T J BOOTH ASSOCIATES

CONSULTING CIVIL & GEOTECHNICAL ENGINEERS

PHASE I ENVIRONMENTAL AUDIT.

Land off Argyle Street to the rear of Argyle Parade, Darnhill, Heywood, OL10 3NW.

Client:	Darnhill & Heywood Boxing Club.
Date:	July 2018.
Version:	rev 0.
Reference:	rep-tjba-mulligan-darnhill & heywood BC-phs 1 env-170718.docx

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1. INTRODUCTION.

T. J. Booth Associates have been appointed by Darnhill & Heywood Boxing Club to undertake a Phase I Environmental Audit to the above Development Site. This report will support a planning application to address Town & Country Planning requirements for development.

The Development Site is located on a small plot of greenfield land/public open space to the rear of Argyle Parade in Darn Hill, Heywood; and within an existing housing estate. Site coordinates are; *E: 384049, N: 410204*.

The Development currently has planning permission, ref No. *17/00812/FUL*; for the erection a *"single storey detached building for use as boxing club with associated hard standing, external lighting and erection of 2.1m high boundary fencing"*.

Planning conditions No.4 relate to environmental issues and state:

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.

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

2. PROPOSED DEVELOPMENT.

The proposed development is for the erection of 1No. single storey detached commercial building, nominally central to the plot. The building will comprise a masonry structure with a partial single pitch roof, and partial flat roof.

The proposed building will take up much of the Site development leaving only space between the building and boundary to be former as a herd landscaped pathway. Thus the Site will comprise no soft landscaping.

3. MAP REVIEW.

3.1. Historic Maps.

Historic maps were obtained from Landmark at nominally 1:2500 and 1:10560 scale of the Site and the surrounding area. Google Maps historic view is also included from c2000. They were reviewed, tabulated below & appended.

DATE	ON-SITE	OFF-SITE/SURROUNDING AREA
c1851	Site is part of agricultural land.	Lancashire and Yorkshire Railway approximately 300m S of the Development Site. Occasional farm houses only within 250m.
c1893	No change.	Some residential development within 150m of the development. No overall change.
c1910	No change.	No overall change.
c1930	No change.	No overall change.
c1937	No change.	No change within 250m of the Development Site. Some sand pits in the wider area, specifically over 250m from the Site to the NE and far N & NW.
c1956-58	No change.	Some minor made ground noted to the N approx 225 m distant produced as part of a residential development, but no other changes.
c1963-66	Site appears to be part of public open space.	Newly erected Darnhill Estate surrounds the Site comprising mostly shops and amenities to the immediate locale, and residential dwellings beyond.
c1968-70	No change.	Further development of the local amenities, ie, clinic & library etc to the SE of the Site.
c1970-75	Community Centre occupies the Site.	No overall change.
c1983-88	No change.	No overall change.
c1992	No change.	No overall change.
c1999	No change.	Tower blocks approx 50-100m distant demolished and replaced with housing.
2005	No change.	No overall change.
2013	Community centre demolished and the Site returned to public open space.	No overall change.

3.2. Present Day Maps.

Present day maps comprise both paper & digital/online resources such as google maps, topographic surveys, OS etc.

PRESENT DAY MAPPING DATA SUMMARY	
Site Boundaries, Outlines of Structures and Buildings:	The Site is currently vacant grassland/public open space, and is bounded by residential dwellings to the N, pavement/pathways to the E & S, and by vegetation (trees) to the W side. There is a local authority highway providing access to the Site.
Ground Contours, Natural Drainage Features:	There is a fall towards the SE over the Site and the residential dwellings to the N side are at a higher level. No topographic survey of the Site has been undertaken.
Water Courses:	No watercourses in close proximity to the Development Site.
Below Ground Obstructions:	None noted within mapping data beneath the site.

3.3. BGS Geological Map Review.

The local geology was accessed via the BGS digital online mapping data service, and paper copies of Manchester Sheet 85, 1:50000 Series (solid & superficial), refer to appendix for Geological Maps.

GEOLOGY DATA SUMMARY	
Bedrock Geology:	The Site is underlain by undifferentiated Carboniferous Westphalian Coal Measures, generally comprising interbedded sandstone and mudstone. The local stratigraphic dip is approx 10 degrees S.
Superficial Geology:	The Site is underlain by glacial sand & gravel, however glacial clays are noted within 200m of the Site so the sand & gravel thickness is estimated to be thin.
Coal Seams/Faults.	There are seams that underlie the area but most are faulted out from beneath the Site. Any coal seams beneath the Site are estimated to be at considerable depth.

4. ENVIRONMENTAL DATA SEARCH.

4.1. Landmark Envirocheck Report.

The Landmark Envirocheck Report comprises a detailed environmental dataset for the site and the surrounding local area.

The summary assessment tables give an account of the environmental issues on site, within 0-250, and between 250-500m of the site (refer to appendix for summary tables). For this location an area up to 250m of the site boundary is critical for environmental purposes and each section of the summary tables is commented on below.

4.1.1. Agency & Hydrological

BGS Groundwater Flooding Susceptibility – Limited potential for groundwater flooding.

Contaminated Land Register Entries & Notices – 0 records within a 250m radius of the Site. Closest is 437m NW.

Discharge Consents – 0 records within a 250m radius of the Site. Closest is 735m SE.

Local Authority Pollution Prevention & Controls – 0 records within a 500m radius of the Site.

Pollution Incidents to Controlled Waters - 0 records within a 500m radius of the Site.

Groundwater Vulnerability – Classified soils as high leaching potential.

Bedrock Aquifer Designation – Secondary A Aquifer.

Superficial Aquifer Designation – Secondary A Aquifer.

Source Protection Zones – Not within a Source Protection Zone.

Flooding from Rivers & Sea – Not within a flood zone.

4.1.2. Waste.

BGS Recorded Landfill Sites – 0 records within a 250m radius of the Site. The closest record is the former Boohole Landfill noted 430m NW.

Historical Landfill Sites – 0 records within a 250m radius of the Site. The closest record is the former Boohole Landfill noted 438m NW.

4.1.3. Hazardous Substances.

No records noted within a 250m radius of the Site.

4.1.4. Geological.

Coal Mining Area – in an area that may be affected by coal mining.

Potential for Collapsible Ground Stability Hazards – no hazard.

Potential for Compressible Ground Stability Hazards – no hazard.

Potential for Ground Dissolution Stability Hazards – very low.

Potential for Landslide Ground Stability Hazards – very low.

Potential for Running Sand Ground Stability Hazards – very low

Potential for Shrinking or Swelling Clay Ground Stability Hazards – no hazard.

Radon Potential/Radon Affected Areas – the property is in a low Probability Radon Area where <1% of homes are estimated to be at or above the action level.

Radon Potential/Radon Protection Measures – no radon protection measures are necessary in the construction of new dwellings or extensions.

4.2. BGS Boreholes Records.

No relevant or available borehole records were found in close proximity to the Site.

4.3. Coal Authority.

Information was obtained from the Coal Authority interactive digital online mapping service. Data tabulated below:

COAL AUTHORITY DATA SUMMARY	
Mine Shafts, Pits, Adits/Entries:	The closest recorded pits or shaft to the Development Site are over 1200m distant.
Past/Present Recorded Underground Mining.	No known deep mining has been recorded beneath the Site. No known shallow mining has been recorded beneath the Site.
Probable/Potential Shallow Underground Workings & Outcrops:	There are some probable workings to the west which coincide with seam outcrops, but these do not extend beneath the Site due to being faulted out.
Outcrops:	See above.
Development High Risk Area:	The Site is not in a Development High Risk Area.

5. FIELDWORK.

5.1. Site Reconnaissance.

A Site reconnaissance was undertaken in July 2018. The weather was sunny and dry.

SITE RECONNAISSANCE SUMMARY	
Details of Existing Structures:	The Site was a vacant plot of grassland/public open space. No existing structures exist on the Site. There are numerous manholes surrounding the Site especially to the E side which may be past connections in to the development.
Adjacent Properties:	To the W & S of the Site is public open space including park land and children's play facilities. However, the immediate Site boundary is formed by an area of vegetated parkland to the W, and by a pathway to the S side. The N is bounded by residential properties, and to the E is the public highway and pavement.
Water Levels, Directions of Flow and Rates in Rivers:	None noted.
Old Mine or Quarry Workings:	None noted.
Obvious/Immediate Hazards to Health/Safety:	None noted.
Areas of Discoloured Soil, Polluted Water, Vegetation, and Significant Odours:	None noted.
Relevant Ground Levels, Ground Water Levels, Positions of Wells and Springs:	The Site was relatively level, with land elevation falling to the SE.

6. DISCUSSION FROM THE DESK STUDY AND FIELDWORK.

6.1. Conceptual Model.

6.1.1. Summary.

The Site was originally part of farm/agricultural land, from c1850s until c1960s when it was developed as part of a local authority residential estate. The Site itself remained vacant and part of public open space until c1970 when it was developed in to the local community centre. The community centre building took up most of the Site. It remained on mapping data until between 2005-1013 when it was demolished and returned back to open space/park land.

The wider local area up to 250m from the development saw little development up to the construction of the current housing estate.

Although there are landfill sites locally, all are over 250m from the Site boundaries and there have been no infilled ponds or other areas closer to the Site.

The Site is not noted to be in a radon area and no shallow coal mining has occurred beneath the Site.

6.1.2. Potential Contaminants.

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

SOURCE/S	CONTAMINANT/S	PRESENT
Made ground	Metals, PAH, sulphates, inorganics, asbestos.	YES

6.1.3. Potential Pathways.

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

PATHWAY	MEDIA	PRESENT
Soil and dust ingestion	Soil and indoor dust	NO
Consumption of home grown fruit and vegetables	Produce	NO
Skin contact (indoors)	Indoor dust	NO
Skin contact (outdoors)	Soil	YES
Inhalation of dust (indoors)	Air	NO
Inhalation of dust (outdoors)	Air	YES
Vapours (indoors)	Air	NO
Vapours (outdoors)	Air	NO

6.1.4. Potential Receptors.

Receptors only comprise workers in the construction phase.

6.1.5. Potential Pollutant Linkages.

Below is a tabulated form of the conceptual model:

	SOURCE	PATHWAY	RECEPTOR	RISK
1	On site surface soils.	Direct ingestion, aerial ingestion, dermal contact, drinking water.	Site construction operatives & future occupants.	LOW RISK.
2	Subsoils.	Contact with potential hazards.	Site buildings.	LOW RISK.
3	Ground gas from geological strata.	Diffusion through soil, aerial inhalation.	Future occupants. Explosion, suffocation.	VERY LOW RISK.
4	Ground gas from waste, landfill or other sources in made ground.	Diffusion through soil, aerial inhalation.	Future occupants. Explosion, suffocation.	NO RISK.
5	Contaminated ground and surface water. Controlled Waters.	Permeation through soils into excavations / basements, dermal contact & ingestion.	Site construction operatives & future occupants.	VERY LOW RISK.
6	Aerial contaminants.	Dermal contact & aerial inhalation.	All site users / occupants.	VERY LOW RISK.

7. CONCLUSIONS.

7.1. Preliminary Contaminant Risk Assessment.

Regarding potential pollutant linkage 1 & 2, due to past development, there is the potential for made ground and building rubble on the Site which can often be a source of metal, PAH, inorganics, sulphates, and asbestos. However, the appears to have only been developed once and due to the type of building that previously existed on the Site, any made ground is likely to be minimal.

Although there may be some minor contaminants in the upper made ground profile, due to the commercial end use of the Site, the levels contained within the upper soil are highly unlikely to be recorded over commercial threshold values requiring action. In addition, no soft landscaping is proposed as part of the development and thus any pathway to the end use receptor is broken.

There is no risk noted of hydrocarbons etc that would have an impact on potable water pipes etc.

Regarding potential pollutant linkage 3, contaminant sources from local geology are thought to pose a low risk to the Development. The local area is not within a radon protection zone (BGS/HPA Class 1 Area), and therefore requires no protection measures. No coal mining has been noted at or close to the surface and thus risks from this source are discounted.

Ground gas sources such as waste & landfill sites in potential pollutant linkage 4 do not comprise a risk of ground gas to the development. There are no sources noted within the data search within a 250m radius of the development.

Regarding potential pollutant linkage 5, potential impact on ground/surface water is considered low. The local area is underlain by clay, the bedrock & superficial aquifers are secondary, and it is not within a Source Protection Zone.

Potential pollutant linkage 6 is considered to pose a low risk. Present legislation regarding the release of aerial contaminants is regulated although past contamination which was unregulated would now be recorded in potential pollutant linkage 1 as shallow ground contamination.

8. RECOMMENDATIONS/SITE INVESTIGATION STRATEGY.

8.1. Shallow Soil Contamination:

On-site made ground is a potential source of minor contamination due to past development, however the risk is considered to be low and is mitigated due to the following:

- Limited made ground anticipated, and contaminant level in soil is unlikely to be over commercial threshold limits requiring action.
- No soft landscaping to the proposed development and thus no pathway, breaking pollutant linkages.

Due to the above, no soil sampling is recommended.

However, should proposals for the development change and any soft landscaping areas be included within the development, then a soil sampling regime will need to be undertaken for those areas; OR, new clean inert soil be imported to a minimum depth of 500mm below final finish levels, with final validation sampling being required to prove clean.

Should any soil be imported to the Site, it should be clean/inert, and free from deleterious materials; and should be suitable for use in a commercial end use setting. Validation samples will be tested for contamination suites: metals, inorganics, PAH USEPA16 speciated, and asbestos screening. Results will be analysed against Defra Category 4 Screening Levels (C4SL) where available, and to EA/DEFRA SGV (2009) data; and to LQM/CIEH GAC 2nd edition (2009) & erratum (2011) thereafter, for use in a residential end use setting.

8.2. Gas Risk:

The desk study has not identified any landfill or infilled sites within a 250m radius of the development, and thus no gas precaution measures are required to the development.

8.3. Additional Notes:

Should any suspected unidentified contamination be encountered throughout the groundworks or construction phase of the development, the suspect area/s should be isolated, advice sought from a suitable qualified environmental professional, and the LPA informed.

A final Site Validation Report should be undertaken following completion of remedial measures and include any subsoil/topsoil import sample results. The report should be submitted to the LPA to obtain full discharge of the environmental planning condition.

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

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

Signed…….

D.S.Slattery BSc (Hons).

T J Booth Associates.

Authorised…….

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

T J Booth Associates.

9. REFERENCES.

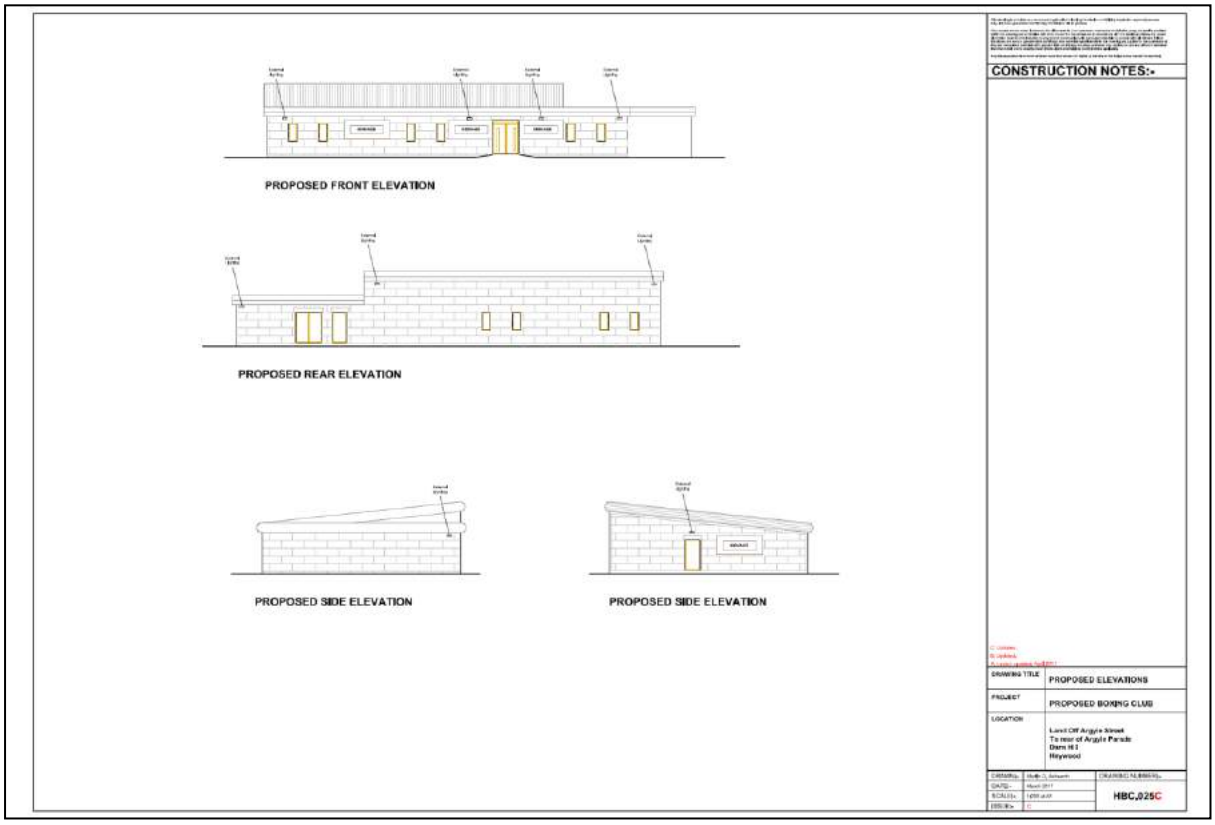
- BSI. 2013. BS 10175:2011+A1:2013. Investigation of Potentially Contaminated Sites – Code of Practice.
- Environment Agency. 2005. Secondary Model Procedure for the Development of Appropriate Soil Sampling Strategies for Land Contamination. R&D Technical Report P5-066/TR.
- CL:AIRE. 2012. Research Bulletin-RB17-A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

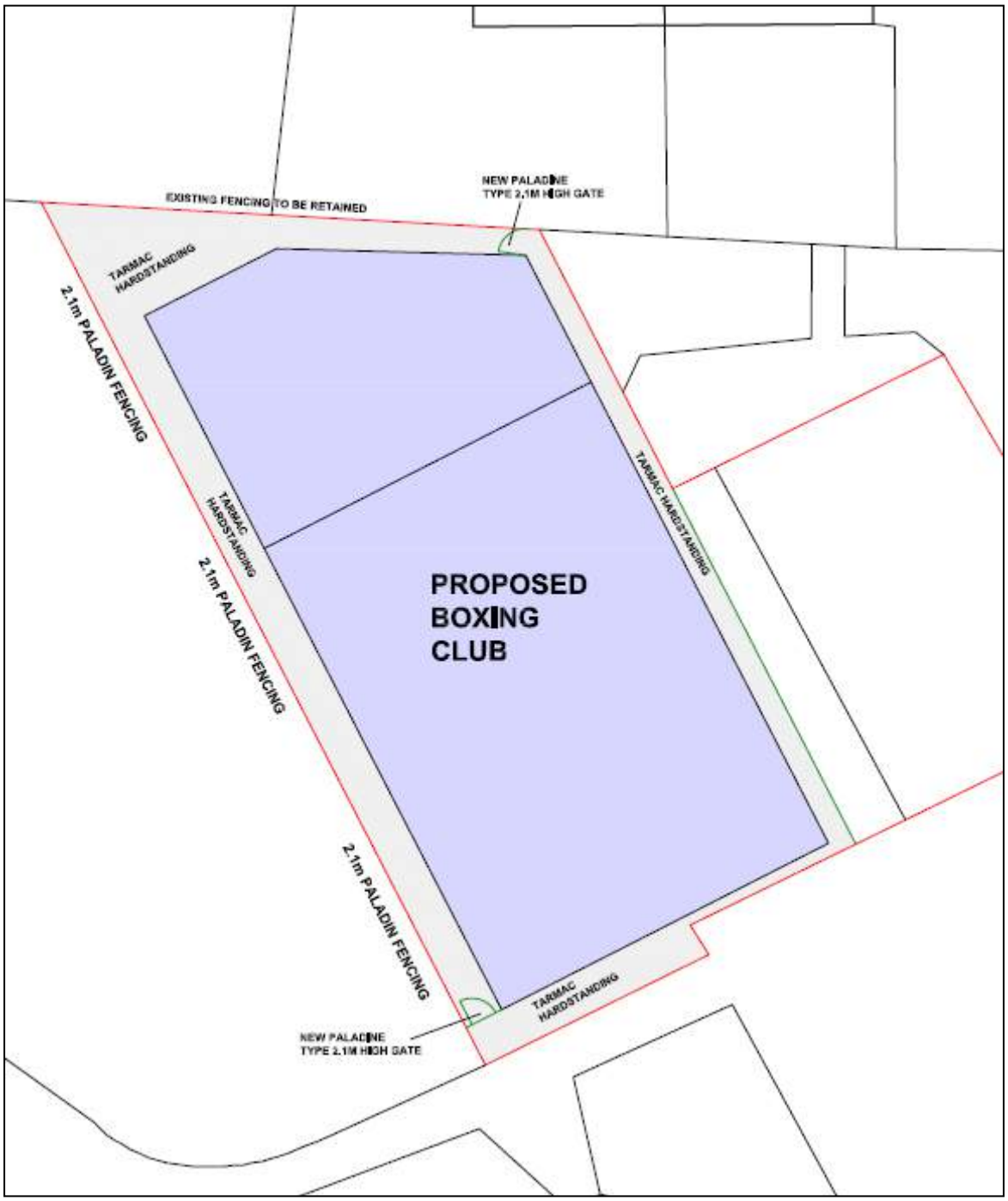
10. APPENDIX A: FIGURES.

10.1. Location Plan.



10.2. Proposed Development.

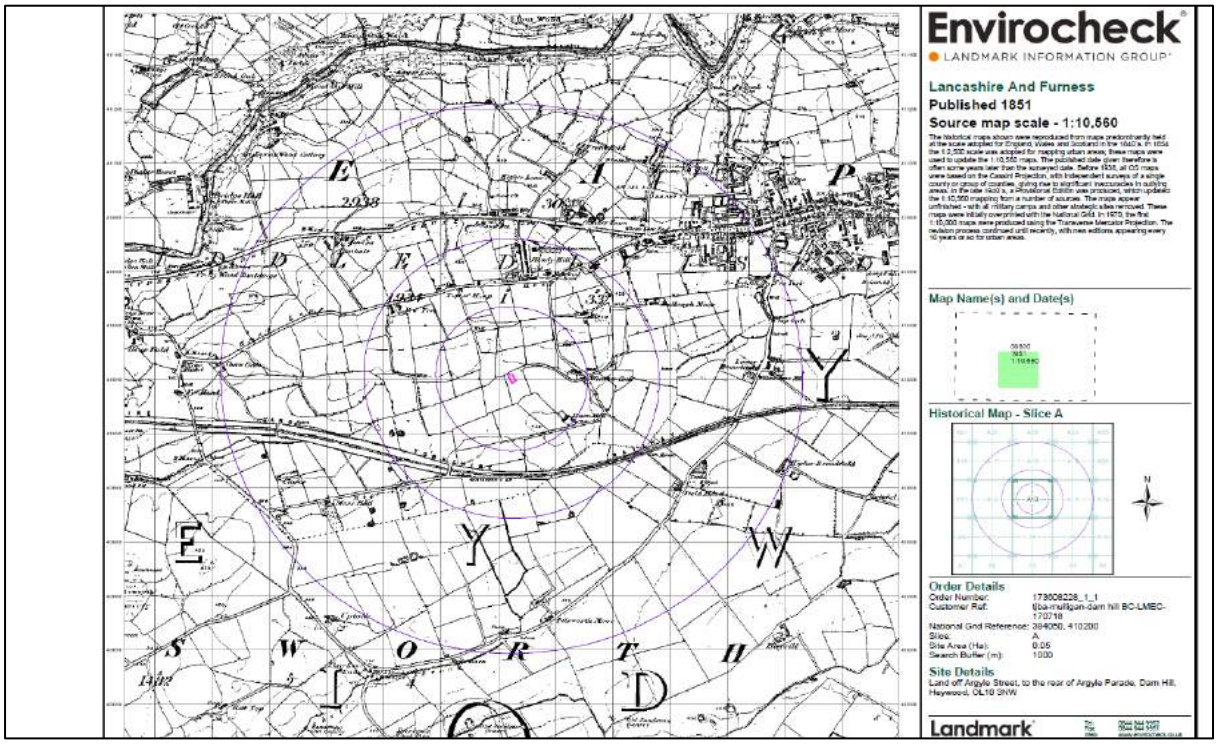



EXISTING FENCING TO BE RETAINED
NEW PALADINE TYPE 2.1M HIGH GATE
TARMAC HARDSTANDING
2.1m PALADIN FENCING
TARMAC HARDSTANDING
2.1m PALADIN FENCING
PROPOSED BOXING CLUB
TARMAC HARDSTANDING
2.1m PALADIN FENCING
TARMAC HARDSTANDING
NEW PALADINE TYPE 2.1M HIGH GATE

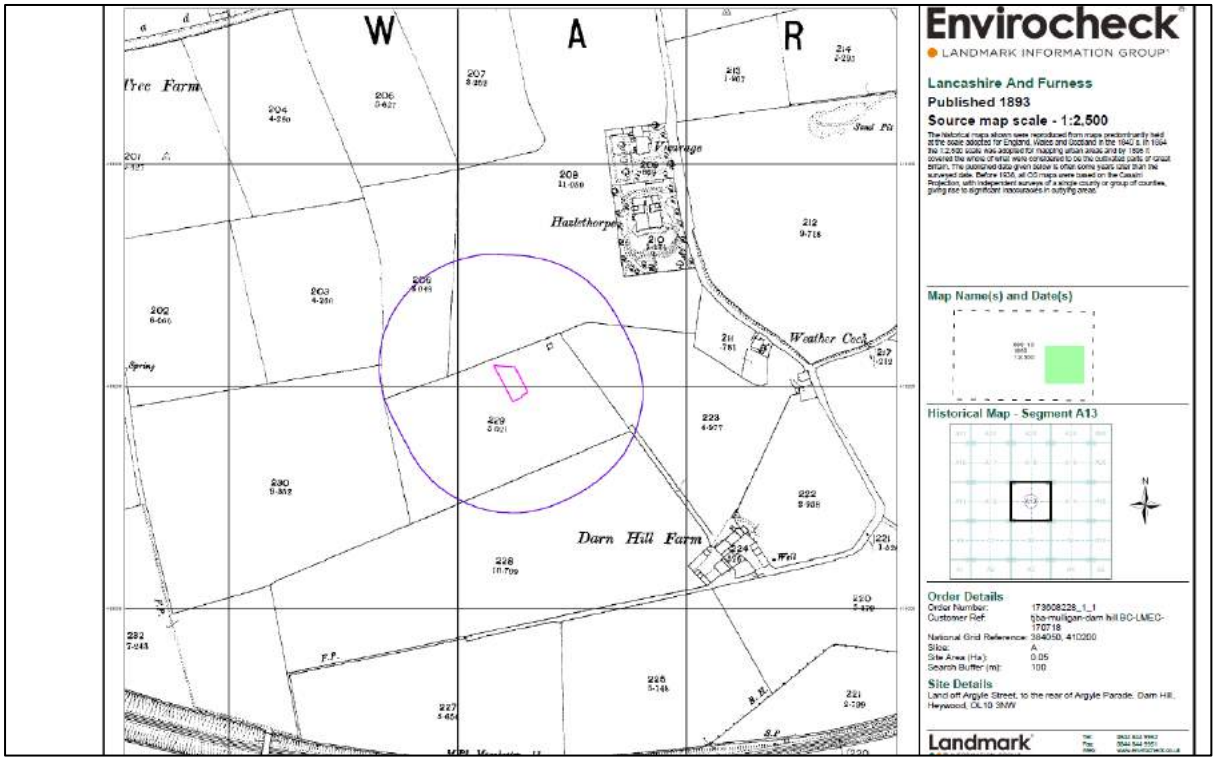
11. APPENDIX B: MAPS.

11.1. Historic Maps.

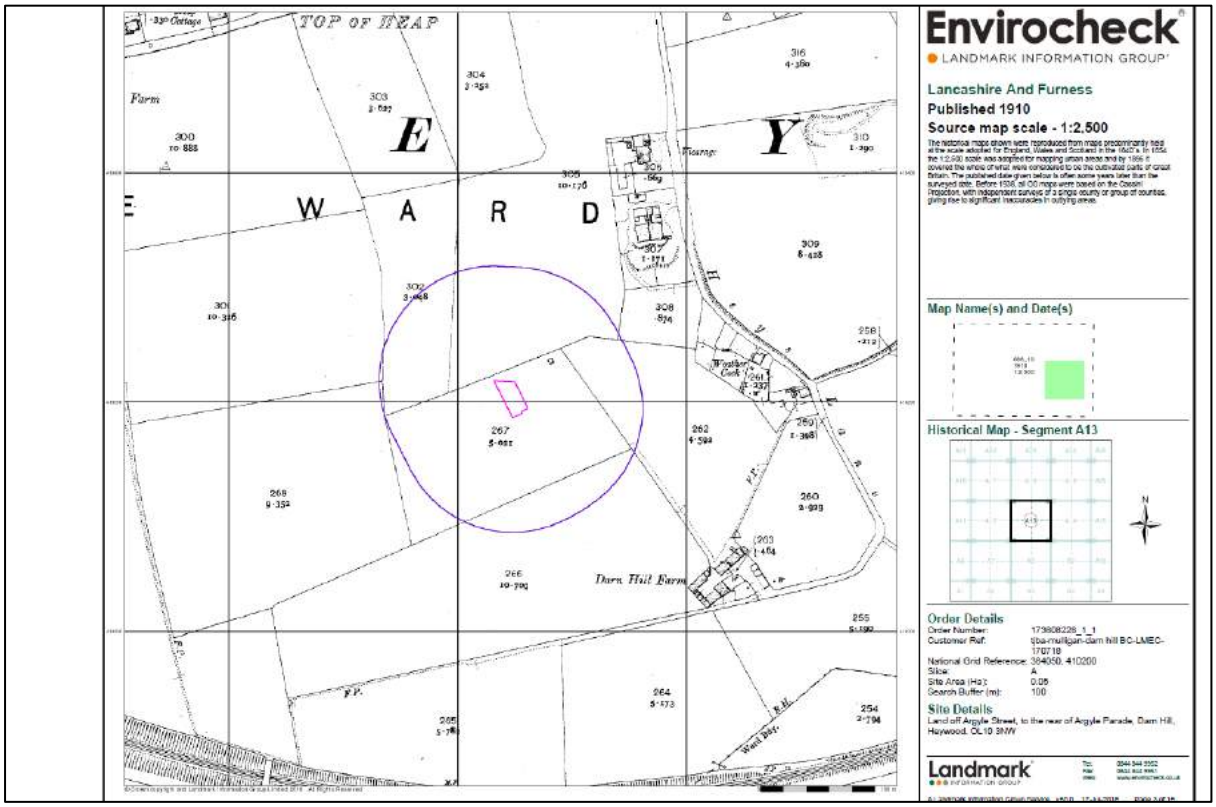
11.1.1. Ordnance Survey c1851



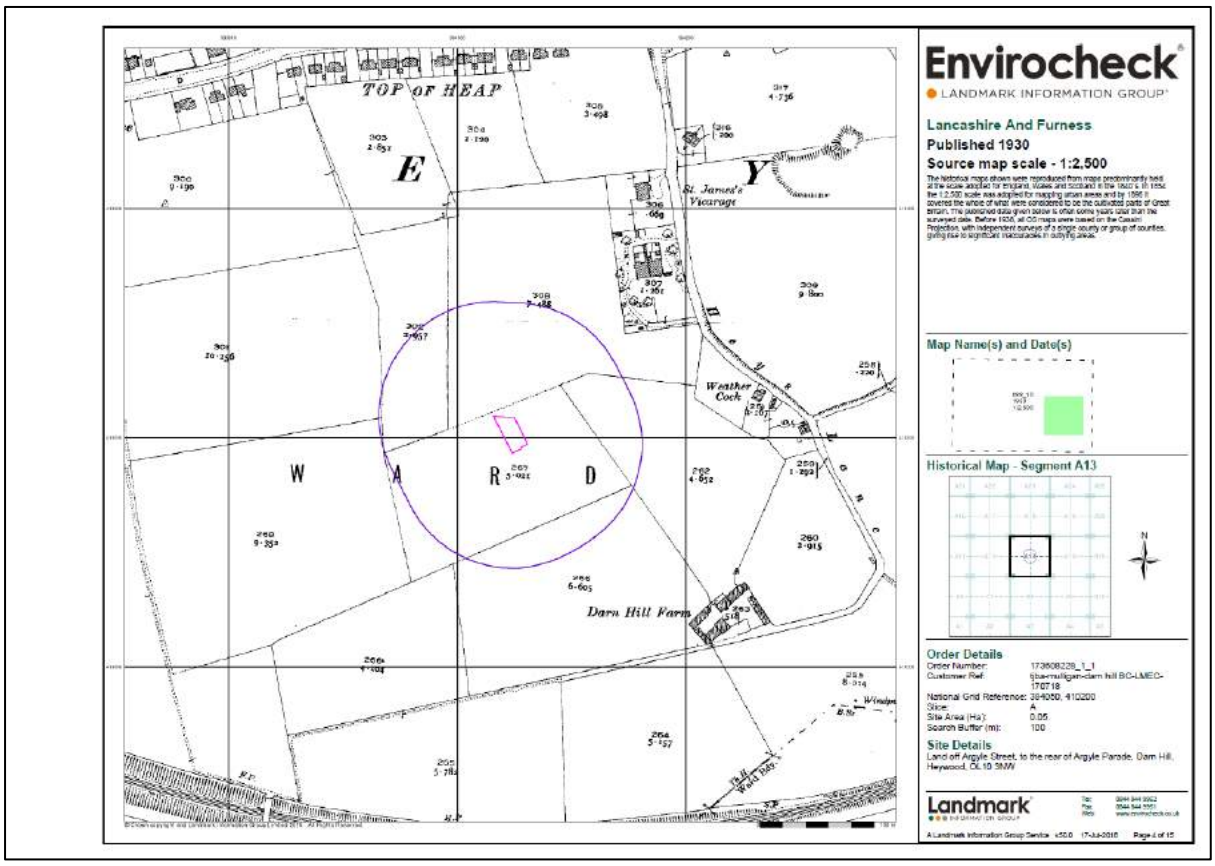
11.1.2. Ordnance Survey c1893



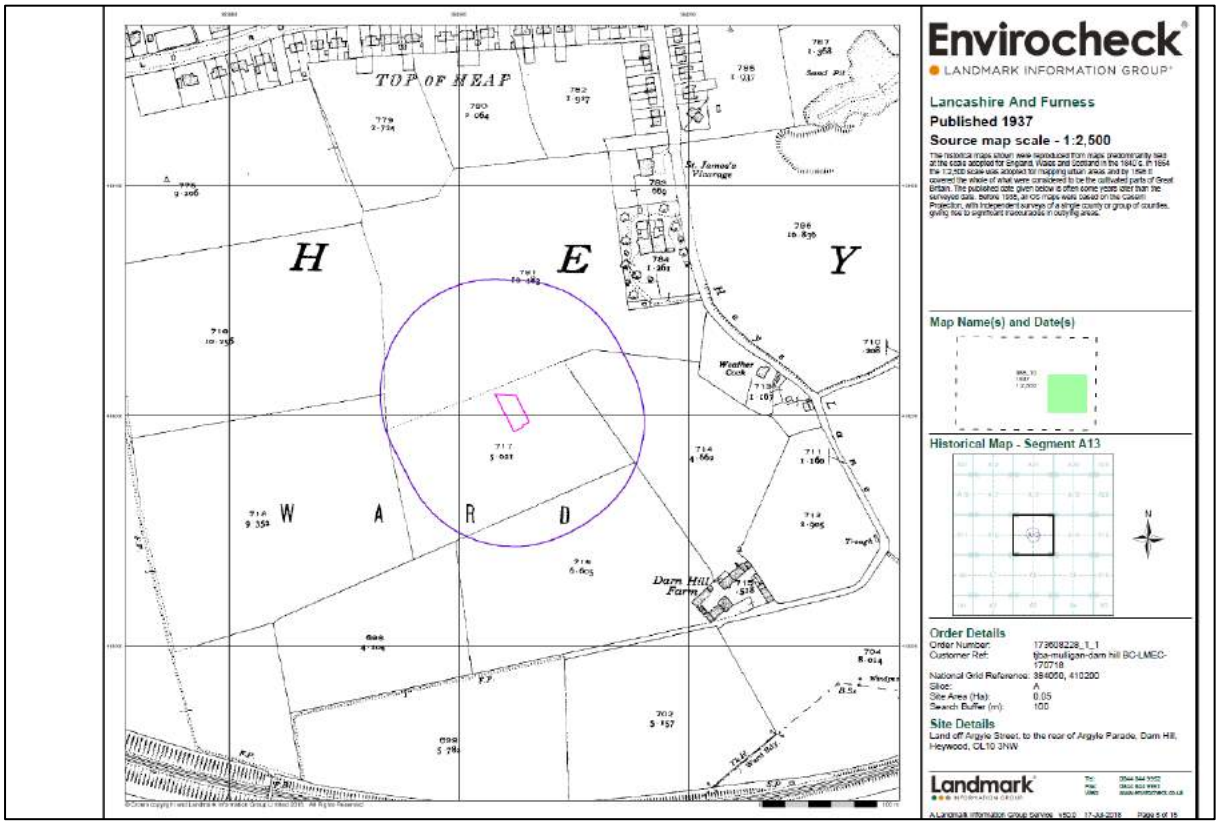
11.1.3. Ordnance Survey c1910



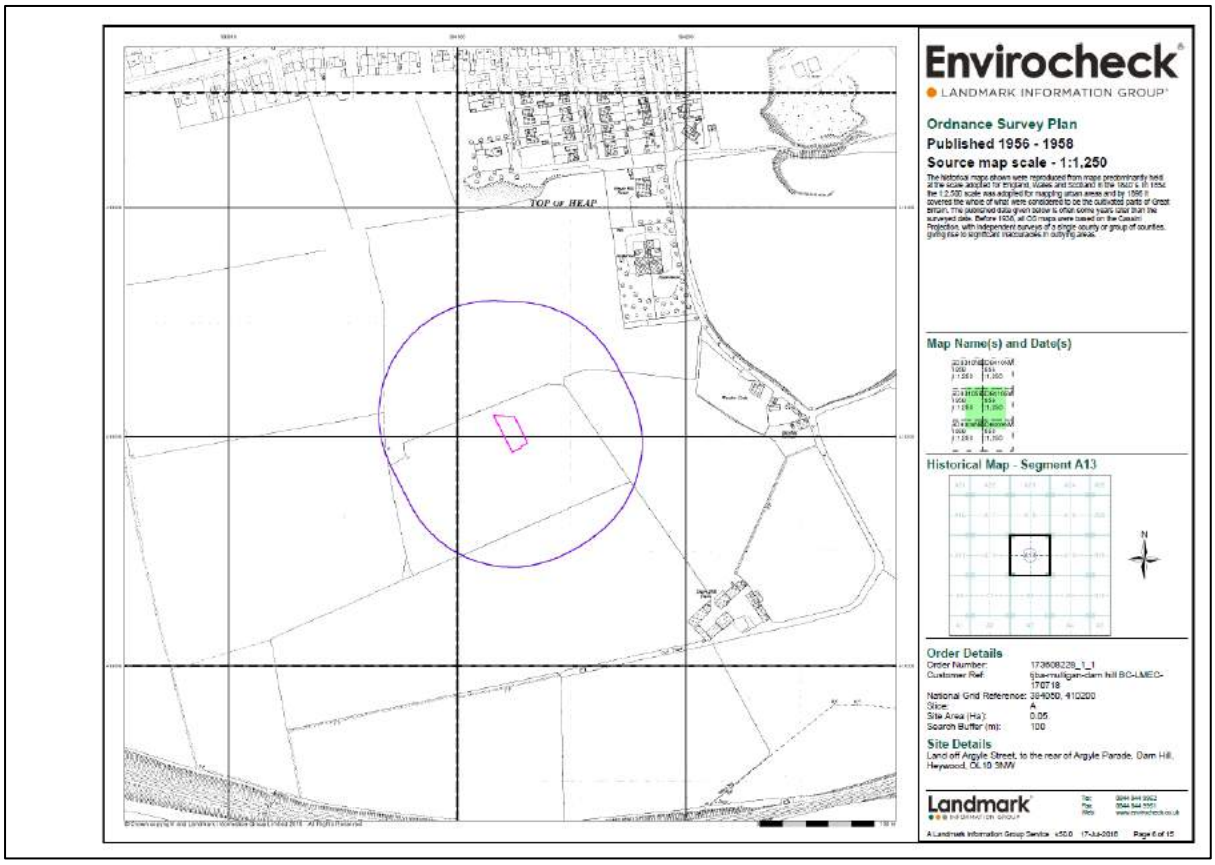
11.1.4. Ordnance Survey c1930



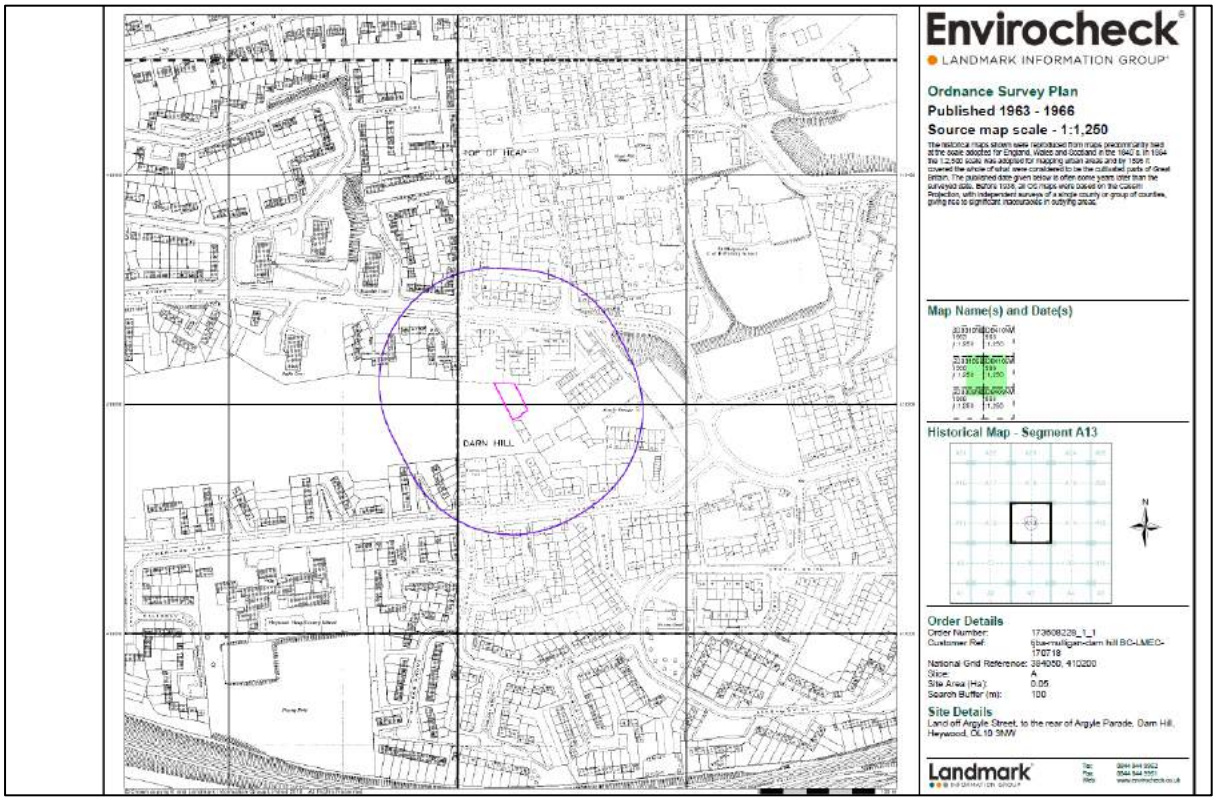
11.1.5. Ordnance Survey c1937



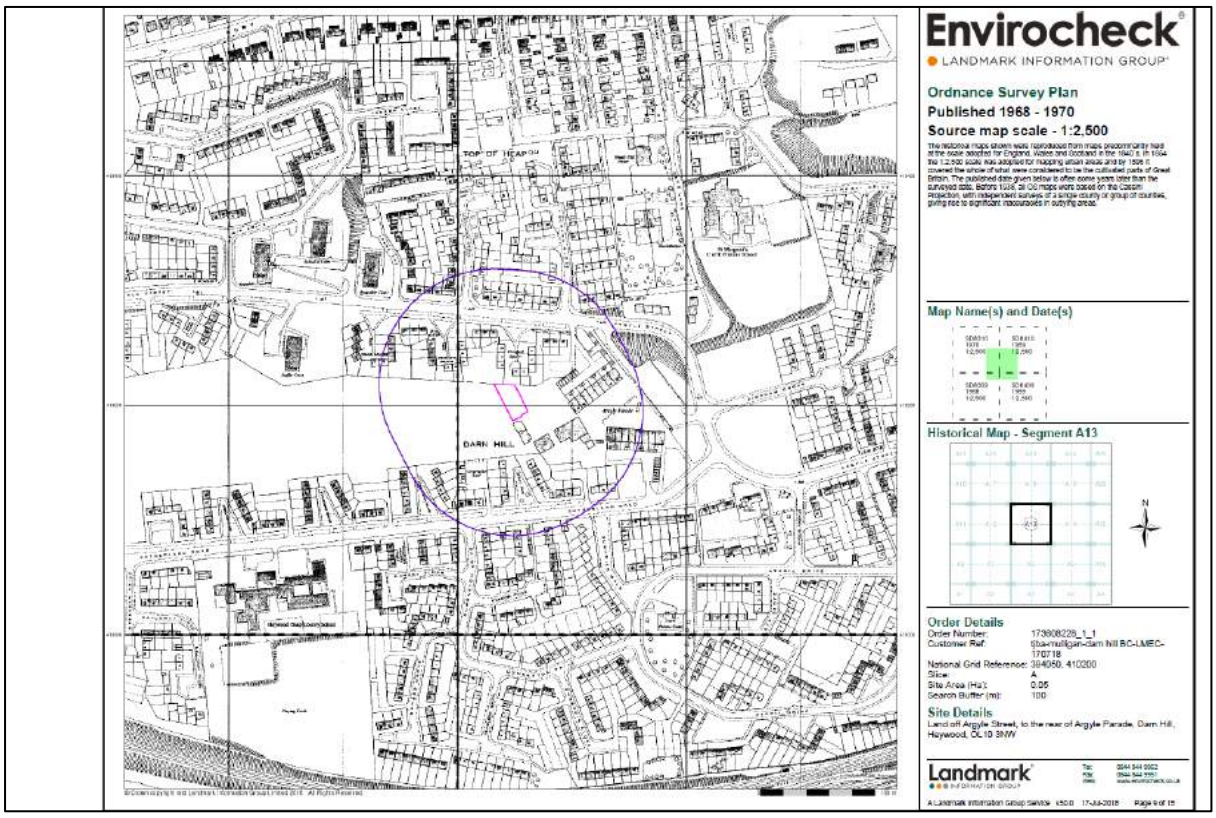
11.1.6. Ordnance Survey c1956-58



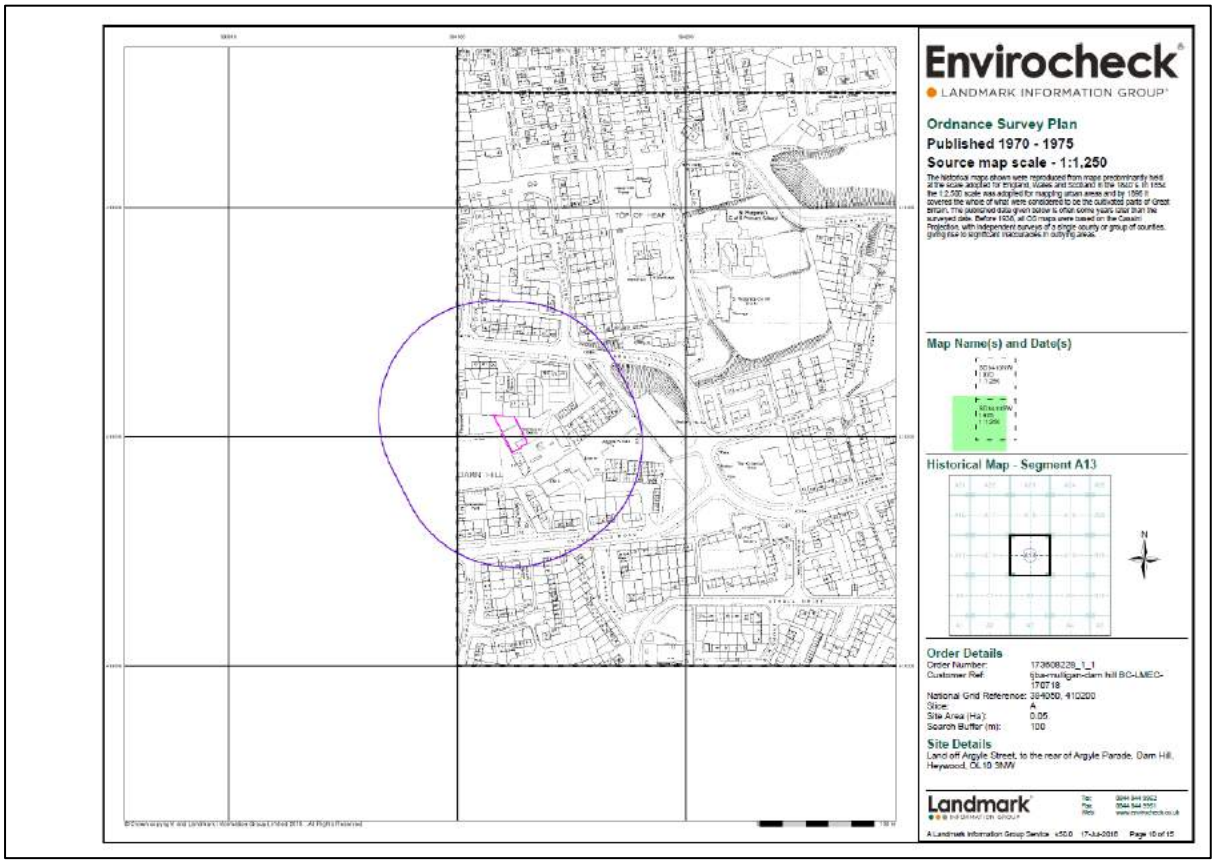
11.1.7. Ordnance Survey c1963-66



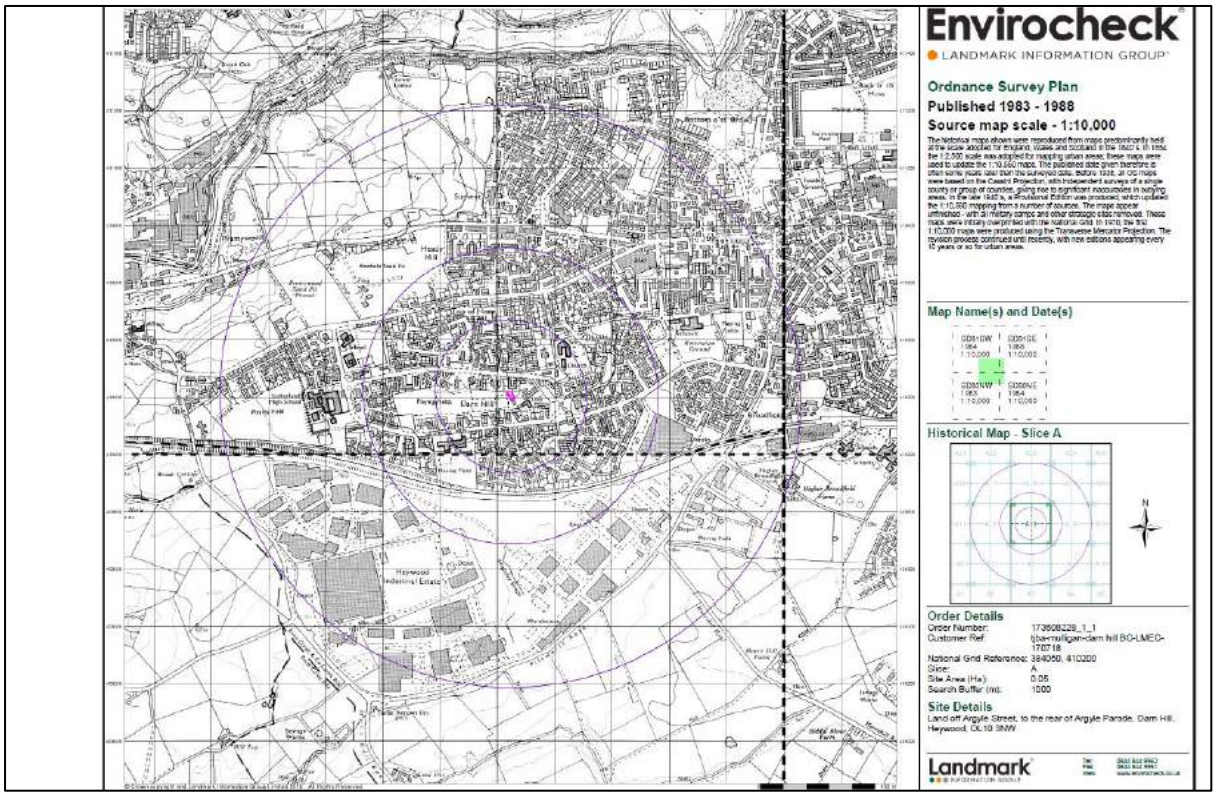
11.1.8. Ordnance Survey c1968-70



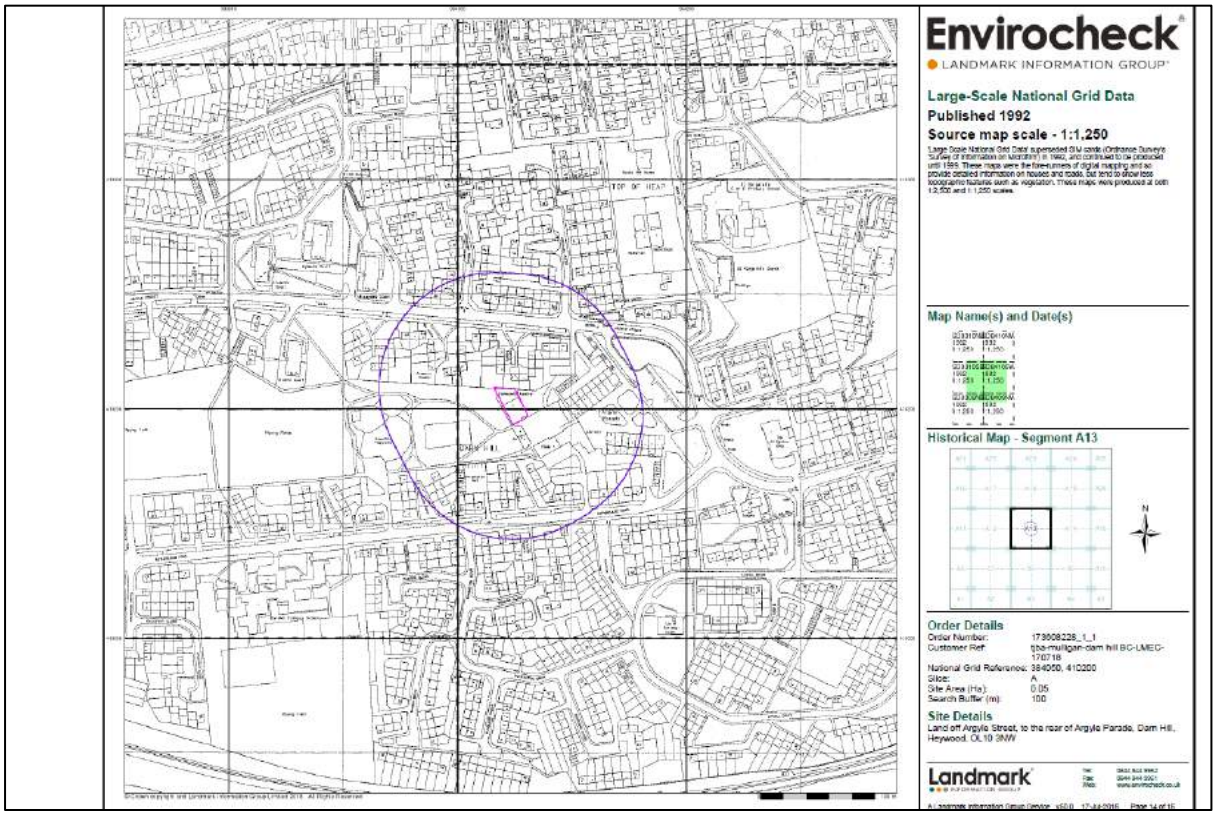
11.1.9. Ordnance Survey c1970-75.



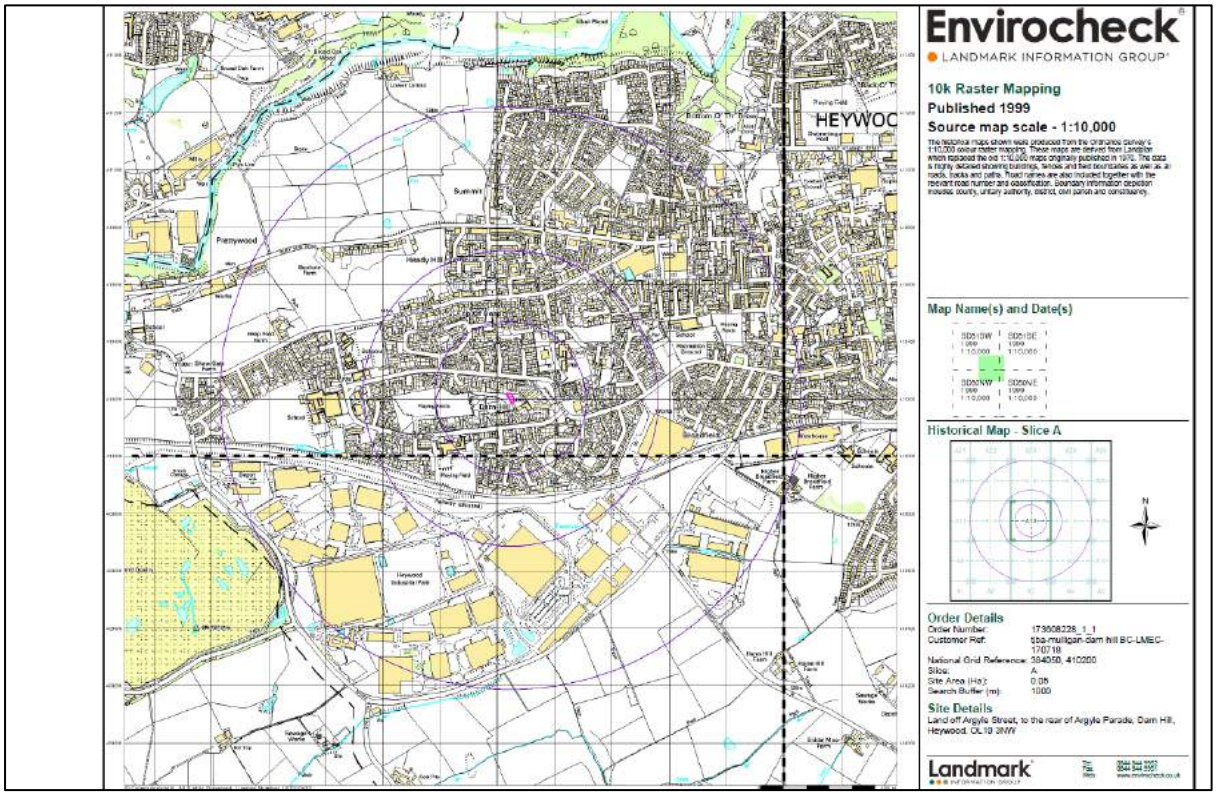
11.1.10. Ordnance Survey c1983-88



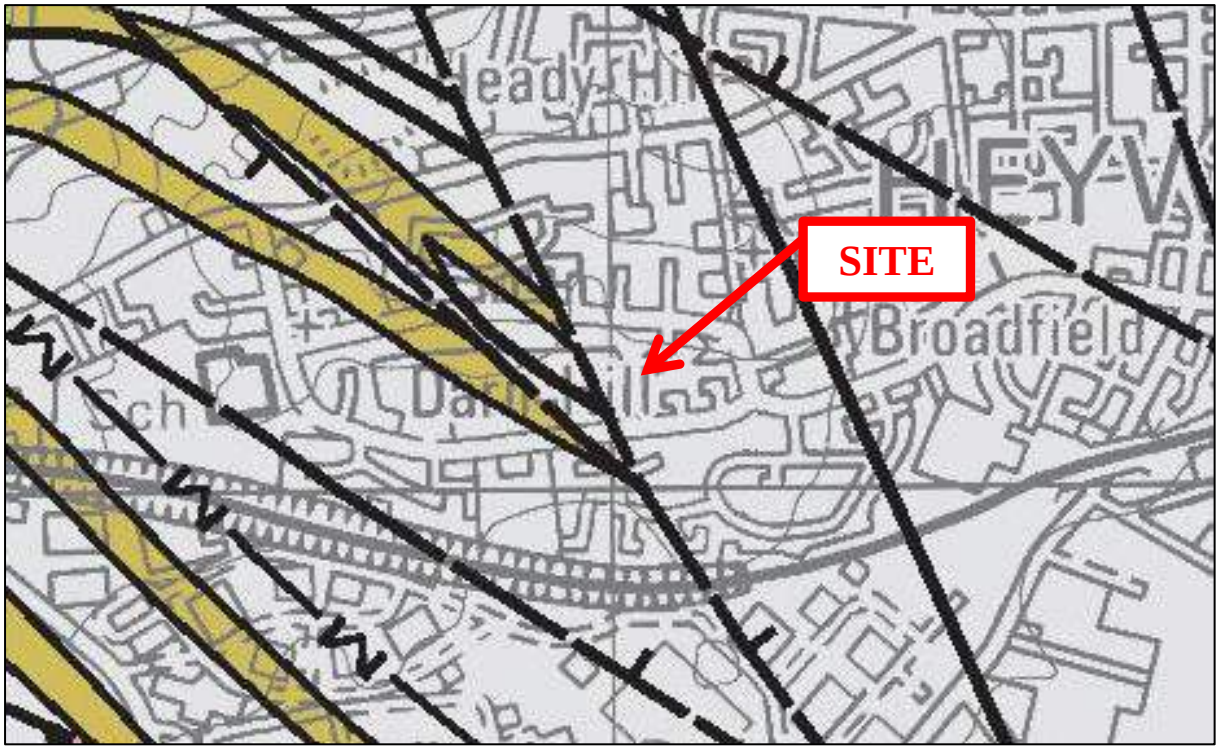
11.1.11. Ordnance Survey c1992



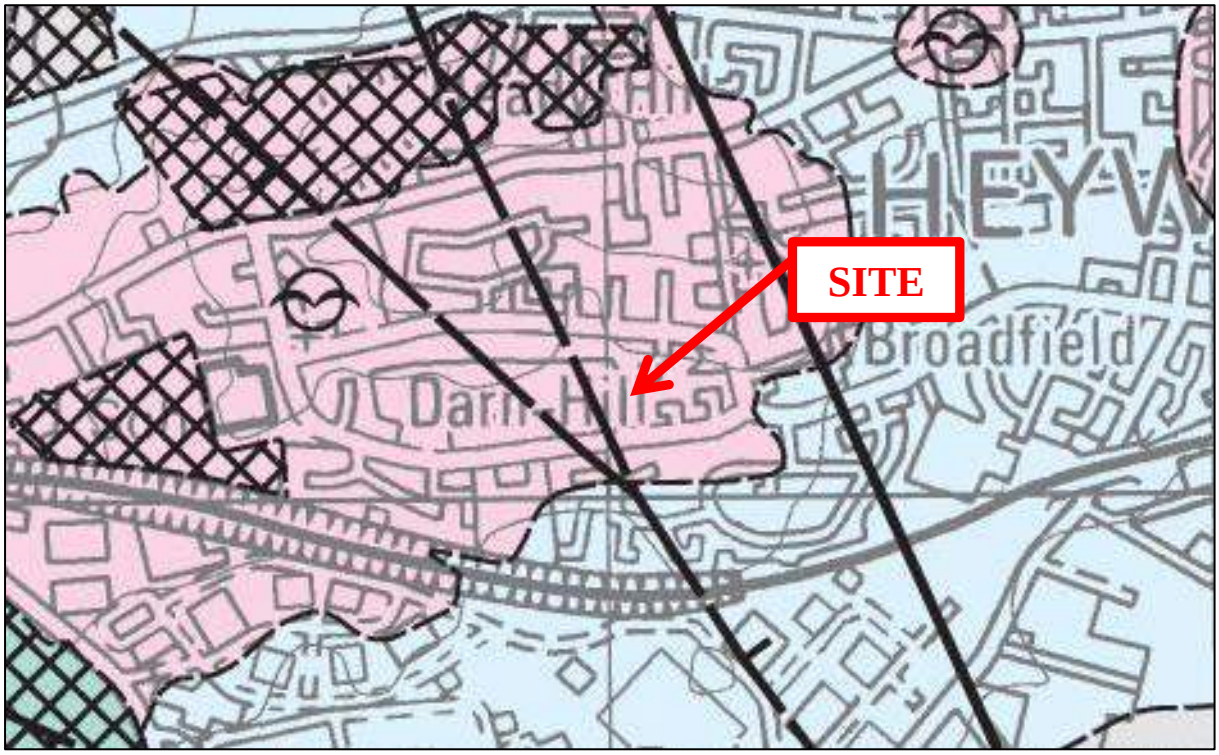
11.1.12. Ordnance Survey c1999



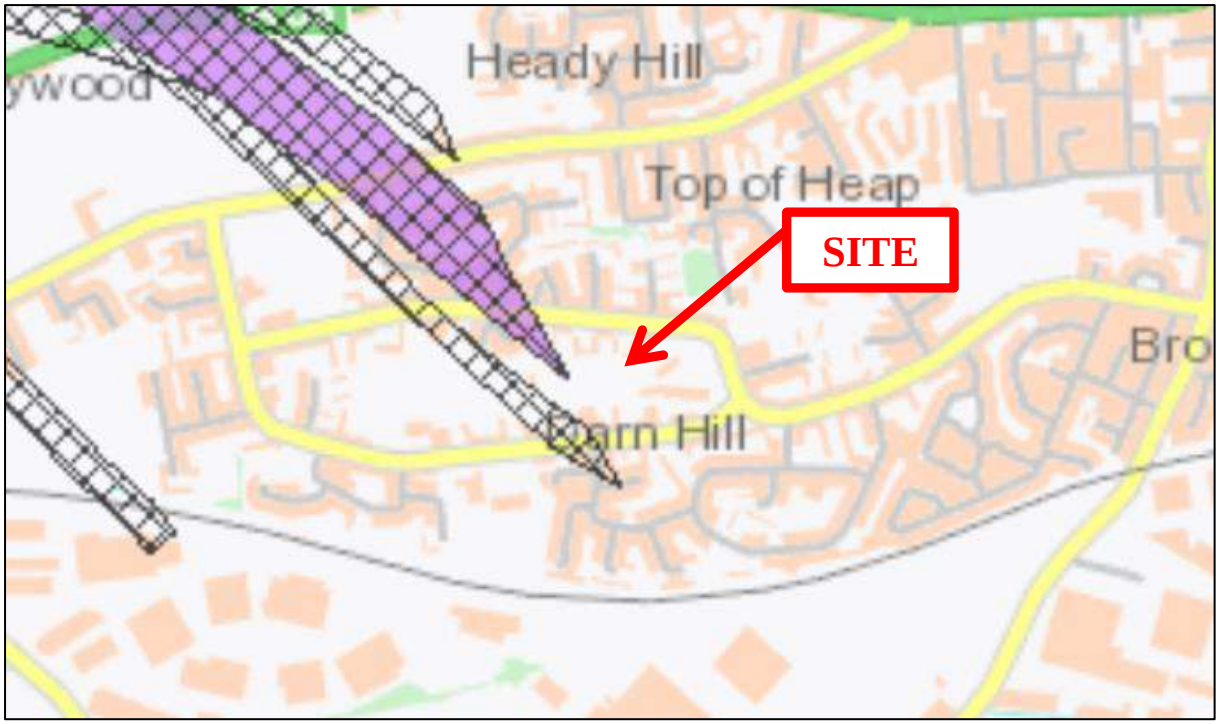
11.2. BGS Geological Map (Solid).



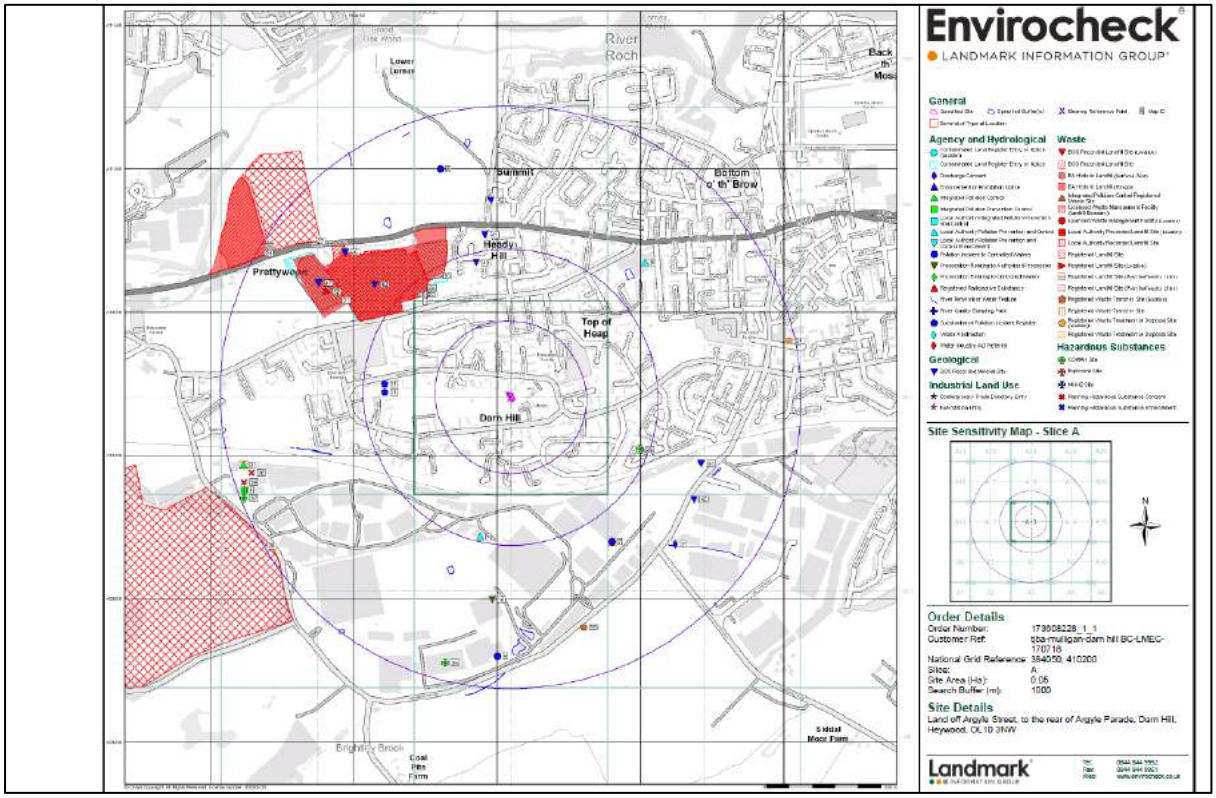
11.3. BGS Geological Map (Superficial).



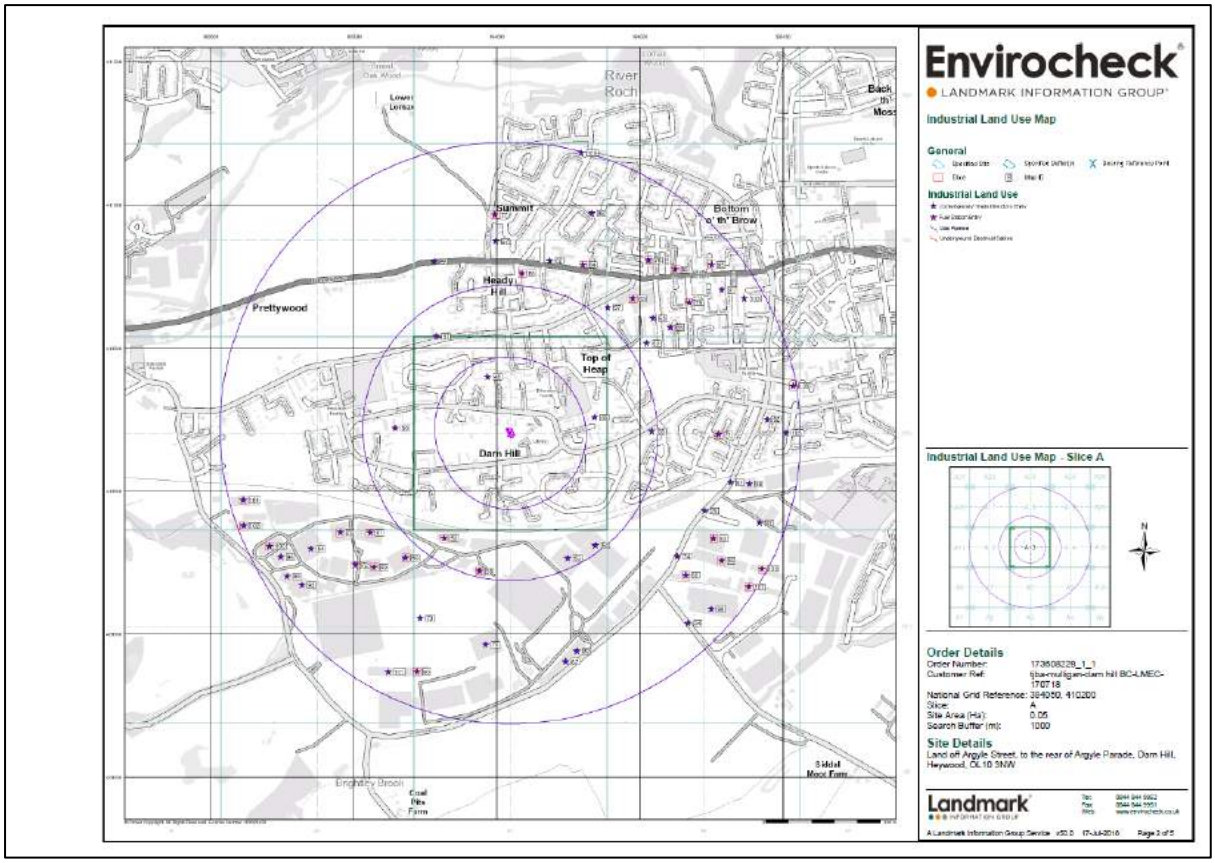
11.4. Coal Authority Map.



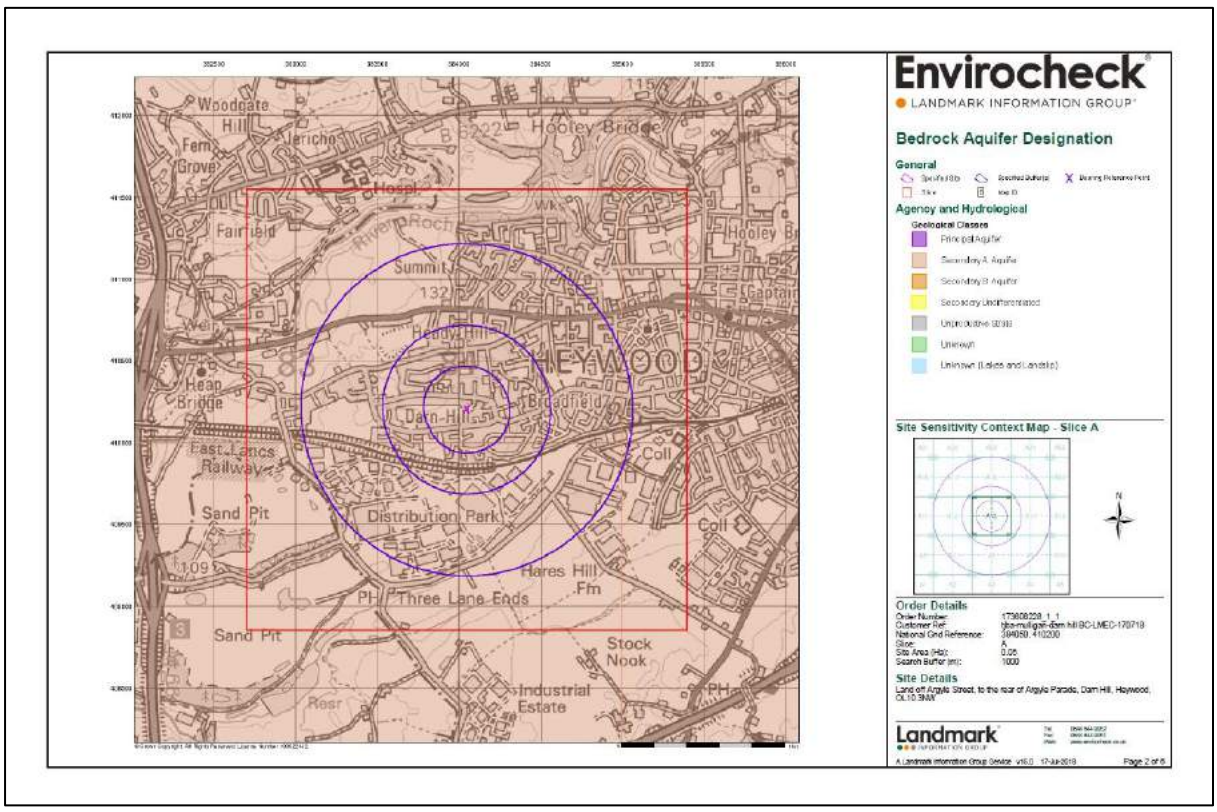
11.5. Agency, Hydrological & Waste Land Use Map.



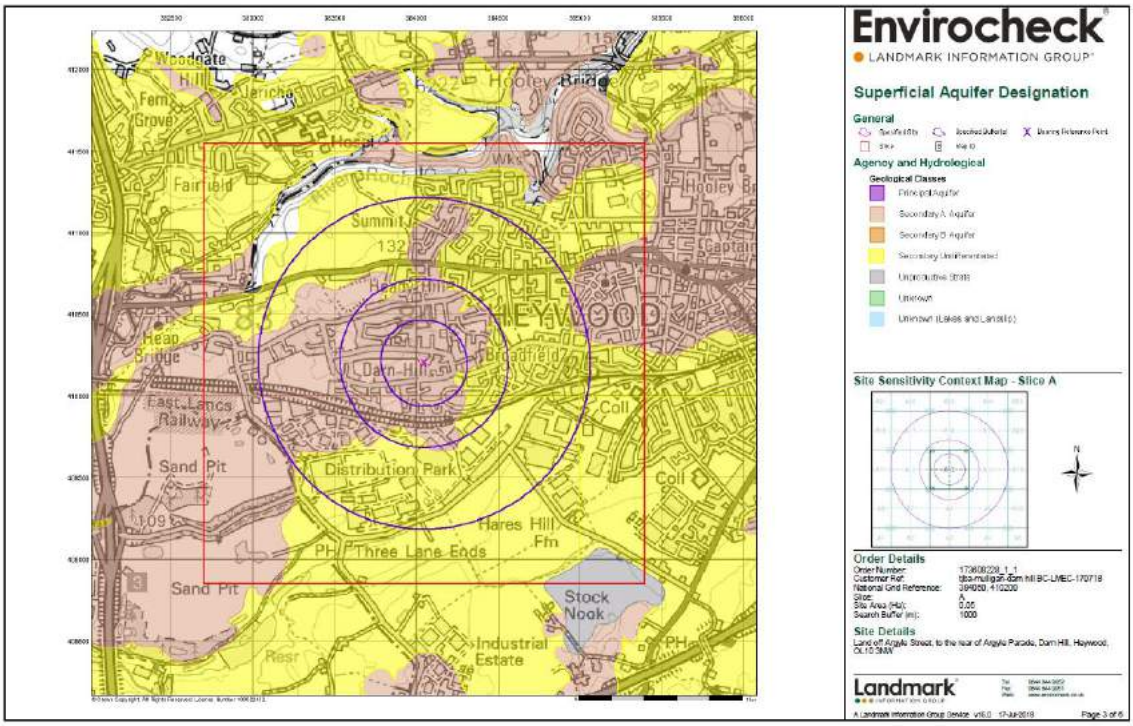
11.6. Landmark Industrial Land Use Map.



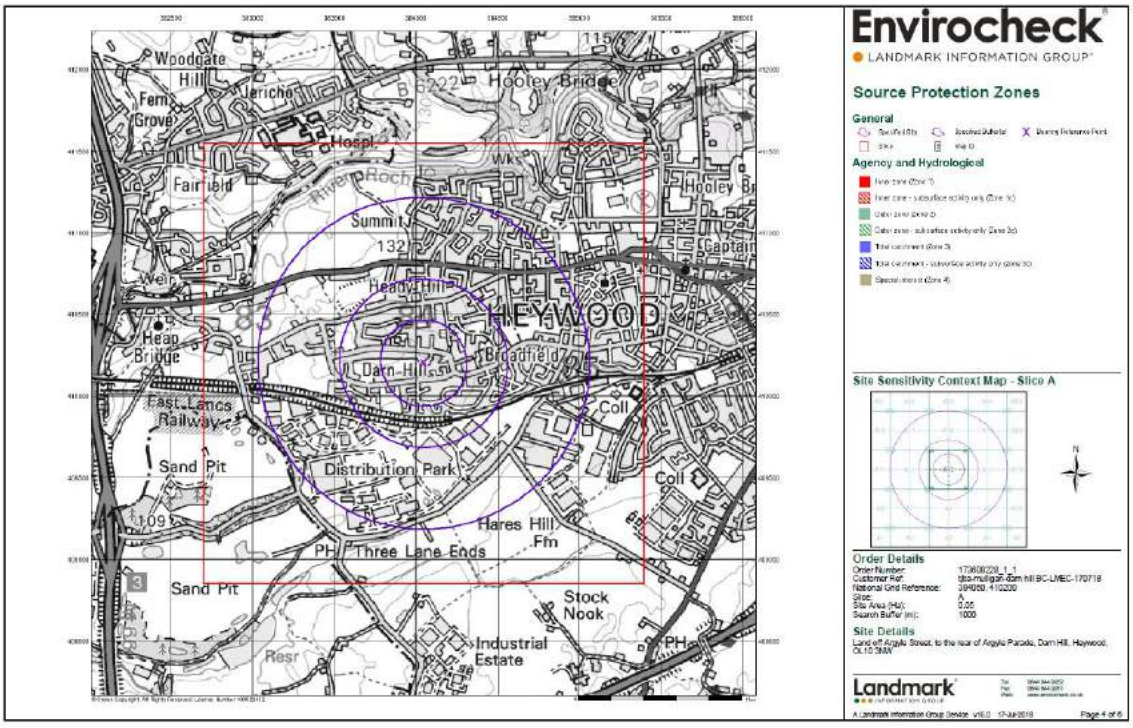
11.7. Landmark Bedrock Aquifer Map.



11.8. Landmark Superficial Aquifer Map.



11.9. Landmark Source Protection Zone Map.



12. APPENDIX C: REPORTS & CERTIFICATES.

12.1. Landmark Envirocheck.

Envirocheck®
LANDMARK INFORMATION GROUP

Envirocheck® Report:

Datasheet

Order Details:

Order Number:
173608228_1_1

Customer Reference:
tjba-mulligan-darn hill BC-LMEC-170718

National Grid Reference:
384050, 410200

Slice:
A

Site Area (Ha):
0.05

Search Buffer (m):
1000

Site Details:

Land off Argyle Street
to the rear of Argyle Parade
Darn Hill
Heywood
OL10 3NW

Client Details:

Mr T Booth
TJ Booth Associates
20a Eastgate Street
Rochdale
Lancashire
OL16 1DH

Landmark
INFORMATION GROUP

Order Number: 173608228_1_1 Date: 17-Jul-2018 rpr_ec_datasheet v53.0 A Landmark Information Group Service

13. APPENDIX D: TABLES.

13.1. 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.

13.2. CLR 8, Table2.1.

Table 2.1 Potential inorganic contaminants for the assessment of industrial land and their receptors

Contaminants [a, b]	Receptors			
	Humans	Water	Vegetation and the ecosystem	Construction materials
Metals				
Barium		✓		
Beryllium	✓	✓	✓	
Cadmium	✓	✓	✓	
Chromium	✓	✓		
Copper		✓	✓	
Lead	✓	✓	✓	
Mercury	✓	✓	✓	
Nickel	✓	✓	✓	
Vanadium	✓	✓		
Zinc		✓	✓	
Semi-metals and non-metals				
Arsenic	✓	✓		
Boron		✓	✓	
Selenium	✓	✓	✓	
Sulphur	✓		✓	✓
Inorganic chemicals				
Cyanide (complex)	✓	✓	✓	✓
Cyanide (free)[c]	✓	✓	✓	
Nitrate		✓		
Sulphate		✓	✓	✓
Sulphide		✓	✓	✓
Other				
Asbestos	✓			
pH (acidity/alkalinity)	✓	✓	✓	✓

Notes

[a] The list should not be regarded as a comprehensive list that should be taken into account in any particular site investigation. Some contaminants will be of no importance on certain types of site, while some sites may be contaminated by elevated concentrations of particular substances, which may not be selected because of their infrequent occurrence generally.

[b] For references to synonyms of substances refer to Appendix C.

[c] Free cyanide is broadly equivalent to "easily liberatable cyanide", which covers compounds that can release hydrogen cyanide at pH 4 and 100°C (see paragraph B.15 in Appendix B).

13.3.CLR 8, Table2.2.

Table 2.2 Potential organic contaminants for the assessment of industrial land and their receptors

Contaminants [a, b]	Receptors			
	Humans	Water	Vegetation and the ecosystem	Construction materials
Acetone	✓	✓		
Oil/fuel hydrocarbons	✓	✓	✓	✓[c]
Aromatic Hydrocarbons				
Benzene	✓	✓	✓	✓[c]
Chlorophenols	✓	✓	✓	✓[c]
Ethylbenzene	✓	✓	✓	✓[c]
Phenol	✓	✓	✓	✓[c]
Toluene	✓	✓	✓	✓[c]
o-Xylene	✓	✓	✓	✓[c]
m,p-Xylene	✓	✓	✓	✓[c]
Polycyclic Aromatic Hydrocarbons	✓	✓		
Chlorinated Aliphatic Hydrocarbons [d]				
Chloroform	✓	✓	✓	
Carbon tetrachloride	✓	✓	✓	✓[c]
Vinyl chloride	✓	✓		
1,2-Dichloroethane	✓	✓	✓	✓[c]
1,1,1-Trichloroethane	✓	✓	✓	✓[c]
Trichloroethene	✓	✓	✓	✓[c]
Tetrachloroethene	✓	✓	✓	✓[c]
Hexachlorobuta-1,3-diene	✓	✓	✓	
Hexachlorocyclohexanes	✓	✓	✓	
Dieldrin	✓	✓	✓	
Chlorinated Aromatic Hydrocarbons				
Chlorobenzenes	✓	✓	✓	
Chlorotoluenes	✓	✓	✓	
Pentachlorophenol	✓	✓	✓	
Polychlorinated biphenyls[e]	✓	✓	✓	
Dioxins and furans[f]	✓	✓	✓	
Organometallics				
Organolead compounds	✓		✓	
Organotin compounds	✓	✓		

Notes

[a] The list should not be regarded as a comprehensive list that should be taken into account in any particular site investigation. Some contaminants will be of no importance on certain types of site, while some sites may be contaminated by elevated concentrations of particular substances, which may not be selected because of their infrequent occurrence generally.

[b] For references to synonyms of substances refer to Appendix C.

[c] The impact of chlorinated hydrocarbons and other organic substances is probably limited to concentrations in the free phase.

[d] Some chlorinated aliphatic hydrocarbons are considered to be of secondary importance (see paragraphs B.16 and B.17 in Appendix B) and are therefore excluded because they are less toxic, highly volatile or have limited industrial use. However, some highly volatile substances may be significant due to their solubility and are not excluded on grounds of volatility alone.

[e] There are 209 polychlorinated biphenyl (PCB) congeners, the significance of which can be expressed using toxic equivalency factors (TEFs) relative to the best-characterised member of the group.

[f] There are 210 possible isomers of chlorinated dioxins and furans, of which the most studied and most toxic representative of the group is 2,3,7,8-tetrachlorodibenzo-*p*-dioxin (2,3,7,8-TCDD). Other dioxins and furans could be expressed in terms of TEFs relative to 2,3,7,8-TCDD.

13.4. 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.

13.5. 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).

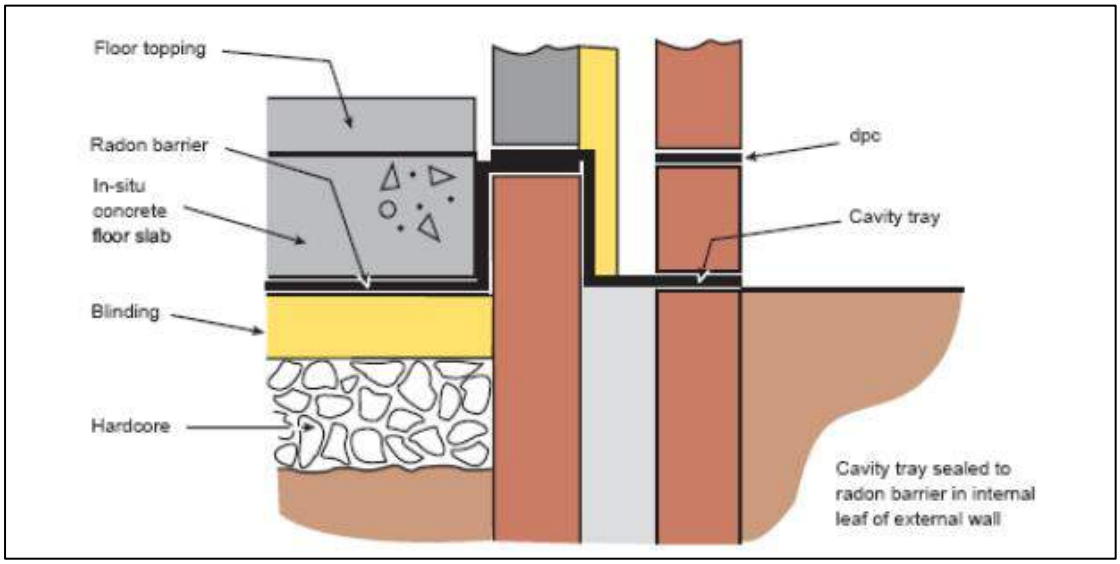
13.6. BGS/HPA report IR/11/044 – Radon Potential Class.

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.

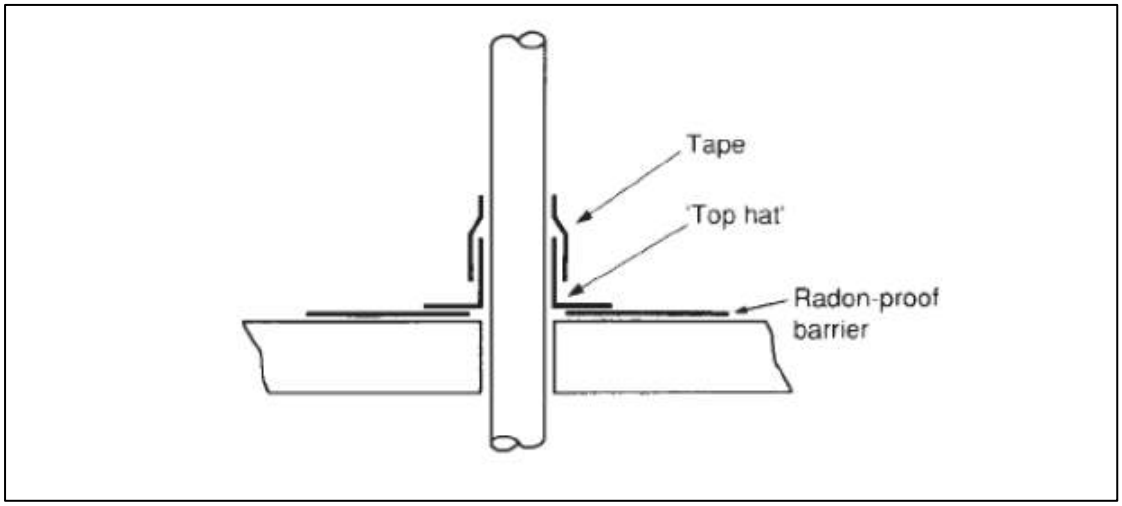
13.7. BGS/HPA report IR/11/044 – Radon Potential Class/Protection Measures.

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

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



BRE 211 – Typical Service Penetration Detail.



13.8. 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.