T J BOOTH ASSOCIATES

CONSULTING CIVIL & GEOTECHNICAL ENGINEERS

PHASE 1 ENVIRONMENTAL AUDIT.

Proposed Residential Development

Higher Stakehill Farm

Stakehill Lane

Rochdale

M24 2RR

Author: Daniel Slattery

Client: John Johnson

Reference: rep-tjba-johnson-higher stakehill fm-PHS1-031120.docx

Revision	Date	Reason
0	Nov 2020	Original for planning.

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 ENVIRONMENTAL AUDIT.

Proposed Residential Development

Higher Stakehill Farm

Stakehill Lane

Rochdale

M24 2RR

CONTENTS:

1. Introduction. 3
2. Proposed Development 3
3. Historic Maps 4
4. Present Day Maps. 4
5. Geology. 5
6. Boreholes Records. 5
7. Landmark Envirocheck 5
8. Coal Authority 6
9. Local knowledge & Planning Search 6
10. Industry Profiles 6
11. Site Reconnaissance 6
12. Site Investigations 7
13. Environmental Site Summary 8
14. Conceptual Model 9
15. Remediation Strategy 10
16. References 12
17. Appendix A: Photos & Figures. 13
18. Appendix B: Maps. 16
19. Appendix C: Publications. 24

1. INTRODUCTION.

T. J. Booth Associates have been appointed by Mr John Johnson to undertake a Phase 1 Environmental Audit to Higher Stakehill Farm.

The site currently comprises an existing farmhouse, disused barn & other outbuildings within a small curtilage formerly part of a wider farm.

The proposal is for renovation of the outbuildings to provide new dwellings.

Planning permission (ref No: 16/01193/FUL) was obtained in September 2018 for the: *"Change of use, conversion and extension of three disused buildings to provide four dwellings"*. Condition 4 on the permission notice concerned environmental assessment, specifically requesting the following:

Part I - Particulars of Application

Date of Application: 3 October 2016

Proposal:	**Change of use, conversion and extension of three disused buildings to provide four dwellings**
Location:	**Higher Stakehill Farm, Stakehill Lane, Middleton, M24 2RT**

Part II - Particulars of decision

The Rochdale Borough Council hereby give notice in pursuance of the provisions of the Town and Country Planning Act 1990 (as amended) that planning permission has been **GRANTED SUBJECT TO CONDITIONS** for the carrying out of the development referred to in Part I above.

The Council hereby permits the above development in accordance with the details given on the application form and subject to the following condition(s):

Conditions and Reasons:

4 No development shall take place until an investigation and risk assessment 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.4 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 a renovation and extension of existing former farm buildings, stables and barns.

The development will provide 4No residential dwellings with associated driveways and parking areas, and soft landscaping garden areas and lawns.

Refer to Existing & Proposed Plans in the Appendix.

3. HISTORIC MAPS.

DATE	ON-SITE	OFF-SITE/SURROUNDING AREA
c1848-51	Stakehill Farm noted on-site with existing main farmhouse and barn shown, an unnamed lane running through to the north-east.	Stakehill Lane to the south-west side of the site, with buildings noted to the south-west side. Whit brook noted 25m south. Wider area is agricultural pasture. Reservoirs noted 250m north.
c1893	No overall change. Curtilage now shown.	Whit brook shown to be culverted for a short length close to the site, resurfacing again south-west of Stakehill Lane. There is also an unnamed stream noted 25m north of the site. Farmhouses/cottages in the wider area.
c1909-10	No change.	No overall change.
c1929-32	Minor outbuildings shown on site.	No overall change.
c1937-39	Additional minor outbuildings shown on site.	No overall change.
c1955	Well noted on site to the rear of the cottages.	No overall change.
c1957	No change.	Buildings across Stakehill Lane now indicated to be Higher Stakehill Hall Farm. Motorway M66 noted 100m north-east of the site.
c1977-85	No change.	The opposite Stakehill Hall Farm now demolished, and land shown as vacant. C1983-84 1:10000 scale maps show Stakehill Fall Farm opposite so is assumed it was demolished in 1985.
c1992	Additional minor outbuildings shown on site.	Construction of the Stakehill Industrial Estate now indicated 200m to the south-west.
c1994	No change.	Large industrial unit erected to the south-west approx. 100m distant.

4. PRESENT DAY MAPS.

Site Boundaries, Outlines of Structures and Buildings:	As of 2020, present-day maps show the existing cottage and barn to the front of the site. There are additional outbuildings to the north & east sides, and the former lane still runs through the site to the north east of the area close to the M66 Motorway. The site is partially landscaped to the rear of the existing cottage, with current and former access running to each side of the main cottage/barn, and around the immediate rear of the cottages. Access also runs up to the former sheds/stables to the north west side.
Ground Contours, Natural Drainage Features:	There is fall in the local area to the west/south west towards Whit Brook. A drainage survey has been undertaken, and the site is connected to the United Utilities mains sewerage which located in the Stakehill Lane.
Water Courses:	Whit Brook is nominally 10-25m west/south-west.
Below Ground Obstructions:	None noted.

5. GEOLOGY.

Bedrock Geology:	Undifferentiated sandstone/mudstone of the Carboniferous Lower Coal Measures.
Superficial Geology:	Drift geology beneath the site is shown to be sand & gravel although the area which it covers is small. There is glacial till (boulder clay) shown all around the development suggesting sand & gravel deposits could be relatively thin if present.
Coal Seams/Faults.	The closest coal seam is the Arley approximately 480m north-east of the site dipping south west. The seam is estimated to be at approximately 80m beneath the ground level at 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:	No discharge consents within a 250m.
Integrated pollution prevention & control:	2No records within a 250m radius, closest is 213m west.
Local Authority pollution prevention & controls:	No records within a 250m radius.
Water abstractions:	1No. record within 500m radius, recorded as a well at Newmarket Farm Chadderton 351m south east.
Groundwater vulnerability:	Noted as high vulnerability.
Bedrock aquifer:	Secondary A aquifer.
Superficial aquifer:	Secondary A aquifer.
Source protection zone:	Not within an SPZ.

7.2. WASTE

BGS recorded landfill sites:	No records within a 250m radius.
Historical landfill sites:	No records within a 250m radius.
Registered landfill sites:	No records within a 250m radius.

7.3. HAZARDOUS SUBSTANCES

Control of major accident hazards sites (COMAH):	1No. record within 250m relating to Proseat LLP 213m east.
Planning hazardous substance consents:	1No. record within 250m relating to SSL International PLC 193m south west.

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:	No hazard.
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.	No shafts within 20m of site boundaries.
Past Recorded Underground Mining.	No workings noted at depth.
Shallow Unrecorded Mining.	No workings noted beneath the site.
Shallow Recorded Mining.	No workings 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 13.11.2020.

Details of Existing Structures:	The site is fronted with the existing masonry farmhouse positioned central with barns to either side. The current site access is to the north side of the existing barn which leads to the rear of the barn & farmhouse, and on to the masonry/timber stables

	and asbestos clad steel shed to the north of the site. Two concrete storage bunds were also noted in this location. There was a timber/metal clad barn/storage shed to the east side of the site, surrounded by soft landscaping – formerly accessed from the south side of the farmhouse. Much of the rear of the site (east side) beyond the farmhouse and immediate access hardstanding was comprised of a tiered garden area with mature and semi mature trees.
Adjacent Properties:	Cottages to the north and south along Stake Hill Lane. The immediate local area is agricultural.
Water Levels, Directions of Flow and Rates in Rivers:	Whit Brook noted to the south east.
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:	Trial holes had been excavated in the hardstanding access areas adjacent the farmhouse, barns and stables for geotechnical purposes. The soil profiles generally revealed 300-600mm of ashy MADE GROUND over predominantly virgin CLAY, with some occasional sand & gravel noted.
Relevant Ground Levels, Ground Water Levels, Positions of Wells and Springs:	The site is approximately 101.50maOD to the rear east side falling to approximately 99.50maOD at the rea of the farmhouse. Stakehill Lane is approximately 99.00maOD.

12. SITE INVESTIGATIONS

12.1. Site Investigations

Site investigations were undertaken for geotechnical purposes by T J Booth Associates on 11.08.2020.

In total 9No. trial holes (THs1-9) were excavated in and around the existing buildings and associated hardstandings. THs 1-4 were undertaken to assess the geotechnical characteristic of the site, and THs 5-9 undertaken to ascertain foundation depth & type for structural assessment (not covered in this report, refer to separate report ref: *calc-tjba-johnson-stakehill ln-SI report-rev0*.

Generally, in trial holes 1-4, MADE GROUND was noted between 200mm and 600mm depth. Made ground comprised a sandy topsoil with occasional brick, plastic and ash.

This was underlain by virgin glaciofluvial deposits made up of CLAY, silty CLAY, and SAND & GRAVEL.

12.2. Soil Sampling Assessment

Soil sampling was not undertaken.

12.3. Gas Monitoring Assessment

Gas monitoring was not undertaken.

13. ENVIRONMENTAL SITE SUMMARY

13.1. Summary

Since earliest mapping data c1850, the site has comprised the farmhouse and adjoining barns fronting Stake Hill Lane, and other buildings adjacent to the north side entrance. The existing stable was added by c1890, with other sheds being added later. A well was noted on site c1950s, which later was removed from the mapping data.

The local area remains agricultural, with another farm across Stake Hill Lane which was demolished c1985. The nearby industrial estate established nominally from the late 1970s to the 1980s increasing in size to the present day but the development is relatively recent suggesting aerial contaminants are regulated.

Site investigations undertaken in either current or former hardstanding areas of the site adjacent indicated made ground, which is expected to strengthen the ground where required by former farmers for access, and comprised ash and brick which is known to comprise contaminants especially metals and PAH.

On site reconnaissance the large steel framed shed to the north side of the site was clad in asbestos sheet (ACM). The ACM sheets were in good condition.

No risk of coal mining was identified in the dataset.

No risk of landfill gas was noted in the dataset.

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.

13.2. Potential Contaminants

CURRENT SOURCE/S	ORIGINAL ASSOCIATED USAGE	CONTAMINANT/S
Made ground to access roads/hardstandings.	N/A.	Metals, PAH, sulphates, inorganics, asbestos.
Asbestos sheet (ACM).	Storage shed.	Asbestos.

13.3. 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

13.4. Potential Receptors

Receptors mainly comprise workers in the construction phase, and workers in 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.	Site construction operatives & future inhabitants.	PRESENT – Site hardstandings and access roads comprise MADE GROUND with ashy topsoil and rubble noted. Asy and building rubble are a source of metal & PAH contamination and should be removed from all garden areas.	Medium.	Likely.	Moderate risk.
Asbestos ACM on storage shed.	N/A.	Chemical contamination.	Aerial ingestion.	Site construction operatives & future inhabitants.	PRESENT – If left can be a risk but the risk can be avoided as the ACM board appears to be in good condition i.e. not friable etc. Removal in accordance with HSE guidelines would remove the source and pathway.	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. No coal seams within shallow depth, no adits or shafts close by & not within a Development High Risk Area.	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.	UNLIKELY – No infilled reservoirs etc noted.	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.

15. REMEDIATION STRATEGY

15.1. Ground/Soil Contamination Risk

The proposed site end use is residential. The historic use of the site has been agricultural, and no particular contaminative use has been noted on site or in the wider area.

However, limited geotechnical site investigations to date have noted made ground including minor building rubble and ash which is a known source of metal and PAH contamination. The made ground was noted in areas that are proposed to be garden area.

Due to the above, existing made ground represents a risk to receptors for the associated end use and should be remediated in the form of removal and replacement where necessary to mitigate the risk to receptors. Where natural virgin topsoil is noted, this is considered suitable for the end use and may be re-used as necessary.

Made ground may remain on site beneath permanent hardstandings such as buildings, roads, pavements & pathways etc.

It is advised that a cover layer of clean inert soil is imported to be used to replace all areas of made ground in garden and soft landscaping areas ONLY, subject to the following:

- Made ground must be reduced to minimum 600mm from finish levels and be replaced with 600mm of clean inert soil.
- Should all made ground be removed from beneath garden areas to virgin clay; then minimal finishes may apply to suit.
- In areas where no made ground exists, existing virgin topsoil may remain.

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.

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 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.
- Cover levels will need to be confirmed by taped trial pits.

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 & subsequent import depth confirmation.

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.

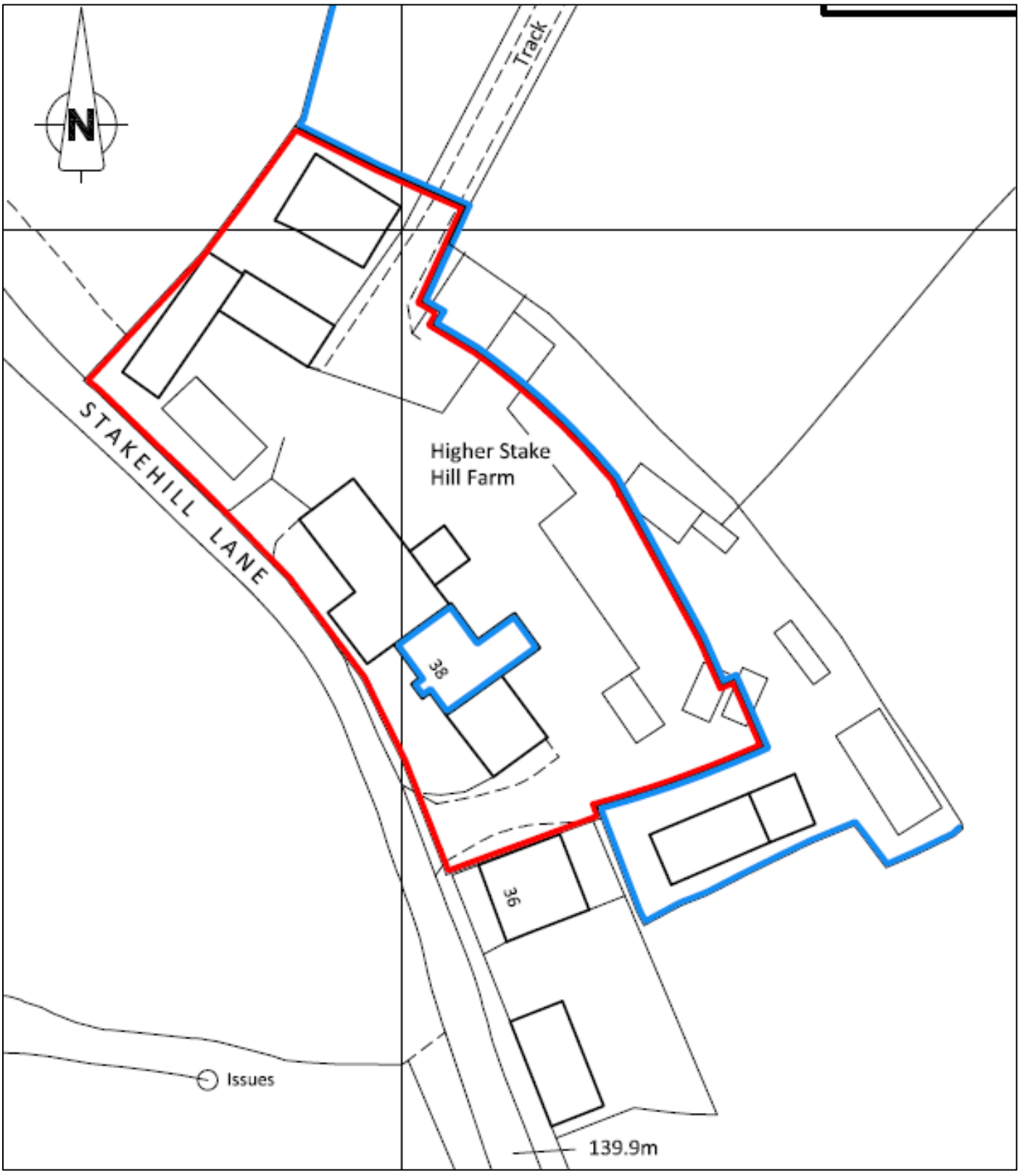
BSI. 2013. BS 8576:2013. Guidance on investigation for ground gas – permanent gases and volatile organic compounds (VOCs).

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

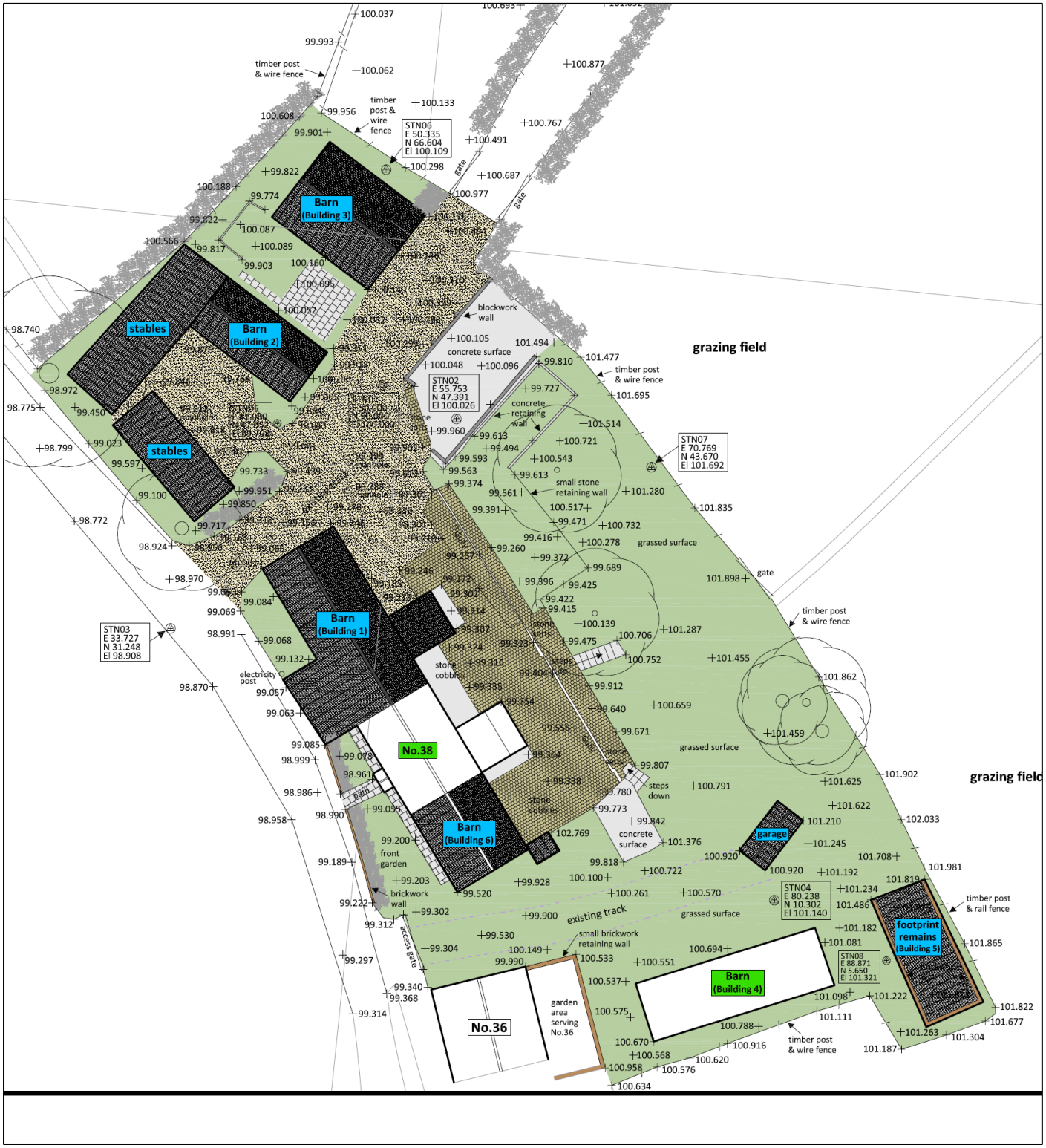
CIRIA. 2019. Report C758D. Abandoned mine workings manual.

17. APPENDIX A: PHOTOS & FIGURES.

17.1. Location Plan.



17.2. Existing Site Plan / Topographic Survey.

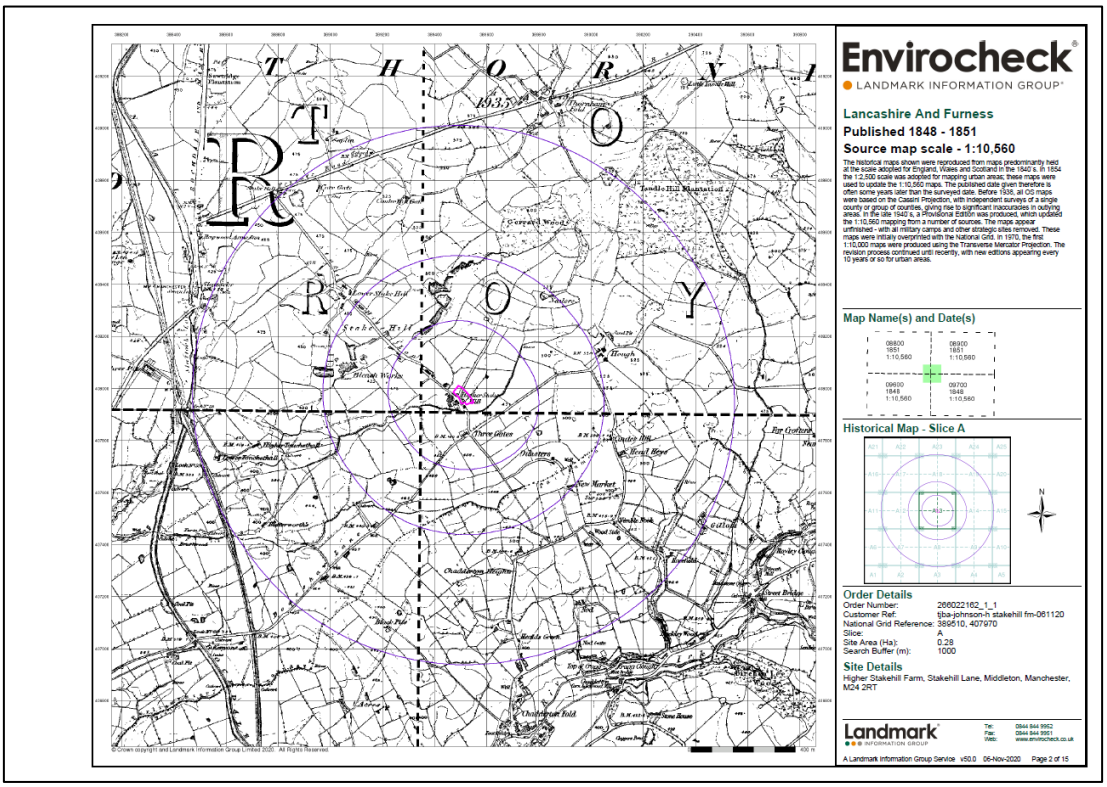


17.4. Proposed Site Plan.

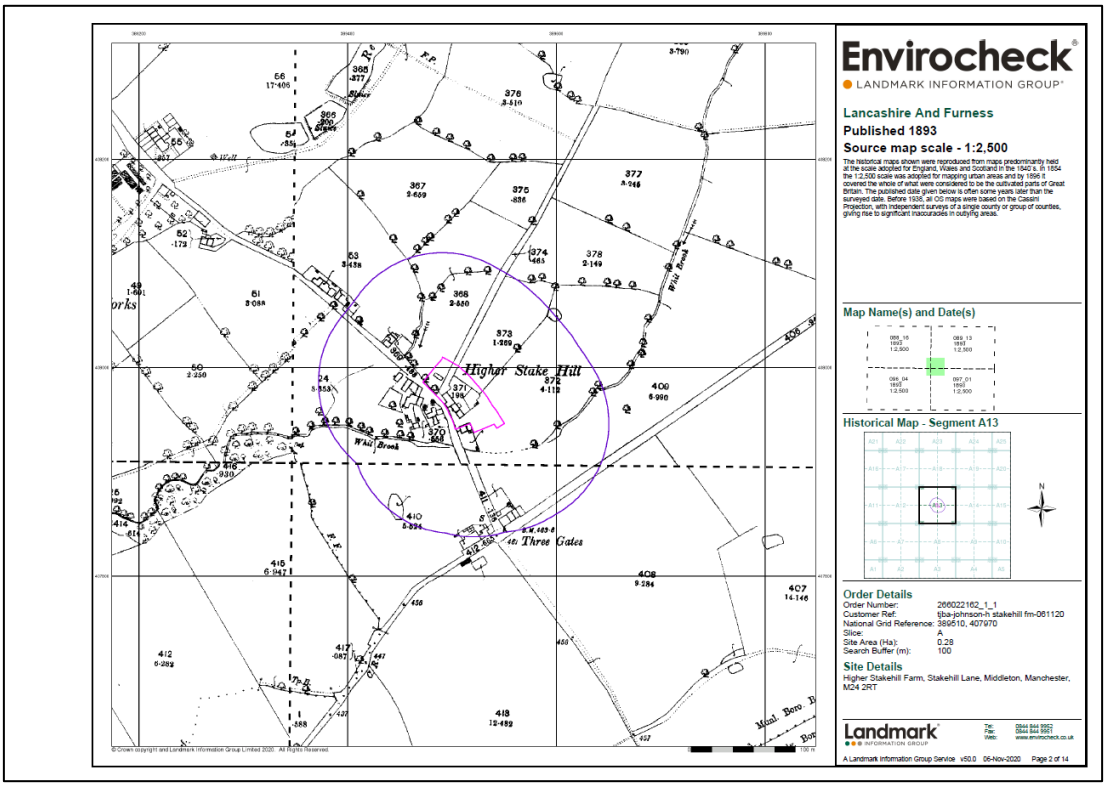


18. APPENDIX B: MAPS.

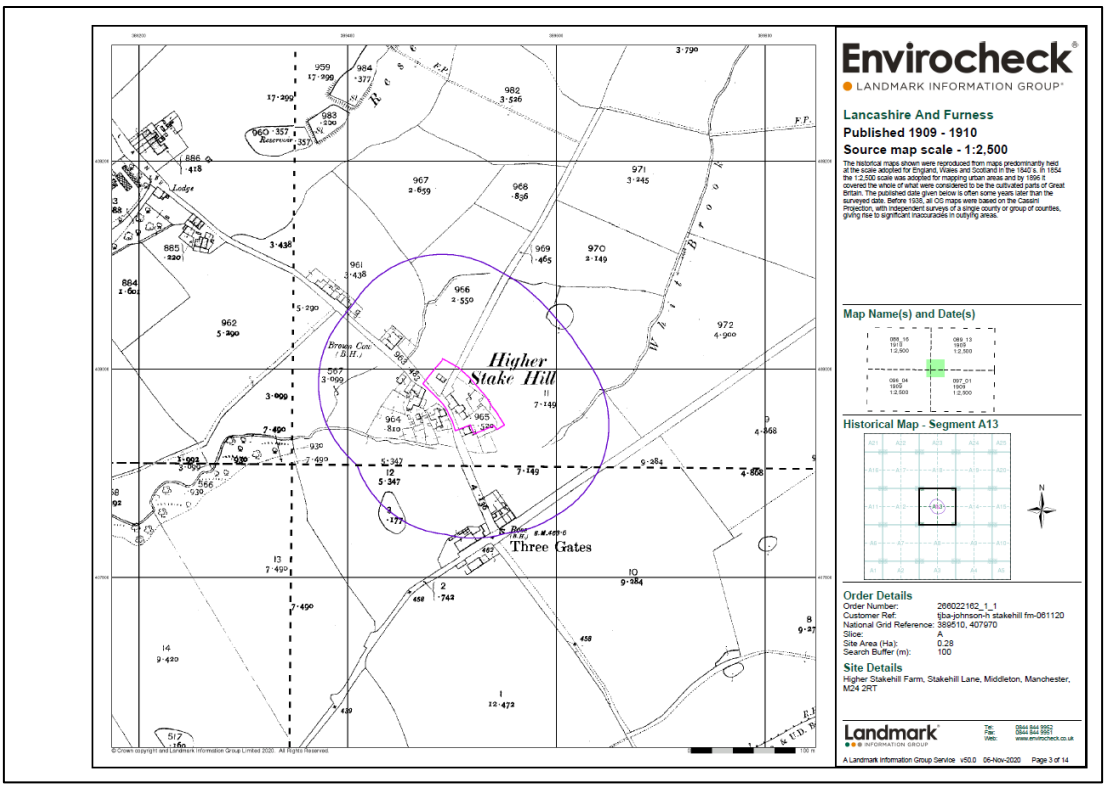
18.1. Ordnance Survey c1848-51



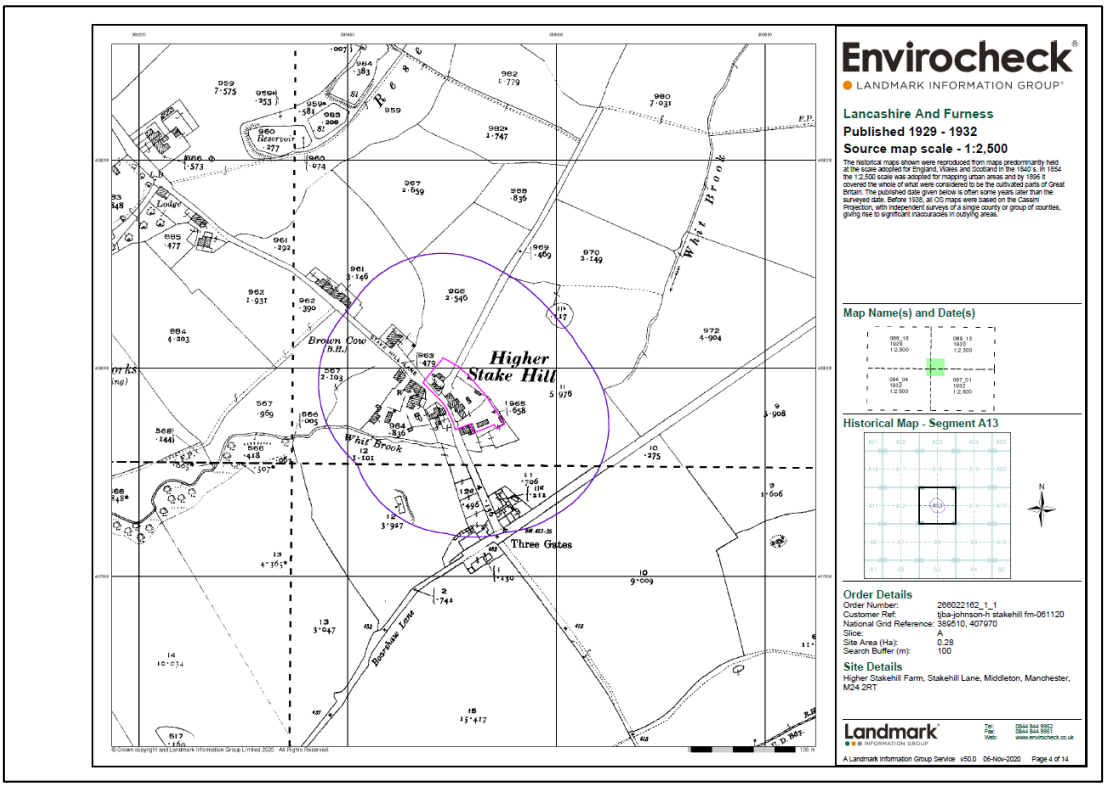
18.2. Ordnance Survey c1893



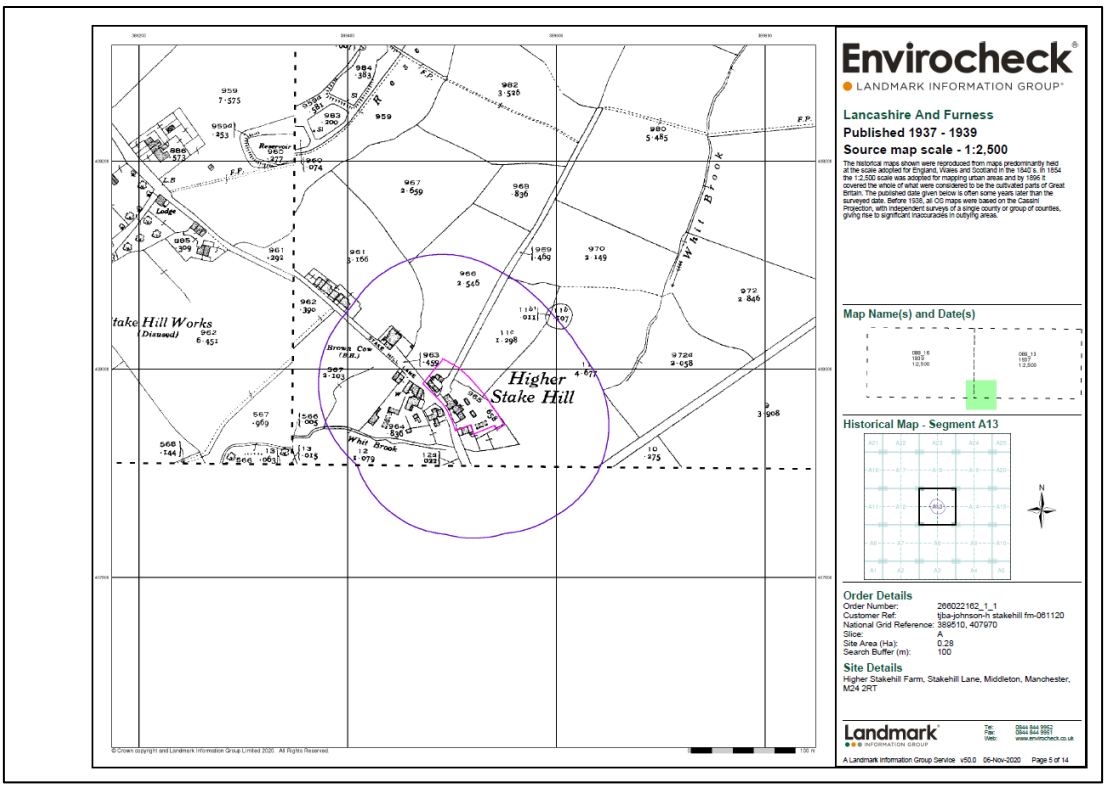
18.3. Ordnance Survey c1909-10



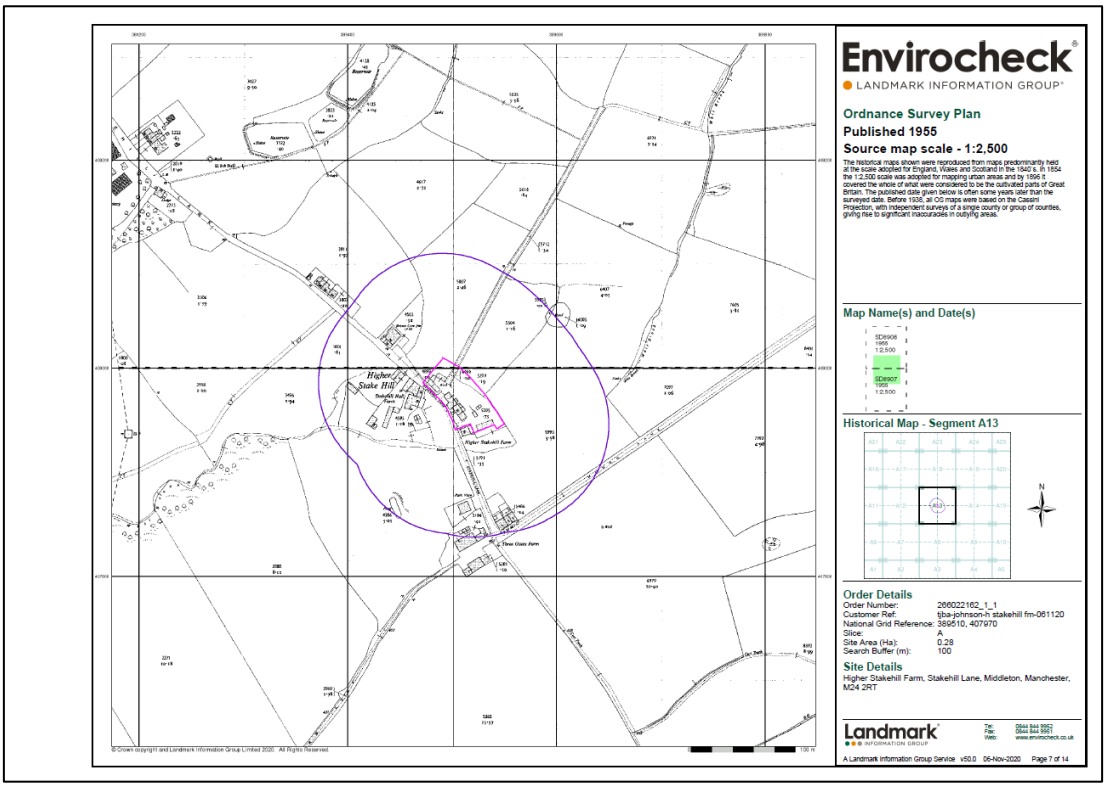
18.4. Ordnance Survey c1929-32



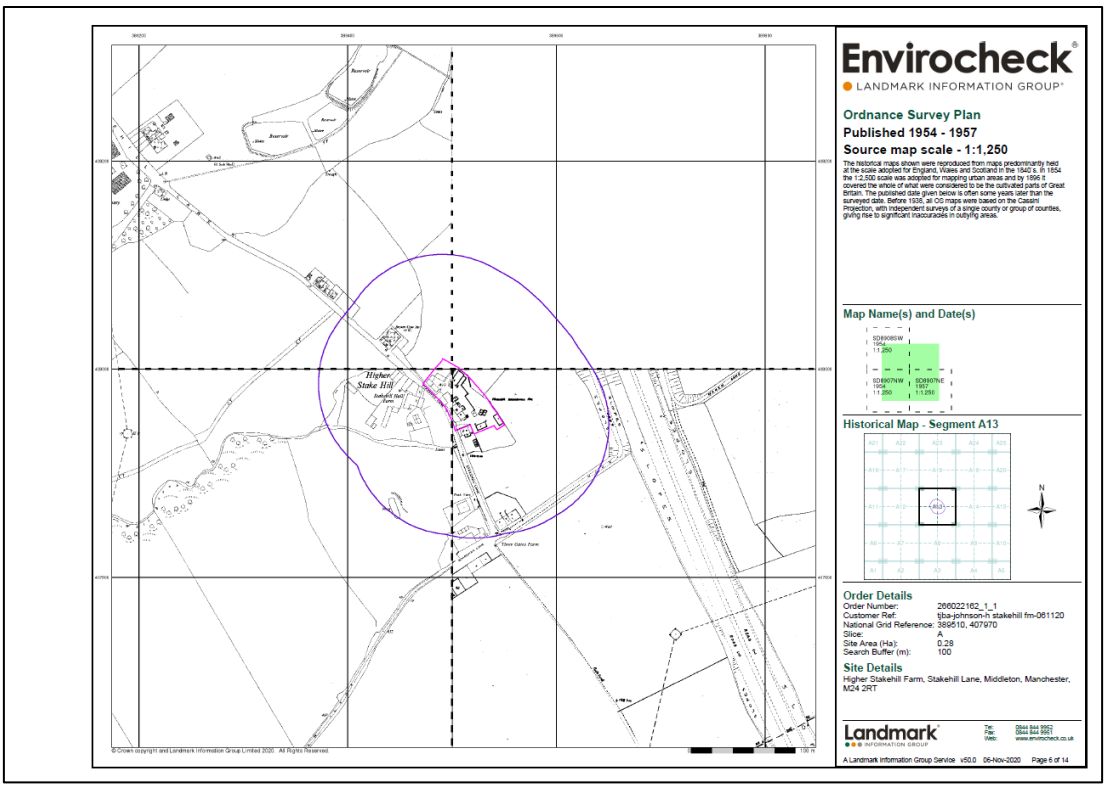
18.5. Ordnance Survey c1937-39



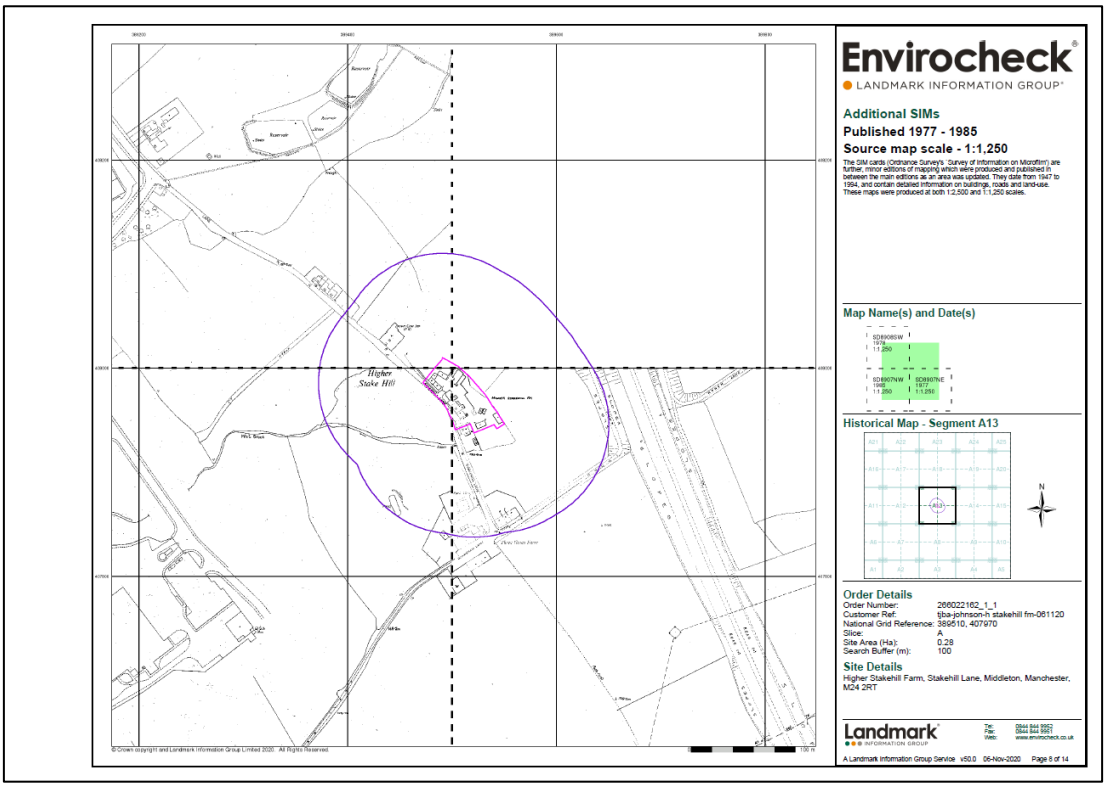
18.6. Ordnance Survey c1955



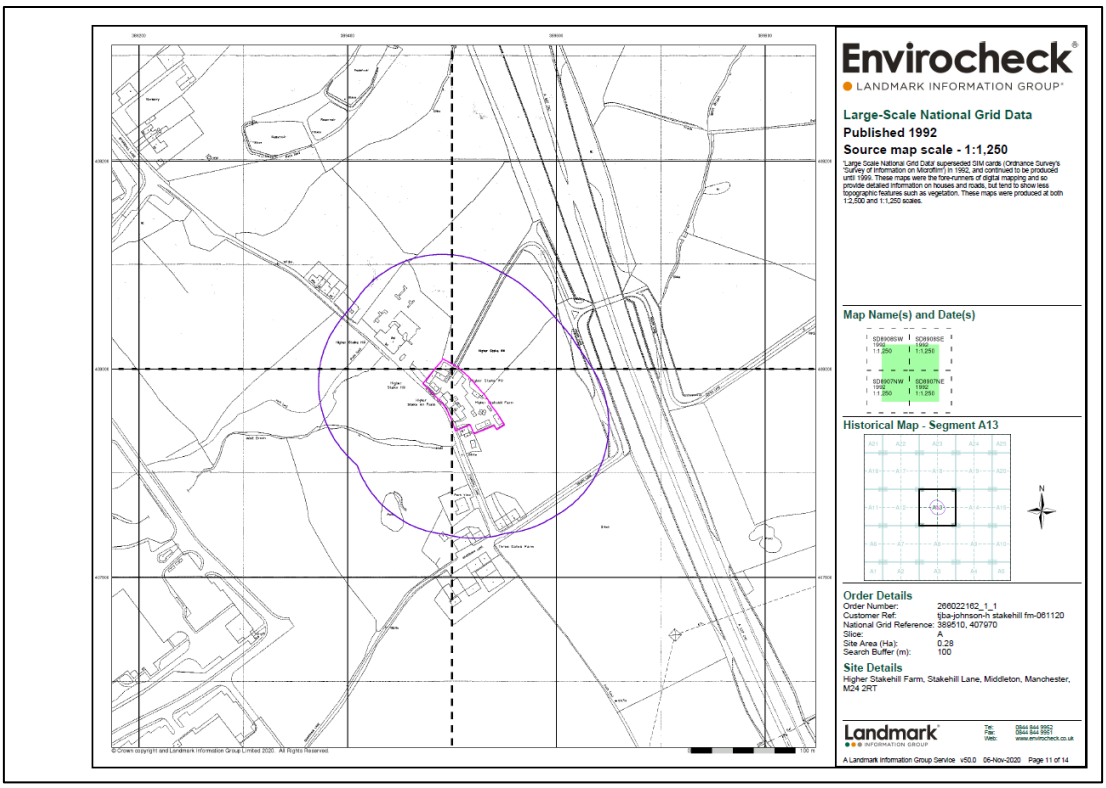
18.7. Ordnance Survey c1954-57



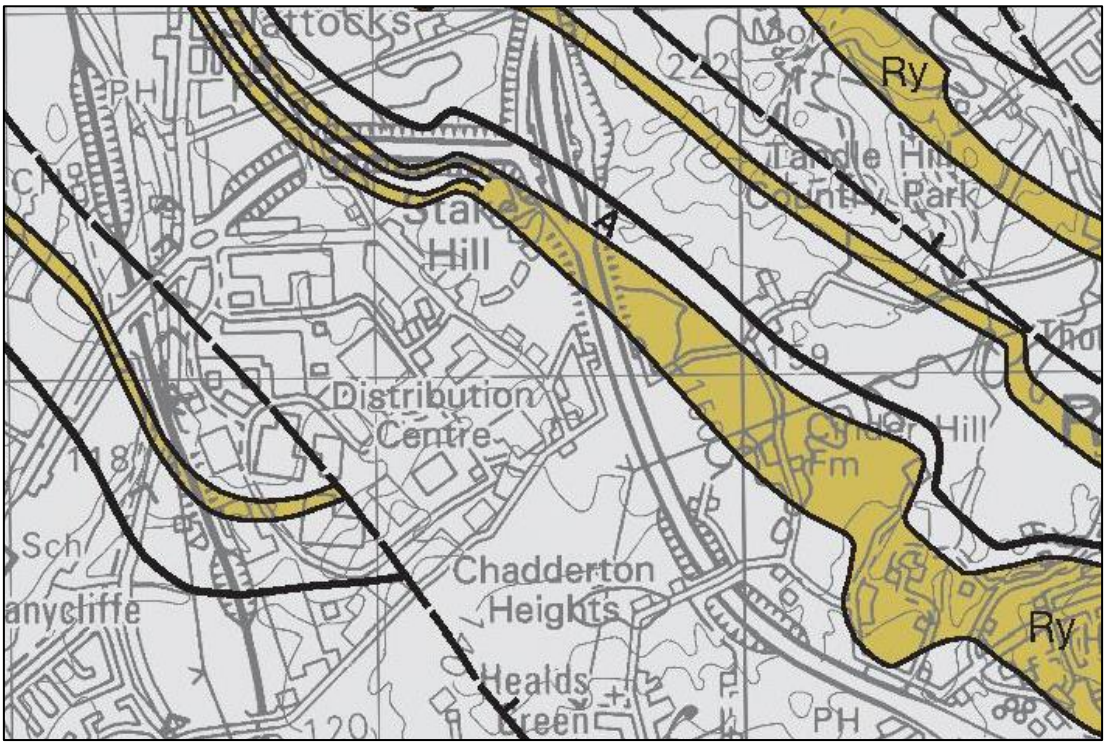
18.8. Ordnance Survey c1977-85



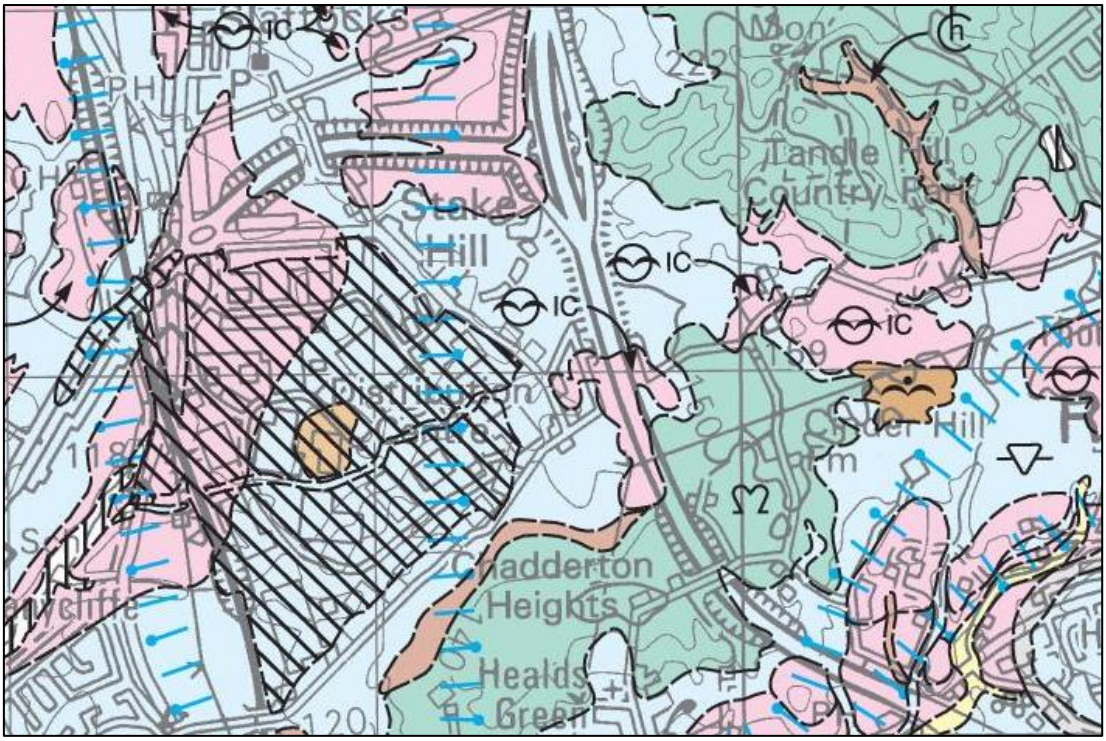
18.9. Ordnance Survey c1992



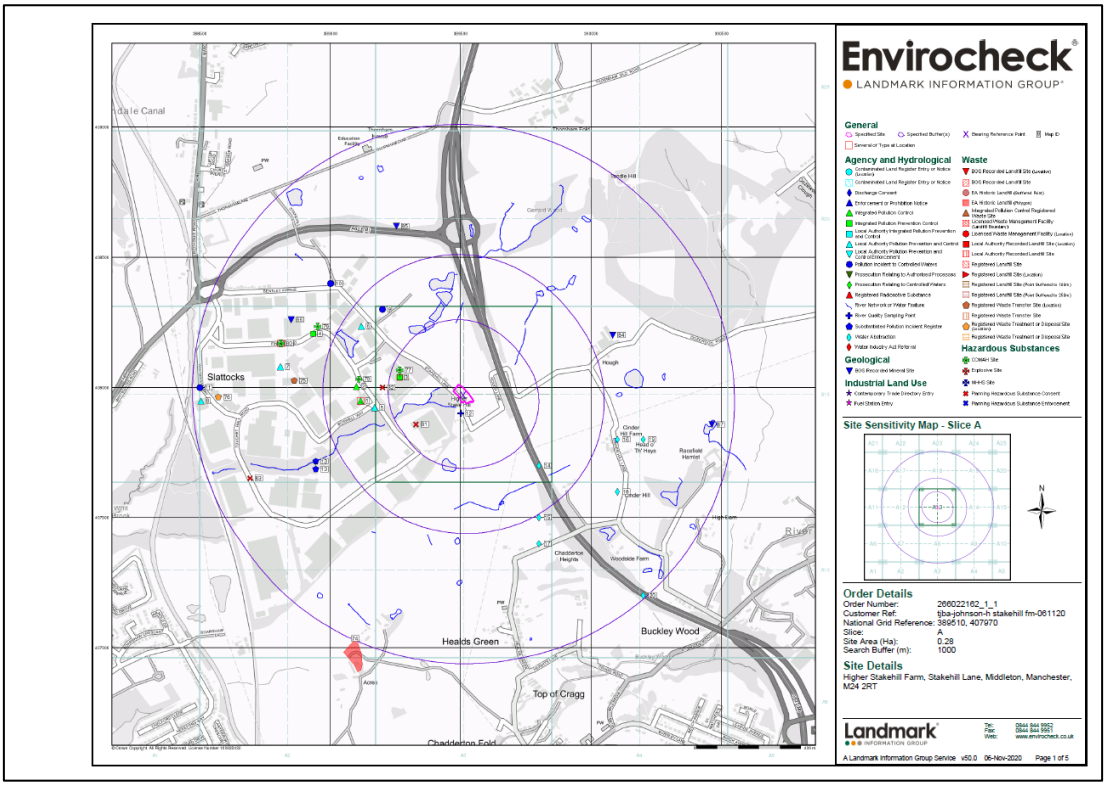
18.10. BGS Geological Map (Solid).



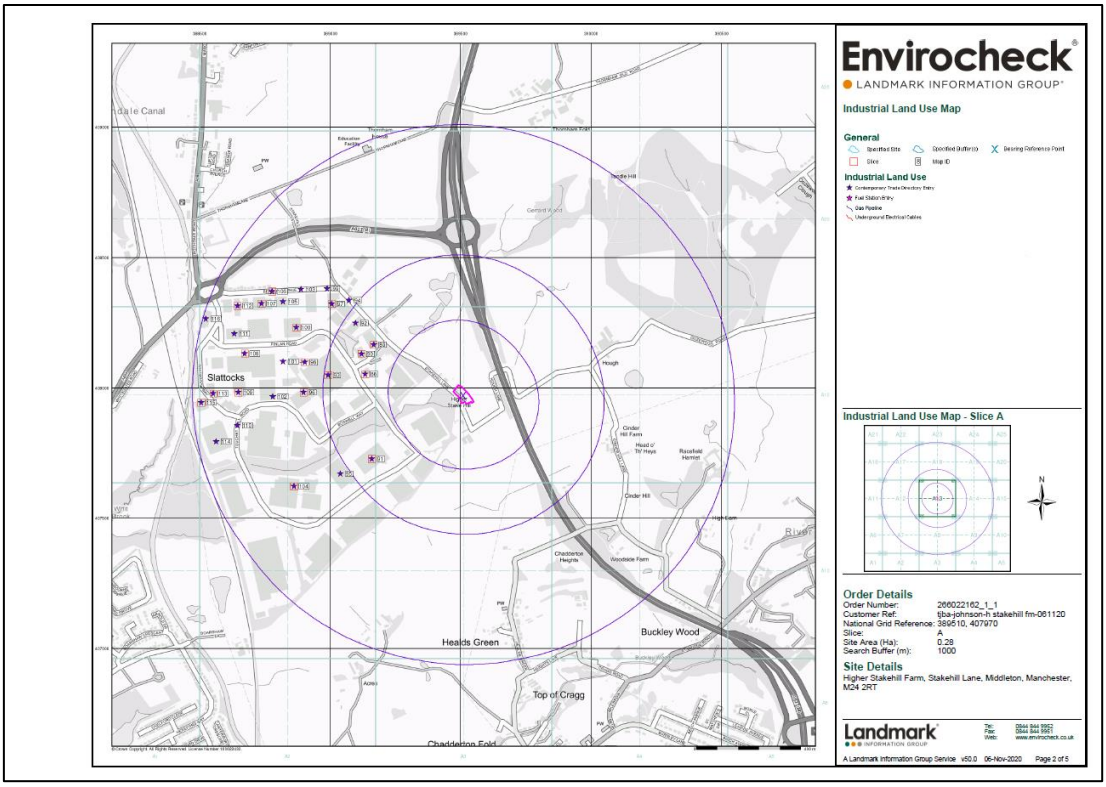
18.11. BGS Geological Map (Superficial).



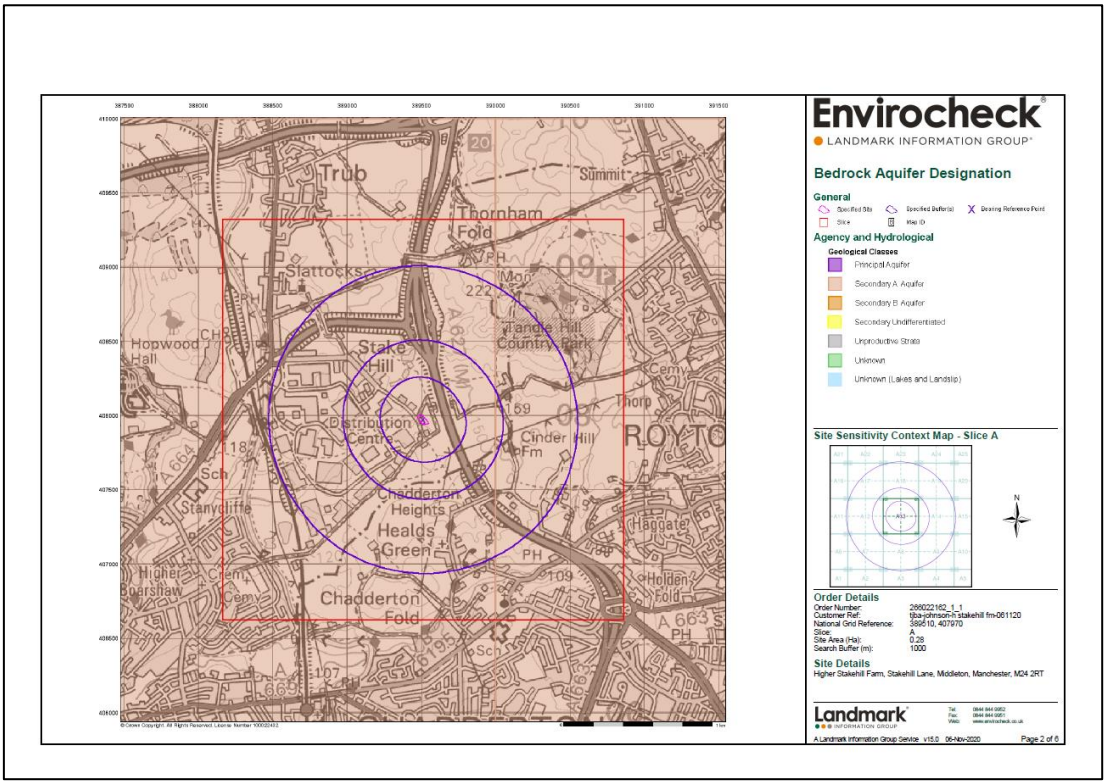
18.12. Landmark General Contaminants Map.



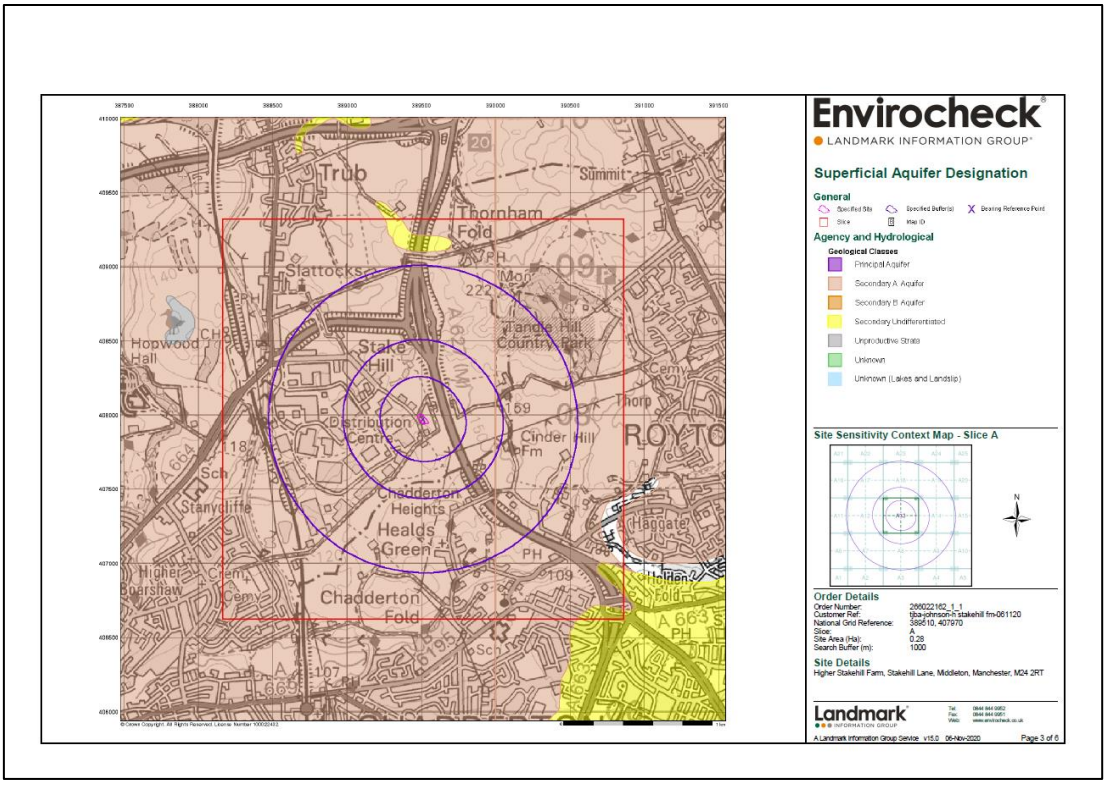
18.13. Landmark Industrial Land Use Map.



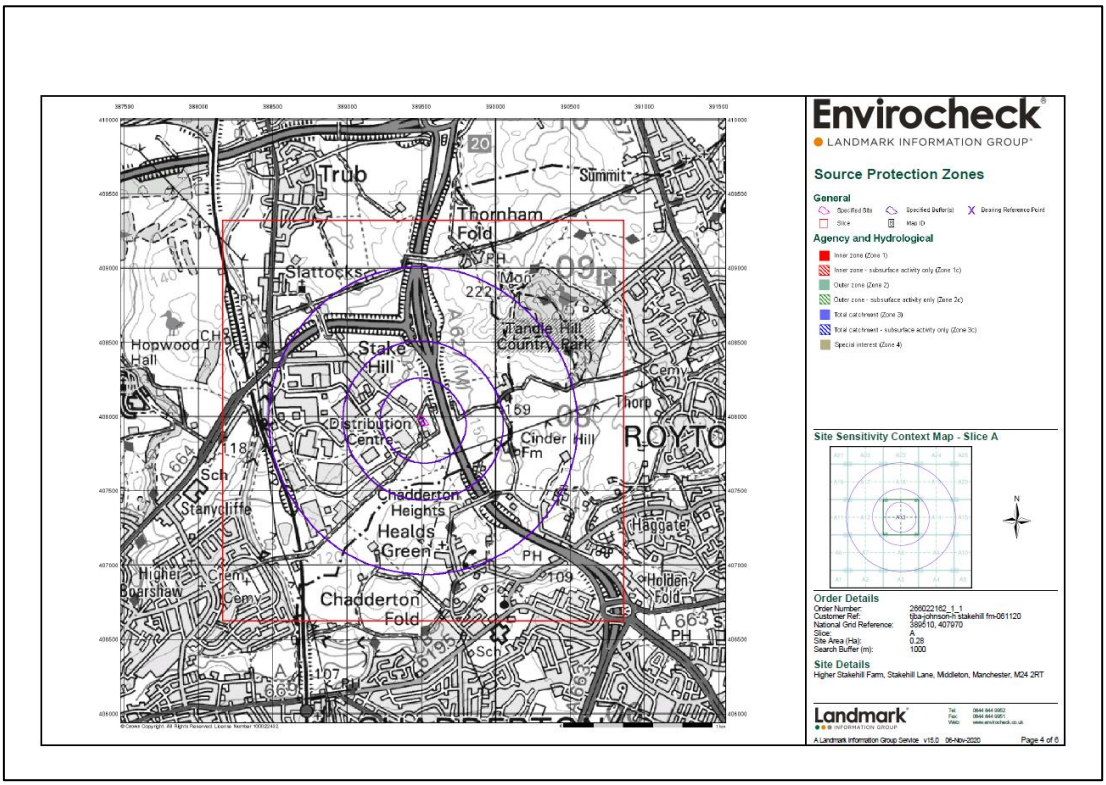
18.14. Landmark Bedrock Aquifer Map.



18.15. Landmark Superficial Aquifer Map.



18.16. Landmark Source Protection Zone Map.



19. APPENDIX C: 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).

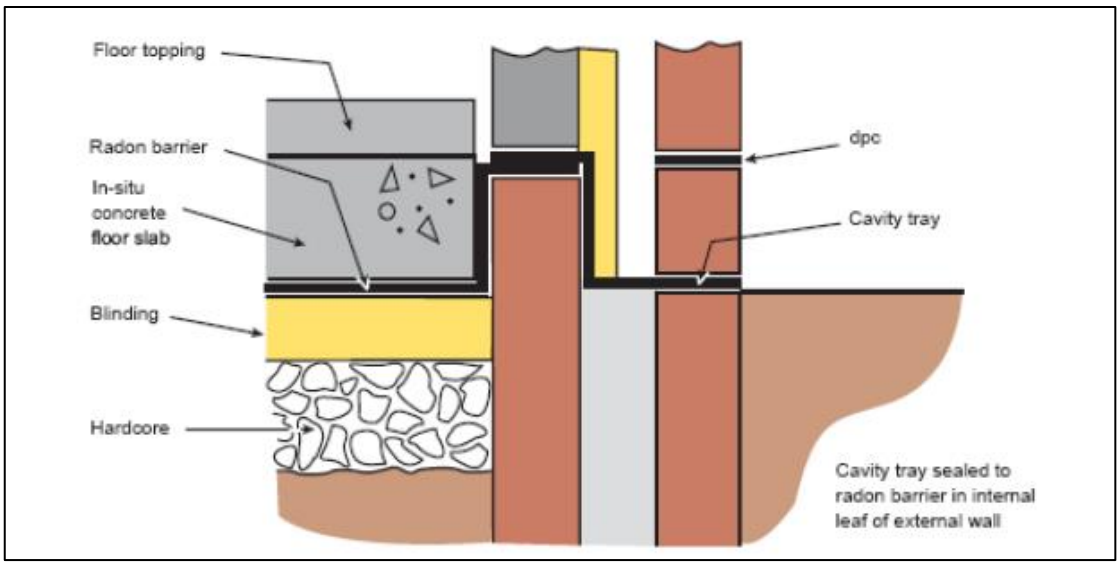
19.4. BGS/HPA report IR/11/044 – Radon Potential Class.

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.

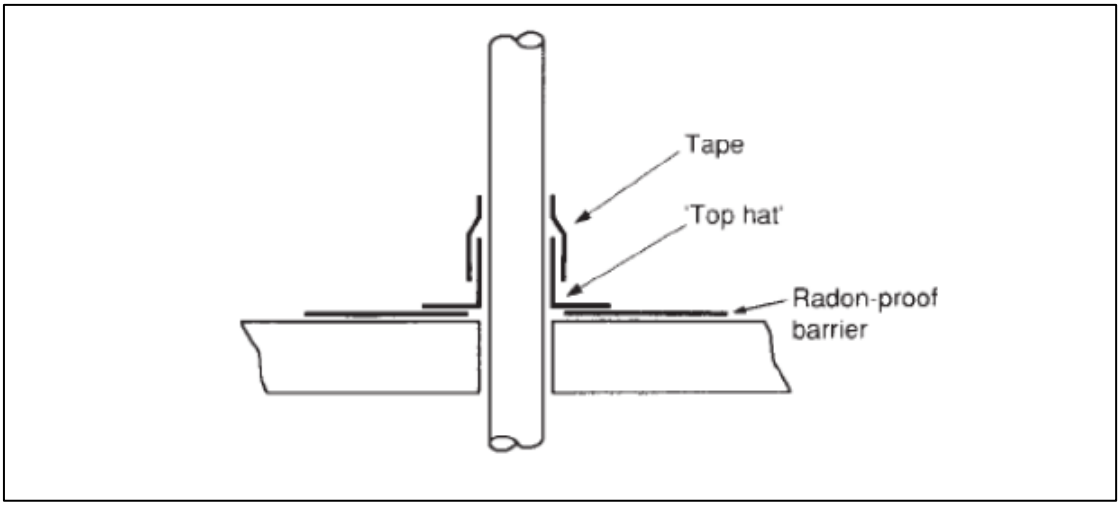
19.5. BGS/HPA report IR/11/044 – Radon Potential Class/Protection Measures.

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*

Probability	Consequence: Severe	Medium	Mild	Minor
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.