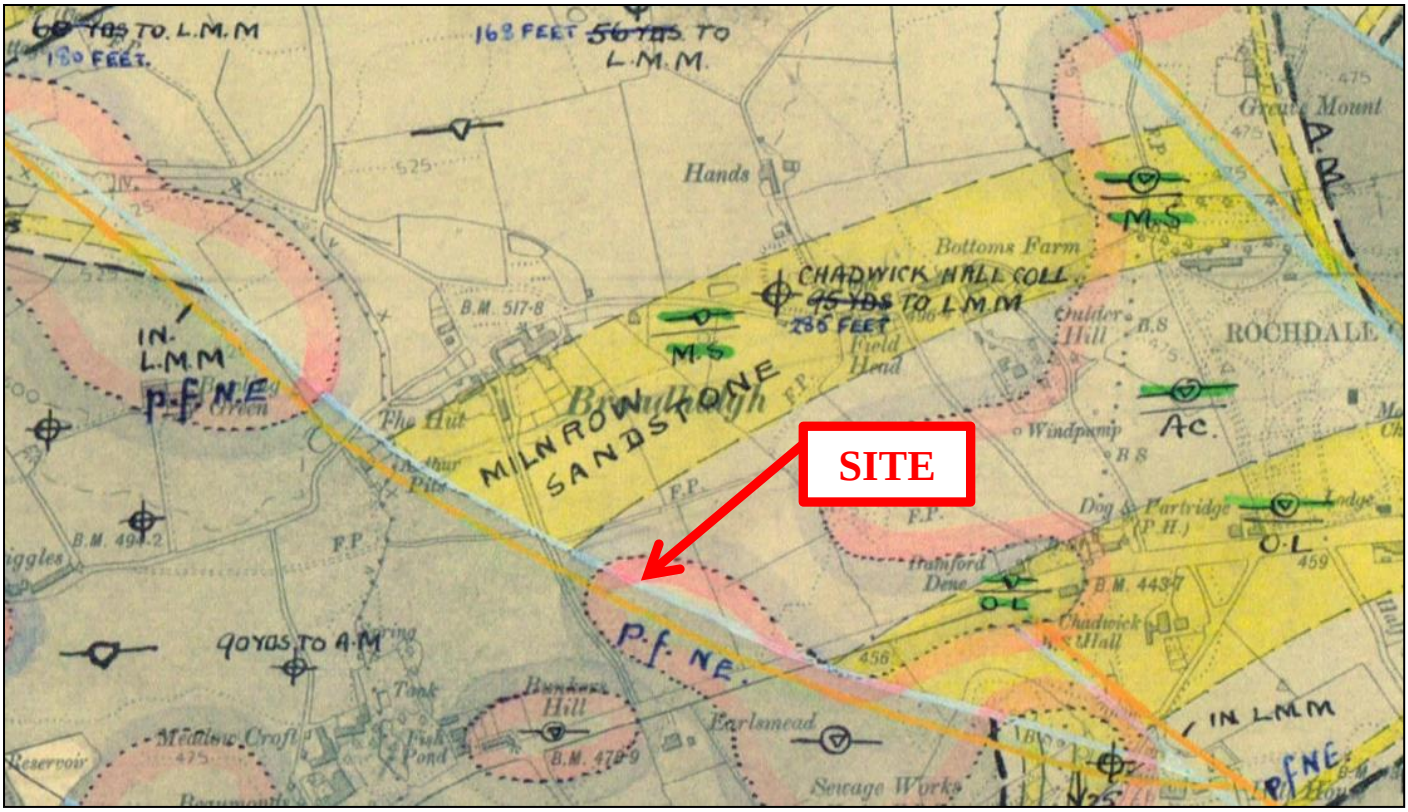
18.5. Ordnance Survey c1957-63



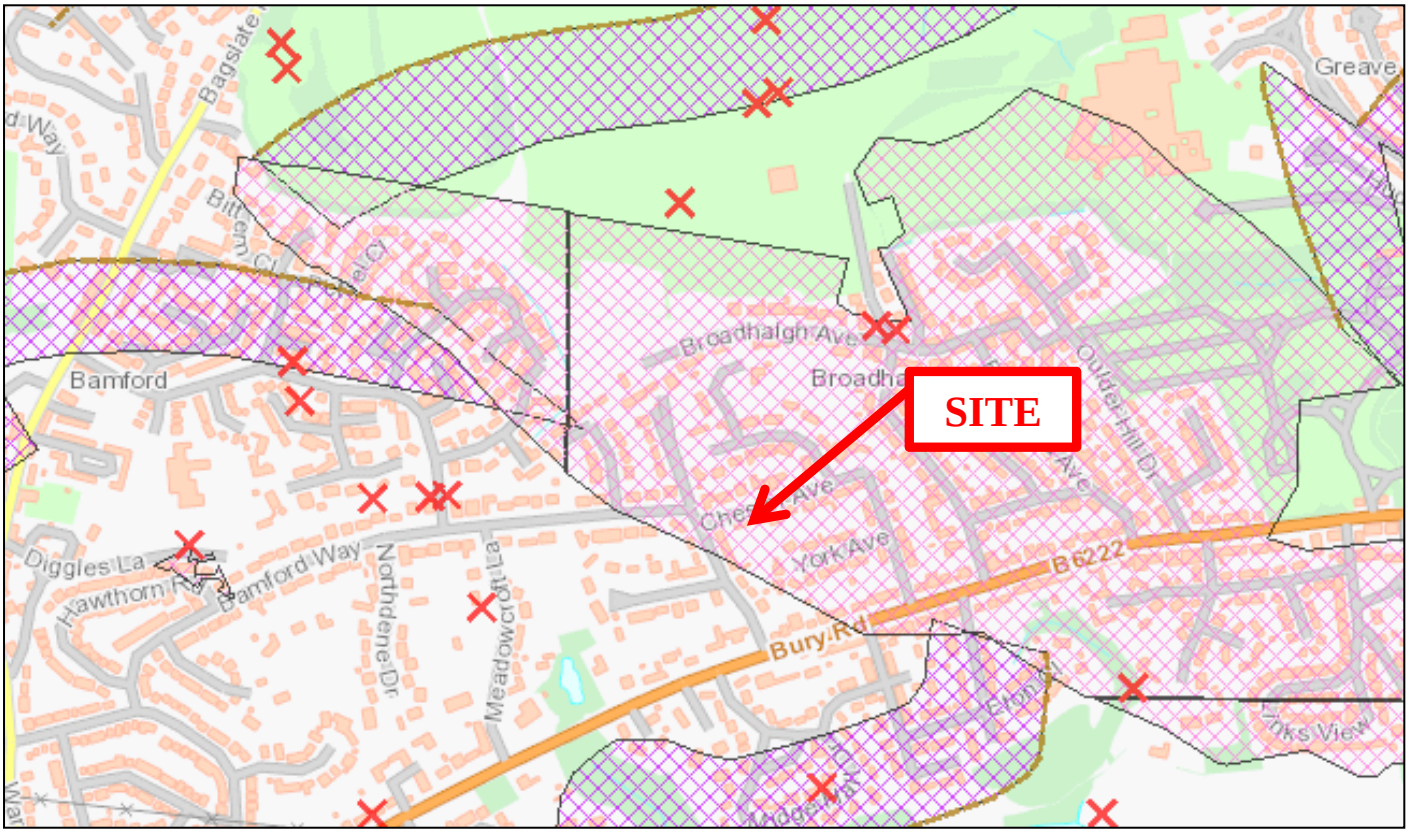
18.6. Ordnance Survey c1977-90



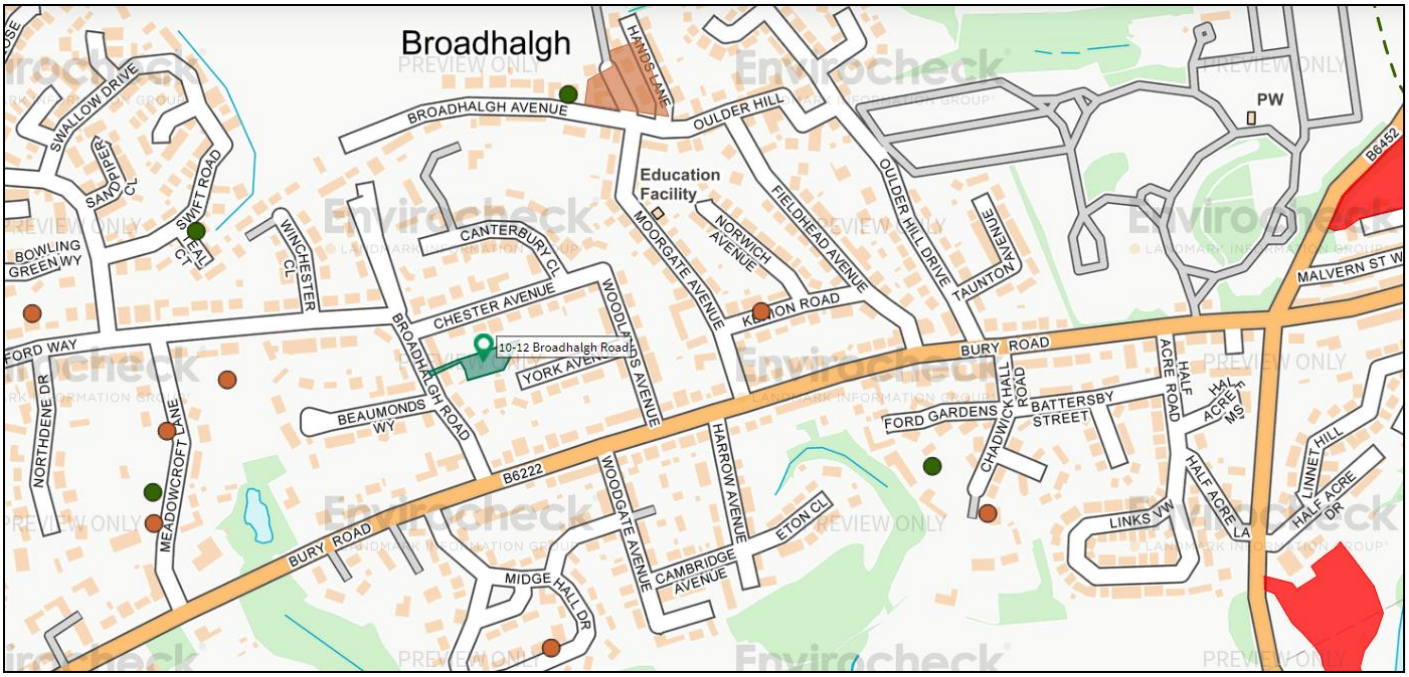
18.7. BGS Geological Map (Solid & Superficial).



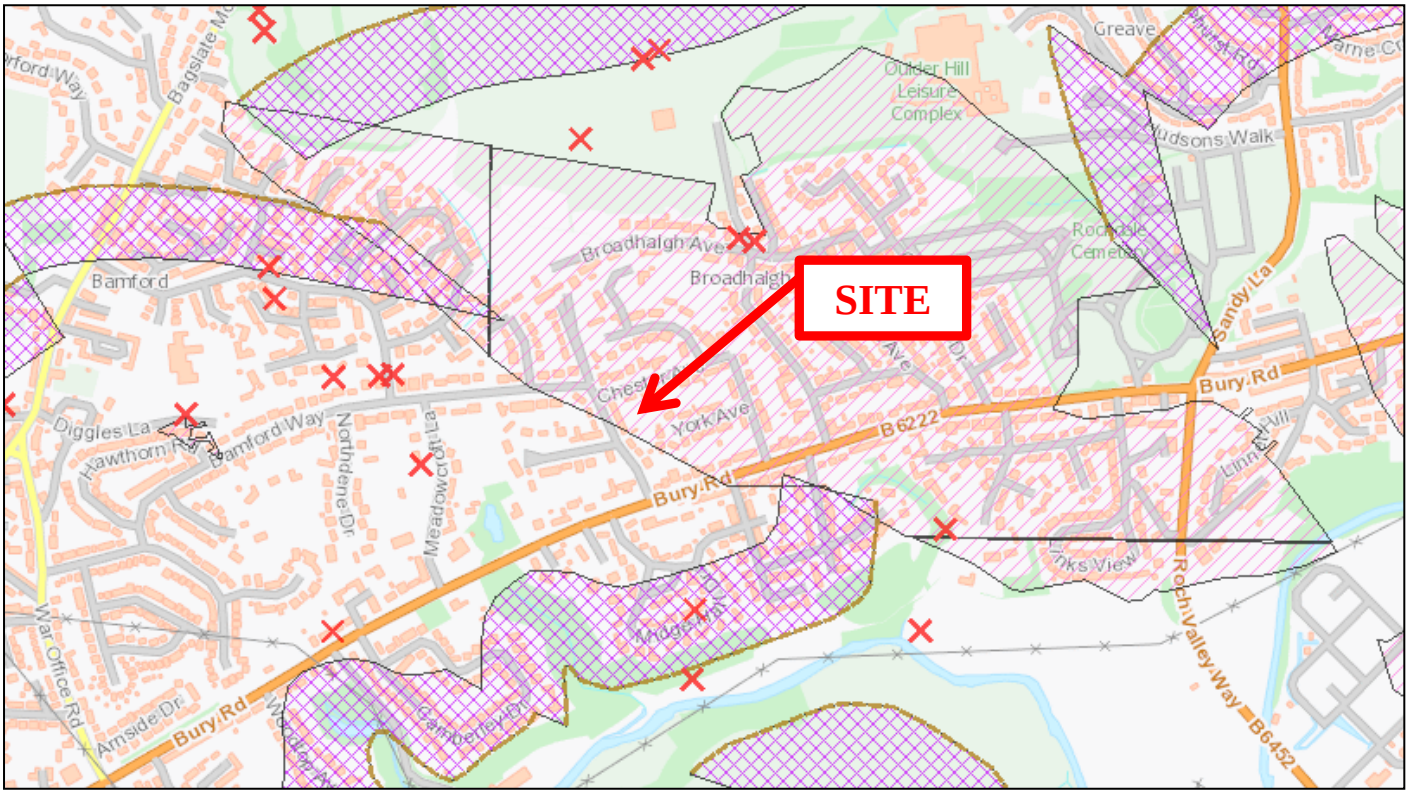
18.8. Coal Authority Map.



18.9. Landmark Landfill Contaminants Map



18.10. Coal Authority Map



19. APPENDIX C: PUBLICATIONS.

19.1. 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.

19.2. 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.

19.3. 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).

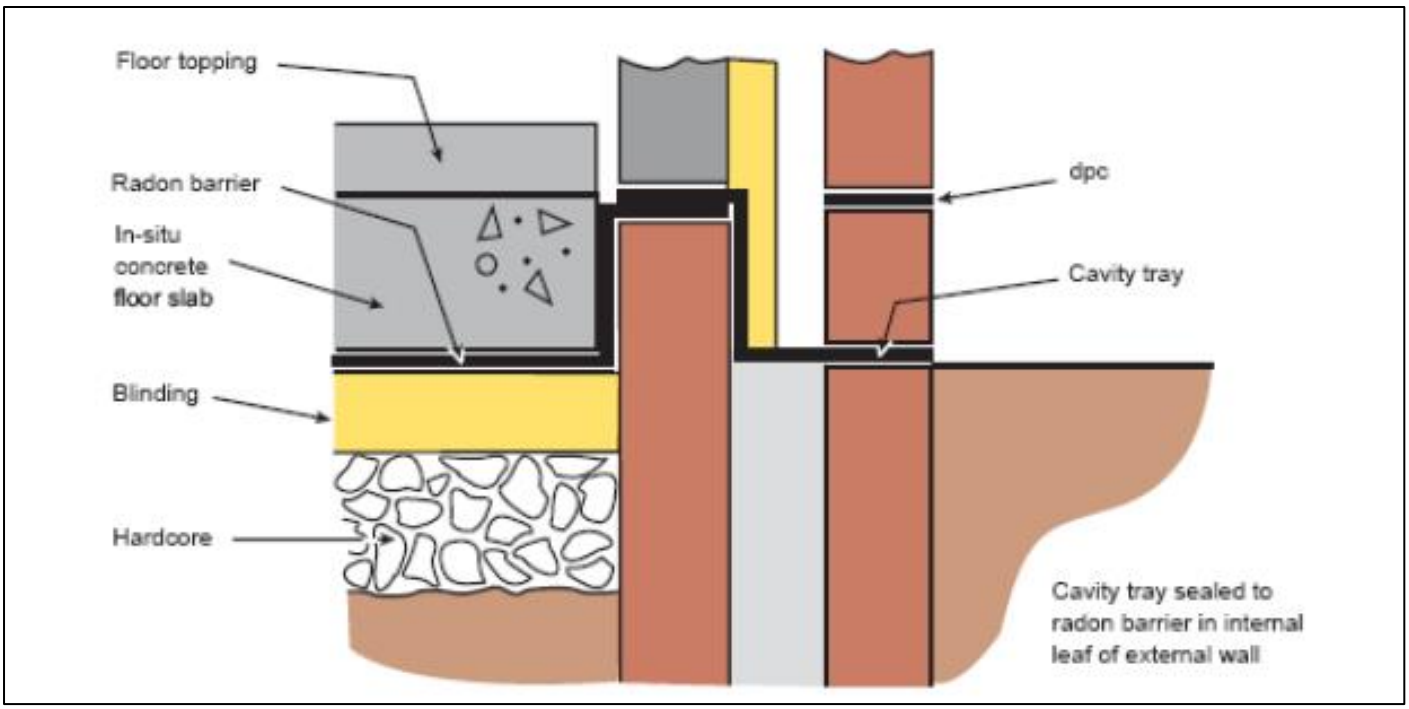
19.4. BGS/HPA report IR/11/044 – Radon Potential Class.

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.

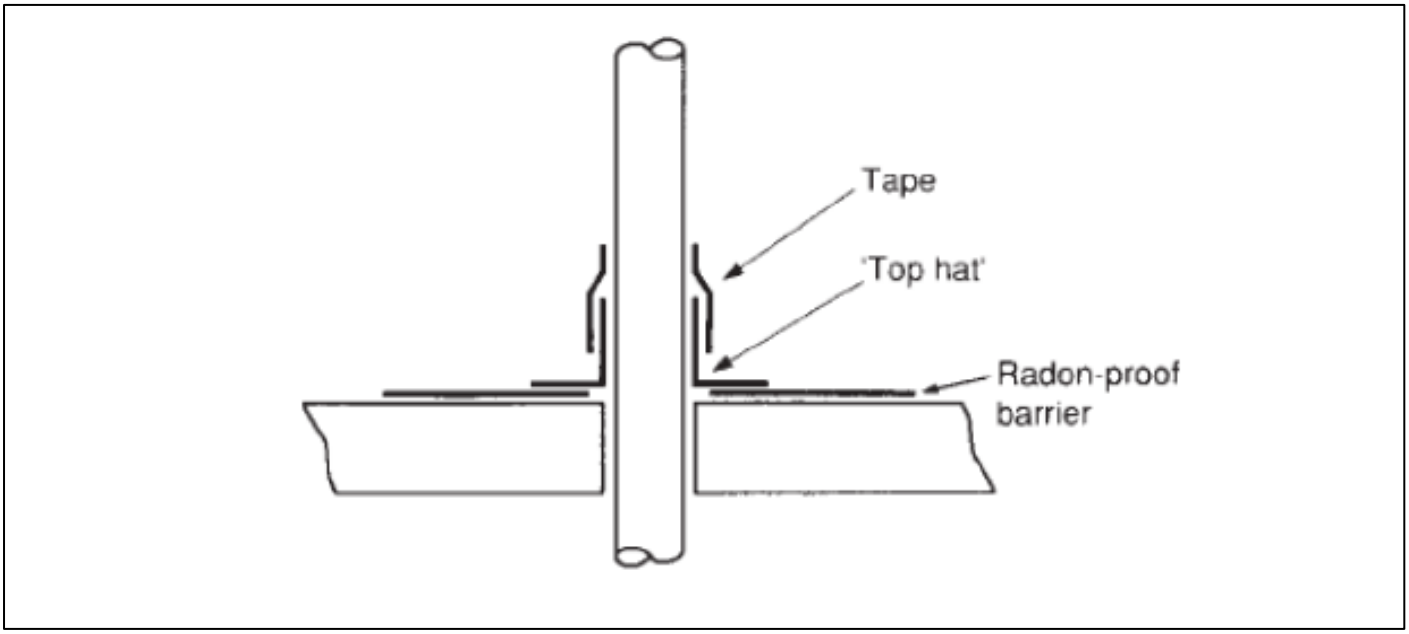
19.5. BGS/HPA report IR/11/044 – Radon Potential Class/Protection Measures.

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

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



19.7. BRE 211 – Typical Service Penetration Detail.



19.8. 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.