

Controlled Waters Risk Assessment

Sladen Mill, Littleborough



**SOIL AND
STRUCTURES**

Controlled Waters Risk Assessment

Sladen Mill, Littleborough

Report Status

Project Number	20403
Report Number	001
Revision	V01 – Issue for information
	V02 – Revised following Client comments
	V03 – Revised following peer review (see info-box below)
Date Issued	29 July 2024 (V01)
	05 August 2024 (V02)
	23 August 2024 (V03)

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Appendices Drawings > Laboratory Analysis Results > Regulatory Consultations (Environment Agency) > Other Correspondence > Heritage Note

Annexes Background Information

Peer review: To support continuity throughout regulatory approval process, this Report has been reviewed by Tim Booth of T J Booth Associates.

Printing: This Report is intended to be read electronically on a >20 inch monitor or printed landscape, as double-sided A3. Font sizes have been selected that means it should remain legible printed landscape, as double-side A4.

Units: Throughout this Report chemical concentrations or target concentrations are reported in: parts per million (ppm) milligrams per kilogram (mg/kg) for solids; and, parts per billion (ppb) micrograms per litre (ug/l) for liquids.

Appointment

Soil and Structures Ltd were instructed by Mere Development Group (*the Client*) in June 2024 to prepare a Controlled Waters Risk Assessment (*the Report*) to support the re-development of a parcel of land formerly occupied by Sladen Mill, Littleborough (*the Site*).

Development proposals include for construction of 25 no. dwellings and associated hardstanding, including access roads, and soft landscaping areas under reserved matters planning application ref. 21/00950/REM pursuant to outline permission ref. 15/0125/OUT.

Reliance on the advice presented herein rests solely with the Client.

Scope and Context

The Controlled Waters Risk Assessment (*this Report*) follows on from and builds on, previous ground-related reporting prepared by others for the Site and the proposed development.

This Report presents a revised assessment of risk presented to ‘Controlled Waters’ (*as defined by the Water Resources Act 1991*) that asks: Is the risk to identified Controlled Waters from identified sources of potentially polluting material pollution acceptably low? And, if not, how can the risk be reduced to acceptably low levels.

In support of this main objective, the Report also;

- > Addresses data gaps, clarifies key elements of the Site’s characterisation and presents updated ground and groundwater models for the Site – the ‘baseline’ condition; and,
- > Supports follow-on decision-making for the proposed development of the Site, advice on which is set out within Soil and Structure’s Remediation Strategy (report ref. 20403-R-002-V01) – the ‘endline’ condition.

The legal context of the advice presented within this Report relates to an assessment of:

- i) **The suitability of the Site for its proposed end use** that is rooted within national planning policy guidance (the National Planning Policy Framework) that is governed by planning law (various acts). The assessment of ‘suitability’ relates specifically to the potential hazard of pollution.

Advice in relation to the hazards of potentially harmful material (‘contamination’) or ground gases is excluded from this assessment but is carried across within the follow-on Remediation Strategy document.

This Report does not include advice in relation to other ground-related hazards, e.g. compressible material or slope stability, but notes that any remedial work need to be reconciled against the broader objectives and influences of all other groundwork activities.

Background to this Report

This Report is preceded by various existing ground-related reports prepared by others the findings of which are discussed within this Report. All available background data, including these reports, are annexed to this Report (included as a separate document available on request).

References

The Report has been written with reference to various sources of information. These are either appended or included as footnotes at the base of each respective page.

A glossary of abbreviations is provided within Section 10 of this Report.

1.0 The Site and Proposed Development

1.1 The Site

Location and size: The Site (the planning boundary) comprises a parcel of land approximately 1.30 ha in area located 175 m north of Halifax Road, Littleborough, Lancashire (Figure 1).

Access: The main body of the Site is accessed on foot and by vehicle via a fenced entrance in the south-eastern corner and the upper level of the Site openly accessible on foot and by vehicle midway down the eastern boundary.

Topography: is characterised by two distinct areas with general westerly and north-westerly fall in levels (within the Castle Brook valley): i) the 'main body' of the Site that lies between 165 and 174 mAO; and, ii) the 'upper level' that is present midway along the eastern boundary of the Site that lies between 176.5 and 177 mAO.

Utilities: Below ground utilities are expected to be present beneath the Site with evidence of overhead lines on Site.

Existing structures: At the point of issue various structures were noted on Site including: a masonry structure and electrical sub-station on the western edge of the Site; sandstone retaining walls in varied conditions along the eastern edge of the Site and locally to the bridge in the southern portion of the Site; and, localised areas of residual concrete hardstanding.

1.2 The Proposed Development

Development proposals: Development proposals (Figure 2) include for construction of 25 no. dwellings and associated hardstanding, including access roads, and soft landscaping areas.

① **Development works and risk:** An appreciation of the construction processes is essential for development-related risk assessments given the groundworks stand to meaningfully alter the level of risk, e.g. unstable slopes being removed by earthworks, or unsuitable material being exposed as part of the works.

To enable this development, the following groundworks are likely to be required, N.B. listing is outline only.

- > **Preparation:** at the point of inspection Site clearance and preparation appears to have been partially completed with remaining works including: demolition of the remaining structures (detailed above); and, removal of remaining hardstanding surfaces.
- > **Earthworks (cut and fill):** Are expected to be required to suit development levels with the existing Made Ground deposits not anticipated to be suitable for re-use as a general fill in its current condition.
- > **Utility Excavations:** Excavation of any drainage and other utility alignments.
- > **Foundations:** Subject to the selected foundation solution, construction of sub-structures (foundations).
- > **Surfacing:** Formation soft landscaping and hardstanding surfaces.

① **Risk profile of the proposed development for 'Controlled Waters' ¹:** The proposed development would see a former industrial site that has been subject to multiple uses (land associated with coal mining, a woollen mill, a cotton raising and finishing mill, and more recently the manufacture of uPVC products) converted to a residential use.

This change of use represents a shift from a land use with low sensitivity and high pollution potential (various industrial uses) to a high sensitivity and low pollution potential (residential). On this basis alone, the requirement for risk management (remedial works) would be anticipated with the requirement for this work and, where required outline nature and extent of this work, being the focus of this Report.

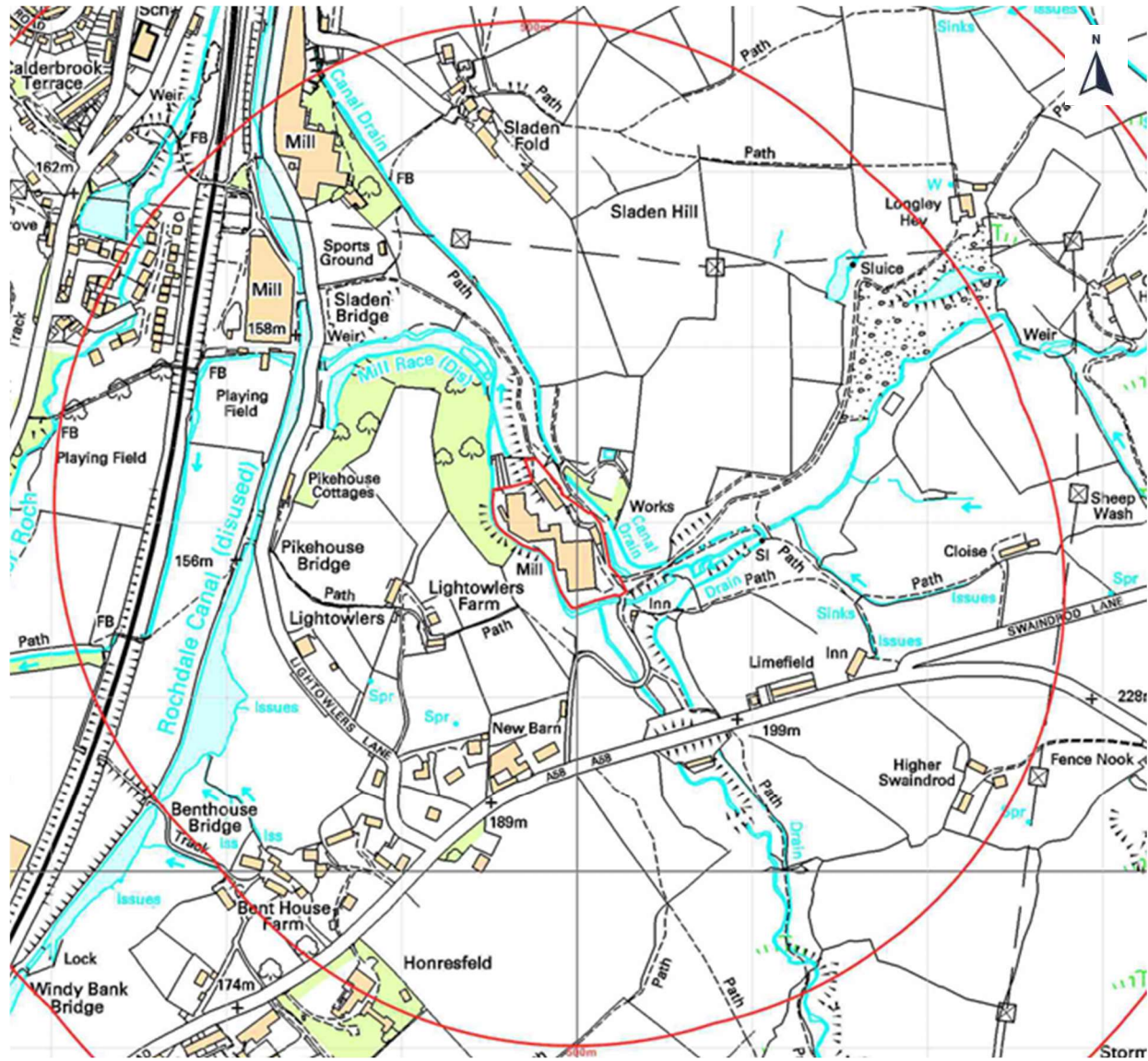


Figure 1: Location Plan

- > Site approximately centred on 394983 417383
- > Central red line = outline planning application boundary; outer red line = 500 m buffer

¹ [Water Resources Act 1991 \(legislation.gov.uk\)](#)

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Figure 2 – Development Plan
> Extract from appended drawing

2.0 Background to this Report

Previous ground-related reporting: This Report follows on from multiple phases of fieldwork and various ground-related reports prepared by Brownfield Solutions Ltd and T J Booth Associates (TJBA) Ltd between April 2015 and May 2024. This reporting was prepared in relation to the two planning applications (and related condition discharge applications); a reserved matters application ref. 21/00950/REM pursuant to outline permission ref. 15/0125/OUT.

Most recently, in response to Environment Agency consultation, TJBA prepared a report entitled; *“Hydrogeology and Potential Contaminant Transport”* dated May 2024 (Revision 0). In overview, this report included:

- > Analytical modelling (Remedial Targets Methodology) relating to the transport of two Poly- and Per-fluoroalkyl Substances (PFAS) present within the groundwater beneath the Site to two receptors; Castle Brook (bordering the Site) and the River Roch (1.5 km west of the Site).

Key assumptions of this model included: i) exclusion of groundwater as a ‘receptor’ identifying Castle Brook and the River Roch as the critical receptors; ii) defining the ‘source’ as the mean concentration of total PFAS (sum of PFOA and PFOS) within the centre of the Site; and, iii) use of the Drinking Water Inspectorate (DWI) threshold (0.1 µg/l) as the target concentration.

Key findings of the analytical modelling included: i) the target concentration was not exceeded in either receptor inferring that the risk presented to the identified receptors was acceptably low. Notwithstanding this, risk management was recommended as detailed in the bullet point below.

- > A recommendation that risk management (remedial works) was required to reduce the risk to Controlled Waters to acceptably low levels superseding earlier advice presented within their (TJBA) earlier reporting *“Phase 2 Site Investigation & Risk Assessment – Phase 3 Remediation Statement”* dated February 2024 (Revision 5) that no remedial works were required.

The recommended remedial action included the provision of a ‘low permeability’ layer as part of the clean capping layer (recommended separately to reduce the risk to human health) to limit the rate of infiltration (rainfall) through the Made Ground deposits on Site.

A more detailed summary of these earlier reports is not included here with readers of this Report expected to either be familiar with this reporting or else have copies available for review and cross-referencing.

Sufficiency of this background information and residual uncertainty: overall, these earlier reports were considered to have generally provided sufficient factual data to: i) inform an assessment of the risk to potential receptors; and/or, ii) inform risk management decisions whilst maintaining a precautionary approach.

In a consultation response dated 14 February 2024, the Environment Agency (EA) also confirmed this position stating:

“We {the EA} are stratified that sufficient information has been submitted to support part (i) of condition 5.” {Part (i) relating to the characterisation of the Site}

Some specific points of uncertainty, or further characterisation, were identified as discussed within Section 3.0 and 4.0.

Regulatory consultations – human health: whilst not directly relating to the scope of this Report, it is noted for completeness, that within a planning decision notice (condition approval) dated 15 December 2023, Rochdale Borough Council confirmed that Condition 5 (that relates to land quality) could not be discharged subject to the Environment Agency’s satisfaction that risks to Controlled Waters were either acceptably low or risk management measures, i.e. remedial works, were set out to ensure the risk would be acceptably low.

Regulatory consultations – Controlled Waters: to date, three formal consultations have been submitted by the Environment Agency on: 14 February 2024; 28 March 2024; and, 07 June 2024; copies of which are appended.

The most recent of these consultations ultimately concludes that the relevant planning condition (Condition 5) is not able to be fully discharged (*partial discharge granted on 14 February 2024*) owing to:

- > The conceptual site model presented not reflecting the revealed ground conditions or other environmental data that the Environment Agency have access to;
- > Only two chemicals of concern being modelled as part of the Remedial Targets Methodology assessment presented as part of TJBA report *“Hydrogeology and Potential Contaminant Transport”* dated May 2024;
- > Not all worksheets for the Remedial Targets Methodology being submitted;
- > The incorrect selection of a target concentration noting that the Annual Average Environmental Quality Standard of 0.00065 µg/l needed to be adopted;
- > The inappropriate use of averaged concentrations of PFOA and PFOS where maximum concentrations should be modelled; and,
- > A general remark that; *“We {the EA} continue to feel that the site will need the benefit of remediation”*.
- > Specific comments drawing attention to: i) the presence of visible presence of hydrocarbons within machine excavated trial pits in select locations across the Site; and, ii) the potential presence of precursor compounds (Fluoroteleimers).

Other groundworks activities: It is also noted that the engineering design has been developed in outline with detailed design completed for select elements, e.g. earth retaining structures along the edge of Castle Brook.

As noted within the Section 1.2, reference to these other aspects of the design is crucial for any environmental risk management works to be effectively integrated into the broader package of groundworks.

In addition to their ground-related reports, TJBA have also prepared several other supporting documents for the development that are relevant to the proposed remedial works. These documents include but are not limited to; a *“Foundation and Earthworks Strategy”* dated May 2023; an *“Archaeological Record & Written Scheme of Investigation”* dated May 2023; and, a *“Drainage Strategy”* dated May 2023.

3.0 Additional Investigation – Desk-Based Research

3.1 Desk-Based Research

A review of the existing commentary and additional desk-based research was completed in support of this Report the findings of which included:

- > **History - Sladen Mill v’s Sladen Wood Mill:** In the 1940s when textile manufacture was rapidly moving out of the UK mill owners looked to diversify to remain financially sustainable.

Within the Littleborough area, Sladen Wood Mill became a centre of excellence for research and development for new materials and finishes² as part of this move to diversify.

Key line of evidence: Despite sharing a similar name Sladen Wood Mill is located c. 700 m north-north-west of the Site (Figure 3) however, the presence of a canal drain between these two mills (and others within the region) does suggest a degree of connectivity. It is however noted that numerous other mills are present closer to Sladen Wood Mill that were known to have been used for the manufacture and application of plastic materials and finishes, e.g. Rock Nook Mill, that is known to have been owned and operated by a PTFE manufacturer (a PFAS compound)¹.

- > **History - Regional Context of Sladen Mill:** The Site was formerly occupied by Sladen Mill that was historically one of many mills located within the Summit and Littleborough region (Figure 3) involved in the manufacture or treatment of textiles³.

Key line of evidence: Sladen Mill (the Site) was later converted as a ‘cotton raising and finishing’ mill. Whilst the exact details of the processes involved are not known, ‘raising’ is a mechanical process and ‘finishing’ also likely to be a mechanical process in this setting given the wider context of numerous other mills within the wider area involved with the ‘fulling and dyeing’ of textiles (chemical dominated processes) that would have been already better set-up for the use of chemicals.

In a separate ‘Heritage Note’ (appended) Wardell Armstrong provided a more in-depth analysis of the Site’s former uses. Of specific note is: i) the adaption of the mil in the 1960s for both the manufacture of wool products together with ‘bleaching, dyeing, raising and finishing...’ over its final 20 years of operation as a mill; ii) the ownership of Wellfield Mill, further upstream of Castle Brook, by Charles Kershaw who also owned and operated Sladen Mill suggesting this was the Site where, for most of the mill’s operation, fabrics were sent for chemical treatment; iii) Sladen Wood Mill (and Rook Nook Mill), that was a confirmed Site of PFAS compound use, was owned and operated by Fothergill & Harvey, local competitors to Charles Kershaw; and, iv) based on the desk-based historical review completed as part of the Heritage Note, no evidence of PFAS use can be found for Sladen Mill.

Similarly, PFAS compounds generally came into use and production from the 1940s onwards in the UK after Sladen Mill had been diversified as a ‘cotton raising and finishing mill’.

- > **History – Former mill race:** A former mill race (Figure 3) traverses the Site in a south to north alignment and was likely in use as a source of process water (boiler water and general water) and potentially, earlier in the Mill’s use, as a direct power source.

² Major move to plastic kept firm in credit - Manchester Evening News

³ 1891 Cotton Mills in Littleborough - Graces Guide

- > **Geology – Discrepancy in the positioning of Site within the geological sequence:** The TJBA reporting positions the Site directly overlying the Woodhead Hill Rock (named sandstone unit).

This is consistent with both the 1921 geological mapping referenced in within the TJBA Coal Mining Risk Assessment (Figure 5) and the Coal Authority mapping records⁴ with the latter also suggesting the presence of a geological fault through the Site (given the abrupt end of coal seam outcrops north of the Site).

However, the most up-to-date British Geological Survey mapping at both 1:50,000 and 1:10,000 scales (Figure 4) indicate the Site lies higher up the geological sequence with the adits to the west of the Site apparently targeting the Upper Foot Coal and not the deeper Lower Foot Coal as suggested by the mapping records discussed above.

On the modern mapping (Figure 4) the fault is located further east of the Site with the Site geology characterised by undifferentiated Pennine Lower Coal Measures (which are typically a mudstone dominated sequence of rocks). This positioning of the Site is most clearly evidenced by the two outcrops of the Upper Foot Coal seam either side of the Site in Figure 3, a seam that, before being eroded away, would otherwise cross the Site following the south-westerly trending bedrock dip direction and angle (16 to 20 degrees).

The Lower Mountain Coal (also known as the Half Yard Coal⁵) and the Lower Foot Coal were both of extractable thickness and mined in the local area⁶.

Based on the rotary borehole record presented within the TJBA reporting, the existing reference material appears to be correct. On this basis, it is likely a geological fault bisects the Site (centrally in a north-to-south alignment) and that the Woodhead Hill Rock does underlie most of the Site (up to the fault’s alignment).

In the Author’s experience, the Coal Authority mapping records tend to be, though not always, more accurate than the British Geological Survey mapping with the former generally based on mining records that typically offer more detail within coalfield regions.

- > **Hydrogeology – Spring lines:** Contemporary Ordnance Survey mapping records the presence of numerous ‘spring’ points at higher elevations to the Site within the same geological unit. This phenomenon is anticipated within this catchment that is dominated by highly varied topography and interbedded layers of variably permeable sedimentary rocks resulting in multi-layered aquifers within the more permeable bands of rock (typically sandstone units).

- > **Geochemistry – Regional Context of the Site:** As noted previously, PFAS compounds were historically used within the local area with no direct evidence of their use on the Site itself.

Key line of evidence: PFAS was detected within groundwater at a concentration of 0.0589 µg/l in a borehole located around 1000 m south-east-east of the Site⁷ higher up within the local catchment and likely ‘up-gradient’ of the Site within the bedrock aquifer.

- > **Geochemistry – Chemical signature of PFAS compounds:** the ratio of PFOA to PFOS can be used as a basic means to profile the chemical signature of PFAS compounds that is often an effective tool to discern whether the source is an Aqueous Fire Fighting Foam (AFFF) or a material coating. AFFF typically has a greater ratio of PFOS to PFOA whereas material coatings typically have a greater ration of PFOA to PFOS.

⁴ Interactive Map Viewer | Coal Authority (bgs.ac.uk)

⁵ Todmorden Moor.pdf (wyorksgeologytrust.org)

⁶ Rochdale district, sheet 76, a brief explanation (bgs.ac.uk)

⁷ PFAS / constituencies and population | Flourish

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- Key line of evidence:** Analysis of the ratios for the existing PFAS dataset and the additional laboratory analysis completed as part of this Report confirmed a consistently greater ratio of PFOA to PFOS (as illustrated on the Ground Model in Section 5.0) indicating that the PFAS present on Site and within the water environment locally to the Site originates from a material coating source. This source links to the regional context of Site and the presence of various ‘fulling and dyeing’ mills within the local area, including Wellfield Mill upstream of the Site (alongside Castle Brook).
- > **Surface water quality – Roch (Source to Spodden):** Contemporary (2019) river quality⁸ data for the local catchment - Roch (source to Spodden) - confirms a ‘moderate’ ecological classification.
 - > **Termination depth of window sample boreholes:** The reason the window sample boreholes typically terminated within the Made Ground deposits was not stated but assumed likely due to practical refusal on a ‘hard’ surface, e.g. cobble sized material or larger, or bedrock. The base depth of the window sample boreholes is considered likely to represent a point at, or close to, the bedrock surface when compared against nearby machine excavated trial pit logs that did prove bedrock.
 - > **Groundwater sampling methodology:** Full details of the sampling methodology employed for obtaining groundwater samples was not stated but referenced to have been in line with current guidance⁹.

It was subsequently confirmed via email (copy appended) that the testing guidelines issued by the laboratory were followed (correct sampling media) with the sampling methodology confirmed in outline.
- Key area of uncertainty:** on sampling, the boreholes likely recharged slowly (if at all) due to the limited volume of water (and likely high proportion of sediments) above the base of each well. In each instance, this is expected to have resulted in positive bias within the analysis, i.e. samples likely representing quality within the well cavity itself (or its sediments) rather than the quality of groundwater locally to the monitoring well.
- > **Sampling rationale:** The rationale for selecting Perfluorooctanic Acid (PFOA) and Perfluorooctane Sulfonic Acid (PFOS) as markers for the broader family of PFAS compounds for both sampling and analytical modelling was not stated.

It is assumed that the PFOA and PFOS were selected as key markers due to their relatively higher mobility, compared to other PFAS compounds, and the fact they represent to key ‘dead end’ daughter products from the degradation of more complex, typically less mobile, PFAS compounds. It is noted that this sampling rationale was supported by, and continued through, the additional fieldworks presented as part of this Reporting.

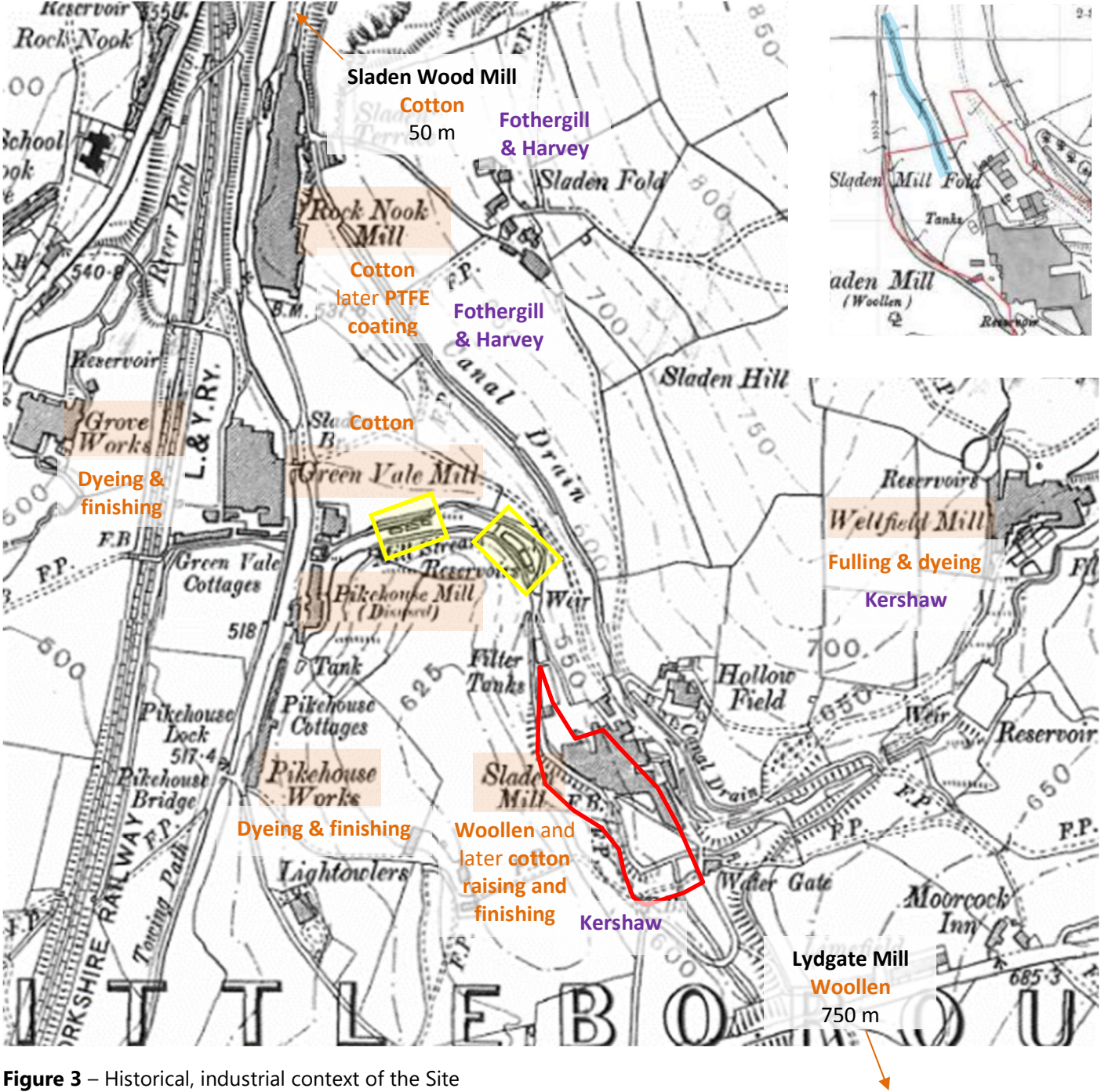


Figure 3 – Historical, industrial context of the Site
> Extract from appended mapping (1910 to 1911)
> Red line = approximate Site boundary
> Brown shaded boxes and text = most mills within the vicinity (1000 m) of the Site and their uses
> Purple text = Site ownership (where known; as presented with the appended Heritage Note)
> Yellow boxes = evidence of the watercourse having been modified to include additional downstream treatment of water remote from the upstream mills
> INSERT: Extract from the 1891 Ordnance Survey mapping with the former mill race highlighted blue

⁸ Ecology Map | The Rivers Trust
⁹ BS ISO 5667-11:2009 Water Quality. Sampling. Guidance On Sampling Of Groundwaters (British Standard)

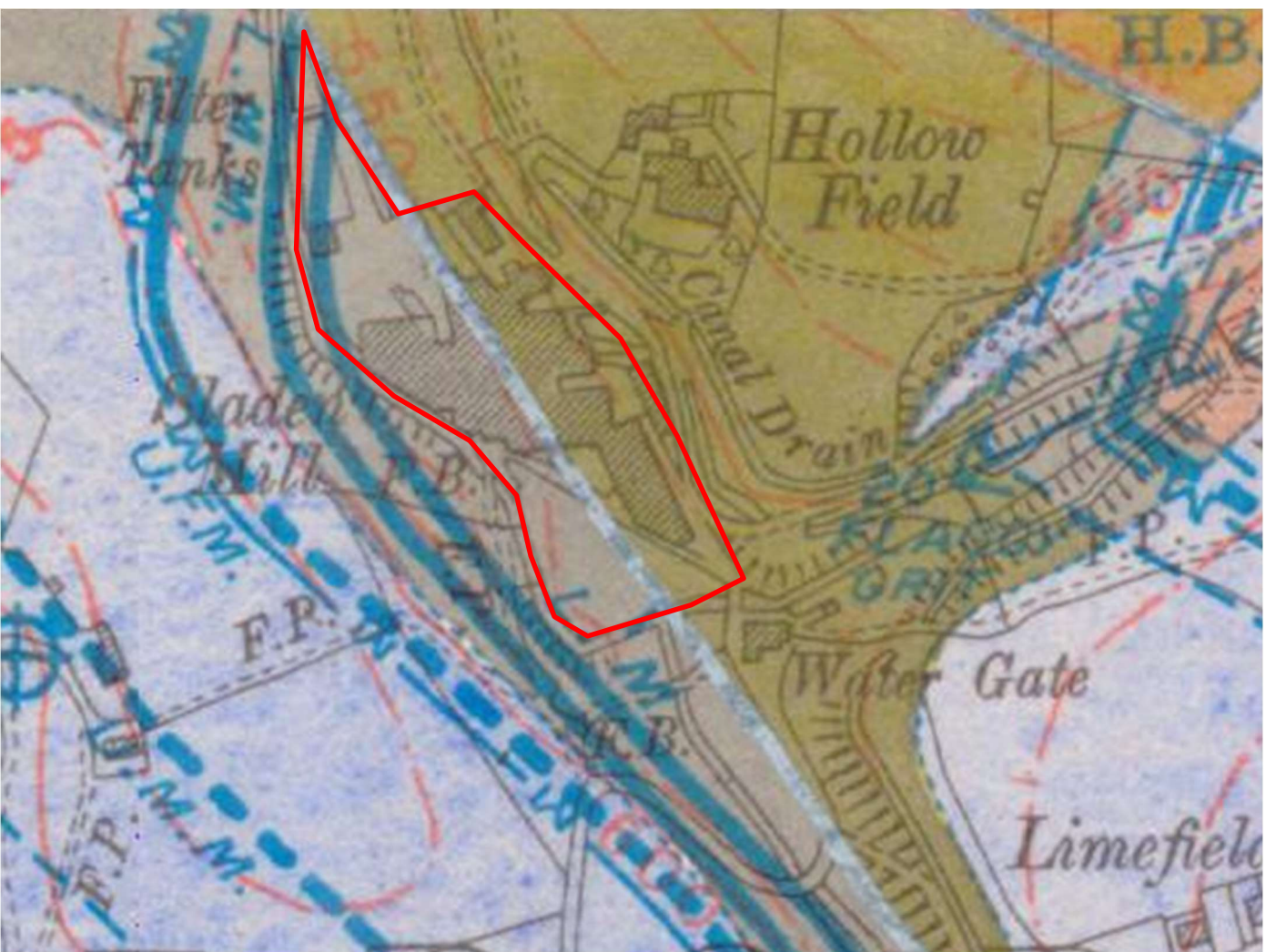
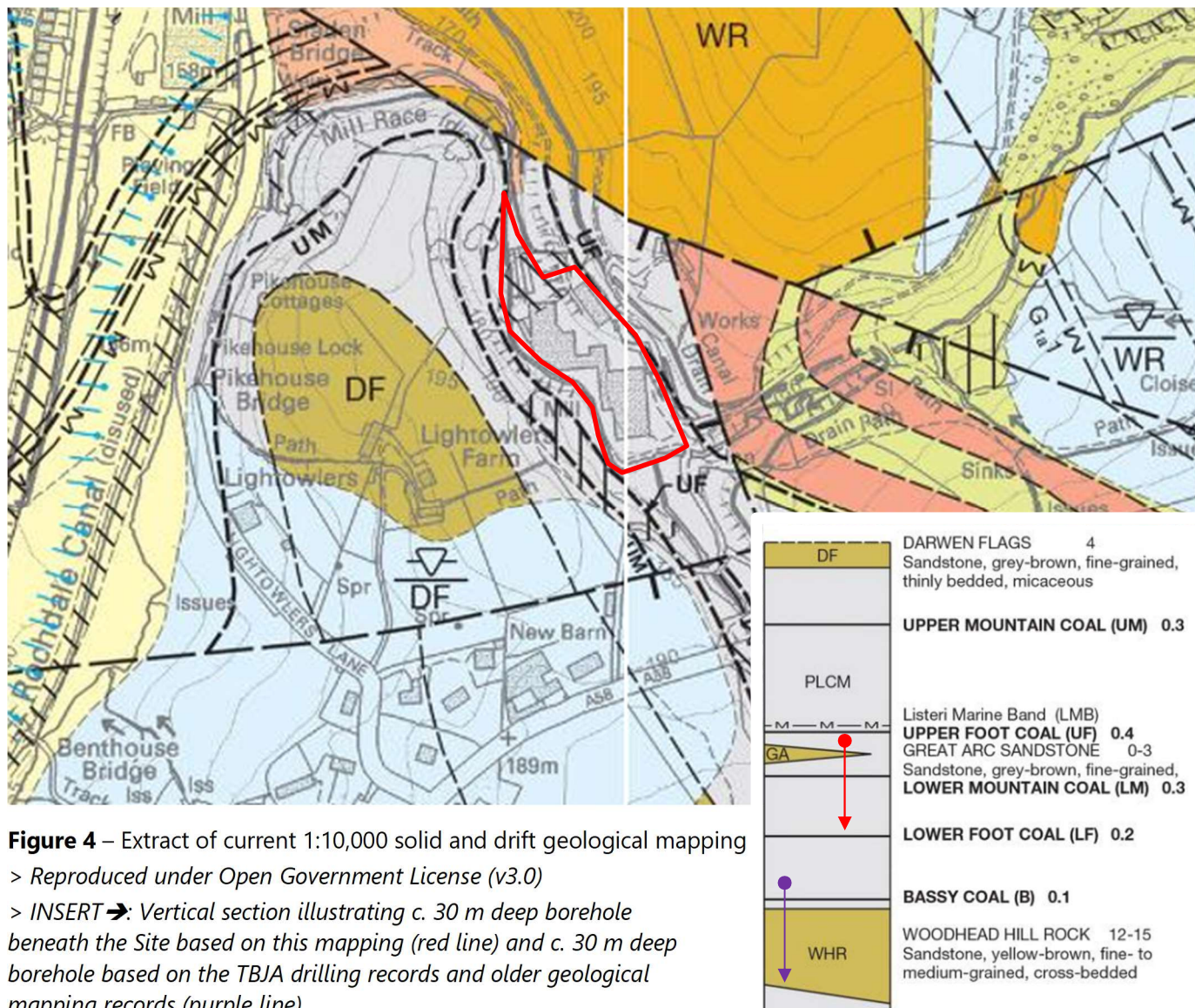


Figure 5 – 1921 1:10,560 solid geological mapping referenced within TBJA Coal Mining Risk Assessment
> Faint white line = fault alignment
> Note the difference in colour (geological units) against Figure 4
> Note the presentation of the Upper Foot coal seam (UFM – higher up the hillside) relative to the presentation within Figure 4 that suggests this was the seam the adits on the western bank of Castle Brook were targeting.

4.0 Additional Investigation – Walkover, Monitoring, Sampling and Laboratory Analysis

The additional fieldworks were completed over two visits; 05 June 2024 and 08 July 2024 the rational and findings of which are summarised in Table 2 with additional notes provided below.

As noted within Section 3.0, the scope of the additional fieldwork was developed following a review of the existing reports prepared for the Site (Figure 2) and to address ‘data gaps’, as necessary and discussed within Section 4.0.

4.1 Walkover

As well as general orientation of the Site and immediate surrounding area, the walkover was completed to investigate specific features.

- > **Former mill race:** An extended walkover, 50 m downstream of the Site along Castle Brook was conducted to assess what evidence, if any, of the historic mill race existed (Figure 3).

Reasoning: to assess the extent to which, if any, this feature was serving as a preferential pathway for either shallow groundwater flows or surface water. On former brownfield sites with heterogenous fill deposits such as those present on the Site, relic sub-structures and particular relic culverts or drains, commonly serve as both sumps and preferential flow paths for water, and any dissolved chemicals within it, as well as any free-product, e.g. hydrocarbons.

Whilst industrial features were noted, e.g. sandstone abutment / retaining wall on the western edge of the brook and, a relic metal (likely steel) pipe projecting from the eastern (Site-side) edge of the brook, no evidence of the former mill race outlet was noted (Photograph 5 & 6).

- > **Bedrock:** Whilst already noted within the TJBA reporting, the outcropping bedrock on the embankment face within the north-eastern portion of the Site was reinspected.

Reasoning: to further characterise the dip and interbedded nature of the sedimentary bedrock sequence beneath the Site given the structural geology of the bedrock will be having a guiding influence on both the movement of groundwater beneath the Site and within the wider catchment.

The bedrock was found to comprise a very thinly bedded fine-grained sandstone interbedded with rare thinly to thickly laminated siltstone and mudstone bands dipping at apparent angles of between 17 to 25 degrees (bed slippage likely exaggerating the upper limit) that is consistent with the recorded dip angles (Section 2.0).

Based on the nature and thickness of this sandstone dominated sequence of bedrock, this is considered likely to represent the outcrop of the Woodhead Hill Rock that further supports the structural geology set out within the TJBA reporting.

- > **Ephemeral springs:** Whilst already noted within the TJBA reporting, the presence of intermittent or ephemeral spring points were identified as key features of the Site’s groundwater regime.

Reasoning: to further characterise these water features that are considered likely to represent points at which the groundwater surface emerges ‘out of the ground’ (springs) that, together with the structural geology, will have a guiding influence on the groundwater regime across the Site.

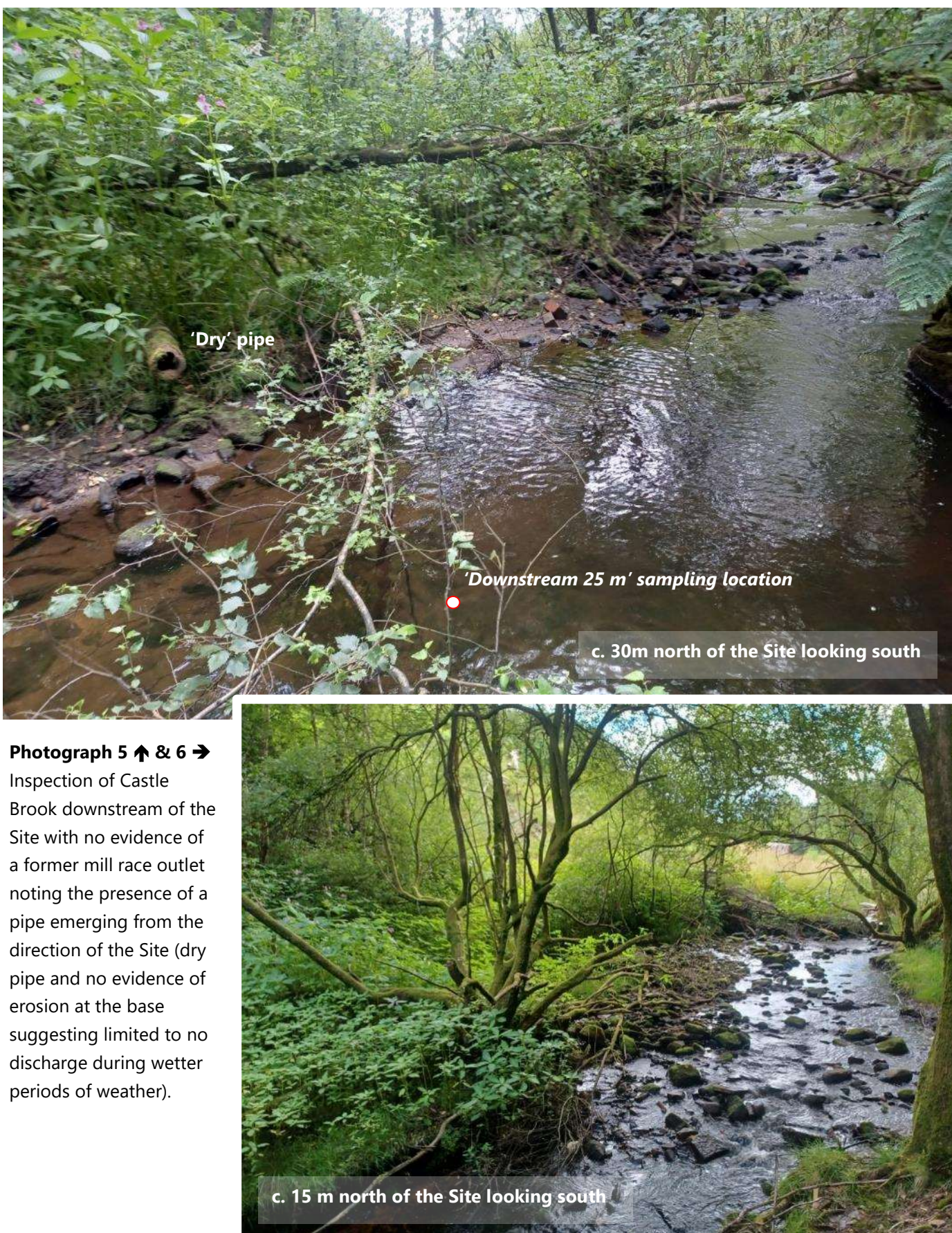
Inspection of the springs occurred on two occasions following both wet (05 June 2024) and dry (08 July 2024) spells in the local weather (48 hrs prior to visit) noting that water flow rates drop off markedly following periods of dry weather with continued flow only evident from one of the spring points (Photograph 3).



Photograph 1 ↑ & 2 → Inspection of the exposed outcrop of bedrock within the north-western portion of the Site.
> Sandstone dominated sequence of rocks



Photograph 3 ↑ & 4 → Inspection of the primary spring point (flowing in wet period – Photograph 3 – positive flow within informal channel; and a dry period – Photograph 4 – minor flows from engineered gap within the wall construction indicating this spring point has been present since the wall’s construction c. 1890s.



Photograph 5 ↑ & 6 → Inspection of Castle Brook downstream of the Site with no evidence of a former mill race outlet noting the presence of a pipe emerging from the direction of the Site (dry pipe and no evidence of erosion at the base suggesting limited to no discharge during wetter periods of weather).

4.2 Monitoring

To obtain a better understanding of groundwater trends across the Site, groundwater level monitoring within existing monitoring wells (boreholes that were locatable and accessible) was undertaken.

Monitoring was completed on two occasions: 05 June 2024; and, 08 July 2024 with the consolidated results (including earlier monitoring completed by TJBA) presented in Table 1.

Access: was possible to all areas of the Site where boreholes were drilled however, some borehole positions were not able to be located or had been destroyed and the emergence of pioneer vegetation over the two visits (despite having coordinates available) meant repeat monitoring of all standpipe locations was not possible.

Pollution control and cross-contamination prevention procedures: were employed during the works that included wiping down of the dip tape with a disposable wipe.

Revealed groundwater trends: The additional monitoring on Site confirmed the anticipated conditions with four key observations.

- > *Observation 1:* no staining or odour was noted on the dip tape within any of the exploratory holes monitored;
- > *Observation 2:* groundwater levels were generally recorded in line with those recorded as part of the previous fieldwork completed by TJBA.

Whilst river levels are only estimated based on projections from the topographical survey, there appears to be a general trend of:

- i) Seasonality with groundwater levels highs typically occurring in Autumn/Winter and groundwater lows typically occurring in Summer;
 - ii) Groundwater levels being higher than the brook across the southern two thirds of the Site and,
 - iii) Groundwater levels that rest close to the level of the brook across the northern third of the Site. This trend suggests that the surface watercourse (Castle Brook) is likely a gaining watercourse along most of its alignment as it passes the Site with possible losses or mixing with groundwater across the northern third of the Site;
- > *Observation 3:* on the second visit, following a dry period, groundwater levels were consistently lower across the Site indicating, as anticipated, that groundwater levels are likely very sensitive to rainfall events that can be described as ‘flashy’; and,
 - > *Observation 4:* Localised variance in groundwater levels, e.g. 3 m level difference between M3 and M5 that are c. 25 m apart, taken together with the findings of the machine excavated trial pits (typically advanced deeper than the monitoring boreholes with variable strikes) is indicative of ‘perched’ groundwater conditions whereby locally deeper, more granular Made Ground deposits are likely acting as ‘sumps’ for both rainwater, spring-water and potentially surface water (when the brook water flows into the groundwater beneath the Site) serving

Whilst the monitoring standpipes didn’t prove bedrock deposits categorically the base / refusal depths are typically consistent with the depths of fill within nearby machine excavated trial pits. It is however noted that fill depths of over 4.00 m were recorded in various areas of the Site (refer to Ground Model in Section 5.0).

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Table 1 – Consolidated Groundwater Level Monitoring Results

				22.08.23				18.10.2023				07.11.2023				05.06.2024				08.07.2024				Range in levels										
				Autumn				Autumn				Winter				Summer				Summer				Cell colours = seasons										
				Water level		Base of well		Water level		Base of well		Water level		Base of well		Water level		Base of well		Water level		Base of well		Water level										
				mbgl	mAOD	mbgl	mAOD	mbgl	mAOD	mbgl	mAOD	mbgl	mAOD	mbgl	mAOD	mbgl	mAOD	mbgl	mAOD	mbgl	mAOD	mbgl	mAOD	Low	High	Range								
M1	170.75	1.00 to 2.40	MG	0.40	170.35	2.80	167.95			0.05	170.70	2.80	167.95	0.70	170.05	1.05	169.70			0.70	0.05	0.65												
M2	168.50	1.00 to 3.00	MG	1.80	166.70	3.00	165.50			1.46	167.04	3.00	167.75									1.80	1.46	0.34										
M3	168.75	1.00 to 3.00	MG	1.54	167.21	3.00	165.75			1.80	166.95	3.00	165.75									2.55	166.20	3.00	165.75	2.65	166.10	3.00	165.75	2.65	1.54	1.11		
M4	167.50	1.00 to 2.70	MG	2.11	165.39	2.70	164.80			1.90	165.60	2.70	166.05									2.35	165.15	2.40	165.10			2.35	1.90	0.45				
M5	167.50	1.00 to 4.00	MG	2.66	164.84	4.00	163.50			4.00	163.50	2.50	165.00									3.40	164.10	2.66	164.84			3.40	164.10	2.66	2.50	0.16		
M6	167.50	1.00 to 4.00	MG	2.62	164.88	4.00	163.50			2.32	165.18	4.00	163.50									2.65	164.85	3.25	164.25			2.72	164.78	3.25	164.25	2.72	2.32	0.40
M7	176.75	1.00 to 2.80	MG into Nat	Dry		2.80	173.95			Dry	2.80	164.70								Dry	Dry													
M8	168.70	1.00 to 2.00	MG	1.57	167.13	2.00	166.70			Flood	2.00	174.75								1.57	0.00		1.57											
M9	172.75	1.00 to 2.40	MG				1.71			171.04	2.40	170.35								0.34	172.41		2.40	166.30	Dry	1.95	170.80	Dry	1.95	170.80	1.95	0.34	1.61	
M10	170.75	1.00 to 2.00	MG into Nat				0.65			170.10	3.00	167.75								0.59	170.16		2.00	170.75			Dry	1.05	169.70	0.65	Dry	0.65		
M11	168.65	0.40 to 1.40	MG into Nat				1.30			167.35	1.40	167.25								Dry	1.40		169.35	Dry			1.40	167.25	Dry	1.40	167.25	Dry	1.30	1.30
M12	178.25	1.00 to 4.00	MG into Nat				Dry				4.00	174.25								Dry	4.00		164.65					Dry		4.00	164.65	Dry		Dry
M13	176.50	1.00 to 4.00	MG into Nat				Dry				4.00	172.50								Dry	4.00		174.25					Dry		4.00	174.25	Dry		Dry
M14	165.00	1.00 to 4.00	MG				2.28			162.72	4.00	161.00								2.30	162.70		3.00	173.50										

Controlled Waters Risk Assessment

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4.3 Sampling

To obtain a better understanding of the chemical quality of the surface water course (Castle Brook) running along the length of the Site, a key Controlled Water receptor, repeat sampling from the existing sampling positions was conducted on; 05 June 2024.

Sampling was completed using PFAS suitable sampling media with samples held within cool boxes chilled to below 4 degrees centigrade.

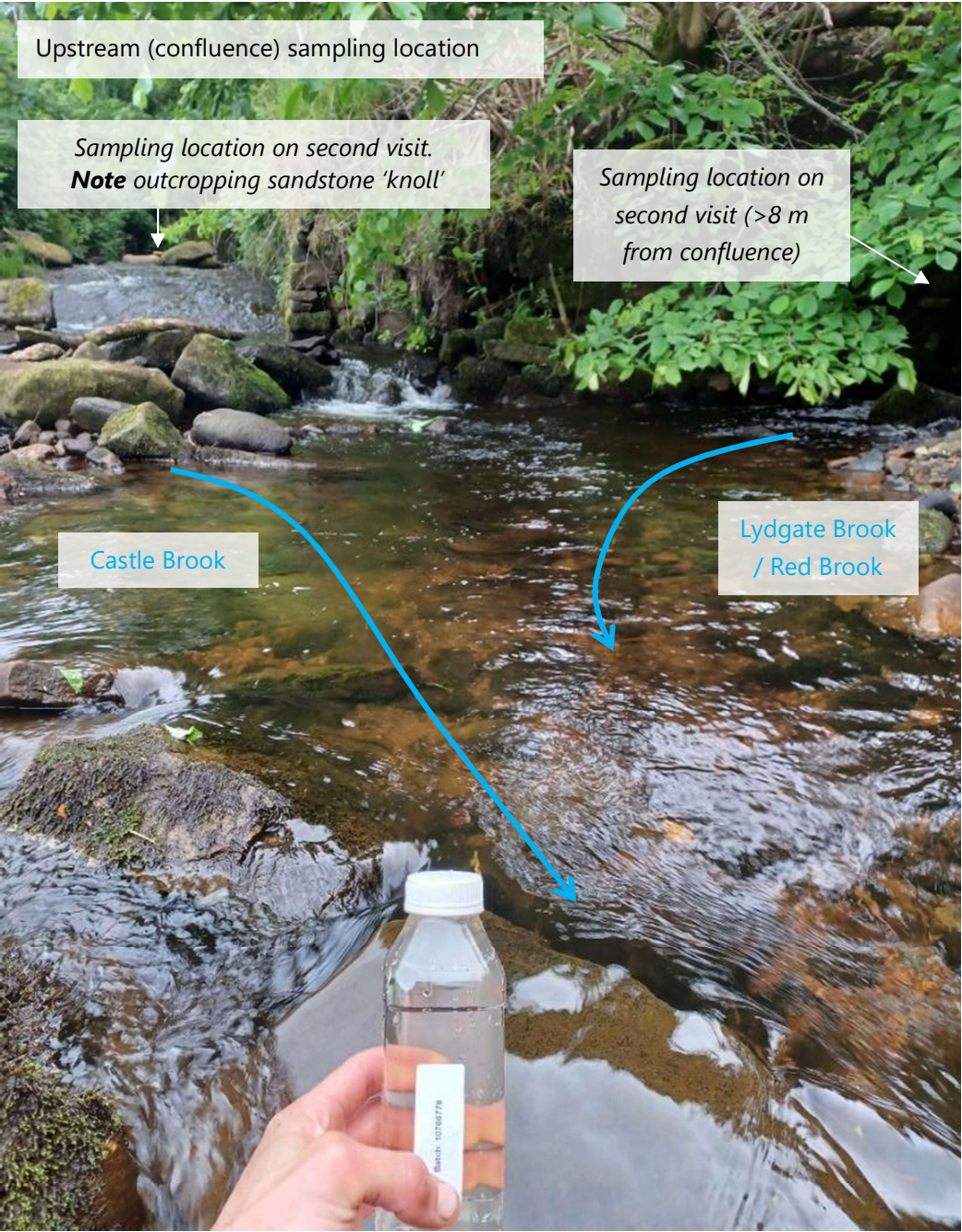
Following the initial visit and sampling, the presence of the spring points on the eastern edge of the Site were earmarked for sampling to better understand how the quality of the water emerging from these locations fed into the Site's surface water and groundwater regime.

A return sampling visit was completed on 08 July 2024 with additional sampling points selected within the local water network.

These additional sampling points included:

- i) Discrete locations > 8 m upstream from the confluence of Lydgate (or Red) Brook and Castle Brook to establish if and where there was a difference in the chemical quality across the two watercourses (*Note: TJBA reporting completed sampling upstream in Castle Brook*); and,
- ii) At least 25 m downstream of the Site (Photograph 5) to establish if surface water quality further downstream followed a similar trend to that expressed by the samples obtained at the upstream, midstream and downstream sampling locations.

Sampling from the midstream sampling location was excluded given two rounds of sampling and laboratory analysis at this location revealed a predictable and repeatable trend of PFAS concentrations remaining within the upstream and downstream concentrations.



Photograph 7 ←
Confluence sampling location with discrete sampling locations within each watercourse indicated.

4.4 Laboratory Analysis

Environmental samples (surface water and ‘spring water’) were obtained from the locations detailed within Section 4.3 and in Figure 6 overleaf.

Sample collection by a UKAS accredited laboratory was scheduled for the following morning (within 12 hrs) to limit the potential for sampling error, e.g. degradation of sample through microbial activity.

The samples were scheduled for the same suite of analysis adopted by TJBA within their existing monitoring programmes to support an assessment of temporal variation in the chemical concentrations.

First round of surface water sampling: The compounds selected for testing on the first round of monitoring included:

Sulphate as SO ₄	USEPA16 PAH	PFOS and PFOA
-----------------------------	-------------	---------------

Whilst the rationale for the selection of these compounds was not stated within earlier ground-related reporting, it is inferred that the selection was because:

- i) These compounds were markers of inorganic (sulphate), organic (PAHs) and emerging (PFAS) pollutants; and,
- ii) These compounds were recorded elevated against the respective threshold concentrations as part of the groundwater monitoring completed on the Site, i.e. there appears to be a ‘source’ of the respective compounds within the groundwater beneath the Site that stands to present an unacceptable risk to surface water (the receptor) for which monitoring of chemical quality is warranted.

Second round of surface water sampling and spring water sampling: The compounds selected for testing on the second round of sampling included:

PFOS and PFOA

Whilst not the only chemical of concern, PFOS and PFOA were selected for repeat sampling given:

- i) The comparatively elevated concentrations of these compounds recorded within groundwater beneath the Site (PFOA; 0.61 µg/l) relative to the Environment Agency’s stated target concentrations (Annual Average Environmental Quality Standard; 0.00065 µg/l);
- ii) The emerged trend of sulphate and PAH fate and transport with the comparatively high concentrations recorded within the groundwater beneath the Site (maximum concentrations of 473,000 µg/l and 0.09 µg/l for sulphate and benzo(a)pyrene {as a marker of PAHs} respectively) not appearing to be carried across into the surface water (maximum concentrations of 7,300 µg/l and <0.01 µg/l for sulphate and benzo(a)pyrene {as a marker of PAHs} respectively); and,
- iii) To allow temporal trends in this key chemical of concern to be better understood.

Sulphate was excluded from the testing schedule given concentrations on the first found of monitoring indicated a possible, marginal increase in concentration downstream but were in line with those concentrations recorded during earlier visits.

Similarly, PAHs were excluded from the testing schedule given non-detectable concentrations (Method Detection Limit of 0.01 µg/l) were recorded across all three sampling locations. Again, this was consistent with the findings of the earlier sampling completed by TJBA and therefore considered to offer a more representative impression of PAH concentrations within the surface water course.

Key findings from this additional laboratory analysis included:

- > A repeated trend of below detection levels of PAHs across the upstream, midstream and downstream samples;
- > A repeated trend of generally ‘stable’ concentrations of sulphate across the upstream, midstream and downstream samples;
- > A repeated trend of generally ‘stable’ concentrations of PFAS across the upstream, midstream and downstream samples during the first sampling visit (noting that previous reporting reported a decrease in concentrations whereas this additional sampling suggests a slight increase);
- > Markedly different concentrations of PFAS compounds within Castle Brook comparted to Lydgate Brook / Red Brook suggesting the former is more heavily impacted by PFAS compounds upstream of the Site;
- > A repeated trend of ‘background’ concentrations of PFAS within surface water upstream of the Site being up to 61 times higher than the Annual Average Environmental Quality Standard (0.00065 µg/l);
- > Markedly elevated concentrations of PFAS compounds within the spring water emerging on the eastern boundary of the Site (two times higher than the average concentration within the groundwater on Site); and,
- > A repeated trend of generally ‘stable’ concentrations of PFAS across the upstream, midstream and downstream samples during the second sampling visit noting concentrations of PFAS further downstream were recorded ten times higher than those passing the Site that, despite the lack of visible evidence, is suggestive of either a preferential pathway existing that is allowing the transport of PFAS compounds from the Site into the watercourse locally to this sampling point; and/or, an off-Site source resulting in this marked increase in PFAS concentrations that could include the spring water emerging on the eastern boundary of the Site where similar concentrations of PFAS were recorded.

These findings are presented within Figure 6 overleaf and represented on the Ground Model within Section 6.0.

Further commentary on these findings is included within the Risk Assessment (Section 6.0).

Controlled Waters Risk Assessment
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SOIL AND
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Sampling events >>>

		20 July 2023				05 June 2024				08 July 2024				Groundwater		
		PFOA	PFOS	Total	Ratio	PFOA	PFOS	Total	Ratio	PFOA	PFOS	Total	Ratio		PFOA	Total
Upstream (Castle Brook)	WS7	0.0291	0.0013	0.0304	4.47	-	-	-	-	0.044	0.00072	0.0447	1.64	Max	0.04	0.65
Upstream (Lydgate Brook / Red Brook)	-	-	-	-	-	-	-	-	-	0.0144	0.00081	0.0152	5.63	Mean	0.01	0.17
Upstream (Confluence)	WS6	0.0306	0.0013	0.0319	4.25	0.0327	0.00081	0.0335	2.48	-	-	-	-			
Midstream	WS5	0.0254	0.0013	0.0267	5.12	0.0346	0.00081	0.0354	2.34	-	-	-	-			
Downstream	WS4	0.0248	0.0013	0.0261	5.24	0.0359	0.00089	0.0368	2.48	0.0323	0.00075	0.0331	2.32			
Downstream (25 m)	-	-	-	-	-	-	-	-	-	0.364	0.00089	0.3649	0.24			
Spring	-	-	-	-	-	-	-	-	-	0.318	0.00177	0.3198	0.56			

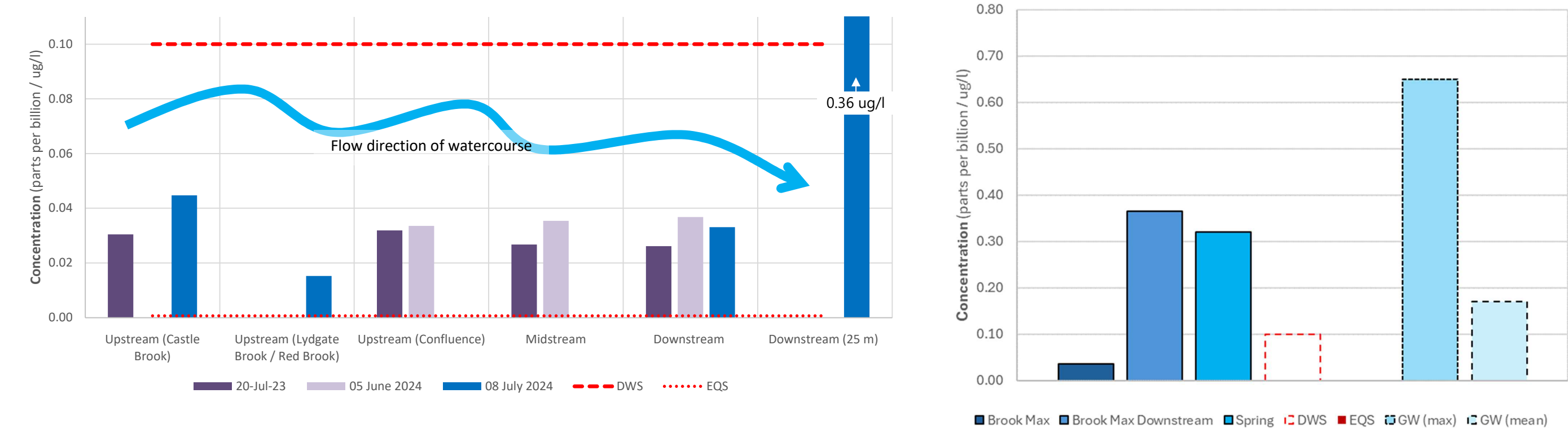


Figure 6 – Tabulated and graphical presentations of PFAS surface water monitoring data (and maximum and mean groundwater concentrations for comparison)
> Table: key 'maximum' concentrations highlighted light yellow
> Left hand graph illustrating spatial and temporal trends in surface water quality data compared against different 'standards'; right hand graph comparing maximum concentrations at key locations including in groundwater (GW)

Sladen Mill, Littleborough

Key

Depths to bedrock and bedrock types (mudstone, ms & sandstone, ss) mapped across exploratory hole positions and colour coded based on depth ranges of:

0 to 1.99 m = 'shallow'

1.99 to 2.99 m = 'moderate'

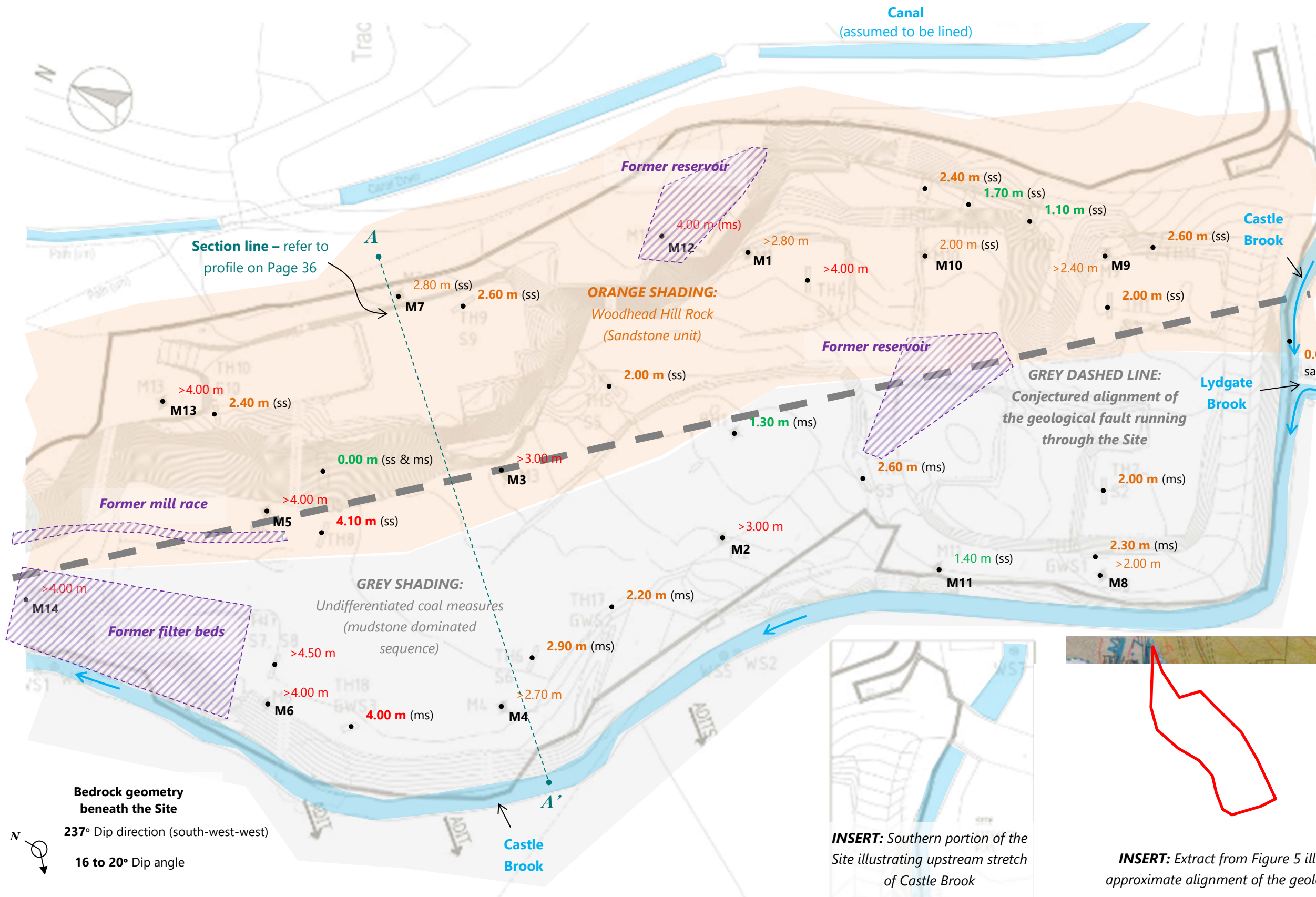
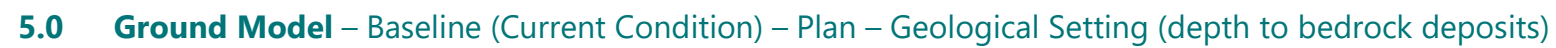
> 2.99 = 'deep'

Bold text = bedrock confirmed within hole
otherwise rockhead depth is tentative

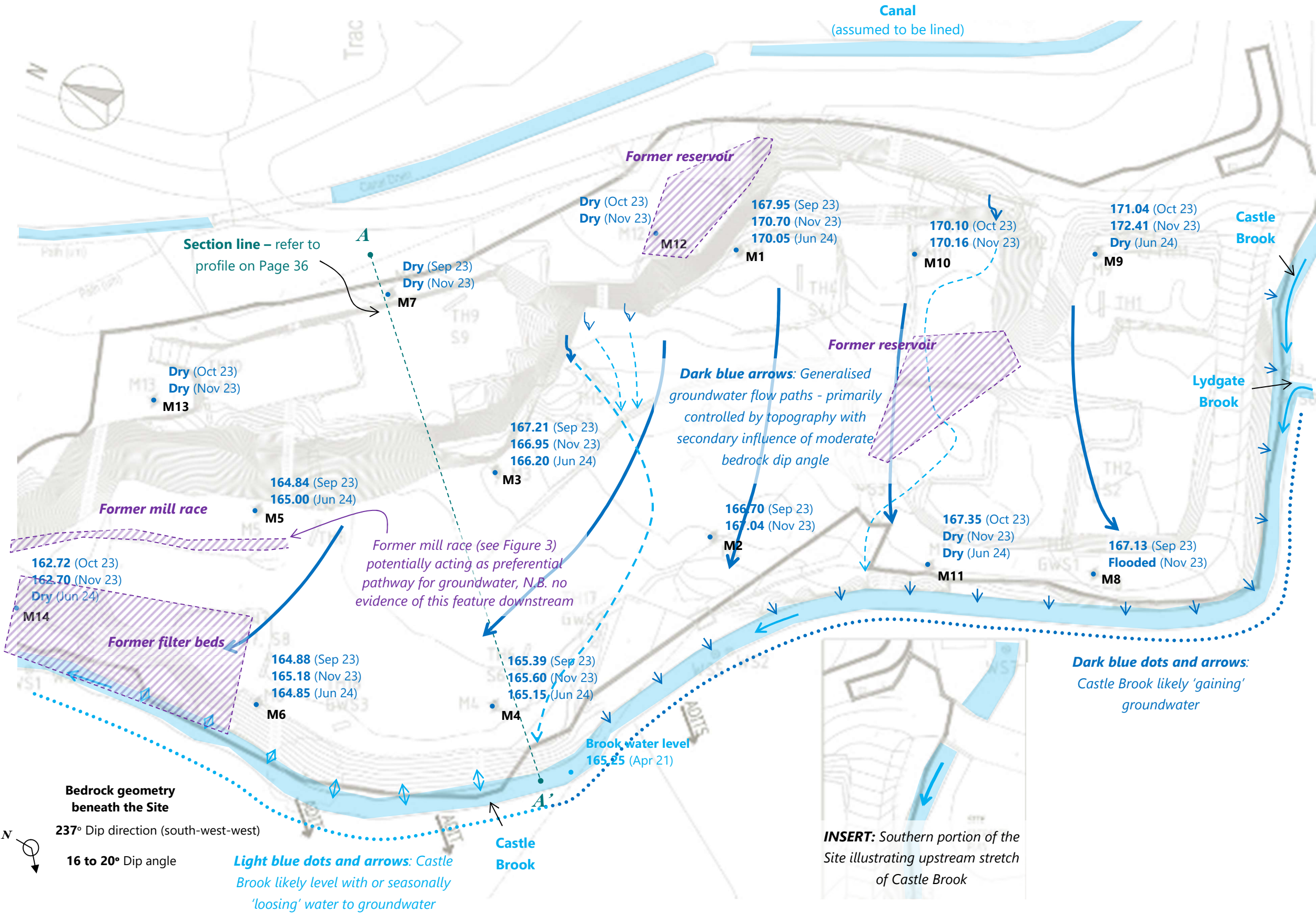
Purple = key sub-structures

Notes

1. The accuracy of the historic exploratory hole positions cannot be confirmed and should be taken as approximate (no coordinates supplied).
2. Drawing is indicative only – do not scale from drawing.



5.0 Ground Model – Baseline (Current Condition) – Plan – Hydrogeological and Hydrological Setting



Key

Groundwater related features illustrated in dark blue.

Surface water related features illustrated in light blue.

Seepage / spring points with bolder lines representing the more dominant / persistent flows (based on visual comparison across two most recent Site visits) and light blue dashed lines representing main flow paths across the Site.

Notes

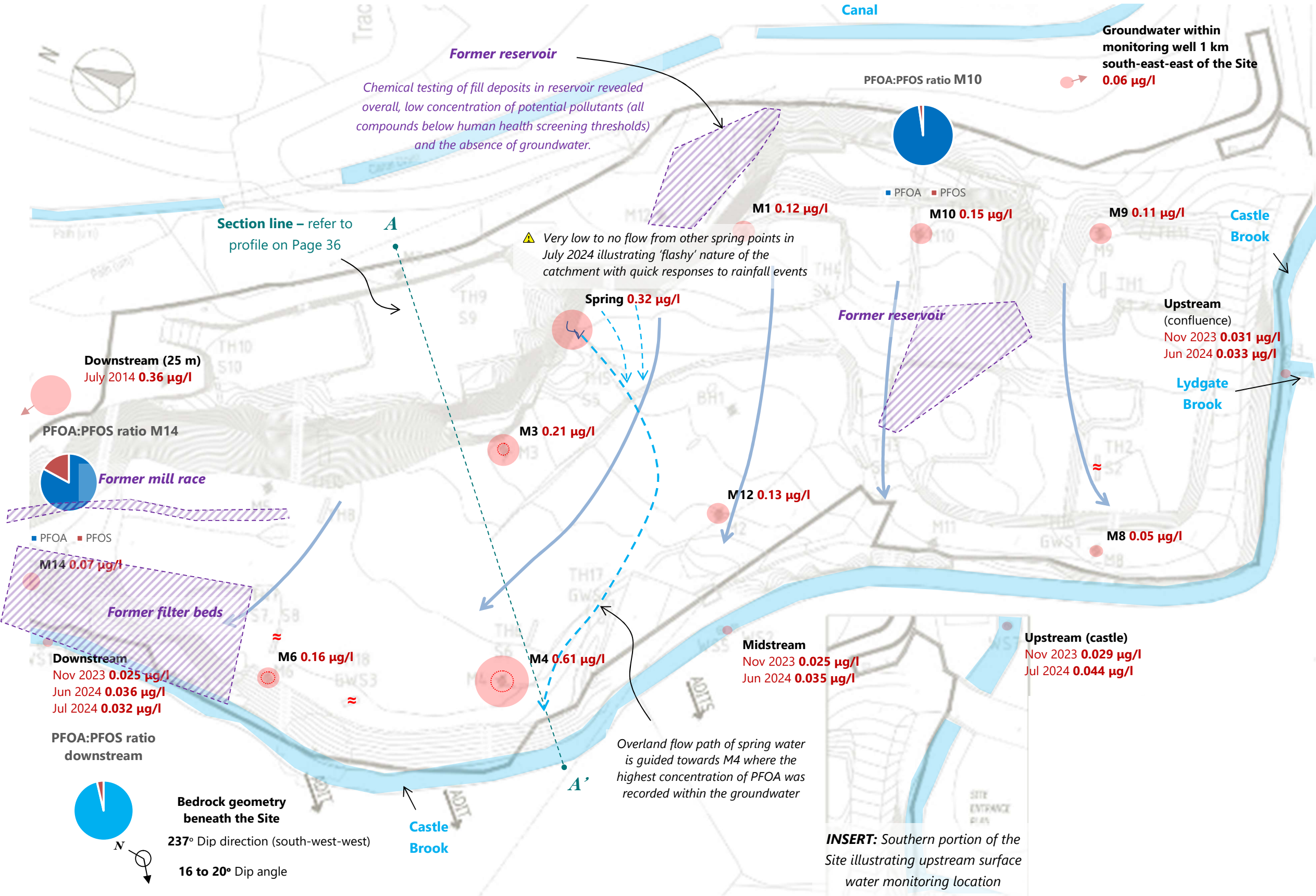
1. The accuracy of the historic exploratory hole positions cannot be confirmed and should be taken as approximate (no coordinates supplied).
2. Drawing is indicative only – do not scale from drawing.

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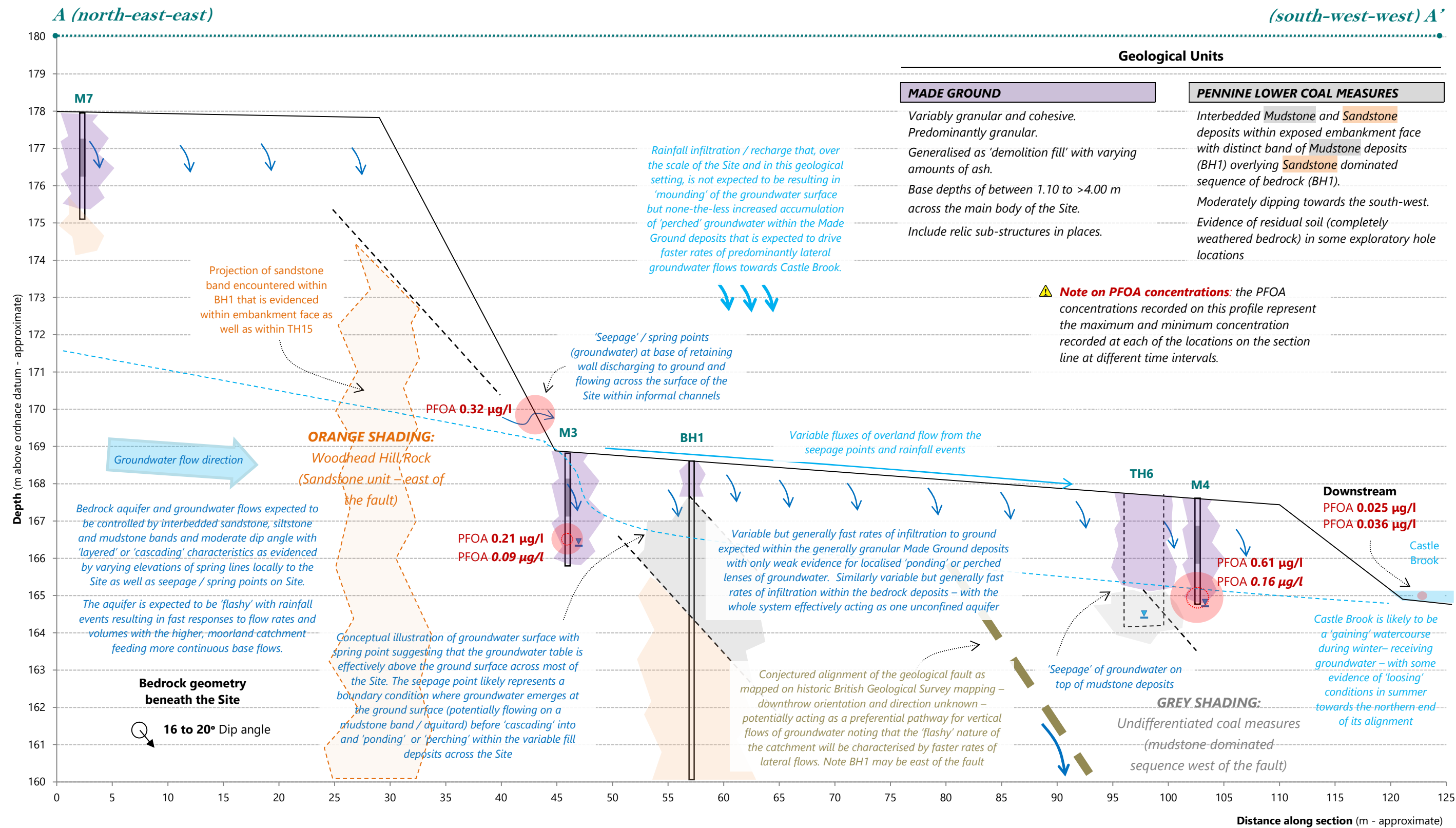
5.0 Ground Model – Baseline (Current Condition) – Plan – Spatial Distribution of PFOA Concentrations in Groundwater and Surface Water on Site and locally to the Site



- Key**
- Concentration 'bubbles' scaled compared to 0.1 µg/l (Drinking Water Inspectorate standard) for relative comparison and distribution of PFOA in groundwater and surface water. Maximum concentration reported and represented as shaded circle with minimum concentration illustrated by dashed line.
 - Average ratios of PFOA to PFOS (across all groundwater data) were 9.56% indicating the original source of PFAS is unlikely to be AFFF. Highest (M14) and lowest (M10) ratios illustrated on the plan.
 - Average ratios of PFOA to PFOS (across all surface water data) were 3.77 % indicating the surface water source of PFAS is unlikely to be AFFF with 'slightly lower' ratios to those found groundwater.
 - Evidence of NAPL encountered either as visual or olfactory marker (trial pits only)

- Notes**
- The accuracy of the historic exploratory hole positions cannot be confirmed and should be taken as approximate (no coordinates supplied).
 - Drawing is indicative only – do not scale from drawing.

5.0 Ground Model – Baseline (Current Condition) – Profile (aligned with dip direction of bedrock)



Illustrative / conceptual only – do not scale from drawing – note compressed horizontal axis that exaggerates dip angle

6.0 Controlled Waters Risk Assessment

① The Risk Management Process

Screening for hazards is first stage of risk management; establishing whether a hazard exists (that could present a risk). The scope of this Report focuses on one specific ‘historical’ hazard – potentially polluting material.

Once the hazard is identified, i.e. material has been encountered that presents a potential risk of pollution, the second stage of risk management starts; establishing if the risk presented is acceptably low or not and, if not, what action is required to either further assess the risk or reduce this risk to acceptably low levels.

This decision-making process based on the stages set out in current guidance¹⁰.

Lines of evidence are used across both stages to inform the assessment. These lines of evidence relate to both the Site itself, the inherent hazards in the ground, and the proposed development, i.e. how other groundworks affects risk.

Site investigation and characterisation is based on judgements being made relating to discrete data points (trial pits and boreholes commonly) across much larger site areas. It therefore follows that unexpected encounters can arise even where all available information (or evidence) indicate a hazard is not present.

6.1 General comments

The commentary presented within this section should be read in conjunction with the background information and reporting relating to the Site that includes more specific details, e.g. summaries of the chemical testing data as well as the original testing certificates.

6.2 Definition of potential ‘Sources’

Chemical testing of the Made Ground (and to a lesser extent underlying natural soils) deposits across the Site revealed:

- > A ‘chemical fingerprint’ that is broadly consistent with that anticipated on a former Victorian-era mill (combustion by-products; PAHs, sulphate and ash-derived trace elements) that was more recently redeveloped as a modern manufacturing centre of uPVC products for the construction sector (weathered oil-range hydrocarbons noting an absence of BTEX compounds).
- > A generally ‘less degraded than anticipated’ chemical profile with concentrations of inorganic and organic species ‘low’ in comparison to those typically encountered on former mill sites based on the Author’s experience and the trends in chemical testing data.

For example, the presence of disperse asbestos within the Made Ground soils guides risk to human health with the chemical quality of this material otherwise generally below screening thresholds for the proposed residential end use. Elaborating on this further; the maximum and mean (arithmetic) concentration of arsenic in the Made Ground soils across the Site was 94 mg/kg and 23 mg/kg respectively; similarly, the maximum and mean (arithmetic) concentration of benzo(a)pyrene was 53 mg/kg and 3 mg/kg respectively with suspected outliers in both chemical datasets.

Localised areas of suspected ‘free-product’ were identified as either visual (staining) or olfactory (odours) evidence of hydrocarbons. Chemical testing of soils and groundwater in these locations (that included a simple ‘grab’ sample of groundwater in TH18) is indicative of slightly more impacted soils compared to the Made Ground deposits more generally as well as a weathered oil source; possible hydraulic oil (heavy range aliphatic and aromatic hydrocarbons >C16).

Chemical testing of the groundwater across Site revealed:

- > The presence of various chemical compounds at ‘elevated’ concentrations to the extent that the groundwater across the Site could be described as ‘degraded’;
- > No discernible pattern to the chemical quality of the groundwater (noting the presence of the previously discussed ‘free-product’) that, based on the heterogeneous nature of the Made Ground deposits, is considered to represent an single source;
- > A ‘chemical fingerprint’ of these compounds that broadly consistent with that anticipated on a former Victorian-era mill (combustion by-products; PAHs, sulphate and ash-derived trace elements; and tars; phenols). Notwithstanding this, there is only a weak, qualitative correlation between the ‘soil source’ and the ‘groundwater source’ with only an apparent correlation between ‘high’ concentrations of sulphate across both media.

Simple examples of this difference in chemical compositions include: i) a maximum concentration of phenol within the soils of 0.7 mg/kg compared against a max and mean (arithmetic) concentrations within groundwater of 100 µg/l and 87.1 µg/l respectively; and, ii) a maximum concentration of hexavalent chromium within the soils of <0.50 mg/kg compared against a max and mean (arithmetic) concentration within groundwater of 10 µg/l and 6.3 µg/l respectively.

- > The presence of PFAS compounds within the groundwater that, of itself, is inconsistent with the historical lines of evidence for the Site’s use. More specifically, there is no historical evidence indicating that PFAS compounds were used on Site with the historic fires (1901 and 1926) occurring prior to the commercial use of PFAS compounds within fire-fighting foam (1964¹¹).

The only identifiable use of PFAS compounds on Site would likely come in the form of additives to hydraulic oils that would have been used as part of the Site’s more recent use as a uPVC product manufacturer.

Furthermore, ratio analysis (PFOA to PFOS) also confirms the PFAS compounds are unlikely to be associated with Aqueous Film Forming Foam (AFFF) used in fire suppressants.

Related to the point above, there is no evidence to indicate that uPVC was synthesized on the Site (from the more toxic and potentially polluting vinyl chloride) but rather Alderbergh Ltd involved with the manufacture (shaping and moulding) of uPVC products.

¹⁰ Environment Agency’s Land Contamination Risk Management (2020).

¹¹ Ross, I., Hurst, J., 2019. Managing Risks and Liabilities associated with Per- and Polyfluoroalkyl Substances (PFASs). CL:AIRE Technical Bulletin TB19. CL:AIRE, London, UK.

Chemical testing of the spring water revealed:

- > The presence of PFAS compounds within the spring water at comparatively ‘high’ concentrations relative to both the Site (two times higher than the mean concentration) and surface water (ten times higher than the concentrations within the surface water course; noting the ‘downstream 25 m’ outlier further commentary on which is detailed within Section 6.4) that, of itself, is indicative of an off-Site source of PFAS owing to: i) the ‘flashy’ nature of the groundwater regime locally; ii) the shallow presentation of bedrock west of this spring point (borehole M12); and, iii) lack of evidence of industrial land use across this upper portion of the Site.

Summary: Based on these chemical profiles (across all soils and waters tested) and supporting lines of evidence it is concluded that:

- > Owing to the weak, qualitative correlation between the soil and groundwater quality datasets, it is plausible that either; i) the soil source represents a markedly diminished source of potentially polluting material that has been ‘washed through’ (leached out) through successive cycles of rainfall since the Site has been left disused; and/or, ii) the groundwater quality is reflective of ‘background’ levels locally to the Site with the groundwater across the Site being continuously recharged by the springs (to varying degrees) present along the eastern border of the Site.
- > Related to the point above and supportive of the second assessment, the presence of markedly elevated concentrations of PFAS within the spring water on the eastern boundary of the Site and lack of historical precedent for the use of PFAS compounds on the Site itself, is indicative of an off-Site source of PFAS. This is further supported by the low concentrations of other chemical compounds within the Made Ground deposits of the former reservoir located on the upper level of the Site (borehole M12).
- > Taken together, the Site’s soils and groundwater are identified as sources of potentially polluting material however, they also represent diminished sources or potentially polluting material with respect to both: i) the passage of time; and, ii) the fact they are being discharged into by spring water that, for PFAS compounds at least, represents a more significant source of potentially polluting material; and one that is located off-Site.

With respect to the latter point, the soils and groundwater across the Site are therefore also identified as ‘receptors’ that are confirmed as being impacted by PFAS compounds.

Whilst only marginally elevated relative to soil and groundwater concentrations across the Site more generally, the presence of potential ‘free product’ locally to TH2, TH7 and TH18 are identified as specific sources of potentially polluting material.

6.3 Definition of potential ‘Pathways’

The surface water regime across the Site is characterised by:

- i) The locally steep topography resulting in generally ‘flashy’ conditions dominating, i.e. heavy rainfall leading to high fluxes (rates and volumes) of surface water run-off;
- ii) The presence of a variably but generally permeable surface cover at the point of issue resulting in a tendency for rainfall landing on the Site to discharge direct to ground – recharging groundwater;
- iii) The presence of spring points along the eastern boundary of the Site that both discharge to ground and, under periods of heavy rainfall, result in overland flows across informal channels towards Castle Brook on the western edge of the Site.

The ground water regime across the Site is characterised by:

- i) Similar characteristics to the surface water regime with the moderate and westerly dipping bedrock further supporting ‘flashy’ conditions dominating within the catchment evidenced by the marked change in flow rates from the springs on the eastern boundary of the Site;
- ii) Recharge of the groundwater on Site being both spring and rainfall fed with the former dominating outside periods of rainfall;
- iii) Groundwater levels that are suggestive of a ‘gaining’ watercourse (Castle Brook) across the southern two thirds of the Site (feeding base flow of Castle Brook) and a ‘neutral’ or possible losing watercourse across the northern third of the Site (water ‘lost’ from Castle Brook into groundwater).
- iv) Through this ‘flashy’ characteristic, a tendency for lateral migration to dominate fed by surges in groundwater levels locally to the Site;
- v) The presence of heterogenous Made Ground deposits into which rainfall and spring water will percolate and collect leading to both the temporary storage of water within the ground, potentially above the groundwater table (perched groundwater) and discrete flow paths that, where present, are likely to have fast rates of flow within them more likely reflective of surface water rates, i.e. flow rates (permeability) potentially around 0.1 m/s, contrasting against areas of more clayey Made Ground and weathered mudstone deposits (across the western portion of the Site) within which rates are expected to be around 10⁻⁶ m/s but potentially less;
- vi) The presence of both a massive sandstone unit (likely the Woodhead Hill Rock) and possible fault zone either of which represent more preferential pathways for the vertical migration of water and any associated chemical compounds. It is noted that the moderately dipping bedrock and spring fed recharge of the Site are likely resulting in a greater rate of lateral groundwater movement relative to vertical groundwater movement.

6.4 Definition of potential ‘Receptors’

The Controlled Water receptors identified include:

- > Castle Brook (surface watercourse) immediately west of the Site – *a watercourse for which the environmental quality is unknown but lying within a currently rurally dominated catchment noting the historical presence of various mills upstream of the Site (including along Lydgate Brook);*
- > The bedrock aquifer beneath the Site (including perched water above the water table) – likely with high vulnerability (sandstone dominated bedrock) with Secondary A classification, lack of Source Protection Zones or other recorded potable abstractions within 1 km of the Site; and,
- > The perched water across the Site (above the water table) – *not classified. As discussed previously within Section 6.2.*
- > Soils across the Site – *as discussed previously within Section 6.2.*

For completeness, Castle Brook is a tributary of the River Roch that represents an indirect receptor and similarly, human health is noted as potential receptor albeit carried through within Soil and Structure’s Remediation Strategy ref. 20403-R-002-V01.

6.5 Assessment of risk

Nationally, the Site is located within an area of the UK where the chemical treatment of fabrics using PTFE and other PFAS compounds developed with Sladen Wood Mill within Littleborough itself a research and development hub for PTFE and PFAS related finishes to fabrics.

Regionally, the Littleborough area included a high concentration of mills and other facilities involved with the dying and finishing of fabrics including mills higher within the water catchment, i.e. Wellfield Mill. Sladen Mill itself was ultimately repurposed as a "cotton raising and fulling mill", a mechanically dominated process, prior to the commercial use of PFAS within the UK textile market noting bleaching and dying was completed at Sladen Mill over a short period of time (c. 1960s to 1980s). Locally, various mills were recorded as "finishing and dying mills" before and after this date and the diversification of Sladen Mill.

Whilst two key Controlled Water receptors are identified for the Site; the bedrock aquifer and Castle Brook immediately to the west of the site, the identification of the soils and groundwater on the Site itself as potential receptors is guiding in the assessment of risk to Controlled Waters.

More specifically, there is direct evidence of both these on-Site receptors being impacted by PFAS from sources outside of the Site boundary and, with specific reference to the spring emerging on the Eastern boundary of the Site, impacted by PFAS at concentrations around two times higher (PFOA = 0.32 µg/l) than the mean concentration of PFAS within groundwater on the Site (PFOA = 0.17 µg/l).

Therefore, the soils and groundwater beneath the Site have been, and continuing to be adversely impacted by PFAS transported onto Site from sources off the site.

It follows that any risk mitigation works in relation to PFAS on the Site stand to have limited efficacy when the primary source is beyond both the control and responsibility of the Site owner.

Notwithstanding this pollutant-linkage, the soils and groundwater beneath the Site having been impacted by PFAS (and other chemicals) and therefore continue to represent sources of potentially polluting material albeit, with respect to PFAS – the main chemical of concern, to a lower extent than off-Site sources. Furthermore, whilst the investigation and assessment of possible off-Site sources is suggested, it is not considered cost-effective when compared against proactive risk reduction measures that can be implemented on Site for the betterment of water quality both on the Site itself and Controlled Waters more broadly.

In their latest consultation response, the Environment Agency advised the adoption of the Annual Average Environmental Quality Standard as a threshold for PFOS (assuming this implies a threshold of 0.00065 µg/l for individual PFAS compounds and not cumulatively). Whilst this threshold may be suitable for 'clean' freshwater receptors where fishing is occurring, PFAS concentrations are 68 times this limit upstream of the Site within surface water and 489 times this limit within groundwater emerging from the spring on the eastern boundary of the Site. This further supports the adoption of remedial action on an 'in-principle' basis that can demonstrate risk reduction to both the Site itself and Controlled Waters more broadly.

Therefore, whilst able to be measured and validated, the recommended risk mitigation measures do not set out to achieve specific remedial targets, e.g. a certain concentration of PFOA in water.

For completeness, with due consideration of the elevated concentrations of PFAS within the spring water, threshold concentrations could, in principle, be set at 0.3 ug/l based on this being a recorded concentration flowing onto the Site. At this level, there would be a single exceedance of PFAS within groundwater (borehole M4) that itself is likely

due to the accumulation of PFAS impacted groundwater flows from the spring source with this borehole position being located 'downstream' of the informal channels of spring water flow.

Taken together, there are multiple lines of direct and indirect evidence indicating that the Site's soil and groundwater has been degraded by its historical, industrial uses however, with specific reference to PFAS, the Site is both: located within an area where PFAS is present in surface water and groundwater at concentrations orders of magnitude higher than the freshwater EQS; and, represents a receptor itself, receiving high concentrations of PFAS from at least one of the springs on the Eastern boundary of the site.

6.6 Risk assessment conclusion

Based on this assessment, the risk presented to Controlled Waters from sources identified on the Site is assessed as **moderate** to **low** with the moderate classification acknowledging that:

- > Residual uncertainty remains, e.g. sampling protocols for groundwater, but not to the extent that meaningful conclusions can't be drawn in relation to Controlled Waters risk management.
- > In having been impacted by PFAS compounds emerging from the spring, the Site's soils and groundwater have themselves become 'sources' of PFAS compounds.

Similarly, whilst this level of assessment could be defined as 'acceptably low', i.e. no further action is recommended, risk mitigation is nonetheless recommended to further reduce the risk to both the Site itself and Controlled Waters more broadly.

The recommended risk mitigation measures are distinct from those inherent risk mitigation measures that will be incorporated as part of the development, e.g. reduction of infiltration through an increase in impermeable areas.

If and where risk mitigation was not adopted, it is likely that Castle Brook and the bedrock aquifer would continue to be exposed to diffuse concentrations of potential pollutants arising from both the Site as well as off-Site sources.

6.7 Risk mitigation recommendations

The recommended risk mitigation measures are illustrated on the Ground Models (endline) within Section 7.0.

Groundwater (general): Recommended risk mitigation – pathway management: Provision of a dedicated, below ground toe-drain along the full length of the engineered slope and/or retaining wall planned along the Site's eastern boundary.

Reasoning: to intercept spring water flows migrating towards the Site and direct the resultant water through a dedicated, manually serviceable granular activated carbon (GAC) filter serving to attenuated PFAS compounds as well as a broad range of other chemical compound, e.g. PAHs.

Installation of this drain is considered critical to the overall betterment of soil and groundwater quality beneath the Site and within the wider catchment. Together with inherent risk mitigation, i.e. reduction in groundwater recharge across the Site through the increase in impermeable areas (roofs and hardstanding areas), this measure is expected to markedly reduce the vertical velocity of groundwater reducing the rate at which any PFAS or other chemicals are transported within the deeper bedrock aquifer.

Measurables: As an 'in-principle' remedial action recommended for the betterment of water quality across the Site and within the wider catchment, a nominal, single-use volume of GAC (designed to treat a volume of water that is to be determined in consultation with the specialist supplier and the Engineer) will be recommended, validation of which would be in the form of as-build drawings and photographic evidence.

Groundwater (general): Recommended risk mitigation – pathway management: Provision of a dedicated, below ground toe-drain along the full length of the engineered slope planned along the Site’s western boundary bordering Castle Brook.

Reasoning: to intercept groundwater flows migrating through the Site towards the brook and direct the resultant water through dedicated, manually serviceable granular activated carbon (GAC) filter serving to attenuated PFAS compounds as well as a broad range of other chemical compounds recorded within the groundwater beneath the Site, i.e. PAHs.

Measurables: As an ‘in-principle’ remedial action recommended for the betterment of water quality across the wider catchment, a nominal, single-use volume of GAC (designed to treat a volume of water that is to be determined in consultation with the specialist supplier and the Engineer) will be recommended, validation of which would be in the form of as-build drawings and photographic evidence.

Groundwater (locally to TH2, TH7 and TH18): Recommended risk mitigation – source removal and/or source modification and pathway management: Excavation, delineation and removal or in-situ stabilisation of visually and olfactory impacted soils and groundwater locally to TH2, TH7 and TH18.

Reasoning: to further investigate and either; through removal - reduce the total mass of visually and olfactory impacted soils and groundwater; or, through in-situ stabilisation - reduce the mobility of visually and olfactory impacted soils and groundwater.

Measurables: As an ‘in-principle’ remedial action, visual screening of materials (together with photographic evidence) is recommended to validate the efficacy of this recommended remedial action.

Regulatory consultation: whilst inherent to the process of planning condition discharge for the proposed development, it is recommended that continued consultation with the Environment Agency is maintained owing to the regionally significant concentrations of PFAS compounds that have been detected: flowing onto the Site; within the groundwater beneath the Site; and, flowing within surface water around the Site.

In this scenario, further investigation on or around the Site by the Environment Agency may be warranted with the findings of any such study valuable information for both parties (the Site owner and the EA).

Remedial recommendation made within existing ground-related reporting: within their “Hydrogeology and Potential Contaminant Transport” dated May 2024 (Revision 0) TBJA recommended that a low permeability layer was incorporated within proposed soft landscaping areas as a form of pathway intervention, limiting the rate of drainage to ground and thus the flux of chemicals (all types) through the soils and groundwater across the Site.

Whilst practically difficult to install, e.g. ensuring thickness consistency and service corridors typically resulting in a ‘leaky’ cover layer, this remedial recommendation is discounted due to; i) the fact the dominant spring-fed recharge of groundwater will not be captured by this approach; and, ii) to the inclusion of a low permeability layer within cover systems liable to result in water logging or possible surface water flooding within soft landscaping areas.

6.8 Residual uncertainty

With specific reference to the most recent consultation response from the Environment Agency, the following commentary addresses areas of residual uncertainty:

- > It is assumed that ‘other environmental data that the Environment Agency have access to’ relates to the background data relating to PFAS concentrations within groundwater locally, as discussed within Section 3.0;
- > Whilst only two compounds were modelled as part of the analytical modelling presented within the existing reporting (the Remedial Targets Methodology), the use of any form of analytical modelling in this scenario is not recommended due to: i) the inherent heterogeneity of the Made Ground deposits rendering any analytical model a very crude approximation of the fate and transport of chemicals within groundwater, likely under-reporting the risk to Controlled Water receptors; and, ii) the presence of maximum concentrations of PFAS within groundwater beneath the Site (borehole M4) being located at a distance of around 10 m from Castle Brook that, of itself, guides the requirement for risk management;
- > As discussed previously within Section 6.5, the use of target concentrations in this scenario is not considered appropriate;
- > The general remark that; “We {the EA} continue to feel that the site will need the benefit of remediation”, is acknowledged through the remedial actions recommended within this Report; and,
- > Whilst offering a more comprehensive picture of the chemical fingerprint of soil and water quality on Site and locally to it, the testing of precursor compounds is not recommended owing to the outcome of any such analysis not materially changing the remedial recommendations set out within this Report.

6.9 Contingency planning

As part of any risk management planning, contingency planning is advised. In this scenario, three key areas of contingency planning are recommended.

Unforeseen encounters: A general advisory, there remains the potential for unidentified sources of potentially polluting material to be encountered as part of the development works for which a response plan is recommended (and set out within Soil and Structures’ Remediation Strategy).

In this scenario, the potential presence of residual sub-structures is highlighted with any relic drains or culverts potentially serving as both sources and critical pathways for the potentially polluting material to be present and to be transported across the Site and towards other key receptors, e.g. Castle Brook.

Third-party liabilities: There is evidence that the Site soils and groundwater have become impacted by PFAS compounds that have been transported onto Site from off sources remote from the Site. In having become impacted, the soils and groundwater on Site have themselves become a source of PFAS compounds and possibly other chemical compounds that are present in the groundwater beneath the Site with no obvious indication of their presence in the Made Ground deposits (the soils). The requirement for any risk mitigation works therefore rests, to a certain extent, on the soils and groundwater having been impacted with evidence supporting this being due to the action of third parties (other landowners).

Investigation and assessment of the source of the PFAS compounds (and any other chemicals present within the spring water) is therefore suggested to further support responsibility being discharged from the Client.

Controlled Waters Risk Assessment

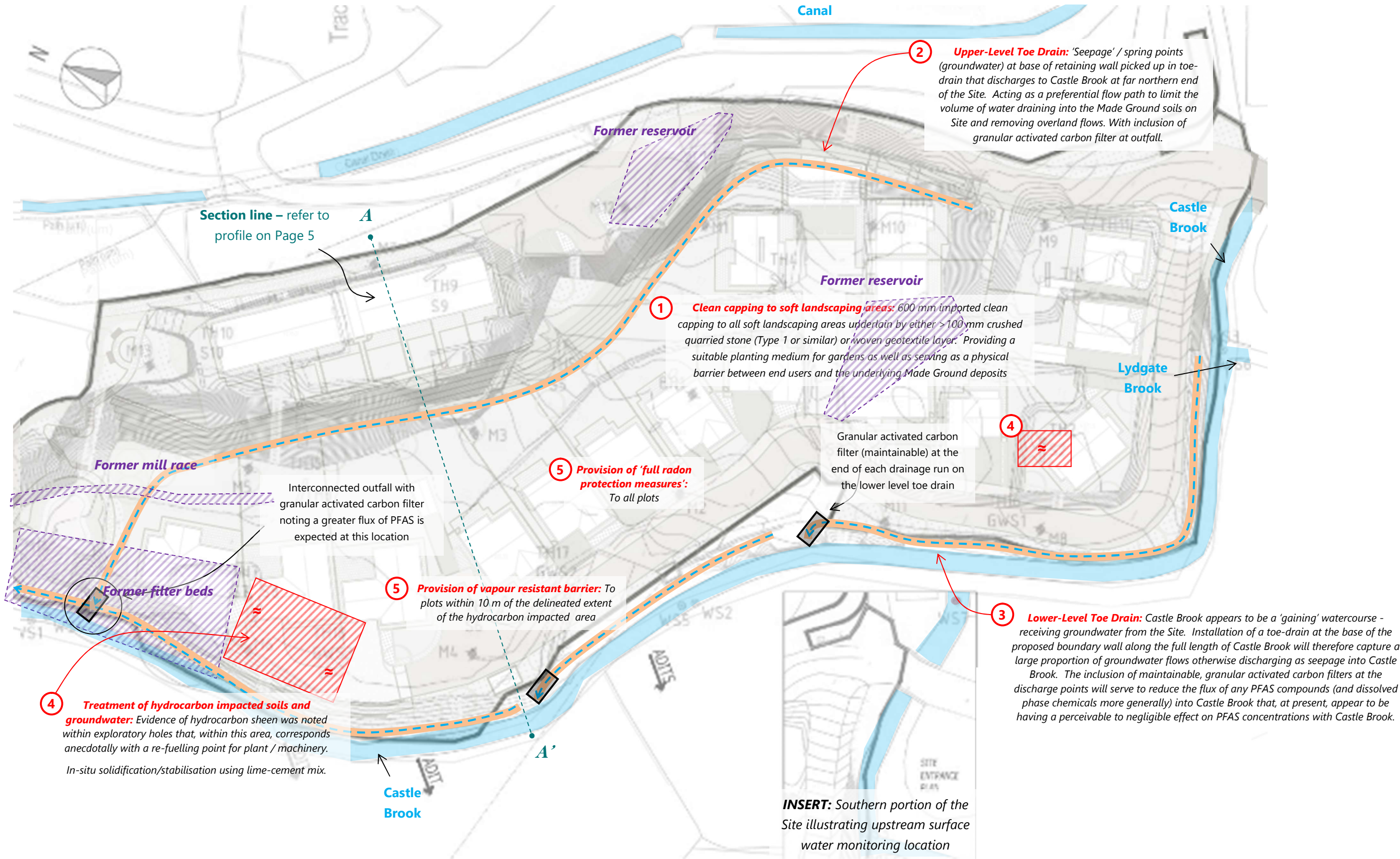
Sladen Mill, Littleborough

Residual liabilities: Related to third-party liabilities, even when the recommended risk mitigation is completed satisfactorily, there remains the potential for future investigations into water quality within the local catchment to include investigations on and around the Site that, in the absence of this Report or other clarification, could lead to unnecessarily protracted and costly investigations where lines of responsibility are not easily established, e.g. why surface water drains along the edge of the Site may be discharging PFAS impacted water into Castle Brook?

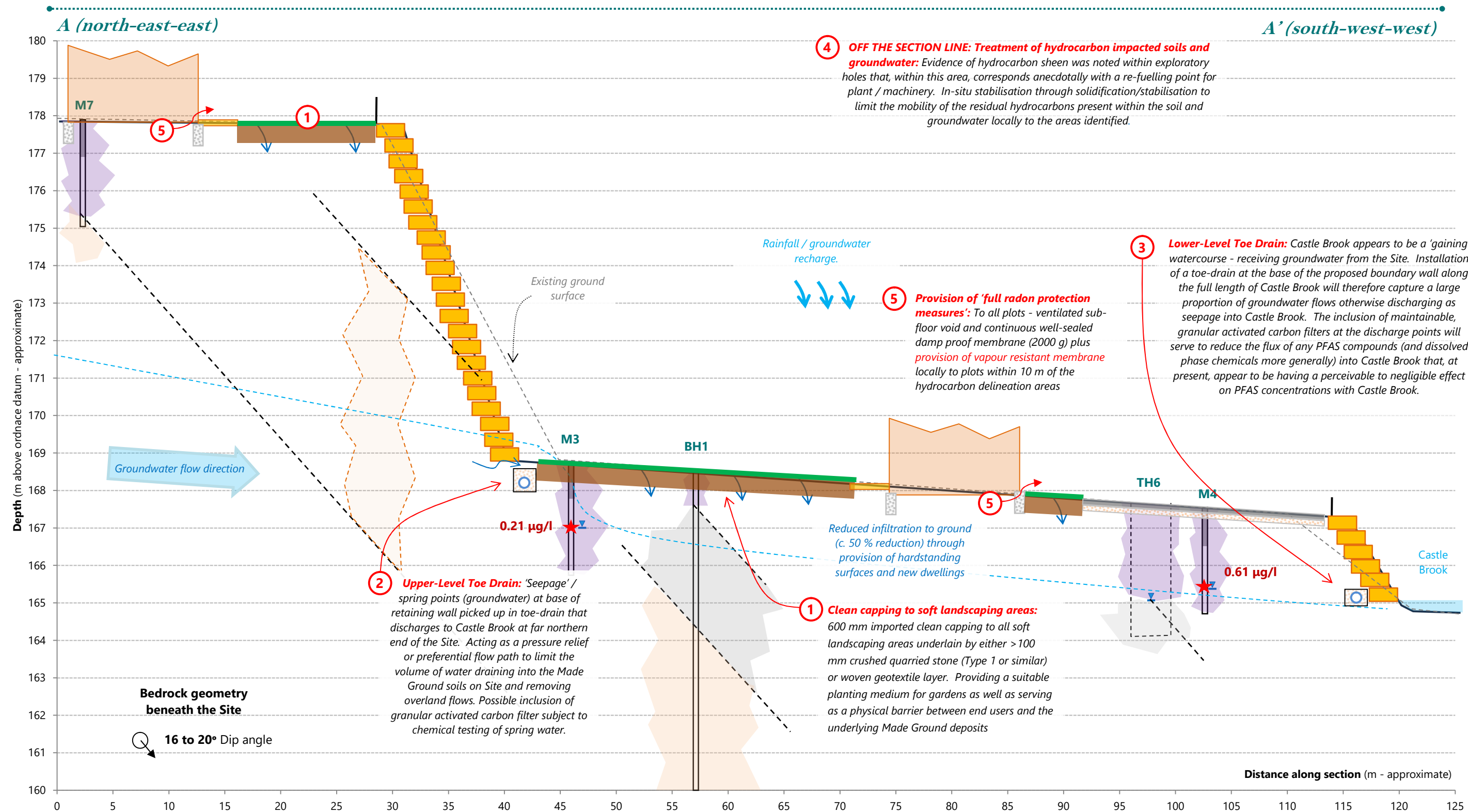
Measures to limit the potential for this to occur include:

- > Submission of this Report and the Soil and Structures Remediation Strategy (report ref. 20403-R-002-V01) to the local planning authority for upload onto the planning portal;
- > The incorporation of this Report and the Soil and Structures Remediation Strategy (report ref. 20403-R-002-V01) within the Health and Safety File for the development; and,
- > The secure and weatherproof installation of either an explanatory note or the Soil and Structures Remediation Strategy (report ref. 20403-R-002-V01) within access covers of the drainage discharge points along Castle Brook.

7.0 Ground Model – Endline (Post-Development Condition) – Plan (presenting an overview of the Remedial Actions)



7.0 Ground Model – Endline (Post-Development Condition) – Profile (aligned with dip direction of bedrock; presenting an overview of the Remedial Actions)



Illustrative / conceptual only – do not scale from drawing – note compressed horizontal axis

8.0 Conclusions and Recommendations

8.1 Conclusions

In conclusion, this Controlled Waters Risk Assessment finds that:

- > The chemical quality of the soils and groundwater beneath the Site have been degraded by the former industrial use of the Site. The extent to which they have been degraded by sources of potentially polluting material on Site appears to be low.
 - > Multiple lines of evidence indicate that the chemical quality of the groundwater beneath the Site is primarily controlled by spring-fed recharge points on the eastern boundary of the Site within which elevated concentrations of PFAS compounds have been detected.
 - > The risk presented to Controlled Waters is assessed as ‘**moderate** to **low**’.
- The moderate rating: i) relates to residual uncertainty (that does not preclude precautionary risk management decision making); and, the soils and groundwater beneath the Site having come to represent sources of potentially polluting material (with specific reference to PFAS compounds); and, ii) guides the requirement for remedial action to achieve a betterment of soil and groundwater quality on the Site and within the wider water catchment (other Controlled Water receptors).
- > Risk mitigation (remedial work) is recommended to further reduce the risk presented to Controlled Water receptors and achieve a betterment of soil and groundwater quality on the Site and within the wider water catchment.

8.2 Recommendations

Recommended follow-on work includes:

1. [Review of this Contaminated Land Risk Assessment](#) and the advice herein;
2. [Submission of this Contaminated Land Risk Assessment](#) to the Local Planning Authority in support of the discharge of Condition 5 of the outline planning application;
3. [Further assessment](#) is not recommended noting that check testing and other fieldworks will be required as part of the recommended remedial works as set out within Soil and Structures’ Remediation Strategy presented under separate cover; and,
4. [Risk mitigation](#) is recommended details of which are outlined within Section 6.7 of this Report with full details, including a validation plan, set out within the Soil and Structures’ Remediation Strategy presented under separate cover.

8.3 Glossary of Abbreviations

- AFFF **Aqueous Film Forming Foam** (fire suppressant)
- DWS **Drinking Water Standard**
- EQS **Environmental Quality Standard**
- PAH **Polycyclic Aromatic Hydrocarbons** – ‘aromatic’ hydrocarbons that are commonly associated with combustion by-products, e.g. soot, dust and exhaust fumes.

- PCB **Polychlorinated Biphenyls** – chemicals now largely banned for use in the UK, commonly used as coolants and electrical insulators within power transmission transformers.
- PFOA **Pefluorooctanoic Acid** – one the better studied PFAS compounds with numerous adverse health effects in humans and wildlife. Commonly a breakdown product from the degradation of more complex, precursor PFAS compounds (fluorotelomer-based polymers).
- PFAS **Per and polyfluoroalkyl substances** – the group or ‘family’ name for millions of chemical compounds that include PFOA, PFOS and PTFE.
- PFOS **Pefluorooctanesulphonic acid** – one the better studied PFAS compounds with numerous adverse health effects in humans and wildlife. Commonly a breakdown product from the degradation of more complex, precursor PFAS compounds (fluorotelomer-based polymers).
- PTFE **Polytetrafluoroethylene** – one of many PFAS compounds commonly referred to as ‘forever chemicals’ or persistent organic pollutants (POPs). Used alongside other PFAS compounds such as PFOA, PFOS and GenX to create non-stick materials.
- PPM **Parts per million** – a unit of concentration. For liquids this represents milligrams per litre (mg/l)
- PPB **Parts per billion** – a unit of concentration. For liquids this represents micrograms per litre (µg/l)
- PPT **Parts per trillion** – a unit of concentration. For liquids this represents nanograms per litre (ng/l)

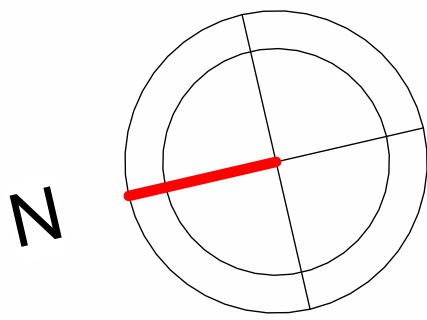
Schedule of Accommodation:

Plot	Accommodation	sqm	sqft
1	3 Bedroom House	96	1032
2	3 Bedroom House	96	1032
3	3 Bedroom House	96	1032
4	3 Bedroom House	96	1032
5	3 Bedroom House	96	1032
6	3 Bedroom House	96	1032
7	3 Bedroom House	96	1032
8	3 Bedroom House	96	1032
9	4 Bedroom House	138	1484
10	4 Bedroom House	138	1484
11	4 Bedroom House	218	2346
12	4 Bedroom House	162	1744
13	4 Bedroom House	130	1398
14	4 Bedroom House	130	1398
15	4 Bedroom House	130	1398
16	4 Bedroom House	160	1722
17	4 Bedroom House	180	1937
18	5 Bedroom House	182	1959
19	5 Bedroom House	182	1959
20	5 Bedroom House	182	1959
21	3 Bedroom House	103	1108
22	3 Bedroom House	103	1108
23	5 Bedroom House	260	2800
24	5 Bedroom House	260	2800
25	5 Bedroom House	278	3000

See landscaping plan for full detail for green space



Visual Scale - 1:300



materials palette

rainwater goods to be black gutters, downpipes and waste pipes fascias where applicable to be s/w painted black doors: composite high security front and rear entrance doors. Garage doors to be aluminium in finish to match main entrance doors

- Hedge with 1000mm metal wired fence separating rear gardens

Low level hedge to front garden

Grass

Green space

Tegula Paviours/sets Vehicle Use
- Tegula Paviours/sets (Pedestrian use Contrasting)

Tarmac Driveways/parking

Tarmac Road

Stone Wall - varies

Tegula Paviours/sets Vehicle Use
- Timber fence

600mmx600mm Pavers

Tegula Paviours/sets public footpath

Pond
- 900mm to front gardens
-1000mm high to rear of retaining wall
-1800mm when creating a privacy garden wall

nicol thomas

Rev	Date	Description
N	02.12.22	pond changed to engineers drawing
O	06.12.22	Revised to EA comments
P	05.01.23	structural detail information included
Q	17.01.23	wall length increased
R	19.01.23	Wall decreased
S	24.01.23	Tim Booth revisions
T	13.02.23	Patio area updated

nicol thomas

architects project managers construction cost consultants CDM co-ordinators

Registered in England and Wales. Reg No. 2140639
Quality Assured to BS ENISO 9001:1994 Certificate Number GB 4723

Heyside House, Blackshaw Lane, Heyside, Royton, Oldham OL2 6NS
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Also at Edinham (Registered Office)

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Client	Mainly Mere		
Job	Sladen Mill, Littleborough		
Drawing title Site Layout			
Project number	M4856	(PL)02	Rev T
Scale	As indicated @ A1		
Date	01/30/23		
Drawn by	KS	Checked by	GRF

13.02.23



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Mr Bowman
Soil and Structures Ltd
89 Moorhead Lane
Shipley BD18 4JW
West Yorkshire

14 June 2024

Test Report: COV/2669225/2024

Dear Mr Bowman

Analysis of your sample(s) submitted on 07 June 2024 is now complete and we have pleasure in enclosing the appropriate test report(s).

An invoice for the analysis carried out will be sent under separate cover.

Should you have any queries regarding this report(s) or any part of our service, please contact Customer Services on +44 (0)24 7642 1213 who will be happy to discuss your requirements.

If you would like to arrange any further analysis, please contact Customer Services. To arrange container delivery or sample collection, please call the Couriers Department directly on 024 7685 6562.

Thank you for using ALS Laboratories (UK) Limited and we look forward to receiving your next samples.

Yours Sincerely,

Signed:

Name:

A. Zunzunegui

Title:

Organics Chemistry Manager



1314



EMS675527

OHS 542058



Report Summary

ANALYSED BY

Mr Russell Bowman
Soil and Structures Ltd
89 Moorhead Lane
Shipley
West Yorkshire
BD18 4JW



Date of Issue: **14 June 2024**

Report Number: **COV/2669225/2024**

Issue **1**

This issue replaces
all previous issues

Job Description: Master Quote 2024

Job Location: 89 Moorhead Lane, Shipley, BD18 4JW

Number of Samples
included in this report **3**

Job Received: **07 June 2024**

Number of Test Results
included in this report **60**

Analysis Commenced: **08 June 2024**

Signed:

Name: **A. Zunzunegui**

Date: **14 June 2024**

Title: **Organics Chemistry Manager**

ALS Laboratories (UK) Limited was not responsible for sampling unless otherwise stated.

Information on the methods of analysis and performance characteristics are available on request.

Opinions and interpretations expressed herein are outside the scope of UKAS accreditation. The results relate only to the items tested and where relevant sampled.

Tests marked 'Not UKAS Accredited' in this Report/Certificate are not included in the UKAS Accreditation Schedule for our laboratory.

This test report is not a statement of conformity to any specification or standard.

This communication has been sent to you by ALS Laboratories (UK) Limited. Registered in England and Wales. Registration No. 02391955. Registered Office: ALS Laboratories (UK) Limited, Torrington Avenue, Coventry, CV4 9GU.

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ALS Laboratories (UK) Limited

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Page 1 of 10

Certificate of Analysis

ANALYSED BY



Report Number: **COV/2669225/2024**
Laboratory Number: **24108157**
Sample Source: **Soil and Structures Ltd**
Sample Point Description:
Sample Description: **Surface Water (Upstream)**
Sample Matrix: **Surface Water**
Sample Date/Time: **05 June 2024 10:04**
Sample Received: **07 June 2024**
Analysis Complete: **14 June 2024**

Issue **1**
Sample **1** of **3**

Test Description	Result	Units	Completed	Accreditation		Method
Sulphate as SO4	6.6	mg/l	10/06/2024	Y	Cov	WAS036
PFOS	0.00081	ug/l	08/06/2024	Y	Cov	GEO82
PFOA	0.0327	ug/l	11/06/2024	Y	Cov	GEO82
Naphthalene	<0.010	ug/l	11/06/2024	Y	Cov	GEO81
Acenaphthylene	<0.010	ug/l	11/06/2024	Y	Cov	GEO81
Acenaphthene	<0.010	ug/l	11/06/2024	Y	Cov	GEO81
Fluorene	<0.010	ug/l	11/06/2024	Y	Cov	GEO81
Phenanthrene	<0.010	ug/l	11/06/2024	Y	Cov	GEO81
Anthracene	<0.010	ug/l	11/06/2024	Y	Cov	GEO81
Fluoranthene	<0.010	ug/l	11/06/2024	Y	Cov	GEO81
Pyrene	<0.010	ug/l	11/06/2024	Y	Cov	GEO81
Benzo(a)anthracene	<0.010	ug/l	11/06/2024	Y	Cov	GEO81
Chrysene	<0.010	ug/l	11/06/2024	Y	Cov	GEO81
Benzo(b)fluoranthene	<0.010	ug/l	11/06/2024	Y	Cov	GEO81
Benzo(k)fluoranthene	<0.010	ug/l	11/06/2024	Y	Cov	GEO81
Benzo(a)pyrene	<0.010	ug/l	11/06/2024	Y	Cov	GEO81
Indeno(123cd)pyrene	<0.010	ug/l	11/06/2024	Y	Cov	GEO81
Dibenzo(ah)anthracene	<0.010	ug/l	11/06/2024	Y	Cov	GEO81
Benzo(ghi)perylene	<0.010	ug/l	11/06/2024	Y	Cov	GEO81
PAH, Total of 16	<0.010	ug/l	11/06/2024	N	Cov	GEO81

Analyst Comments for 24108157: No Analyst Comment

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Analysed at: CHE = Chester(CH5 3US), COV = Coventry(CV4 9GU), S = Subcontracted, TRB = Subcontracted to Trowbridge(BA14 0XD), WAK = Wakefield(WF5 9TG).

For Microbiological determinands 0 or ND=Not Detected, For Legionella ND=Not Detected in volume of sample filtered.

I/S=Insufficient sample For soil/sludge samples: AR=As received, DW=Dry weight.

Signed:



Name: **A. Zunzunegui**

Date: **14 June 2024**

Title: **Organics Chemistry Manager**

Certificate of Analysis

ANALYSED BY



Report Number: **COV/2669225/2024**
Laboratory Number: **24108158**
Sample Source: **Soil and Structures Ltd**
Sample Point Description:
Sample Description: **Surface Water (Midstream)**
Sample Matrix: **Surface Water**
Sample Date/Time: **05 June 2024 10:07**
Sample Received: **07 June 2024**
Analysis Complete: **14 June 2024**

Issue **1**
Sample **2** of **3**

Test Description	Result	Units	Completed	Accreditation		Method
Sulphate as SO ₄	6.7	mg/l	10/06/2024	Y	Cov	WAS036
PFOS	0.00081	ug/l	08/06/2024	Y	Cov	GEO82
PFOA	0.0346	ug/l	11/06/2024	Y	Cov	GEO82
Naphthalene	<0.010	ug/l	11/06/2024	Y	Cov	GEO81
Acenaphthylene	<0.010	ug/l	11/06/2024	Y	Cov	GEO81
Acenaphthene	<0.010	ug/l	11/06/2024	Y	Cov	GEO81
Fluorene	<0.010	ug/l	11/06/2024	Y	Cov	GEO81
Phenanthrene	<0.010	ug/l	11/06/2024	Y	Cov	GEO81
Anthracene	<0.010	ug/l	11/06/2024	Y	Cov	GEO81
Fluoranthene	<0.010	ug/l	11/06/2024	Y	Cov	GEO81
Pyrene	<0.010	ug/l	11/06/2024	Y	Cov	GEO81
Benzo(a)anthracene	<0.010	ug/l	11/06/2024	Y	Cov	GEO81
Chrysene	<0.010	ug/l	11/06/2024	Y	Cov	GEO81
Benzo(b)fluoranthene	<0.010	ug/l	11/06/2024	Y	Cov	GEO81
Benzo(k)fluoranthene	<0.010	ug/l	11/06/2024	Y	Cov	GEO81
Benzo(a)pyrene	<0.010	ug/l	11/06/2024	Y	Cov	GEO81
Indeno(123cd)pyrene	<0.010	ug/l	11/06/2024	Y	Cov	GEO81
Dibenzo(ah)anthracene	<0.010	ug/l	11/06/2024	Y	Cov	GEO81
Benzo(ghi)perylene	<0.010	ug/l	11/06/2024	Y	Cov	GEO81
PAH, Total of 16	<0.010	ug/l	11/06/2024	N	Cov	GEO81

Analyst Comments for 24108158:

No Analyst Comment

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For Microbiological determinands 0 or ND=Not Detected, For Legionella ND=Not Detected in volume of sample filtered.

I/S=Insufficient sample For soil/sludge samples: AR=As received, DW=Dry weight.

Signed:



Name: **A. Zunzunegui**

Date: **14 June 2024**

Title: **Organics Chemistry Manager**

Certificate of Analysis

ANALYSED BY



Report Number: **COV/2669225/2024**
Laboratory Number: **24108159**
Sample Source: **Soil and Structures Ltd**
Sample Point Description:
Sample Description: **Surface Water (Downstream)**
Sample Matrix: **Surface Water**
Sample Date/Time: **05 June 2024 10:12**
Sample Received: **07 June 2024**
Analysis Complete: **14 June 2024**

Issue **1**
Sample **3** of **3**

Test Description	Result	Units	Completed	Accreditation		Method
Sulphate as SO4	6.8	mg/l	10/06/2024	Y	Cov	WAS036
PFOS	0.00089	ug/l	08/06/2024	Y	Cov	GEO82
PFOA	0.0359	ug/l	11/06/2024	Y	Cov	GEO82
Naphthalene	<0.010	ug/l	11/06/2024	Y	Cov	GEO81
Acenaphthylene	<0.010	ug/l	11/06/2024	Y	Cov	GEO81
Acenaphthene	<0.010	ug/l	11/06/2024	Y	Cov	GEO81
Fluorene	<0.010	ug/l	11/06/2024	Y	Cov	GEO81
Phenanthrene	<0.010	ug/l	11/06/2024	Y	Cov	GEO81
Anthracene	<0.010	ug/l	11/06/2024	Y	Cov	GEO81
Fluoranthene	<0.010	ug/l	11/06/2024	Y	Cov	GEO81
Pyrene	<0.010	ug/l	11/06/2024	Y	Cov	GEO81
Benzo(a)anthracene	<0.010	ug/l	11/06/2024	Y	Cov	GEO81
Chrysene	<0.010	ug/l	11/06/2024	Y	Cov	GEO81
Benzo(b)fluoranthene	<0.010	ug/l	11/06/2024	Y	Cov	GEO81
Benzo(k)fluoranthene	<0.010	ug/l	11/06/2024	Y	Cov	GEO81
Benzo(a)pyrene	<0.010	ug/l	11/06/2024	Y	Cov	GEO81
Indeno(123cd)pyrene	<0.010	ug/l	11/06/2024	Y	Cov	GEO81
Dibenzo(ah)anthracene	<0.010	ug/l	11/06/2024	Y	Cov	GEO81
Benzo(ghi)perylene	<0.010	ug/l	11/06/2024	Y	Cov	GEO81
PAH, Total of 16	<0.010	ug/l	11/06/2024	N	Cov	GEO81

Analyst Comments for 24108159:

No Analyst Comment

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Analysed at: CHE = Chester(CH5 3US), COV = Coventry(CV4 9GU), S = Subcontracted, TRB = Subcontracted to Trowbridge(BA14 0XD), WAK = Wakefield(WF5 9TG).

For Microbiological determinands 0 or ND=Not Detected, For Legionella ND=Not Detected in volume of sample filtered.

I/S=Insufficient sample For soil/sludge samples: AR=As received, DW=Dry weight.

Signed:



Name: **A. Zunzunegui**

Date: **14 June 2024**

Title: **Organics Chemistry Manager**



ANALYST COMMENTS FOR REPORT COV/2669225/2024

Issue 1

This issue replaces
all previous issues

Date of Issue: **14 June 2024**

Sample No

Analysis Comments

24108157

24108158

24108159

Signed:

Name: **A. Zunzunegui**

Date: **14 June 2024**

Title: **Organics Chemistry Manager**



DETERMINAND COMMENTS FOR REPORT COV/2669225/2024

ISSUE 1

Date of Issue: 14 June 2024

This issue replaces
all previous issues

Sample No	Description	Determinand	Comments

Signed:

Name: **A. Zunzunegui**

Date: **14 June 2024**

Title: **Organics Chemistry Manager**

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ALS Laboratories (UK) Limited
Torrington Avenue
Coventry
CV4 9GU

T: +44 (0)24 7642 1213
F: +44 (0)24 7685 6575
www.alsenvironmental.co.uk

Mr Bowman
Soil and Structures Ltd
89 Moorhead Lane
Shipley BD18 4JW
West Yorkshire

17 July 2024

Test Report: COV/2687173/2024

Dear Mr Bowman

Analysis of your sample(s) submitted on 11 July 2024 is now complete and we have pleasure in enclosing the appropriate test report(s).

An invoice for the analysis carried out will be sent under separate cover.

Should you have any queries regarding this report(s) or any part of our service, please contact Customer Services on +44 (0)24 7642 1213 who will be happy to discuss your requirements.

If you would like to arrange any further analysis, please contact Customer Services. To arrange container delivery or sample collection, please call the Couriers Department directly on 024 7685 6562.

Thank you for using ALS Laboratories (UK) Limited and we look forward to receiving your next samples.

Yours Sincerely,

Signed:

Name:

D. Lewis

Title:

Technical Inorganic Manager



1314



EMS675527

OHS 542058



This communication has been sent to you by ALS Laboratories (UK) Limited. Registered in England and Wales. Registration No.02391955.
Registered Office: ALS Laboratories (UK) Limited, Torrington Avenue, Coventry, CV4 9GU.

Report Summary

ANALYSED BY

Mr Russell Bowman
Soil and Structures Ltd
89 Moorhead Lane
Shipley
West Yorkshire
BD18 4JW



Date of Issue: **17 July 2024**

Report Number: **COV/2687173/2024**

Issue **1**

This issue replaces
all previous issues

Job Description: Master Quote 2024

Job Location: 89 Moorhead Lane Shipley BD184JW

Number of Samples
included in this report **5**

Job Received: **11 July 2024**

Number of Test Results
included in this report **10**

Analysis Commenced: **13 July 2024**

Signed: 

Name: **D. Lewis**

Date: **17 July 2024**

Title: **Technical Inorganic Manager**

ALS Laboratories (UK) Limited was not responsible for sampling unless otherwise stated.

Information on the methods of analysis and performance characteristics are available on request.

Opinions and interpretations expressed herein are outside the scope of UKAS accreditation. The results relate only to the items tested and where relevant sampled.

Tests marked 'Not UKAS Accredited' in this Report/Certificate are not included in the UKAS Accreditation Schedule for our laboratory.

This test report is not a statement of conformity to any specification or standard.

This communication has been sent to you by ALS Laboratories (UK) Limited. Registered in England and Wales. Registration No. 02391955. Registered Office: ALS Laboratories (UK) Limited, Torrington Avenue, Coventry, CV4 9GU.

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ALS Laboratories (UK) Limited

Torrington Avenue, Coventry, CV4 9GU
Tel:+44 (0)24 7642 1213 Fax:+44 (0)24 7685 6575

Page 1 of 9

Certificate of Analysis

ANALYSED BY



Report Number: **COV/2687173/2024**
Laboratory Number: **24234575**
Sample Source: **Soil and Structures Ltd**
Sample Point Description:
Sample Description: **Surface Water (Castle Brook)**
Sample Matrix: **Surface Water**
Sample Date/Time: **08 July 2024 14:00**
Sample Received: **11 July 2024**
Analysis Complete: **17 July 2024**

Issue **1**
Sample **1** of **5**

Test Description	Result	Units	Completed	Accreditation	Method
PFOS	0.00081	ug/l	13/07/2024	Y Cov	GEO82
PFOA	0.0440	ug/l	16/07/2024	Y Cov	GEO82

Analyst Comments for 24234575:

No Analyst Comment

This issue replaces all previous issues

Accreditation Codes: Y = UKAS / ISO17025 Accredited, N = Not UKAS / ISO17025 Accredited, M = MCERTS.

Analysed at: CHE = Chester(CH5 3US), COV = Coventry(CV4 9GU), S = Subcontracted, TRB = Subcontracted to Trowbridge(BA14 0XD), WAK = Wakefield(WF5 9TG).

For Microbiological determinands 0 or ND=Not Detected, For Legionella ND=Not Detected in volume of sample filtered.

I/S=Insufficient sample For soil/sludge samples: AR=As received, DW=Dry weight.

Signed:

Name: **D. Lewis**

Date: **17 July 2024**

Title: **Technical Inorganic Manager**

ALS Laboratories (UK) Limited

Torrington Avenue, Coventry, CV4 9GU
Tel:+44 (0)24 7642 1213 Fax:+44 (0)24 7685 6575

Certificate of Analysis

ANALYSED BY



Report Number: **COV/2687173/2024**
Laboratory Number: **24234576**
Sample Source: **Soil and Structures Ltd**
Sample Point Description:
Sample Description: **Surface Water (Lydgate Brook)**
Sample Matrix: **Surface Water**
Sample Date/Time: **08 July 2024 14:02**
Sample Received: **11 July 2024**
Analysis Complete: **17 July 2024**

Issue **1**
Sample **2** of **5**

Test Description	Result	Units	Completed	Accreditation	Method
PFOS	0.00072	ug/l	13/07/2024	Y Cov	GEO82
PFOA	0.0144	ug/l	16/07/2024	Y Cov	GEO82

Analyst Comments for 24234576:

No Analyst Comment

This issue replaces all previous issues

Accreditation Codes: Y = UKAS / ISO17025 Accredited, N = Not UKAS / ISO17025 Accredited, M = MCERTS.

Analysed at: CHE = Chester(CH5 3US), COV = Coventry(CV4 9GU), S = Subcontracted, TRB = Subcontracted to Trowbridge(BA14 0XD), WAK = Wakefield(WF5 9TG).

For Microbiological determinands 0 or ND=Not Detected, For Legionella ND=Not Detected in volume of sample filtered.

I/S=Insufficient sample For soil/sludge samples: AR=As received, DW=Dry weight.

Signed:

Name: **D. Lewis**

Date: **17 July 2024**

Title: **Technical Inorganic Manager**

ALS Laboratories (UK) Limited

Torrington Avenue, Coventry, CV4 9GU
Tel:+44 (0)24 7642 1213 Fax:+44 (0)24 7685 6575

Certificate of Analysis

ANALYSED BY



Report Number: **COV/2687173/2024**
Laboratory Number: **24234577**
Sample Source: **Soil and Structures Ltd**
Sample Point Description:
Sample Description: **Surface Water (Downstream)**
Sample Matrix: **Surface Water**
Sample Date/Time: **08 July 2024 13:50**
Sample Received: **11 July 2024**
Analysis Complete: **17 July 2024**

Issue **1**
Sample **3** of **5**

Test Description	Result	Units	Completed	Accreditation	Method
PFOS	0.00075	ug/l	13/07/2024	Y Cov	GEO82
PFOA	0.0323	ug/l	16/07/2024	Y Cov	GEO82

Analyst Comments for 24234577:

No Analyst Comment

This issue replaces all previous issues

Accreditation Codes: Y = UKAS / ISO17025 Accredited, N = Not UKAS / ISO17025 Accredited, M = MCERTS.

Analysed at: CHE = Chester(CH5 3US), COV = Coventry(CV4 9GU), S = Subcontracted, TRB = Subcontracted to Trowbridge(BA14 0XD), WAK = Wakefield(WF5 9TG).

For Microbiological determinands 0 or ND=Not Detected, For Legionella ND=Not Detected in volume of sample filtered.

I/S=Insufficient sample For soil/sludge samples: AR=As received, DW=Dry weight.

Signed:

Name: **D. Lewis**

Date: **17 July 2024**

Title: **Technical Inorganic Manager**

ALS Laboratories (UK) Limited

Torrington Avenue, Coventry, CV4 9GU
Tel:+44 (0)24 7642 1213 Fax:+44 (0)24 7685 6575

Certificate of Analysis

ANALYSED BY



Report Number: **COV/2687173/2024**
Laboratory Number: **24234578**
Sample Source: **Soil and Structures Ltd**
Sample Point Description:
Sample Description: **Surface Water (25m Downstream)**
Sample Matrix: **Surface Water**
Sample Date/Time: **08 July 2024 13:52**
Sample Received: **11 July 2024**
Analysis Complete: **17 July 2024**

Issue **1**
Sample **4** of **5**

Test Description	Result	Units	Completed	Accreditation	Method
PFOS	0.00089	ug/l	13/07/2024	Y Cov	GEO82
PFOA	0.364	ug/l	16/07/2024	Y Cov	GEO82

Analyst Comments for 24234578:

No Analyst Comment

This issue replaces all previous issues

Accreditation Codes: Y = UKAS / ISO17025 Accredited, N = Not UKAS / ISO17025 Accredited, M = MCERTS.

Analysed at: CHE = Chester(CH5 3US), COV = Coventry(CV4 9GU), S = Subcontracted, TRB = Subcontracted to Trowbridge(BA14 0XD), WAK = Wakefield(WF5 9TG).

For Microbiological determinands 0 or ND=Not Detected, For Legionella ND=Not Detected in volume of sample filtered.

I/S=Insufficient sample For soil/sludge samples: AR=As received, DW=Dry weight.

Signed:

Name: **D. Lewis**

Date: **17 July 2024**

Title: **Technical Inorganic Manager**

ALS Laboratories (UK) Limited

Torrington Avenue, Coventry, CV4 9GU
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Certificate of Analysis

ANALYSED BY



Report Number: **COV/2687173/2024**
Laboratory Number: **24234579**
Sample Source: **Soil and Structures Ltd**
Sample Point Description:
Sample Description: **Surface Water (Spring)**
Sample Matrix: **Surface Water**
Sample Date/Time: **08 July 2024 13:58**
Sample Received: **11 July 2024**
Analysis Complete: **17 July 2024**

Issue **1**
Sample **5** of **5**

Test Description	Result	Units	Completed	Accreditation	Method
PFOS	0.00177	ug/l	13/07/2024	Y Cov	GEO82
PFOA	0.318	ug/l	16/07/2024	Y Cov	GEO82

Analyst Comments for 24234579:

No Analyst Comment

This issue replaces all previous issues

Accreditation Codes: Y = UKAS / ISO17025 Accredited, N = Not UKAS / ISO17025 Accredited, M = MCERTS.

Analysed at: CHE = Chester(CH5 3US), COV = Coventry(CV4 9GU), S = Subcontracted, TRB = Subcontracted to Trowbridge(BA14 0XD), WAK = Wakefield(WF5 9TG).

For Microbiological determinands 0 or ND=Not Detected, For Legionella ND=Not Detected in volume of sample filtered.

I/S=Insufficient sample For soil/sludge samples: AR=As received, DW=Dry weight.

Signed:

Name: **D. Lewis**

Date: **17 July 2024**

Title: **Technical Inorganic Manager**

ALS Laboratories (UK) Limited

Torrington Avenue, Coventry, CV4 9GU
Tel:+44 (0)24 7642 1213 Fax:+44 (0)24 7685 6575



ANALYST COMMENTS FOR REPORT COV/2687173/2024

Issue 1

This issue replaces
all previous issues

Date of Issue: **17 July 2024**

Sample No	Analysis Comments
24234575	
24234576	
24234577	
24234578	
24234579	

Signed: *D. Lewis*

Name: **D. Lewis**

Date: **17 July 2024**

Title: **Technical Inorganic Manager**



DETERMINAND COMMENTS FOR REPORT COV/2687173/2024

ISSUE 1

Date of Issue: 17 July 2024

This issue replaces
all previous issues

Sample No	Description	Determinand	Comments

Signed: *D. Lewis*

Name: **D. Lewis**

Date: **17 July 2024**

Title: **Technical Inorganic Manager**

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Rochdale Borough Council
Number One Riverside
Smith Street
Rochdale
OL16 1XU

Our ref: SO/2024/123863/03-L01
Your ref: 24/00001/DOC
Date: 07 June 2024

Dear Sir/Madam

SUBMISSION OF DETAILS TO COMPLY WITH CONDITION 5 (INVESTIGATION AND RISK ASSESSMENT) 15/01235/OUT SLADEN MILL OFF HALIFAX ROAD LITTLEBOROUGH

Thank you for referring the above application regarding the discharge of condition 5 to the Environment Agency. We wish to make the following comments.

Environment Agency position

We have reviewed the Supplementary Geo-Environmental Report; hydrogeology and potential contaminant transport by T J Booth Associates dated May 2024.

We have reviewed the submission to understand and characterise the risks to controlled waters from the current and future condition of the land.

Our review is based on previous submissions of ground investigation and assessments that have been undertaken for the proposed development site. This work identified a prolonged industrial land usage on site which, most recently included the manufacturing of textiles, plastics, and waterproof coatings.

The submitted reports have identified several contaminants of concern that include Per- and Polyfluoroalkyl substances (PFAS) and PFOS and PFOA.

Based on the history of the site and its use in conjunction with the previous submissions we have considered and assessed the risk assessment process in this submission. We have reviewed the report in the context of the Remedial Targets Methodology guidance document (Remedial Targets Methodology: Hydrogeological Risk Assessment for Land Contamination (RTM P20) ref. LIT 6627, EA, 2006).

We welcome the use of site-specific information to populate the remedial target methodology and acknowledge that where that information is not available or cannot be collected then literature values have been used as an alternative.

Remedial Target Methodology (RTM) assessment.

The report has been reviewed on the basis that the input parameters are a combination of both on-site values as well as literature values. We are however equally aware that the site conditions assessment is based on a limited dataset with limited groundwaters and soils sampling and that many of the investigation points do not extend beyond the base of the made ground.

In reviewing RTM assessment, we have formed the conclusion that the methodology approach does not reflect the conceptual site model as we have understood it based on the ground investigation and wider environmental information that we have accessed.

We have also identified that only two contaminants of concern have been modelled whereas a wider number of contaminants of concern have previously been found during earlier ground investigations.

On this occasion only the RTM P20 worksheets for a groundwater level 3 calculation have been included when the RTM guidance requires that all the worksheets (levels 1-3) should be completed and submitted.

Additionally, we note that amongst other input parameters, which do not reflect site conditions, the use of relevant environmental quality standards is incorrect. The current UK surface water quality standard which has been adopted for PFAS contaminants is 0.65ng/l.

We further advise that the modelling of risks to the river Roch is unnecessary as the distance of 650m is too great for effective modelling and is not supported by the current conceptual site model.

Finally, as per the narrative, in the report the use of a mean value is inappropriate. Due to the complexity and inherent conservatism in the RTM process, maximum values should be used rather than mean or average or 95% percentile values.

Advice to applicant / LPA

Further to our previous comments. We continue to feel that the site will need the benefit of remediation. We additionally advise that the Concawe Performance of water treatment systems for PFAS removal report (2016) provides advice and guidance on remediation treatment rather than risk assessment and that some of the information in this report has now been superseded by contemporary PFAS research science which has, in places, greatly reduced some of the values published in this report.

Further, the presence of PFOA (a Carboxylic acid [PFCAs]) suggests at a more mobile contaminant of concern that reflects their latent hydrophobic characteristics in the saturated zone/conditions.

We also continue to draw your attention to the prevent and limit requirements of the Groundwater (Daughter) directive 2006/118/EC especially as PFOS is a confirmed hazardous substance with other PFAS contaminants likely to be classified similarly in the future.

We further note, in reviewing the previously submitted ground investigation report [Geo-Environmental Audit; Phase 2 Site Investigation & Risk Assessment and Phase 3 Remediation Statement report (ver. 5) dated Feb 2024] that some of the trial pits report a hydrocarbon odour to be present with trial hole 7 having an accompanying non-aqueous phase sheen. This is likely to represent a long-term significant risk to controlled waters which be preferentially removed through remediation.

You may also wish to consider the present of Fluorotelomers (associated with plastics manufacturing and waterproofing coating) as these are known pre-cursors to PFOA and PFOS as well as being pre-oxidising agents to PFAS contaminants. These are also known to have advanced chemical relationships with the types of contamination which have been found to co-exist on site (organics and inorganics). Where necessary, you may additionally wish to consider further sampling and laboratory analysis to improve and enhance your risk assessment of the site.

Per- and Polyfluoroalkyl substances (PFAS) are an emerging contaminant of concern which are rapidly coming to fore front of public and regulatory attention. They form a group of over 9000 individual compounds which are known to pose a risk to environmental receptors and, in the right setting public protection as well. Due to their complex chemistry, they are suspected of having influence on other contaminants of concern such that greater consideration of the risks arising from their presence is needed to ensure that as many risks as possible are known about and, where necessary, mitigated against.

The risks to controlled waters fall within our remit. However, we do not take the lead of risks to public protection, these matters are regulated by the council environmental health team. When in doubt, we advise that you consult the council environmental health team for additional advice and guidance.

We, therefore, do not recommend the discharge of condition 5 attached to planning permission 15/01235/OUT at this time.

Once details have been submitted to address the above, we will be happy to comment further.

Please forward a copy of this letter to the applicant.

Yours faithfully

Mrs. SYLVIA WHITTINGHAM
Planning Advisor

SSPlanning.RFH@environment-agency.gov.uk

Rochdale Metropolitan Borough Council
Number One Riverside
Rochdale
Lancashire
OL16 1JH

Our ref: SO/2024/123863/01-L01
Your ref: 24/00001/DOC
Date: 14 February 2024

Dear Sir/Madam

SUBMISSION OF DETAILS TO COMPLY WITH CONDITION 5 (INVESTIGATION AND RISK ASSESSMENT) 15/01235/OUT SLADEN MILL OFF HALIFAX ROAD LITTLEBOROUGH

Thank you for referring the above application for the discharge of condition 5 to the Environment Agency. We would wish to make the following comments.

Environment Agency position

We have previously engaged with the developer and their environmental consultant through the Environment Agency's chargeable advice service providing verbal and written advice. Furthermore, we shared relevant industry guidance documents to support their further investigation and assessment of the former industrial site.

We have carefully reviewed the submitted report Geo-Environmental Audit (Phase 2 Site Investigation & Risk Assessment and Phase 3 Remediation Statement) by T J Booth & Associates Ltd (dated Dec. 2023). In keeping with the wording of condition 5 of outline planning permission 15/01235/OUT we advise as follows:

Condition 5

- We are satisfied that sufficient information has been submitted to support part (i) of condition 5.
- We consider that part (ii) of condition 5 has not provided sufficient assessment details to meet a standard that allows us to recommend discharge of part (ii) of the condition.
- We consider that there is deficiency in the limited assessments that have been made to satisfy part (iii) of the condition and as such do not recommend discharge of part (iii) of the condition.

Advice to the LPA,

We are satisfied that the development would prevent pollution of the water environment and ensure the safe development of the site in the interests of the amenity of future occupiers in accordance with Policy G9 of the adopted Rochdale Core Strategy, saved Policy EM/8 of the adopted Rochdale Unitary Development Plan and the National Planning Policy Framework 2023 paragraph 189(b) – *'land should not be capable of being determined as contaminated land under Part IIA of the Environmental Protection Act 1990'*.

Please forward a copy of this letter to the applicant.

Yours faithfully

Mrs. SYLVIA WHITTINGHAM
Planning Advisor

Direct dial 0203 0251059

Direct e-mail sylvia.whittingham@environment-agency.gov.uk

Rochdale Metropolitan Borough Council
Number One Riverside
Smith Street
Rochdale
OL16 1XU

Our ref: SO/2024/123863
Your ref: 24/00001/DOC
Date: 28 March 2024

Dear Majid Mir,

Submission of details to comply with condition 5 (investigation and risk assessment) 15/01235/OUT.

Sladen Mill Halifax Road Littleborough Rochdale OL15 0LB.

Thank you for the submission of a Geo-Environmental Audit (Phase 2 Site Investigation & Risk Assessment and Phase 3 Remediation Statement) [Version 5] by T J Booth & Associates Ltd (dated February 2024) for the Proposed Residential Development on land at the former Sladen Mill, Littleborough in Rochdale pursuant to the application discharge conditions in compliance with condition 5 (investigation and risk assessment) attached to planning permission 15/01235/OUT.

Environment Agency position

At the request of Rochdale Metropolitan Borough Council, we have reviewed the submission of version 5 of the above report to ascertain if it contains sufficient information to allow us to recommend the discharge of condition 5 of planning permission 15/01235/OUT.

We have carefully considered the information that is contained in the context of our recommendations to the applicant following the review of version 4 of the same report. We have reviewed the report in the context of the Land Contamination Risk Management guidance (LCRM, 2023) and the National planning policy framework guidance document (NPPF, 2023).

We again welcome the additional ground investigation work that has been undertaken as it continues to improve the characterisation and understanding of the site allowing for a more thorough assessment of risks to controlled waters.

We have therefore considered the results of this additional information and identified that certain contaminants of concern are present in the identified groundwaters beneath the site, but the final conceptual model has assessed this to be of very low risk.

We disagree with this position as the ground investigation logs confirm the absence of a lower permeability layer that is protective of the underlying sandstone bedrock deposits suggesting that there is indeed a likely pathway between the source and receptors. A good number of the reported logs show a likely direct linkage between the upper made ground deposits and the underlying natural deposits and therefore the underlying aquifer.

Environment Agency
Richard Fairclough House Knutsford Road, Warrington, WA4 1HT.
Customer services line: 03708 506 506
www.gov.uk/environment-agency

Cont/d..

Based on the principles of LCRM, 2023 we strongly disagree with this evaluation as the presence of contaminants of concern in relevant receptors (i.e. the groundwater body identified beneath the site in the attached borehole and trial pit logs) is in itself at least a moderate to high risk as this is, in itself, a source, pathway and relevant receptor.

When we previously recommended that further assessment was undertaken, we anticipated that the principles of LCRM, 2023 would be applied and that a suitable (numeric) detailed quantitative risk assessment would be undertaken especially as some of the contaminants of concern are considered hazardous and assessment of their risk to relevant receptors undertaken. We feel that this is additionally supported by the Groundwater (Daughter) directive 2006/118/EC.

This version does not undertake that work therefore we are unable to agree that no remediation is required.

In undertaking this work we advise that you consider and follow the Remedial Targets Methodology guidance document (Remedial Targets Methodology: Hydrogeological Risk Assessment for Land Contamination (RTM P20) ref. LIT 6627, EA, 2006) which can be found at this website address [Land contamination: remedial targets methodology \(RTM\) - GOV.UK \(www.gov.uk\)](http://www.gov.uk/government/uploads/system/uploads/attachment_data/file/281221/RTM_P20.pdf).

Further, we recommend that where possible site specific input parameters are used to populate your chosen model so that the risk assessment reflects ground conditions as closely as possible and only used academic or generic values in the absence of real-world alternatives.

Therefore, regretfully, we are unable to recommend the discharge of condition 5 attached to planning permission 15/01235/OUT at this time.

-

Should you have any queries regarding this response, please do not hesitate to contact me.

Yours sincerely,

Miss India Blythin
Planning Advisor

Spplanning.rfh@environment-agency.gov.uk

From: David Marsden <>
Sent: 31 May 2024 08:55
To: 'Ben James'
Cc: Russell Bowman
Subject: RE: Sladen Mill

Good Morning Ben,

Please see the groundwater sampling methodology below:

- The standpipes were purged prior to sampling.
- The monitoring wells and river were sampled using 39mm diameter disposable bailers fitted with non-return ball valves in general accordance with BS ISO 5667-11, 2009.
- The bailers were emptied directly into 50ml vial which were transported from site in insulated containers with ice packs to maintain a low temperature.
- Fresh clean bailers were used for each sample location.
- The groundwater levels were recorded before carrying out the purging/sampling.
- The sampling containers, insulated boxes and ice packs were supplied by the testing laboratory (ALS) and were certified as PFAS free. The bailers, were also certified as PFAS free by our suppliers.

If you need anything further, please do not hesitate to get in touch.

Kind regards
David Marsden MEng (Hons.) CEng MICE
Director

For and on behalf of
Sub Surface North West Ltd
3 Peel Street, Preston, Lancashire, PR2 2QS

Phone:
Email: _____
Website: www.subsurface.co.uk

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CLIENT:	Mere Development Group
PROJECT:	Sladen Mill, Littleborough
SUBJECT:	Historical research into the industrial uses and practises at Sladen Mill in comparison with nearby Wellfield Mill, Rock Nook Mill and Sladen Wood Mill
JOB NO.:	GM12948
DATE:	14th August 2024
PREPARED BY:	Gabriella Amos BA MSc PCIfA
CHECKED BY:	Mike Birtles Bsc (Hons) Msc ACIfA

1.1 Introduction

This Heritage Note has been prepared to provide an overview of the historical and industrial uses and practises that occurred at Sladen Mill (the 'Site'), in comparison with other historical mills including Wellfield Mill, Rock Nook Mill and Sladen Wood Mill. This Heritage Note has been prepared on behalf of Mere Development Group (the 'Client') in response to an ongoing enquiry with the Environment Agency regarding the historical use of contaminant material at the Site during its function as a mill. The Environment Agency has highlighted the presence of chemical contaminants at the Site:

"Our review is based on previous submissions of ground investigation and assessments that have been undertaken for the proposed development site. This work identified a prolonged industrial land usage on site which, most recently included the manufacturing of textiles, plastics, and waterproof coatings. The submitted reports have identified several contaminants of concern that include Per- and Polyfluoroalkyl substances (PFAS) and PFOS and PFOA. Based on the history of the site and its use in conjunction with the previous submissions we have considered and assessed the risk assessment process in this submission. We have reviewed the report in the context of the Remedial Targets Methodology guidance document (Remedial Targets Methodology: Hydrogeological Risk Assessment for Land Contamination (RTM P20) ref. LIT 6627, EA, 2006)" (pers comms from Client, dated 05.08.2024).

The Client has noted that other textile-producing mills within the vicinity of the Site were undertaking practises using the abovementioned chemicals, which they believe may have infiltrated into watercourses or groundwater, and thus point to a wider-scale problem within the area of Littleborough not solely isolated to the Client's site (pers comms, dated 05.08.2024).

This document is intended to set out the historical narrative of each of the four mills: Sladen Mill; Wellfield Mill; Rock Nook Mill and Sladen Wood Mill, based on the available historical evidence. It is important to note that Sladen Mill (the Client's site) and Sladen Wood Mill are two separate sites that functioned under different corporations during their history. There is no clear relationship between these two sites beyond their proximity to Littleborough and the use of the local placename 'Sladen' in their titles.

A historical appraisal of the Site was previously conducted by Wardell Armstrong in 2015. A Heritage Impact Assessment was written in support of a planning application for a proposed residential development at the Site. This Heritage Note is not intended to act as a replica of the Impact Assessment, although elements of the assessment have been consulted to inform this report (Wardell Armstrong 2015). In conjunction with the above, the following baseline data has been consulted for this Heritage Note:

- Greater Manchester Historic Environment Record (GMHER)
- Rochdale Local Studies Archive Centre
- Ordnance Survey (OS) Historic Mapping, via the National Library of Scotland
- Historic England's Aerial Photography Archive

Documentary and online sources which have been consulted are cited within the text and listed in the Bibliography of this report.

This report has been prepared in accordance with documents published by the Chartered Institute for Archaeologists (CIfA 2022).

1.2 Sladen Mill

The earliest known document considered to be related to the Site dates to 1789 and refers to an auction, comprising '*a farmhold and mill called Sladon Mill, containing 25 acres land, in the occupation of Mr. Richard Hold and Samuel Lomar*' (GMHER 2024). A document dated to 1804 records a lease for the duration of twenty-one years by Charles Chadwick to Samuel Lomax, a woollen manufacturer of Sladen Mill (National Archives Ref: RYCH/3550). Lomax and Holt are mentioned later in Pigot's Directory of 1841 as 'woollen manufacturers' in the area of Rochdale (Pigot & Co. 1841).

Further evidence of occupation at the Site during the late-18th century can be seen in the 1970 discovery of a coin, ‘truck token’, dating to 1791 and uncovered during demolition works on former workers cottages associated with the mill. The coin was inscribed with the following text: ‘payable at the warehouse of John Kershaw’ (Rochdale Observer, 1970). John Kershaw and his brothers Isaac and Charles ran Sladen Mill until the partnership was dissolved in 1867. John and Isaac continued operating Sladen Mill, while Charles operated Field [Wellfield] Mill under Charles Kershaw Limited from c.1867 onwards (Seyd & Co. 1885-6).

Sladen Mill is referenced in several trade directories from the 19th to 20th centuries. Wright’s directory from 1871-2 lists the Kershaw Brothers at Sladen Mill as flannel manufacturers (Wright 1871), whilst the Cotton Spinners & Manufacturers’ Directory of 1891 notes the Site manufactured wool and flannel (Worrall 1891). Furthermore, a newspaper article from 1889 records that a warehouse was constructed at Sladen Mill, on the site of the ‘woolen mills’ (Wade 1889). Kelly’s directory of 1907 also notes that Sladen Mill manufactured flannel, and that the Kershaw Brothers were wool merchants (Kelly’s Directories Ltd 1907).

The mill suffered from a fire in 1926, which caused extensive damage to most of the buildings on site. This event led to the site being advertised for auction in The Guardian paper, which describes the ‘fire salvage of flannel, flannelette, wool’ (The Guardian 1926).

Further trade directories from 1967 and 1971 show that Sladen Mill was still functioning under the Kershaw name of ‘Kershaw Chas Ltd’, undertaking business in wool manufacturing of ‘imitation Welsh and Lancashire flannels’ (John Worrell Publishers 1967) as well as bleaching, dyeing, raising and finishing flannelettes, winceyettes and cotton blankets, which was introduced at the Site during the 1960s (Thomas Skinner Directories 1971). The Site ceased its function as a working mill and was separated into industrial units during the 1980s (Wardell Armstrong 2015), prior to its demolition and clearing over the past 10 years.

Cartographic sources can be used to show the development of the Site over time from the mid-19th century to the mid-20th century. In Lancashire map of 1851, the mill is depicted as a series of buildings in an irregular form, adjacent to a watercourse to the south (identifiable as Lydgate Brook / Lydgate Clough / Red Brook) and a canal drain to the north (Plate 1). Lydgate Brook is marked on the first edition OS map of 1893 with arrows pointing to indicate the direction of flow, marked as flowing downstream from south to north. This watercourse meanders from south towards the Site, around the Site heading north, then travelling west to pass underneath the Rochdale Canal via a weir. This course is largely unchanged and is still visible as an earthwork today (Google Earth 2024). The canal drain to the north of the Site appears to be shown extending from Wellfield Mill and heading south towards the Site, then

meandering northwest towards Rock Nook Mill (Plate 2). It is noted that the drain was constructed to transport water from surrounding reservoirs such as Hollingbrook Lake, located 2.5km south of the Site, to infill the Rochdale Canal (MBA Ltd 2020). The OS map of 1911 depicts the direction of water flow of the canal drain indicated by an arrow pointing northwest, adjacent to Rock Nook Mill (Plate 3).

Over time, the Site changes in shape and form, reflecting the rebuilding of Sladen Mill after the destructive 1926 fire. The surrounding vicinity is largely unchanged, with Lydgate Brook and the canal drain maintaining their general trajectory running between Wellfield Mill, Sladen Mill and Rock Nook Mill (Plates 3–5).

Similarly, aerial photographs can provide an understanding of the historical changes which have occurred on Site. An aerial photograph from 1948 depicts the Site within its industrialised rural landscape, located in the background of the photograph looking southeast. Within the foreground is the nearby Greenvale Mill, operated at this time by Fothergill & Harvey (see Section 1.4 below). The tramway identifiable on the OS 1893 map (Plate 2) appears to have been turned into a road, and the canal drain is located on a higher level to most of the mill buildings to the north. Lydgate Brook to the south of the Site disappears underneath the elevated canal at the point where it joins to the southeast of Greenvale Mill, entering a culvert or weir as shown on historic mapping from this period (Plate 4) (Historic England Ref: EAW020428). Further aerial photographs from the 1980s were provided by the Greater Manchester HER. These depict the Site as more built-up, with the addition of more modernised warehouse buildings on the southern side of the mill. The canal drain appears to be largely dried out at this time, although Lydgate Brook to the south of Sladen Mill seems to contain water (GMHER Refs: SF316355 – SF316358).

In consideration of the evidence presented above, the historical use of the Site seems to have comprised the manufacturing of cotton, wool and flannel materials, with a later addition of dyeing and bleaching in the 1960s, prior to the cessation of mill workings during the 1980s when the Site was converted into industrial units (Wardell Armstrong 2015).

1.3 Wellfield Mill

Situated 450m northeast of the Site is the location of the former Wellfield Mill. The earliest evidence of Wellfield Mill is shown on the Lancashire Map of 1851, where the site is labelled as a ‘fulling’ mill (Plate 1). As previously noted, Charles Kershaw operated the site under his own company name from c.1867 onwards (Seyd & Co. 1885-6). Twenty years after this event, the mill is referenced in Leuchs’ Directory as a ‘Fulling Mill’ under the ownership of Charles

Kershaw (C. Leuchs & Co. 1888). In 1891, the mill is mentioned in the Cotton Spinners & Manufacturers' Directory as a dyers and finishers mill (Worrall 1891).

Between the late 19th and mid-20th centuries, historical evidence of the use of Wellfield Mill is limited. However, this can be insinuated from the descriptions of the mill on historic mapping during this time. For instance, the OS map of 1911 depicts Wellfield Mill with the description of 'Fuelling, Dyeing, etc.' (Plate 3). It is clear there was a slight change in working processes at the site, as the following map of 1930 describes Wellfield Mill as a 'bleaching & dyeing' mill (Plate 4).

The next available historical reference of Wellfield Mill is within the Cotton Spinners' and Manufacturers' Directory of 1962, which described the mill as a 'bleachers, dyers, raisers and finishers' (John Worrell Publishers 1962). In 1967, the same directory describes the site as manufacturing 'flannels, flannelettes and serges' under the ownership of Kershaw Chas Ltd, now listed in combination with the Kershaw's site at Sladen Mill (John Worrell Publishers 1967). Wellfield Mill and Sladen Mill are both described as bleachers, dyers, raisers and finishers of flannelettes, winceyettes and cotton blankets under Kershaw Chas Ltd in The Lancashire Textile Industry directory of 1971 (Thomas Skinner Directories 1971).

Aerial photographs from the mid-20th century were reviewed as part of this assessment, but the available photographs were captured at a far distance, making it difficult to form an interpretation of the mill during this time period.

In summary, the available evidence suggests that Wellfield Mill functioned as a fulling mill, working with cotton materials for the recorded periods of its operation. The mill diversified into bleaching, dyeing and finishing during the early to mid-20th century. Historical evidence detailing the types of chemicals which may have been used in these processes has not been identified as part of this assessment. However, it is clear that the relationship between the Site and Wellfield Mill extends beyond their physical proximity, with Wellfield Mill located upstream from Sladen Mill. The connection between these two mills is reflected in their shared ownership under the Kershaw name, and their involvement in the wool and cotton industries for a recorded period of around 130 years.

1.4 Rock Nook Mill

Located 550m northwest of the Site is the former Rock Nook Mill. This mill was established in 1886 by Fothergill & Harvey, a company formed in 1847 (Fothergill Group 2024; GMHER 2024). The mill formed part of the Rock Nook Conservation Area prior to its recent demolition

in 2023 (GMHER 2024), and a Statement of Heritage Significance of the mill was produced in 2020 (MBA Ltd 2020).

Early evidence indicates that the mill was originally used for spinning cotton, as reflected on historic mapping from 1893 (Plate 2). Kelly's Directory of 1907 also notes that the mill operated as a cotton manufacturer (Kelly's Directories Ltd 1907). During the decline of the cotton trade in the mid-20th century, Fothergill & Harvey diversified into producing synthetic fabrics such as glass and carbon fibre, whilst also creating products under the trading name of 'Tygaflor' [also referred to as 'Tygan', 'Tyglas', 'Tygadure'] at Rock Nook Mill and other mills around Littleborough, including Sladen Wood Mill, detailed in Section 1.5 below (MBA Ltd 2020). The company conducted business in the manufacturing of synthetic materials which were advertised as moth-proof, waterproof, and resistant to 'acids, alkalis, alcohol and many other organic solvents' (Plate 6). The reports and accounts of Fothergill & Harvey from 1980, available from Companies House, further describe the materials manufactured under the 'Tygaflor' trademark, including fluorocarbon-based products and advanced composite materials (Fothergill & Harvey Ltd 1980).

The gradual expansion of the business is reflected in historic mapping and aerial photographs throughout the 20th century. Between the OS maps of 1893 and 1911, the site underwent expansion to the south, following the trajectory of the Rochdale Canal (Plates 2–3). By the publication of the 1930 OS map, new buildings had been constructed to the southeast of the site. Further expansion southeast occurred during the mid-20th century, reflected on the OS Plan of 1963 (Plate 5). It is noted that the company built across the Rochdale Canal when the canal officially closed to traffic in 1952, and that after the reopening of the canal 50 years later these features were removed (Evans 2023). Aerial photographs taken as part of the Greater Manchester Textile Mills Survey of 1985–6 reflect this, showing part of the canal covered with concrete, resulting in the surrounding area of the canal drying out (GMHER Ref: SF316348).

Adjacent to east of the former Rock Nook Mill buildings is the canal drain. As mentioned previously, this drain was likely constructed as a means of infilling the Rochdale Canal during its original construction and passes within the immediate vicinity to Sladen Mill (MBA Ltd 2020). By the 1980s aerial photography survey, it appears that much of this drain had dried out, but some water remained present towards the south of the site (GMHER Refs: SF316345 - SF316349).

The historical evidence consulted above describes the development of Rock Nook Mill over the course of its history. Functioning primarily as a cotton mill during its early history, the mill

later diversified into the production of synthetic fabrics under the direction of Fothergill & Harvey Group. The Group later formed the trademark name 'Tygaflor', producing fluorocarbon-based products and advanced composite materials at Fothergill & Harvey mills around Littleborough, including Rock Nook Mill. The mill itself was demolished in 2023 following concerns on public safety and the stability of the structure after it was subject to a destructive fire in 2015 (GMAAS 2024). However, the remaining buildings and structures at the site still form part of the Fothergill Engineered Fabrics Ltd premises today.

1.5 Sladen Wood Mill

Sladen Wood Mill is situated immediately north of Rock Nook Mill on the western side of the Rochdale Canal, around 880m northwest of the Site. This mill was also established by the group Fothergill & Harvey, who purchased the site containing a weaving shed adjacent to Punch Bowl Lock. The original weaving shed displays a plaque which reads "F & H Ltd. Built 1852 Rebuilt 1949" (GMHER 2024). In 1907, the mill is listed within the directory of cotton manufacturers under the name of 'Sladen Wood Mill Co', referencing the nearby Rock Nook and Greenvale mills (Kelly's Directories Ltd 1907). Following a similar business development as Rock Nook Mill during the 20th century, Sladen Wood Mill also diversified into the development of synthetic fabrics and fibreglass clothes, as described within the Cotton Spinners' and Manufacturers' Directory of 1962 (John Worrell Publishers 1962). The 1971 Lancashire Textile Industry directory provides an account of the workings of Fothergill & Harvey Ltd, comprising yarn preparation and sizing, the weaving of glass, nylon, "Terylene", saran, polyethylene and other man-made fibres, and the production of 'industrial fabrics for coating, filtration, reinforcement'. The directory also states that the group ran sites across Littleborough at Sladen Wood, Rock Nook, Greenvale, Ealees and Gale Mills (Thomas Skinner Directories 1971).

The most notable changes identifiable on historic mapping of this area occurred between the OS maps of 1851 and 1893, with the construction and establishment of Sladen Wood Mill during the mid to late 19th century. Some expansion occurred to the southern and northern extents of the mill between the 1911 and 1930 OS maps, however beyond this point very little change is discernible within the OS map of 1963. Aerial photographs from the 1980s show the site and its proximity to Rock Nook Mill, located south of Sladen Wood Mill. In the same way as the aerial photographs captured of Rock Nook Mill, images of Sladen Wood Mill show that the canal had been constructed over, which resulted in the immediate areas of the Rochdale Canal becoming dried out (GMHER Ref: SF316350 – SF316353).

Analysis of the available historical records and data concerning the practises undertaken at Sladen Wood Mill shows that Fothergill & Harvey were involved in the production and manufacturing of synthetic fibres, including fluorocarbon-based products and advanced composite materials (Fothergill & Harvey Ltd 1980). The site followed a similar development to the nearby Rock Nook Mill, producing cotton in the 19th century and later diversifying into synthetic and man-made fabrics during the 20th century. By 1999, the Sladen Wood Mill site was transformed into a business centre (GMAAS 2024). It appears that Fothergill & Harvey moved from the premises slightly south, where they remain under the trading name of Fothergill Engineered Fabrics Ltd at the former Rock Nook Mill site (Google Earth 2024).

1.6 Discussion

The historical evidence consulted within this Technical Note provides an insight into the manufacturing processes of the Site at Sladen Mill and the three other mills located within its vicinity, including: Wellfield Mill; Rock Nook Mill; and Sladen Wood Mill.

Historically, Sladen Mill and Wellfield Mill both operated under the Kershaw name and are recorded to have operated primarily as a cotton and wool manufacturers, diversifying into dyeing and bleaching from the mid-20th century onwards. The two mills operated by Fothergill & Harvey, Rock Nook Mill and Sladen Wood Mill, are recorded to have functioned as cotton spinning factories during the late 19th century, expanding their services to produce synthetic materials in the 20th century. These synthetic materials comprised the use of fluorocarbon-based products and advanced composite materials, which may have contained chemicals similar to those identified within geo-environmental investigations at the Client's Site (T J Booth Associates 2022).

A newspaper cutting from 1974 details an event which occurred at Greenvale Mill, one of the several Littleborough mills owned by Fothergill & Harvey. The article describes a fine issued to the company due to the release of pollutant materials into Lydgate Brook. The pollutant is reported to have entered the Brook and flowed downstream to Smithy Bridge. It is unclear which course of the Brook this pollutant took but, taking into consideration the flow of stream indicated on historic mapping (Plates 2–3), it is likely the pollution headed west from Greenvale Mill and south along the western side of the Rochdale Canal, instead of travelling upstream towards the Client's site at Sladen Mill. The pollutant comprised heating fuel oil which was reported to have 'escaped from a tank', and the company was ordered to pay £25 to cover the lawyer's fees (Rochdale Observer 1974).

1.7 Conclusion

This Technical Note was produced to provide a historical appraisal of the Site at Sladen Mill, in conjunction with three other mills located within the area of Littleborough: Wellfield Mill; Rock Nook Mill; and Sladen Wood Mill. It is important to note that Sladen Mill (the Site) and Sladen Wood Mill are two separate sites that historically functioned under two separate companies. Sladen Mill operated under the Kershaw Brothers, while Sladen Wood Mill was owned by the group Fothergill & Harvey. Although both sites originated within the cotton industry, the available historical evidence notes that Sladen Mill continued processing and manufacturing cotton, wool and flannel materials, introducing bleaching and dyeing processes during the mid to late 20th century. In comparison, the group Fothergill & Harvey diversified into the production of synthetic materials, comprising fluorocarbon-based products and advanced composite materials at their sites in Littleborough (comprising Rock Nook, Sladen Wood, Greenvale, Ealees and Gale Mills).

Although there has been no evidence yet identified which suggests the use of Per- and Polyfluoroalkyl substances (PFAS) and PFOS and PFOA chemicals at the Sladen Mill site, unless a full record of all imported and exported materials to and from the Site is available for examination, the historic evidence alone is not sufficient to explain the presence of these chemicals within deposits at the Site. It would be recommended that geo-environmental specialists are consulted for further advice and support.

This report was written in accordance with documents published by the Chartered Institute for Archaeologists (CIfA 2022).

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Appendix 1: Plates



Plate 1: Sladen Mill on the Lancashire Map of 1851, indicated in red. Wellfield Mill indicated in blue. Reproduced with the permission of the National Library of Scotland (2024)



Plate 2: Sladen Mill on the First Edition OS Map of 1893, indicated in red. Wellfield Mill indicated in blue, and Rock Nook Mill in green. Reproduced with the permission of the National Library of Scotland (2024)



Plate 3: Sladen Mill on the OS Map of 1911, indicated in red. Wellfield Mill indicated in blue, and Rock Nook Mill in green. Reproduced with the permission of the National Library of Scotland (2024)



Plate 4: Sladen Mill depicted on the OS Map of 1930, indicated in red. Wellfield Mill indicated in blue, and Rock Nook Mill in green. Reproduced with the permission of the National Library of Scotland (2024)



Plate 5: Sladen Mill on the OS Plan of 1963, indicated in red. Wellfield Mill indicated in blue, and Rock Nook Mill in green. Reproduced with the permission of the National Library of Scotland (2024)

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Tygan is woven from BEXAN, a new synthetic yarn developed by B.X. Plastics Limited.

Tygan is tops where treatment is tough

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Tygan undergoes the same rigorous testing as other Tyga Textiles in the laboratories of Fothergill & Harvey Limited. This is an assurance of the consistent high quality and serviceability of Tygan, which conforms in every respect to the highest standards of Lancashire woven productions.

Write for illustrated folder containing patterns, quoting reference T.1, to FOTHERGILL & HARVEY LTD., Thirty-seven Peter Street, Manchester 2



Plate 6: An advertisement in 1948 showcasing Fothergill & Harvey's material products.
Image retrieved from Grace's Guides (2024)