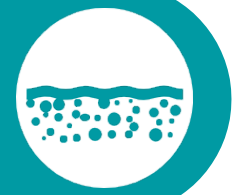


SuDSmart Design



Sustainable Drainage Assessment

Site Address

Unicorn House
Cheetham Road
Middleton
Manchester
M24 4DG

Date updated

2026-02-20

Date issued

2024-09-24

Report Status

FINAL

Grid Reference

386561, 405628

Site Area

0.1 ha

Report Prepared for

Signature Estates

Report Reference

83402R2



Infiltrate to Ground

The proposed Sustainable Drainage Scheme (SuDS) strategy is comprised of self-draining permeable paving and a soakaway to attenuate and infiltrate surface water runoff during the 1 in 100 plus 45% climate change event.

Surface water is proposed to infiltrate to ground at a confirmed infiltration rate of 6.17×10^{-5} m/s (GroundTech, 2025).

Foul water will continue to discharge via the existing connection to the public sewer network.

Report Author

Harriet Parker

Consultant

Report Checker

Annabel Ellera

Project Consultant

Report Reviewer

Bob Sargent

Associate

GeoSmart Information Ltd
Suite 9-11, 1st Floor, Old Bank Buildings,
Bellstone, Shrewsbury, SY1 1HU
+44(0)1743 298 100
info@geosmartinfo.co.uk
www.geosmartinfo.co.uk

1 Executive summary



This report assesses the feasibility of a range of Sustainable Drainage Scheme (SuDS) options in support of the Site development process. A Detailed Drainage Design has been completed by BrennanConsult, 2025 to ensure surface water runoff can be managed effectively over the lifetime of the development.

SuDS suitability

Risk	Issue	Result
Runoff destination feasibility	Priority 1: rainwater collected for non-potable use	Yes
	Priority 2: infiltration to ground	High
	Priority 3: discharge to an above ground surface water body	Low
	Priority 4: discharge to surface water sewer	Low
	Priority 5: discharge to combined sewer	High
Flooding	What is the river (fluvial) flood risk at the Site?	Very Low
	What is the surface water (pluvial) flood risk at the Site?	Very Low to Low
	What is the groundwater flood risk at the Site?	Negligible
Pollution	Is the groundwater a protected resource?	No
	Is the surface water feature a protected resource?	N/A

Summary of existing and proposed development

The Site is currently vacant, but was previously used within a commercial capacity as a gym. At present there is a single, two storey building with a car park and landscaped areas. Development proposals comprise the change of use and reconfiguration of the internal structure to a new residential building comprising of 11 apartments.

National Standard 1: Runoff Destinations

Priority 1: collection for non-potable use

In line with DEFRA's national guidance, the potential for the collection of rainwater for non-potable use across the proposed development has been considered.

Given the use of the Site as an apartment building, with minimal proposed landscaped or vegetated areas, there is limited scope for the collection and re-use of rainwater within the proposed development. As such, rainwater harvesting is not considered to be feasible.

Priority 2: infiltration to ground

GeoSmart's SuDS Infiltration Potential (SD50) map indicates the Site has a High potential for infiltration, primarily due to the high permeability of the underlying geology (clay, silt, sand and gravel underlain by mudstone, siltstone and sandstone). Infiltration to ground is therefore likely to be feasible.

Priority 3: discharge to above ground surface water body

Ordnance Survey (OS) mapping indicates that there are no surface water features within 100 m of the Site. Therefore, discharge to surface water feature is not feasible.

Priority 4: discharge to surface water sewer

The asset location plan included in Appendix D confirms that there are no public surface water sewers within the vicinity of the Site that could feasibly be discharged to. As such, discharge to surface water sewer is not considered to be feasible.

Priority 5: discharge to combined sewer

The asset location plan included in Appendix D confirms the Site is located within c. 5 m of a public combined sewer. Due to the relatively short distance, discharging surface water runoff to the sewer is likely to be feasible.

Runoff rate and attenuation requirements

Discharging via infiltration requires 38.80 m³ of attenuation to be provided to ensure there is no flooding as a result of the development in all storm events up to and including the 1 in 100 year including a 45% allowance for climate change. This volume is based on an infiltration rate of 6.17×10^{-5} m/s taken from the results of infiltration testing undertaken by GroundTech (2025) and would ensure runoff is not increased above the greenfield scenario.

A detailed drainage layout has been commissioned separately by the Client and has been completed by BrennanConsult (2025) independently of GeoSmart's SuDS assessment. This has been included in Appendix B, and the associated calculations are included within Appendix C.

2 National & local policy context



National Guidance

DEFRA - National standards for sustainable drainage systems (SuDS) (2025)

Standard 1: runoff destinations

A 'SuDS approach' shall be adopted to address the management of surface water by the development and where it should be discharged. Runoff shall be treated as a resource and managed in a way that avoids negative impacts of the development on flood risk, the morphology and water quality of receiving waters and the associated ecology.

Runoff from the development shall be discharged to the following final destinations, to the maximum extent practicable, in accordance with the below hierarchy:

- priority 1: collected for non-potable use
- priority 2: infiltrated to ground
- priority 3: discharged to an above ground surface water body
- priority 4: discharged to a surface water sewer, or another piped surface water drainage system
- priority 5: discharged to a combined sewer

Note 1: priority 1 is the highest priority and priority 5 is the lowest.

Note 2: for the purposes of this standard, a combined sewer is a sewer intended to receive both foul sewage and surface runoff and does not include a sewer intended to receive only foul sewage, even if it has the capacity to accommodate additional flows or has an element of surface water in it already.

To utilise a lesser priority final destination, appropriate evidence shall be provided that demonstrates all higher priority final destinations have been utilised to the maximum extent practicable. Higher cost alone shall not be a reason to utilise lower priority final destinations.

Where more than one final destination is utilised, each final destination's ability to accept runoff shall be maximised in order of priority.

Standard 2: management of everyday rainfall (interception)

Apply a 'SuDS approach' so that at least the first 5mm of rainfall for the majority of rainfall events does not result in runoff from the site to surface waters or piped drainage systems.

Evidence shall be provided that the approach to managing runoff from 'everyday' rainfall has been developed alongside and in support of the management of runoff quality (standard 4) and the delivery of amenity and biodiversity benefits (standards 5 and 6).

Standard 3: management of extreme rainfall and flooding

A 'SuDS approach' shall be adopted to address the management of development runoff during extreme rainfall, including allowances for climate change and urban creep to:

- protect people and property on the development from flooding of the surface water drainage system
- mitigate any increased flood risk to people and property adjacent to or downstream of the development
- protect the receiving water body from morphological damage or minimise the impact on sewer capacity

When discharging to an infiltration feature, the system shall be appropriately sized to accommodate the design event based on ground conditions and contributing areas.

When discharging to an above ground surface water body, sewer or other piped drainage system, the surface water runoff (rate and volume) for the 1% annual exceedance probability (AEP) event shall be controlled to ensure the runoff from the development does not increase flood risk elsewhere.

When discharging to an above ground surface water body, sewer or other piped drainage system, the surface water runoff rate for the 50% AEP event shall be controlled to ensure development runoff from an event of this magnitude has no negative impact.

Any flooding from the surface water drainage system for events up to the 1% AEP event shall be managed within the development.

Any flooding from off-site sources for the 1% AEP event should be managed on site or safely routed through the site, ensuring any downstream risks are not increased compared to the pre-development scenario.

The risks (both on and off the development) associated with flooding from the surface water drainage system for exceedance events greater than the 1% AEP event shall be appropriately managed.

Standard 4: water quality

Apply a 'SuDS approach' that protects surface waters, groundwater and coastal waters by managing the quality of the surface water runoff to adequately address water quality risks from the development.

The proposed SuDS management train(s) shall be based on a robust water quality risk assessment, appropriate to the pollution hazard and sensitivity of receiving waters, reflecting industry recognised guidance or other quantitative assessment as agreed with the approving body and permitting requirements.

Standard 5: amenity

A 'SuDS approach' shall be adopted that maximises benefits for amenity through the creation of multi-functional places and landscapes.

Standard 6: biodiversity

A 'SuDS approach' shall be adopted to ensure the surface water drainage system maximises biodiversity benefits throughout the development lifecycle.

The surface water drainage system shall add biodiversity value by:

- creating diverse, self-sustaining, resilient local ecosystems which contribute to net gains in biodiversity
- supporting and promoting natural local habitat and species, for example, through local nature recovery strategies (LNRS)
- contributing to the delivery of local biodiversity strategies
- contributing to habitat connectivity

Standard 7: design of drainage for construction, operation, maintenance, decommissioning and structural integrity

A 'SuDS approach' shall be adopted to ensure that surface water drainage systems are designed so they can be easily and safely constructed, operated and maintained taking account of the need to minimise negative impacts on natural resources and the environment.

The designer shall provide a management and maintenance plan that supports the design objectives detailed in standards 1 to 6 and ensures the performance of the surface water drainage system with regards to runoff destinations, everyday and extreme rainfall, water quality, amenity and biodiversity is maintained throughout the lifetime of the development.

Surface water drainage design shall examine for the likelihood and consequences of potential failure scenarios that may occur during the operation phase and safely manage the associated risks.

The surface water drainage system shall be designed to ensure structural integrity of all components under anticipated loading conditions for the design life of the development so that it does not affect the structural integrity of any existing or proposed components within, or adjacent to, the development.

Urban creep

Within developments an urban creep uplift factor shall be applied by adding a percentage increase to the calculated area of the impermeable area within the property curtilages. This shall be 10% for all developments unless there are no external private permeable spaces, for example, flats and apartments, when it shall be 0%.

Ministry of Housing, Communities & Local Government – National Planning Practice Guidance: Flood risk assessments: climate change allowances (2022)

The peak rainfall intensity allowances section provides advice on the increased rainfall effects on river levels and land and urban drainage systems. As of May 2022, the applicable climate

change allowance is defined by specific Management Catchment for the 1 in 30 ($\geq 3.3\%$ AEP) and 1 in 100 (< 3.3 to 1% AEP) year event.

As the Site is located within the Irwell Management Catchment the following climate change allowances are applicable.

Table 1. Irwell Management Catchment peak rainfall allowances

Irwell Management Catchment	3.3% Annual exceedance rainfall event		1% Annual exceedance rainfall event	
	2050s	2070s	2050s	2070s
Central	25%	30%	25%	30%
Upper end	35%	40%	40%	45%

The drainage system should be designed to make sure there is no increase in the rate of runoff discharged from the Site for the upper end allowance.

Where on-Site flooding for the upper end allowance presents a significant flood hazard (for example, depths and velocities of surface water runoff cause a significant danger to people), you will need to take further mitigation measures to protect people and property (for example, raising finished floor levels). As a minimum, there should be no significant flood hazard to people from on-Site flooding for the central allowance.

Local Policy

Rochdale Local Plan Adopted Core Strategy (Rochdale Borough Council, 2016)

Policy G1 Tackling and adapting to climate change

We will address climate change and ensure growth does not increase CO₂ emissions by:

- Locating growth in areas which are likely to minimise the need for travel and which are well served by public transport, services and infrastructure;
- Expecting all development and regeneration schemes to be well connected to surrounding areas and facilities by sustainable means of transport (Policy T2);
- Encouraging and promoting renewable energy developments, including standalone and community developments, that do not, by virtue of their scale, siting, construction or operation, cause harm to the local area, its character and environmental assets and adjoining uses, which cannot be satisfactorily mitigated (Policy G3);
- Promoting the efficient re-use of buildings, especially those of heritage value, and the recycling of construction waste;

- Ensuring that development does not cause unacceptable harm to the borough's peatlands and woodlands, and encouraging their restoration and responsible management;
- Promoting sustainable waste management through the operation of policies in the Core Strategy and Greater Manchester Joint Waste Plan;
- Making the best use of open space to contribute to climate change mitigation and adaptation; and
- Securing planning obligations for energy infrastructure and climate change adaptation measures.

New developments will be expected to:

- a. Be zero carbon in line with national targets and definitions;
- b. Adhere to the 'energy hierarchy' as outlined in policy G2, being designed in such a way that ensures that buildings require the minimum amount of energy to function over their lifetime;
- c. Reduce CO₂ emissions through the use of renewable and low carbon decentralised energy technologies and networks. This will be through both on-site provision in new developments and through connection to local networks;
- d. Address the impacts of climate change by incorporating comprehensive adaptation measures, including:
 - i. suitable measures, such as urban greening, for tackling the 'urban heat island' effect;
 - ii. where possible, the opening up of covered and culverted sections of waterways and provision of new water features, to help cooling and provide biodiversity, landscape and flood prevention benefits;
 - iii. the incorporation of appropriate water conservation and management measures, such as Sustainable Drainage Systems (SuDS), including ensuring that the rate of run-off on 'greenfield' sites is not increased and on 'brownfield' sites is significantly reduced, and avoiding the use of impermeable surfaces;
 - iv. the retention of existing trees wherever possible and the taking of all appropriate opportunities to plant trees and other suitable vegetation on site; and
 - v. the incorporation of 'green roofs' wherever possible, such as with flat roofs.

Policy G8 Managing water resources and flood risk

We will ensure that new development (including flood risk mitigation measures) does not lead to any form of increased flooding locally or further downstream, does not impede natural water and flood risk management, is not detrimental to existing or potential flood storage

areas, contributes where possible to alleviating existing flood risk, is itself well protected from flood risk and ensures prudent use of water resources. We will require:

- a. Compliance with a 'sequential' approach to new development and flood risk, directing development away from areas of high risk, in accordance with the National Planning Policy Framework;
- b. Full regard to and compliance with the advice of the Environment Agency (or equivalent agency) and the objectives and priorities for flood risk management set out in the Local Flood Risk Management Strategy, including any mitigation measures recommended for particular sites;
- c. Full regard to the published evidence of local flood risk and its significance as included in Strategic Flood Risk Assessments, Surface Water Management Plans and other recognised sources of flood risk data and the production of additional Flood Risk Assessments (FRAs) as appropriate;
- d. Incorporation of appropriate measures for the management of surface and flood water, including flood storage areas, Sustainable Urban Drainage Systems (SUDS) and the protection of 'overland flow paths';
- e. Compliance with any Surface Water Management Plan or drainage strategies produced, such as for the identified critical drainage areas of Littleborough and Heywood;
- f. The avoidance of culverting, and support the opening up of existing culverts wherever possible;
- g. The incorporation of measures for the conservation of water to minimise potable water consumption, including rainwater collection measures, which should be integral to the design of buildings and spaces;
- h. Development that does not directly or indirectly lead to pollution of existing water resources such as watercourses and groundwater or the derogation of the quantity of groundwater;
- i. The incorporation of measures to improve water quality; and
- j. The taking of opportunities to improve the habitat value of watercourses and water bodies.

In addition, we will identify additional flood storage areas which will be protected from development.

*Rochdale Borough's Strategy for Flood Risk Management 2014-2024
(Rochdale Metropolitan Borough Council, 2014)*

Development and sustainable drainage

- Spatial planning aims to ensure development is sustainable and delivers social, economic and environmental benefits. Spatial planning whilst promoting development must also ensure the appropriate safeguarding and protection of the

natural environment including agricultural land, biodiversity and land which helps to manage and protect our communities from current and future environmental risks such as those from climate change which includes for example our natural flood plains and other land which is important for managing current or future flood risks.

- One of the principal influences on flood risk is the impact of development. Development which is poorly located and designed may result in significant flood risk for its occupants or users and also significant disruption to its use e.g. for habitation or for work. There may also be downstream impacts. Development can also contribute to improved drainage and flood risk management where it is well located and incorporates or provides appropriate flood risk management measures based on a robust flood risk assessment. It is important that early advice is sought through the Local Planning Authority, the Environment Agency and others to help inform the location and design of development through pre-application discussions and use of available flood risk data which will inform more detailed site assessments, site selection and design.
- Rochdale borough's Core Strategy recognises the importance of good flood risk management and has taken account of existing studies for fluvial and surface water flooding and national planning policy in its production. The impact of flood risk in future Development Plan Documents such as relating to allocating land for categories of use will also take full account of flood risk management matters in terms of risk and also opportunities to better manage that risk in the future for example through flood water storage or other sustainable drainage measures. The Council will produce a Supplementary Planning Document setting out the Council's planning approach to flood risk management and the role of the Local Flood Risk Management Strategy in delivering sustainable development and land use.
- At the time of writing, guidance to support the establishment of a new system for managing surface water through sustainable drainage systems by April 2014 is awaited. The Flood and Water Management Act 2010 requires the establishment of a Sustainable Drainage Approval Body (SAB) which will receive applications for sustainable drainage proposals that require approval. This is a separate process from existing planning and building control approval processes but will need to relate to the timescales of these processes where appropriate as SAB approval will be required prior to development being able to commence.
- Sustainable drainage systems can include one or more of the following:
 - permeable surfaces which allow water to infiltrate the ground or into underground drainage;
 - drainage ditches such as swales;
 - temporary storage basins which can be specific or have multiple open space functions outside of a flood event;
 - ponds; and
 - wetlands

- Sustainable drainage systems can help to manage pollution and also provide opportunities for biodiversity. Sustainable drainage systems can also provide opportunities to store and re-use water for a range of purposes for which 'grey' water is appropriate. It is important to ensure that appropriate sustainable drainage approaches are introduced based on proper consideration of factors such as geology, previous land use and ground contamination so that drainage will be effective and not increase risks of contamination. This should include seeking appropriate early advice and carrying out site investigations where required.

3 Site analysis

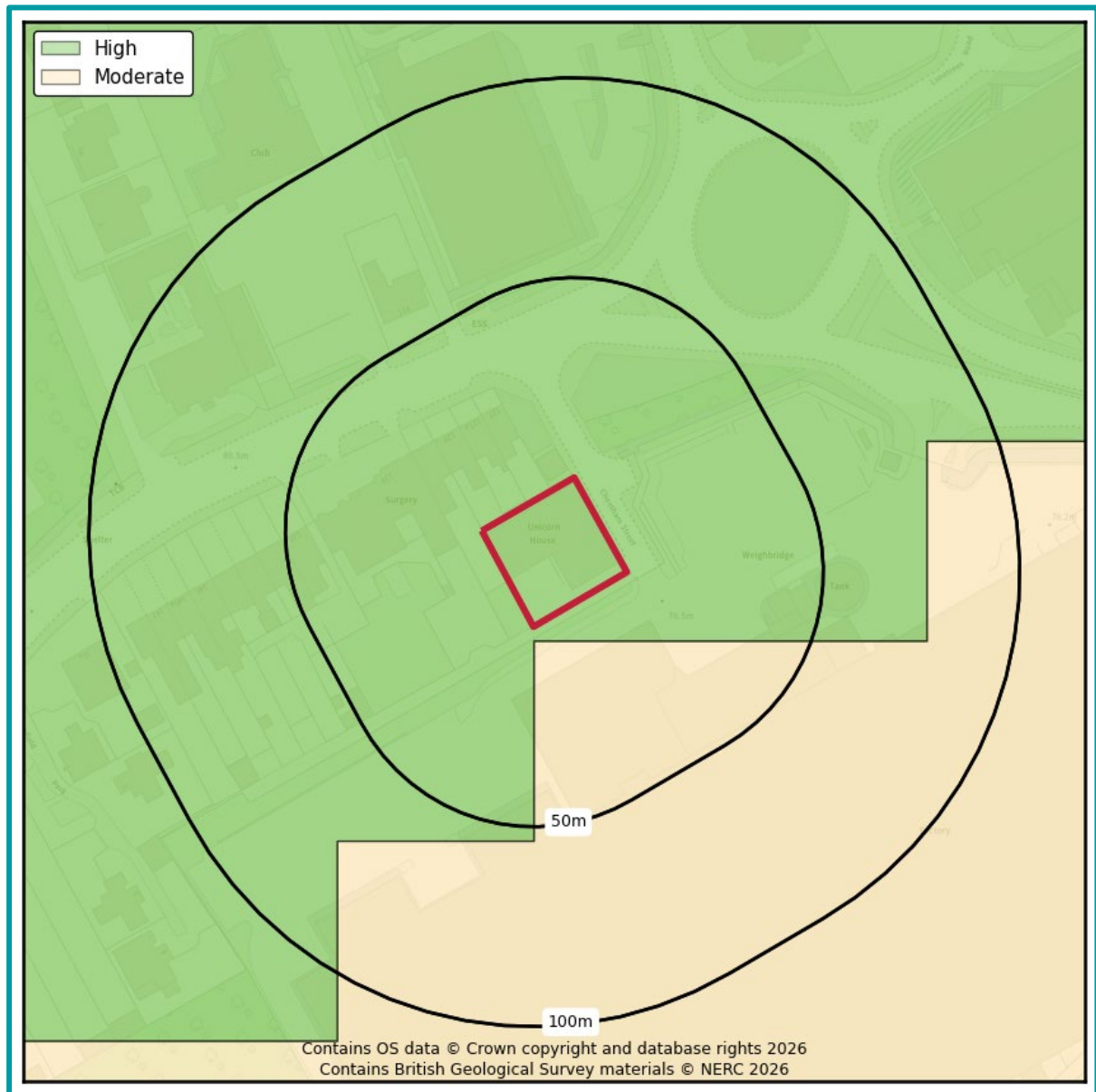


Site location

Figure 1. Aerial Imagery (Bluesky, 2026)



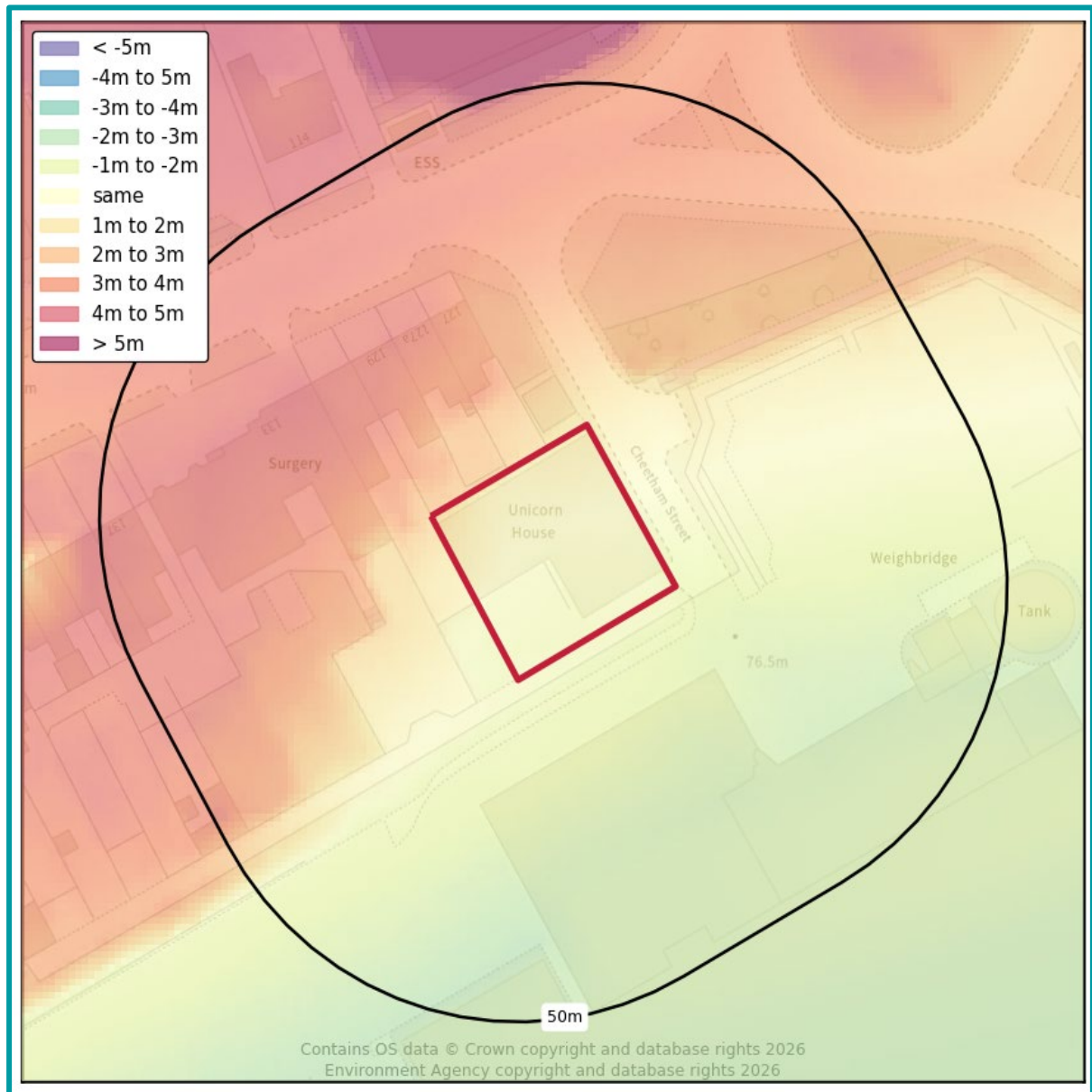
Figure 2. SuDS infiltration suitability (SD50) map (GeoSmart, 2026)



According to GeoSmart's SD50 mapping, there is a High potential for infiltration SuDS across the Site. It is likely that the underlying geology at the Site has high permeability and an infiltration SuDS scheme should be possible at the Site.

Site-specific ground investigation and infiltration testing (GeoAssist Limited, 2026 & GroundTech, 2026 respectively; reports included within Appendix E) has confirmed an infiltration rate of 6.17×10^{-5} m/s within the superficial/bedrock geology, which would be sufficient to accommodate infiltration SuDS features. As such, infiltration is proposed.

Figure 3. Site topography (GeoSmart, 2026)

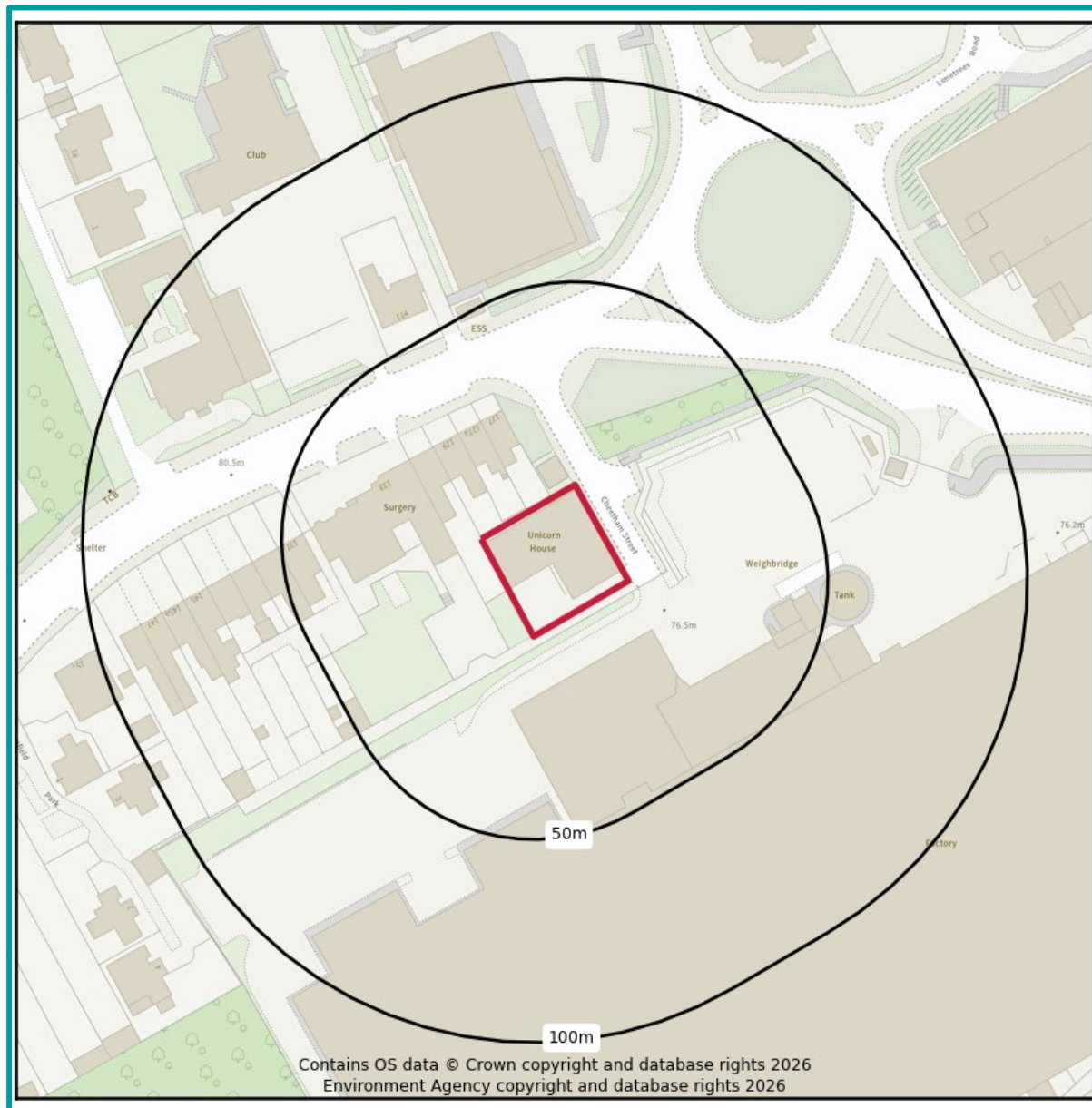


According to a review of the LiDAR DTM5 elevation data for the prevailing area, the ground levels within the vicinity of the Site generally steeply slope to the south east.

The topography on-Site typically falls to the south east from 76.94 to 79.62 mAOD. This is based on EA elevation data obtained for the Site to a 1 m resolution with a vertical accuracy of ± 150 mm.

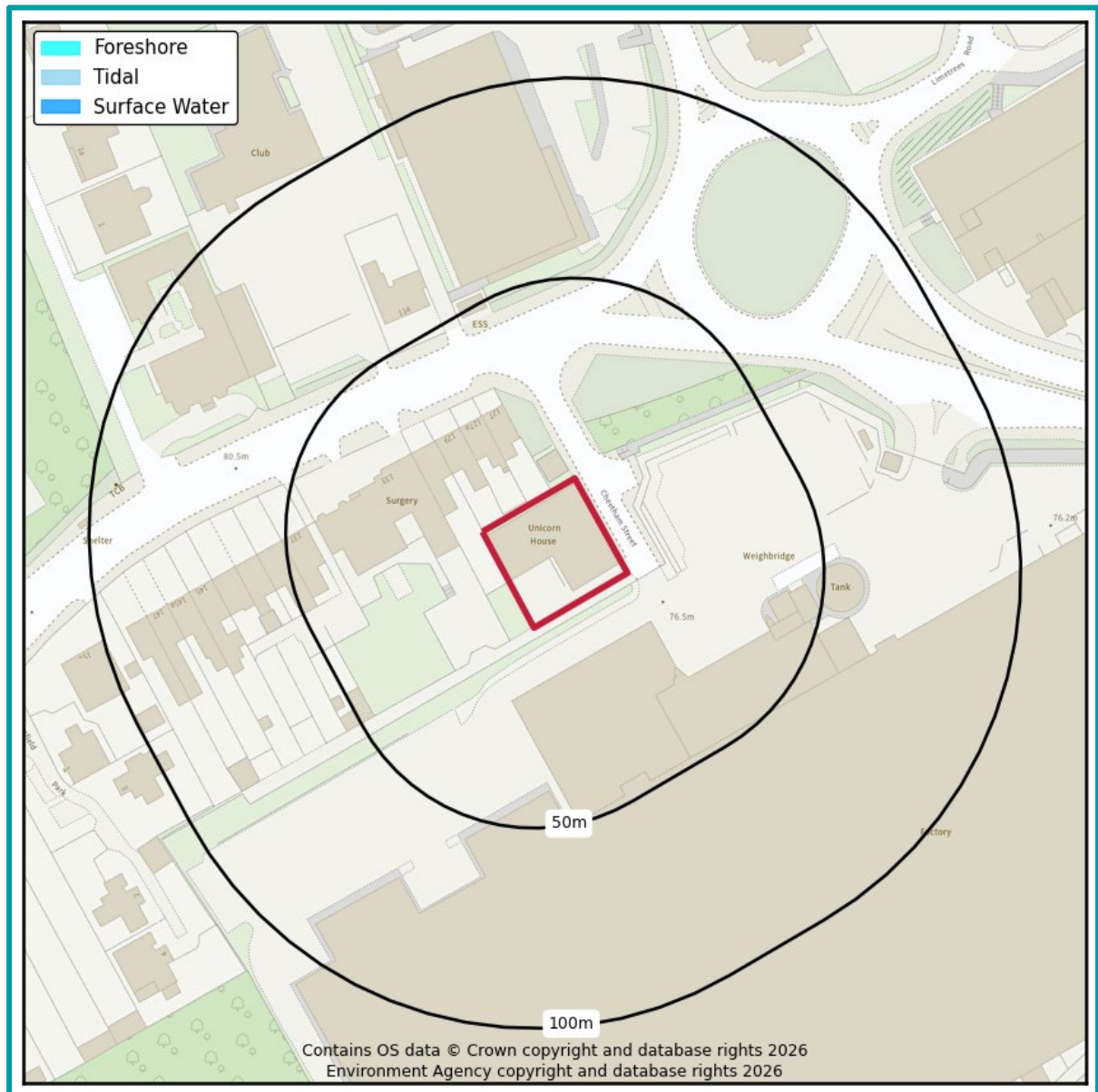
Further analysis could be undertaken by visiting the Site or by collecting additional topographic survey to provide further confirmation of ground levels.

Figure 4. Source protection zone map (EA, 2026)



An assessment of the EA's groundwater Source Protection Zones (SPZs) has been undertaken within the vicinity of the Site and confirms the Site is not located within an SPZ.

Figure 5. Surface water features map (EA, 2026)



Ordnance Survey (OS) mapping indicates that there are no surface water features within 100 m of the Site. Therefore, discharge to surface water feature is not feasible.

According to DEFRA's Magic Map, the Site is not within 250 m of a SSSI or SPA.

Further analysis could be undertaken by visiting the Site or by contacting the Local Council and the Environment Agency (EA) to confirm the presence, location and condition of any unmapped surface water features.

Figure 6. Sewer features map (OS & United Utilities, 2024)

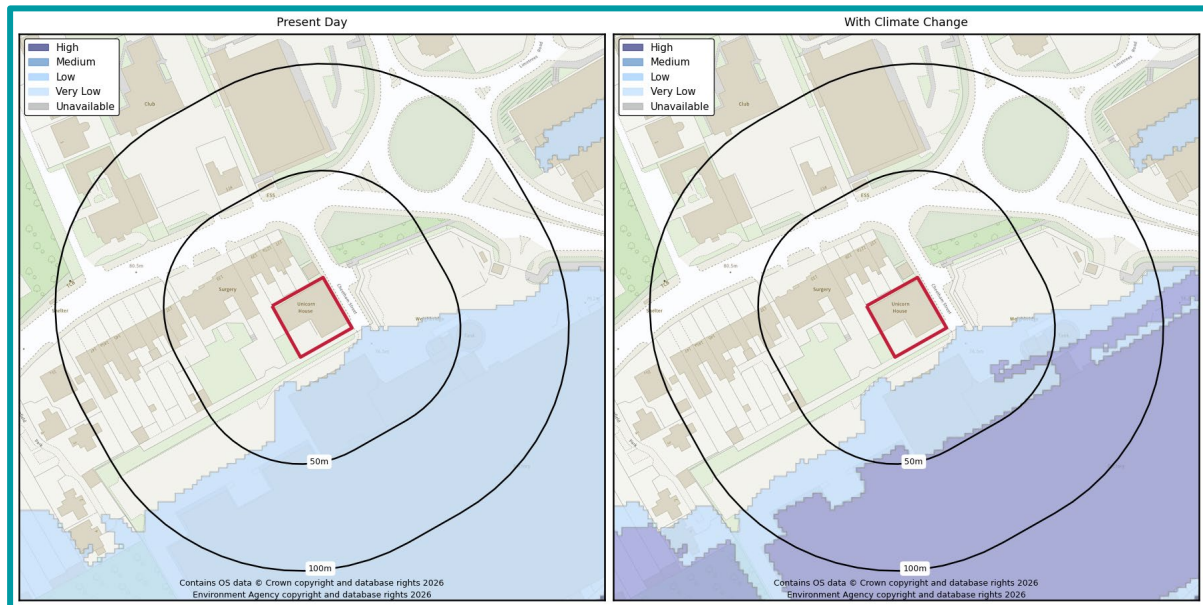


GeoSmart has undertaken an assessment of the location of sewer features within the vicinity of the Site.

According to the United Utilities asset location plan obtained for the Site (Appendix D), there is a public combined sewer, located adjacent to the northern and eastern boundaries of the Site. Therefore, discharge to sewer is likely to be appropriate.

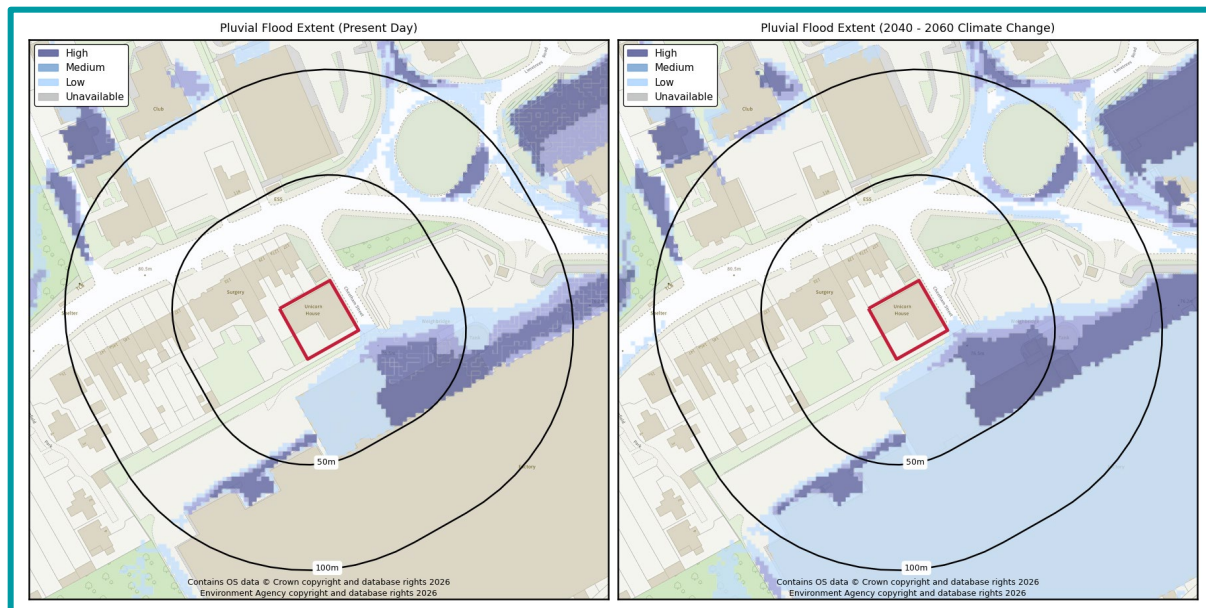
The asset location plan also confirms that there are no public surface water sewers located within the vicinity of the Site.

Figure 7. Risk of flooding from rivers & sea map (EA, 2026)



According to the EA's Risk of Flooding from Rivers and the Sea (RoFRS) map, the Site has a Very Low risk of flooding from fluvial or coastal flooding in both the present day and climate change (2036-2069) scenarios. This equates to a less than 0.1% annual probability of flooding, therefore, the SuDS design is unlikely to be affected.

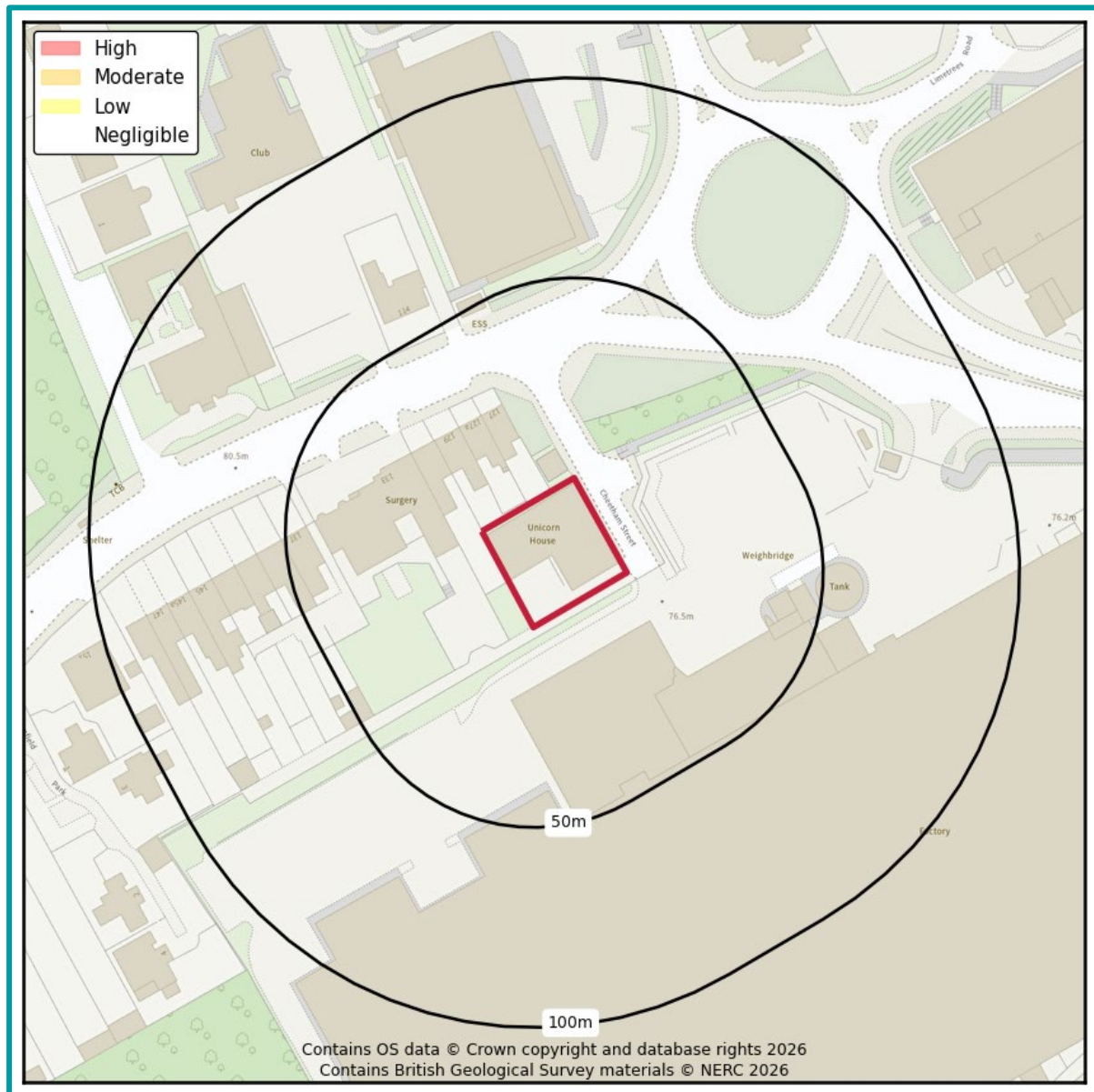
Figure 8. Risk of surface water flooding map (EA, 2026)



GeoSmart have undertaken an assessment of the risk of flooding from surface water (pluvial) sources within the vicinity of the Site using the EA's Risk of Flooding from Surface Water (RoFSW) mapping. The EA's mapping confirms the Site is considered to be at Very Low to Low risk of surface water flooding.

The above map shows the extent and depth of flooding during the >3.3% annual probability (AEP) (1 in 30 year – High risk), 3.3 – 1% AEP (1 in 100 year – Medium risk) and 1 – 0.1% AEP (1 in 1000 year – Low risk) events. This confirms that the majority of the Site would not be affected by surface water flooding.

Figure 9. Groundwater flood risk (GW5) map (GeoSmart, 2026)



GeoSmart have undertaken an assessment of the risk of flooding from groundwater within the vicinity of the Site. GeoSmart's Groundwater Flood Risk Screening (GW5) map confirms the Site has a Negligible risk of groundwater flooding during a 1% annual probability (1 in 100 year) event.

4 Site context



Site information

The purpose of this report is to assess the potential for disposing of surface water through a Sustainable Drainage System (SuDS) for the site of Unicorn House, Cheetham Rd, Middleton, Manchester, M24 4DG (the Site). The Site is located within a suburb of Manchester in a setting of commercial and residential land use.

Development

The Site is currently vacant, but was previously used within a commercial capacity as a gym. At present there is a single, two storey building with a car park and landscaped areas.

Development proposals comprise the change of use and reconfiguration of the internal structure to a new residential building comprising 11 apartments. Site plans and drawings are provided in Appendix A.

Geology, permeability and thickness

British Geological Survey (BGS) national superficial and bedrock geology mapping confirms the geological formations underlying the Site and each formation may have a range of permeability.

Table 2. Site Geology

Geology present on-Site		Potentially permeable?
Superficial geology (Figure 10)	Glaciofluvial Sheet Deposits, Devensian (GFSDD) – sand and gravel (found in the north of the Site) Alluvium (ALV) – clay, silt, sand and gravel (found along the southern boundary)	✓
Bedrock geology (Figure 11)	Pennine Lower Coal Measures Formation (PLCM) – mudstone, siltstone and sandstone	✓

Figure 10. Superficial Geology (BGS, 2026)

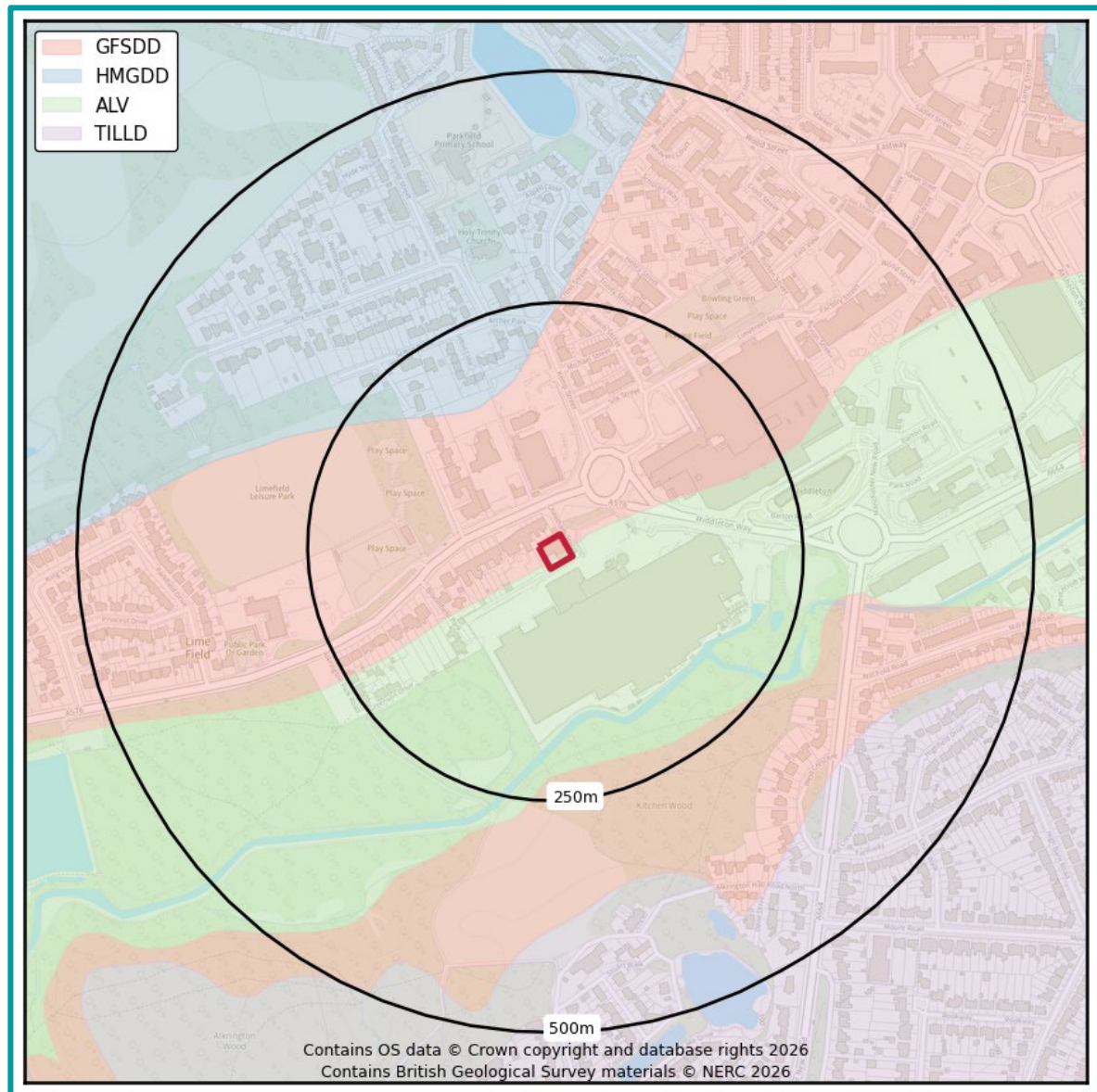
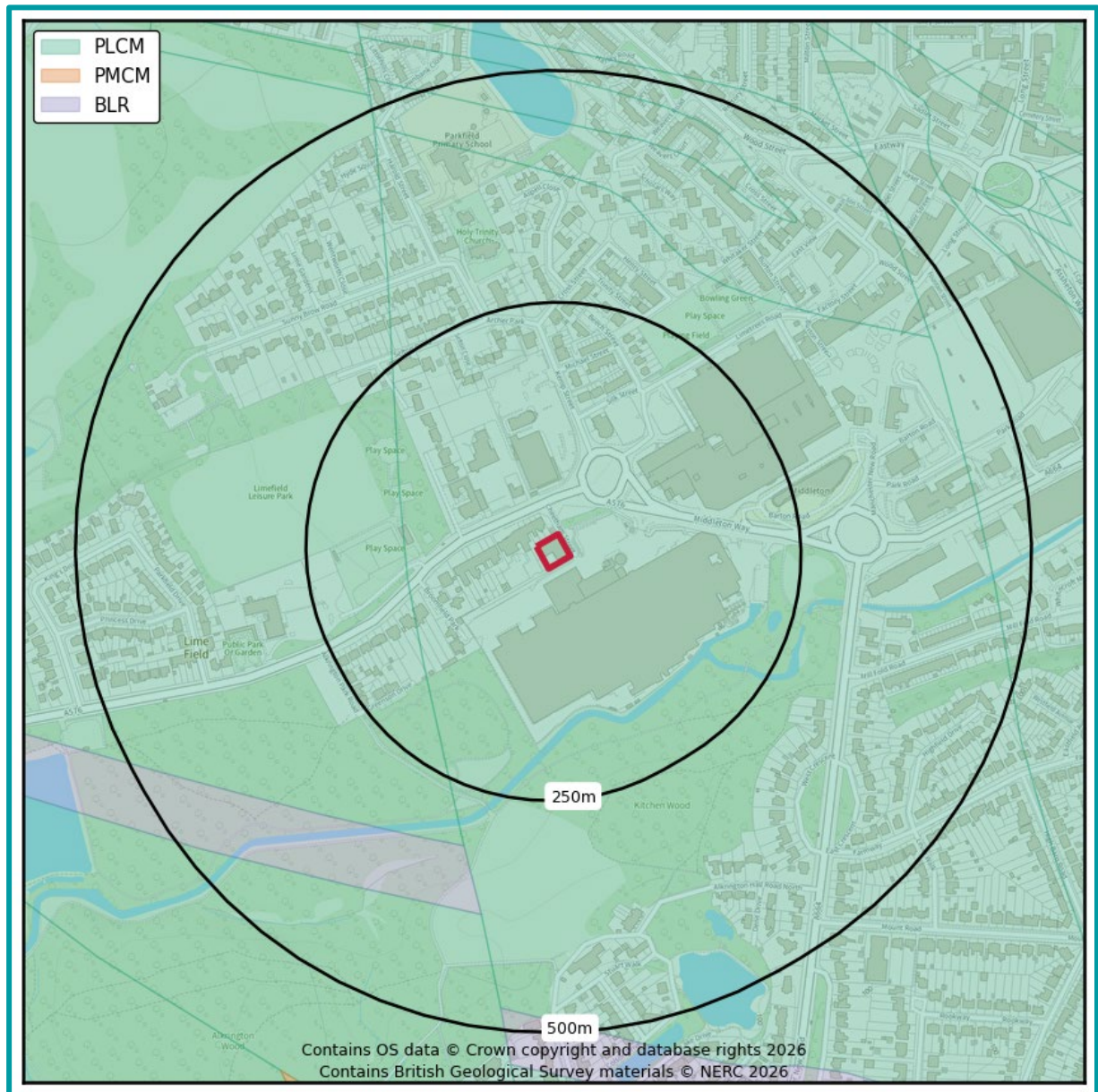


Figure 11. Bedrock Geology (BGS, 2026)



The BGS website was used to extract ground information from the nearest borehole records to the Site (ref: SD80NE21 and SD80NE13). These boreholes are located approximately 100 m to the southeast and 140 m to the north of the Site at an elevation of 73.2 mAOD and 82.3 mAOD.

Despite being located within areas of different superficial deposits (SD80NE13 on GFSD and SD80NE21 on ALV), borehole records indicate similar underlying geology. They confirm that the underlying geology is comprised of sand, gravel and clay layers to a depth of between 32 m and 35.66 m below ground level (bgl) underlain by shales and rock to a depth of between 124.36 m and 91.44 m bgl at core completion.

Two Site-specific ground investigations have been undertaken at the Site, comprising geotechnical ground investigation by GeoAssist Limited in January 2026, and infiltration testing by GeoTech in July 2025 (reports included within Appendix E).

The GeoAssist Limited investigation included 1 borehole to a maximum depth of 4 m bgl, while the GeoTech investigation comprised of three trial pits to a maximum depth of 2.20 m bgl, with percolation testing undertaken in line with BRE 365 guidance. The results of the investigations are summarised within the tables below:

Table 3. Summary of Site Investigation (GeoAssist Limited, 2025)

Strata encountered	Borehole BH1	
	Depth to base of stratum (m bgl)	Strata composition
Made Ground	0.10	Concrete
	1.40	Dark brown/grey gravelly sandy concrete and brick fragments
Glaciofluvial Sheet Deposits	>4.00 (base of borehole)	Orange/brown silty fine to medium sand with occasional gravel and dark grey inclusions from 3 m depth

Table 4. Summary of Site Investigation (GroundTech Consulting, 2026)

Strata encountered	Borehole SUDS1		Borehole SUDS2	
	Depth to base of stratum (m bgl)	Strata composition	Depth to base of stratum (m bgl)	Strata composition
Made Ground	0.25	Light grey concrete	0.25	Light grey concrete
	0.80	Grey brown sandy fine to coarse angular to subrounded gravel of concrete, brick, sandstone and siltstone. Sand is fine to coarse.	0.80	Grey brown sandy fine to coarse angular to subrounded gravel of concrete, brick, sandstone and siltstone. Sand is fine to coarse.
Glaciofluvial Sheet Deposits	>2.00 (base of borehole)	Orange brown gravelly fine to coarse sand. Gravel is angular to subrounded fine to	>2.20 (base of borehole)	Orange brown gravelly fine to coarse sand. Gravel is angular to subrounded fine to

Strata encountered	Borehole SUDS1		Borehole SUDS2	
	Depth to base of stratum (m bgl)	Strata composition	Depth to base of stratum (m bgl)	Strata composition
		coarse of sandstone, siltstone and flint.		coarse of sandstone, siltstone and flint.

Infiltration SuDs are proposed directly into permeable superficial deposits.

Depth to groundwater

The SuDS system should be designed to operate in periods of extreme groundwater levels.

- Borehole records indicate groundwater levels may be around 13.72 mbgl (ref: SD80NE13) within the permeable superficial geology.
- On-Site borehole ref: WS01, undertaken as part of Site-specific ground investigation (GeoAssist Limited, 2025; Appendix E), was noted to be wet from 3.20 m bgl during drilling, and following two days of monitoring recorded a maximum groundwater level of 3.05 m bgl in January 2026.
- On-Site trial pits ref: SUDS1 and SUDS2, undertaken as part of Site-specific infiltration testing (GroundTech Consulting, Appendix E), did not encounter groundwater within their maximum depths of 2.20 m in July 2025.

According to Site-specific ground investigation, borehole data and GeoSmart's Groundwater Flood Risk (GW5) map, shallow groundwater is unlikely to be an issue at the Site.

The base of the infiltration system needs to be 1 m above the expected seasonal high-water table. Passage through unsaturated soil is important for improving the quality of infiltrating water before it reaches the water table.

Ground conditions

Infiltration SuDS are proposed within permeable superficial deposits containing sand, therefore a detailed review of underlying ground conditions is recommended to ensure focused infiltration does not cause ground instability as a result of landslide or collapse associated with running sand.

Soakaways should be a minimum of 5 m away from the foundations of a building and local guidance may recommend a greater distance, such as 10 m on some areas of the Chalk.

Infiltration testing undertaken as part of ground investigation (GroundTech, 2025; report included within Appendix E) has confirmed an infiltration rate of 6.17×10^{-5} m/s (0.222 m/hr), which would be sufficient to feasibly accommodate focused infiltration SuDS features.

Water quality

The Site does not lie within an SPZ. The infiltrated water quality should be of sufficient quality that it does not give rise to pollution of the underlying groundwater. Further consultation with the water company is unlikely to be required.

Infiltration systems should not be used where there is a risk of contaminating groundwater by infiltrating polluted runoff or where receiving groundwater is particularly sensitive.

The influence of surface runoff on water quality will depend on whether there is a source of contamination on-Site and the sensitivity of the receiving environment, either groundwater or surface water. The intervening pathway from source to receptor including mitigation and natural attenuation will determine the final impact.

The impact of contaminants on the groundwater will be reduced by travel and natural attenuation through the unsaturated soil zone. A greater depth of unsaturated zone and the presence of significant clay and organic material will provide greater protection for the underlying groundwater. Rapid flow through fractures will provide less protection than intergranular flow around soil and rock particles.

5 Runoff destination



National Standard 1: runoff destinations

Options for the destination for the runoff generated on-Site have been assessed in line with the prioritisation set out in DEFRA's national standards for sustainable drainage systems (2025).

Priority 1: Collection for non-potable use

An assessment of the potential for rainwater collection and re-use across the proposed development has been undertaken, which confirms that there is limited scope for the collection and re-use of rainwater due to the minimal landscaped or vegetated areas across the Site.

Priority 2: Discharge to ground

The Site has high potential for infiltration, with permeable underlying geology. Based on the available borehole information (subject to confirmation by site investigation) and groundwater flood risk mapping there is a Negligible risk for groundwater flooding and low potential for high groundwater levels.

There are no known issues identified relating to Site contamination or the presence of a SPZ.

Priority 3: Discharge to above ground surface water body

Ordnance Survey (OS) mapping indicates that there are no surface water features within 100 m of the Site. Therefore, discharge to surface water feature is not feasible.

Priority 4: Discharge to surface water sewer

According to the United Utilities asset location plan obtained for the Site (Appendix D), there are no public surface water sewers within the vicinity of the Site.

Due to the significant distance to the nearest public sewer, discharge of runoff to surface water sewer is not considered to be feasible for the Site and is not proposed.

Priority 5: Discharge to combined sewer

According to the United Utilities asset location plan obtained for the Site (Appendix D), there is a public combined sewer located c. 5 m to the north of the Site; therefore, discharge to sewer is likely to be appropriate.

Due to the relatively short distance to the nearby combined sewer, discharge of runoff to this location is likely to be feasible.

6 Storage, volume and peak flow rate



Urban creep

According to Paragraph 3.3 of the DEFRA National standards for SuDS, urban creep should be taken into account as part of the SuDS design. Urban creep accounts for the potential for impermeable areas to increase over the lifespan of a development, such as extensions to proposed building footprints and increases in patio areas.

As the development proposals are for an apartment building with limited landscaped areas and no private garden areas, no Urban Creep uplift factor is required to be applied to the impermeable surface area and as such the standard proposed impermeable area has been utilised within the calculations.

Surface water runoff

An increase in impermeable areas on-Site will result in greater rainfall runoff. A reduction in runoff will help mitigate flood risk both on and off-Site.

Table 5. Change in impermeable area associated with the development

Total Site area	742 m ²
Impermeable area (and as a percentage of the total area of the proposed development footprint of 742 m ²)	
Pre-development	Post-development
707 m ² (95%)	540 m ² (73%)
Impermeable land use: Building roof with hardstanding Permeable land use: Landscaped areas	New impermeable land use: Building roof with hardstanding and bin store New permeable land use: Permeable paving and landscaped areas

Storage requirements for an infiltration SuDS scheme for the development footprint are set out below.

**Table 6. Storage requirements at the proposed development Site
(Discharge runoff via infiltration)**

Attenuation scenario	Attenuation required (m ³)	Explanation
1 in 100 year including 45% CC	24.3*	Attenuation required to ensure surface water runoff is attenuated in all storm events up to and including the 1 in 100 year event including a 45% allowance for climate change. Calculations completed by BrennanConsult are based on the most conservative measured infiltration rate of 6.17×10^{-5} m/s (0.222 m/hr) as confirmed through Site-specific infiltration testing (GroundTech, 2025; report included in Appendix E).

*As per calculations completed by BrennanConsult (2025) and provided by the Client (included in Appendix C).

Peak discharge rates and total discharge volumes

The peak discharge rate is the maximum flow rate at which surface water runoff leaves the Site during a particular storm event, without considering the impact of any mitigation such as storage, infiltration or flow control. Proposed discharge rates (with mitigation) should be no greater than existing rates for all corresponding storm events. If all runoff is disposed of via infiltration, there will be no discharge off-Site.

Drainage calculations commissioned separately by the Client and completed by BrennanConsult (2025) are included in Appendix C.

7 Water quality



A key requirement of any SuDS system is that it protects the receiving water body from the risk of pollution. This can be effectively managed by an appropriate “train” or sequence of SuDS components that are connected in series. The frequent and short duration rainfall events are those that are most loaded with potential contaminants (silts, fines, heavy metals and various organic and inorganic contaminants). Therefore, the first 5-10 mm of rainfall (first flush) should be adequately treated with SuDS.

The minimum number of treatment stages will depend on the sensitivity of the receiving water body and the potential hazard associated with the proposed development SuDS Manual (CIRIA, 2015). The proposed development is a combination of Very Low (roof water) to Low hazard (runoff from car parking). The Site does not lie within an SPZ and therefore additional treatment stages are not required.

Table 7. Pollution hazard indices for different land use classifications

Land use	Pollution hazard level	Total suspended solids (TSS)	Metals	Hydrocarbons
Residential roofs	Very Low	0.2	0.2	0.05
Other roofs (typically commercial/industrial roofs)	Low	0.3	0.2 (up to 0.8 where there is potential for metals to leach from the roof)	0.05
Individual property driveways, residential car parks, low traffic roads and non-residential car parking within infrequent change (i.e. less than 300 traffic movements/day)	Low	0.5	0.4	0.4
Commercial yard and delivery areas, non-residential car parking with frequent change (e.g. hospitals, retail), all roads except low traffic roads and trunk roads/motorways	Medium	0.7	0.6	0.7
Sites with heavy pollution (e.g. haulage yards, lorry parks, highly frequented lorry approaches to industrial estates, waste sites), sites where chemicals and fuels (other	High	0.8	0.8	0.9

than domestic fuel oil) are to be delivered, handled, storage, used or manufactured: industrial sites; trunk roads and motorways				
--	--	--	--	--

Table 8. Indicative SuDS mitigation indices for discharges to groundwater

Characteristics of the material overlying the proposed infiltration surface, through which the runoff percolates	TSS	Metals	Hydrocarbons
A layer of dense vegetation underlain by a soil with good contaminant attenuation potential of at least 300 mm in depth	0.6	0.5	0.6
A soil with good contaminant attenuation potential of at least 300 mm in depth	0.4	0.3	0.3
Infiltration trench (where a suitable depth of filtration material is included that provides treatment, i.e. graded gravel with sufficient smaller particles but not single size coarse aggregate such as 20 mm gravel) underlain by a soil with good contaminant attenuation potential of at least 300 mm in depth	0.4	0.4	0.4
Constructed permeable pavement (where a suitable filtration layer is included that provides treatment, and including a geotextile at the base separating the foundation from the subgrade) underlain by a soil with good contaminant attenuation potential of at least 300 mm in depth	0.7	0.6	0.7
Bioretention underlain by a soil with good contaminant attenuation potential of at least 300 mm in depth	0.8	0.8	0.8
Proprietary treatment systems	These must demonstrate that they can address each of the contaminant types to acceptable levels for inflow concentrations relevant to the contributing drainage area		

As indicated within Tables 9 and 10, the proposed permeable paving and soakaway would provide sufficient mitigation indices to treat the Low pollution hazard associated with the Site use.

8 Background Information



Health and safety considerations for SuDS

The CDM Regulations place specific Health and Safety duties on those commissioning, planning and undertaking construction works. If you are uncertain what this means you should seek the advice of your architect, builder or other competent professional.

GeoSmart does not provide health and safety advisory services but we are required to advise you of your general responsibilities under CDM (visit <http://geosmartinfo.co.uk/knowledge-hub/cdm-2015/> for more information).

Please remember that any detailed design work should be undertaken by a competent professional who might be your engineer, architect, builder or another competent party.

It is noted that GeoSmart do not endorse or verify the design work of others, and that the drainage design provided by the Client has been completed separately from this report by BrennanConsult (2025).

GeoSmart SuDS Infiltration Suitability Map (SD50)

The GeoSmart SuDS Infiltration Suitability Map (SD50) screens the suitability for infiltration drainage in different parts of the Site and indicates where further assessment is recommended. In producing the SuDS Infiltration Suitability Map (SD50), GeoSmart used data from the British Geological Survey on groundwater levels, geology and permeability to screen for areas where infiltration SuDS may be suitable. The map classifies areas into 3 categories of High, Medium and Low suitability for infiltration SuDS. This can then be used in conjunction with additional data on Site constraints to give recommendations for SuDS design and further investigation.

The primary constraint on infiltration potential is the minimum permeability of the underlying material and in some cases the range in permeability may be considerable, ranging down to low. The map classifies these areas as moderate infiltration suitability requiring further investigation. In cases where the thickness of the receiving permeable horizon is less than 1.5 meters then additional Site investigation is recommended. If the Site is at risk of groundwater flooding for up to the 1% annual occurrence the map classifies these areas as moderate infiltration suitability requiring further investigation.

The GeoSmart SuDS Infiltration Suitability Map (SD50) is a national screening tool for infiltration SuDS techniques but a Site specific assessment should be used before final detailed design is undertaken. Further information on the GeoSmart SuDS Infiltration Suitability Map (SD50) is available at geosmartinfo.co.uk.

How was surface water runoff estimated from the Site?

Runoff from the Site has been calculated as part of the detailed drainage design produced by BrennanConsult (2025), which is included in Appendix C.

What is the peak discharge rate?

An estimation of peak runoff flow rate and volume is required to calculate infiltration, storage and discharge requirements. The peak discharge rate is the maximum flow rate at which surface water runoff leaves the Site during a particular storm event, without considering the impact of any mitigation such as storage, infiltration or flow control. Proposed discharge rates (with mitigation) should be no greater than existing rates for all corresponding storm events. If all runoff will be disposed of via infiltration there will be no discharge off-Site. Discharging all flow from Site at the existing 1 in 100 event would increase flood risk during smaller events. Flow restriction is generally required to limit the final discharge from Site during all events as a basic minimum to the green field QBAR rate. A more complex flow restriction which varies the final discharge rate from the Site depending on the storm event will reduce the volume of storage required on-Site. Drainage to infiltration SuDS is subtracted from the total discharge off-Site to achieve a beneficial net effect.

What is the total discharge volume?

The total discharge volume is calculated on the basis of the surface water runoff that has the potential to leave the Site as a result of the assumed 6 hour duration design storm event. The runoff is related to the underlying soil conditions, impermeable cover, rainfall intensity and duration of the storm event. The total volume generated by the current Site is compared to the potential total volume from the developed Site (not taking into consideration any mitigation). The difference provides the minimum total volume that will need to be stored and infiltrated on-Site or released at a controlled rate. Guidance indicates that the total discharge volume should never exceed the runoff volume from the development Site prior to redevelopment for that event and should be as close as is reasonably practicable to the Greenfield runoff volume.

9 Additional Products



The following table includes a list of additional products by GeoSmart:

Additional GeoSmart Products			
	Additional assessment: FloodSmart Report		The FloodSmart Report range provides clear and pragmatic advice regarding the nature and potential significance of flood hazards which may be present at a Site. Our consultants assess available data to determine the level of risk based on professional judgement and years of experience. Please contact info@geosmartinfo.co.uk for further information.
	Additional assessment: EnviroSmart Report		Provides a robust desk-based assessment of potential contaminated land issues, taking into account the regulatory perspective. Our EnviroSmart reports are designed to be the most cost effective solution for planning conditions. Each report is individually prepared by a highly experienced consultant conversant with Local Authority requirements. Ideal for pre-planning or for addressing planning conditions for small developments. Can also be used for land transactions. Please contact info@geosmartinfo.co.uk for further information.

10 References and glossary



BrennanConsult (2026) Residential development drainage strategy plan (Unicorn House, Cheetham Street, Middleton, M24 4DG). Ref: 2982. (as provided by client).

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CEH (2026) Online FEH web service Depth/duration/frequency modelling using the FEH 2022 models. Accessed from: <https://fehweb.ceh.ac.uk/> on 19/09/2026.

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Rochdale Metropolitan Borough Council (2014). Rochdale Borough's Strategy for Flood Risk Management. Accessed from: <https://www.rochdale.gov.uk/downloads/file/808/flood-risk-management-strategy> on 19/09/2026.

United Utilities (2024). (Unicorn House, Cheetham Rd, Middleton, Manchester M24 4DG) Asset Location Plan. Ref: UUPS-ORD-600670.

Glossary

General terms

Attenuation	Reduction of peak flow and increased duration of a flow event.
Combined sewer	A sewer designed to carry foul sewage and surface water in the same pipe.
Detention basin	A vegetated depression, normally is dry except after storm events, constructed to store water temporarily to attenuate flows. May allow infiltration of water to the ground.
Evapotranspiration	The process by which the Earth's surface or soil loses moisture by evaporation of water and by uptake and then transpiration from plants.
FEH	Flood Estimation Handbook, produced by Centre for Ecology and Hydrology, Wallingford (formerly the Institute of Hydrology).
Filter drain or trench	A linear drain consisting of a trench filled with a permeable material, often with a perforated pipe in the base of the trench to assist drainage, to store and conduct water, but may also be designed to permit infiltration.
First flush	The initial runoff from a site or catchment following the start of a rainfall event. As runoff travels over a catchment it will collect or dissolve pollutants, and the "first flush" portion of the flow may be the most contaminated as a result. This is especially the case for intense storms and in small or more uniform catchments. In larger or more complex catchments pollution.
Flood plain	Land adjacent to a watercourse that would be subject to repeated flooding under natural conditions (see Environment Agency's Policy and practice for the protection of flood plains for a fuller definition).
Greenfield runoff	This is the surface water runoff regime from a site before development, or the existing site conditions for brownfield redevelopment sites.
Impermeable surface	An artificial non-porous surface that generates a surface water runoff after rainfall.
Permeability	A measure of the ease with which a fluid can flow through a porous medium. It depends on the physical properties of the medium, for example grain size, porosity and pore shape.

Runoff	Water flow over the ground surface to the drainage system. This occurs if the ground is impermeable, is saturated or if rainfall is particularly intense.
Sewerage undertaker	This is a collective term relating to the statutory undertaking of water companies that are responsible for sewerage and sewage disposal including surface water from roofs and yards of premises.
Soakaway	A subsurface structure into which surface water is conveyed to allow infiltration into the ground.
Treatment	Improving the quality of water by physical, chemical and/or biological means.

The terms included in this glossary have been taken from CIRIA (2025) guidance.

Data Sources

Aerial Photography	Contains Ordnance Survey data © Crown copyright and database right 2026 BlueSky copyright and database rights 2026
Bedrock & Superficial Geology	Contains British Geological Survey materials © NERC 2026 Ordnance Survey data © Crown copyright and database right 2026
Flood Risk (RoFRS/Pluvial/Surface Water Features/SPZ)	Environment Agency copyright and database rights 2026 Ordnance Survey data © Crown copyright and database right 2026
Flood Risk (Groundwater) and SuDS infiltration suitability (SD50)	GeoSmart, BGS & OS GW5 (v2.4) Map (GeoSmart, 2026) Contains British Geological Survey materials © NERC 2026 Ordnance Survey data © Crown copyright and database right 2026
Sewer Location	Contains Ordnance Survey data © Crown copyright and database right 2026 Contains United Utilities Drainage and Water Search data 2026
Topographic Data	OS LiDAR/EA Contains Ordnance Survey data © Crown copyright and database right 2026 Environment Agency copyright and database rights 2026

11 Appendices



Appendix A



Site plans

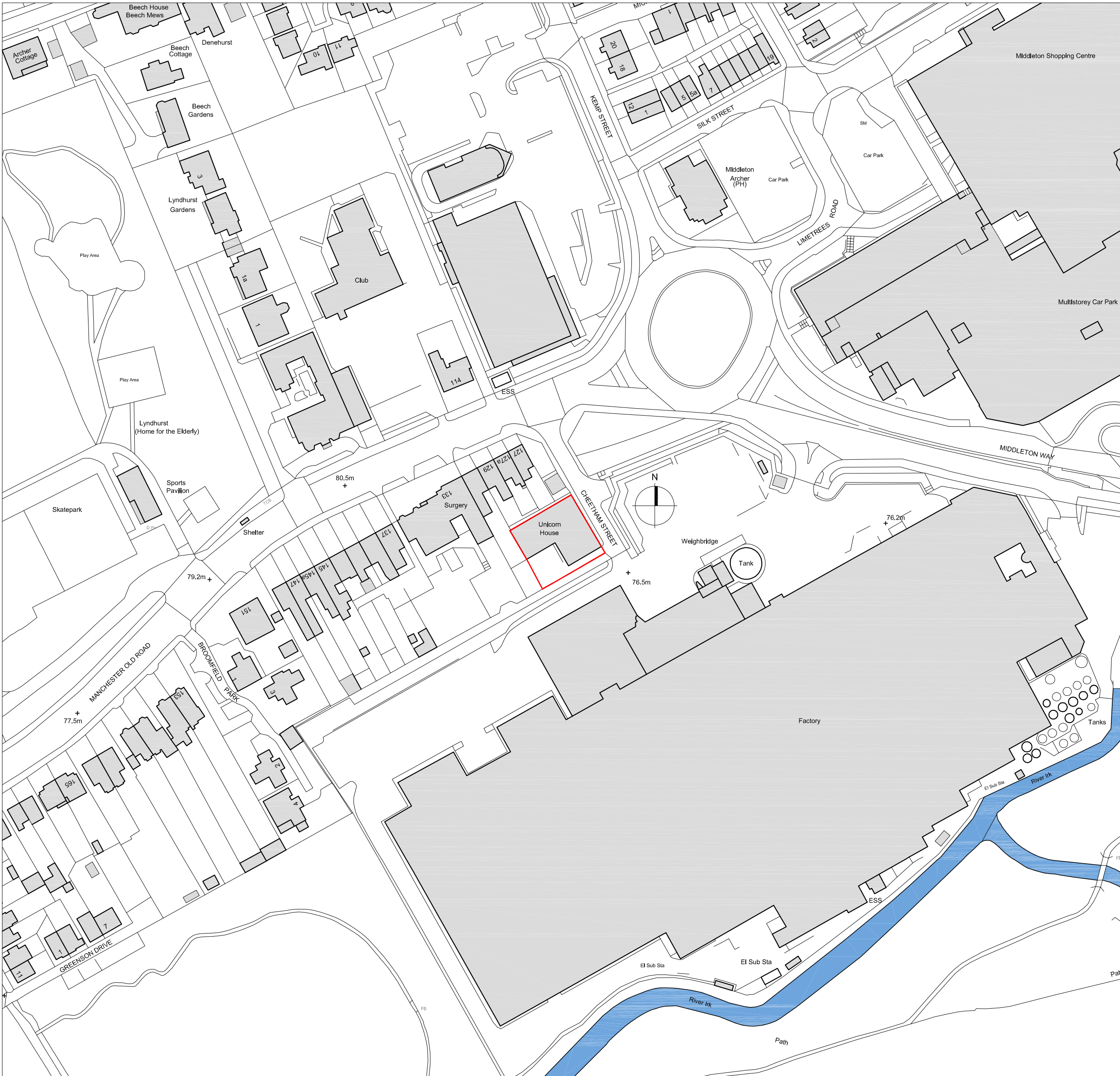
All dimensions are to be checked on site, any discrepancies are to be reported to the Architect before work commences. Do not scale from this drawing.

This drawing is to be read in conjunction with all relevant consultants and specialists drawings / documents, any discrepancies are to be reported to the Architect before the affected work commences.

All structural components shown are indicative only. Details / calculations of structural members are to be provided by the Structural Engineer.

This drawing is copyright.

A First Issue 19/02/2026



Location Plan 1:1250

Scale Bar 1:1250



Tel : 0161 877 8587 10/F, 1 City Approach, Albert Street, Eccles, Manchester, M30 0BG, UK
e-mail: barrytang@tangassociates.co.uk

Client:
Signature Estates (NW) Ltd

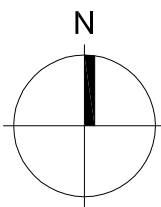
Project:
Unicorn House, Cheetham Street, Middleton M24 6EN

Drawing Title:
Location Plan

Scale: 1:1250 @ A1 Date: February 2026

Drawing No: 9925/001 Revision: A

All structural components shown are indicative only. Details / calculations of structural members are to be provided by the Structural Engineer.



Drawing No:	Revision:
9925/002	C

All dimensions are to be checked on site, any discrepancies are to be reported to the Architect before work commences. Do not scale from this drawing.

This drawing is to be read in conjunction with all relevant consultants and specialists drawings / documents, any discrepancies are to be reported to the Architect before the affected work commences.

All structural components shown are indicative only. Details / calculations of structural members are to be provided by the Structural Engineer.

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A	First Issue	09/09/2025
B	RVP & SVP information added following Site Visit 17/09/2025 for Drainage Engineer Consultation	23/09/2025
C	Additional Topographical information following receipt of updated topographical survey on 24/09/2025	08/10/2025
D	Additional Landscaping information following submission of 250108100C planning application on 23/10/2025	28/10/2025
E	Updates to levels and external ramp following client request 19/11/2025 and Plans Check received from the Registered Building Control Approver 28/11/2025	27/10/2025
F	Updates to foul drainage following Civil Engineer's request on 20/01/2026	20/01/2026
G	Omission of content for clarity requested by the Drainage Consultant on 19/02/2026	19/02/2026



T+A Tang & Associates Ltd
Chartered Architects

Tel : 0161 877 9587 10/F, 1 City Approach, Albert Street,
e-mail: barrytang@tangassociates.co.uk Eccles,
Manchester, M30 0BS, UK

Client:

Signature Estates (NW) Ltd

Project:
Unicorn House, Cheetham Street, Middleton
M24 6EN

Drawing Title:

Proposed Site Plan

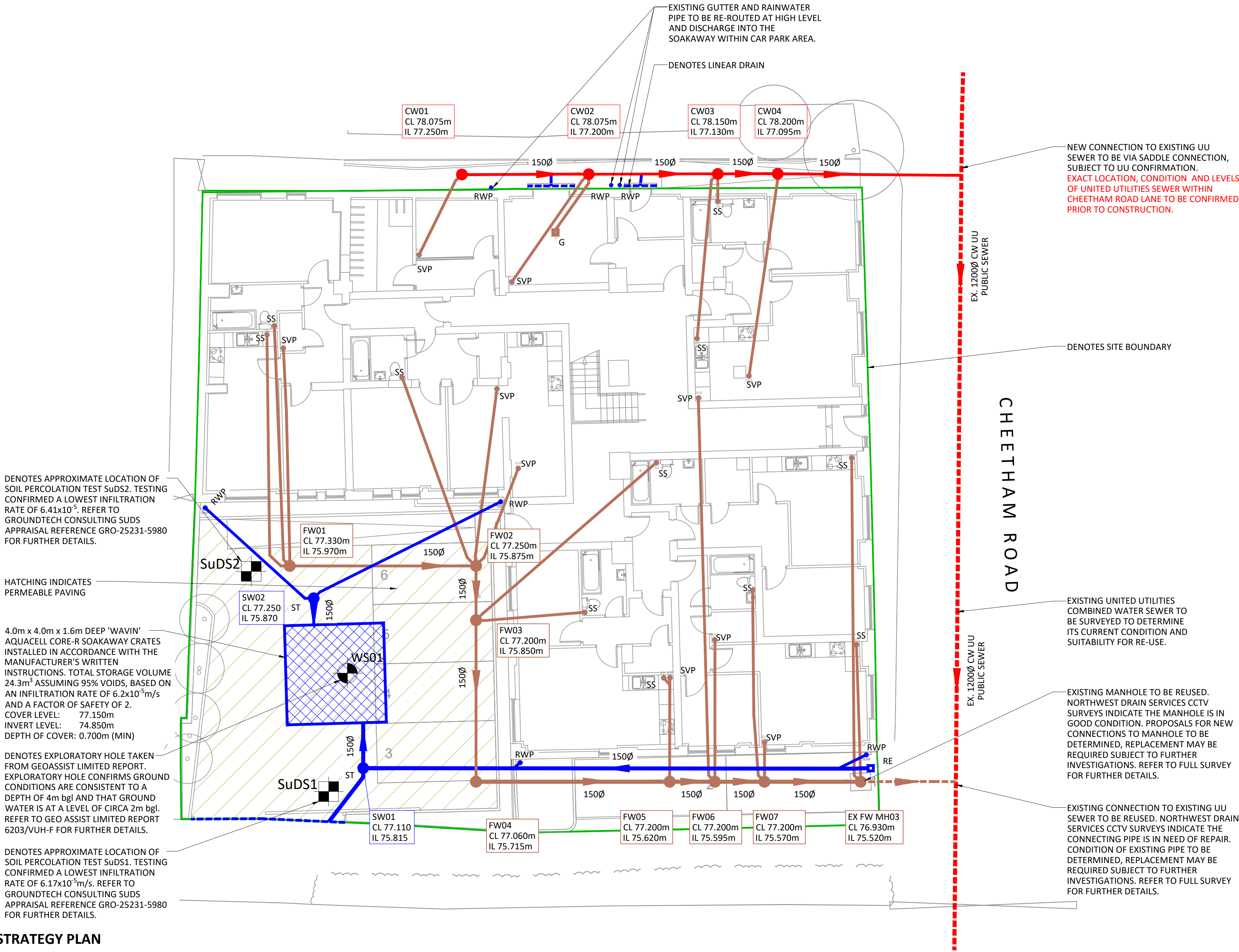
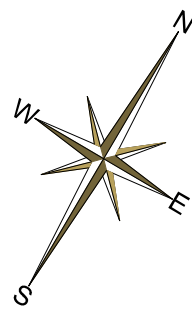
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Drawing No: 9925/102 Revision: G

Appendix B



Detailed surface water drainage layout (Completed by BrennanConsult, 2025)



DRAINAGE STRATEGY PLAN
SCALE 1:100

DRAINAGE NOTES

- THIS DRAWING IS PRELIMINARY AND IS SUBJECT TO CHANGE DEPENDING ON FURTHER DEVELOPMENT OF THE G.A., SITE LAYOUT, RWP AND POP-UP LAYOUT.
- EXISTING SEWER LOCATIONS AND LEVELS TO BE CONFIRMED BY CONTRACTOR ON SITE, PRIOR TO WORK COMMENCING.
- ANY PART OF THE EXISTING DRAINAGE SYSTEM TO BE RETAINED AS PART OF THE NEW SCHEME SHALL BE CLEANED AND INSPECTED. ANY STRUCTURAL DEFECTS SHALL BE REPAIRED USING APPROPRIATE AND APPROVED MEANS.
- ALL REDUNDANT EXISTING DRAINAGE TO BE GRUBBED UP OR GROUTED, ANY EXISTING LIVE DRAINAGE SHOULD BE REPORTED TO THE ENGINEER AND RECONNECTED..
- PRIVATE DRAINS TO BE CONSTRUCTED IN ACCORDANCE WITH BUILDING REGULATIONS.
- ALL PRIVATE DRAINAGE WITHIN THE SITE TO COMPLY WITH THE REQUIREMENTS OF BS EN 752 AND BUILDING REGULATIONS PART H.
- NO CONNECTION TO BE MADE TO THE PUBLIC SEWER UNTIL APPROVAL HAS BEEN RECEIVED FROM THE RELEVANT AUTHORITY
- ALL MANHOLE LEVELS ARE INDICATIVE ONLY.
- ALL MANHOLE AND PIPE POSITIONS ARE APPROXIMATE AND MAY BE UPDATED FOLLOWING FURTHER DISCUSSIONS WITH THE RELEVANT AUTHORITIES.
- ALL INSPECTION CHAMBER SIZES ARE 450Ø UNLESS INDICATED OTHERWISE.
- UNLESS INDICATED OTHERWISE ALL PIPES TO BE LAID SOFFIT TO SOFFIT.
- WHERE PROPOSED DRAINS ARE IN PROXIMITY TO PROPOSED FOUNDATIONS, THE FOUNDATIONS SHALL BE TAKEN DEEPER TO BELOW THE DRAINS OR THE DRAIN SHOULD BE PROTECTED WITH A FULL CONCRETE SURROUND.
- PROPOSED PIPEWORK WITH LESS THAN THE FOLLOWING DEPTHS TO SOFFIT REQUIRES A CONCRETE SURROUND:
 - 1.2m IN ROADS
 - 0.75m UNDER PRIVATE DRIVES
 - 0.6m UNDER FOOTPATHS AND UNDER BUILDINGS.
- SETTING OUT OF RAINWATER PIPES, WASTEWATER CONNECTIONS AND POPUP POSITIONS OF ABOVE GROUND DRAINAGE BY OTHERS.
- CHANNEL DRAIN AND GULLY LOCATIONS AND NUMBERS SUBJECT TO CHANGE.
- ALL CHANNEL DRAINAGE TO HAVE SILT BUCKETS ON OUTLETS.
- ALL PRIVATE SURFACE WATER PIPES TO BE MIN 100mmØ LAID AT A MAX 1:80 GRADIENT U.N.O.
- ALL UNDERSLAB FOUL PIPES TO BE 100mmØ LAID AT A MAX 1:40 GRADIENT U.N.O. OTHER FOUL PIPES TO BE 100mmØ LAID AT A MAX 1:80 GRADIENT U.N.O.
- AT LEAST ONE SOIL PIPE AT THE HEAD OF EACH FOUL RUN SHALL VENT TO THE ATMOSPHERE.
- PROPOSED DRAINAGE IS SUBJECT TO CONFIRMATION (BY CONTRACTOR) OF LEVELS OF EXISTING DRAINAGE AT PROPOSED CONNECTION POINTS.
- DISCHARGE RATE INTO WATERCOURSE SUBJECT TO AGREEMENT WITH UNITED UTILITIES AND LOCAL AUTHORITY.
- CONTRACTOR TO ARRANGE ALL SEWERS AND DRAINS TO BE FLUSHED OUT BEFORE FINAL CCTV SURVEY IS CARRIED OUT ON COMPLETION OF WORKS.
- CONTRACTOR TO APPLY FOR SEWER PERMITS AND ROAD OPENING PERMITS AS NECESSARY FROM THE APPROPRIATE AUTHORITIES, PRIOR TO COMMENCING WORKS.
- THE CONTRACTOR SHALL ALLOW FOR ALL TRAFFIC MANAGEMENT IN CONNECTION WITH ROAD AND SEWER WORKS.
- THE CONTRACTOR IS RESPONSIBLE FOR ALL TEMPORARY WORKS AND CONSTRUCTION PROCEDURE

SURFACE WATER DRAINAGE

CONSIDERATION HAS BEEN GIVEN TO THE HIERARCHY OF DRAINAGE OPTIONS FOR THE SITE AS FOLLOWS:

- DISCHARGE INTO GROUND - IT IS PROPOSED TO DISCHARGE SURFACE WATER RUNOFF WITHIN GEOCELLULAR SOAKAWAY CRATES LOCATED BENEATH THE CAR PARKING AREA. SOIL PERCOLATION TESTS CONFIRMED A MINIMUM INFILTRATION RATE OF 6.17x10⁻⁵ m/s AND EXPLORATORY HOLES CONFIRMED GROUND CONDITIONS WERE CONSISTENT TO A DEPTH OF 4m bgl, WITH GROUND WATER ENCOUNTERED AT APPROXIMATELY 3.0m bgl.
- DISCHARGE TO SURFACE WATER BODY - THERE ARE NO SURFACE WATER BODIES CONSIDERED TO BE WITHIN CLOSE PROXIMITY TO THE SITE.
- DISCHARGE TO SURFACE WATER SEWER, HIGHWAY DRAIN OR OTHER DRAINAGE SYSTEM - THERE ARE NO SURFACE WATER SEWERS CONSIDERED TO BE WITHIN CLOSE PROXIMITY TO THE SITE.
- DISCHARGE TO COMBINED WATER SEWER - HIGHER OPTIONS AVAILABLE.

SUMMARY

IT IS PROPOSED TO DISCHARGE SURFACE WATER VIA INFILTRATION. A TOTAL OF 24.3m³ OF STORAGE IS REQUIRED BASED ON AN INFILTRATION RATE OF 6.2x10⁻⁵m/s AND A FACTOR OF SAFETY OF 2.

SUDS TO ENCOMPASS:

- PERMEABLE SURFACING
- GEOCELLULAR SOAKAWAY CRATES.

FOUL WATER DRAINAGE

FOUL WATER GENERATED BY THE DEVELOPMENT WILL DISCHARGE INTO THE EXISTING COMBINED UNITED UTILITIES SEWER LOCATED WITHIN CHEETHAM ROAD. AN EXISTING CONNECTION EXISTS TO THE SOUTH OF THE DEVELOPMENT, FURTHER INVESTIGATIONS ARE REQUIRED TO DETERMINE THE SUITABILITY FOR REUSE. A NEW SADDLE CONNECTION IS PROPOSED TO DISCHARGE OF THE FOUL WATER TO THE NORTH OF THE DEVELOPMENT, SUBJECT TO AGREEMENT WITH UNITED UTILITIES AND ROCHDALE BOROUGH COUNCIL.

ALL EXTERNAL HARD LANDSCAPED AREAS TO BE PERMEABLE SURFACING OR FALL TO ADJACENT SOFT LANDSCAPED AREAS.

REFER TO ARCHITECT'S DRAWING FOR LOCATION & SETTING OUT OF ALL FOUL & SURFACE WATER POP-UPS

THE PRIVATE DRAINAGE IS SUBJECT TO LLFA APPROVAL THEREFORE DO NOT COMMENCE WORKS UNTIL APPROVED.

THIS DRAWING AND ITS CONTENTS ARE STRICTLY THE COPYRIGHT OF BRENNANCONSULT LTD

GENERAL NOTES

- THIS DRAWING IS TO BE READ IN CONJUNCTION WITH ALL OTHER ASSOCIATED DRAWINGS. ANY DISCREPANCY TO BE RAISED PRIOR TO CONSTRUCTION. ANY CONSTRUCTION WORKS WHICH COMMENCE BEFORE THESE DRAWINGS ARE APPROVED ARE AT THE RISK OF THE BUILDING CONTRACTOR.
- ALL DIMENSIONS ARE IN MILLIMETERS (mm). DO NOT SCALE FROM THIS DRAWING, WORK TO STATED DIMENSIONS ONLY.
- BUILDING CONTRACTOR TO ENSURE ALL WORKS COMPLY WITH THE CURRENT EDITION OF THE BUILDING REGULATIONS. ALL MATERIALS AND WORKMANSHIP SHALL BE IN ACCORDANCE WITH APPROVED DOCUMENT REGULATION 7.
- THE CONTRACTOR SHALL BE RESPONSIBLE FOR THE DESIGN, FABRICATION, ERECTION AND REMOVAL OF ALL TEMPORARY WORKS AND SHALL PROVIDE ALL TEMPORARY BRACING AS NECESSARY TO MAINTAIN STRUCTURAL STABILITY DURING CONSTRUCTION.
- IF THE CONTRACTOR CONSIDERS THAT THEY DO NOT HAVE SUFFICIENT INFORMATION TO SAFELY COMPLETE THE WORKS DETAILED ON THIS DRAWING, THEY SHOULD CONTACT THE ENGINEER.

CDM DESIGNER'S RISK ASSESSMENT

BRENNANCONSULT ASSUME THAT THE CONTRACTOR IS COMPETENT IN MATTERS OF HEALTH & SAFETY AND IS AWARE OF ALL THE NORMAL RISKS ASSOCIATED WITH CONSTRUCTION OF THE TYPE SHOWN ON THIS DRAWING. REMAINING UNUSUAL RISKS ARE:-

CONSTRUCTION

	CHK'D.
1. POSSIBILITY OF UNCHARTED BURIED SERVICES, CONTRACTOR TO SURVEY AND SCAN FOR LOCATION OF ANY POSSIBLE BURIED SERVICES IN ADVANCE OF ANY FOUNDATION WORKS BEING UNDERTAKEN.	CB

MAINTENANCE / CLEANING

NO UNUSUAL RISKS	CB
------------------	----

DECOMMISSIONING / DEMOLITION

NO UNUSUAL RISKS	CB
------------------	----

DRAINAGE LEGEND

SITE BOUNDARY	EX. CW DRAINAGE
NEW SW DRAINAGE	EX. FW DRAINAGE
NEW CW DRAINAGE	NEW FW DRAINAGE

ALL MANHOLES TO BE CONCRETE ENCASED 450 ØPPIC'S UNO.

ST	SW MH IMMEDIATELY PRIOR TO GEOCELLULAR SOAKAWAY CRATES TO BE FITTED WITH SILT TRAP
----	--

P04	UPDATED DRAINAGE STRATEGY	MM	21.01.26	LM
P03	FURNITURE REMOVED FROM SITE PLAN	MM	21.10.25	LM
P02	MINOR AMENDMENTS	MM	21.10.25	LM
P01	PRELIMINARY ISSUE	JKS	13.10.25	LM
REV	REVISION DESCRIPTION	BY	DATE	CHECKED

BrennanConsult
Civil & Structural Consulting Engineers
www.brennanconsult.com
info@brennanconsult.com
0161 428 2880
Stockport | London

UNICORN HOUSE, CHEETHAM STREET, MIDDLETON, M24 4DG

RESIDENTIAL DEVELOPMENT
DRAINAGE STRATEGY PLAN

Status

PRELIMINARY

Project No.	Originator	Zone	Level	Type	Role	Drawing No.	Revision
2982	BCL	00	XX	DR	D	0100	P04

Scale	Size	Drawn	Date	Checked	Passed
1:100	A1	JKS	OCT 25	LM	CB

Appendix C



Micro Drainage surface water calculations (Completed by BrennanConsult, 2025)

Brennan Consult		Page 1
Oak House, 2 Gatley Road Cheadle Stockport, SK8 1PY	2982 Unicorn House Surface Water Calcs	
Date 22/01/2026	Designed by MM	
File 2982 SW Calcs 20.01.26.MDX	Checked by	
Innovyze	Network 2019.1	

STORM SEWER DESIGN by the Modified Rational Method

Design Criteria for Storm

Pipe Sizes STANDARD Manhole Sizes STANDARD

FSR Rainfall Model - England and Wales

Return Period (years)	1	Maximum Time of Concentration (mins)	30	Add Flow / Climate Change (%)	0	Min Vel for Auto Design only (m/s)	1.00
M5-60 (mm)	18.800	Foul Sewage (l/s/ha)	0.000	Minimum Backdrop Height (m)	0.200	Min Slope for Optimisation (1:X)	500
Ratio R	0.320	Volumetric Runoff Coeff.	0.750	Maximum Backdrop Height (m)	1.500		
Maximum Rainfall (mm/hr)	50	PIMP (%)	100	Min Design Depth for Optimisation (m)	1.200		

Designed with Level Soffits

Network Design Table for Storm

PN	Length (m)	Fall (m)	Slope (1:X)	I.Area (ha)	T.E. (mins)	Base Flow (l/s)	k (mm)	HYD SECT	DIA (mm)	Section Type	Auto Design
1.000	20.482	0.223	91.8	0.023	4.00	0.0	0.600	o	150	Pipe/Conduit	
1.001	1.311	0.013	100.8	0.003	0.00	0.0	0.600	o	150	Pipe/Conduit	
2.000	6.537	0.082	79.7	0.028	4.00	0.0	0.600	o	150	Pipe/Conduit	
1.002	1.646	0.021	78.4	0.000	0.00	0.0	0.600	o	150	Pipe/Conduit	

Network Results Table

PN	Rain (mm/hr)	T.C. (mins)	US/IL (m)	Σ I.Area (ha)	Σ Base Flow (l/s)	Foul (l/s)	Add Flow (l/s)	Vel (m/s)	Cap (l/s)	Flow (l/s)
1.000	48.69	4.33	76.038	0.023	0.0	0.0	0.0	1.05	18.5	3.0
1.001	48.60	4.35	75.815	0.026	0.0	0.0	0.0	1.00	17.7	3.4
2.000	49.69	4.10	75.870	0.028	0.0	0.0	0.0	1.13	19.9	3.8
1.002	48.50	4.37	74.450	0.054	0.0	0.0	0.0	1.14	20.1	7.1

Manhole Schedules for Storm

MH Name	MH CL (m)	MH Depth (m)	MH Connection	MH Diam.,L*W (mm)	Pipe Out PN	Pipe Out Invert Level (m)	Pipe Out Diameter (mm)	Pipes In PN	Pipes In Invert Level (m)	Pipes In Diameter (mm)	Backdrop (mm)	MH Name	MH CL (m)	MH Depth (m)	MH Connection	MH Diam.,L*W (mm)	Pipe Out PN	Pipe Out Invert Level (m)	Pipe Out Diameter (mm)	Pipes In PN	Pipes In Invert Level (m)	Pipes In Diameter (mm)	Backdrop (mm)
RE	76.930	0.892	Open Manhole	450	1.000	76.038	150					TANK	77.150	2.700	Open Manhole	150	1.002	74.450	150	1.001	75.802	150	1352
SW01	77.110	1.295	Open Manhole	450	1.001	75.815	150	1.000	75.815	150										2.000	75.788	150	1338
SW02	77.250	1.380	Open Manhole	450	2.000	75.870	150						77.150	2.721	Open Manhole	0		OUTFALL		1.002	74.429	150	

MH Name	Manhole Easting (m)	Manhole Northing (m)	Intersection Easting (m)	Intersection Northing (m)	Manhole Access	Layout (North)
RE	386572.612	405619.740	386572.612	405619.740	Required	
SW01	386554.958	405609.355	386554.958	405609.355	Required	
SW02	386549.762	405614.249	386549.762	405614.249	Required	
TANK	386555.213	405610.641	386555.213	405610.641	Required	
	386556.859	405610.641			No Entry	

PIPELINE SCHEDULES for Storm

Upstream Manhole

PN	Hyd Sect	Diam (mm)	MH Name	C.Level (m)	I.Level (m)	D.Depth (m)	MH Connection	MH DIAM., L*W (mm)
1.000	o	150	RE	76.930	76.038	0.742	Open Manhole	450
1.001	o	150	SW01	77.110	75.815	1.145	Open Manhole	450
2.000	o	150	SW02	77.250	75.870	1.230	Open Manhole	450
1.002	o	150	TANK	77.150	74.450	2.550	Open Manhole	150

Downstream Manhole

PN	Length (m)	Slope (1:X)	MH Name	C.Level (m)	I.Level (m)	D.Depth (m)	MH Connection	MH DIAM., L*W (mm)
1.000	20.482	91.8	SW01	77.110	75.815	1.145	Open Manhole	450
1.001	1.311	100.8	TANK	77.150	75.802	1.198	Open Manhole	150
2.000	6.537	79.7	TANK	77.150	75.788	1.212	Open Manhole	150
1.002	1.646	78.4		77.150	74.429	2.571	Open Manhole	0

Network Classifications for Storm

PN	USMH	Pipe	Min Cover	Max Cover	Pipe Type	MH	MH	MH Ring	MH Type	PN	USMH	Pipe	Min Cover	Max Cover	Pipe Type	MH	MH	MH Ring	MH Type
	Name	Dia	Depth	Depth		Dia	Width	Depth			Name	Dia	Depth	Depth		Dia	Width	Depth	
		(mm)	(m)	(m)		(mm)	(mm)	(m)				(mm)	(m)	(m)		(mm)	(mm)	(m)	
1.000	RE	150	0.742	1.145	Unclassified	450	0	0.742	Unclassified	2.000	SW02	150	1.212	1.230	Unclassified	450	0	1.230	Unclassified
1.001	SW01	150	1.145	1.198	Unclassified	450	0	1.145	Unclassified	1.002	TANK	150	2.550	2.571	Unclassified	150	0	2.550	Unclassified

Free Flowing Outfall Details for Storm

Outfall	Outfall	C. Level	I. Level	Min	D,L	W
Pipe Number	Name	(m)	(m)	I. Level	(mm)	(mm)
				(m)		
1.002		77.150	74.429	0.000	0	0

Simulation Criteria for Storm

Volumetric Runoff Coeff 0.750Hot Start Level (mm) 0Additional Flow - % of Total Flow 0.000Flow per Person per Day (l/per/day) 0.000

Areal Reduction Factor 1.000Manhole Headloss Coeff (Global) 0.500MADD Factor * 10m³/ha Storage 2.000Run Time (mins) 60

Hot Start (mins) 0Foul Sewage per hectare (l/s) 0.000Inlet Coeffiecient 0.800Output Interval (mins) 1

Number of Input Hydrographs 0Number of Online Controls 1Number of Offline Controls 0Number of Storage Structures 1Number of Time/Area Diagrams 0Number of Real Time Controls 0

Synthetic Rainfall Details

Rainfall Model FSRRegion England and WalesRatio R 0.320Cv (Summer) 0.750Storm Duration (mins) 30

Return Period (years) 1M5-60 (mm) 18.800Profile Type Summer Cv (Winter) 0.840

Online Controls for Storm

Pump Manhole: TANK, DS/PN: 1.002, Volume (m³): 0.2

Invert Level (m) 74.850

Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)
0.200	0.0000	1.000	0.0000	1.800	0.0000	2.600	0.0000	3.400	0.1000	4.200	0.1000	5.000	0.1000	5.800	0.1000
0.400	0.0000	1.200	0.0000	2.000	0.0000	2.800	0.0000	3.600	0.1000	4.400	0.1000	5.200	0.1000	6.000	0.1000
0.600	0.0000	1.400	0.0000	2.200	0.0000	3.000	0.1000	3.800	0.1000	4.600	0.1000	5.400	0.1000		
0.800	0.0000	1.600	0.0000	2.400	0.0000	3.200	0.1000	4.000	0.1000	4.800	0.1000	5.600	0.1000		

Brennan Consult		Page 6
Oak House, 2 Gatley Road	2982 Unicorn House	
Cheadle	Surface Water Calcs	
Stockport, SK8 1PY		
Date 22/01/2026	Designed by MM	
File 2982 SW Calcs 20.01.26.MDX	Checked by	
Innovyze	Network 2019.1	

Storage Structures for Storm

Cellular Storage Manhole: TANK, DS/PN: 1.002

Invert Level (m) 74.850 Infiltration Coefficient Side (m/hr) 0.22320 Porosity 0.95
Infiltration Coefficient Base (m/hr) 0.22320 Safety Factor 2.0

Depth (m)	Area (m²)	Inf. Area (m²)	Depth (m)	Area (m²)	Inf. Area (m²)	Depth (m)	Area (m²)	Inf. Area (m²)
0.000	16.0	16.0	1.600	16.0	41.6	1.601	0.0	41.6

1 year Return Period Summary of Critical Results by Maximum Level (Rank 1) for Storm

Simulation Criteria

Areal Reduction Factor 1.000 Hot Start Level (mm) 0 Foul Sewage per hectare (l/s) 0.000 MADD Factor * 10m³/ha Storage 2.000 Flow per Person per Day (l/per/day) 0.000
Hot Start (mins) 0 Manhole Headloss Coeff (Global) 0.500 Additional Flow - % of Total Flow 0.000 Inlet Coeffiecient 0.800

Number of Input Hydrographs 0 Number of Online Controls 1 Number of Offline Controls 0 Number of Storage Structures 1 Number of Time/Area Diagrams 0 Number of Real Time Controls 0

Synthetic Rainfall Details

Rainfall Model FSR Region England and Wales M5-60 (mm) 18.800 Ratio R 0.320 Cv (Summer) 0.750 Cv (Winter) 0.840

Margin for Flood Risk Warning (mm) 300.0 DTS Status ON Inertia Status OFF
Analysis Timestep 2.5 Second Increment (Extended) DVD Status OFF

Profile(s) Summer and Winter

Duration(s) (mins) 15, 30, 60, 120, 240, 360, 480, 960, 1440

Return Period(s) (years) 1, 30, 100

Climate Change (%) 0, 45, 45

									Water	Surcharged	Flooded	Pipe					
PN	US/MH			Return	Climate	First (X)	First (Y)	First (Z)	Overflow	Level	Depth	Volume	Flow /	Overflow	Flow	Level	
	Name	Storm		Period	Change	Surcharge	Flood	Overflow	Act.	(m)	(m)	(m³)	Cap.	(1/s)	(1/s)	Status	Exceeded
1.000	RE	15	Winter	1	+0%	100/60	Winter			76.079	-0.109	0.000	0.17		3.0	OK	
1.001	SW01	15	Winter	1	+0%	30/15	Summer			75.871	-0.094	0.000	0.30		3.3	OK	
2.000	SW02	15	Winter	1	+0%	30/120	Winter			75.917	-0.103	0.000	0.22		3.6	OK	
1.002	TANK	120	Winter	1	+0%	1/15	Summer			75.116	0.516	0.000	0.00		0.0	SURCHARGED	

Brennan Consult		Page 8
Oak House, 2 Gatley Road Cheadle Stockport, SK8 1PY	2982 Unicorn House Surface Water Calcs	
Date 22/01/2026 File 2982 SW Calcs 20.01.26.MDX	Designed by MM Checked by	
Innovyze	Network 2019.1	

30 year Return Period Summary of Critical Results by Maximum Level (Rank 1) for Storm

Simulation Criteria
Areal Reduction Factor 1.000 Hot Start Level (mm) 0 Foul Sewage per hectare (l/s) 0.000 MADD Factor * 10m³/ha Storage 2.000 Flow per Person per Day (l/per/day) 0.000
Hot Start (mins) 0 Manhole Headloss Coeff (Global) 0.500 Additional Flow - % of Total Flow 0.000 Inlet Coeffiecient 0.800
Number of Input Hydrographs 0 Number of Online Controls 1 Number of Offline Controls 0 Number of Storage Structures 1 Number of Time/Area Diagrams 0 Number of Real Time Controls 0

Synthetic Rainfall Details
Rainfall Model FSR Region England and Wales M5-60 (mm) 18.800 Ratio R 0.320 Cv (Summer) 0.750 Cv (Winter) 0.840
Margin for Flood Risk Warning (mm) 300.0 DTS Status ON Inertia Status OFF
Analysis Timestep 2.5 Second Increment (Extended) DVD Status OFF

Profile(s) Summer and Winter
Duration(s) (mins) 15, 30, 60, 120, 240, 360, 480, 960, 1440
Return Period(s) (years) 1, 30, 100
Climate Change (%) 0, 45, 45

									Water	Surcharged	Flooded	Pipe					
PN	US/MH			Return	Climate	First (X)	First (Y)	First (Z)	Overflow	Level	Depth	Volume	Flow /	Overflow	Flow	Level	
	Name	Storm		Period	Change	Surcharge	Flood	Overflow	Act.	(m)	(m)	(m³)	Cap.	(1/s)	(1/s)	Status	Exceeded
1.000	RE	15	Winter	30	+45%	100/60	Winter			76.122	-0.066	0.000	0.61		10.6	OK	
1.001	SW01	240	Winter	30	+45%	30/15	Summer			76.060	0.095	0.000	0.23		2.5	SURCHARGED	
2.000	SW02	240	Winter	30	+45%	30/120	Winter			76.061	0.041	0.000	0.16		2.7	SURCHARGED	
1.002	TANK	240	Winter	30	+45%	1/15	Summer			76.060	1.460	0.000	0.00		0.0	SURCHARGED	

Brennan Consult		Page 9
Oak House, 2 Gatley Road Cheadle Stockport, SK8 1PY	2982 Unicorn House Surface Water Calcs	
Date 22/01/2026	Designed by MM	
File 2982 SW Calcs 20.01.26.MDX	Checked by	
Innovyze	Network 2019.1	

100 year Return Period Summary of Critical Results by Maximum Level (Rank 1) for Storm

Simulation Criteria
Areal Reduction Factor 1.000 Hot Start Level (mm) 0 Foul Sewage per hectare (l/s) 0.000 MADD Factor * 10m³/ha Storage 2.000 Flow per Person per Day (l/per/day) 0.000
Hot Start (mins) 0 Manhole Headloss Coeff (Global) 0.500 Additional Flow - % of Total Flow 0.000 Inlet Coeffiecient 0.800
Number of Input Hydrographs 0 Number of Online Controls 1 Number of Offline Controls 0 Number of Storage Structures 1 Number of Time/Area Diagrams 0 Number of Real Time Controls 0

Synthetic Rainfall Details
Rainfall Model FSR Region England and Wales M5-60 (mm) 18.800 Ratio R 0.320 Cv (Summer) 0.750 Cv (Winter) 0.840
Margin for Flood Risk Warning (mm) 300.0 DTS Status ON Inertia Status OFF
Analysis Timestep 2.5 Second Increment (Extended) DVD Status OFF

Profile(s) Summer and Winter
Duration(s) (mins) 15, 30, 60, 120, 240, 360, 480, 960, 1440
Return Period(s) (years) 1, 30, 100
Climate Change (%) 0, 45, 45

									Water	Surcharged	Flooded	Pipe					
PN	US/MH			Return	Climate	First (X)	First (Y)	First (Z)	Overflow	Level	Depth	Volume	Flow /	Overflow	Flow	Level	
	Name	Storm		Period	Change	Surcharge	Flood	Overflow	Act.	(m)	(m)	(m³)	Cap.	(1/s)	(1/s)	Status	Exceeded
1.000	RE	240	Winter	100	+45%	100/60	Winter			76.465	0.277	0.000	0.16		2.9	SURCHARGED	
1.001	SW01	240	Winter	100	+45%	30/15	Summer			76.450	0.485	0.000	0.30		3.2	SURCHARGED	
2.000	SW02	240	Winter	100	+45%	30/120	Winter			76.459	0.439	0.000	0.21		3.5	SURCHARGED	
1.002	TANK	240	Winter	100	+45%	1/15	Summer			76.450	1.850	0.000	0.00		0.0	SURCHARGED	

Appendix D



United Utilities Asset Location Plan

GeoSmart Information

Suite 9-11, Old Bank Buildings
Bellstone,
Shropshire,
SY1 1HU

FAO:

How to contact us:

United Utilities Water Limited
Property Searches
Haweswater House
Lingley Mere Business Park
Great Sankey
Warrington
WA5 3LP

Telephone: 0370 7510101

E-mail: propertysearches@uuplc.co.uk

Your Ref: 83402
Our Ref: UUPS-ORD-600670
Date: 18/09/2024

Dear Sirs

Location: Unicorn House

I acknowledge with thanks your request dated 16/09/2024 for information on the location of our services.

Please find enclosed plans showing the approximate position of United Utilities' apparatus known to be in the vicinity of this site.

The enclosed plans are being provided to you subject to the United Utilities terms and conditions for both the wastewater and water distribution plans which are shown attached.

If you are planning works anywhere in the North West, please read United Utilities' access statement before you start work to check how it will affect our network. <http://www.unitedutilities.com/work-near-asset.aspx>.

I trust the above meets with your requirements and look forward to hearing from you should you need anything further.

If you have any queries regarding this matter please [contact us](#).

Yours Faithfully,



Karen McCormack
Property Searches Manager

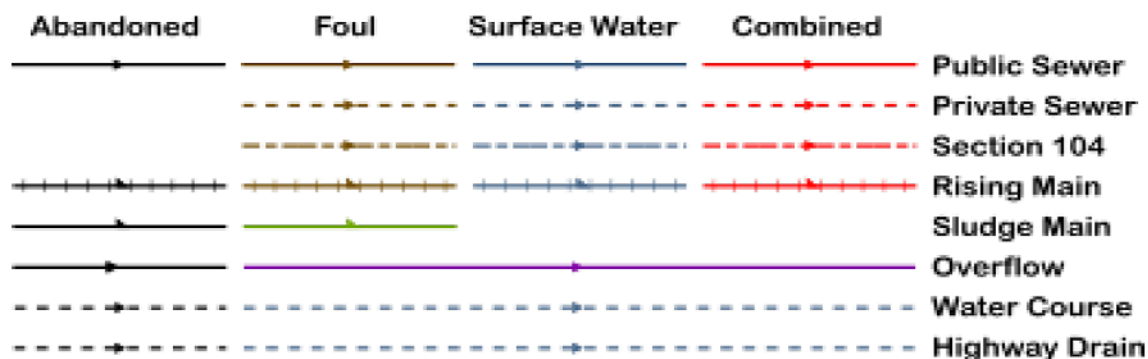
TERMS AND CONDITIONS - WASTEWATER AND WATER DISTRIBUTION PLANS

These provisions apply to the public sewerage, water distribution and telemetry systems (including sewers which are the subject of an agreement under Section 104 of the Water Industry Act 1991 and mains installed in accordance with the agreement for the self construction of water mains) (UUWL apparatus) of United Utilities Water Limited "(UUWL)".

TERMS AND CONDITIONS:

- This Map and any information supplied with it is issued subject to the provisions contained below, to the exclusion of all others and no party relies upon any representation, warranty, collateral contract or other assurance of any person (whether party to this agreement or not) that is not set out in this agreement or the documents referred to in it.
- This Map and any information supplied with it is provided for general guidance only and no representation, undertaking or warranty as to its accuracy, completeness or being up to date is given or implied.
- In particular, the position and depth of any UUWL apparatus shown on the Map are approximate only. UUWL strongly recommends that a comprehensive survey is undertaken in addition to reviewing this Map to determine and ensure the precise location of any UUWL apparatus. The exact location, positions and depths should be obtained by excavation trial holes.
- The location and position of private drains, private sewers and service pipes to properties are not normally shown on this Map but their presence must be anticipated and accounted for and you are strongly advised to carry out your own further enquiries and investigations in order to locate the same.
- The position and depth of UUWL apparatus is subject to change and therefore this Map is issued subject to any removal or change in location of the same. The onus is entirely upon you to confirm whether any changes to the Map have been made subsequent to issue and prior to any works being carried out.
- This Map and any information shown on it or provided with it must not be relied upon in the event of any development, construction or other works (including but not limited to any excavations) in the vicinity of UUWL apparatus or for the purpose of determining the suitability of a point of connection to the sewerage or other distribution systems.
- No person or legal entity, including any company shall be relieved from any liability howsoever and whensoever arising for any damage caused to UUWL apparatus by reason of the actual position and/or depths of UUWL apparatus being different from those shown on the Map and any information supplied with it.
- If any provision contained herein is or becomes legally invalid or unenforceable, it will be taken to be severed from the remaining provisions which shall be unaffected and continue in full force and affect.
- This agreement shall be governed by English law and all parties submit to the exclusive jurisdiction of the English courts, save that nothing will prevent UUWL from bringing proceedings in any other competent jurisdiction, whether concurrently or otherwise.

Wastewater Symbolology



All point assets follow the standard colour convention: **red** – combined **brown** - foul
blue – surface water **purple** - overflow

Manhole	Side Entry Manhole
Head of System	Outfall
Extent of Survey	Screen Chamber
Rodding Eye	Inspection Chamber
Inlet	Bifurcation Chamber
Discharge Point	Lamp Hole
Vortex	T Junction / Saddle
Penstock	Catchpit
Washout Chamber	Valve Chamber
Valve	Vent Column
Air Valve	Vortex Chamber
Non Return Valve	Penstock Chamber
Soakaway	Network Storage Tank
Gully	Sewer Overflow
Cascade	Ww Treatment Works
Flow Meter	Ww Pumping Station
Hatch Box	Septic Tank
Oil Interceptor	Control Kiosk
Summit	DNM Network Monitoring Point
Drop Shaft	Change of Characteristic
Orifice Plate	

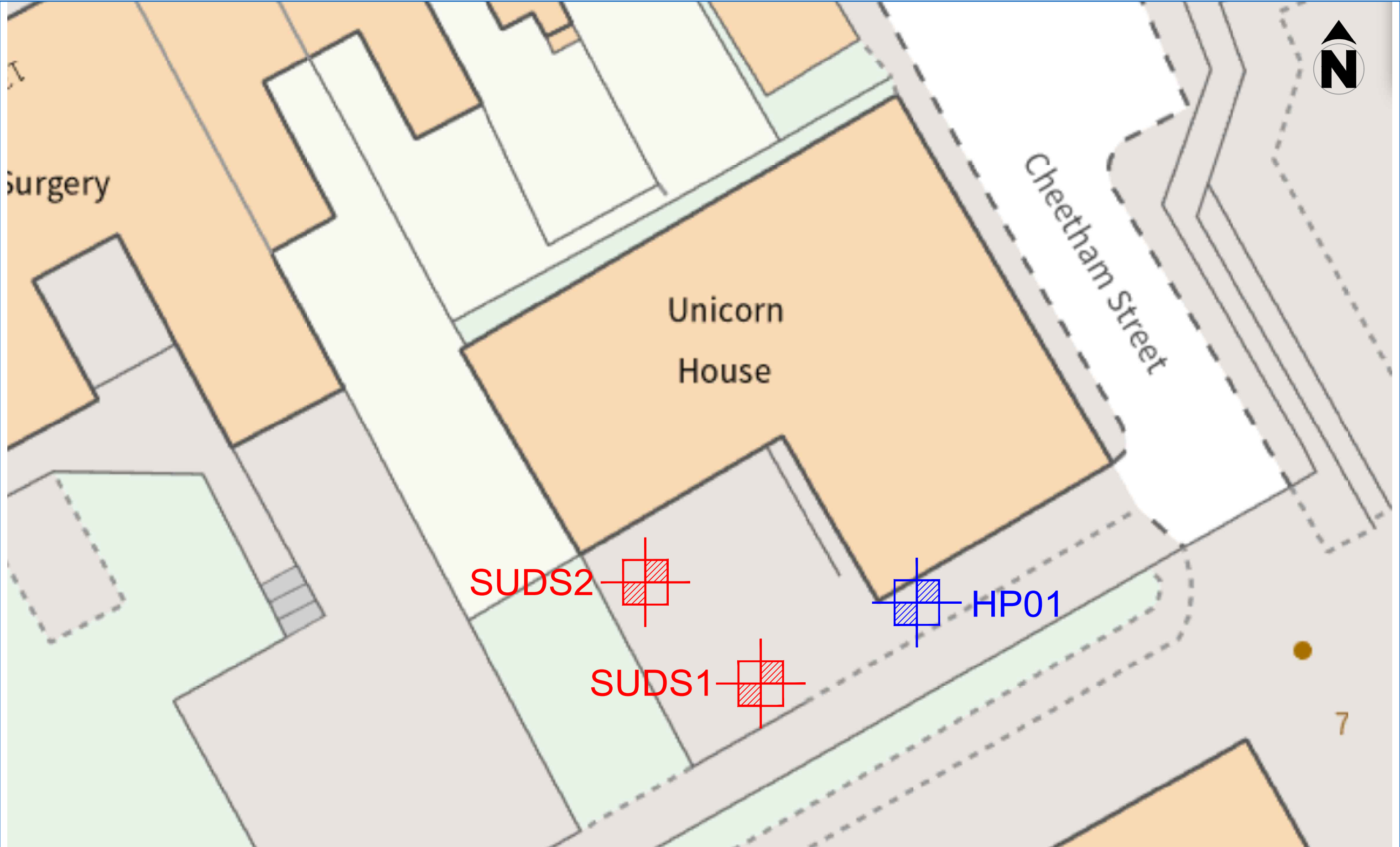


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Appendix E



Site Investigation Report (GroundTech, 2025 and GeoAssist, 2026)



GROUNDTECH CONSULTING	CLIENT	DATE	1.1	Draft	25/07/25	Status		Notes Soil Percolation Test Location Hand Dug Trial Pit Location
	SIGNATURE ESTATES LTD.	JULY 2025				Preliminary		
	PROJECT TITLE	SCALE				Draft		
	UNICORN HOUSE, CHEETHAM ROAD	NTS				Issued		
	PLAN TITLE	PLAN NUMBER				For Comment		
	PROPOSED EXPLORATORY HOLE LOCATION PLAN	GRO-25231-P01	Rev.	Details	Date	Approved		

Trial Pit Log

Trialpit No

HP01

Sheet 1 of 1

Project Name:	UNICORN HOUSE, CHEETHAM ROAD
---------------	------------------------------

Project No.	GRO-25231
-------------	-----------

Co-ords:	-
Level:	

Date
15/07/2025

Location: MIDDLETON

Dimensions
(m):

1

Scale
1:25

Client: SIGNATURE ESTATES NORTH WEST LTD

Depth
0.35

0.5

Logged
AT

[illegible]

Remarks:	1. Location cleared by specialised utility clearance. 2 No groundwater encountered. 3. Pit sides stable. 4. Trial pit terminated at 0.35m begl due to concrete obstruction and suspected communications line. 5. Trial pit backfilled with arisings.
----------	--

Stability:



Trial Pit Log

Trialpit No
SUDS1
Sheet 1 of 1

Project Name: UNICORN HOUSE, CHEETHAM ROAD

Project No.
GRO-25231

Co-ords: -
Level:

Date
15/07/2025

Location: MIDDLETON

Dimensions (m):

2

Depth
2.00

0.6

Scale
1:25

Logged
AT

Client: SIGNATURE ESTATES NORTH WEST LTD

Water Strike	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description	
	Depth	Type	Results					
				0.25			MADE GROUND: Light grey CONCRETE	
	0.50	ES					MADE GROUND: Grey brown sandy fine to coarse angular to subrounded GRAVEL of concrete, brick, sandstone, and siltstone. Sand is fine to coarse.	
				0.80				
	1.00	ES					Orange brown gravelly fine to coarse SAND. Gravel is angular to subrounded fine to coarse of sandstone, siltstone, and flint.	1
				2.00			End of pit at 2.00 m	2
								3
								4
								5

Remarks: 1. Location cleared by specialised utility clearance. 2 No groundwater encountered. 3. Pit sides stable. 4. Trial pit terminated at 2.00m begl. 5. Trial pit backfilled with arisings.

Stability:



Trial Pit Log

Trialpit No
SUDS2
Sheet 1 of 1

Project Name:	UNICORN HOUSE, CHEETHAM ROAD	Project No.	GRO-25231	Co-ords:	-	Date	15/07/2025
Location:	MIDDLETON	Dimensions (m):	2	Depth	2.20	Scale	1:25
Client:	SIGNATURE ESTATES NORTH WEST LTD	Logged	AT				

Water Strike	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description	
	Depth	Type	Results					
	0.50	ES		0.25			MADE GROUND: Light grey CONCRETE	
				0.80			MADE GROUND: Grey brown sandy fine to coarse angular to subrounded GRAVEL of concrete, brick, sandstone, and siltstone. Sand is fine to coarse.	
	1.00	ES					Orange brown gravelly fine to coarse SAND. Gravel is angular to subrounded fine to coarse of sandstone, siltstone, and flint.	1
				2.20			End of pit at 2.20 m	2
								3
								4
								5

Remarks: 1. Location cleared by specialised utility clearance. 2 No groundwater encountered. 3. Pit sides stable. 4. Trial pit terminated at 2.20m begl. 5. Trial pit backfilled with arisings.

Stability:



SOIL PERCOLATION TEST

Sheet 1 of 2

Date of Test: 16/05/2025

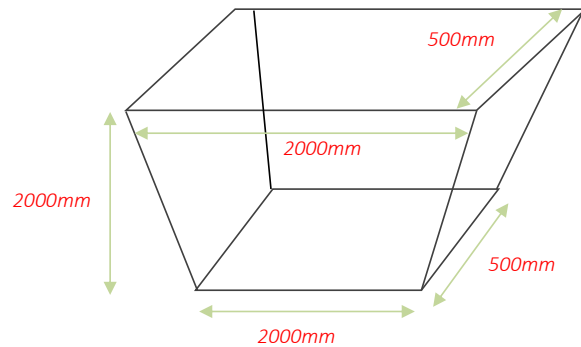
POSITION: SuDS2
TEST 3

Weather: Sunny, clear

Engineer: A. Turnbull

Checked: L. Harrison

Trial Pit Measurements



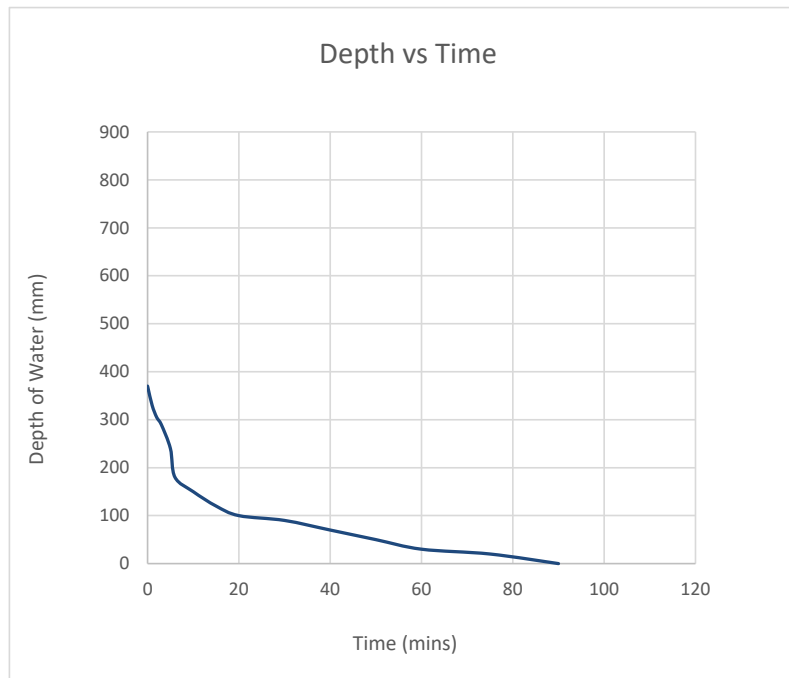
Pit Depth (mm):	2000
Pit Details:	Open with no stone filling
Groundwater Level:	NGW

Test Data

Time Elapsed (mins)	Depth to Water Level (mm)
0	1630
1	1670
2	1695
3	1710
5	1760
6	1820
10	1850
15	1880
20	1900
30	1910
40	1930
50	1950
60	1970
75	1980
90	2000
0	
0	

SOIL PERCOLATION TEST

POSITION: SuDS2
TEST 3



Volume of Pit (m ³)	2
Void Ratio of Infill	1
Volume of Infill (m ³)	N/A
Volume of Water in Pit (m ³)	0.37

Compliance Check:

Water Level at 75% effective depth (mm)	277.5
Water Level at 25% effective depth (mm)	92.5

Compliant with BRE 365

Soil Infiltration Rate Calculation

Water Level 1	277.5
Water Level 2	92.5
Time to Drain from Level 1 to Level 2 (mins)	25
Volume of water discharged (m ³)	0.185

Discharge Area (m ²)	1.925
----------------------------------	-------

Soil Infiltration Rate (m/min)	0.003844156
--------------------------------	-------------

Soil Infiltration Rate (m/sec)	6.41E-05
--------------------------------	----------

SOIL PERCOLATION TEST

Sheet 1 of 2

Date of Test: 16/05/2025

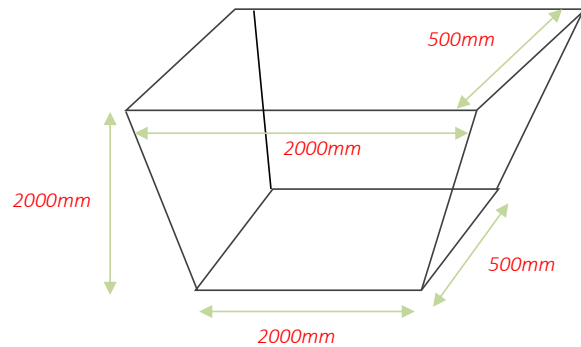
POSITION: SuDS2
TEST 2

Weather: Sunny, clear

Engineer: A. Turnbull

Checked: L. Harrison

Trial Pit Measurements



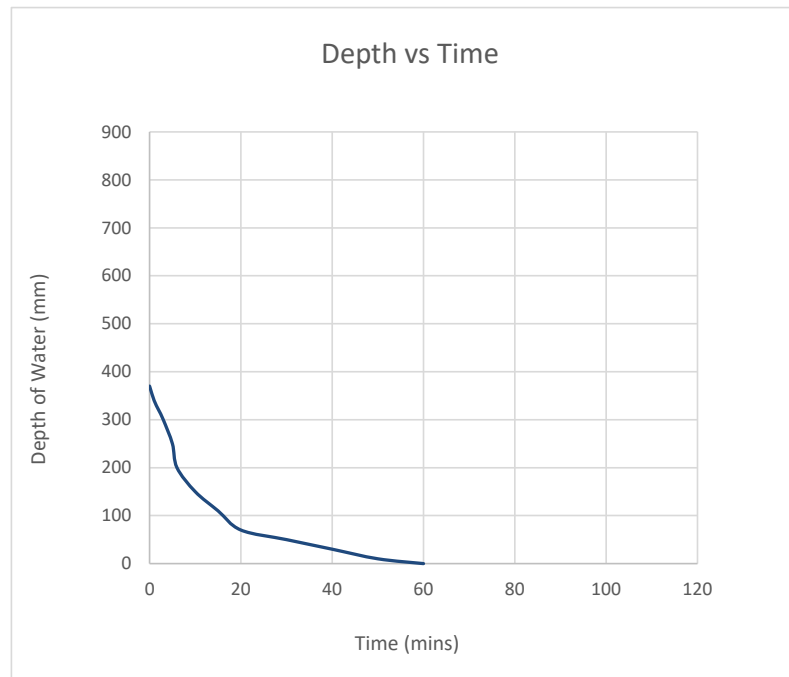
Pit Depth (mm):	2000
Pit Details:	Open with no stone filling
Groundwater Level:	NGW

Test Data

Time Elapsed (mins)	Depth to Water Level (mm)
0	1630
1	1660
2	1680
3	1700
5	1750
6	1800
10	1850
15	1890
20	1930
30	1950
40	1970
50	1990
60	2000
0	
0	
0	
0	

SOIL PERCOLATION TEST

POSITION: SuDS2
TEST 2



Volume of Pit (m ³)	2
Void Ratio of Infill	1
Volume of Infill (m ³)	N/A
Volume of Water in Pit (m ³)	0.37

Compliance Check:

Water Level at 75% effective depth (mm)	277.5
Water Level at 25% effective depth (mm)	92.5

Compliant with BRE 365

Soil Infiltration Rate Calculation

Water Level 1	277.5
Water Level 2	92.5
Time to Drain from Level 1 to Level 2 (mins)	13
Volume of water discharged (m ³)	0.185

Discharge Area (m ²)	1.925
----------------------------------	-------

Soil Infiltration Rate (m/min)	0.007392607
--------------------------------	-------------

Soil Infiltration Rate (m/sec)	1.23E-04
--------------------------------	----------

SOIL PERCOLATION TEST

Sheet 1 of 2

Date of Test: 16/05/2025

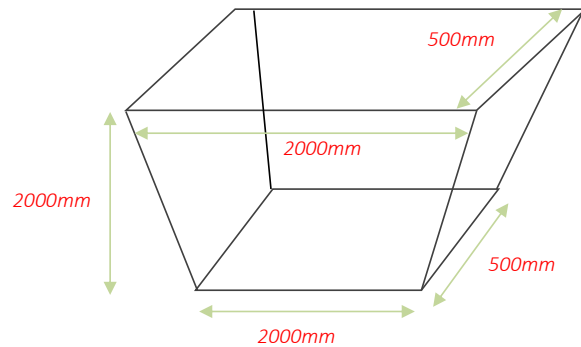
POSITION: SuDS2
TEST 1

Weather: Sunny, clear

Engineer: A. Turnbull

Checked: L. Harrison

Trial Pit Measurements



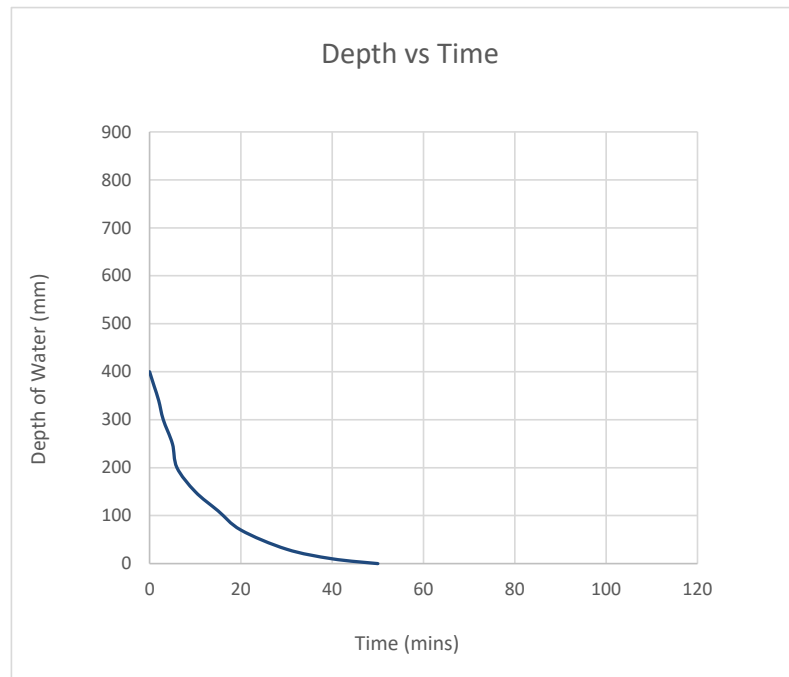
Pit Depth (mm):	2000
Pit Details:	Open with no stone filling
Groundwater Level:	NGW

Test Data

Time Elapsed (mins)	Depth to Water Level (mm)
0	1600
1	1630
2	1660
3	1700
5	1750
6	1800
10	1850
15	1890
20	1930
30	1970
40	1990
50	2000
0	
0	
0	
0	
0	

SOIL PERCOLATION TEST

POSITION: SuDS2
TEST 1



Volume of Pit (m ³)	2
Void Ratio of Infill	1
Volume of Infill (m ³)	N/A
Volume of Water in Pit (m ³)	0.4

Compliance Check:

Water Level at 75% effective depth (mm)	300
Water Level at 25% effective depth (mm)	100

Compliant with BRE 365

Soil Infiltration Rate Calculation

Water Level 1	300
Water Level 2	100
Time to Drain from Level 1 to Level 2 (mins)	13
Volume of water discharged (m ³)	0.2

Discharge Area (m ²)	2
----------------------------------	---

Soil Infiltration Rate (m/min)	0.007692308
--------------------------------	-------------

Soil Infiltration Rate (m/sec)	1.28E-04
--------------------------------	----------

SOIL PERCOLATION TEST

Sheet 1 of 2

Date of Test: 16/05/2025

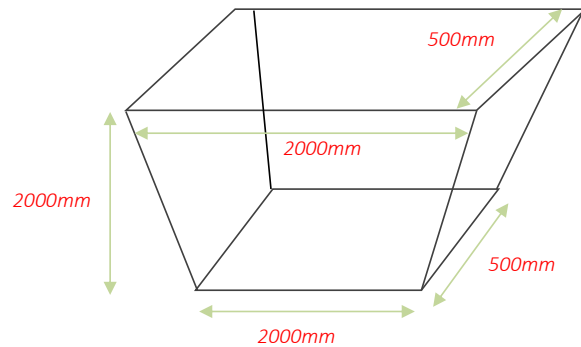
POSITION: SuDS1
TEST 1

Weather: Sunny, clear

Engineer: A. Turnbull

Checked: L. Harrison

Trial Pit Measurements



Pit Depth (mm):	2000
Pit Details:	Open with no stone filling
Groundwater Level:	NGW

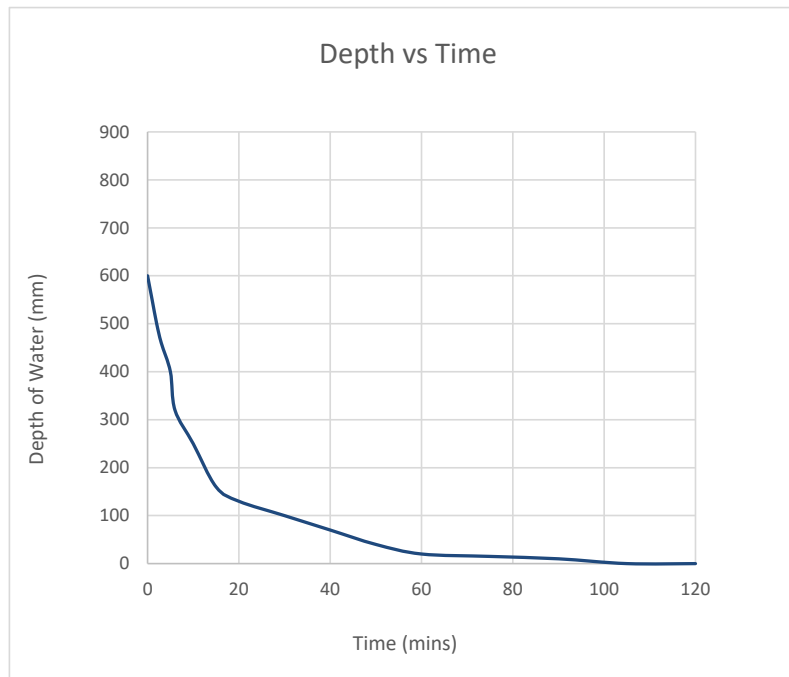
Test Data

Time Elapsed (mins)	Depth to Water Level (mm)
0	1400
1	1450
2	1500
3	1540
5	1600
6	1680
10	1750
15	1840
20	1850
30	1900
40	1930
50	1960
60	1980
75	1985
90	1990
105	2000
120	2000

SOIL PERCOLATION TEST



POSITION: SuDS1
TEST 1



Volume of Pit (m ³)	2
Void Ratio of Infill	1
Volume of Infill (m ³)	N/A
Volume of Water in Pit (m ³)	0.6

Compliance Check:

Water Level at 75% effective depth (mm)	450
Water Level at 25% effective depth (mm)	150

Compliant with BRE 365

Soil Infiltration Rate Calculation

Water Level 1	450
Water Level 2	150
Time to Drain from Level 1 to Level 2 (mins)	17
Volume of water discharged (m ³)	0.3

Discharge Area (m ²)	2.5
----------------------------------	-----

Soil Infiltration Rate (m/min)	0.007058824
--------------------------------	-------------

Soil Infiltration Rate (m/sec)	1.18E-04
--------------------------------	----------

SOIL PERCOLATION TEST

Sheet 1 of 2

Date of Test: 16/05/2025

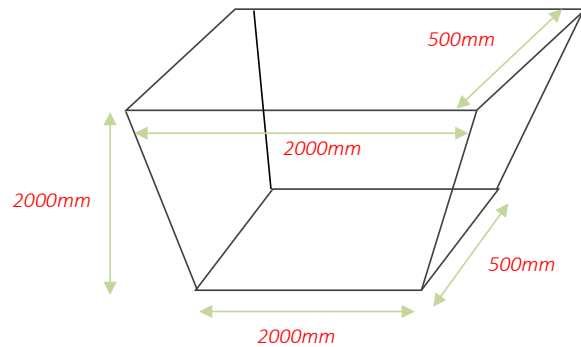
POSITION: SuDS1
TEST 2

Weather: Sunny, clear

Engineer: A. Turnbull

Checked: L. Harrison

Trial Pit Measurements



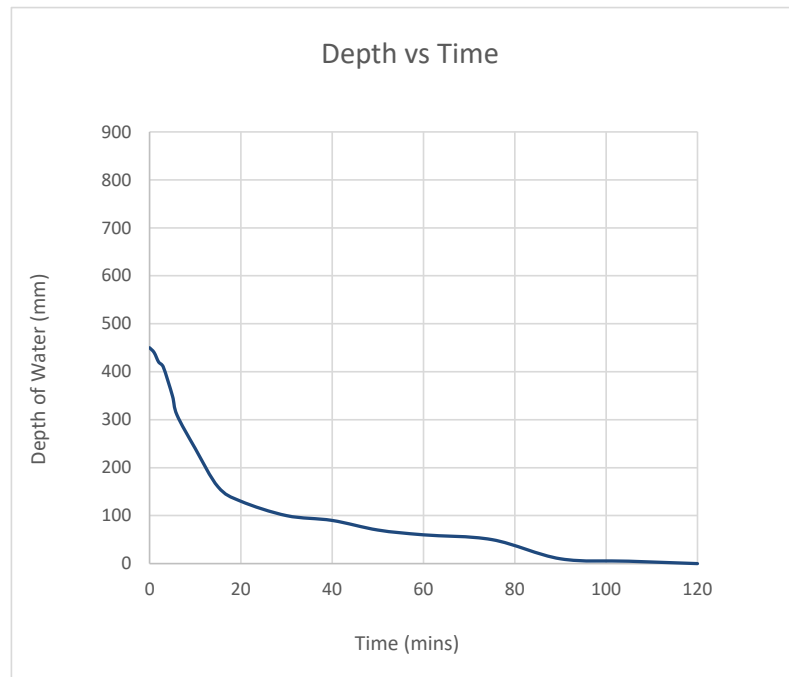
Pit Depth (mm):	2000
Pit Details:	Open with no stone filling
Groundwater Level:	NGW

Test Data

Time Elapsed (mins)	Depth to Water Level (mm)
0	1550
1	1560
2	1580
3	1590
5	1650
6	1690
10	1760
15	1840
20	1880
30	1900
40	1910
50	1930
60	1940
75	1950
90	1990
105	1995
120	2000

SOIL PERCOLATION TEST

POSITION: SuDS1
TEST 2



Volume of Pit (m ³)	2
Void Ratio of Infill	1
Volume of Infill (m ³)	N/A
Volume of Water in Pit (m ³)	0.45

Compliance Check:

Water Level at 75% effective depth (mm)	337.5
Water Level at 25% effective depth (mm)	112.5

Compliant with BRE 365

Soil Infiltration Rate Calculation

Water Level 1	337.5
Water Level 2	112.5
Time to Drain from Level 1 to Level 2 (mins)	21
Volume of water discharged (m ³)	0.225

Discharge Area (m ²)	2.125
----------------------------------	-------

Soil Infiltration Rate (m/min)	0.005042017
--------------------------------	-------------

Soil Infiltration Rate (m/sec)	8.40E-05
--------------------------------	----------

SOIL PERCOLATION TEST

Sheet 1 of 2

Date of Test: 16/05/2025

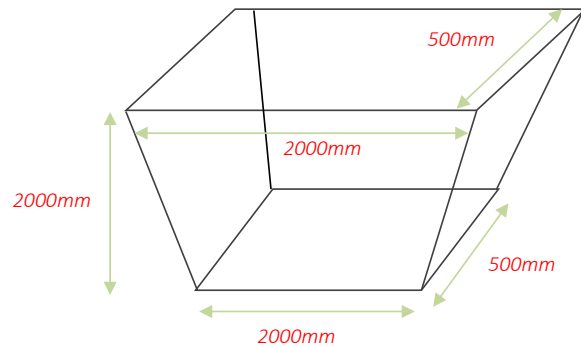
POSITION: SuDS1
TEST 3

Weather: Sunny, clear

Engineer: A. Turnbull

Checked: L. Harrison

Trial Pit Measurements



Pit Depth (mm):	2000
Pit Details:	Open with no stone filling
Groundwater Level:	NGW

Test Data

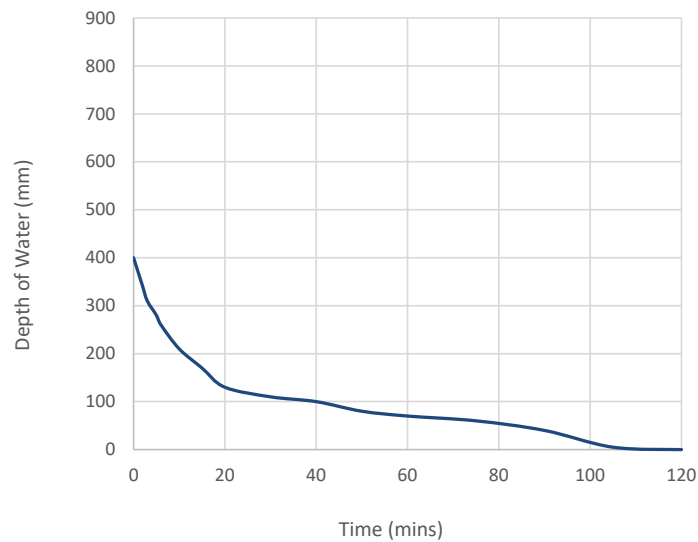
Time Elapsed (mins)	Depth to Water Level (mm)
0	1600
1	1630
2	1660
3	1690
5	1720
6	1740
10	1790
15	1830
20	1850
30	1890
40	1900
50	1920
60	1930
75	1940
90	1960
105	1995
120	2000

SOIL PERCOLATION TEST

POSITION: SuDS1
TEST 3



Depth vs Time



Volume of Pit (m ³)	2
Void Ratio of Infill	1
Volume of Infill (m ³)	N/A
Volume of Water in Pit (m ³)	0.4

Compliance Check:

Water Level at 75% effective depth (mm)	300
Water Level at 25% effective depth (mm)	100

Compliant with BRE 365

Soil Infiltration Rate Calculation

Water Level 1	300
Water Level 2	100
Time to Drain from Level 1 to Level 2 (mins)	27
Volume of water discharged (m ³)	0.2

Discharge Area (m ²)	2
----------------------------------	---

Soil Infiltration Rate (m/min)	0.003703704
--------------------------------	-------------

Soil Infiltration Rate (m/sec)	6.17E-05
--------------------------------	----------



Client:

Signature Estates (NW) Limited
263 Moorside Road
Swinton
Manchester
M27 9PJ

Consultant/Engineer:

Tang & Associates Architecture Ltd
10/F, 1 City Approach
Albert Street
Eccles
M30 0BG

Ground Investigation - Geotechnical

Unicorn House, Cheetham Street, Middleton

January 2026

Site Ref: 6203/VUH-F

Unit 4
Sheffield Street
Heaton Norris
Stockport
Cheshire
SK4 1RU
Telephone : 0161 480 8885
e-mail : info@geoassist.co.uk

Client:

Signature Estates (NW) Limited
263 Moorside Road
Swinton
Manchester
M27 9PJ

Consultant:

Tang & Associates Architecture Ltd
10/F, 1 City Approach
Albert Street
Eccles
M30 0BG

Ground Investigation - Geotechnical

1. Introduction.....	3
2. Description of the Site	3
3. Intrusive Investigation	4
3.1 Exploratory Hole Programme	4
3.2 Field Sampling and Testing	4
3.3 Field Results.....	4

Appendices

- A1. Site Plan with Exploratory Hole Location
- B1. Terminology used in Soil Descriptions
- B2. List of Abbreviations
- C1. Exploratory Hole Log WS1

Client:

Signature Estates (NW) Limited
263 Moorside Road
Swinton
Manchester
M27 9PJ

Consultant:

Tang & Associates Architecture Ltd
10/F, 1 City Approach
Albert Street
Eccles
M30 0BG

Ground Investigation - Geotechnical

1. Introduction

This report is a factual account of a limited intrusive Geotechnical Ground Investigation carried out by GeoAssist Limited as instructed by Tang & Associates Architecture Ltd on behalf of the Client Signature Estates (NW) Limited at Unicorn House, Cheetham Street, Middleton.

The object of this ground investigation was to provide geotechnical information on the nature of the ground for the proposed installation of a soakaway for the redevelopment on Unicorn House, Cheetham Street, Middleton.

The ground investigation was required to identify the depth, thickness and nature of superficial soils at the proposed soakaway location including groundwater depth.

The work was commissioned following acceptance of the quotation and an instruction to proceed issued by the Client Tang & Associates Architecture Ltd on 7th January 2026.

The area of the site scheduled for investigation is indicated on the site plan in Appendix A1 along with the exploratory hole location.

2. Description of the Site

The site is located on relatively level ground within the curtilage of the Unicorn House located on Cheetham Street, Middleton.

The borehole was located at a position as indicated by the Clients Engineer taking note of accessibility, services and principally safety constraints.

3. Intrusive Investigation

3.1 Exploratory Hole Programme

One exploratory hole referenced WS1 was undertaken using Dynamic Windowless sampling techniques. The position of the exploratory hole was located as near as possible to the location requested by the Clients Structural Engineer and to the centre of the proposed soakaway. An inspection pit was excavated using hand tools at the exploratory hole location where services or field drains were suspected. The details of the strata in the exploratory holes were recorded by a suitably qualified Professional Engineer.

All intrusive work was carried out in accordance with British Standard 5930: 1999 Code of Practice for Site Investigations and BS EN 1997-2:2007- Eurocode 7 where practicable and relevant.

The fieldwork for the works was completed on the 12/01/2026 in mixed weather conditions.

3.2 Field Sampling and Testing

Windowless samples were recovered of particular strata encountered in the exploratory hole. The windowless samples were recovered in semi rigid plastic coreline and returned to the laboratory for examination and logging.

Observations of groundwater conditions were made throughout the fieldwork operations.

On completion of the exploratory hole a groundwater monitoring standpipe was installed.

GeoAssist returned to site within 2 days to record the standing groundwater level in the standpipe.

3.3 Field Results

Full details of the subsoil conditions and the groundwater depth recorded in the standpipe in the exploratory hole are given in the exploratory hole log sheet which forms Appendix C1 to this report.



Matthew Benson MSc GMICE
Geotechnical/Environmental Engineer



Mark Richardson MSc CEng MICE
Technical Director

Field investigations have been restricted to a level of detail required to achieve the stated objectives of the work. Ground conditions are, and can be, variable and have only been tested at a particular isolated location on the site. Therefore, the potential exists for ground conditions to be encountered which are different to those considered in this report.

This report has been prepared by GeoAssist Limited with all reasonable professional skill and care within the terms of the contract with Signature Estates (NW) Limited and Tang & Associates Architecture Ltd. The report is confidential to Signature Estates (NW) Limited and Tang & Associates Architecture Ltd, their / the named persons advisors and bankers, and GeoAssist Limited accepts no responsibility of whatever nature to third parties to whom this report may be divulged. GeoAssist Limited owns the copyright in this report. All rights are reserved and unauthorised use is prohibited. Signature Estates (NW) Limited and Tang & Associates Architecture Ltd may use the report for their / her / his own purposes.

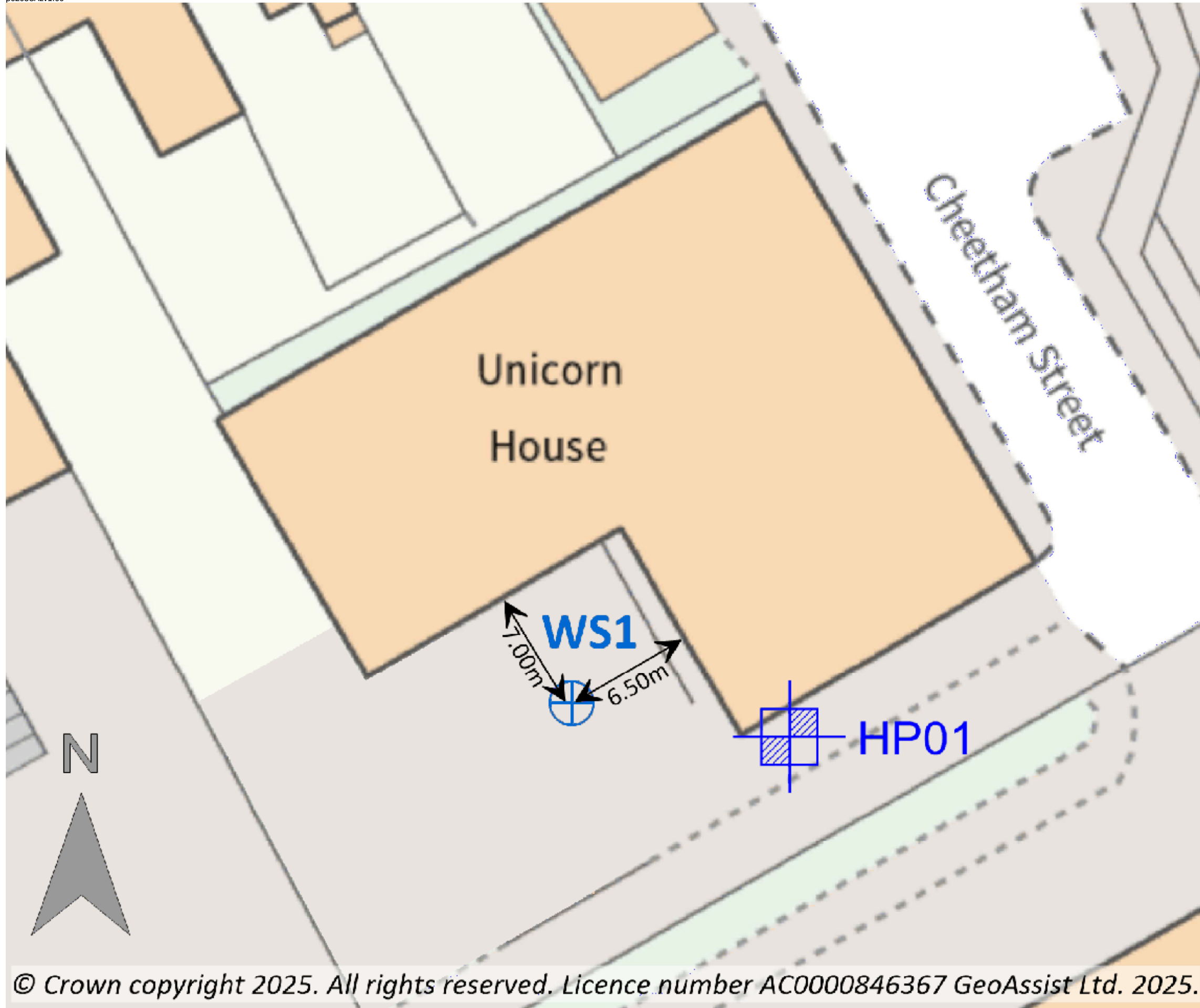
Appendix A

A1 Site Plan with Exploratory Hole Location

A1 Site Plan

Site Name	Unicorn House
Location	Cheetham Street, Middleton
GeoAssist Ref	6203VUH
Client	Signature Estates (NW) Limited
	263 Moorside Road Swinton Manchester M27 9PJ
Planning Consultant	Tang & Associates Architecture Ltd
NGR (centre of site)	,
Production Date	Jan 2026
Survey Method	
Surveyor	Others
Status	Final v1.00
Base Survey	OSGB36

Do Not Scale



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Appendix B

- B1 Terminology used in Soil Descriptions
- B2 List of Abbreviations

Terminology used in Soil Descriptions

The procedure and principles given in BS EN ISO 14688-1:2002 Part 1: 'Identification and description' have been adopted in producing the soil descriptions contained within this report.

The general identification and description of soils is based on a flexible system for immediate (field) use by experienced persons, covering both material and mass characteristics by visual and manual techniques.

Details are given of the individual characteristics for identifying soils and the descriptive terms in regular use, including those related to the results of tests from the field.

This part of ISO 14688 is applicable to natural soils *in situ*, similar man-made materials *in situ* and soils redeposited by man.

Particular sections of BS EN ISO 14688-1:2002 Part 1 are reproduced here in order to clarify the production of the soil descriptions contained within this report.

Identification of soil

General

Soil characteristics that generally permit soil to be identified with adequate accuracy for general (or preliminary) characterization are outlined below. A more accurate identification and classification based on grading, plasticity or organic content can be achieved by laboratory tests. In addition to identifying soils, the condition in which a soil is encountered, any particular secondary constituents, other features of a soil, such as carbonate content, particle shape, surface roughness of particles, odour, any common names and the geological classification are indicated.

The identification and description of soils generally follows the flow chart in Figure B1.1 attached.

Particle size

Particle size is the fundamental basis for designating mineral soils using particle fractions to distinguish the soil mechanical behaviour.

Table B1 shows the terms to be used for each soil fraction and its sub-fractions, together with the corresponding chosen range of particle sizes.

Basic soils are soils with uniform grading (i.e. they consist of particles of only one size range as specified in Table B1.1

Table B1.1 Particle Size Fractions

Soil fractions	Sub-fractions	Symbols	Particle sizes mm
Very coarse soil	Large boulder	LBo	> 630
	Boulder	Bo	> 200 to 630
	Cobble	Co	> 63 to 200
Coarse soil	Gravel	Gr	> 2,0 to 63
	Coarse gravel	CGr	> 20 to 63
	Medium gravel	MGr	> 6,3 to 20
	Fine gravel	FGr	> 2,0 to 6,3
	Sand	Sa	> 0,063 to 2,0
	Coarse sand	CSa	> 0,63 to 2,0
	Medium sand	MSa	> 0,2 to 0,63
	Fine sand	FSa	> 0,063 to 0,2
Fine soil	Silt	Si	> 0,002 to 0,063
	Coarse silt	CSi	> 0,02 to 0,063
	Medium silt	MSi	> 0,006 3 to 0,02
	Fine silt	FSi	> 0,002 to 0,006 3
	Clay	Cl	≤ 0,002

APPENDIX B1

Form No.: QF029AEN

Composite soils

General

Most soils are composite and consist of principal and secondary fractions. They are designated by a noun (main term) describing the principal fraction and by one or more adjectives (qualifying terms) describing the secondary fractions (e.g. sandy gravel saGr, gravelly clay grCl).

Principal fraction

The principal fraction in terms of mass determines the engineering properties of the soil and is given in capital letters for clarity.

In the case of very coarse soils, the principal fraction is the relevant very coarse soil fraction predominating in terms of mass. The very coarse fraction should be separated from the sample before identifying the fine and coarse fractions.

In the case of coarse soils, the principal fraction is the relevant coarse soil fraction predominating in terms of mass.

Composite coarse soils include a fines fraction (silt and/or clay) that does not determine the engineering properties of the soil.

In the case of fine soils, the principal fraction is the relevant fine soil type determining the engineering properties of the soil.

In the case of composite fine soils, the fines fraction determines the engineering properties of the soil. The fines fraction is regarded as determining the characteristics of a composite soil if this is of at least medium dry strength or exhibits a certain degree of plasticity.

In both cases, the soil is termed either "clay" or "silt", depending on the plasticity of the fines fraction and not on the grading.

Secondary fractions

Secondary and further fractions do not determine but will affect the engineering properties of the soil. The secondary fractions as adjectives are placed with the term describing the principal fraction in the order of their relevance.

If coarse secondary fractions are present in a particularly small or particularly large proportion, the term "slightly" or "very" shall precede the qualifying term.

If it is a fine soil, the properties of which are determined by fines fractions, a soil can be identified as "silt" or "clay" by checking for the presence of fine secondary constituents on the basis of its plasticity properties.

If, in the case of coarse soils, two soil fractions are present in approximately equal proportions, an oblique shall be placed between the relevant terms, e.g. gravel/sand (Gr/Sa) or fine/medium sand (FSa/MSa).

Plasticity

Assessment of the plasticity and identification of a soil as either silt or clay permits the soil to be qualified as being of low plasticity or high plasticity.

An exact determination can only be made by establishing the liquid limit and the plastic limit in laboratory tests.

Organic content

Small quantities of dispersed organic matter in a soil can produce a distinctive odour and colour. The intensity of odour and colour indicates the proportion of organic matter and should be described.

Determination of consistency

The consistency of a cohesive soil shall be determined in a manual test, permitting the following identification and description:

- a) a soil is to be identified as **very soft** if it exudes between the fingers when squeezed in the hand;
- b) a soil is to be identified as **soft** if it can be moulded by light finger pressure;
- c) a soil is to be identified as **firm** if it cannot be moulded by the fingers, but rolled in the hand to thick threads without breaking or crumbling;
- d) a soil is to be identified as **stiff** if it crumbles and breaks when rolled to thick threads but is still sufficiently moist to be moulded to a lump again;
- e) a soil is to be identified as **very stiff** if it has dried out and is mostly light coloured. It can no longer be moulded but crumbles under pressure. It can be indented by the thumbnail.

Preliminary descriptions are based on visual and manual identification only.

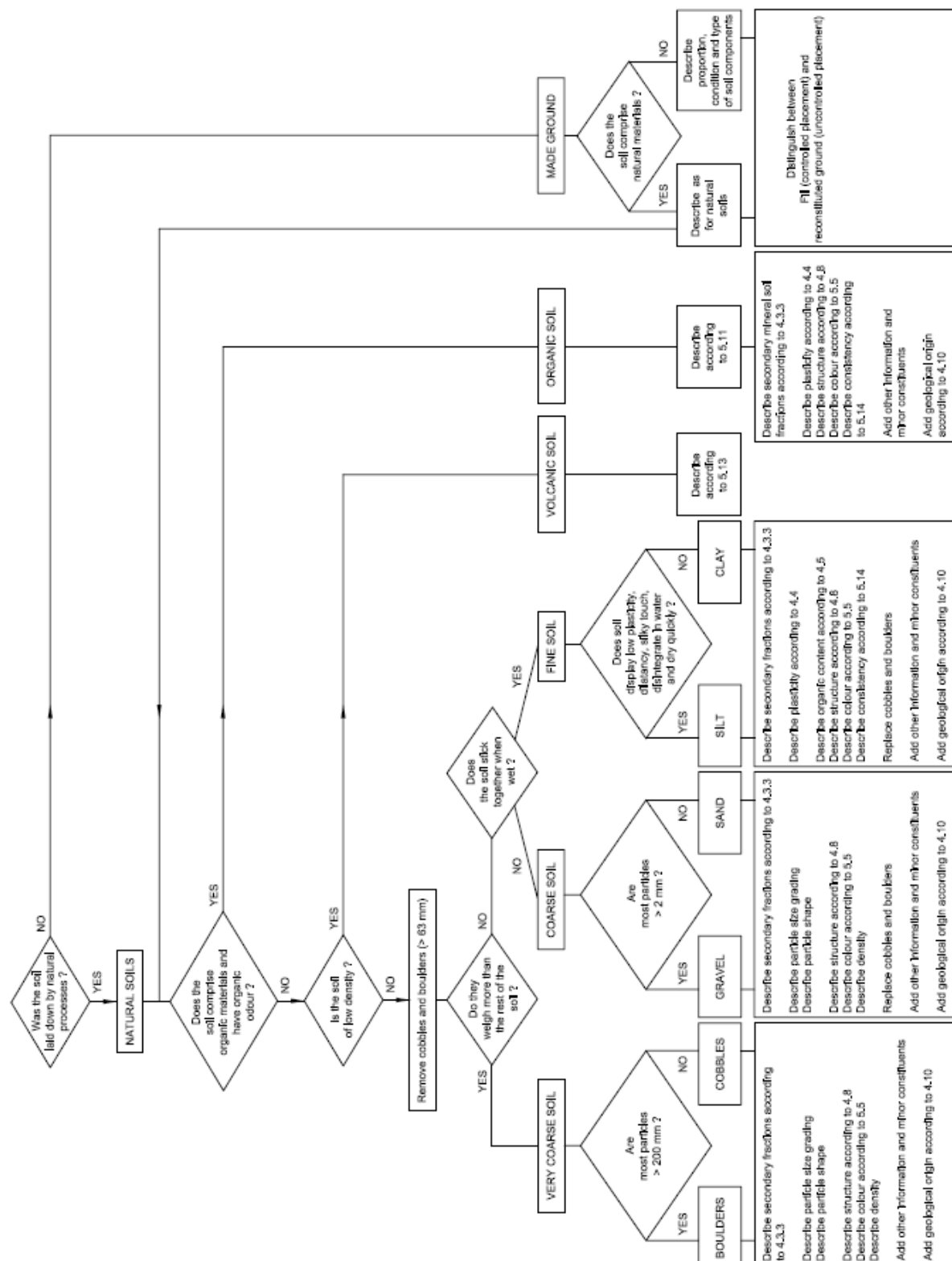


Figure B1.1 Flow chart for the identification and description of soils

APPENDIX B1

Form No.: QF029AEN

Terminology used in Soil Classification

The procedure and principles given in BS EN ISO 14688-2:2004 Part 2: 'Principles for a classification' have been adopted in producing the soil descriptions contained within this report where laboratory or in situ field tests have been carried out.

The classification principles established in this part of ISO 14688 permit soils to be grouped into classes of similar composition and geotechnical properties and, with respect to their suitability for geotechnical engineering purposes.

This part of ISO 14688 is applicable to natural soil and similar man-made material *in situ* and redeposited, but it is not a classification of soil by itself.

Particular sections of BS EN ISO 14688-1:2002 Part 2 are reproduced here in order to clarify the production of the soil descriptions contained within this report.

Principles of soil classifications

General

Soils shall be classified into soil groups on the basis of their nature, which is the composition only, irrespective of their water content or compactness, taking into account the particle size distribution (grading), plasticity, organic content, genesis as appropriate.

The most common approach to classification is to divide the soils on the basis of particle size grading and plasticity. The division is made on the relative size fractions present for the coarser soil fractions, determined on the whole sample, and on the plasticity of the finer fractions (Table B1.2).

Table B1.2 Principles of a classification of soils

Criterion	Soil group	Quantification	Denomination into groups of similar properties			Further subdivision as appropriate by
Wet soil does not stick together	very coarse	most particles > 200 mm	Bo	xBo		Requires special consideration
			boCo	coBo		
	most particles > 63 mm	Co	saCo, grCo	sagrCo		
	coarse	most particles > 2 mm	Gr	coGr	cosaGr	Particle size (grading) Shape of grading curve Relative density Permeability
most particles > 0,063 mm		Sa	siGr, clGr orSa	sasiGr, grsiSa siSa, clSa, saclGr	(Mineralogy) (Particle shape)	
Wet soils sticks together	fine	low plasticity dilatant	Si	saSi	sagrSi saclSi	Plasticity Water content Strength, sensitivity Compressibility, stiffness (Clay mineralogy)
			clSi, siCl			
		plastic non-dilatant	Cl	orSi, orCl	sagrCl	
Dark colour, low density	organic		Or	saOr, siOr	clOr	Requires special consideration
Not naturally	Made ground	deposited	Mg	xMg	Man-made material	Requires special consideration
					Relaid natural materials	As for natural soils
Key to symbols						Cases requiring special consideration should be classified according to national or project requirements
Soil	Principal	Secondary or tertiary component				
Boulders	Bo	bo	Gr(gr) and Sa(sa) can be subdivided into fine F(f), medium M(m) or coarse C(c)			
Cobbles	Co	co				
Gravel	Gr	gr				
Sand	Sa	sa				
Silt	Si	si				
Clay	Cl	cl	any combination of components			
Organic	Or	or				
Made ground	Mg	—				
		x				

Appendix B1

Page 4 of 8

GeoAssist Limited

APPENDIX B1

Form No.: QF029AEN

Fractions

Soil is a mixture of materials of different particle size, which are grouped into fractions as specified in BS EN ISO 14688-1.

Classification of coarse and very coarse soils is to be based on the particle size distribution alone (see Table B1.3)

Table B1.3 Classification of very coarse soils

Fraction	Percent by mass	Term
Boulders	< 5	low boulder content
	5 to 20	medium boulder content
	> 20	high boulder content
Cobbles	< 10	low cobble content
	10 to 20	medium cobble content
	> 20	high cobble content

In the case of soils composed of both fine and coarse material, classification is to be based on both plasticity and particle size distribution.

Particle size distribution (grading)

The particle sizes and their distribution in a soil are determined by mechanical analysis carried out by the separation of the coarser fractions by sieving on a series of standard sieves and the determination of the finer fractions by sedimentation.

The results of the sieving and sedimentation process are plotted as a grading curve.

Plasticity

The fine fractions of soil, represented by clay and silt and containing clay minerals (see also BS EN ISO 14688-1), both alone or in mixtures with coarser material, are usually classified according to their plasticity characteristics. This is carried out on the basis of laboratory tests to determine the liquid limit w_L and plastic limit w_P .

Organic content

When soils with organic constituents are classified according to their organic content (Table B1.4), a distinction is to be made between organic soils and mineral soils with an organic content.

Table B1.4 Classification of soils with organic constituents

Soil	Organic content (≤ 2 mm) % of dry mass
Low-organic	2 to 6
Medium-organic	6 to 20
High-organic	> 20

Classification of coarse and composite organic soils accumulated *in situ* is based on the type of organic matter and that of organic soils, on the genetic origin and the degree of decomposition of the organic constituents.

APPENDIX B1

Form No.: QF029AEN

Undrained shear strength of fine soils

The terms to be used for the designation of the undrained shear strength according to the results of laboratory and field tests are given in Table B1.5.

Table B1.5 Undrained shear strength of fine soils

Undrained shear strength of clays	Undrained shear strength c_u kPa
Extremely low	< 10
Very low	10 to 20
Low	20 to 40
Medium	40 to 75
High	75 to 150
Very high	150 to 300
Extremely high ^a	> 300
^a Materials with shear strength greater than 300 kPa may behave as weak rocks and should be described as rocks according to ISO 14689-1.	

Table B1.6 Guiding values for the division of mineral soils on a basis of the contents of various fractions

Fraction	Content of fraction in wt % of material ≤ 63 mm	Content of fraction in wt % of material ≤ 0,063 mm	Name of soil	
			Modifying term	Main term
Gravel	20 to 40 > 40		gravelly	gravel
Sand	20 to 40 > 40		sandy	sand
Silt + clay (fine soil)	5 to 15 15 to 40 > 40	< 20 ≥ 20 < 20 ≥ 20 < 10 10 to 20 20 to 40 > 40	slightly silty slightly clayey silty clayey clayey silty	 silt silt clay clay

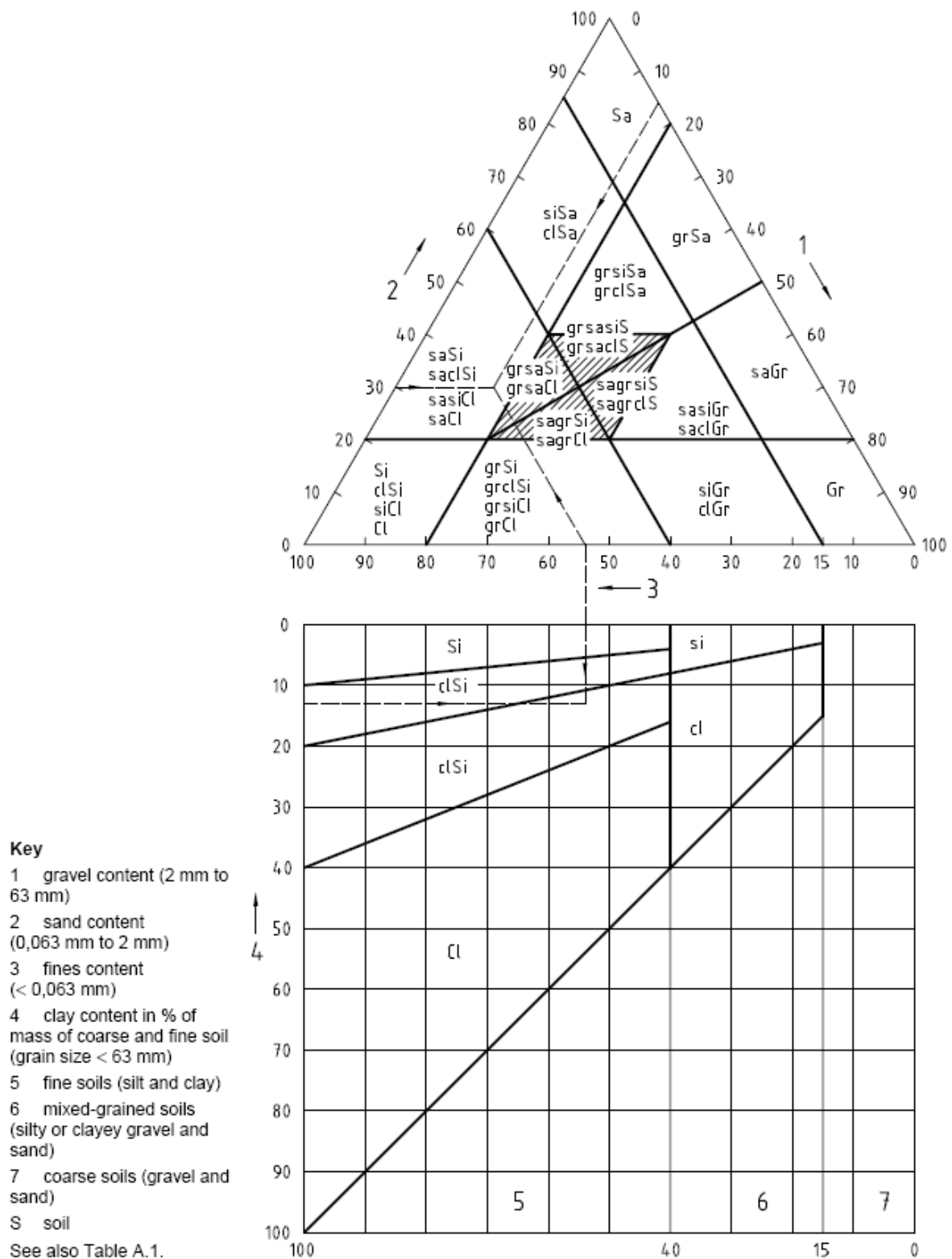


Figure B1.2 Classification of soils, based on grading alone

References

BS EN ISO 14688-1: 2002

Geotechnical investigation and testing — Identification and classification of soil — Part 1: Identification and description

BS EN ISO 14688-2: 2004

Geotechnical investigation and testing — Identification and classification of soil — Part 2: Principles for a classification

Abbreviations

Exploratory Hole log

Sample Type

AGS Code	Sample Type	AGS Code	Sample Type
B	Bulk Disturbed sample	SPT	Penetration Test – split spoon
CBR	CBR sample	U	Undisturbed sample – open drive
CPT	Penetration Test – cone	UF	Undisturbed sample failed recovery
D	Small disturbed sample	W	Water sample
PU	Piston sample	C - ES	Environmental sample

SPT and CPT – Standard Penetration Test

Blow Count (N) – If full penetration of 450mm then the total number of blows for the last 300mm is given.

If limited penetration following 150mm seating blows then the number of blows for the stated penetration is given.

If limited penetration then the total number of blows for the stated penetration is given.

The N values are actual blows recorded and uncorrected.

U - Undisturbed Sample

Blow Count – total number of blows for recovered length

Legend – As per British Standard – if blank then CAVITY/OPEN HOLE

Strata Legend Abbreviation

Abbreviation Soil	Strata	Abbreviation Rock	Strata
ALV	Alluvium	MDT	Mudstone
FG or GF	Fluvioglacial or Glacial-Fluvio	SIS	Siltstone
GT	Glacial Till	SST	Sandstone
MG	Made Ground		
RT	River Terrace		

Core Rec.:

T - Total Core Recovery as a percentage of the cored run

S – Solid Core Recovery as a percentage of the cored run

RQD – Rock Quality Designation as a percentage of the cored run

FI – Fracture index as number of fractures per metre

l_f – Fracture spacing as the average length of solid core pieces between natural fractures over core length of reasonable uniform characteristics

APPENDIX B2

Form No.: QF033AEN

Laboratory Test Summary Sheet

Tests on Soils

AGS Code	Test Name	AGS Code	Test Name
ASB	Asbestos	IDEN	In Situ Density
BDEN	Bulk Density	IGNIS	Loss on Ignition
CBR	California Bearing Ratio	IVAN	In Situ Vane
CD	Consolidated drained (single stage)	LS	Linear shrinkage
CDM	Consolidated drained (multi stage)	MCVG	Moisture Condition Value
CLSS	Atterberg Limits	NMC	Natural Moisture content
CMPG	Compaction	OMS	Organic Matter
CNMT	Contaminant and Chemical	PD	Particle density
CONG	Consolidation	PHS	pH
CU	Consolidated undrained with pwp measurement (single stage)	PTST	Laboratory permeability
CUM	Consolidated undrained with pwp measurement (multi stage)	RELD	Relative Density
DDEN	Dry Density	SHBG	Shear box
FRST	Frost Susceptibility	SLIM	Shrinkage Limit
GRAD HY	Particle Size (Hydrometer)	SULWS SULTS	Sulphate on 2:1 Water:Soil Extract Sulphate Total on Acid Extract
GRAD WS	Particle size (wet Sieve)	TNPC	Ten Per Cent Fines
HVP	Hand vane – peak	UU	Unconsolidated quick undrained (single stage)
ICBR	In situ CBR	UUM	Unconsolidated quick undrained (multi stage)

Tests on rocks and Aggregates

AGS Code	Test Name	AGS Code	Test Name
ACV	Aggregate crushing value	SHOR	Shore hardness
BRAZ	Tensile Strength by Brazilian method	SOUN	Aggregate Soundness Test
LOSA	Aggregate Los Angeles Abrasion	UCS	Uniaxial Compressive Strength
PLSI	Point Load Index – size corrected	WTAB	Aggregate Water Absorption

4. Reference AGS Format Edition 3

Appendix C

C1 Exploratory Hole Logs WS1

GeoAssist Limited		Exploratory Hole Record Sheet					Ref: WS1	
Consultant: Tang & Associates Architecture Ltd		Project: Unicorn House Location: Cheetham Street, Middleton					Sheet: 1	
Client: Signature Estates (NW) Limited		Equipment: Archway Dart Rig					Ground Level: m.AOD Co-ordinates: Easting: (m) Northing: (m) Dates: 12/01/2026 to 12/01/2026	
Drilling Foreman: M Walton		Depth (Thick) (m)	Reduced Level (mAOD)	Strata Legend/ Standpipe Backfill	Samples/Tests			Field Records
STRATUM DESCRIPTION					Depth (m) from to	Sample Type/No	Blow Count N/(U)	
Engineer/Geologist: M Benson								
0 CONCRETE Dark brown/grey gravelly sandy concrete and brick fragments - MADE GROUND		0.10						
1		(1.30)						
2		1.40						
Orange/brown silty fine to medium SAND with occasional gravel and dark grey inclusions from 3.00m depth								
3		(2.60)						
4		4.00						
5								
6								
7								
8								
9								
10								
Remarks: 12/01/2026: Inspection pit excavated to 1.00m depth to avoid services.							Logged: M Benson Date: 13/01/2025 Checked: M Richardson Date: 16/01/2025 Site Ref: 6203/VUH Scale 1:50 approx	
The groundwater conditions entered on the exploratory hole logs are those observed at the time of the drilling operations and the water level may not have reached equilibrium with the surrounding water level prior to the record being taken. Standing groundwater levels will be subject to seasonal variation or changes in local drainage conditions and could be higher at certain times of the year particularly after periods of heavy rainfall.								

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Tel: 01743 298 100

Email: info@geosmartinfo.co.uk

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Milford House
43-55 Milford Street
Salisbury
Wiltshire SP1 2BP
Tel: 01722 333306
Fax: 01722 332296
Email: admin@tpos.co.uk

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Please ask your search provider if you would like a copy of the search code

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Liz Lloyd

Finance Manager

GeoSmart Information Limited

Suite 9-11, 1st Floor,

Old Bank Buildings,

Bellstone, Shrewsbury, SY1 1HU

Tel: 01743 298 100

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