T J BOOTH ASSOCIATES

CONSULTING CIVIL & GEOTECHNICAL ENGINEERS

PHASE 1 & 2 ENVIRONMENTAL AUDIT

Proposed Residential Development

Wham Street

Heywood

Rochdale

OL10 4QU

Author: Daniel Slattery

Client: Mr Hart & Mr Manning.

Reference: rep-tjba-hart-wham st, heywood-phs 1 enviro-131219.docx

Revision	Date	Reason
0	January 2020	Original for planning application.
1	November 2020	Phase 2/site investigations & final contamination assessment.

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1. INTRODUCTION

T. J. Booth Associates have been appointed by Mr Lee Hart to undertake a Phase 1 & 2 Environmental Audit to the above Development Site, to support a Town & Country planning application for development.

A previous planning application for a similar development was submitted and withdrawn. Consultation with the planning officer for future applications indicated a Phase 1 Desk Study would be required to validate any new application. A new planning application is to be submitted for the development of 5No residential dwellings.

The Application Site was a dilapidated former commercial/warehouse/storage unit, formerly used as a builders yard. The National Grid Reference for the site is SD 84538 10834. A location plan of the site can be found in the appendix.

The Phase 1 edition of this report was submitted to RMBC Planning as part of the planning application for development, ref No: 20/00060/FUL, granted permission in May 2020 for the 'Demolition of existing dilapidated buildings and construction of 5 dwellings with associated external works and boundary treatments (part retrospective) - Resubmission of 19/00353/FUL'.

Condition No.3 of the permission related to environmental assessment of the site. Refer to planning & condition reference below:

PLANNING PERMISSION GRANTED

APPLICATION REFERENCE: 20/00060/FUL

Name and address for correspondence:	Applicant name:
Nigel Longshaw AJ Cocker Associates New Century House 176 Drake Street Rochdale OL16 1UP	Mr D Leigh

Part I - Particulars of Application

Date of Application: 12 February 2020

Proposal:	**Demolition of existing dilapidated buildings and construction of 5 dwellings with associated external works and boundary treatments (part retrospective) - Resubmission of 19/00353/FUL**
Location:	**Former Clarkes Printers, Wham Street, Heywood, OL10 4QU**

3 No construction works in relation to the erection of any building comprised in the development (or ground works relating thereto, but not including works of demolition of the existing building) shall take place until a site 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 inform a remediation strategy for the site.

If the risk assessment includes a remediation strategy for the site, no dwelling shall be occupied until a verification report for that plot has been submitted to and approved in writing by the Local Planning Authority.

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 proposed development is for 5No. terrace style residential dwellings. 3 of the dwellings will be located to the E side fronting on Duke Street, and 2 to the W fronting Wham Street.

Each of the properties will have rear gardens, with a central alleyway running through the middle of the development.

The plot to the SW corner will have parking space for 2 vehicles.

3. HISTORIC MAPS

DATE	ON-SITE	OFF-SITE/SURROUNDING AREA
c1851	Site is part of agricultural land, with Wham Lane to the W side.	Both commercial & residential terraced housing in the wider area over 100m distant. Wham Lane Cotton Mill 100m S. Unnamed cotton mill and associated mill reservoirs/chimneys/gasometers between 100-200m E. Peel Street Mill approx 220m NE. The majority of development centred around Bury New Road.
c1893-94	Site is within the curtilage of Star Boiler Works between Wham Street & Lord Street. Small building noted to the NW corner. Remainder of site area appears to be a yard.	Reservoirs remain to unnamed mill to E although they are now noted as disused. Additional terraced dwellings in the local and wider area. Additional mills in the wider area over 100m from Site boundaries. Mill Bank Brick works noted 350m NE. Derby Mills and associated mill reserviors150-200m N.
c1910	Additional small building noted to the W side. Larger building encompassing the centre and E side. Site now noted as Star Match Works.	Further development in the local area, predominantly residential with some commercial. Further excavation to Mill Bank Brick Works to the NE.
c1929-30	Site remains the same although there is no descriptive note to suggest the processes undertaken.	Further extensive excavation and made ground to the NE around Mill Bank Brick Works. Sand pit noted 350m NW.
c1937	No change on the site itself. It is likely that there is a change of use to the Site especially considering the new Site layout noted in 1957, see below.	Buildings to the S side (previously part of the Match Works) appears to be demolished. Sand pit to the NW increase in size. There is heap/household wastes noted on what is now the former Mill Bank Brick Works, with a refuse destructor noted to the N side, and a tramway linking it to the S side around the made ground.
c1957	Site (including that to the S side) appears to have been redeveloped into a Sheet Metal Works. The on-site building is the same shape and location as current day.	Sand pit to the NW now much larger but remains approx 350+m distant at closest point.
c1969	No change.	Further development of estates replacing much of the commercial mills/works to the N/E/W of the local area.
c1985-90	Site noted as a builders yard. Layout as present with extension building to the NW corner.	Almost complete urban infill in the wider area, predominantly residential.
c1992	No change.	No change.

4. PRESENT DAY MAPS

Site Boundaries, Outlines of Structures and Buildings:	Site boundaries are formed by masonry walls to the former buildings on all sides – except from the front entrance gate. The former factory/warehouse buildings line the N & E site boundaries. Much of the south part of the

	site comprises internal yard area.
Ground Contours, Natural Drainage Features:	The local area falls towards the north – ultimately to the River Roch valley. The site itself is drained via internal sewerage systems flowing to the local public sewer network.
Water Courses:	The River Roch is the closest watercourse approximately 600m north.
Below Ground Obstructions:	None indicated on current maps.

5. GEOLOGY

Bedrock Geology:	Lower Carboniferous Westphalian Coal Measures. The stratigraphic dip is 10degs S.
Superficial Geology:	Most of the local area surrounding and beneath the site comprise Divensian Till. However, there is a small area of glaciofluvial sand & gravels cover close to the south site boundary.
Coal Seams/Faults.	The Arley Mine coal seam subcrops approximately 300m N. Due to dip, distance and ground level change, the seam is estimated to lie at not less than 65m below site GL (not accounting for glacial cover).

6. BOREHOLES RECORDS

No records within close proximity.

7. LANDMARK ENVIROCHECK

7.1. AGENCY & HYDROLOGICAL

Contaminated land register entries & notices:	No records within a 250m radius.
Discharge consents:	No records within a 250m radius.
Local authority pollution prevention and control:	There was 1 record noted 156m south.
Bedrock aquifer:	Secondary A.
Superficial aquifer:	Secondary Undifferentiated.
Source protection zone:	Not within a Source Protection Zone.

7.2. WASTE

BGS recorded landfill sites:	No waste or landfill sites were recorded within a 250m radius.
Historical landfill sites:	No waste or landfill sites were recorded within a 250m radius.
Registered landfill sites:	No waste or landfill sites were recorded within a 250m radius.

7.3. HAZARDOUS SUBSTANCES

Planning hazardous substance consents:	No records within a 250m radius.
Planning hazardous substance enforcements:	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.	No shafts within the local area.
Past Recorded Underground Mining.	No records of coal worked at depth.
Shallow Unrecorded Mining.	None noted.
Shallow Recorded Mining.	None noted.
Development High Risk Area.	Not within a Development High Risk Area.

9. LOCAL KNOWLEDGE & PLANNING SEARCH

N/A.

10. INDUSTRY PROFILES

Match industry contaminants:

Paraffin, potassium chlorate, potassium dichromate, ammonium phosphate, tetraphosphorus trisulphide, sulphur, white & red phosphorus, ammonium thiocyanate.

11. SITE RECONNAISSANCE

Site reconnaissance was undertaken on 18.12.19.

Details of Existing Structures:	The site is located between Wham Street & Duke Street, Heywood.

	The entrance was located to the west side via Wham Street. The site boundary was enclosed by masonry walls due to building structures on the west, north & east sides. There was a masonry wall to the south boundary dividing the Application Site with the adjacent commercial property. All of the remaining part of the site (that generally to the south side) was covered in hardstanding. The site buildings were in a dilapidated state with some of the external walls to the site interior collapsed, and much of the roofs missing. The yard was covered in piles of building rubble and general tipping. Internal gullies served hardstanding areas and rainwater pipes. There was a manhole to the front gate within the site, presumably a FW connection to the public sewer with a 500mm deep IL. A gas connection was noted beside the entrance on Wham Street.
Adjacent Properties:	Residential dwellings to all sides except the commercial premises to the South.
Water Levels, Directions of Flow and Rates in Rivers:	None noted on site reconnaissance.
Old Mine or Quarry Workings:	None noted.
Obvious/Immediate Hazards to Health/Safety:	Site dilapidated, roofs close to collapse.
Areas of Discoloured Soil, Polluted Water, Vegetation, and Significant Odours:	No evidence of such but the Site was completely covered with either floor slabs/buildings or external hardstanding.
Relevant Ground Levels, Ground Water Levels, Positions of Wells and Springs:	Internal site areas were level, nominally 1m to 1.2m above the alley to the north boundary.

12. ENVIRONMENTAL SITE SUMMARY

12.1. Summary

The Application Site was part of agricultural land from earliest mapping data c1851 until c1890s when it was noted as part of Star Boiler Works between Wham Street & Lord Street (later Duke Street), with a small building noted to the north-west corner and the remainder occupied by a yard. By 1910 additional buildings were noted which were part of Star Match Works.

The buildings to the south of the Application Site but part of the match works at the time, were demolished by 1937 suggesting that the match making process may well have changed by then, and that the site was in the process of redevelopment to the sheet metal works noted in the 1950s. By the 1970s, commercial extension the north-west made the site outline the same as in the present day. The site was later noted to be a builders yard c1990.

The local area has predominantly been residential with mills and associated infrastructure were nominally >100m distant.

On reconnaissance, the site was recorded as completely covered with hardstanding, so the ground could not be assessed. However, it is likely contaminated with made ground from over 100 years of commercial activity including a boiler works, a match works and sheet metal works, which is expected in made ground below the hardstandings.

There is an asbestos risk form the use as a boiler works between c1890s & c1910s. There is also a risk of heavier hydrocarbons, inorganics such as sulphur, sulphides, and metals such as arsenic due to the use after 1910 as a match works. It should be noted that the use of the toxic white phosphorous was banned in 1910 so there is little risk of this as a contaminant.

Regarding coal mining risk, the closest seam to underlie the site is estimated to lie at least 60m depth. The local superficial cover is not known and thus has not been added to the depth estimate. The site is not within a Development High Risk Area.

No landfills were noted within 250m, and the local area is within a Class 1 Radon Protection Area, with less than 1% of properties in this zone affected. As such no protection is required to new development from radon ground gas.

12.2. Potential Contaminants

CURRENT SOURCE/S	ORIGINAL ASSOCIATED USAGE	CONTAMINANT/S
Made ground/upper soil.	Boiler works.	Metals, PAH, asbestos.
Made ground/upper soil.	Match works.	Metals, inorganics, hydrocarbons.
Made ground/upper soil.	Sheet metal works.	Metals, PAH, sulphates, inorganics.

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 residents for 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 commercial processes & 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.	Medium.	High likelihood.	High 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 commercial processes & development.	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. Pathway not present.	Minor.	Unlikely.	Very low risk.
Aerial contaminants.	Local industrial activity.	Chemical contamination.	Dermal contact & aerial inhalation.	All site users / occupants.	NOT PRESENT – Any historic contamination related to aerial contamination will now be recorded as shallow contamination. Current aerial discharges are regulated.	Minor.	Unlikely.	Very low risk.

14. SITE INVESTIGATIONS

14.1. Investigation Design from Conceptual Model

The proposed site end use is residential, and potential for contamination has been noted within the conceptual model. Soil sampling 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, 4 soil samples representative of the upper 500mm of MADE GROUND would satisfy guidance criteria.

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

Site investigations were undertaken on the 18.11.2020, comprising 3No. machine excavated trial holes (THs 1-3) to assess the ground for geo-environmental and geotechnical purposes.

The existing site finish level was elevated from the surrounding pavements to a max height of approximately 1m from the alleyway to the north side (ground level falls locally to the north).

The site stratigraphy comprised the following (refer to trial hole logs in appendix):

- A sandy ashy MADE GROUND with building rubble to approx. 1m deep;
- Firm becoming firm to stiff CLAY to approx. 2m deep;
- Firm to stiff shaley CLAY to approximately 3m deep.

Four soil samples (S1-4) were collected to categorise made ground. No visual/olfactory evidence of hydrocarbon contamination was noted on site.

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.

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.

Existing MADE GROUND samples tested above the threshold for metals, PAH, and inorganics; specifically: arsenic, lead, sulphate, asbestos, benzo(b)fluoranthene, and dibenz(ah)anthracene.

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

14.4. Gas Monitoring Assessment

N/A – no risk.

15. REMEDIATION STRATEGY

15.1. Risk & Site Proposals

The proposed site end use is for residential purposes, and existing soils should be categorised to ensure they do not pose a risk to site receptors.

The existing site was nominally levelled off retained by the former factory foundation walls to the south side, to approximately 700mm down to the alleyway ground level. Made ground will have to be removed excavated to attain finish levels in accordance with the surrounding pavements/ground level.

The virgin clay recorded beneath made ground was noted to be approximately level with the surrounding pavements.

15.2. Ground/Soil Contamination Risk

Soil test results analysed against current threshold data for a residential use identified elevated levels of common contaminants unsuitable for the proposed end use.

Due to proposed site levels and the reduced level dig required, most of the contaminated made ground horizon will be removed from site.

For remedial purposes specifically in soft landscaping & garden areas, the following protective cover system should apply:

- Should any made ground remain, it 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.

All imported soil should be clean/inert and of good quality, generally to BS3882 (Topsoil); but should specifically be able to pass contaminant 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 as a minimum:

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

15.3. Ground Gas Risk

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

15.4. Validation Requirements

Ground gas risk was not identified at the development and so no validation is required in this respect.

Due to the unsuitable nature of the made ground for residential purposes, clean/inert soil will need to be imported as part of the development finishes, and will require subsequent validation by a suitably qualified independent consultant.

All imported soil will need to be tested for the following contamination suites: metals, inorganics, PAH USEPA16 speciated, and asbestos screening.

Results will need to be analysed as a minimum against Defra Category 4 Screening Levels (C4SLs) where available, and then to the LQM/CIEH (S4ULs), for use in a residential end use setting.

Validation sampling quantities will be tailored to the amount of material imported to site, and will be as follows:

- Unknown sources: 1 sample per 50m3 (minimum of 3 samples).
- Greenfield or known source: 1 sample per 200m3 (minimum of 3 samples).

A depth validation should also be undertaken by taped trial holes to ensure a suitable cover has been provided to contaminated material. Depth validation should comprise the following for areas where:

- Made ground is to remain; a 600mm imported soil cover depth will need to be implemented.
- The garden level/soft landscaping is reduced to virgin clay; then minimal cover only will be required to suit finishes.

The above should be reported on as necessary for Building Control/Planning to obtain final discharge of the environmental condition.

15.5. Additional Notes

If any suspected contamination not already encountered is found within the groundworks/construction phase of the development, it will need to be assessed by a suitably qualified, independent consultant, who should advise on further steps for approval with the LPA.

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

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.

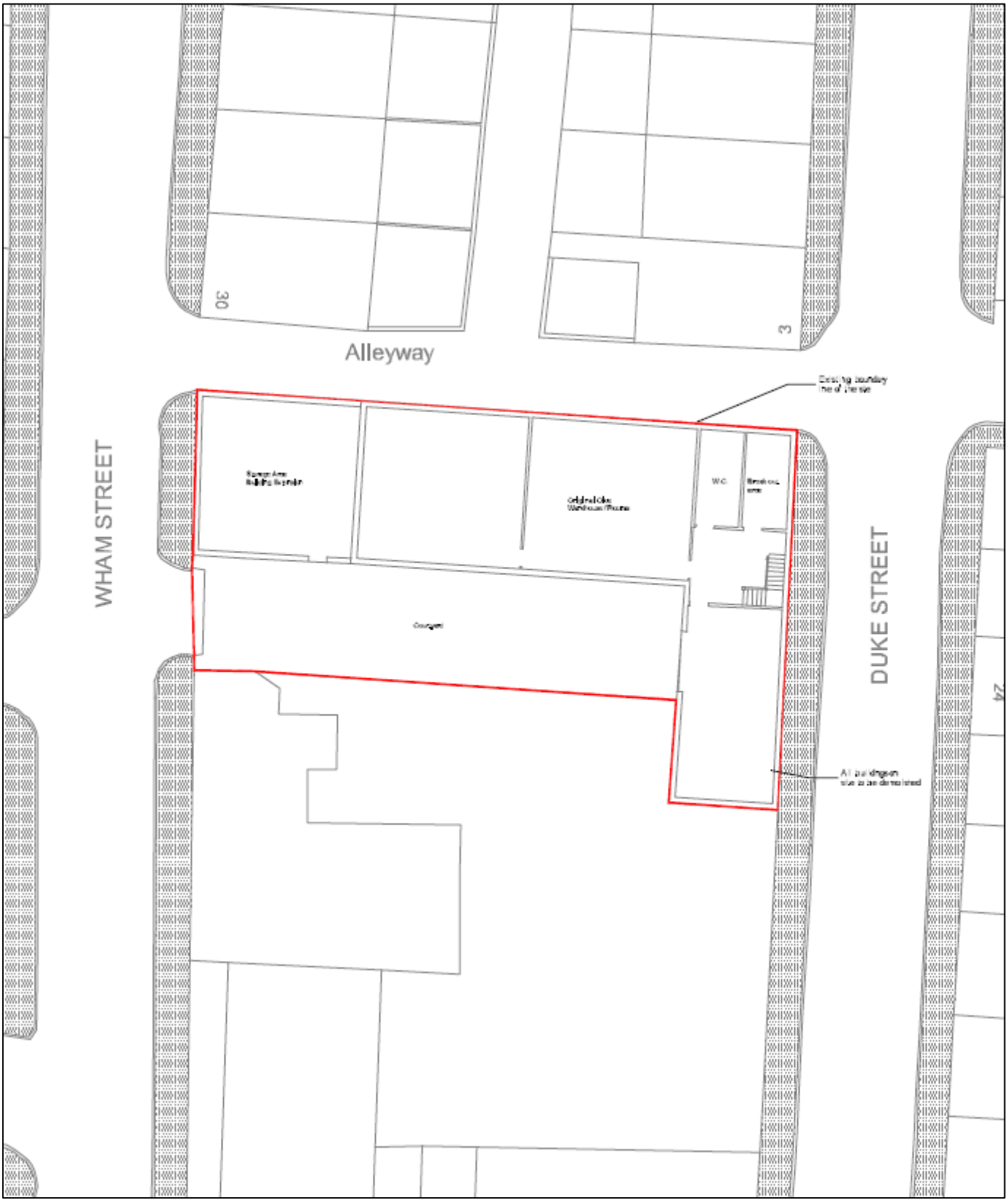
T J Booth Associates.

16. REFERENCES

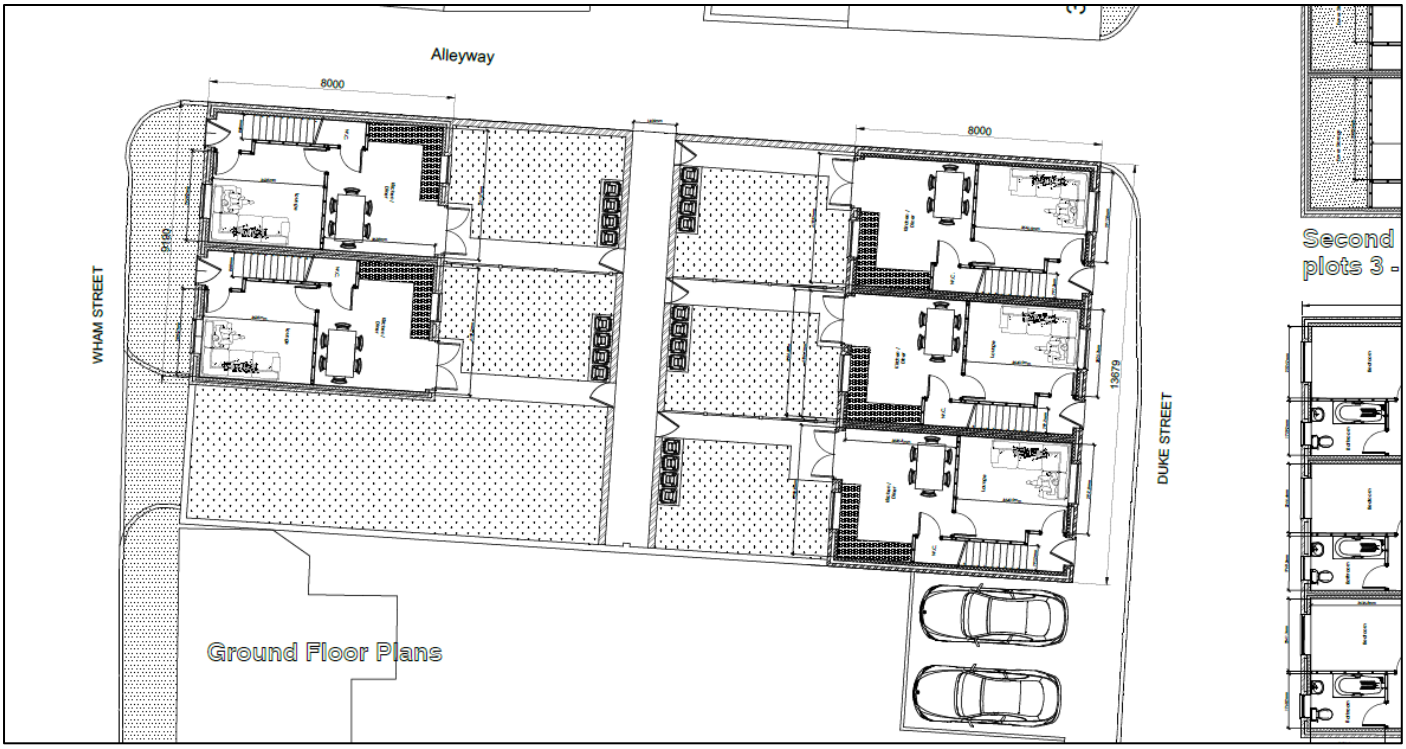
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- CL:AIRE. 2012. Research Bulletin-RB17-A pragmatic approach to ground gas risk assessment.
- BSI. 2013. BS 10175:2011+A2:2017. Investigation of potentially contaminated sites – code of practice.
- BSI. 2013. BS 8576:2013. Guidance on investigation 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: FIGURES

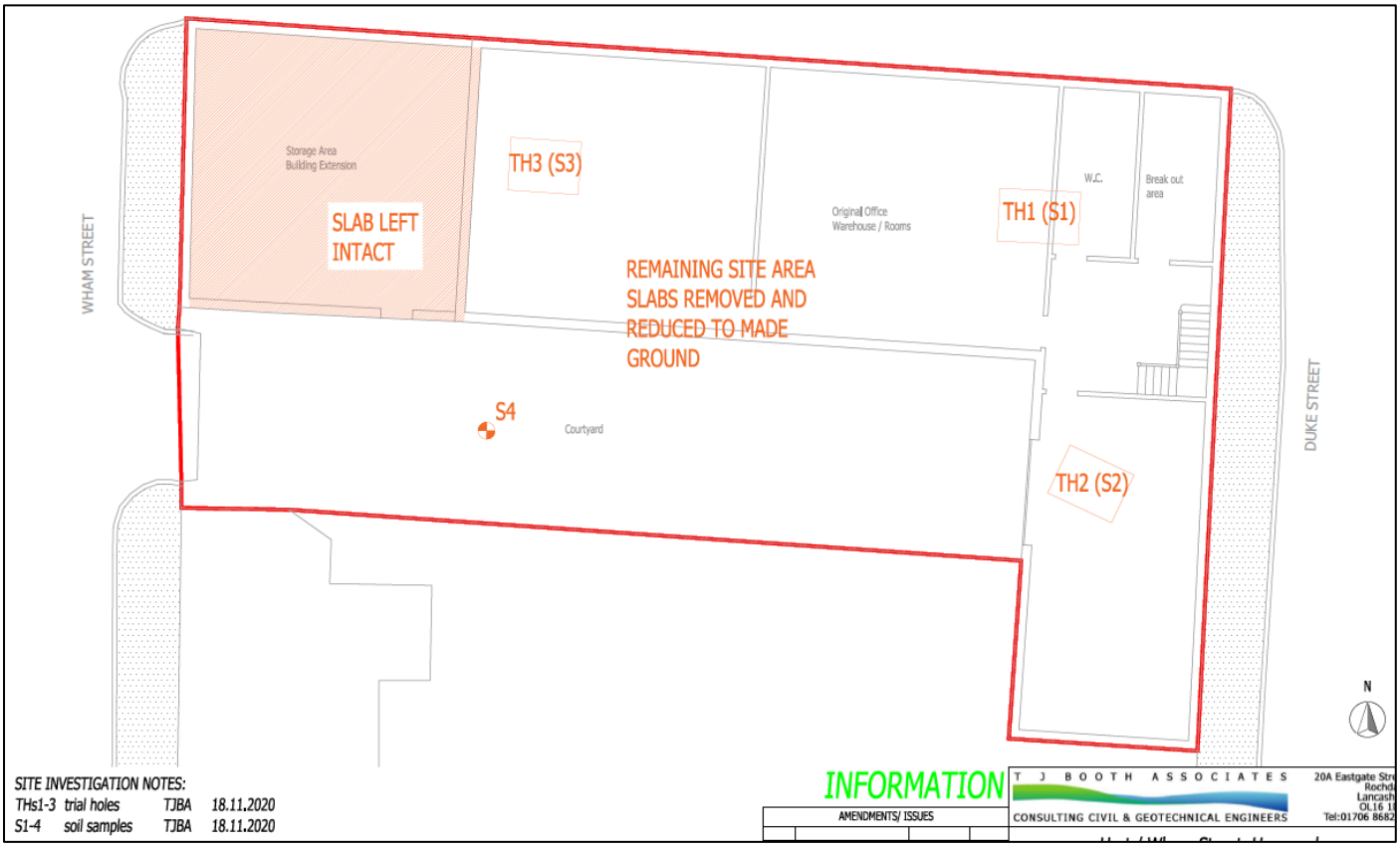
17.1. Location/Existing Plan



17.2. Proposed Development



17.3. Proposed Development



17.4. TJBA Trial Hole Logs

Trial pit reference TH1				Sheet 1 of 1
Water	Reduced Level (m)	Legend	Depth (m)	Description
	100.00			
	98.90	X X X X X X X X X X	(1.10) 1.10	Dark brown MADE GROUND with much brick, stone, plaster etc. (S1)
	98.05	- - - - - - - - - - - -	(0.85) 1.95	Firm to stiff orange-brown/grey mottled CLAY
	97.20	- - - - - - - - - - - -	(0.85) 2.80	Firm dark brown shaley CLAY
				Trial pit ends
Not shown to scale Additional notes: Site was nominally level with the front entrance given level datum 100.00				

Trial pit reference TH2				Sheet 1 of 1
Water	Reduced Level (m)	Legend	Depth (m)	Description
	100.00			
	99.25	X X X X X X	(0.75) 0.75	Black/brown ashy MADE GROUND much demolition rubble. (S3)
	98.00	- - - - - - - - - - - -	(1.25) 2.00	Firm to stiff orange-brown/grey mottled CLAY
	97.70	- - - - - -	(0.30) 2.30	Firm to stiff dark brown shaley CLAY
				Trial pit ends
Not shown to scale Additional notes: Site was nominally level with the front entrance given level datum 100.00				

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Trial pit reference TH3				Sheet 1 of 1
Water	Reduced Level (m)	Legend	Depth (m)	Description
	100.00			
	98.95	X X X X X X X X X X	(1.05) 1.05	Black sandy, ashy MADE GROUND (S3)
	97.75	- - - - - - - - - - - -	(1.20) 2.25	Firm to stiff orange-brown/grey mottled CLAY
	97.50	- - - - - -	(0.25) 2.50	Stiff dark brown CLAY
				Trial pit ends

Not shown to scale

Additional notes: Site was nominally level with the front entrance given level datum 100.00

;

17.5. TJBA Soil Analysis

Client / Site	***Hart - Wham Street, Heywood***						
Sampling Date	***18.11.2020***						
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	4	38	30	37.4	37	FAIL	
	Boron as B, hot water sol dw	4	1.3	0.878	1.27	290	PASS	
	Cadmium as Cd, dry weight	4	0.32	0.273	0.316	22	PASS	
	chromium as Cr(III) dry weight	4	19	15.75	18.55	910	PASS	
	Chromium as Cr(VI), dry weight	4	0.5	0.5	0.5	21	PASS	
	Copper, as Dry Weight	4	220	113	206.5	2400	PASS	
	Lead, as Dry Weight	4	1200	525	1098	200	FAIL	
	Mercury as Hg, dry weight	4	0.39	0.243	0.375	1.2	PASS	
	Nickel as Ni, dry weight	4	72	47.75	70.65	130	PASS	
	Selenium as Se, dry weight	4	0.59	0.495	0.586	250	PASS	
	Zinc as Zn, dry weight	4	380	160.3	339.5	3700	PASS	
INORGANIC	Cyanide (Total)	4	0.5	0.5	0.5	2.5	PASS	
	Sulphate (Total) as SO4	4	0.35	0.3	0.349	0.24	FAIL	
	Sulphide	4	9.2	7.15	9.14	250	PASS	
	pH	4	8.2	7.975	8.185	6 to 8	ALKALINE	
	Sulphur (Elemental)	4	150	55.75	134.6	100	comment	
	Asbestos Identification	4	1	0.25	0.85	0	FAIL	
ORGANIC	SOM	4	6	6	6			
PAH	acenaphthene	4	0.1	0.1	0.1	1100	PASS	
PAH	acenaphthylene	4	0.1	0.1	0.1	920	PASS	
PAH	anthracene	4	0.65	0.275	0.59	11000	PASS	
PAH	benzo[a]anthracene	4	3	1.063	2.664	13	PASS	
PAH	benzo[a]pyrene	4	3.4	0.925	2.905	5	PASS	
PAH	benzo[b]fluoranthene	4	4.6	1.225	3.925	3.7	FAIL	
PAH	benzo[g,h,i]perylene	4	2.2	0.625	1.885	350	PASS	
PAH	benzo[k]fluoranthene	4	2.1	0.6	1.8	100	PASS	
PAH	chrysene	4	4	1.44	3.58	27	PASS	
PAH	dibenz[ah]anthracene	4	1.3	0.4	1.12	0.3	FAIL	
PAH	fluoranthene	4	5	1.998	4.43	890	PASS	
PAH	fluorene	4	0.1	0.1	0.1	860	PASS	
PAH	indeno[123-cd]pyrene	4	2.9	0.8	2.48	41	PASS	
PAH	napthalene	4	0.1	0.1	0.1	13	PASS	
PAH	phenanthrene	4	3.2	1.125	2.885	440	PASS	
PAH	pyrene	4	6.9	2.613	6.09	2000	PASS	
PAH	PAH (Total - SUM EPA16)	4	39	12.55	33.84	1	comment	
SVOC	phenol	4	0.3	0.3	0.3	380	PASS	

17.6. Chemtest Ltd Soil Testing Certificates

UKAS TESTING 2183

eurofins | Chemtest

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

Final Report

Report No.:	20-31737-1		
Initial Date of Issue:	01-Dec-2020		
Client	TJ Booth Associates		
Client Address:	20a Eastgate Street Rochdale Lancs OL16 1DH		
Contact(s):	Daniel Slattery		
Project	Hart Wham Street, Heywood		
Quotation No.:	Q19-18321	**Date Received:**	20-Nov-2020
Order No.:		**Date Instructed:**	20-Nov-2020
No. of Samples:	4		
Turnaround (Wkdays):	10	**Results Due:**	03-Dec-2020
Date Approved:	01-Dec-2020		

Approved By:



Details: Glynn Harvey, Technical Manager

Page 1 of 5

Results - Soil

Project: Hart Wham Street, Heywood

Client: TJ Booth Associates			Chemtest Job No.:		20-31737	20-31737	20-31737	20-31737
Quotation No.: Q19-18321			Chemtest Sample ID.:		1100563	1100564	1100565	1100566
Order No.:			Client Sample Ref.:		S1	S2	S3	S4
			Client Sample ID.:		1	2	3	4
			Sample Location:		TH1	TH2	TH3	N/A
			Sample Type:		SOIL	SOIL	SOIL	SOIL
			Top Depth (m):		0.50	0.50	0.50	0.30
			Date Sampled:		18-Nov-2020	18-Nov-2020	18-Nov-2020	18-Nov-2020
			Asbestos Lab:		COVENTRY	COVENTRY	COVENTRY	COVENTRY
Determinand	**Accred.**	**SOP**	**Units**	**LOD**				
ACM Type	U	2192		N/A	-	-	-	Free Fibres
Asbestos Identification	U	2192		N/A	No Asbestos Detected	No Asbestos Detected	No Asbestos Detected	Chrysotile
ACM Detection Stage	U	2192		N/A	-	-	-	Stereo Microscopy
Moisture	N	2030	%	0.020	13	21	17	16
pH	U	2010		4.0	8.2	8.1	7.8	7.8
Boron (Hot Water Soluble)	U	2120	mg/kg	0.40	1.3	0.71	1.1	< 0.40
Sulphur (Elemental)	U	2180	mg/kg	1.0	11	150	47	15
Cyanide (Total)	U	2300	mg/kg	0.50	< 0.50	< 0.50	< 0.50	< 0.50
Thiocyanate	U	2300	mg/kg	5.0	< 5.0	< 5.0	< 5.0	< 5.0
Sulphide (Easily Liberatable)	N	2325	mg/kg	0.50	6.1	8.8	9.2	4.5
Sulphate (Total)	U	2430	mg/kg	100	3400	3500	3000	2100
Arsenic	U	2450	mg/kg	1.0	15	33	34	38
Cadmium	U	2450	mg/kg	0.10	0.22	0.29	0.26	0.32
Chromium	U	2450	mg/kg	1.0	13	15	19	16
Copper	U	2450	mg/kg	0.50	32	220	130	70
Mercury	U	2450	mg/kg	0.10	0.15	0.29	0.39	0.14
Nickel	U	2450	mg/kg	0.50	23	63	72	33
Lead	U	2450	mg/kg	0.50	140	1200	520	240
Selenium	U	2450	mg/kg	0.20	0.29	0.59	0.54	0.56
Zinc	U	2450	mg/kg	0.50	59	92	110	380
Chromium (Hexavalent)	N	2490	mg/kg	0.50	< 0.50	< 0.50	< 0.50	< 0.50
Organic Matter	U	2625	%	0.40	5.5	16	29	6.6
Naphthalene	U	2700	mg/kg	0.10	< 0.10	< 0.10	< 0.10	< 0.10
Acenaphthylene	U	2700	mg/kg	0.10	< 0.10	< 0.10	< 0.10	< 0.10
Acenaphthene	U	2700	mg/kg	0.10	< 0.10	< 0.10	< 0.10	< 0.10
Fluorene	U	2700	mg/kg	0.10	< 0.10	< 0.10	< 0.10	< 0.10
Phenanthrene	U	2700	mg/kg	0.10	1.1	< 0.10	3.2	< 0.10
Anthracene	U	2700	mg/kg	0.10	0.25	< 0.10	0.65	< 0.10
Fluoranthene	U	2700	mg/kg	0.10	1.2	1.1	5.0	0.69
Pyrene	U	2700	mg/kg	0.10	1.2	1.5	6.9	0.85
Benzo[a]anthracene	U	2700	mg/kg	0.10	0.39	0.76	3.0	< 0.10
Chrysene	U	2700	mg/kg	0.10	0.46	1.2	4.0	< 0.10
Benzo[b]fluoranthene	U	2700	mg/kg	0.10	< 0.10	< 0.10	4.6	< 0.10
Benzo[k]fluoranthene	U	2700	mg/kg	0.10	< 0.10	< 0.10	2.1	< 0.10
Benzo[a]pyrene	U	2700	mg/kg	0.10	< 0.10	< 0.10	3.4	< 0.10

Results - Soil

Project: Hart Wham Street, Heywood

Client: TJ Booth Associates				Chemtest Job No.:	20-31737	20-31737	20-31737	20-31737
Quotation No.: Q19-18321				Chemtest Sample ID.:	1100563	1100564	1100565	1100566
Order No.:				Client Sample Ref.:	S1	S2	S3	S4
				Client Sample ID.:	1	2	3	4
				Sample Location:	TH1	TH2	TH3	N/A
				Sample Type:	SOIL	SOIL	SOIL	SOIL
				Top Depth (m):	0.50	0.50	0.50	0.30
				Date Sampled:	18-Nov-2020	18-Nov-2020	18-Nov-2020	18-Nov-2020
				Asbestos Lab:	COVENTRY	COVENTRY	COVENTRY	COVENTRY
Determinand	**Accred.**	**SOP**	**Units**	**LOD**				
Indeno(1,2,3-c,d)Pyrene	U	2700	mg/kg	0.10	< 0.10	< 0.10	2.9	< 0.10
Dibenz(a,h)Anthracene	U	2700	mg/kg	0.10	< 0.10	< 0.10	1.3	< 0.10
Benzo[g,h,i]perylene	U	2700	mg/kg	0.10	< 0.10	< 0.10	2.2	< 0.10
Total Of 16 PAH's	U	2700	mg/kg	2.0	4.6	4.6	39	< 2.0
Total Phenols	U	2920	mg/kg	0.30	< 0.30	< 0.30	< 0.30	< 0.30

18. APPENDIX B: PHOTOS



Trial hole 1.



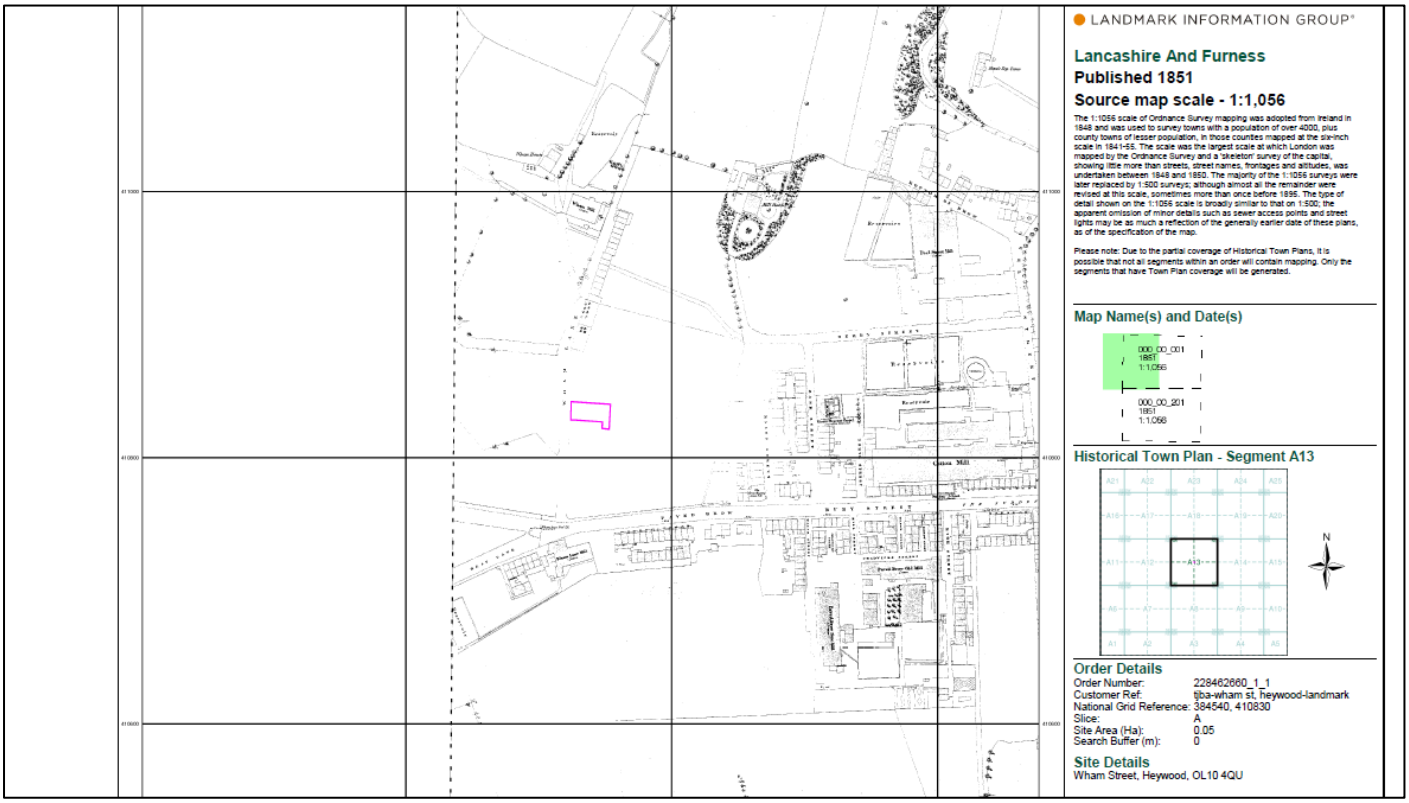
Trial hole 2.



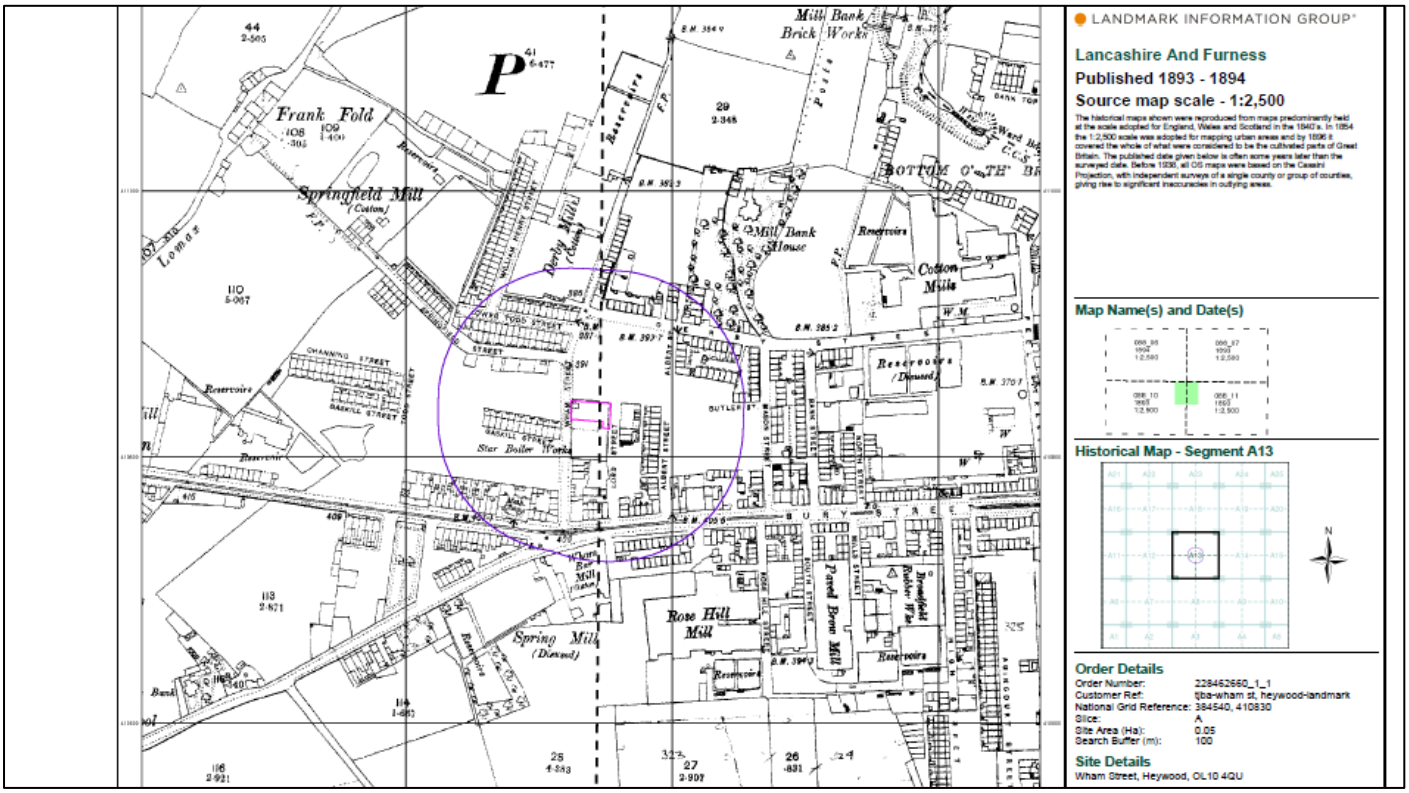
Trial hole 3.

19. APPENDIX C: MAPS

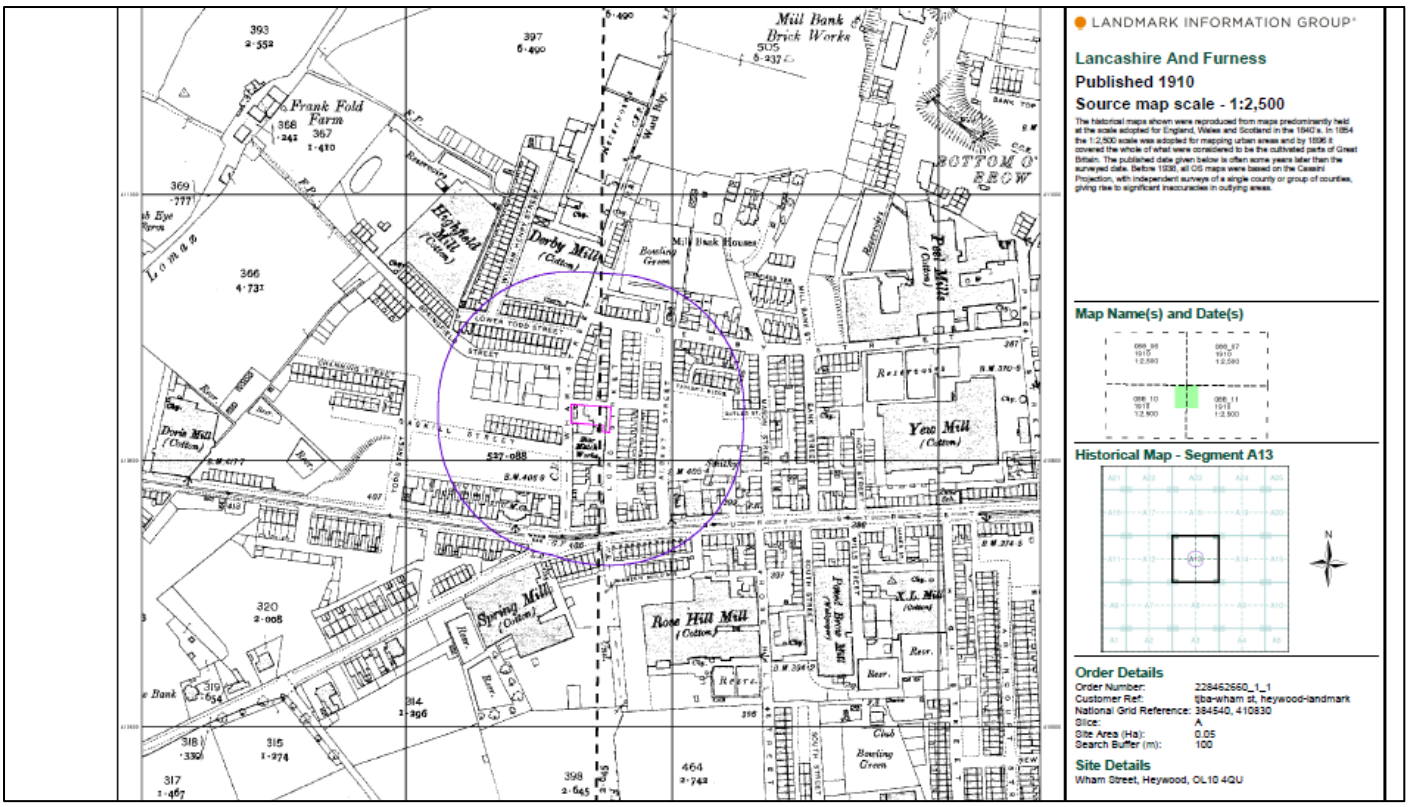
19.1. Ordnance Survey c1851



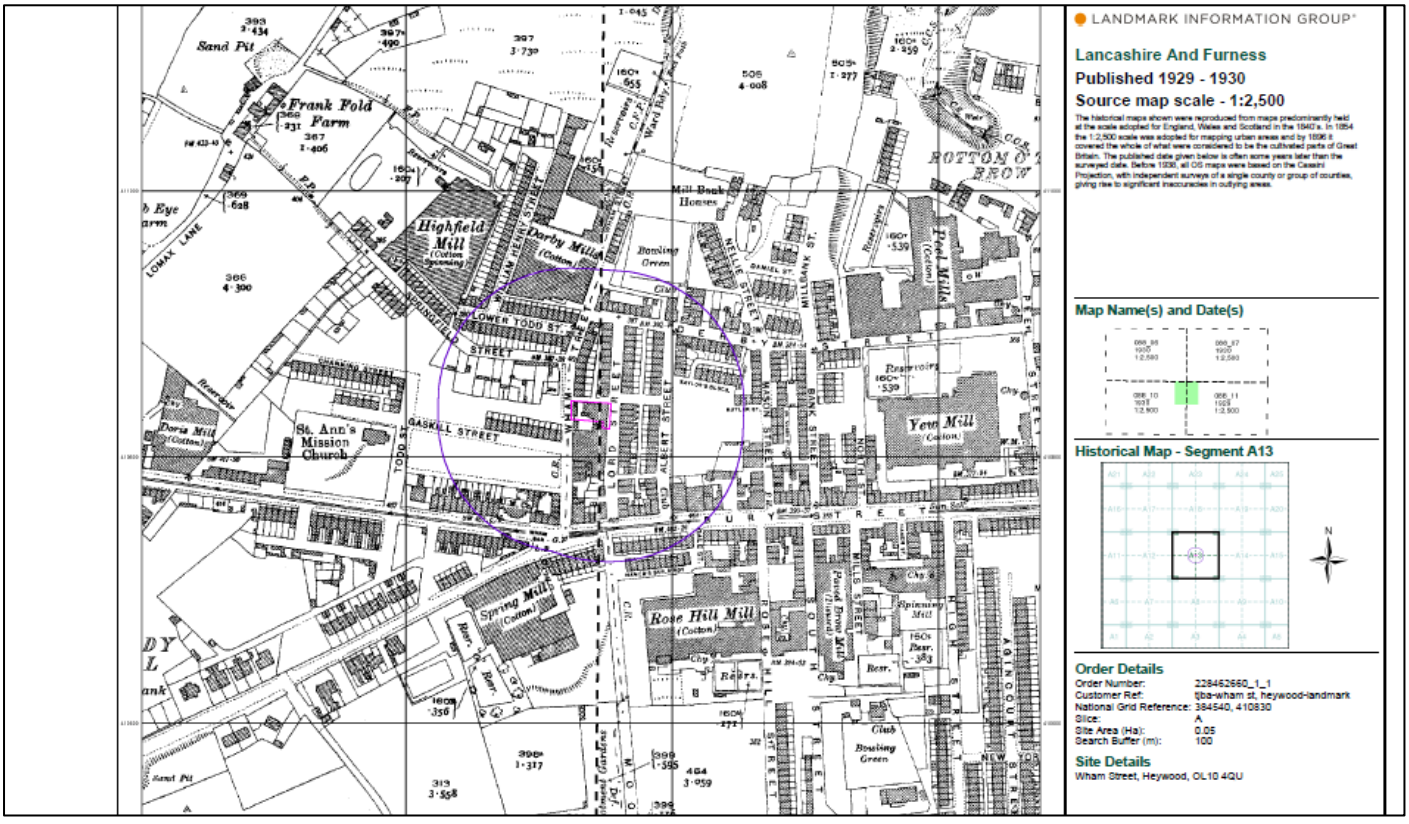
19.2. Ordnance Survey c1883-94



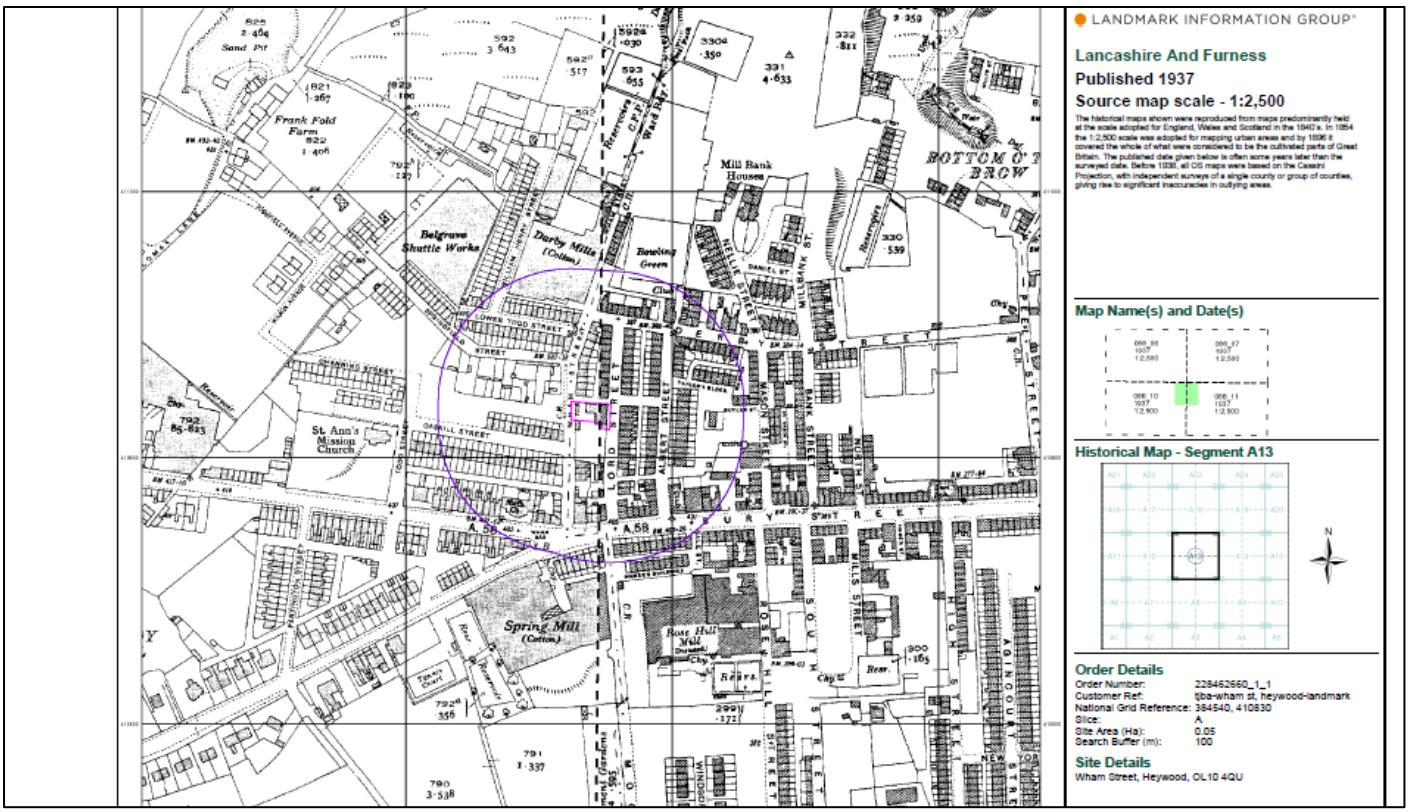
19.3. Ordnance Survey c1910



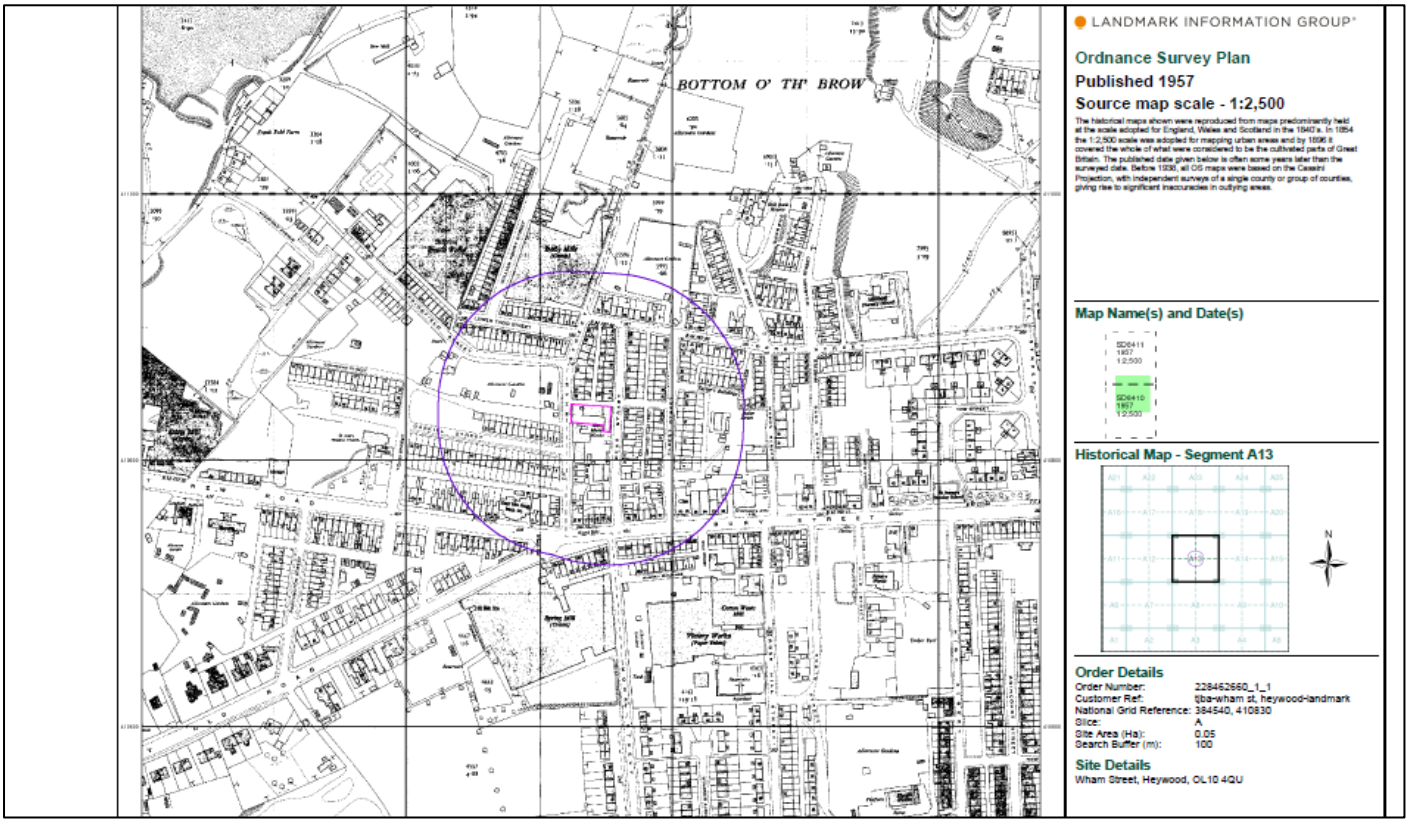
19.4. Ordnance Survey c1929-30



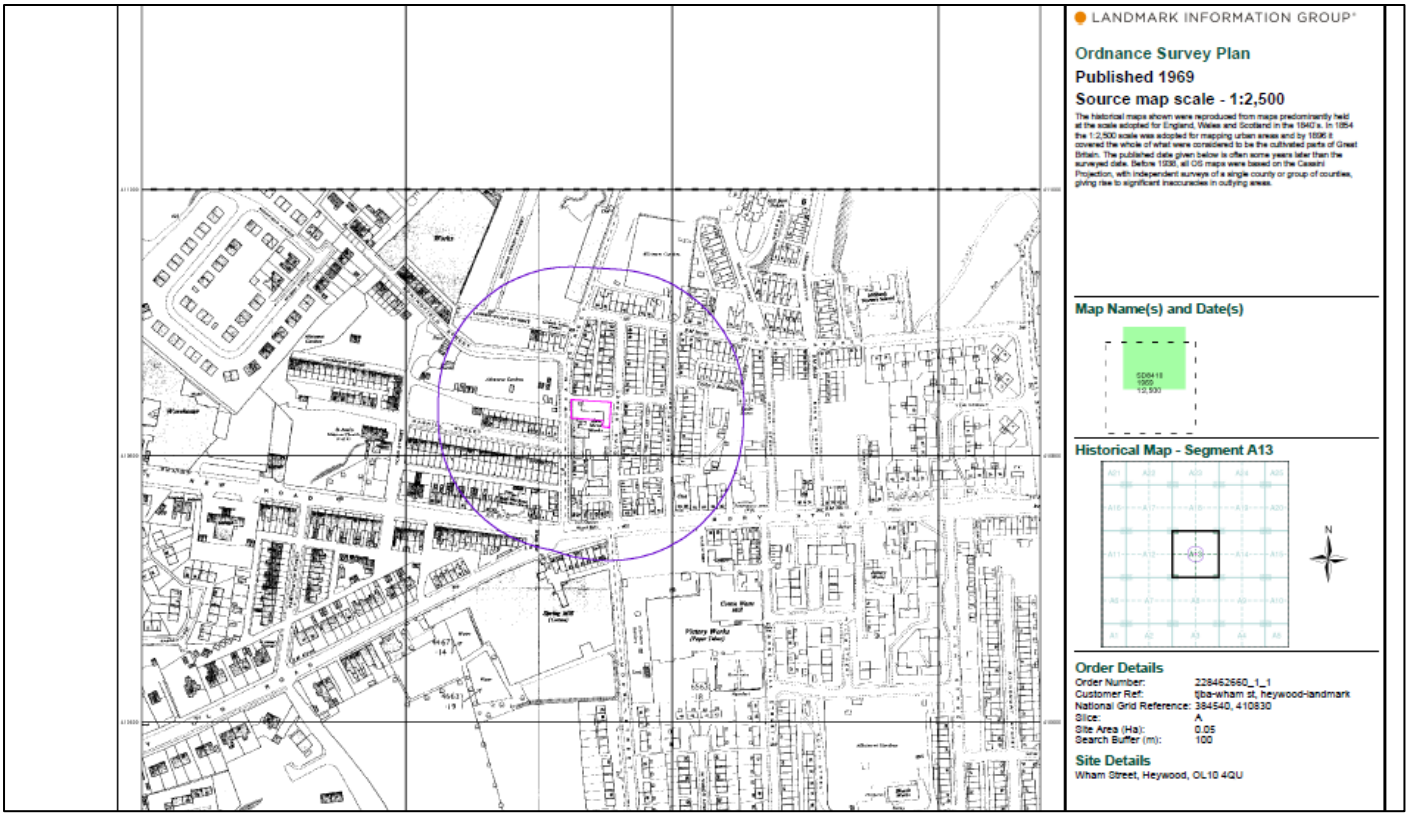
19.5. Ordnance Survey c1937



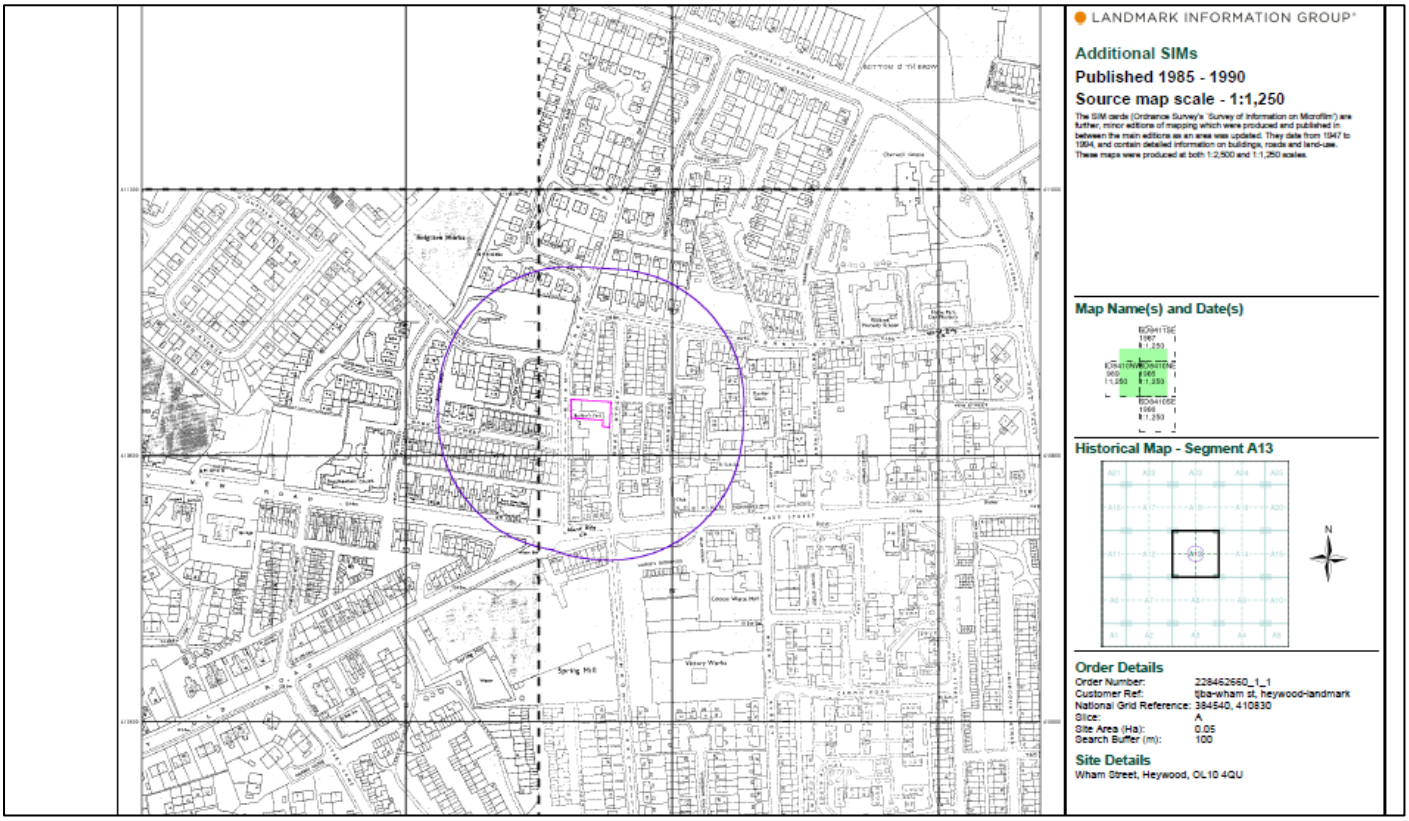
19.6. Ordnance Survey c1957



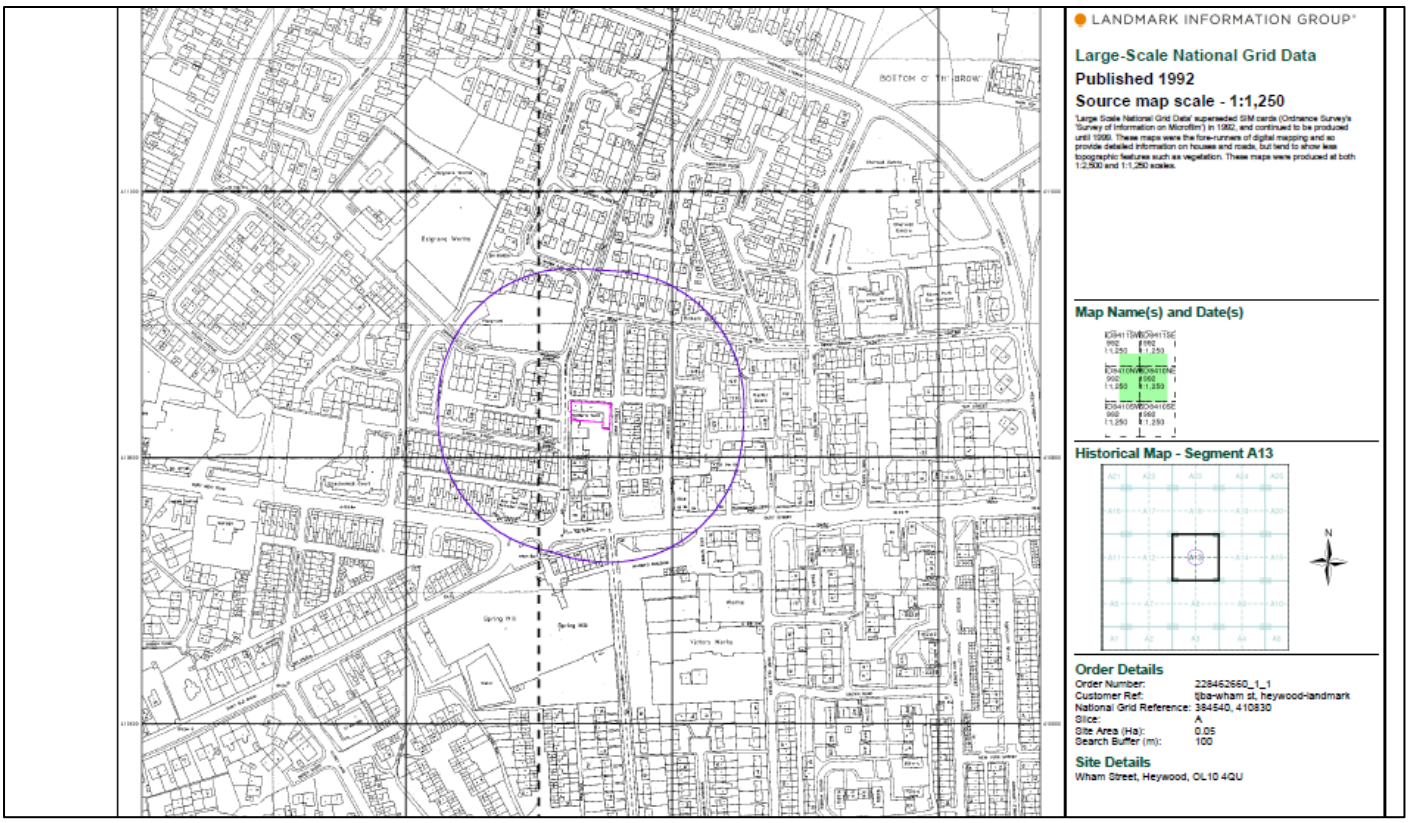
19.7. Ordnance Survey c1969



19.8. Ordnance Survey c1985-90



19.9. Ordnance Survey c1992



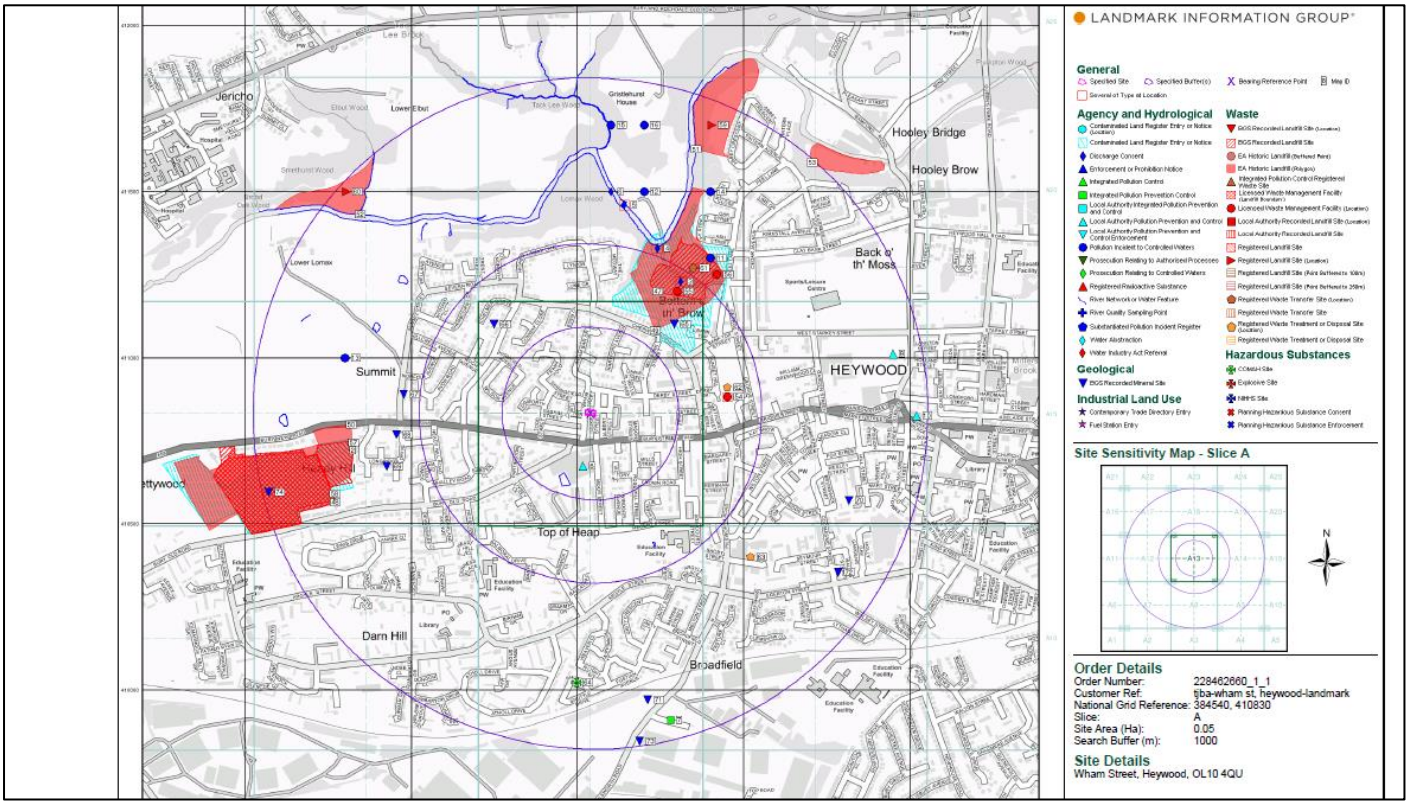
19.10. BGS Geological Map (Solid)



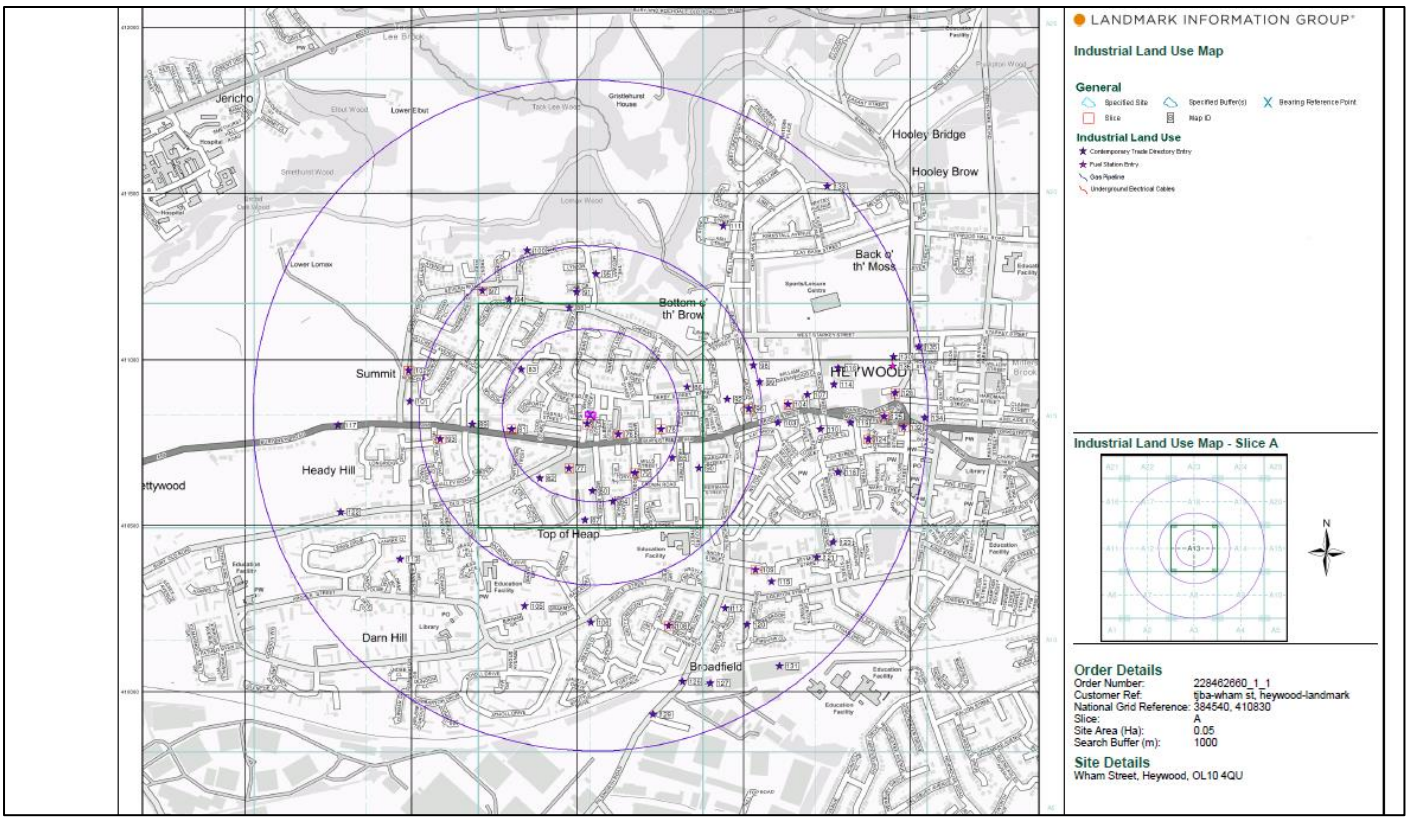
19.11. BGS Geological Map (Superficial)



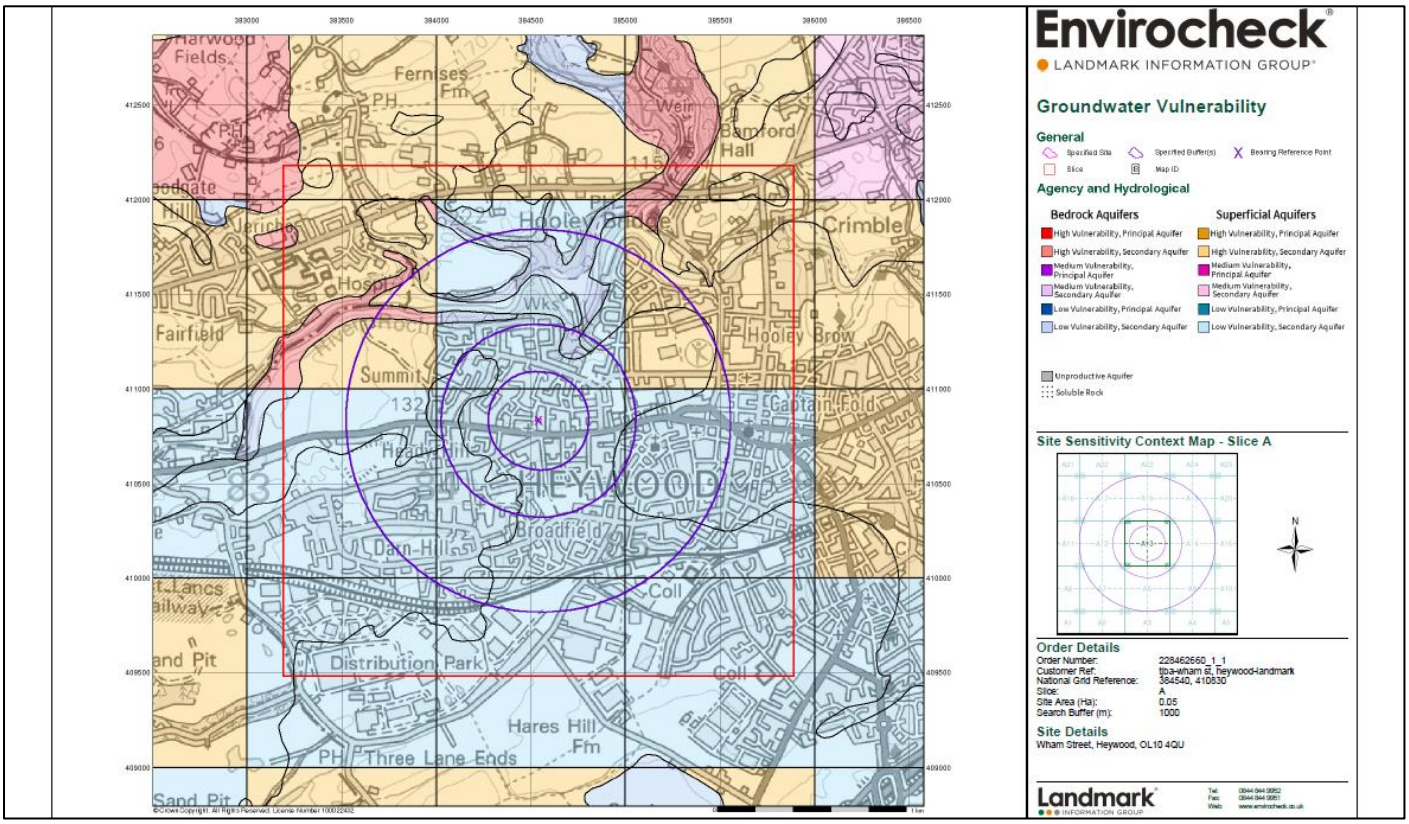
19.12. Landmark Contaminants Map



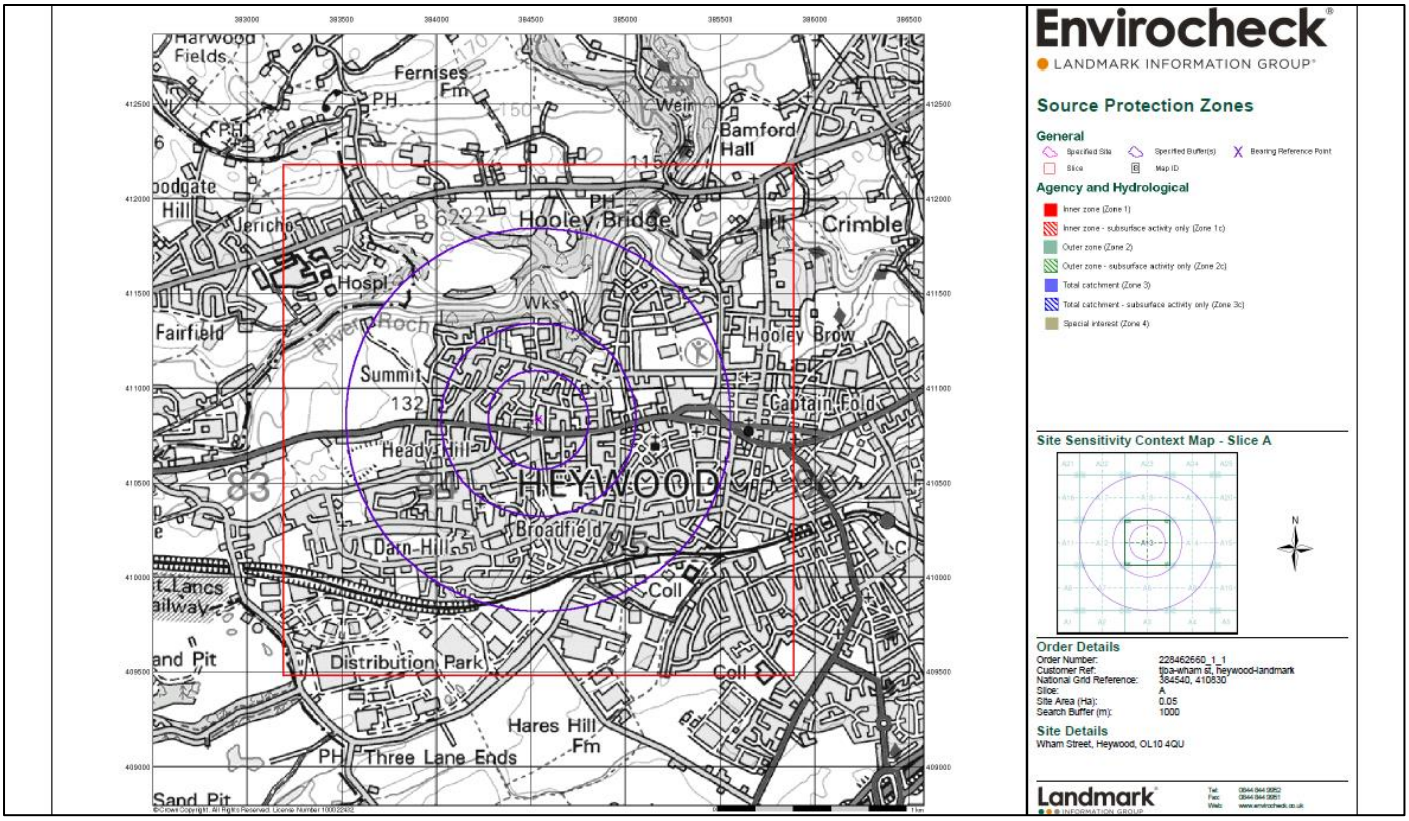
19.13. Landmark Industrial Land Use Map



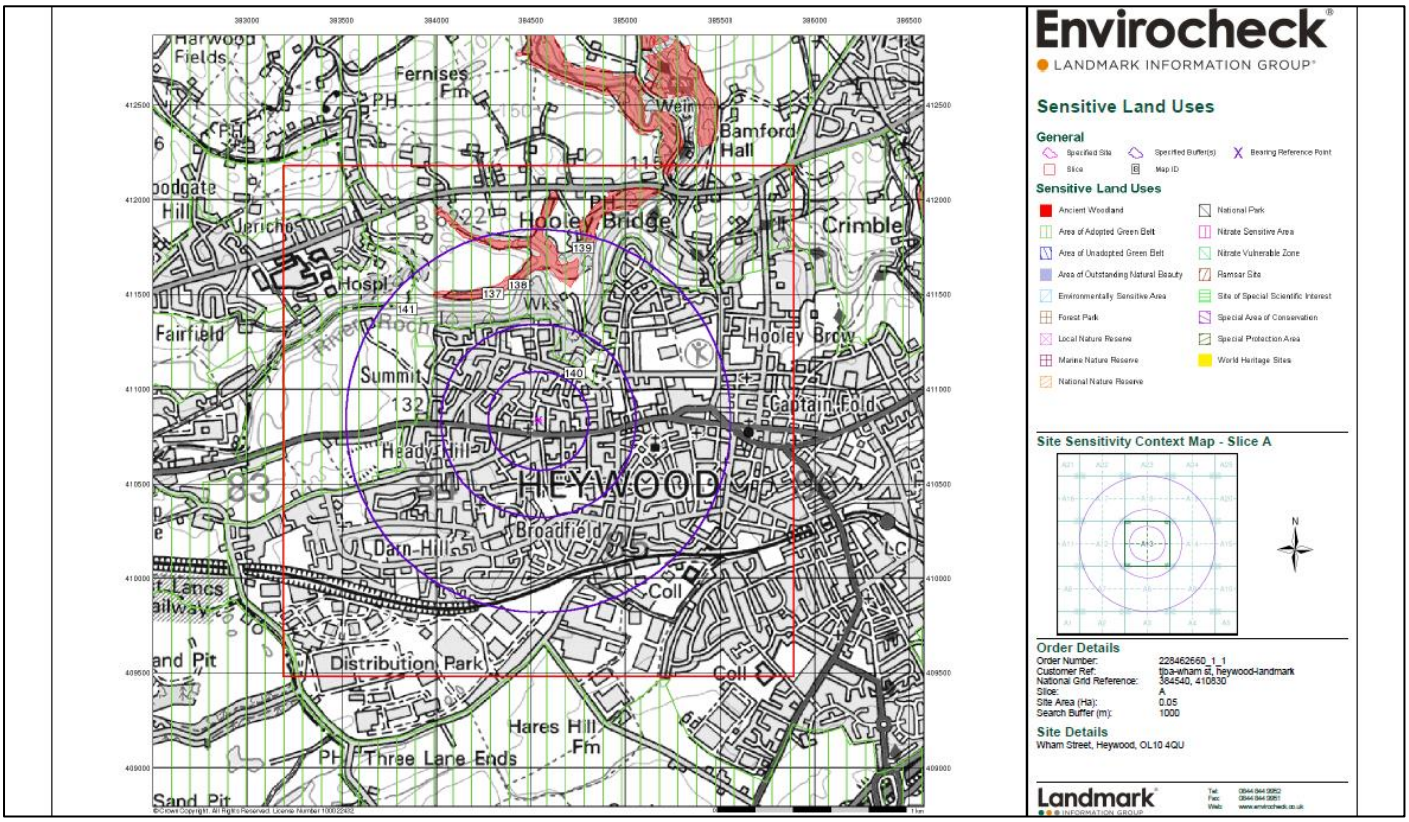
19.14. Landmark Bedrock Aquifer Map



19.15. Landmark Source Protection Zone Map



19.16. Landmark Sensitive Land Use Map



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).

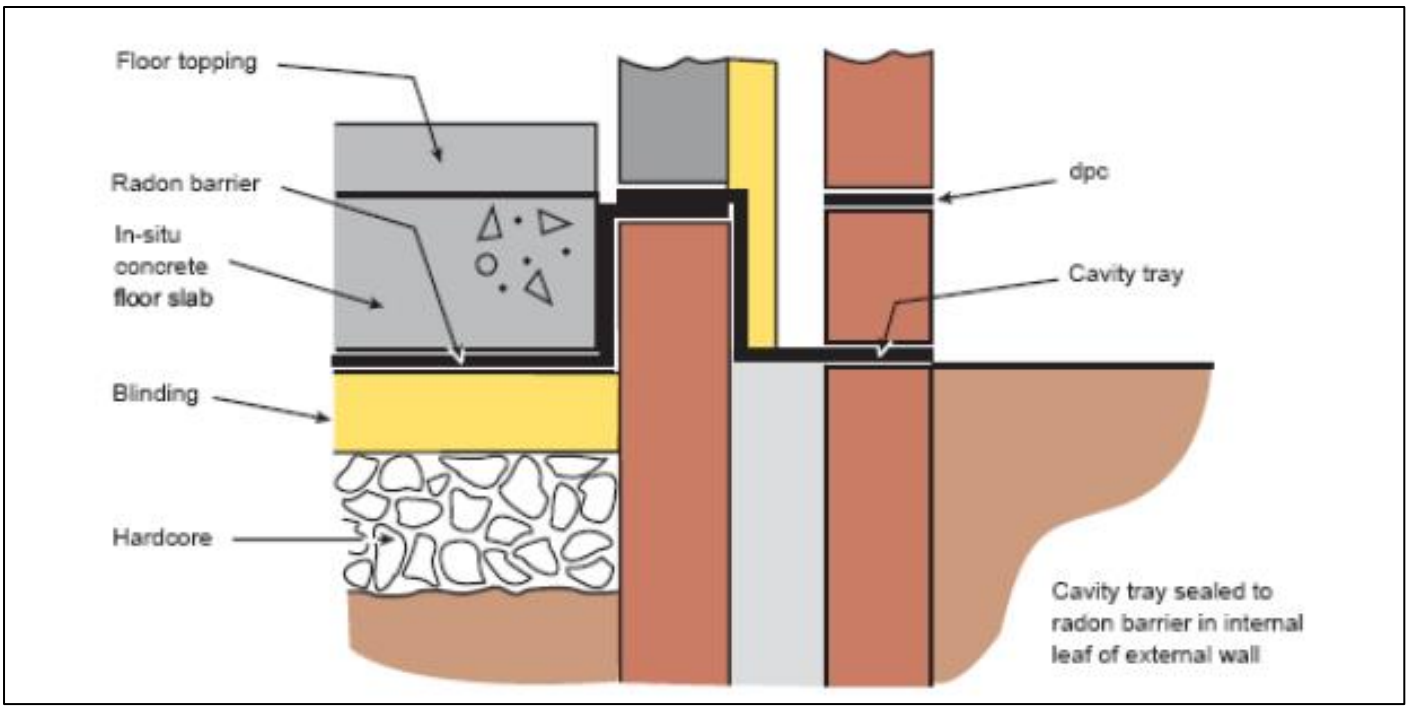
20.4. BGS/HPA report IR/11/044 – Radon Potential Class

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.

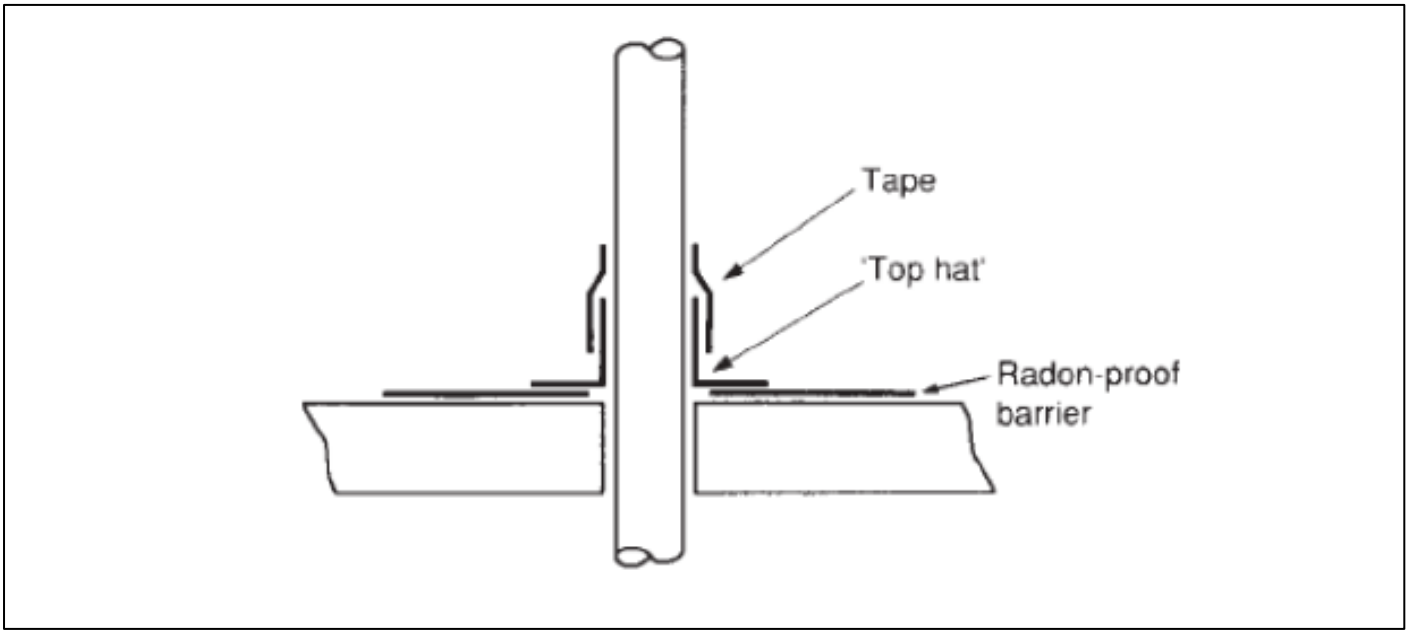
20.5. BGS/HPA report IR/11/044 – Radon Potential Class/Protection Measures.

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*

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.