

GEO-ENVIRONMENTAL AUDIT

PHASE 1 Preliminary Risk Assessment

PHASE 2 Site Investigation

PHASE 3 Remediation Statement

Proposed Residential Development

Chestnut Way

Littleborough

Rochdale

OL15 8RJ

Author: Daniel Slattery
Client: Clive Rainford Homes
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Revision	Date	Reason
0	May 2021	Original to support planning application.
1	Sept 2022	Update with site investigation info.
2	Jun 2023	Update with further site investigation info.

T J Booth Associates.
20A Eastgate St,
Rochdale,
Lancs,
OL16 1DH.
Tel: 01706 868288.
Email: office@tjba.co.uk

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1. PHASE 1 – PRELIMINARY RISK ASSESSMENT

1.1. Introduction.

T. J. Booth Associates have been appointed by Clive Rainford Homes to undertake an Environmental Audit to support a Town & Country Planning application for a new residential development.

The Development Site is located on a vacant plot of land between existing residential dwellings within the Bents Farm Housing Estate.

A planning application for was submitted in Spring 2021 for the construction of 9No. detached residential dwellings, under reference 21/00282/FUL. The revision 0 version of this report was submitted as part of the application pack.

As of summer 2022, a new application for development had been submitted to planning. The proposal was based on the original approved layout, with changes to the types and layout of dwellings.

There is an adjacent development ("Starring Road Development Site"), that was formerly part of the same piece of land but split off prior to development of that Site c2018-2022, and which is referred to in the report.

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.

1.2. Proposed Development

The proposed development is for the erection of 9No. two-storey, detached residential dwellings.

The dwellings shall comprise individual plots with associated driveways, and front/rear soft landscaping/garden areas.

A new access road will run through the centre of the Site from Chestnut Way.

1.3. Historic Maps

DATE	ON-SITE	OFF-SITE/SURROUNDING AREA
c1851	Site is part of agricultural land.	Site bound by Starring Rd to SW side. Only farmhouses/cottages within 100m of the Site. Coal pits noted between 200-250m SW, W, & NW. Featherstall Brook 200m N. Tenters fields 250m S. Sandstone quarry 300m NW.
c1893	No change.	Old coal & air shafts noted 50m W. Starring Works (fire brick & pipe works) noted between 100-300m SW. The site comprised coal & air shafts approx 250m SW, as well as kilns, chimneys, and a reservoir 275m SW. Birch Hill Hospital approx 250m SW, other mills and reservoirs over 250m from Site.
c1910	No change.	No overall change.
c1930	No change.	Spring noted 25m NW of Site. Starring Works now noted as Sanitary pipe Works. Made Ground (quarry waste) now noted to within 50m of the Site boundaries.
c1937	No change.	No overall change.
c1960	No change.	No overall change.
c1978	No change.	Bents Farm housing estate erected to the SE & E side of the Site, enclosing the SE Development Site boundary.

c1978-88	No change.	By '87-88 the development to the NE boundary of the Site had been constructed.
c1992	No change.	No overall change.

1.4. Present Day Maps

Site Boundaries, Outlines of Structures and Buildings:	The Application Site is currently vacant but was previously used to store soil stockpiles, as well as the building compounds to the Starring Road Development Site. It formerly comprised a grass field. The Application Site is bound by development to the NW, NE & SE sides, with Starring Road to the SW. The mostly completed Starring Road Development Site now exists to the south west. The boundary of the Site is delineated by dry stone walls and timber fencing.
Ground Contours, Natural Drainage Features:	The Site falls in elevation to the east. Ground level is at its highest nominally 169.90m aOD in the west corner, falling to approximately 166.00m aOD in the east at the entrance to the Site from Chestnut Way.
Water Courses:	The closest watercourse is Featherstall Brook approx 180m NE.
Below Ground Obstructions:	There are 5No. manholes within the Site collecting foul and surface water from the Starring Road Development Site and flowing into Chestnut Way via a combined private sewer, and also from a private sewer to the north of the Site.

1.5. Geology

Bedrock Geology:	Undifferentiated Carboniferous Westphalian Coal Measures, generally comprising interbedded sandstone and mudstone. The local stratigraphic dip is approx 5-10 degrees southwest.
Superficial Geology:	Glacial clay till underlies the local area.
Coal Seams.	There are several coal seams in the local area which are detailed in the separate Coal Mining Risk Assessment by TJ Booth Associates.

1.6. Boreholes Records

There are no borehole records within close or relevant proximity to the Site.

1.7. Planning/Other Data.

The adjacent Starring Road Development Site was subject to site investigations on 03.07.2018.

The investigations comprised of 7No. trial holes (TH1-7) and 6No. hand excavated soil samples (S1-6), refer to SI Plan in appendix for locations.

The investigations revealed the Phase 1 Site comprised approximately 250mm of TOPSOIL over firm to stiff CLAY becoming slightly gravelly at depth. There was some grey blue CLAY and a thin horizon of PEAT (nom 100mm) around TH4 but otherwise the stratigraphy was relatively uniform across the Site.

Soil samples were taken of the upper topsoil in each location and were sealed in 1kg white plastic snap top containers, amber jars & vials where appropriate and were sent to Scientific Analysis Laboratories Ltd (now Concept Life Sciences Ltd), to be tested for a range of common contaminants.

Samples were representative of the upper soil profile, and were tested for metals, speciated PAH, inorganics & sulphates, SOM, and asbestos screening.

No visual or olfactory evidence of hydrocarbon contamination was noted within the Phase 1 Site soil and thus no testing for such contaminants was warranted.

On return the samples were assessed by TJ Booth Associates to common threshold comparison data; firstly, to the Defra Category 4 Screening Levels (C4SL) where available, and then to EA/DEFRA SGV (2009) data and LQM/CIEH GAC 2nd edition (2009) & erratum (2011) thereafter. The soil results were compared to residential threshold levels.

Results indicated the topsoil was generally clean when held to residential standards. There was an outlier noted in sample S4 in which arsenic was noted slightly higher than the residential threshold, however the average for the Site was well below threshold levels.

The Starring Road Development Site topsoil was classified as clean and suitable for re-use in a residential end use setting.

1.8. Groundsure Environmental Data

1.8.1. AGENCY & HYDROLOGICAL

Discharge consents:	1 record within a 250m radius of the Site, relating to a surface water overflow 227m NE.
Groundwater Vulnerability:	Classified soils as both low and high leaching potential.
Bedrock aquifer:	Secondary A Aquifer.
Superficial aquifer:	Secondary undifferentiated Aquifer.
Source protection zone:	Not within a Source Protection Zone.

1.8.2. WASTE

BGS recorded landfill sites:	No records within 250m.
Historic landfill sites:	No records within 250m.
Registered landfill sites:	No records within 250m.

1.8.3. HAZARDOUS SUBSTANCES

Planning hazardous substance consents:	No records within 250m.
Planning hazardous substance enforcements:	No records within 250m.

1.8.4. GEOLOGICAL

Mining Instability:	In an area that may be affected by coal mining.
Potential for Collapsible Ground Stability Hazards:	Very low.
Potential for Compressible Ground Stability Hazards:	No hazard.
Potential for Ground Dissolution Stability Hazards:	No hazard.
Potential for Landslide Ground Stability Hazards:	Very low. There are areas within 50m of the Site which have a moderate hazard but these are thought to be associated with made ground associated with the former Starring Works.
Potential for Running Sand Ground Stability Hazards:	Very low.

Potential for Shrinking or Swelling Clay Ground Stability Hazards:	Very low.
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.

1.9. Coal Authority

A separate Coal Mining Risk Assessment is to be undertaken by T J Booth Associates, please refer to that report for coal mining legacy risks.

1.10. Industry Profiles

N/A.

1.11. TJBA Site Reconnaissance – July 2018 & May 2021.

Details of Existing Structures & Features:	Initially the Site was inspected in July 2018, prior to the Starring Road Development Site construction, and was accessed via Starring Road. The overall predevelopment site area (Application Site & Starring Road Development Site combined) comprised a vacant grazing field with long grass and rushes. It was surrounded by dry stone walling on all sides apart from the NW side which comprised timber fencing and Laurel hedging. There was a stockpile of building stone to the N side of the Application Site. Apart from two manholes noted to the Application Site on initial reconnaissance, no other structures were noted. Further to the original Site reconnaissance, a further inspection and walkover was undertaken in May 2021. The Starring Road Development Site was partially complete with new residents occupying some of the dwellings. The Application Site had been used to store materials while the Starring Road Development Site was being undertaken, and there were 4 containers to the northeast boundary for this purpose. The stone stockpile noted in the original reconnaissance remained to the north corner, as did a large topsoil stockpile scraped from the Starring Road Development Site that was to be stored for reuse. There was some minor brick and other inclusions noted in the topsoil stockpile which suggests some intermixing could have occurred with made ground, & which may have contaminated the topsoil. There was some mixed made ground (clay/sand/MOT, general stone & brick rubble) from the Starring Road Development Site build which had been spread on the southern part of the Application Site, and nominally in the position of the proposed access road though the Starring Road Development Site to Chestnut Way.
Adjacent Properties:	Site is surrounded by residential housing on NW, NE, SE sides, and Starring Lane to the SW. Open/agricultural land was noted beyond this.
Water Levels, Directions of Flow and Rates in Rivers:	None noted.

Old Mine or Quarry Workings:	Evidence of spoil heaps to the W approx 100m distant on the former Starring Works site.
Areas of Discoloured Soil, Polluted Water, Vegetation, and Significant Odours:	None noted. Nominally 250mm of virgin topsoil directly on to clay.

1.12. Identification of Source-Pathway-Receptor.

1.12.1. Potential Contaminants.

CURRENT SOURCE/S	ORIGINAL ASSOCIATED SOURCE	CONTAMINANT/S
Made ground	Phase 1 development	Metals, PAH, inorganics, asbestos
Natural peat deposits	N/A.	Primarily CO ₂ , some CH ₄ .

1.12.2. Potential Pathways.

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

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

1.12.3. Potential Receptors.

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

1.13. Environmental Site Risk Summary/Conclusions

Historic records of the Site and local area indicate the The Application Site have been a vacant plot of land since earliest mapping data c1850 to the present day. The area surrounding the site also comprised agricultural land from c1850 with only tenters fields in the wider area. By c1850, Starring Pipe & Brick Works existed approx 125m SE, and remained up until c1960s when it was noted as disused.

The local estate was constructed around both the Phase 1 Site & Application Site c1970s-1980s and remained this way until the present day.

Upon site reconnaissance, made ground was noted on the Site as well as stockpiled topsoil/made ground. Sampling of the There was a minor horizon of peat beneath the Phase 1 Site so it is expected that peat deposits will be located on the Application Site.

No landfill sites have been noted within a 250m radius of the Site & the Site is not noted to be in a radon area.

1.14. Preliminary Conceptual Model.

CURRENT SOURCE/S	ORIGINAL ASSOCIATED USAGE	CONTAMINANT TYPE	PATHWAY	RECEPTOR	POLLUTION LINKAGE	CONSEQUENCE	PROBABILITY	RISK
Site surface /sub soil.	Made ground	Chemical contamination metals, PAH, inorganics, asbestos, hydrocarbons.	Direct ingestion, aerial ingestion, dermal contact, drinking water. Contact with potential hazards.	Site construction operatives & future occupants. Site buildings.	POTENTIALLY PRESENT – Site investigations in the Starring Road Development Site noted that topsoil was virgin & relatively thin over virgin clay. An outlier in arsenic was noted in sample S4, however, the Site average was lower than threshold trigger levels, as was all other tested contaminants. No sulphates or other contaminants were noted that could have had a negative effect on buildings or services. Due to the above the existing topsoil is considered clean. However, the Application Site has been used for stockpiling of material and from the Starring Road Development Site. It has also been noted that made ground has been spread across the Site. This will need sampling prior to reuse and to ensure made ground noted on the Site is not contaminated.	Medium.	Likely.	Moderate risk.
Geology - Carboniferous coal measures & ground gas.	Coal seams & radon sources.	CH ₄ , CO ₂ , Rn, other trace gases.	Diffusion through soil, substructures, aerial inhalation.	Future occupants. Explosion, suffocation.	NOT PRESENT – Although there are coal seams beneath the Site, the seams aren't recorded as worked, and there are impermeable clay deposits between the solid geology and the ground surface, mitigating pathways to the development.	Minor.	Unlikely.	Very low risk.
Geology – superficial peat deposits & ground gas.	Peat sources.	CO ₂ , CH ₄ .	Diffusion through soil, substructures, aerial inhalation.	Future occupants. Explosion, suffocation.	POTENTIALLY PRESENT – Minor peat deposits were noted in the adjacent Starring Road Development Site, and thus the likelihood is that this Site may contain deposits also.	Medium.	Likely.	Moderate risk.
Anthropogenic ground gas from decomposing organic material.	Wastes deposited in historic landfill areas to the SE.	CH ₄ , CO ₂ , other trace gases.	No credible pathway. Landfills at higher level and against hydraulic gradients.	Future occupants. Explosion, suffocation.	NOT PRESENT – No sources were noted in the local area.	Minor.	Unlikely.	Very low risk.
Contaminated ground /surface water. Controlled Waters.	Made ground.	Chemical contamination.	Permeation through soil into ground water, local watercourses, or aquatic habitats.	Water supplies, watercourses, aquatic habitats & associated wildlife.	NOT PRESENT – No controlled waters in the local area. Impermeable superficial geology to lower aquifers.	Minor.	Unlikely.	Very low risk.
Aerial contaminants.	Local industrial activity.	Chemical contamination.	Dermal contact & aerial inhalation.	All site users / occupants.	NOT PRESENT – Current aerial contaminants are regulated, and none were found locally.	Minor.	Unlikely.	Very low risk.

2. PHASE 2 - SITE INVESTIGATION & RISK ASSESSMENT

2.1. Site Investigation Strategy

Considering the above preliminary conceptual model, potential risks have been found with regard to site soils including made ground and stockpiled topsoil.

Made ground was noted across the Site, as well as some intermixed within the stockpiled topsoil.

Although no major contamination is suspected, minor contamination with contaminants of concern such as metals & PAH will need to be considered.

No gas risk to the Site from anthropogenic sources was noted, however, a minor layer of peat was noted in a single trial hole in the adjacent Phase 1 Site which suggests more could be located beneath the current Application Site.

All TJBA Soil analysis will use the LQM/CIEH S4ULs, and the DEFRA C4ULs. The LQM/CIEH S4UL data is the most current and comprehensive list of contaminant exposure level based on proposed end use, however, contaminant levels within S4ULs are considered 'low risk' and exceedance of S4ULs may warrant further analysis to ensure suitability for the specified end use.

The C4SL data relates to updated DEFRA Statutory Guidance under Part 2A of the Environmental Protection Act 1990 (Part 2A). The guidance introduces a 4 category system in which Category 4 is of the least concern and levels falling within this risk category are considered as 'acceptably low'.

As the S4ULs are considered more conservative than C4SLs, any contaminant levels exceeding a S4UL although not considered 'low risk' can still be considered 'acceptably low' for use within the planning regime as long as it is still within the C4SL risk category. Thus, soil sampling results are firstly held to C4SLs where available and then to S4ULs thereafter to define suitability with respect to specified proposed end uses within the planning regime.

2.2. Site Investigations 22.09.2022

2.2.1. Trial Holes

A limited Site investigation was undertaken by T J Booth Associates on the 22.09.2022. The investigations comprised 2No. machine excavated trial holes (TH1 & TH4), undertaken with a 1.5t back acting excavator to obtain a general understanding of the overall ground profile. Although further investigations will need to be undertaken for geotechnical purposes, the investigations undertaken so far are considered robust enough for geo-environmental characterisation of the Site.

TH1 was taken to the west corner of the Site, and TH2 to the centre east side. The stratigraphy is tabulated below:

TH1 (GL 168.63m aOD)

0-700	Dark brown/black slightly sandy, gravelly clay MADE GROUND. Sand & gravel sized brick, mortar, glass, stone, cable, occasional timber (S1).
700-950	Brown fibrous slightly spongy peaty soft CLAY.
950-1200	Grey-brown soft to firm becoming firm CLAY.

TH2 (GL 166.70m aOD)

0-450	Brown slightly sandy/gravelly, silty topsoil MADE GROUND. Gravel sized brick & slate mixed at GL (S4).
450-1300	Brown soft spongy peat.
1300-1600	Grey soft CLAY, slightly sandy towards bottom.
1600-2000	Grey firm to stiff CLAY.
2000-2100	Blue-grey stiff sandy/gravelly CLAY.

2.2.2. Soil Sampling

Soil sampling (S1-6) was undertaken across the Site to gain an understanding of the upper made ground and topsoil stockpile stratigraphy.

Samples S1 & S4 were taken in the respective upper profiles of THs1 & 2, and all further soil samples were representative of the upper soils as encountered. All sample descriptions are indicated below for clarity:

- S1 Dark brown/black slightly sandy, gravelly clay MADE GROUND. Sand & gravel sized brick, mortar, glass, stone, occasional timber.
- S2 Brown slightly sandy, slightly gravelly, silty topsoil MADE GROUND (topsoil stockpile). Gravel is fine brick & stone.
- S3 Brown slightly sandy, silty topsoil MADE GROUND (topsoil stockpile).
- S4 Brown slightly sandy/gravelly, silty TOPSOIL. Gravel is fine brick & slate.
- S5 Brown clayey gravelly topsoil MADE GROUND. Gravel is mortar, brick, stone, plastic, rare glass.
- S6 Brown slightly sandy, silty TOPSOIL.

Samples were placed into 500ml plastic tubs & 250ml amber jars and sent to Eurofins Chemtest Ltd for chemical testing for analytical suites including metals, speciated PAH, inorganics/sulphates, SOM, & asbestos screening in accordance with the preliminary conceptual model.

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

Testing of made ground revealed contaminant levels above residential threshold values with elevated levels of the following contaminants of concern:

Trial Hole/Soil Sample	Elevated Contaminants Encountered
TH1/S1	Sulphate (DS2)
S2	Sulphate (DS2), benzo[b]fluoranthene, dibenz[ah]anthracene, naphthalene
S3	benzo[a]pyrene, benzo[b]fluoranthene, dibenz[ah]anthracene, naphthalene
TH2/S4	dibenz[ah]anthracene
S5	dibenz[ah]anthracene
S6	dibenz[ah]anthracene, naphthalene

Risk couldn't be further reduced regarding BaP surrogate marker analysis due to elevations recorded in BaP.

2.2.3. Gas Monitoring

No gas monitoring has been undertaken for the Site.

2.3. Site Investigations 10.02.2023

2.3.1. Trial Holes

Further investigations were undertaken on the 10.02.2023. The remainder of the trial holes as initially planned were completed (TH2, TH3a, TH3b, T5, TH6 & TH7).

Investigations revealed that the Site had been subjected to recent minor stockpiling of topsoil from the adjacent development Site (originally part of the same land under the same ownership). The minor fill was particularly evident to the north side of the Site with fill material generally comprising topsoil, and clayey made ground across the centre of the Site for access.

Generally, the Site geology comprises a thin layer of topsoil & occasionally clayey made ground in places, underlain by virgin brown silty TOPSOIL, up to 300mm of brown spongy clayey PEAT in TH2, TH3a, TH3b only (north side of the Site). Below was soft to firm becoming stiff CLAY down to weathered bedrock.

In THs 6 & 7, the area local to these trial holes only had been filled to with an angular gravel (shale) MADE GROUND, which was noted to a max depth of 3.1m (TH6).

Full geotechnical trial hole logs can be found in the Appendix.

2.4. Site Investigations 16 & 17.02.2023

2.4.1. Boreholes

Site investigations were undertaken by Site Investigation Services Ltd on the 16th & 17th of May 2023, and comprised 2No. boreholes (BH1 & 2), undertaken with a rotary drill rig with water flush method; undertaken to satisfy Coal Authority investigation requirements.

The local/regional geology dips to the southwest. Due to the shape of the Site, BH1&2 were positioned to encounter both up & down dip bedrock strike planes. Boreholes were sunk to ~30m.

Both boreholes encountered MADE GROUND & glacial CLAY up to 3m depth, over interbedded mudstone and sandstone beds to a depth of up to 34m. The stratigraphy in the two boreholes matched up as expected, resulting in an apparent dip of approximately 5 degrees in Site section.

No coal seams were encountered in the investigation.

Full geotechnical borehole logs can be found in the Appendix.

2.5. Final Conceptual Model.

CURRENT SOURCE/S	ORIGINAL ASSOCIATED USAGE	CONTAMINANT TYPE	PATHWAY	RECEPTOR	POLLUTION LINKAGE	RISK	MITIGATION
Site surface /sub soil.	Made ground	Chemical contamination metals, PAH, inorganics, asbestos, hydrocarbons.	Direct ingestion, aerial ingestion, dermal contact, drinking water. Contact with potential hazards.	Site construction operatives & future occupants. Site buildings.	PRESENT – Site investigations and soil sampling have recorded sulphate (DS2), benzo[a]pyrene, benzo[b]fluoranthene, dibenz[ah]anthracene, & naphthalene contamination above residential threshold levels which will require mitigation/remediation.	Moderate risk.	Provide a suitable cover system in areas such as soft landscaping where pathways exist.
Geology – superficial peat deposits & ground gas.	Peat sources.	CO2, CH4.	Diffusion through soil, substructures, aerial inhalation.	Future occupants. Explosion, suffocation.	PRESENT – Minor peat deposits have been located below the development Site which will require mitigation/remediation.	Moderate risk.	Provide CS2 protection to foundations/floor slabs.

3. PHASE 3 - REMEDIATION

3.1. Basic Site Details

The Site is for a residential development comprising access road, and private residential dwellings with associated driveways and soft landscaping.

3.2. Site & Remedial Objectives, Final Conceptual Model & Pollution Linkages

Refer to Phase 2 Site Investigation and Assessment section of the report for Final Conceptual Model.

Two pollutant linkages were identified that require mitigation/remediation:

1. Existing site soil was found to be contaminated with sulphate (DS2), benzo[a]pyrene, benzo[b]fluoranthene, dibenz[ah]anthracene, & naphthalene above residential threshold levels.
2. Peat deposits were noted beneath the Site which are a source of CH₄ & CO₂ predominantly.

The primary environmental objectives are to break the pollution linkages by either the source being removed, or pathways mitigated.

The receptors considered in the assessment are predominantly the end user. Site construction operatives can mitigate risk by adopting PPE, and risk cannot be reduced further due to construction workers being a necessary part of the construction process.

3.3. Recommended Remediation:

General Made ground:

The Site is covered with a minor amount of made ground which shall be removed to get the Site back to original level as of 2011, pre adjacent site development.

The clayey made ground is considered contaminated and should be removed from garden areas etc, but may remain beneath permanent hardstanding finishes.

The stockpiled topsoil does have some deleterious materials contained within it, which may be the reason for minor spikes in PAH. It is proposed to scrape back to predevelopment levels, and restockpile and riddle out any such materials from the current stockpiles. Once this has been undertaken, the stockpiles can be assessed by further sampling for reuse in garden areas.

To mitigate the risk to receptors, it is advised that a cover layer of clean inert soil will be required to protect the end user for garden and soft landscaping areas ONLY. This will either be by reuse of the existing topsoil subject to further testing as the Site progresses and groundworks can start; and depending on the results, topsoil may need to be imported.

Imported soil should be clean/inert and free from deleterious materials, and should be suitable for use in a residential end use setting.

It should be able to pass testing of metals, speciated PAH, inorganics & sulphates, SOM, and asbestos screening 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.

Ground gas protection:

Guidelines around gas protection are covered in BS 8485:2015+A1:2019 which states that for natural deposits that are a source of ground gas generation such as peat, gas protection may be provided in lieu of gas monitoring.

The report builds upon and refers back to earlier work undertaken as part of CL:AIRE Research Bulletin RB17, 'A Pragmatic Approach to Ground Gas Risk Assessment'.

In the report, guidance on ground gas mitigation from natural deposits including peat horizons suggests that mitigation can be provided by specifying CS2 level protection in building foundations.

Due to the nature of peat deposits, ground bearing slabs will not be suitable for the Site, and so a suspended or block & beam design will need to be employed.

CS2 gas protection measures can be provided to comply with a minimum score of 3.5 (from at least two sources) as set out and in accordance with BS8485:2019. There are two options for floor slab type and the corresponding gas protection requirements, as follows:

CS2 GAS PROTECTIVE MEASURES		BS8485:2019 score required: 3.5
FOUNDATION TYPE: Traditional/trench		
SLAB	Beam & block	0
MEMBRANE	Reinforced gas membrane Alderprufe GRA comprising <40ml/day/m2 CH4 transmission rate, >0.4mm thick. All joints and penetrations sealed to manufacturers details & specifications.	2
VOID/SUBSPACE	Void min 100mm thick.	2.5
VENTS	1500mm2/m wall (<15m wide building), 2000mm2/m for larger buildings. Both account for regulations up to CS3.	

CS2 GAS PROTECTIVE MEASURES		BS8485:2019 score required: 3.5
FOUNDATION TYPE: Traditional/trench		
SLAB	Suspended reinforced cast in situ floor slab	1.5
MEMBRANE	Reinforced gas membrane Alderprufe GRA comprising <40ml/day/m2 CH4 transmission rate, >0.4mm thick. All joints and penetrations sealed to manufacturers details & specifications.	2

3.4. Verification (Phase 4 requirements)

Verification of the imported soil may be required for Planning or Building Control/Building Regulations submission. Should this be required, it will need to be undertaken by suitably qualified consultants and comprise the following:

- Import source material.
- Characterisation & suitability of material.
- Soil sampling should be undertaken as per YALPAG Guidelines as per the following ratios:
 - Virgin quarried materials, 1-2 samples to confirm inert nature.
 - Crushed hardcore, stone, brick, min 1 sample per 500cum.
 - Greenfield/manufactured, generally 1 sample per 250cum (min 3 samples).
 - Brownfield, generally 1 sample per 50cum (min 6 samples).

Samples should be tested for the following contamination suites: metals, inorganics, PAH USEPA16 speciated, and asbestos screening. Results will be analysed against Defra Category 4 Screening Levels (C4SLs) where available, and then to the LQM/CIEH (S4ULs), for use in a residential end use setting.
- Verification Depth.
- Reporting (including photographic evidence).
- Independent gas protection measures inspection.

3.5. Additional Notes

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

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.

4. REFERENCES.

BS 8485:2015+A1:2019. Code of practice for the design of protective measures for methane and carbon dioxide ground gases for new buildings.

BS 10175:2011+A2:2017. Investigation of potentially contaminated sites. Code of practice.

BS5930:2015. Code of practice for site investigations.

CL:AIRE. 2012. Research Bulletin-RB17-A Pragmatic Approach to Ground Gas Risk Assessment.

CIRIA. Report C665.

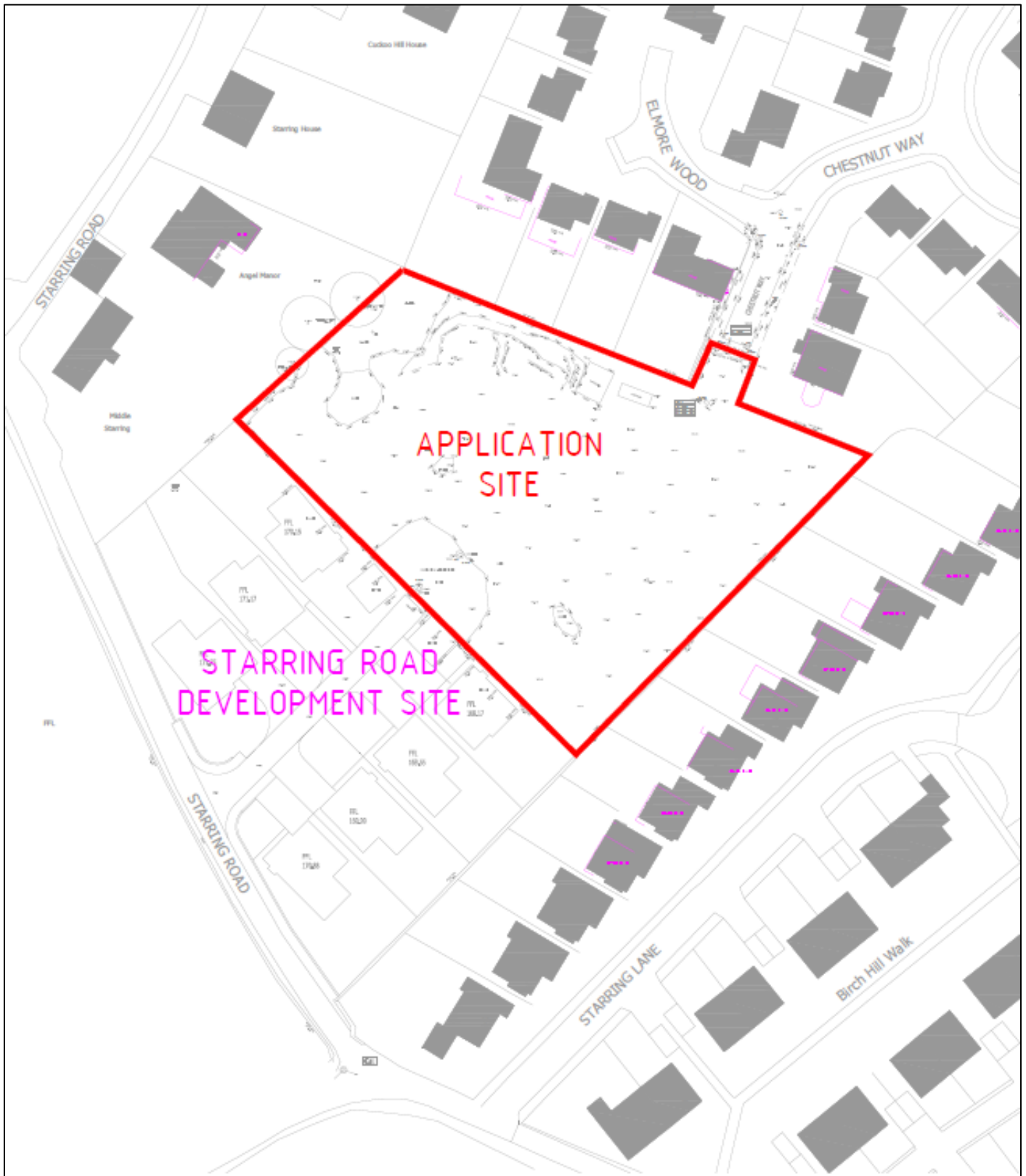
Environment Agency. 2005. Secondary Model Procedure for the Development of Appropriate Soil Sampling Strategies for Land Contamination. R&D Technical Report P5-066/TR.

ICE Manual of Geotechnical Engineering Volume I. 2012.

CIRIA. Report SP32.

5. APPENDIX A: PHOTOS & FIGURES.

5.1. Location Plan.



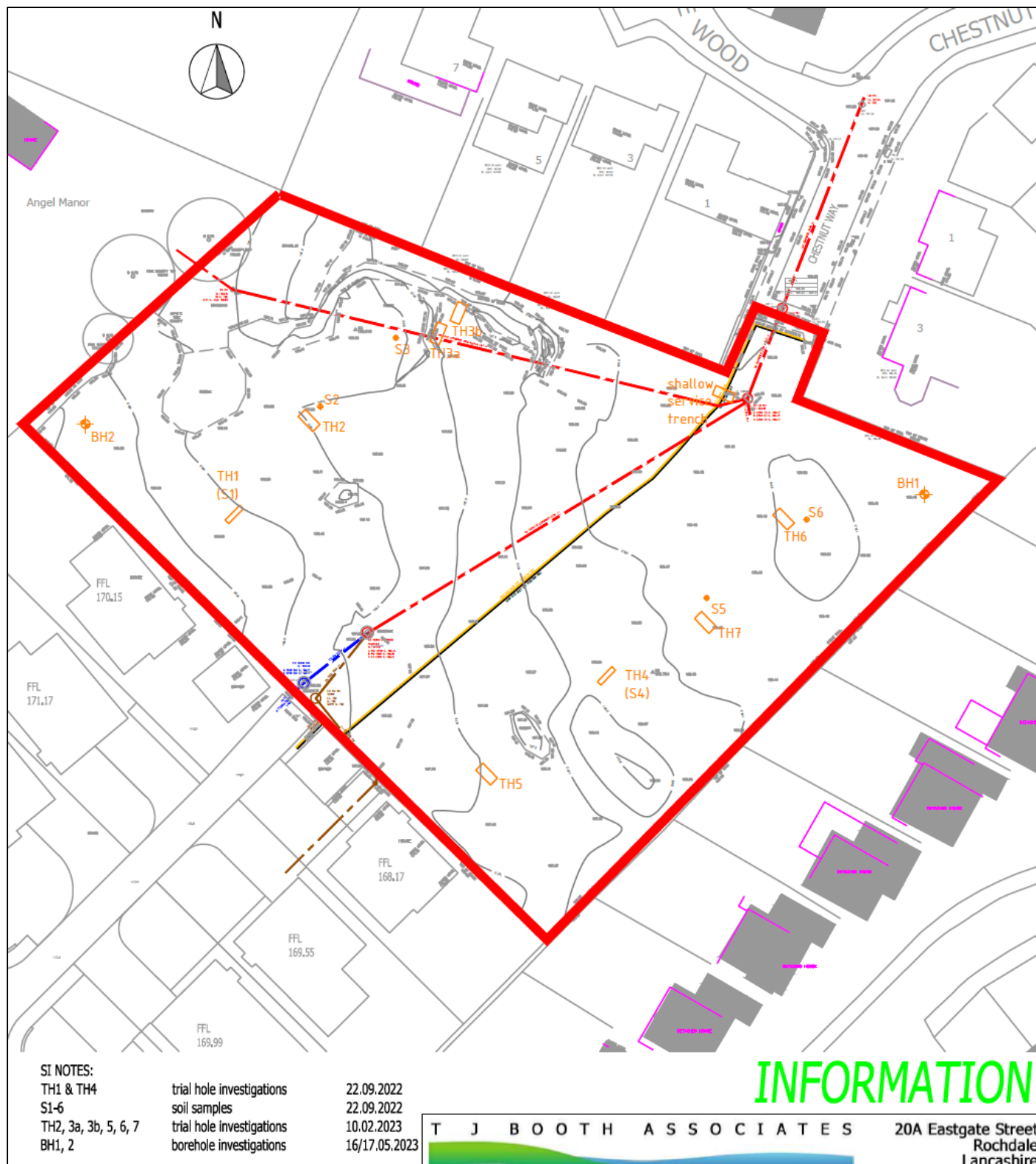
5.2. Existing Site Plan.



5.3. Proposed Site Plan.



5.4. Site Investigation Plan.



[illegible]

		on behalf of						T J Booth Associates							Rotary Drilling Log									
Depth of Stratum Top (m)	Driller's Stratum Description	Sample / Hole / Test Details						Drilling Details						Standard Penetration Test										
		No	Type	In situ test	From (m)	To (m)	Liner Dia (mm)	Core run time (hh:mm)	Total core Recovery (m)	Flush Return %	Flush Colour	Self Weight Pen (mm)	75 mm	150 mm	Seating Pen (mm)	75 mm	150 mm	225 mm	300 mm	Main Pen (mm)	N value	Casing Depth (m)	Water flush level (m)	
0.00	Crushed concrete ash and brick clayey MADE GROUND over soft to firm becoming firm to stiff brown CLAY																							
2.80	Weak (weathered) brown MUDSTONE																							
6.30	becoming Medium strong brown MUDSTONE																							
14.20	Strong dark brown MUDSTONE																							
21.50	Medium strong brown MUDSTONE																							
23.40	Strong light brown MUDSTONE																							

Shift details				Drilling Equipment Details												Ground Water Record									Backfill (m)			
Start time (hh:mm)	Hole (m)	Water (m)	Casing (m)	Coring (C) Open hole (RH) Coring (RC)	Dia. (mm)	From (m)	To (m)	Barrel	Liner Type	Core Dia (mm)	Bit Type	Casing Type	Bit serial No.	Flush	Polymer	Time of strike	Depth struck (m)	Casing (m)	Inflow	5 min	10 min	15 min	20 min	Depth tested (m)	Type	From (m)	To (m)	
0800																												
Finish Time (hh:mm)	Hole (m)	Water (m)	Casing (m)																									
1500	0.00																											

Time from	Duration (hh:mm)	Remarks or details of any additional testing information, Dayworks	SPT I.D. Number	x140	Calibration Date	14/09/2019	Project Title					
0800		CAT Scanned: Yes	SPT Rod Type	Sonic	SPT Energy Ratio	79.00	Chestnut Way, Littleborough					
0800		Permit Completed: Yes	Drilling Crew Details			CSCS No						
0900	0030	Dayworks: Collecting water bowser Filling water bowser	Support Operative	Dylan Williamson		6562606	Weather	Sunny	Project No	20922		
1100	0030	Dayworks: Filling water bowser	Lead Driller	Reece Bray		4691177	Date	17/05/2023	Day	Wednesday		
		General: 100% flush all the way down	Site category	Green			Rig type	ML DUO SONIC	Borehole Number			
			Project Engineer	dan			Inclination		BH02			
			Lead Driller's signature				Sheet	1	of	2	Completed	Y

[illegible]

5.6. Trial Hole Logs.

Trial pit reference TH1					Sheet 1 of 1
Water	Reduced Level (m)	Legend	Depth (m)	Description	
	166.80				
	166.10	X X X X X X	(0.70) 0.70	Dark brown/black slightly sandy, gravelly, clayey MADE GROUND. Sand & gravel sized brick, glass, stone, occasional timber & rare cables. (S1)	
	165.85	- - - - - -	(0.25) 0.95	Soft brown slightly spongy fibrous peaty CLAY	
	165.60	- - - - - -	(0.25) 1.20	Soft to firm becoming firm grey/brown CLAY	
				Trial pit ends	
Not shown to scale					
Additional notes:					

Trial pit reference TH3a					Sheet 1 of 1
Water	Reduced Level (m)	Legend	Depth (m)	Description	
	167.55				
	166.55	X X X X X X X X	(1.00) 1.00	Dark brown silty topsoil MADE GROUND	
	166.45	X x X x	1.10	Dark brown silty TOPSOIL (virgin)	
	166.15	w w w w	(0.30) 1.40	Brown spongy fibrous clayey PEAT (combined drain at approx 1350)	
				Trial pit ends	
Not shown to scale					
Additional notes:					

Trial pit reference TH2				Sheet 1 of 1
Water	Reduced Level (m)	Legend	Depth (m)	Description
	168.00			
	167.55	X X X X X X	(0.45) 0.45	Dark brown silty topsoil MADE GROUND
	167.40	X x X x	0.60	Dark brown silty TOPSOIL (virgin)
	167.10	w w w w	(0.30) 0.90	Spongy fibrous clayey brown PEAT
	166.80	- - - - - -	(0.30) 1.20	Soft to firm light grey/brown CLAY
	165.80	- - - - - - - - - - - -	(1.00) 2.20	Firm becoming stiff grey-brown/blue slightly sandy, gravelly CLAY
				Trial pit ends
Not shown to scale				
Additional notes:				

Trial pit reference TH3a				Sheet 1 of 1
Water	Reduced Level (m)	Legend	Depth (m)	Description
	167.55			
	166.55	X X X X X X X X X X	(1.00) 1.00	Dark brown silty topsoil MADE GROUND
	166.45	X x X x	1.10	Dark brown silty TOPSOIL (virgin)
	166.15	w w w w	(0.30) 1.40	Brown spongy fibrous clayey PEAT (combined drain at approx 1350)
				Trial pit ends
Not shown to scale				
Additional notes:				

Trial pit reference TH3b				Sheet 1 of 1
Water	Reduced Level (m)	Legend	Depth (m)	Description
	166.80			
	166.55	X X X X	(0.25) 0.25	Dark brown slightly sandy/gravelly silty topsoil MADE GROUND. Gravel is brick, stone, with fabric, plastic, and rare cable also noted.
	166.45	X x X x	0.35	Dark brown silty TOPSOIL (virgin)
	166.10	w w w w	(0.35) 0.70	Brown spongy fibrous clayey PEAT
	165.25	- - - - - - - - - - - -	(0.85) 1.55	Soft light grey/brown CLAY
	164.60	- - - - - - - - - - - -	(0.65) 2.20	Firm grey-brown/blue CLAY
				Trial pit ends
Not shown to scale				
Additional notes:				

Trial pit reference TH4				Sheet 1 of 1
Water	Reduced Level (m)	Legend	Depth (m)	Description
	166.84			
	166.39	X X X X X X	(0.45) 0.45	Brown slightly sandy, slightly gravelly, silty occasionally clayey TOPSOIL sand & gravel is brick, concrete, slate. (S4)
	165.54	w w w w w w w w	(0.85) 1.30	Soft brown spongy clayey PEAT
	165.24	- - - - - -	(0.30) 1.60	Soft grey CLAY
	164.84	- : - : - : : - : - : -	(0.40) 2.00	Firm to stiff grey slightly sandy CLAY
	164.44	- - - - - -	(0.40) 2.40	Stiff blue-grey sandy, gravelly CLAY
				Trial pit ends
Not shown to scale				
Additional notes:				

Trial pit reference TH5					Sheet 1 of 1
Water	Reduced Level (m)	Legend	Depth (m)	Description	
	167.45				
	167.05	X X X X	(0.40) 0.40	Brown gravelly, clayey MADE GROUND. Gravel is brick, stone, slate, rare plastic, timber, clay pipe, plaster.	
	166.75	X x X x x X x X	(0.30) 0.70	Brown silty TOPSOIL (virgin)	
	166.05	- o - o - o - o - o - o - o - o - o - o	(0.70) 1.40	Soft to firm orange-brown/grey mottled slightly gravelly CLAY (becoming firm to stiff at 1200)	
	165.30	- o - o - o - o - o - o - o - o - o - o	(0.75) 2.15	Stiff brown-grey/blue very gravelly CLAY	
				Trial pit ends	
Not shown to scale					
Additional notes:					

Trial pit reference TH6					Sheet 1 of 1
Water	Reduced Level (m)	Legend	Depth (m)	Description	
	166.43				
	166.13	X X X X	(0.30) 0.30	Brown silty topsoil MADE GROUND	
	165.23	X - X - - X - X - X - X - - X - X - X - X -	(0.90) 1.20	Light brown-grey clayey MADE GROUND	
	164.43	X X X X X X X X	(0.80) 2.00	Orange-brown/grey gravelly (angular shale) MADE GROUND. Abundant cobbles, occasional boulders (mudstone).	
<u>v</u>	163.43 163.33	X X X X X X X X X X	(1.10) 3.10	Dark grey/black gravelly (angular shale) MADE GROUND. Abundant cobbles, occasional boulders (mudstone).	
				Trial pit ends	
Not shown to scale					
Additional notes:					

Trial pit reference TH6				Sheet 1 of 1
Water	Reduced Level (m)	Legend	Depth (m)	Description
	166.43			
	166.13	X X X X	(0.30) 0.30	Brown silty topsoil MADE GROUND
	165.23	X - X - - X - X - X - X - - X - X - X - X -	(0.90) 1.20	Light brown-grey clayey MADE GROUND
	164.43	X X X X X X X X	(0.80) 2.00	Orange-brown/grey gravelly (angular shale) MADE GROUND. Abundant cobbles, occasional boulders (mudstone).
<u>v</u>	163.43 163.33	X X X X X X X X	(1.10) 3.10	Dark grey/black gravelly (angular shale) MADE GROUND. Abundant cobbles, occasional boulders (mudstone).
				Trial pit ends
Not shown to scale				
Additional notes:				

5.7. Soil Sampling Analysis.

Client / Site:		CRH - Chestnut Way, Littleborough					
Sample Type:		Soil Samples					
Sampling Date:		22.09.2022					
Contaminant		No	Max	Mean	t 95	RESIDENTIAL (with or without plant uptake)	
						Pass/Fail	Comment
METALS	Arsenic as As, dry weight	6	20	14.983	20	37	PASS
	Boron as B, hot water sol dw	6	1.5	0.9067	1.4	290	PASS
	Cadmium as Cd, dry weight	6	0.41	0.2467	0.388	22	PASS
	chromium as Cr(III) dry weight	6	18	11.23	17.75	910	PASS
	Chromium as Cr(VI), dry weight	6	0.5	0.5	0.5	21	PASS
	Copper, as Dry Weight	6	42	26.333	41.25	2400	PASS
	Lead, as Dry Weight	6	120	69	112.5	200	PASS
	Mercury as Hg, dry weight	6	0.38	0.1517	0.345	1.2	PASS
	Nickel as Ni, dry weight	6	25	11.217	21.75	130	PASS
	Selenium as Se, dry weight	6	1.4	0.6733	1.275	250	PASS
	Zinc as Zn, dry weight	6	63	44.333	62.5	3700	PASS
INORGANIC	Cyanide (Total)	6	2.8	1.7333	2.575	2.5	comment S2
	Sulphate (Total) as SO4	6	0.47	0.2147	0.42	0.24	FAIL S1 , S2 (max DS2)
	Sulphide	6	4.8	2.7833	4.45	250	PASS
	pH	6	8.6	7.2833	8.475	6 to 8	ALKALINE
	Sulphur (Elemental)	6	150	42.383	126.5	100	comment
	Asbestos Identification	6	0	0	0	0	PASS
ORGANIC	SOM	6	6	6	6		
	PAH acenaphthene	6	1.5	0.4183	1.225	1100	PASS
	PAH acenaphthylene	6	0.39	0.2367	0.388	920	PASS
	PAH anthracene	6	3.7	0.83	2.92	11000	PASS
	PAH benzo[a]anthracene	6	12	4.0333	10.2	13	PASS
	PAH benzo[a]pyrene	6	12	3.0533	9.775	5	FAIL S3
	PAH benzo[b]fluoranthene	6	16	4.0417	13.13	3.7	FAIL S2, S3
	PAH benzo[g,h,i]perylene	6	8.2	2.5833	7.025	350	PASS
	PAH benzo[k]fluoranthene	6	6.3	2.2167	5.4	100	PASS
	PAH chrysene	6	22	7.4	18.75	27	PASS
	PAH dibenz[ah]anthracene	6	2.5	0.8617	2.15	0.3	FAIL S2, S3, S4, S5, S6
	PAH fluoranthene	6	31	7.175	24.6	890	PASS
	PAH fluorene	6	1.4	0.385	1.143	860	PASS
	PAH indeno[123-cd]pyrene	6	7.9	2.0767	6.45	41	PASS
	PAH naphthalene	6	20	8.05	18.75	13	FAIL S2, S3, S6
	PAH phenanthrene	6	21	4.55	16.43	440	PASS
	PAH pyrene	6	30	7.1433	23.9	2000	PASS
SVOC	phenol	6	0.14	0.1067	0.13	380	PASS

5.8. Eurofins Chemtest – Soil Testing Certificates.



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

Final Report

Report No.:	22-36652-1		
Initial Date of Issue:	11-Oct-2022		
Client	TJ Booth Associates		
Client Address:	20a Eastgate Street Rochdale Lancs OL16 1DH		
Contact(s):	Daniel Slattery		
Project	BROADBENT - CHESTNUT WAY		
Quotation No.:	Q19-18321	Date Received:	26-Sep-2022
Order No.:		Date Instructed:	26-Sep-2022
No. of Samples:	6	Results Due:	07-Oct-2022
Turnaround (Wkdays):	10		
Date Approved:	11-Oct-2022		
Approved By:			
Details:	Stuart Henderson, Technical Manager		

Results - Soil

Project: BROADBENT - CHESTNUT WAY												
Client: TJ Booth Associates Quotation No. : Q 19-18321	Chemtest Job No.:		22-36652		22-36652		22-36652		22-36652		22-36652	
	Chemtest Sample ID.:		1512978		1512979		1512980		1512981		1512982	
	Client Sample ID.:		S1		S2		S3		S4		S5	
	Sample Location		TH1						TH2			
	Sample Type		SOIL		SOIL		SOIL		SOIL		SOIL	
	Top Depth (m):		0.0		0.0		0.0		0.0		0.0	
	Bottom Depth (m):		0.5		0.3		0.3		0.45		0.3	
	Date Sampled		22-Sep-2022		22-Sep-2022		22-Sep-2022		22-Sep-2022		22-Sep-2022	
	Asbestos Lab		COVENTRY		COVENTRY		COVENTRY		COVENTRY		COVENTRY	
Determinand	Accred.	SOP	Units	LOD								
ACM Type	U	2192		N/A								
Asbestos Identification	U	2192		N/A	No Asbestos Detected	No Asbestos Detected	No Asbestos Detected	No Asbestos Detected	No Asbestos Detected	No Asbestos Detected	No Asbestos Detected	No Asbestos Detected
Moisture	N	2030	%	0.020	17	31	6.8	32	27	20	25	25
pH	U	2010		4.0	8.6	6.9	6.8	7.4	7.4	8.1	5.9	5.9
Boron (Hot Water Soluble)	U	2120	mg/kg	0.40	1.5	1.1	0.88	0.57	0.57	0.77	0.82	0.82
Sulphur (Elemental)	U	2180	mg/kg	1.0	150	19	56	8.5	8.5	9.8	11	11
Cyanide (Total)	U	2300	mg/kg	0.50	1.4	2.8	1.9	6.4	1.5	1.2	1.6	1.6
Thioyanate	U	2300	mg/kg	5.0	<5.0	8.7	6.4	5.4	5.4	<5.0	7.1	7.1
Sulphide (Easily Liberatable)	N	2325	mg/kg	0.50	4.8	2.1	1.8	1.7	1.7	3.4	2.9	2.9
Sulphate (Total)	U	2430	mg/kg	100	4700	2700	2300	1100	1100	1100	980	980
Arsenic	U	2455	mg/kg	0.5	19	20	14	20	20	6.9	10	10
Cadmium	U	2455	mg/kg	0.10	0.31	0.41	0.32	0.17	0.17	0.13	0.14	0.14
Chromium	U	2455	mg/kg	0.5	18	17	9.9	8.3	8.3	8.6	5.6	5.6
Copper	U	2455	mg/kg	0.50	39	42	30	20	20	14	13	13
Mercury	U	2455	mg/kg	0.05	0.05	0.38	0.24	0.08	0.08	0.07	0.09	0.09
Nickel	U	2455	mg/kg	0.50	25	12	9.7	7.5	7.5	7.4	5.7	5.7
Lead	U	2455	mg/kg	0.50	30	120	90	56	56	33	85	85
Selenium	U	2455	mg/kg	0.25	0.25	0.90	0.56	1.4	0.56	0.46	0.47	0.47
Zinc	U	2455	mg/kg	0.50	63	61	53	34	34	31	24	24
Chromium (Hexavalent)	N	2490	mg/kg	0.50	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50
Organic Matter	U	2625	%	0.40	5.2	20	21	18	18	11	17	17
Naphthalene	U	2700	mg/kg	0.10	< 0.10	20	15	< 0.10	< 0.10	< 0.10	13	13
Acenaphthylene	U	2700	mg/kg	0.10	< 0.10	0.35	0.38	< 0.10	< 0.10	< 0.10	0.39	0.39
Acenaphthene	U	2700	mg/kg	0.10	< 0.10	0.40	1.5	< 0.10	< 0.10	< 0.10	0.31	0.31
Fluorene	U	2700	mg/kg	0.10	< 0.10	0.37	1.4	< 0.10	< 0.10	< 0.10	0.24	0.24
Phenanthrene	U	2700	mg/kg	0.10	< 0.10	2.7	21	1.0	1.0	2.1	1.5	1.5
Anthracene	U	2700	mg/kg	0.10	< 0.10	0.58	3.7	0.16	0.16	0.20	0.24	0.24
Fluoranthene	U	2700	mg/kg	0.10	0.45	5.4	31	1.7	1.7	2.0	2.5	2.5
Pyrene	U	2700	mg/kg	0.10	0.56	5.6	30	1.9	1.9	2.0	2.8	2.8
Benz[a]anthracene	U	2700	mg/kg	0.10	< 0.10	4.8	12	1.2	1.2	2.2	3.9	3.9

Page 2 of 5



Results - Soil

Project: BROADBENT - CHESTNUT WAY

Client: TJ Booth Associates	Chemtest Job No.:	22-36652	22-36652	22-36652	22-36652	22-36652	22-36652
Quotation No.: Q19-18321	Chemtest Sample ID.:	1512978	1512979	1512980	1512981	1512982	1512983
	Client Sample ID.:	S1	S2	S3	S4	S5	S6
	Sample Location:	TH1	SOIL	SOIL	TH2	SOIL	SOIL
	Sample Type:	SOIL	SOIL	SOIL	SOIL	SOIL	SOIL
	Top Depth (m):	0.0	0.0	0.0	0.0	0.0	0.0
	Bottom Depth (m):	0.5	0.3	0.3	0.45	0.3	0.3
	Date Sampled:	22-Sep-2022	22-Sep-2022	22-Sep-2022	22-Sep-2022	22-Sep-2022	22-Sep-2022
	Asbestos Lab:	COVENTRY	COVENTRY	COVENTRY	COVENTRY	COVENTRY	COVENTRY
	Accred.	SOP	Units	LOD			
Determinand	U	2700	mg/kg	0.10			
Benzo[a,h,i]perylene	U	2700	mg/kg	2.0			
Total Of 16 PAH's	U	2920	mg/kg	0.10			
Total Phenols							

Test Methods

SOP	Title	Parameters included	Method summary
2010	pH Value of Soils	pH	pH Meter
2030	Moisture and Stone Content of Soils (Requirement of MCERTS)	Moisture content	Determination of moisture content of soil as a percentage of its as received mass obtained at <37°C.
2040	Soil Description (Requirement of MCERTS)	Soil description	As received soil is described based upon BS5930
2120	Water Soluble Boron, Sulphate, Magnesium & Chromium	Boron; Sulphate; Magnesium; Chromium	Aqueous extraction / ICP-OES
2180	Sulphur (Elemental) in Soils by HPLC	Sulphur	Dichloromethane extraction / HPLC with UV detection
2192	Asbestos	Asbestos	Polarised light microscopy / Gravimetry
2300	Cyanides & Thiocyanate in Soils	Free (or easily liberatable) Cyanide; total Cyanide; complex Cyanide; Thiocyanate	Alkaline extraction followed by colorimetric determination using Automated Flow Injection Analyser.
2325	Sulphide in Soils	Sulphide	Steam distillation with sulphuric acid / analysis by 'Aquakem 600' Discrete Analyser, using N,N-dimethyl-p-phenylenediamine.
2430	Total Sulphate in soils	Total Sulphate	Acid digestion followed by determination of sulphate in extract by ICP-OES.
2490	Hexavalent Chromium in Soils	Chromium [VI]	Soil extracts are prepared by extracting dried and ground soil samples into boiling water. Chromium [VI] is determined by 'Aquakem 600' Discrete Analyser using 1,5-diphenylcarbazide.
2625	Total Organic Carbon in Soils	Total organic Carbon (TOC)	Determined by high temperature combustion under oxygen, using an Eltra elemental analyser.
2700	Speciated Polynuclear Aromatic Hydrocarbons (PAH) in Soil by GC-FID	Acenaphthene; Acenaphthylene; Anthracene; Benzo[a]Anthracene; Benzo[a]Pyrene; Benzo[b]Fluoranthene; Benzo[ghi]Perylene; Benzo[k]Fluoranthene; Chrysene; Dibenz[ah]Anthracene; Fluoranthene; Fluorene; Indeno[123cd]Pyrene; Naphthalene; Phenanthrene; Pyrene	Dichloromethane extraction / GC-FID (GC-FID detection is non-selective and can be subject to interference from co-eluting compounds)
2920	Phenols in Soils by HPLC	Phenolic compounds including Resorcinol, Phenol, Methylphenols, Dimethylphenols, 1-Naphthol and Trimethylphenols. Note: chlorophenols are excluded.	60:40 methanol/water mixture extraction, followed by HPLC determination using electrochemical detection.

Report InformationKey

U	UKAS accredited
M	MCERTS and UKAS accredited
N	Unaccredited
S	This analysis has been subcontracted to a UKAS accredited laboratory that is accredited for this analysis
SN	This analysis has been subcontracted to a UKAS accredited laboratory that is not accredited for this analysis
T	This analysis has been subcontracted to an unaccredited laboratory
I/S	Insufficient Sample
U/S	Unsuitable Sample
N/E	not evaluated
<	"less than"
>	"greater than"
SOP	Standard operating procedure
LOD	Limit of detection

Comments or interpretations are beyond the scope of UKAS accreditation

The results relate only to the items tested

Uncertainty of measurement for the determinands tested are available upon request

None of the results in this report have been recovery corrected

All results are expressed on a dry weight basis

The following tests were analysed on samples as received and the results subsequently corrected to a dry weight basis TPH, BTEX, VOCs, SVOCs, PCBs, Phenols

For all other tests the samples were dried at < 37°C prior to analysis

All Asbestos testing is performed at the indicated laboratory

Issue numbers are sequential starting with 1 all subsequent reports are incremented by 1

Sample Deviation Codes

-
- A - Date of sampling not supplied
 - B - Sample age exceeds stability time (sampling to extraction)
 - C - Sample not received in appropriate containers
 - D - Broken Container
 - E - Insufficient Sample (Applies to LOI in Trommel Fines Only)

Sample Retention and Disposal

All soil samples will be retained for a period of 30 days from the date of receipt

All water samples will be retained for 14 days from the date of receipt

Charges may apply to extended sample storage

If you require extended retention of samples, please email your requirements to:
customerservices@chemtest.com

6. APPENDIX B: PHOTOS.



Figure 1 – View northeast to Chestnut Way.



Figure 2 – View northwest along the Phase1/Current Application Site boundary.



Figure 3 – View east along the Site boundary with properties to Chestnut Way.



Figure 4 – View southwest towards the Phase1/Application Site boundary.



Figure 5 – TH1



Figure 6 – TH2



Figure 7 – TH3a



Figure 8 – TH3b



Figure 9 – TH4



Figure 10 – TH5

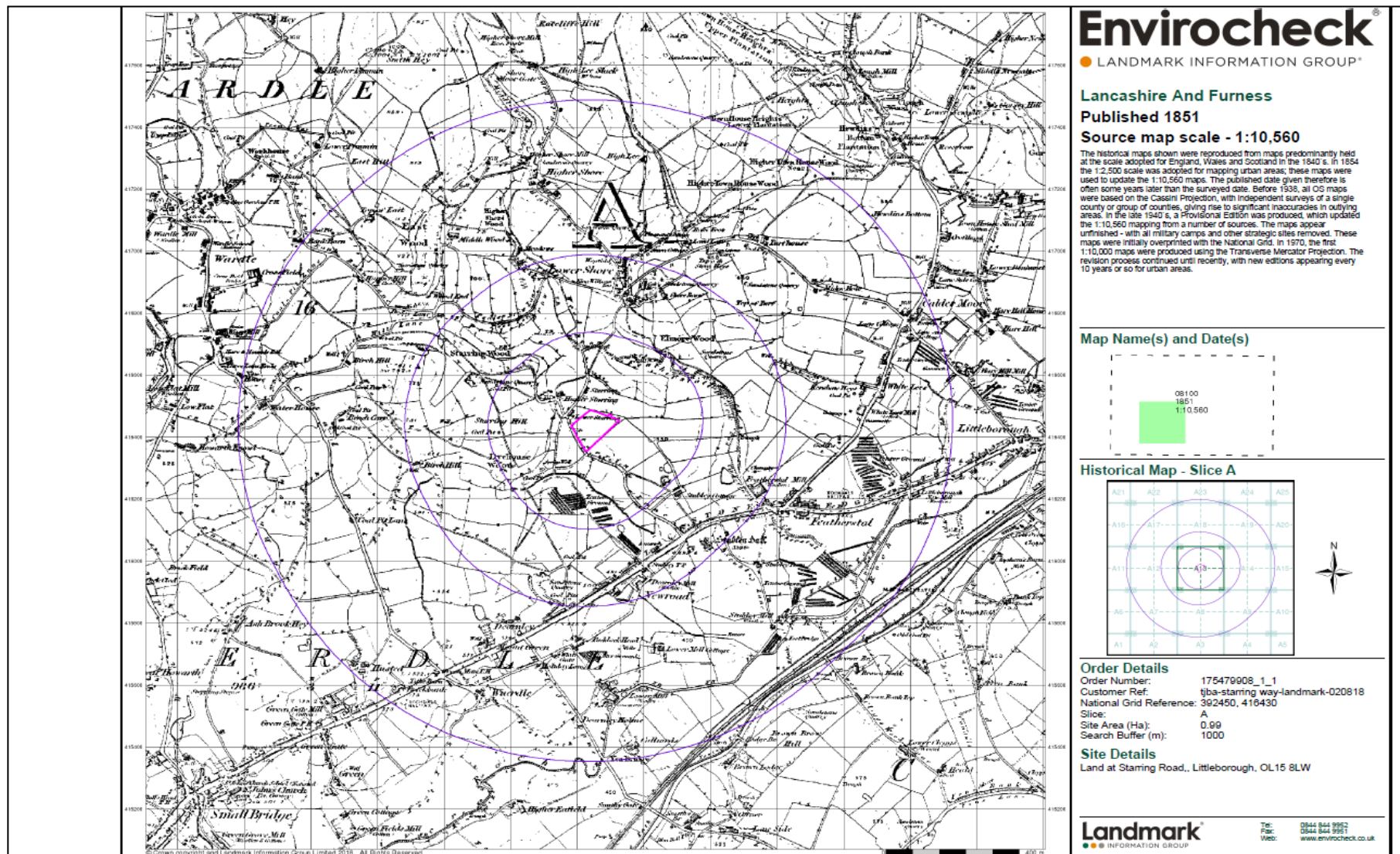


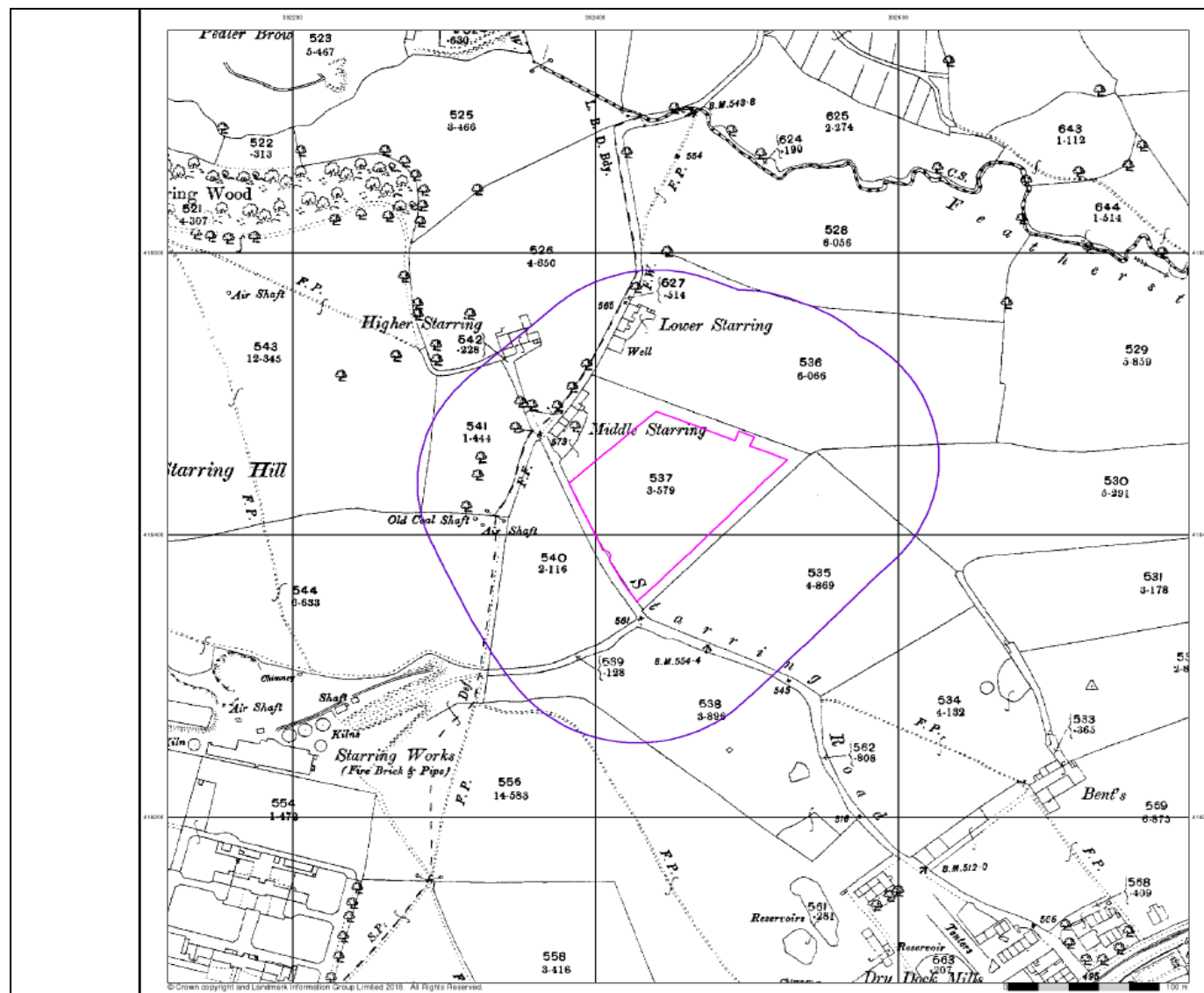
Figure 11 – TH6



Figure 12 – TH7

7. APPENDIX C: ENVIROCHECK.





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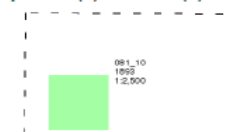
Lancashire And Furness

Published 1893

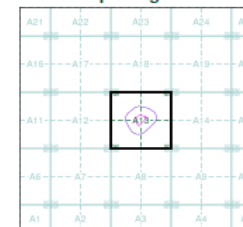
Source map scale - 1:2,500

The historical maps shown were reproduced from maps predominantly held at the scale adopted for England, Wales and Scotland in the 1840's. In 1854 the 1:2,500 scale was adopted for mapping urban areas and by 1896 it covered the whole of what were considered to be the cultivated parts of Great Britain. The published date given below is often some years later than the surveyed date. Before 1936, all OS maps were based on the Cassini Projection, with independent surveys of a single county or group of counties, giving rise to significant inaccuracies in outlying areas.

Map Name(s) and Date(s)



Historical Map - Segment A13



Order Details

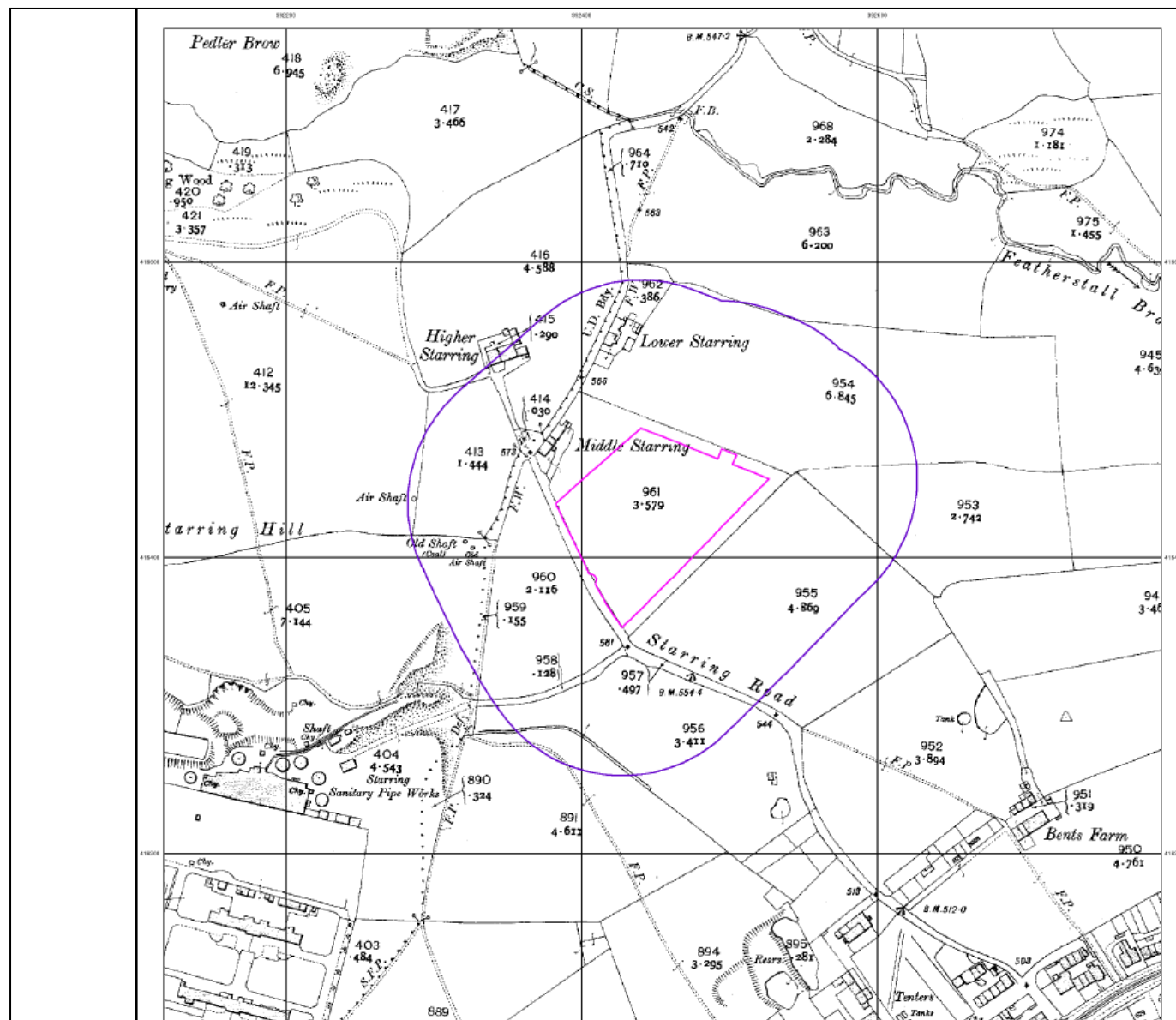
Order Number: 175479908_1_1
Customer Ref: tjba-starring way-landmark-020818
National Grid Reference: 362450, 416430
Site Area (Ha): 0.99
Search Buffer (m): 100

Site Details

Land at Starring Road, Littleborough, OL15 8LW

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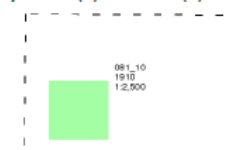
Lancashire And Furness

Published 1910

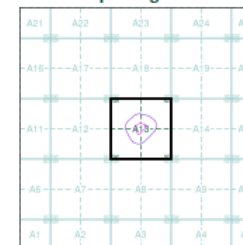
Source map scale - 1:2,500

The historical maps shown were reproduced from maps predominantly held at the scale adopted for England, Wales and Scotland in the 1840's. In 1854 the 1:2,500 scale was adopted for mapping urban areas and by 1896 it covered the whole of what were considered to be the cultivated parts of Great Britain. The published date given below is often some years later than the surveyed date. Before 1936, all OS maps were based on the Cassini Projection, with independent surveys of a single county or group of counties, giving rise to significant inaccuracies in outlying areas.

Map Name(s) and Date(s)



Historical Map - Segment A13



Order Details

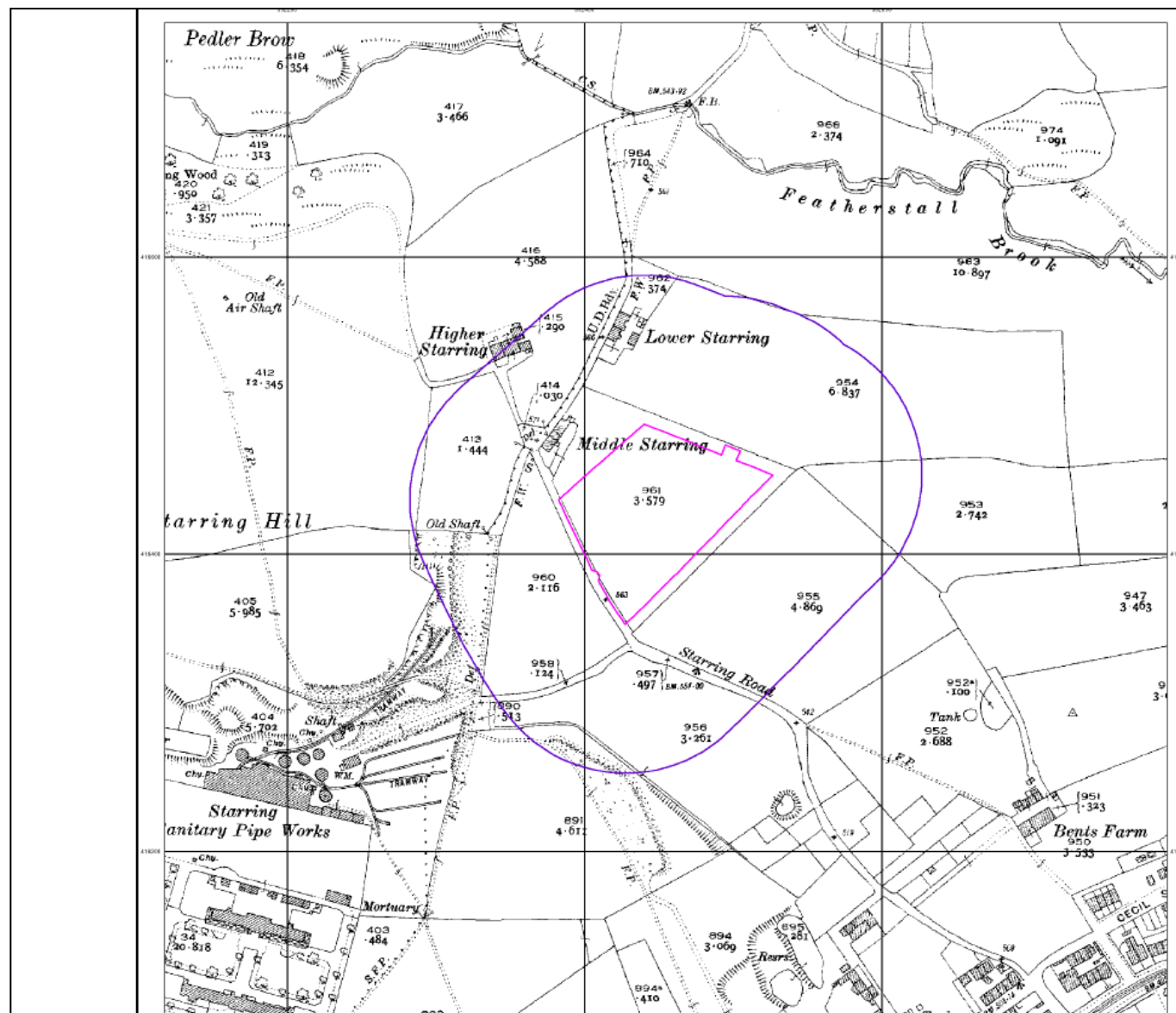
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Customer Ref: tjba-starring way-landmark-020818
National Grid Reference: 392450, 416430
Slice: A
Site Area (Ha): 0.99
Search Buffer (m): 100

Site Details

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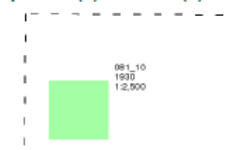
Lancashire And Furness

Published 1930

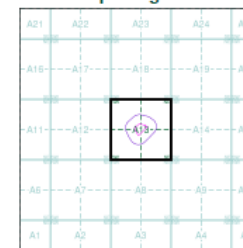
Source map scale - 1:2,500

The historical maps shown were reproduced from maps predominantly held at the scale adopted for England, Wales and Scotland in the 1840's. In 1854 the 1:2,500 scale was adopted for mapping urban areas and by 1896 it covered the whole of what were considered to be the cultivated parts of Great Britain. The published date given below is often some years later than the surveyed date. Before 1938, all OS maps were based on the Cassini Projection, with independent surveys of a single county or group of counties, giving rise to significant inaccuracies in outlying areas.

Map Name(s) and Date(s)



Historical Map - Segment A13



Order Details

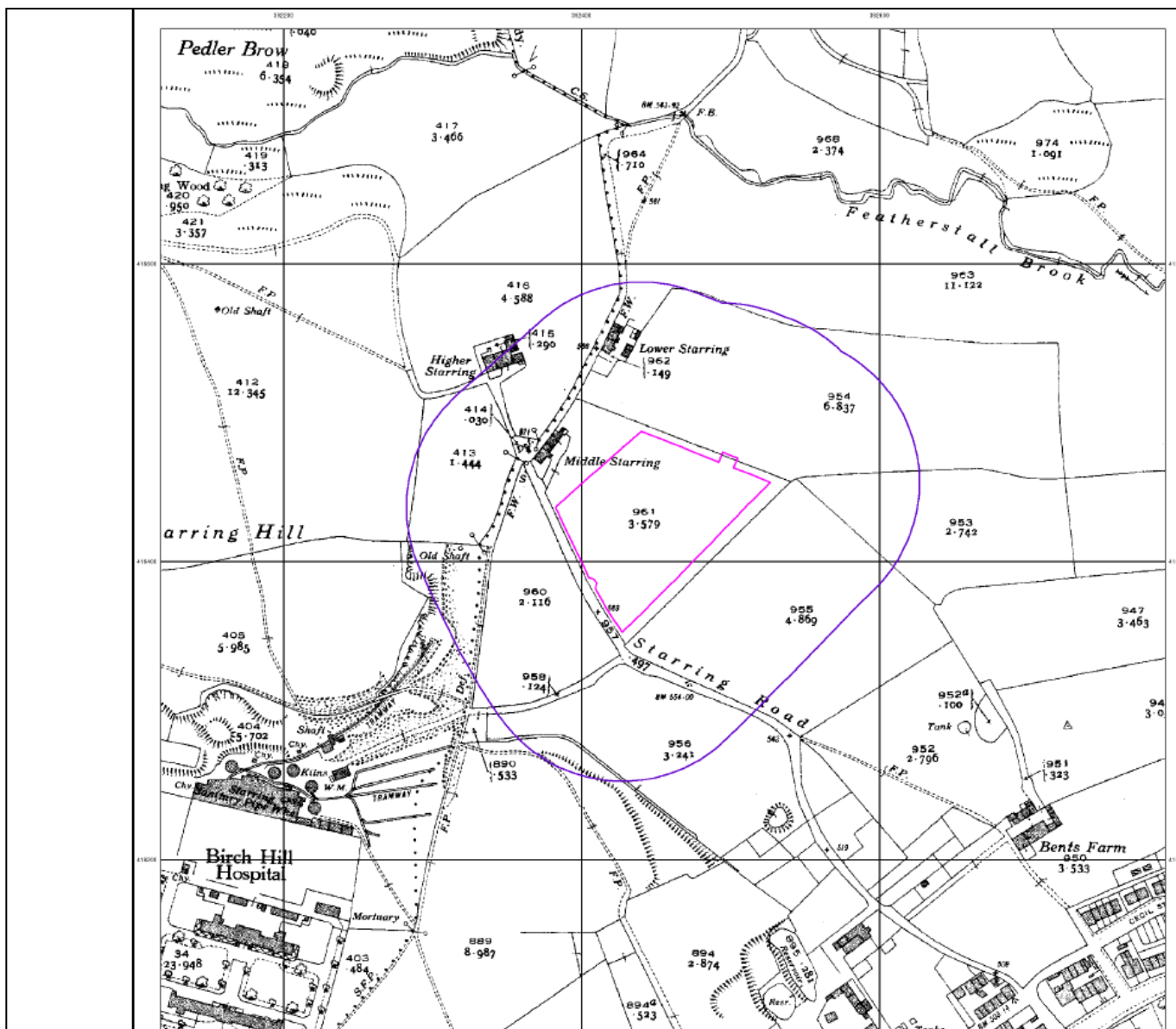
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 Customer Ref: tjba-starring way-landmark-020818
 National Grid Reference: 392450, 410430
 Slice: A
 Site Area (Ha): 0.99
 Search Buffer (m): 100

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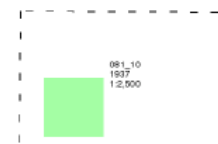
Lancashire And Furness

Published 1937

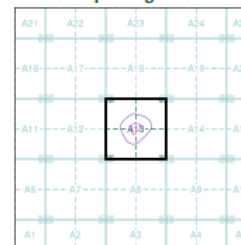
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The historical maps shown were reproduced from maps predominantly held at the scale adopted for England, Wales and Scotland in the 1840's. In 1854 the 1:2,500 scale was adopted for mapping urban areas and by 1896 it covered the whole of what were considered to be the cultivated parts of Great Britain. The published date given below is often some years later than the surveyed date. Before 1936, all OS maps were based on the Cassini Projection, with independent surveys of a single county or group of counties, giving rise to significant inaccuracies in outlying areas.

Map Name(s) and Date(s)



Historical Map - Segment A13



Order Details

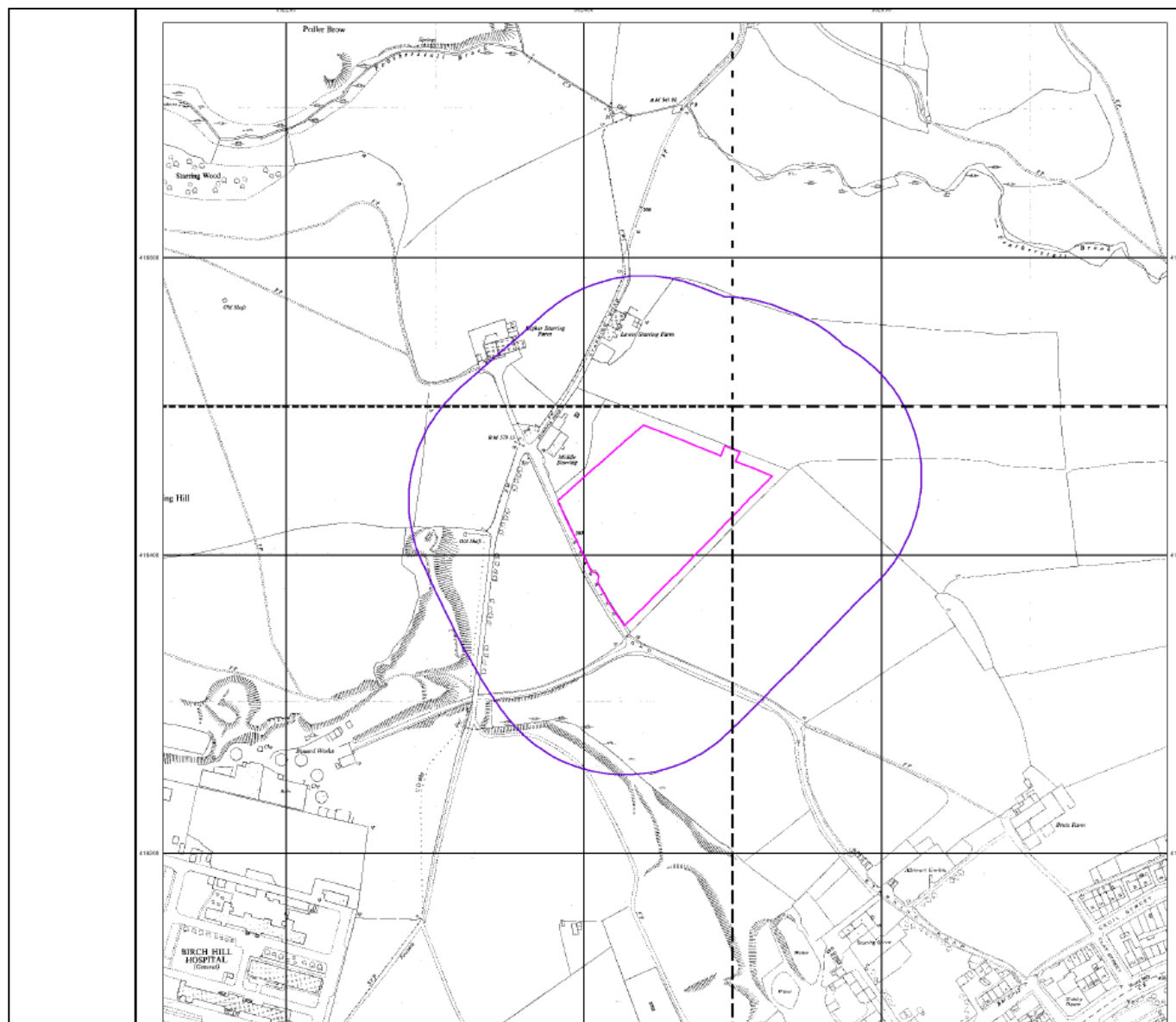
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Customer Ref: tjba-starring way-landmark-020818
National Grid Reference: 392450, 416430
Site: A
Site Area (Ha): 0.99
Search Buffer (m): 100

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Ordnance Survey Plan

Published 1960

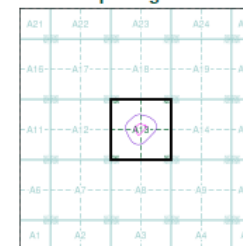
Source map scale - 1:1,250

The historical maps shown were reproduced from maps predominantly held at the scale adopted for England, Wales and Scotland in the 1840's. In 1854 the 1:2,500 scale was adopted for mapping urban areas and by 1899 it covered the whole of what were considered to be the cultivated parts of Great Britain. The published date given below is often some years later than the surveyed date. Before 1938, all OS maps were based on the Cassini Projection, with independent surveys of a single county or group of counties, giving rise to significant inaccuracies in outlying areas.

Map Name(s) and Date(s)

SD9216NW	SD9218NE
1960	1960
1:1,250	1:1,250
SD9216SW	SD9218SE
1960	1960
1:1,250	1:1,250

Historical Map - Segment A13



Order Details

Order Number: 175479908_1_1
 Customer Ref: tjba-staring way-landmark-020818
 National Grid Reference: 392450, 416430
 Slice: A
 Site Area (Ha): 0.99
 Search Buffer (m): 100

Site Details

Land at Staring Road., Littleborough, OL15 8LW

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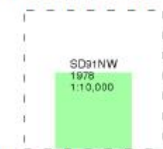
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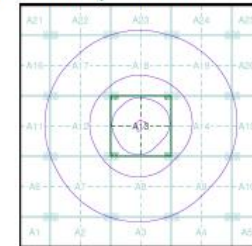
Ordnance Survey Plan
Published 1978
Source map scale - 1:10,000

The historical maps shown were reproduced from maps predominantly held at the scale adopted for England, Wales and Scotland in the 1840's. In 1854 the 1:2,500 scale was adopted for mapping urban areas; these maps were used to update the 1:10,560 maps. The published date given therefore is often some years later than the surveyed date. Before 1938, all OS maps were based on the Cassini Projection, with independent surveys of a single county or group of counties, giving rise to significant inaccuracies in outlying areas. In the late 1940's, a Provisional Edition was produced, which updated the 1:10,560 mapping from a number of sources. The maps appear unfinished - with all military camps and other strategic sites removed. These maps were initially overprinted with the National Grid. In 1970, the first 1:10,000 maps were produced using the Transverse Mercator Projection. The revision process continued until recently, with new editions appearing every 10 years or so for urban areas.

Map Name(s) and Date(s)



Historical Map - Slice A

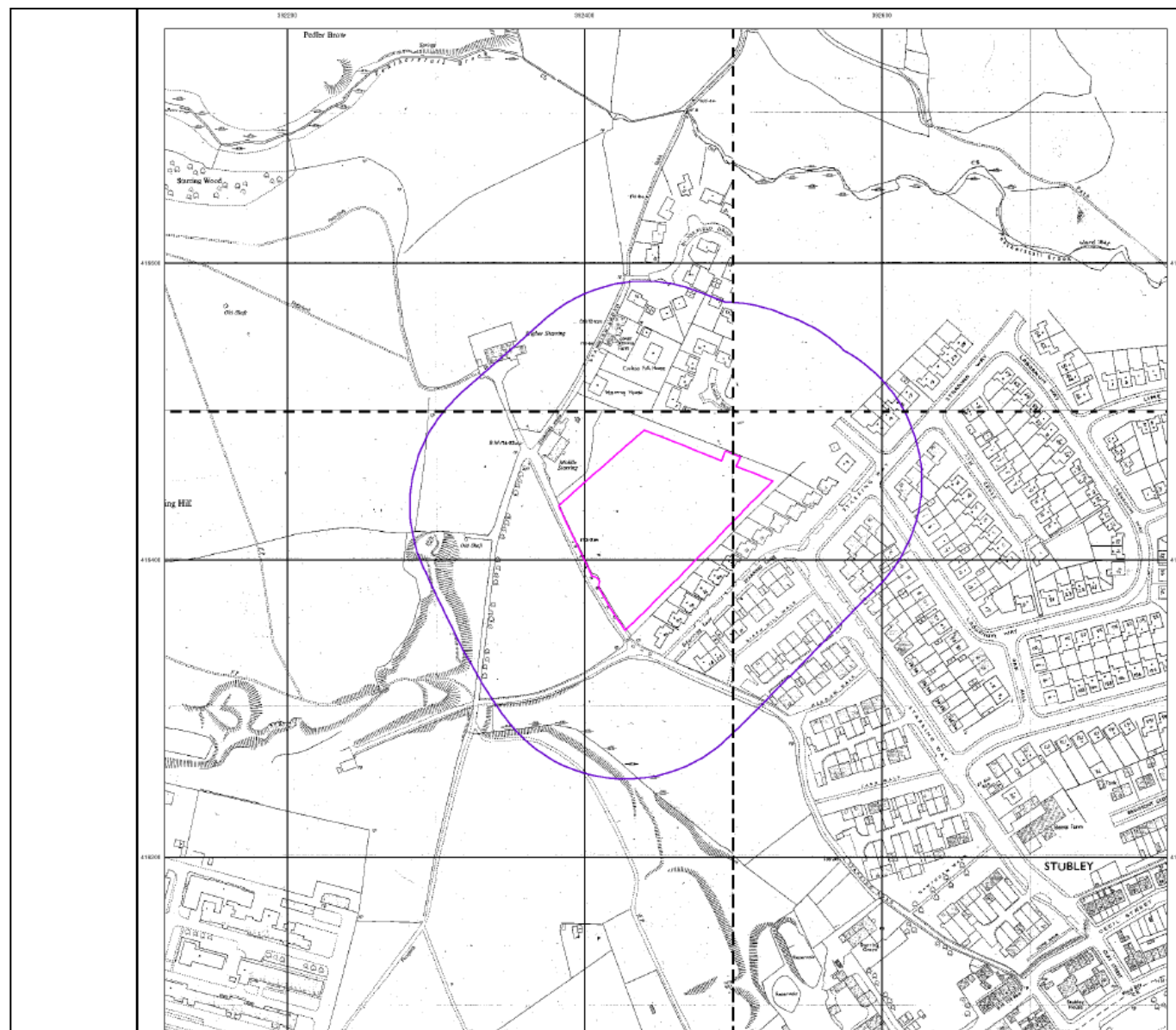


Order Details

Order Number: 175479908_1_1
 Customer Ref: tjba-starning way-landmark-020818
 National Grid Reference: 392450, 416430
 Slice: A
 Site Area (Ha): 0.99
 Search Buffer (m): 1000

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Additional SIMs

Published 1978 - 1988

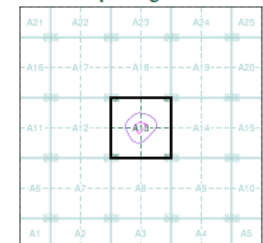
Source map scale - 1:1,250

The SIM cards (Ordnance Survey's 'Survey of Information on Microfilm') are further, minor editions of mapping which were produced and published in between the main editions as an area was updated. They date from 1947 to 1994, and contain detailed information on buildings, roads and land-use. These maps were produced at both 1:2,500 and 1:1,250 scales.

Map Name(s) and Date(s)

SD9216NW 1988 1:1,250	SD9216NE 1984 1:1,250
SD9216SW 1980 1:1,250	SD9216SE 1978 1:1,250

Historical Map - Segment A13

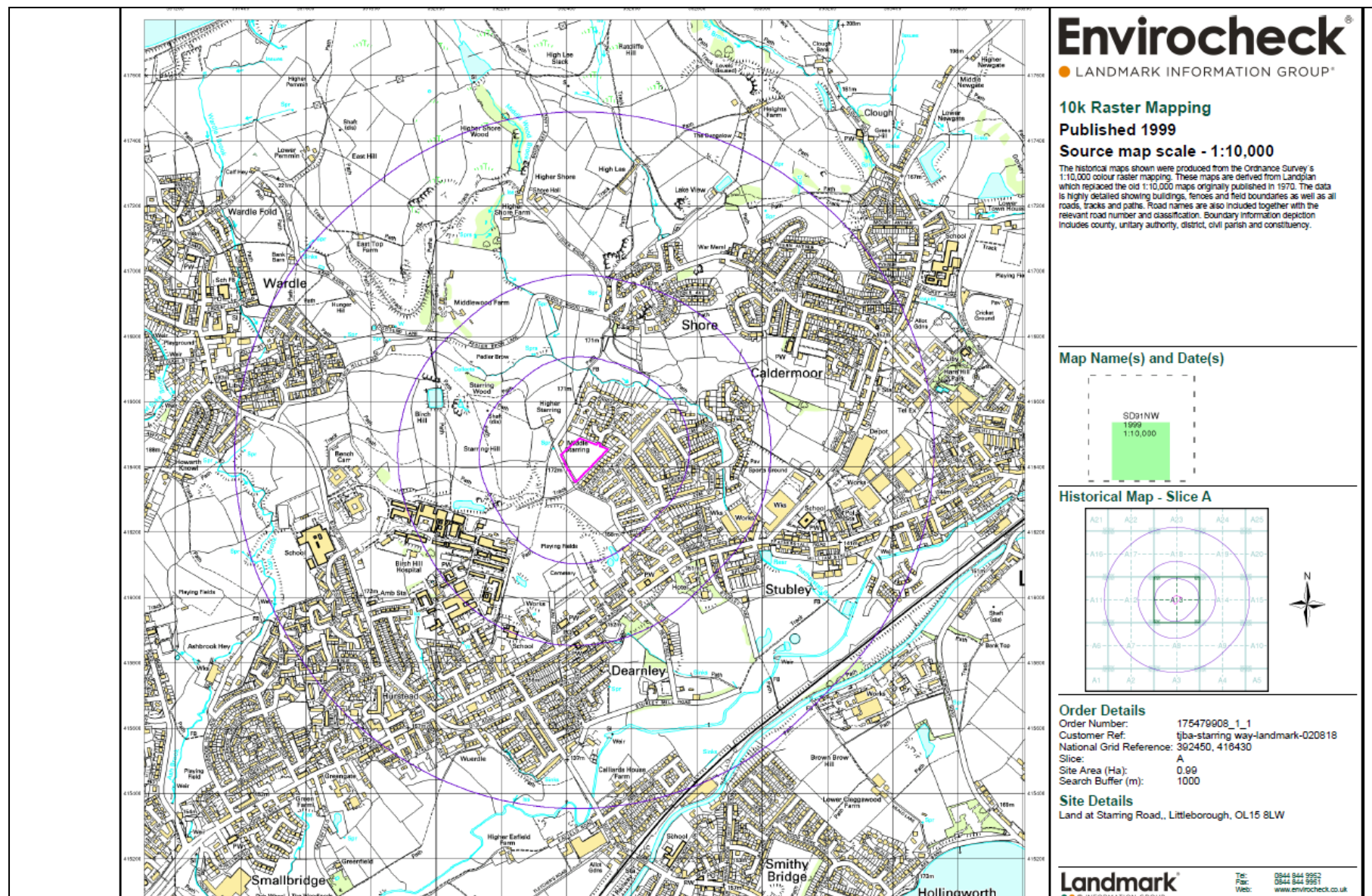


Order Details

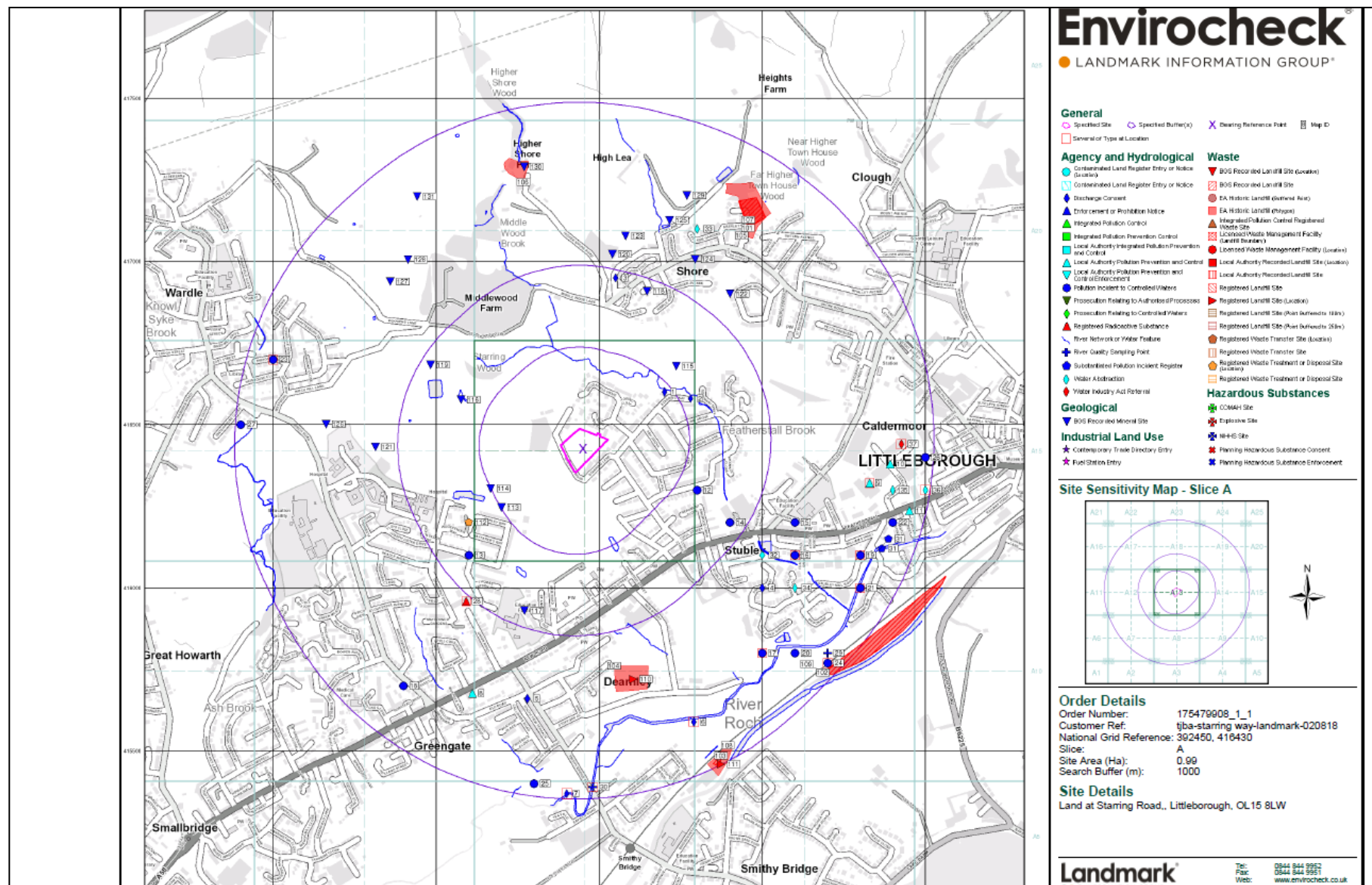
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 National Grid Reference: 392450, 416430
 Slice: A
 Site Area (Ha): 0.99
 Search Buffer (m): 100

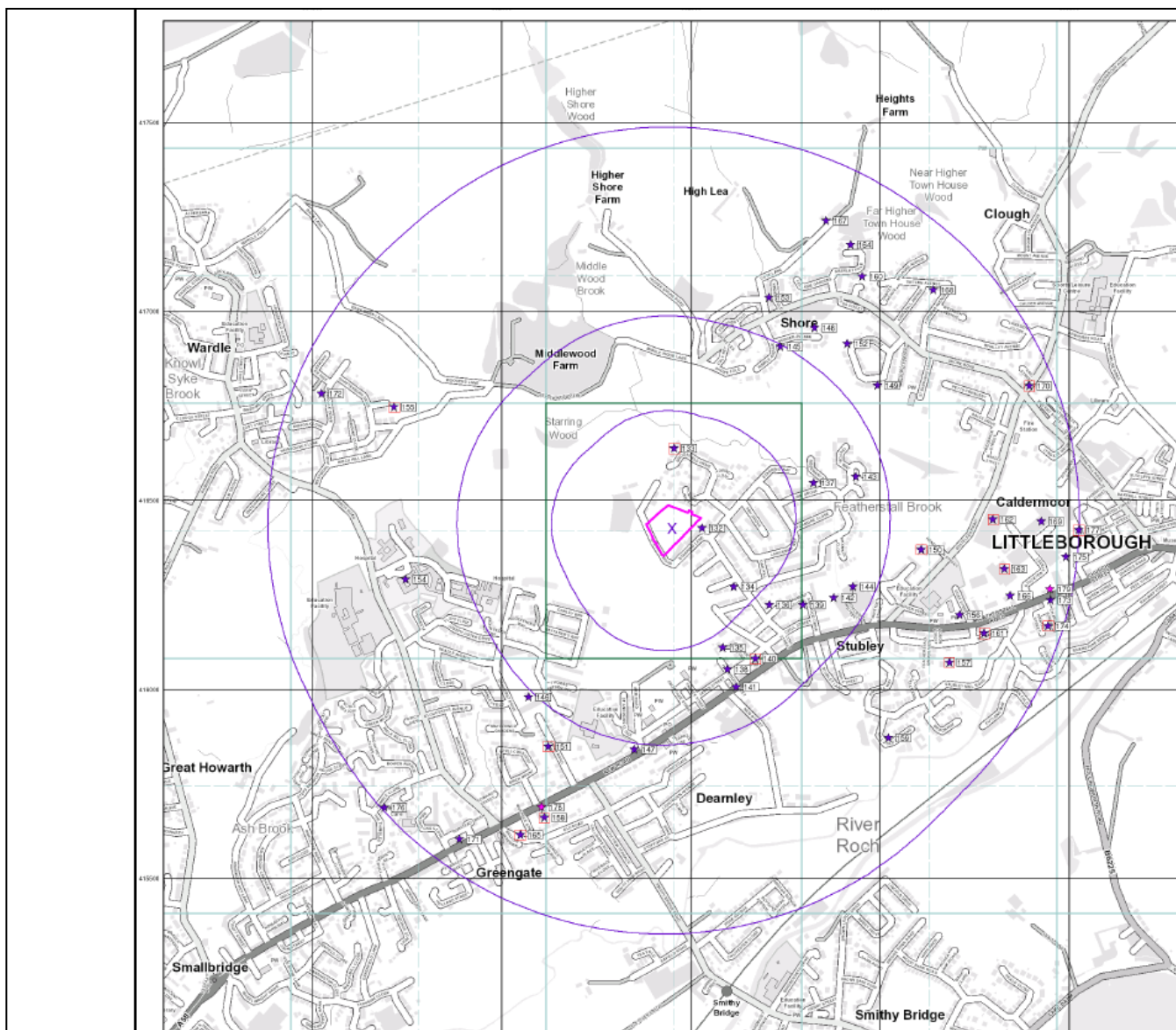
Site Details

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Industrial Land Use Map

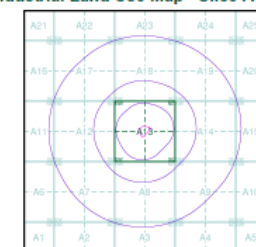
General

Specified Site Specified Buffer(s) Bearing Reference Point
 Slice Map ID

Industrial Land Use

Contemporary Trade Directory Entry
 Fuel Station Entry
 Gas Pipeline
 Underground Electrical Cables

Industrial Land Use Map - Slice A



Order Details

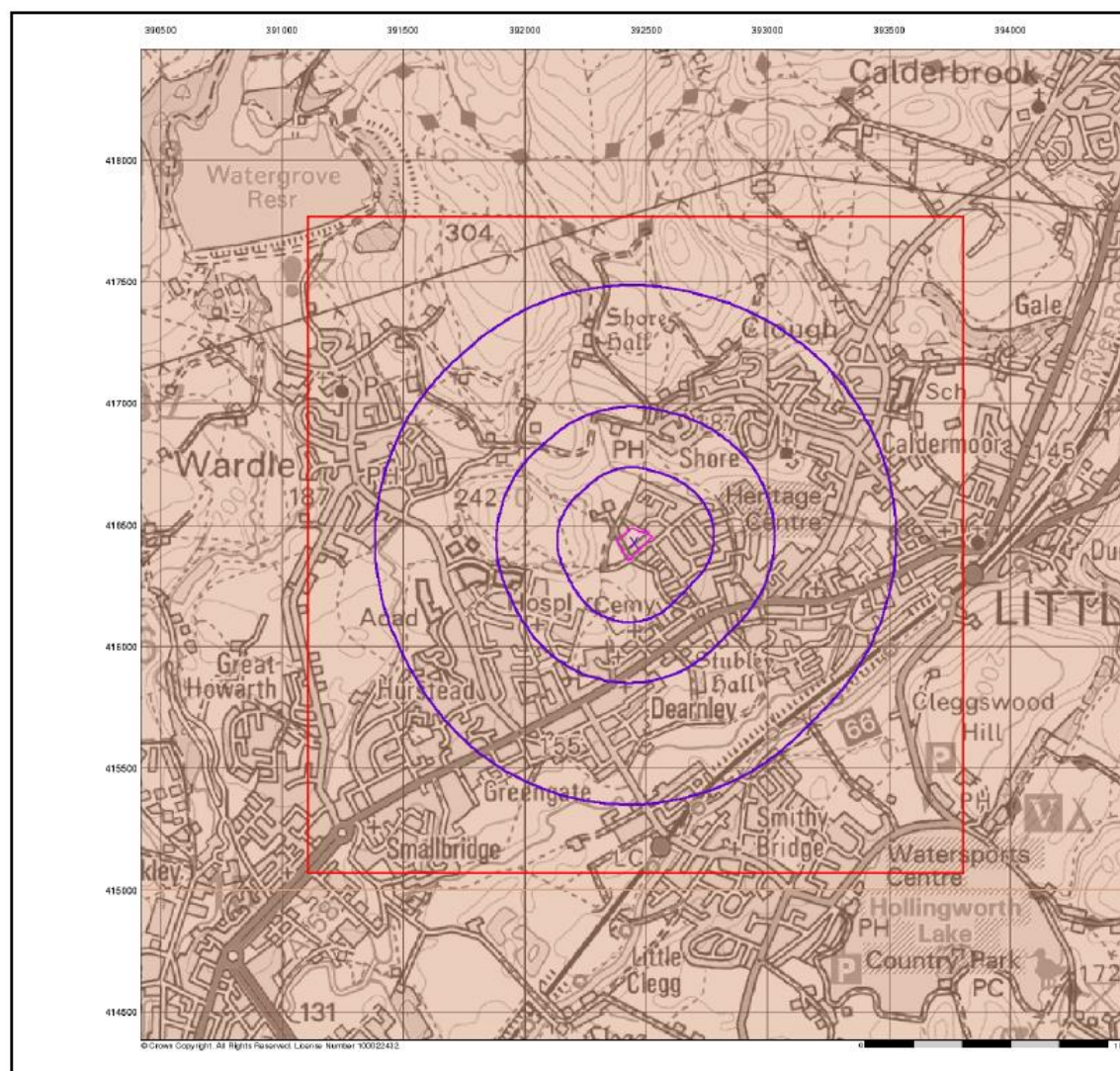
Order Number: 175479908_1_1
 Customer Ref: tjba-starning way-landmark-020818
 National Grid Reference: 392450, 416430
 Slice: A
 Site Area (Ha): 0.99
 Search Buffer (m): 1000

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Bedrock Aquifer Designation

General

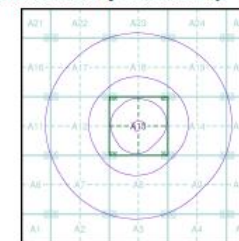
- Specified Site
- Specified Buffer(s)
- Bearing Reference Point
- Site
- Map ID

Agency and Hydrological

Geological Classes

- Principal Aquifer
- Secondary A Aquifer
- Secondary B Aquifer
- Secondary Undifferentiated
- Unproductive Strata
- Unknown
- Unknown (Lakes and Landslip)

Site Sensitivity Context Map - Slice A



Order Details

Order Number: 175479908_1_1
 Customer Ref: tjba-starning way-landmark-020818
 National Grid Reference: 392450, 416430
 Slice: A
 Site Area (Ha): 0.99
 Search Buffer (m): 1000

Site Details

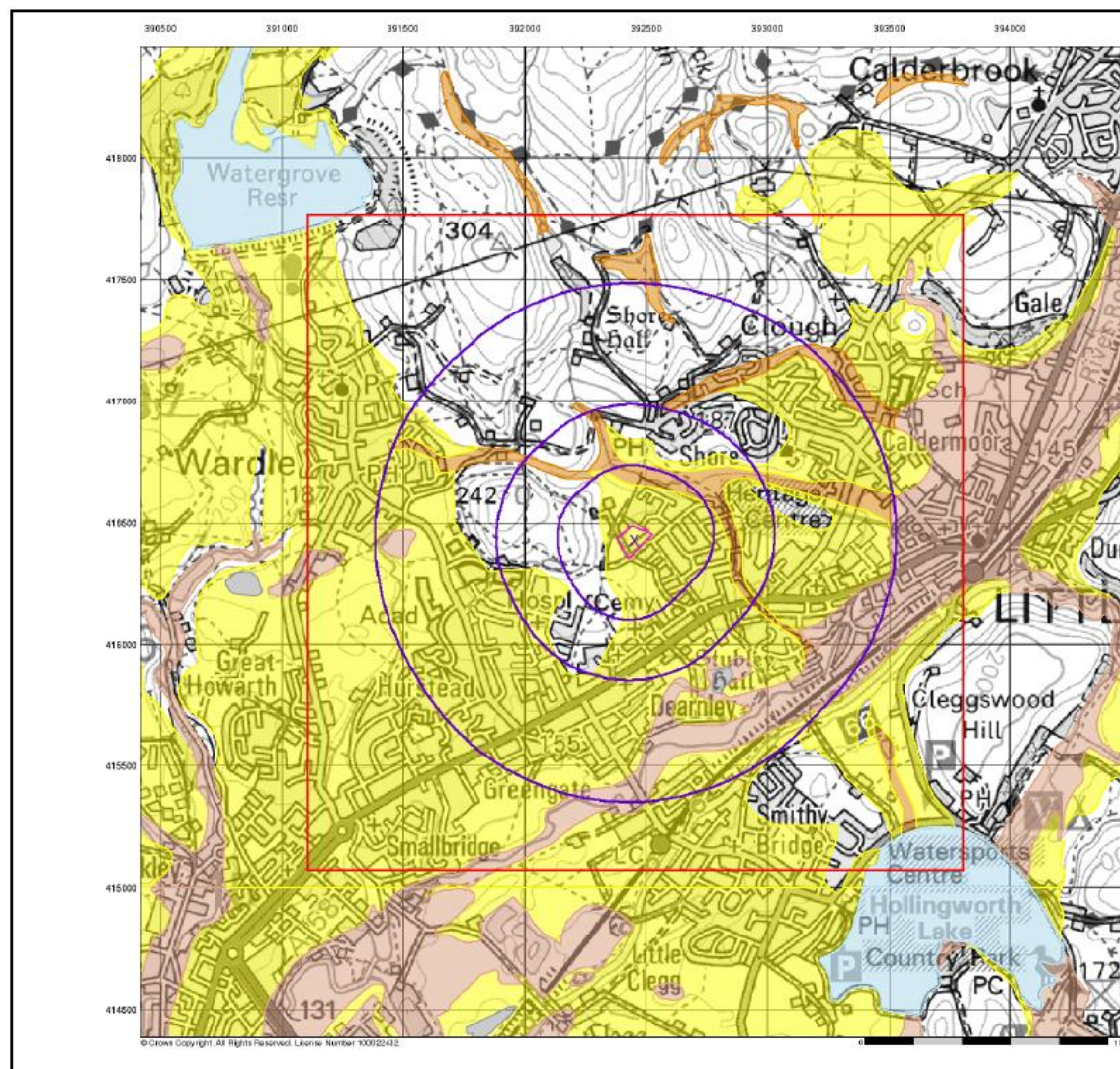
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Superficial Aquifer Designation

General

- Specified Site
- Specified Buffer(s)
- Bearing Reference Point
- Site
- Map ID

Agency and Hydrological

Geological Classes

- Principal Aquifer
- Secondary A Aquifer
- Secondary B Aquifer
- Secondary Undifferentiated
- Unproductive Strata
- Unknown
- Unknown (Lakes and Landslip)

Site Sensitivity Context Map - Slice A

Order Details

Order Number:	175479908_1_1
Customer Ref:	tjba-starming way-landmark-020818
National Grid Reference:	392450, 416430
Site:	A
Site Area (Ha):	0.99
Search Buffer (m):	1000

Site Details

Land at Starming Road., Littleborough, OL15 8LW

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