C1876/EAJ/DPS/bz/20260034_V01

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Dear Jessica,

LAND AT BARNHILL STREET/RABY STREET, MOSS SIDE
PILE DESIGN RISK ASSESSMENT

1. BACKGROUND

SGI Consulting Engineers Ltd (trading as SGI) have been instructed by Caddick Construction / Mossacre St Vincent's Housing Group Ltd to undertake a contamination risk assessment for penetrative foundation systems, which is referred to as a Contamination Piling Risk Assessment, for a proposed high-rise development at the land off Barnhill Street/Raby Street in Moss Side, Manchester, herein referred to as the site.

The site comprises a generally rectangular parcel of open land with grassed open space in the north and scrubland in the south and southwest.

SGI has prepared this Contamination Piling Risk Assessment to demonstrate that the proposed construction works will not present any unacceptable risk to controlled waters of the wider environment.

This assessment has been written with due consideration to the CL:AIRE guidance document Piling and Penetrative Ground Improvement Methods on Land Affected by Contamination: Guidance on Pollution Prevention, March 2025.

1.1. PREVIOUS REPORTS

SGI have been provided with the following geoenvironmental investigations and assessments that have previously been carried out at the site:

- **Phase I Geoenvironmental Site Assessment** (Ref: 18-145-R1-3) dated July 2025. The report was prepared by E3P on behalf of Caddick Construction Ltd.
- **Phase II Geoenvironmental Site Assessment** (Ref: C1876/EAJ/DPS/bz/20250184_V02) dated October 2025. The report was prepared by Shepherd Gilmour Consulting Engineers on behalf of Caddick Construction Ltd / Mossacre St Vincent's Housing Group Ltd
- **Remediation Strategy** (Ref: C1876/EAJ/DPS/bz/20260031_V01) dated March 2026. The report was prepared by Shepherd Gilmour Consulting Engineers on behalf of Caddick Construction Ltd / Mossacre St Vincent's Housing Group Ltd

ace consultancy engineering business environment member

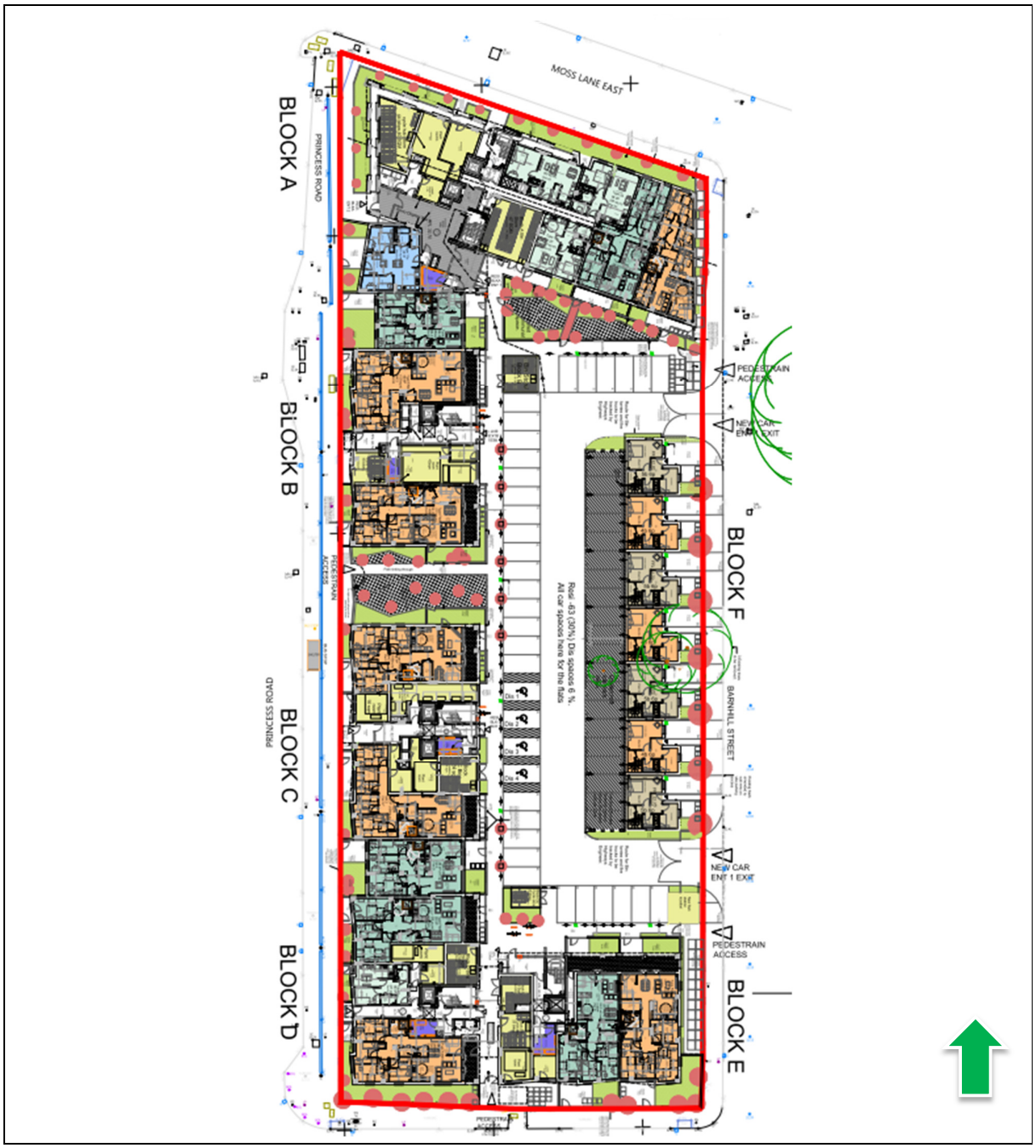
For the avoidance of any doubt, the reports should be read both as a precursor to and in conjunction with this document.

1.2. PROPOSED DEVELOPMENT

The proposed development will comprise a residential development of around 212 units comprising a mixture of 1,2, 3 and 4 bed flats between 5 to 10 storey high, and 7 No. 3 storey town houses.

Proposed Development Plan is presented in Figure 1 below.

FIGURE 1 PROPOSED DEVELOPMENT LAYOUT



2. SITE SETTING

The site comprises 0.55 hectares of land located off Barnhill Street Moss Side, Manchester M14 4SS.
National Grid Reference: E 383934, N 395772

2.1. GROUND CONDITIONS

MADE GROUND

Made Ground was encountered in each of the exploratory holes, from ground level to a maximum proven depth of 2.20 m bgl (WS104), but generally less than 2.00 m deep. The full depth of Made Ground remained unproven in TP105 and TP108 due to encountering potential services.

A layer of reworked Topsoil was identified across the majority of the site to depths of 0.10 – 0.40 m bgl, described as brown slightly gravelly fine to medium sand with occasional rootlets and gravels of fine to coarse angular to subrounded of brick, mudstone, sandstone, glass and rare metal.

Beneath the reworked Topsoil, and from ground level in locations where reworked Topsoil wasn't identified, Made Ground comprised reddish, dark brown and grey multicoloured sandy gravel with frequent cobbles with occasionally high ash content. The gravel comprised fine to coarse angular to subrounded of brick, glass, concrete, sandstone, mudstone, slate rare metal, timber, clinker and plastic, with cobbles of angular of brick and concrete.

Frequent relict brick and concrete foundations and masonry were encountered in the Made Ground at depths generally between 0.50 – 1.50 m bgl.

A layer of concrete hard standing was identified from ground level – 0.10 m bgl in RB101 and in RB106 between 1.90 – 2.10 m bgl.

Bitumen bonded cobble setts were also encountered between 0.30 – 0.40 m bgl in TP101.

SUPERFICIAL SOILS

Natural superficial deposits were encountered beneath the Made Ground to a maximum proven depth of 8.80 m bgl (RB105 and RB106).

The material was described as a firm to stiff greyish brown slightly sandy slightly gravelly CLAY with gravel of fine to coarse angular to rounded sandstone, mudstone and rare coal.

Granular soils were occasionally encountered beneath the Made Ground in the centre-west and southwest of the site as follows:

- Yellow and grey clayey sandy GRAVEL – TP103 (0.60-2.00 m).
- Orange and grey clayey fine to medium SAND – TP104 (1.00-1.70 m)
- Greyish brown very clayey gravelly fine to coarse SAND – TP106 (1.10-1.90 m)
- Loose light greyish brown clayey fine to coarse SAND – WS105 (1.40-2.30m)
- Light brown slightly clayey fine to medium SAND – WS106 (1.50-1.80m)

Greyish brown and a reddish-brown SAND and GRAVEL were encountered beneath the CLAY at depths of between 7.50 – 8.80 m bgl in RB101, RB104, RB105 and RB106, with gravel of fine to coarse angular to rounded of sandstone, mudstone and coal. This is likely to be weathered bedrock.

SOLID GEOLOGY

Weathered red SANDSTONE was confirmed in the rotary boreholes from rockhead (top) depths of between 7.80 – 8.80 m bgl, becoming shallower towards the northeast.

The SANDSTONE was found to be poorly cemented and interbedded with sand and gravel bands, resulting in poor core recovery during drilling. Where intact, the SANDSTONE was generally inferred to be weak/moderately weak.

Rockhead has also been inferred from refusals during dynamic probing from the base of the window sample probeholes. Refusals were encountered in the SHDPs at depths between 6.90 m (WS101) and 8.00 m bgl (WS103), which are generally consistent with the depth of rockhead confirmed in the rotary boreholes.

A Depth to Bedrock Plan is presented in Appendix III as drawing 18-145-007. It should be noted that the plan only shows rockhead confirmed by rotary drilling and does not include the depth of rockhead inferred from SHDPs due to the nature of the test (i.e. no sample recovery).

SOLID GEOLOGY

Weathered red SANDSTONE was confirmed in the rotary boreholes from rockhead (top) depths of between 7.80 – 8.80 m bgl, becoming shallower towards the northeast.

Three water strikes were encountered during the course of the intrusive investigation, as listed in Table 2.1 below. Table 2.1 Groundwater Strikes

LOCATION	DEPTH OF STRIKE (M BGL)	APPROXIMATE STRIKE LEVEL (M AOD)	STRATUM	DETAILS
TP103	2.00	30.69	GRAVEL	Slow ingress
WS101	2.10	30.54	CLAY	Strike
WS102	4.20	28.38	CLAY	Strike

2.2. TIER 2 HEALTH RISK ASSESSMENT

SOILS

The Tier 2 human health risk assessment completed by SGI concluded that the majority of the identified elevated concentrations have primary exposure pathways related to dermal contact and ingestion, soil ingestion and vapour/gas inhalation.

The risk to end users is expected to be minimised where hardstanding is present within the proposed development as this will prevent exposure to impacted soils on site. A suitable clean cover system will be required in proposed private gardens as well as landscaping and communal garden areas to mitigate the risk of direct exposure to impacted soils.

In consideration of this report, the site workers are most likely to be the significant receptor with dermal contact, ingestion of soil and vapour inhalation being possible pathways. However, where normal washing and hygiene practise is adopted on site, and appropriate PPE/RPE is worn, there is perceived to be a low risk.

Soils will likely be excavated and removed early into the earthworks and so exposure will be limited.

GROUNDWATER

This assessment has included a comparison of soil leachate analysis from samples of the Made Ground and groundwater samples to Drinking Water Standards (DWS) in the first instance and where absent, environmental quality standards (EQS).

The DWS values specifically relate the to protection of potable water supply, with the underlying bedrock aquifer being the sensitive receptor for the purpose of this assessment.

The comparison recorded that the data exceeds the EQS values for the following inorganic compounds:

- Chromium (VI)
- Chromium (III)
- Anthracene
- Fluoranthene

The principal bedrock aquifer (Chester Sandstone Formation) is considered to be the primary receptor due to the absence of any nearby surface water receptors and has been confirmed beneath the site at depths between 6.90 – 8.80 m bgl.

The exceedances of EQS values identified in the leachate and groundwater are therefore not considered further due to there being no viable pollutant linkage.

In respect of the risk to the principal bedrock aquifer, only Chromium III has been found in exceedance of the drinking water standards (DWS). This isolated exceedance was found in a leachate sample of Made Ground taken from WS102 at 1.50 m bgl. The Chromium III concentrations within the corresponding soil sample analysed were not found to be significantly elevated and would therefore not be considered a point source.

Due to insufficient volumes of water in other wells, only one groundwater sample could be obtained (RB101). No exceedances of Chromium III were identified in the groundwater sample, indicating downward and/or lateral migration is not occurring.

Given the depth of groundwater recorded (3.85 – 4.20 m) is deeper than the Made Ground, it is unlikely that groundwater would rise to mobilise this contamination. Furthermore, the presence of predominantly cohesive (low permeability) superficial deposits beneath the Made Ground and overlying the bedrock aquifer would likely inhibit downward migration.

Given there is no significant source or viable migration pathway, the overall risk to the principal aquifer from site derived contamination is considered to be low.

3. PILE DESIGN CONTAMINATION RISK ASSESSMENT

3.1. PILE DESIGN

During the enabling works, a Made Ground turnover will likely be required to remove any obstruction and facilitate the installation of new foundation. During this process, the Made Ground in the locality of WS102 will likely be removed to create a reduced level excavation for the substructure works.

Upon completion of enabling works, the foundation solutions will comprise likely comprise a piled foundation with Continuous Flight Auger (CFA) Piling being the recommended solution.

3.2. CONTAMINATION RISK ASSESSMENT

The 2025 CL:AIRE guidance considers seven pollution scenarios based on the site setting, ground investigation findings and the type of piling method used.

Based on the information obtained for the site, SGi has assessed these and the findings are summarised in Table 3.1.

Table 3.1 Piling Pollution Scenarios and Risk Assessment

POLLUTION SCENARIO	RISK	S-P-R CONSIDERATIONS
1 Creation of preferential pathways, through a low permeability layer (e.g. an aquitard that transmits water at slower rates than an aquifer), to allow potential contamination of an underlying aquifer	Low	**Continuous Flight Auger (CFA)** Continuous Flight Auger (CFA) piling involves the advancement of a continuous auger into the ground to the required depth, during which soil is removed to form a bore. Upon reaching the design depth, concrete is pumped through the hollow stem of the auger as the auger is gradually withdrawn, allowing the bore to be filled from the base upwards. The formation of the bore has the potential to create a temporary vertical preferential pathway within the ground. This could arise particularly where issues such as inadequate concrete pressure, overbreak, ground relaxation, or necking occur during installation. In such circumstances, there is a theoretical potential for a pathway to be created within the upper strata through which soluble-phase contaminants could migrate. However, the overall potential for such a pathway to persist is considered limited. The CFA installation method involves the continuous pumping of concrete from the base of the pile upwards as the auger is withdrawn. This process maintains positive pressure within the bore and promotes full displacement and replacement of the excavated material, thereby substantially mitigating the likelihood of a continuous preferential pathway being formed or remaining open within the surrounding strata.
2 The driving of solid contaminants down into an aquifer during pile driving	Low	During CFA piling, soil is excavated and conveyed upward along the auger flights to the surface. Concrete is then pumped through the hollow stem of the auger during its gradual withdrawal from the ground. Given that the CFA process transports excavated material to the surface via the auger flights, there is limited potential for soils to be displaced or driven downward during installation.
3 Contamination of groundwater and subsequently surface waters by turbidity, support fluids, concrete, cement paste or grout	Low	The concrete specified for use in the Continuous Flight Auger (CFA) piles is designed and classified in accordance with relevant construction standards for structural and geotechnical applications. The constituents of the concrete—typically cement, aggregates, water, and approved admixtures—are inert once cured and do not contain substances that would reasonably be expected to leach harmful contaminants into the surrounding soil or groundwater.

4 Direct contact with contaminated soil or leachate causing degradation of pile materials	Low	The concrete used in CFA piles will be specified to a recognised standard according to the pH and sulphate concentrations recorded in the SGi site investigation.
5 Creation of preferential pathways to allow migration of landfill gas or contaminant vapours to the surface	Low	The site is classified as Characteristic Situation 1 (CS1), reflecting the absence of significant gas-generating materials within the subsurface. As a result, ground gas is unlikely to be generated at concentrations or volumes that could present a risk to human health. Accordingly, the site is considered to pose a low ground gas risk, and specialist gas protection measures are not required.
6 Causing off site migration of ground gas or increased vertical emissions as a result of vibration or other effects from the pile installation process	Low	Given the absence of an potentially significant concentration or volume of hazardous ground gas identified within standpipes during monitoring period, it is unlikely that offsite migration will occur.
7 Direct contact with contaminated soil arisings that have been brought to the surface	Low	The use of CFA piles will return arisings as the bores are created providing the potential for piling operators and site workers to come into contact with contaminated soils. However, where normal washing and hygiene practise is adopted on site, and appropriate PPE/RPE is worn, there is perceived to be a low risk. Soils will likely be excavated and removed early into the earthworks and so exposure will be limited

4. CONCLUSION

The Piling Risk Assessment has determined that based on the ground and perched groundwater conditions within the Made Ground and underlying drift strata, the use of CFA piling bearing within the underlying drift will pose a low risk.

I trust this information is satisfactory to your requirements, and should I be able to be of any further assistance, please do not hesitate to contact me.

Yours sincerely,
SGI Consulting Engineers Ltd



Damien Schofield
Structural Director