



Project Title

Flood Risk Assessment & Outline Drainage Strategy

At

**Fothergill Coated Fabrics Ltd
Smallbridge Business Park
Riverside Drive
Rochdale
OL16 2SH**

For

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Executive Summary

Item	Brief Description
Development Proposed	Planning permission for extension to existing Industrial unit with associated car parking and service yard on land at Fothergill Coated Fabric Ltd, Smallbridge Business Park, Riverside Drive, Rochdale, OL16 2SH.
Flood Risk Review	Tidal: Low Risk Flood Zone 1 Fluvial: Low Risk Flood Zone 1 Surface Water: Very Low Risk. Sewer & Drainage: Low Risk Groundwater: Low Risk Reservoir: Low Risk
Geology	A review of the BGS online mapping has indicated the Superficial Deposits to encompass Till, Devensian (Silt and clays) with the underlying bedrock comprising the Pennine Lower Coal Measures Formation – Mudstone.
Infiltration Rate	Based on the assessment of the BGS data set and the presence of the silts & clays over the deeper mudstone, infiltration as a means of draining the site has been discounted. However, this will be confirmed as part of the future Phase 2 site investigations.
Local Hydrology	The River Roch watercourse is located some 120m to the southwest of the site flowing generally in a southwesterly direction.
Nearest Adopted Sewers and onsite private drainage	A review of the United Utilities (UU) sewer records has indicated no sewers passing through the site boundary. Beyond the northwest boundary a 600mm diameter combined water sewer flows south. Within Riverside Drive to the south of the site is a 375mm diameter surface water sewer that outfalls to the River Roch. Investigations have determined that the existing building outfalls to these respective foul and surface water sewers unrestricted.
Existing Discharge Rate	For the purpose of this assessment, the site will be classed as fully Greenfield. The greenfield discharge rates for the proposed 0.19ha impermeable areas only are defined below: 1yr – 1.5 l/s Qbar – 1.7 l/s 30yr – 4.2 l/s 100yr – 6.1 l/s
Proposed Discharge Rate	In line with Rochdale Metropolitan Borough Council (RMBC) Sustainable Drainage Systems (SuDS) Policy, the predevelopment respective Greenfield runoff rates will be applied, but also to take account of the minimum rates to prevent blockage.
Surface Water Drainage Outfall and SuDS Hierarchal Approach	Based on current site information and the identified mudstone, infiltration is discounted, with the proposed surface water drainage strategy to discharge to the River Roch watercourse via the existing private pipework and UU adopted surface water sewer at a peak discharge rate not exceeding 5l/s.
Allowance for Climate Change	30% - based on a commercial < 70-year design life to 'the 2070's Central Allowance.

Item	Brief Description
SuDS features	Geocellular tanks & flow controls.
Maintenance Responsibility	Property owner
Foul Drainage Strategy	Any new foul drainage will connect to the existing private drain that outfalls to the UU combined water sewer.

1.0 Introduction

- 1.1 Paul Graveney Consulting (PGC) has been appointed by Fothergill Coated Fabric Ltd to prepare this Flood Risk Assessment & Outline Drainage Strategy to support a planning application for an extension to an existing Industrial unit plus associated car parking and service yard on land at Fothergill Coated Fabric Ltd, Smallbridge Business Park, Riverside Drive, Rochdale, OL16 2SH.
- 1.2 The proposed layout for this application can be found in Appendix A.
- 1.3 The assessment has been undertaken in line with Section 14 of the National Planning Policy Framework (NPPF) plus the accompanying Planning Policy Guidance (PPG) on Flood Risk.
- 1.4 This Flood Risk Assessment (FRA) has been commissioned by Fothergill Coated Fabric Ltd and is specific to their interests in the development proposals as described by the Architectural plan in Appendix A. This report may not be assigned.
- 1.5 The report has been commissioned to identify any flood-related issues associated with the proposed developments and any likely constraints that could be imposed plus consider the outline drainage strategy for it. The following issues have been suggested by the Environment Agency (EA), United Utilities (UU), Rochdale Metropolitan Borough Council (RMBC) subsequently addressed within this report.
- Identify available data relating to flood risk at the site.
 - Determine whether the site is at risk from flooding from all sources, including but not exhaustive, from breach or overtopping of any existing flood defences, watercourse flooding, surface water flooding and/or ground water flooding.
 - If at risk from any source, devise appropriate measures to prevent flood risk whilst not compromising the flood risk elsewhere.
 - Determine the current surface water drainage regime and assess impacts as a result of the proposed development.
 - Discuss if required Sustainable Drainage Systems (SuDS) as an option for reducing surface water flood risk. Determine any potential increase in surface water runoff as a result of the proposed development.
 - Devise an appropriate outline foul and surface water drainage strategy to deal with any increase in surface water runoff and include for climate change.
 - Consider the recommendations of the Rochdale Metropolitan Borough Council (RMBC) Strategic Flood Risk Assessment (SFRA).
 - Prepare the Flood Risk Assessment and Surface Water Drainage Strategy report.
 - Assess mitigation measures & off-site impacts and define any residual risks.

2.0 Development Description and Location

2.1 Site Location

The site is referenced in Table 1, and a site location map is provided in Appendix A.

Item	Brief Description
Site name	Fothergill Coated Fabrics Ltd.
Site address and location	Smallbridge Business Park, Riverside Drive, Rochdale, OL16 2SH.
Council Area	Rochdale Metropolitan Borough Council (RMBC)
Approximate Grid Reference	OS: 391149, 414712
General Locality	The development is located approximately 3km northeast of Rochdale Town Centre.

Table 1: Site Referencing Information

2.2 Existing site Description

- 2.2.1 The application site is largely rectangular in plan shape and is located within the northern periphery of Smallbridge industrial Estate. The existing building and service yard / car park are located to the south of the site boundary.
- 2.2.2 Trees and other dense vegetation are located to the west, north and eastern boundaries with access to the site from Riverside Drive to the south.
- 2.2.3 The general area is predominantly commercial & industrial with limited residential areas located approximately 40m to the northwest.
- 2.2.4 Refer to Figure 1 for further location details.

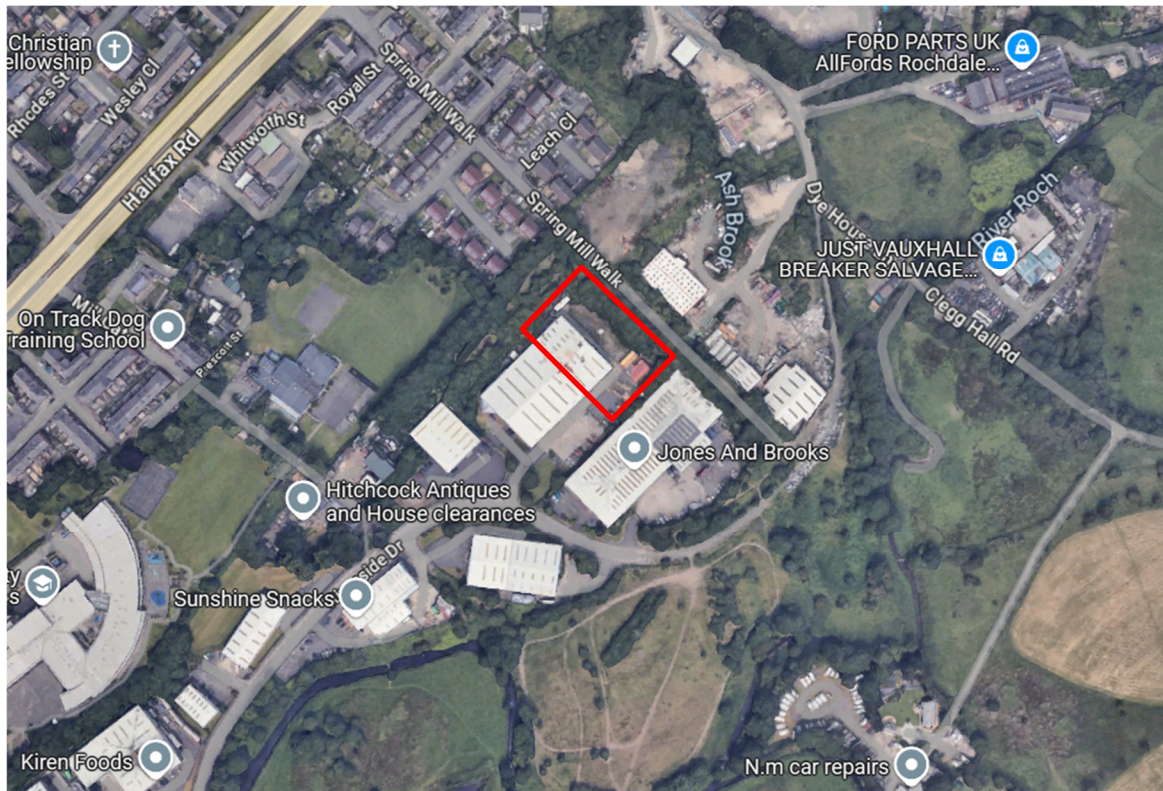


Figure 1: Location Plan

2.3 Topographical Survey

- 2.3.1 A full topographical survey has been undertaken at this site. This has identified the existing building to hold a level of 130.87m AOD with the southeastern service yard falling away. The location of the new extension is predominantly flat with a steep graded bank up to 133.70m AOD at the northeastern & western boundary.

3.0 Planning Policy and Consultation

3.1 National Planning Policy Framework

3.1.1 The indicative flood maps provided by the Environment Agency locate the main development area within low-risk Flood Zone 1 classification, i.e., land assessed as having less than a 1 in 1000 annual probability of fluvial flooding (<0.1%) in any year.

3.1.2 As a requirement of the new NPPF (2024), Section 14, the proposed development must satisfy the requirements of the Sequential Test and where applicable the Exception Test.

3.1.3 Sequential Test:

Under the NPPF (2024) and accompanying Planning Policy Guidance (PPG), Flood Zone 1 is defined as low probability flood risk. The proposal is for a commercial development, which in line with Table 1 is classified as 'Less Vulnerable'.

Placing both these criteria into Table 2 (Flood Risk Vulnerability and Flood Zone 'Compatibility'), Less Vulnerable development in Flood Zone 1 determines that the 'Development is Appropriate' and that the Exception Test is not applicable to this development proposal.

3.2 Strategic Flood Risk Assessment (SFRA)

3.2.1 SFRA's assess the risk associated with all types of flooding and provide the information required to identify the amount of development permitted in an area, how drainage systems in the area should function and also how risks in vulnerable areas can be reduced and/or mitigated. The NPPF states that regional planning bodies (RPB's) or Local Planning Authorities should prepare SFRA's in consultation with the EA.

3.2.2 The building sits within the coverage of the Rochdale Metropolitan Borough Council (RMBC) Level 1 SFRA. The published SFRA identifies current and future broad scale flood related issues in the Rochdale district. The purpose of the SFRA is to assess and map all known sources of flood risk including fluvial, surface water, sewer, groundwater and all impounded water bodies, taking into account future climate change predictions. The purpose of the SFRA is to assess and map all known sources of flood risk including fluvial, surface water, sewer, groundwater and all impounded water bodies, taking into account future climate change predictions.

3.2.3 A summary of the main objectives and elements from the SFRA associated with the district is detailed below. The full report can be obtained from the Rochdale Metropolitan Borough Council (RMBC) website.

- Determine the variations in risk from all sources of flooding across the Council area;
- Prepare broad policies for the management of flood risk;
- Steer development towards areas of lowest flood risk, through application of the Sequential Test and, where necessary, the Exception Test;
- Consider opportunities to reduce flood risk to existing communities through better management of surface water, provision for conveyance and storage for flood water; and
- Identify the level of detail required for site-specific Flood Risk Assessments

- SFRA maps indicate the site to be at low risk of fluvial flooding (FZ1).
- The site is not located within a Critical Drainage Area (CDA).
- Low risk of groundwater flooding.
- Full sequential and exception tests to be carried out (where applicable).

3.3 Local Flood Risk Management Strategy

3.3.1 The aim of Rochdale Metropolitan Borough Council (RMBC) Flood Risk Management Strategy (2014) document is to set out the council's approach to managing flood risk in the short and long term. The primary aim of the document is to improve the understanding of flood risks within the County and provide a source of information which can be utilised to identify ways of managing flood risk. The second objective is to reduce the risk of flooding for people and businesses in the County, and put forward key actions to ensure this can be achieved.

3.4 Rochdale Metropolitan Borough Council (RMBC) Sustainable Drainage Guidance

3.4.1 Rochdale Metropolitan Borough Council acting as the LLFA for the area do not appear to have any specific information defining how SuDS can be integrated into the fabric of development starting at the planning stage and leading through the concept, outline and detailed design stages.

3.4.2 However, it would be expected that the integration of SuDS for Major developments that should be included in the Flood Risk Assessment and designs are summarised below.

- Sustainable surface water management is a material consideration for all planning applications. This means all development proposals must include a site-specific surface water drainage strategy following sustainable urban drainage guidelines (SuDS).
- Details of how runoff is collected from roofs, roads and other hard surfaces to keep water at or near the surface.
- Site control features shown with approximate volumes, flow control locations and details.
- Flow routes including low flow, overflow and exceeding routes.
- Confirm the destination of the "controlled flow of clean water" from the site – the ground by infiltration, a watercourse or the surface water sewer.
- Existing brownfield sites to discharge at Greenfield rates.
- On greenfield sites, surface water run off must be managed to achieve the respective greenfield run off rates.
- Detailed SuDS management train approach to be incorporated throughout the scheme with appropriate measures from prevention, source control through to site control.
- Exceedance flows beyond the 30-year event can be incorporated as long as the water is managed and does not flow off site or cause flood risk to the development building.
- Detailed plans and hydraulic calculations to be provided at planning stage.

4.0 Definition of Flood Hazard

4.0.1 Flood risk to the proposed development building is considered from all sources of flooding, as defined by the NPPF.

4.1 Sources of information

4.1.1 The following section defines the flood risk receptors and anticipated flood risk. Section 4.8 then summarises the probability of flooding and the likely impacts. Table 2 defines the main sources of information used in the identification of flood risk.

Source of Information	Details
Environment Agency	Various Flood Maps from EA website
United Utilities	Sewer Records
Rochdale LLFA	SFRA Report & Various Maps

Table 2: Sources of information used in the identification of flood risk

4.2 Flooding from Sea (Tidal)

4.2.1 The site is situated at a minimum level of circa 130.00m AOD and thus is suitably placed above sea level. Therefore, the risk of tidal flooding is removed.

4.3 Flooding from River (Fluvial)

4.3.1 As mentioned in earlier sections, the closest identified hydrological feature is the River Roch, located some 120m to the south of the site.

4.3.2 The National Planning Policy Framework (NPPF) categorises fluvial and tidal flood risk as follows:

- Zone 1 (low probability) – Land assessed as having less than a 1 in 1,000 annual probability of river or sea flooding (<0.1%).
- Zone 2 (medium probability) – Land assessed as having between a 1 in 100 and 1 in 1,000 annual probability of river flooding (1% – 0.1%), or between a 1 in 200 and 1 in 1,000 annual probability of sea flooding (0.5% – 0.1%) in any year; and
- Zone 3a (high probability) - Land assessed as having a 1 in 100 or greater annual probability of river flooding (>1%), or a 1 in 200 or greater annual probability of flooding from the sea (>0.5%) in any year.
- Zone 3b The Functional Floodplain - This zone comprises land where water has to flow or be stored in times of flood. Local planning authorities should identify in their Strategic Flood Risk Assessments areas of functional floodplain and its boundaries accordingly, in agreement with the EA. (Not separately distinguished from Zone 3a on the Flood Map).

4.3.3 Figure 2 below locates the site on the Environment Agency's indicative floodplain map. The development site holds a low-risk Flood Zone 1 classification, i.e., land assessed as having less than a 1 in 1000 annual probability of fluvial flooding (<0.1%) in any year. The risk from fluvial flood water is therefore reduced to acceptable levels and no further assessment is required.

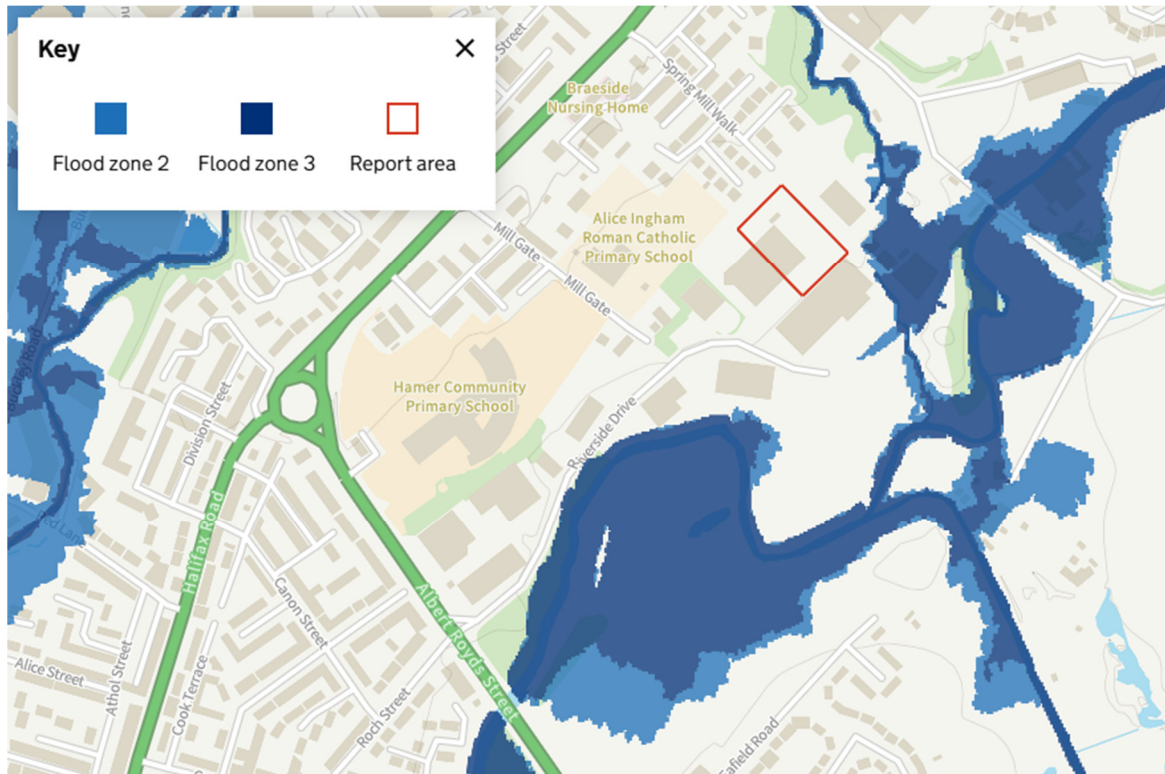


Figure 2 – The EA's Indicative Fluvial Floodplain Map

4.4 Flooding from Land and Surface Waters (Overland Flow)

4.4.1 The EA descriptions for the High, Medium and Low risk scenarios for surface water flooding are as follows:

- High risk means that each year this area has a chance of flooding of greater than 3.3%.
- Medium risk means that each year this area has a chance of flooding between 1% and 3.3%.
- Low risk means that each year this area has a chance of flooding between 0.1% and 1%.
- Very Low risk means that each year this area has a chance of flooding of less than 0.1%.

4.4.2 The general area within and surrounding the proposed development falls in a southerly direction towards the River Roch.

- 4.4.3 The Environment Agency's (EA's) surface water flood maps (refer to Figure 3) indicate that the large majority of the site is at very low risk of surface water flooding. There is a very small area of higher risk (1 in 100 year) to the rear of the existing building, which is associated with a low point in the topography.
- 4.4.4 There are no identified existing surface water flow routes through the site that would need to be maintained.
- 4.4.5 As part of the proposed development the ground levels will be modified to ensure that all low points are located away from the elevated buildings. The new surface water drainage will also be designed and installed in accordance with the latest guidance and climate change allowances to ensure no surface water ponding will occur.
- 4.4.6 With these measures incorporated into the layout, the risk from surface water is considered to be very low.

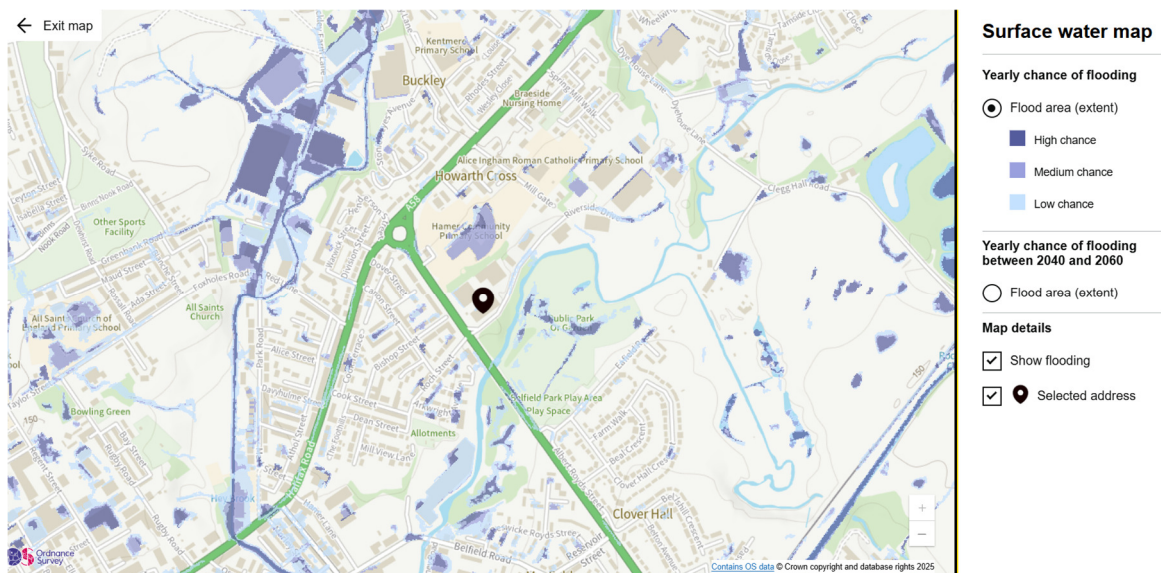


Figure 3 – Extract EA Flood Risk Mapping - Flood Risk from Surface Water

4.5 Flooding from Sewers

- 4.5.1 A review of the United Utilities (UU) sewer records has indicated no sewers passing through the site boundary. Beyond the northwest boundary a 600mm diameter combined water sewer flows south. Within Riverside Drive to the south of the site is a 375mm diameter surface water sewer that outfalls to the River Roch.
- 4.5.2 Investigations have determined that the existing building outfalls to these respective foul and surface water sewers unrestricted.
- 4.5.3 The drainage networks serving the adjacent highways ensure that the development footprint is protected from the impact of both upstream and downstream runoff. It is speculated that complete protection may well exist beyond a storm event equivalent to the 30-year statistical event. Beyond this projection, there may be a small degree of peripheral 'Exceedance' flooding within the areas above the drains and gullies. However, this is expected to be localised and restricted to the location of specific manhole covers located outside the development footprint. Thus, flood risk to the site from drainage is diminished to acceptable levels.

4.6 Flooding from Groundwater

- 4.6.1 Groundwater flooding occurs when the water table, the level of water below the ground, rises above the ground surface or into cellars and basements. Groundwater flooding is most likely to occur in low lying areas underlain by permeable rocks (aquifers). These may be extensive, regional aquifers, such as chalk or sandstone, or maybe localised sands or river gravels in valley bottoms underlain by less permeable rocks.
- 4.6.2 No site investigation has been carried out at the site. British Geological Survey mapping confirmed that the bedrock strata for the site to encompass a Principal Aquifer.
- 4.6.3 Based on there being no proposed basements, the building levels set above existing ground levels, and the lower lying watercourse beyond the southern boundary, the risk of groundwater flooding is considered to be Low. A full Phase 2 intrusive site investigation will confirm this at detailed design stage.

4.7 Flooding from Other Water Features

- 4.7.1 Reservoir flooding is extremely unlikely to happen and there has been no loss of life in the UK from reservoir flooding since 1925. The Environment Agency is the enforcement authority and ensures that reservoirs are inspected regularly, and essential safety work is carried out.
- 4.7.2 The Long-Term Flood Risk Assessment (Flood Risk from Reservoirs) map shows that the site is at a very low risk of reservoir flooding.

4.8 Summary

Below is a table summary of the flood risks associated with the development site.

Source	Probability of Flood Risk	Impacts	Remarks
Tidal	Low	Low	The development building is not influenced by Tidal flood risk.
Fluvial (Watercourse)	Low	Low	The development is located in low flood risk zone 1.
Surface (Overland Flood Flow)	Low	Low (with raised FFL's)	The development buildings are located within a very Low Risk Zone. Proposed buildings to be raised above existing ground and flood levels.
Sewers & New Drainage	Low	Low	No sewers in close proximity. Adjacent highways are served by local drainage networks to direct water to local watercourses. New drainage is to be designed in line with local and national guidance.
Groundwater	Low	Low	SFRA records would indicate the groundwater levels to be deep, supported by the raised levels of the building compared to the local watercourses.
Artificial Sources	Low	Low	No artificial sources in close proximity.

Table 3 – Flood Risk Summary

5.0 Outline Drainage Strategy

5.1 Existing Drainage

- 5.1.1 A review of the United Utilities (UU) sewer records has indicated no sewers passing through the site boundary. Beyond the northwest boundary a 600mm diameter combined water sewer flows south. Within Riverside Drive to the south of the site is a 375mm diameter surface water sewer that outfalls to the River Roch.
- 5.1.2 Investigations have determined that the existing building outfalls to these respective foul and surface water sewers unrestricted.

5.2 Existing Runoff Rates

- 5.2.1 For the purpose of this assessment the site will be classed as fully greenfield with greenfield discharge rates defined below.
- 5.2.2 Greenfield discharge calculations have been undertaken for the site in accordance with Rainfall Runoff Management for Developments (Report SC030219, October 2013, Defra/EA). In accordance with the Non-statutory Technical Standards for Sustainable Drainage Systems (March 2015, Defra) greenfield rates have been calculated for the 1 in 1 year, Q_{bar} , 1 in 30 and 1 in 100-year rainfall events. Table 4 below provides a summary of the existing greenfield runoff rates based on the new 0.19ha impermeable area.

Impermeable Area	Greenfield Runoff Rates (l/s)			
	1 yr	Q_{bar}	30yr	100yr
0.19	1.5 l/s	1.7 l/s	4.2 l/s	6.1 l/s

Table 4: Existing Greenfield Runoff Rates

5.3 Geology

- 5.3.1 No site-specific intrusive Phase 2 Site Investigation has been carried out at the site at this time. review of the BGS online mapping has indicated the Superficial Deposits to encompass Till, Devensian (Silt and clays) with the underlying bedrock comprising the Pennine Lower Coal Measures Formation – Mudstone.
- 5.3.2 Due to the presence of the upper clays and deeper Mudstone to depth, infiltration is not considered a viable means of draining the new development area. However, infiltration testing in line with BRE 365 guidance will be undertaken as part of the future Phase 2 site investigations.

5.4 Hydrological Assessment

- 5.4.1 As mentioned earlier the River Roche watercourse is located some 120m to the south of the site.

5.5 Sustainable Drainage Systems (SuDS) Assessment

5.5.1 SuDS Objectives

Sustainable drainage developed in line with the ideals of sustainable development is collectively referred to as Sustainable Drainage Systems (SuDS). At a particular site, these systems are designed both to manage the environmental risks resulting from urban runoff and to contribute wherever possible to environmental enhancement. SuDS objectives are therefore to minimise the impacts from the development on the quantity and quality of the runoff and maximise amenity and biodiversity opportunities (CIRIA C753, 2015).

5.5.2 SuDS Design Themes

The 'Management Train Approach' should be central to the surface water drainage strategy of the proposed site. The main objective is treatment and control of runoff as near to the source as possible protecting downstream habitats and further enhancing the amenity value of the site. This concept uses a hierarchy of drainage techniques to incrementally reduce pollution, flow rates and volumes of storm water discharge from the site, and is as follows:

- i. **Prevention** – The use of good site design and housekeeping measures to prevent runoff and pollution and includes the use of rainwater reuse / harvesting.
- ii. **Source Controls** – Control of runoff at source or as close to source as possible (e.g. soakaways, green roofs, pervious pavements).
- iii. **Site Control** – Management of water in a local area and can include below ground storage / attenuation, detention basins, large infiltration devices.
- iv. **Regional Control** – Management of water from a site or various sites and can include wetlands and balancing ponds.

5.5.3 SuDS Site Constraints

SuDS techniques are suitable for all sites; therefore, an assessment of the existing site is required so that SuDS limitations can be determined.

- *Land Use Characteristics:* The size and type of development enables the potential range of prevention, source control and site control SuDS devices to be considered above and below ground.
- *Site Characteristics:* No site investigation has been carried out at the site. Findings from a review of the BGS maps indicate that the ground encompasses sandstone to depth, such that infiltration techniques are unlikely to be suitable.
- *Catchment Characteristics:* The site is currently classed for drainage purposes as 'Greenfield'.
- *Environmental and Amenity Performance:* The inclusion of SuDS within the overall development is a key driver in providing both amenity and habitat creation. All types of SuDS will be considered and blended into the landscaping zone, if possible. Safety for all future users is paramount and so best practice guidance will be incorporated so that there is no requirement for significant safety precautions. Maintenance plans will be prepared for all SuDS devices that are included.

5.5.4 SuDS Methods

Table 5 & 6 on the following pages provide an assessment of various above and below ground SuDS methods that can provide water quality treatment and management of flows to reduce runoff rates and volumes and whether they can be suitably incorporated at this development site. The purpose of this assessment is to set out options to be considered at the planning stage with consideration of time constraints, viability and lifetime maintenance of the commercial development.

Method	Comment	Suitability for Development
Green Roofs	Can be used on suitable low-rise buildings to provide retention, attenuation and treatment of rainwater Promotes evaporation. and local biodiversity.	<u>Not suitable:</u> - Additional costs of installation would have a severe effect on the viability of the development. - Pitched roof profile are not suitable for Green roofs.
Water Butts	Plastic tanks placed at the base of rainwater down pipes to collect rainwater runoff from the roof areas.	<u>Not suitable:</u> Limited end use.
Rainwater Harvesting	Rainwater harvesting reduces the total runoff volume from the developed site and reduces treated water consumption.	<u>Not Suitable:</u> - Additional costs of installation would have a severe effect on viability of development. - Limited end use with small office area. - The ability to restrict peak flow rates and short-term peak volumes is non-existent where a critical storm event occurs.
Permeable Surfacing (Infiltration)	- Reduces total run off volume from the development. - Can be used to enhance water quality.	<u>Not Suitable:</u> Initial investigations would indicate that the underlying ground is unsuitable for infiltration due to clay and mudstone geology.
Permeable Surfacing (Standard)	- Can be used to enhance the quality of runoff water. - Sub-base provides 'source' storage and reduces the volume of storage downstream. - The storage can be created with selection of the stone fill or use of plastic box stems. - Impermeable membrane at base of construction to prevent impact on pavement stability.	<u>Not Suitable:</u> No specific new parking areas

Swales, basins and ponds	• Provide areas for above ground surface runoff storage. • Swales also improve water quality through filtration.	<u>Not suitable:</u> • No available area for attenuation pond to be allocated. Plus very steep ground profiles.
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Table 5: Surface SuDS Methods

Method	Comment	Suitability for Development
Geocellular Storage	• Suitable for sites with insufficient space for basins etc. • Suitable for sites where topography prevents the use of open basins etc.	<u>Suitable:</u> • Potential to be incorporated as part of the attenuation measures beneath the yard areas.
Large Diameter Pipes, Culverts or Tanks	• Suitable for sites with insufficient space for basins etc. • Provide a volume of below ground storage with a high void ratio and good man entry provision to allow for future maintenance and cleaning. • Generally, be suitable for adoption by the statutory water company (e.g. United Utilities (UU)).	<u>Suitable:</u> • Suited to adoptable drainage networks such as those proposed on this scheme.

Table 6: Sub-Surface SuDS Methods

5.5.5 SuDS Hierarchal Approach

Based on the SuDS assessment in Tables 5 & 6, plus an assessment of the local site conditions, the SuDS hierarchal approach for discharge of surface water at the development site is considered in greater detail below:

Method	Suitability	Suitability for Development
Infiltration to Ground	No	Initial assessment has determined that the underlying Clays and deeper mudstone ground conditions would not be suitable for infiltration-based options. Further investigation and testing required to confirm.
Connection to Watercourse	No	No new direct connection to the watercourse is feasible.
Connection to Surface Water Sewer	Yes	Should insitu testing prove that infiltration is not possible then a new connection to be made to the UU surface water public sewer via the existing connection at respective Greenfield rates.
Connection to a Combined Sewer	No	Higher options take precedent.

Table 7: SuDS Hierarchal Approach

5.5.6 SuDS Design Philosophy

SuDS assessment and hierarchal approach discussed in Table 5, 6 and 7 above has defined the overall SuDS strategy. Thus, the SuDS philosophy for the development site is the promotion of Site Control techniques with discharge to the adjacent surface water sewer.

The following design philosophy is proposed:

- Surface water treatment using the 'Management Train' approach to remove and isolate contamination at all SuDS facilities prior to conveyance to the existing drainage infrastructure.
- Site Control features in the form of below ground geocellular attenuation tanks to accommodate the additional surface water runoff generated by the development site.
- Surface water discharges to the surface water sewer at a controlled rate.
- Aim to limit where possible the impermeable fraction of development.

5.6 The Non-Statutory Technical Standards for SuDS

- 5.6.1 It is best practice to develop drainage strategies to the DEFRA document 'The Non-Statutory Technical Standards for SuDS'.
- 5.6.2 The DEFRA document advises the following with respect to 'Peak Flow Control' (S2) and 'Volume Control' (S4) for Greenfield sites such as this:
- **S2** *For greenfield developments, the peak runoff rate from the development to any highway drain, sewer or surface water body for the 1 in 1 year rainfall event and the 1 in 100-year rainfall event should never exceed the peak greenfield runoff rate for the same event.*
 - **S4** *Where reasonably practicable, for greenfield development, the runoff volume from the development to any highway drain, sewer or surface water body in the 1 in 100-year, 6-hour rainfall event should never exceed the greenfield runoff volume for the same event.*
 - **S6** *Where it is not reasonably practicable to constrain the volume of runoff to any drain, sewer or surface water body in accordance with S4 above, the runoff volume must be discharged at a rate that does not adversely affect flood risk.*
- 5.6.3 As noted above, and in line with policy, it is intended that surface water discharge rates will be restricted to the respective Greenfield runoff rates with a peak at 5.0l/s, which is in line with Rochdale Metropolitan Borough Council (RMBC) policy for greenfield sites in accordance with standard **S2** and to comply with the peak volume requirements as per **S4** and **S6**.

5.7 Climate Change

- 5.7.1 In May 2022, the Environment Agency released updated climate change allowances for peak rainfall intensities which should be applied to new developments. Rather than nationwide allowances, each area will have its own peak rainfall allowances. In the case of the Rochdale area, this is the Irwell Management Catchment peak rainfall allowances.
- 5.6.2 Based on the commercial nature of the development, a lifespan no greater than 70 years is anticipated. Therefore, the potential climate change allowance for the 2070's 'Less Vulnerable' development is 30% for the central allowance, which will be incorporated in the hydraulic calculations.

5.8 Outline Surface Water Drainage Strategy

- 5.8.1 The general principle of the surface water drainage strategy is to collect the runoff from the new roof and external areas and direct it to a below ground surface water drainage network that will outfall to the southeastern yard before connecting to the existing network serving the current building. This then outfalls to the UU sewer prior to outfalling to the River Roch watercourse. The flows from the new development will discharge at a rate not exceeding 5.0l/s. Attenuation of the peak flows will encompass below ground geocellular tanks.

- 5.8.2 The proposed drainage layout for the new development site will be designed in accordance with Design & Construction Guidance (DCG), BS EN 752: 2008 and Building Regulations Part H guidance, i.e., up to the 30-year storm return period criterion and tested for the 1 in 100-year return period including a 30% increase to account for climate change to confirm that there is no flood risk to the buildings.
- 5.8.3 Flooding can occur on a local scale beyond the 30yr criteria due to runoff exceeding the capacity of the minor system during extreme events and it can only be addressed on a site-specific basis. Guidance states that development should be protected against flooding from extreme events (1 in 30 year) and that flood pathways are identified when the drainage system is exceeded.
- 5.8.4 In the case of this development, exceedance flows will be all those over and above the 30-year design criterion set by Design & Construction Guidance. Using storage within the external yard and parking areas would be achievable and would direct flood water away from the proposed buildings, with flows directed back into the surface water drainage network as water levels in the drainage network recede. During the detailed design of the development layout, consideration of these sewers to coordinate with the highway networks will be made to retain any flood water within the highway.
- 5.8.5 Although it is envisaged that Prevention and source control measures could be included in the final scheme, this strategy will assume for outline calculations purposes that site control only methods are incorporated. A detailed hydraulic surface water network has been simulated in the Causeway Flow Hydraulic Design Software for all the roof and hard paved areas. This takes into account the peak greenfield rate of 5.0l/s. It is noted that these rates and volumes are preliminary for this outline assessment and are likely to alter at detailed design stage when more site-specific information is made available.
- 5.8.6 Drawing PGC1246-DR-C-001 in Appendix C indicates the Drainage Strategy based on the Architects masterplan intent, with the supporting hydraulic calculations in Appendix D.

5.9 Volume Control

- 5.9.1 The impermeable area of the application site will be increased as a result of the development and therefore the volume of run-off in the 100-year 6-hour storm event will be increased above the pre-development greenfield level. The management of the additional volume through infiltration or re-use is not considered reasonably practicable for the development and therefore the rate of runoff will be restricted to a maximum of 5.0l/s, for all storm events, in order to prevent an adverse effect on flood risk.

5.10 Pollution Control

- 5.10.1 Runoff from roofs is generally considered to be clean and will be discharged directly into the new drainage network. Surface water run-off from hard paved areas at risk of contamination should receive water quality treatment. The yards are considered as a medium hazard in terms of contamination. Figure 4 illustrates the pollution hazard indices for different land use classifications from The CIRIA SuDS Manual C753 (2015).

TABLE 26.2 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 (eg cul de sacs, homezones and general access roads) and non-residential car parking with infrequent change (eg schools, offices) ie < 300 traffic movements/day	Low	0.5	0.4	0.4
Commercial yard and delivery areas, non-residential car parking with frequent change (eg hospitals, retail), all roads except low traffic roads and trunk roads/motorways ¹	Medium	0.7	0.6	0.7
Sites with heavy pollution (eg haulage yards, lorry parks, highly frequented lorry approaches to industrial estates, waste sites), sites where chemicals and fuels (other than domestic fuel oil) are to be delivered, handled, stored, used or manufactured; industrial sites; trunk roads and motorways ¹	High	0.8 ²	0.8 ²	0.9 ²

Figure 4: Pollution Hazard indices for land use classification (Table 26.2 the CIRIA SuDS manual 2015)

5.10.2 Figure 5 then illustrates the SuDS Component mitigation indices from the CIRIA SuDS Manual C753 (2015).

5.10.3 The selection of treatment should ensure that the SuDS mitigation component index (Figure 5) exceeds the pollution hazard index (Figure 4).

TABLE 26.3 Indicative SuDS mitigation indices for discharges to surface waters			
Type of SuDS component	Mitigation indices ¹		
	TSS	Metals	Hydrocarbons
Filter strip	0.4	0.4	0.5
Filter drain	0.4 ²	0.4	0.4
Swale	0.5	0.6	0.6
Bioretention system	0.8	0.8	0.8
Permeable pavement	0.7	0.6	0.7
Detention basin	0.5	0.5	0.6
Pond ⁴	0.7 ³	0.7	0.5
Wetland	0.8 ³	0.8	0.8
Proprietary treatment systems ^{5,6}	These must demonstrate that they can address each of the contaminant types to acceptable levels for frequent events up to approximately the 1 in 1 year return period event, for inflow concentrations relevant to the contributing drainage area.		

Notes

- 1 SuDS components only deliver these indices if they follow design guidance with respect to hydraulics and treatment set out in the relevant technical component chapters.
- 2 Filter drains can remove coarse sediments, but their use for this purpose will have significant implications with respect to maintenance requirements, and this should be taken into account in the design and Maintenance Plan.
- 3 Ponds and wetlands can remove coarse sediments, but their use for this purpose will have significant implications with respect to the maintenance requirements and amenity value of the system. Sediment should normally be removed upstream, unless they are specifically designed to retain sediment in a separate part of the component, where it cannot easily migrate to the main body of water.
- 4 Where a wetland is not specifically designed to provide significantly enhanced treatment, it should be considered as having the same mitigation indices as a pond.
- 5 See Chapter 14 for approaches to demonstrate product performance. A British Water/Environment Agency assessment code of practice is currently under development that will allow manufacturers to complete an agreed test protocol for systems intended to treat contaminated surface water runoff. Full details can be found at: <http://tinyurl.com/qf7yuj7>
- 6 SEPA only considers proprietary treatment systems as appropriate in exceptional circumstances where other types of SuDS component are not practicable. Proprietary treatment systems may also be considered appropriate for existing sites that are causing pollution where there is a requirement to retrofit treatment. SEPA (2014) also provides a flowchart with a summary of checks on suitability of a proprietary system.

Figure 5: Indicative SuDS mitigation indices (Table 26.3 the CIRIA SuDS manual 2015)

5.10.4 The roof areas have a low pollution hazard level and thus no further treatment is required.

5.10.5 The new yard is classed as medium risk and will pass through a new petrol interceptor, thus providing the necessary treatment to reduce contamination risk to the downstream catchments.

5.11 Maintenance

5.12.1 This section is intended to give an overview of the operation and maintenance for the drainage features included with the drainage strategy and in relation to typical details. Where proprietary products are specified, the manufacturer's instructions and recommendations should be followed in priority to this document unless specifically noted otherwise due to project constraints. The recommended operations and frequencies are typical only and should be more frequent initially to ensure that there are no unforeseen issues with the operation and then adjusted to suit the site requirements.

5.12.2 There are three types of maintenance activities associated with surface water drainage systems. The SuDS Manual, CIRIA C753, defines these as:

- Regular Maintenance – *'basic tasks undertaken on a frequent and predictable schedule' including vegetation management, litter and debris removal, and inspections.'*
- Occasional Maintenance – *'tasks that are likely to be required periodically, but on a much less frequent and predictable basis than the routine tasks (sediment removal is an example).'*
- Remedial Maintenance – *'intermittent tasks that may be required to rectify faults associated with the system, although the likelihood of faults can be minimised by good design. Where remedial work is found to be necessary, it is likely to be due to site-specific characteristics or unforeseen events, and as such timings are difficult to predict.'*

5.12.3 Piped Networks, Inspection, Manhole and Catchpit Chambers

The appropriate health and safety equipment must be used when accessing manholes. Confined space certificates must be held by any personnel entering a manhole and the appropriate permits should be obtained where required.

Pipes are proprietary products, and the materials can vary across the site and as such where used the manufacture's recommendations should be followed.

Pipes are intended to be the main conveyance across the development and where oversized they form the attenuation volume required by the limitation of the discharge rate. They are intended to be dry except for during rainfall events. These have been designed to be self-cleaning where possible for smaller diameter pipes, and for larger diameters the risk is reduced due to the overall pipe size.

Access for maintenance is provided through access chambers and manholes.

Regular inspection and maintenance are important to identify areas which may have been obstructed / clogged and may not be drainage correctly thus exposing the development to a greater level of flood risk.

Maintenance Schedule	Required Action	Typical Frequency
Regular Maintenance	Inspect and identify any features that are not operating correctly. If required, take remedial action	Monthly for three months, then six monthly
	Debris removal from catchment surface / gratings (where may cause risks to performance)	Monthly (and after large storms)
	Remove sediment from trapped sumps, manholes and catchpits.	Annually or as required
Remedial Maintenance	Repair / rehabilitation of gratings, inlets and outlets	As required
Monitoring	Inspect / check all gratings, trapped sumps, manholes and catchpits to ensure that they are in good condition and operating as designed	Annually and after large storm events
Structure Rehabilitation / Repair	Regular Maintenance and Monitoring to identify if repair and / or replacement of features or pipework is required.	As required

Table 8: Operation and Maintenance Requirements of Piped Networks and Inspection Chambers

5.12.4 Geocellular tanks

Geocellular tanks are modular storage systems made with plastic units. These units can be assembled to achieve the required volume and usually on multiple layers. Generally, the units have 95% of voids content and are used to create an efficient below ground structure to store surface water.

The geocellular units and geotextile are proprietary products and therefore manufacturer's recommendations should also be taken into consideration.

Access for maintenance should be provided by an access shaft located on the tank and from the manhole chambers downstream of the tank.

Regular inspection and maintenance are important for the effective operation of attenuation tanks as designed. As the feature is buried, a regular inspection regime is very important to ensure the correction functionality of the surface water drainage network.

Maintenance schedule	Required action	Typical frequency
Regular Maintenance	Inspect and identify any areas that are not operating correctly. If required, take remedial action.	Monthly for 3 months, then annually.
	Remove debris from the catchment surface (where it may cause risks to performance).	Monthly.
	For systems where rainfall infiltrates into the tank from above, check surface of filter for blockages by sediment, algae or other matter; remove and replace surface infiltration medium as required.	Annually.
	Remove sediments from pre-treatment structures and/or internal forebays.	Annually, or as required.
Remedial Actions	Repair/rehabilitate inlets, outlets, overflows and vents.	As required.
Monitoring	Inspect/check all inlets, outlets, vents and overflows to ensure that they are in good condition and operating as designed.	Annually
	Survey inside of tank for sediment build-up and remove if necessary.	Every 5 years or as required.

Table 9: Operation & maintenance requirements for attenuation storage tanks - Based on CIRIA SuDS Manual 2015

5.12.5 Flow Control Units

The flow control units are intended for flood control and flow restriction.

The flow control is specified as Hydro-brake and is a proprietary product; therefore, the manufacturer's recommendations should also be taken into consideration.

Access for maintenance has been provided by locating within manhole chambers.

Maintenance Schedule	Required Action	Frequency
Monitoring (to be undertaken more regularly within the first year of operation and adjusted as required).	Inspect inlets for blockages, and clear if required. If faults persist, jetting and CCTV survey may be required.	Monthly and after large storms.
Regular maintenance	Inspect and identify any areas that are not operating correctly. If required, take remedial action.	Monthly for 3 months, then six monthly.
	Debris removal from catchment surface (where may cause risks to performance).	Monthly
	Remove sediment from pre- treatment structures and flow control chambers.	Annually (or as required after heavy rainfall events)
Remedial Actions	Repair/rehabilitation of inlets.	As required.

Table 10: Operation and Maintenance Requirements for Flow Controls

5.12 Foul Water Drainage

5.12.1 Any new foul drainage required as part of the extension will connect to the existing private network that in turn outfalls to the combined public sewer.

5.12.2 The proposed private drainage layout for the new development site will be designed in accordance with BS EN 752: 2017, Building Regulations Part H guidance.

6.0 Management Measures, Off Site Impacts and Residual Risk

6.1 Flood Risk Management Measures

- 6.1.1 The assessment has confirmed that there is no flood risk to the proposed commercial extension from all sources.
- 6.1.2 The surface water drainage strategy for the new development site will be to direct the surface water runoff to the adjacent surface water sewer and watercourse at restricted greenfield discharge rates. The new surface water network will be designed in line with current British Standard and adoption guidance up to the 100-year storm return period including an allowance for climate change. Beyond the 30yr criterion out of chamber flooding may occur with flood water directed away from the building to the external areas where it will then be directed back into the drainage network as the pipe water levels recede.
- 6.1.3 The use of SuDS in the form of Site Control measures will help to reduce the flood risk impact to the surrounding watercourse network.
- 6.1.4 There will be a site management health and safety document prepared in respect of the final development. This will include the required maintenance regime for the on-site drains and drainage facilities such as the channels, gullies, pipes, manholes and all SuDS facilities.
- 6.1.5 The current owner will be responsible for site cleanliness and drain cleansing to ensure that the surface water drainage system will always operate at its maximum efficiency.

6.2 Off Site Impacts

- 6.2.1 The development of the site does not impair the hydraulic continuity of any watercourse and the current 'local hydraulics' of distributing watercourses / outfalls.
- 6.2.2 Surface water runoff will look to mimic the predevelopment Greenfield regime and utilises SuDS solutions to satisfy the site constraints. This will reduce surface water flooding impact onto the downstream catchment.
- 6.2.3 As there is no flood displacement or increased rate of runoff as part of this proposal into the adjacent watercourse, the proposed development will therefore not increase flood risk onto its locality.

6.3 Residual Risk

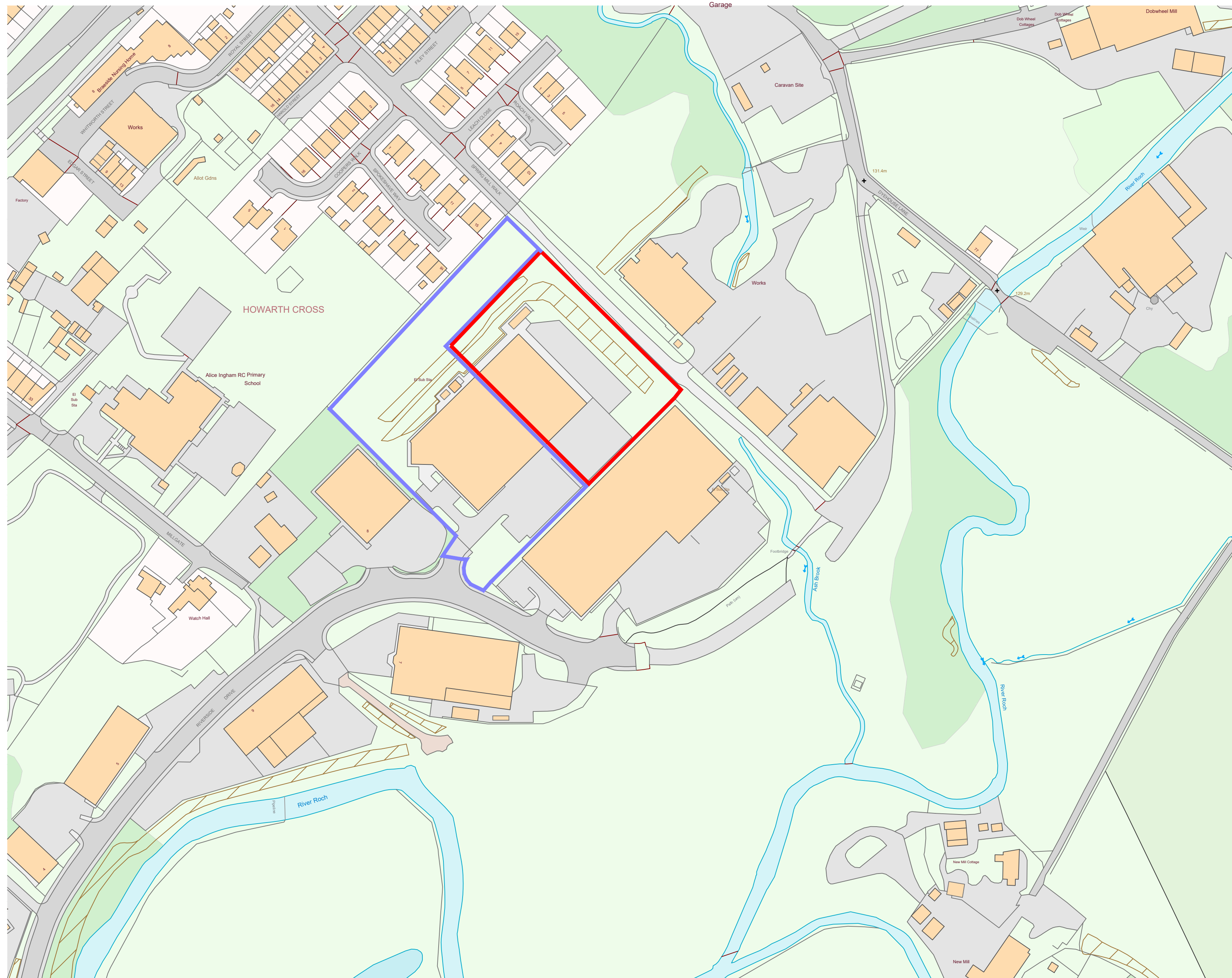
- 6.3.1 With careful design of the drainage elements as described above there will be no residual flood-related risks that will remain after the development has been completed.
- 6.3.2 Flood risk to people and property can be managed but it can never be completely removed; a residual risk remains after flood management or mitigation measures have been put in place. The only known flood related residual risk that will remain after flood management or mitigation measures have been put in place will be the risk of flooding from the new drainage network beyond the extreme event. With the proposed units raised above the external levels, the risk is mitigated.

Appendix A – Architects Drawings

N

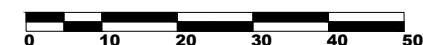
REVISION

KEY:



LOCATION PLAN

SCALE 1:1250



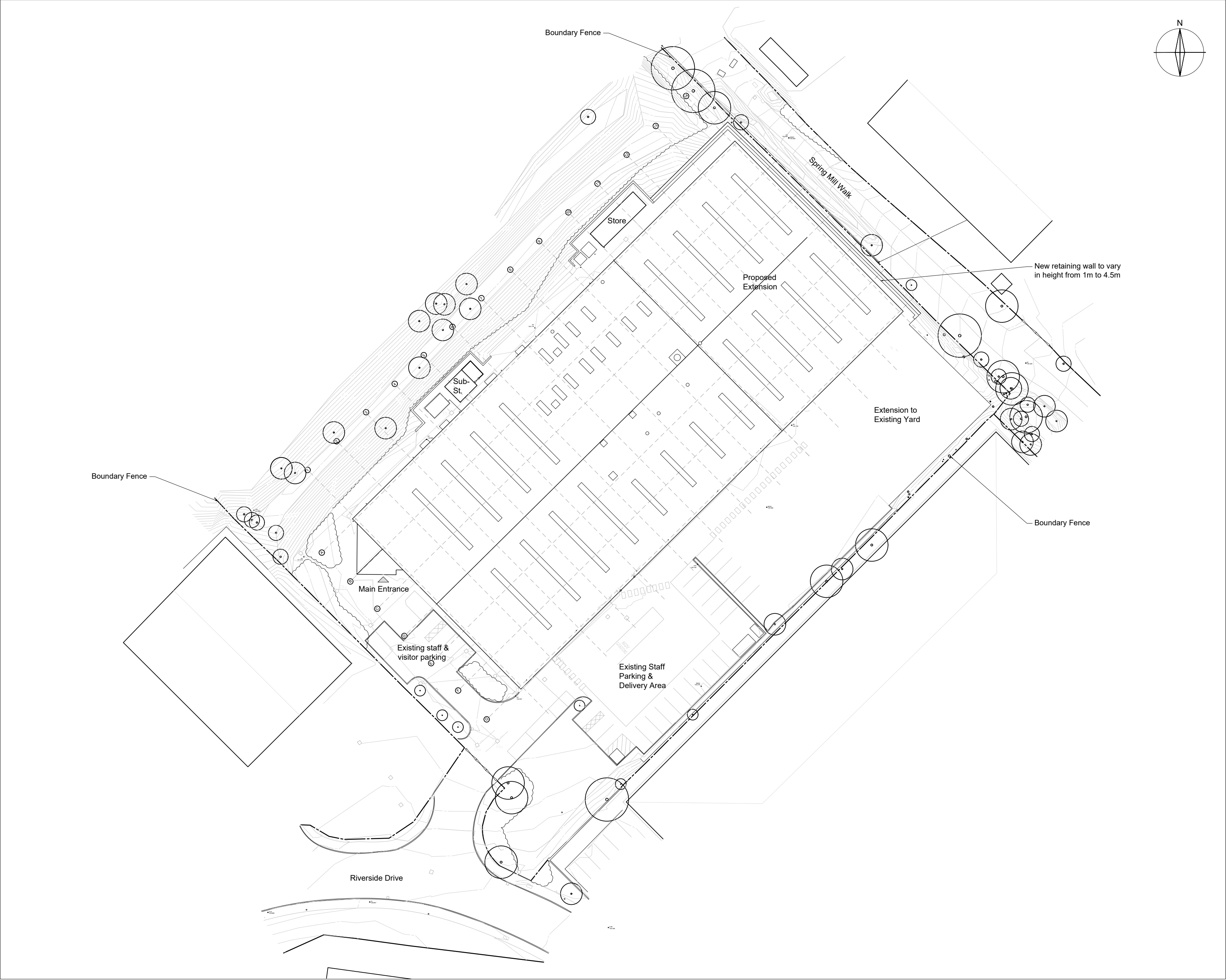
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JH.A

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**Architectural
Registration
Board**



PROPOSED SITE PLAN
SCALE 1:500

INB	Do not scale off this drawing. All dimensions to be checked on site prior to manufacture and construction. This drawing is the property of JH. Architects and should not be reproduced without permission. All discrepancies to be brought to the attention of the architect immediately. This drawing to be read in conjunction with the specification / bill of quantities and related drawings.		
REVISION			
-	FIRST ISSUE	18.03.25	SZ
A	GENERAL UPDATE	27.03.25	DG
B	GENERAL UPDATE	08.04.25	DG

CLIENT	FOTHERGILL COATED FABRICS
PROJECT	SMALLBRIDGE BUSINESS PARK RIVERSIDE DRIVE, ROCHDALE OL16 2SH
TITLE	PROPOSED SITE PLAN WITH ROOF PLAN
JOB NO.	X141
DWG NO.	X141-PR-AK1.01 Rev. B
SCALE	1:500 @ A2
DRAWN	SZ

46 MANCHESTER ROAD
CHORLTON
MANCHESTER
M21 9PH

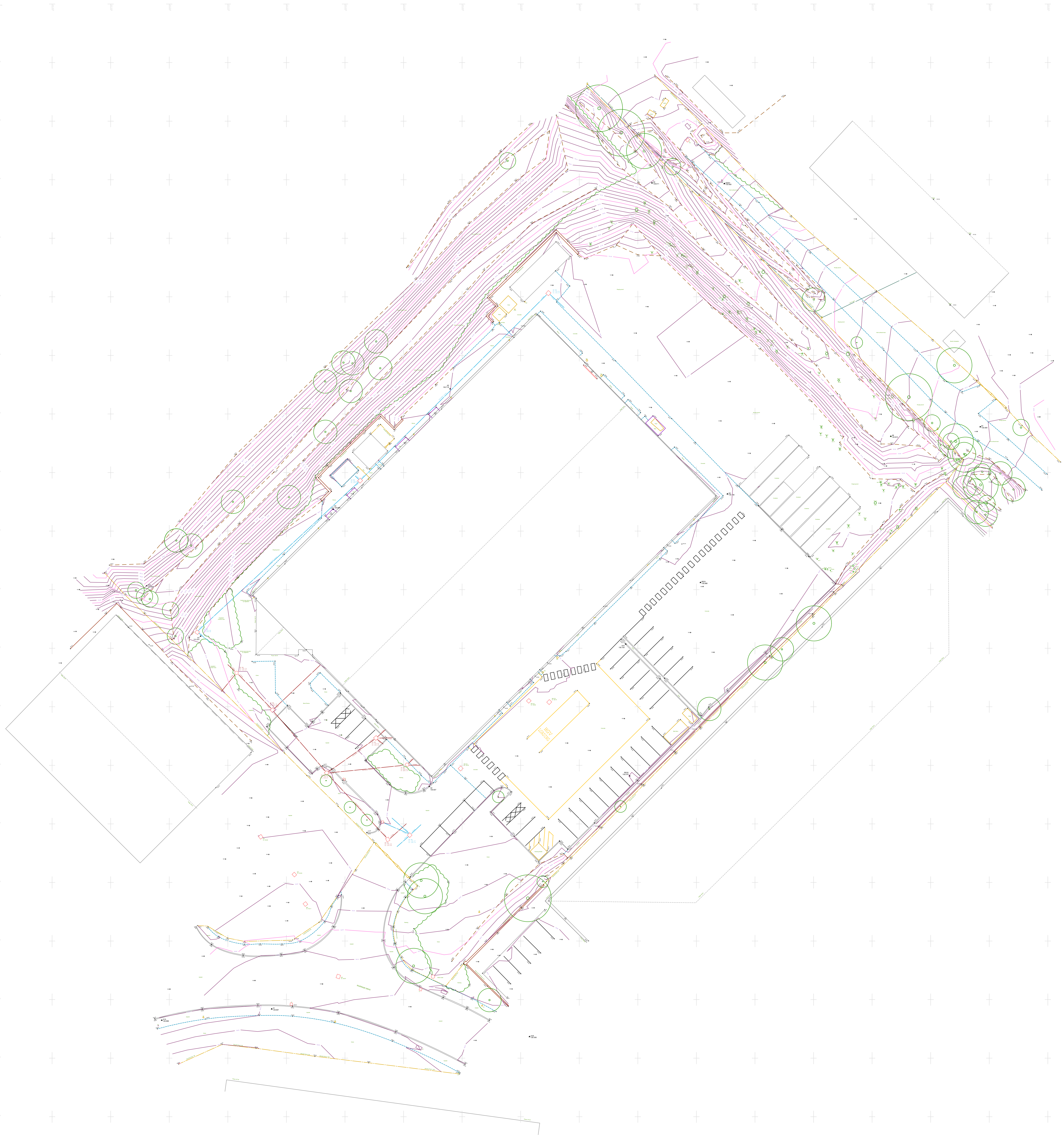
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Appendix B – Topographical Survey



Coordinate System

This survey has been oriented to the Ordnance Survey (OS) National Grid and Datum using GPS observations and the OS Active Network.

A true OS coordinate was established near to the centre of the site. This survey has been orientated to this point. Further OS coordinates were established to create a true OS bearing for angle orientation.

No scale factor has been applied to this survey. The coordinates shown are arbitrary and not true OS coordinates which do have a scale factor applied.

Notes

1. Dimensions should not be scaled. All dimensions should be verified on site prior to construction.

2. All dimension and levels are in metres unless otherwise stated.

3. Some detail may have been obscured by parked vehicles, stored materials, overgrown vegetation, and bad filter.

4. All data shall remain Copyright of Robertson Elliot unless formally agreed otherwise.

5. The surveyed boundary features may not be legal boundaries.

6. Robertson Elliot cannot accept any responsibility for any damage to computer systems from viruses which may be contained in the datafile supplied.

Key to Abbreviations

Inspection Covers & Chambers	Walls & Fence Types
AV Air Valve	BL Block Wall
BR Benchhole	BR Brick Wall
BT British Telecom Cover	BW Barbed Wire Fence
C2P Cable Drove (N)	C2B Chain Barbed Fence
CW Combined Water	C1 Corrugated Iron Fence
Dr Ch Drainage Channel	CL Chain Link Fence
Elec Electric Inspection Cover	C2P Concrete Post
ER Earth Road	Gap Gap
FH Fire Hydrant	HR Hand Rail
FW Foul Water	HR Iron Railings
G Gully	Pal Palisade Fence
GC Gas Cock	PR Post & Rail Fence
GV Gas Valve	PW Post & Wire Fence
IC Inspection Cover	Ret Retaining Wall
KO Kerb Outlet	St Stone Wall
MR Manhole	
RE Rodding Eye	Street Furniture
SC Stop Cock	B Bollard
SV Stop Valve	BB Bellisha Beacon
SW Storm Water	DP Down Pipe
TV Cable Television Cover	EP Election Pole
UL Up lighter	FB Flower Bed
UTL Unable to Lift	JB Junction Box
WM Water Meter	LP Lamp Post
WO Washout	MP Marker Post

Ground Surface Types

Asp Asphalt	RS Road Sign
BSP Block Pavers	RWP Rain Water Pipe
Conc Concrete	SP Sign Post
Pav Concrete Paving	SW Sign Wire
Tac Tactile Paving	SWP Sol Vent Pipe
	TCS Telephone Call Box

Measurement Descriptions

CL Cover Level	TL Traffic Light
d Diameter (mm)	TP Telegraph Pole
d Depth (m)	VP Vent Pipe
FFL Finished Floor Level	
n Feature Height (m)	
IL Invert Level	
SL Sump Level	
Stiff Level	
WL Water Level	

Linetypes & Symbols

Banking	Banking
Buildings	Flow Direction
Building Overhead	Gate
Change of Surface	Survey Station
Fences	Tree
Kerbs	
Overhead Cables	
Ridges & Eaves	
Steps	
Walls	
Vegetation	
Tree Canopy	
Combined Water	
Foul Water	
Storm Water	

Sheet Layout

N

002

001

Rev	Date	Drawn	Details

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RICS

REGISTERED SURVEYORS

Title: Topographical Survey

Project: Fothergill Coated Fabrics, Riverside Drive, Rochdale

Client: JH Architects

Drawn: DB	Checked: DE
Date: 13/03/2025	Scale: N.T.S
Drawing Number: OVERVIEW	Rev: 1

Appendix C – PGC Drawings

Appendix D – Outline Hydraulic Calculations

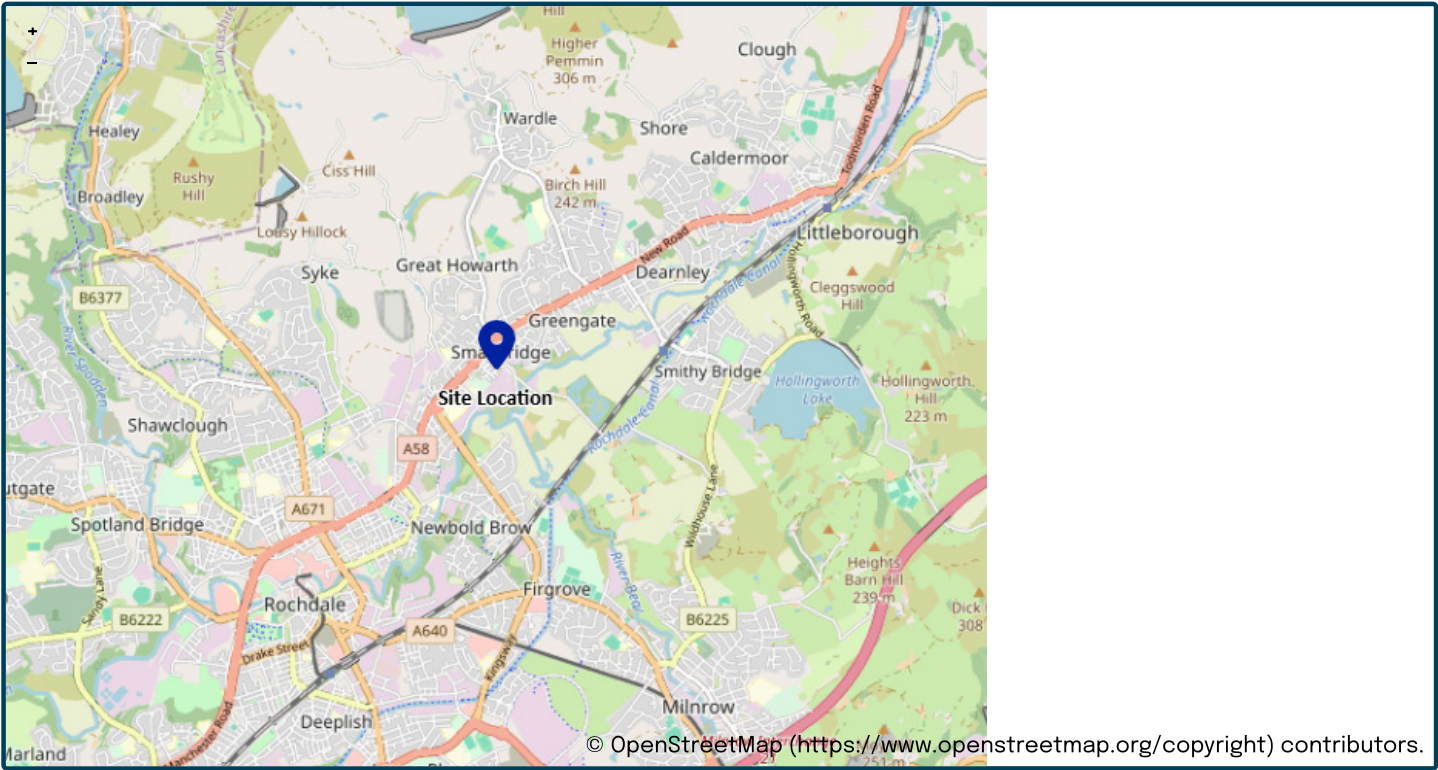
This is an estimation of the greenfield runoff rates that are used to meet normal best practice criteria in line with Environment Agency guidance “Rainfall runoff management for developments”, SC030219 (2013), the SuDS Manual C753 (CIRIA, 2015) and the non-statutory standards for SuDS (Defra, 2015). This information on greenfield runoff rates may be the basis for setting consents for the drainage of surface water runoff from sites.

Project details

Date	10/04/2025
Calculated by	Paul Graveney
Reference	1246
Model version	0.6.5

Location

Site name	Fothergill
Site location	Rochdale



Site easting	391266
Site northing	414848

Site details

Total site area (ha)	0.192	ha
----------------------	-------	----

Greenfield runoff

Method

Method	IH124
--------	-------

IH124

SAAR (mm)	My value 1185mm	Map value ☐ 1185
How should SPR be derived?	WRAP soil type	
WRAP soil type	4	☐ 4
SPR	0.47	☐ 0.47
QBar (IH124) (l/s)	1.7l/s	

Growth curve factors

Hydrological region	My value 5	Map value ☐ 10
1 year growth factor	0.87	
2 year growth factor	0.89	
10 year growth factor	1.65	
30 year growth factor	2.45	
100 year growth factor	3.56	
200 year growth factor	4.21	

Results

Method	IH124
Flow rate 1 year (l/s)	1.5l/s
Flow rate 2 year (l/s)	1.5l/s
Flow rate 10 years (l/s)	2.8l/s
Flow rate 30 years (l/s)	4.2l/s
Flow rate 100 years (l/s)	6.1l/s
Flow rate 200 years (l/s)	7.2l/s

Disclaimer

This report was produced using the Greenfield runoff rate estimation tool (0.6.5) developed by HR Wallingford and available at uksuds.com (<https://www.uksuds.com/>). The use of this tool is subject to the UK SuDS terms and conditions and licence agreement, which can both be found at [uksuds.com/terms-conditions](https://www.uksuds.com/terms-conditions) (<https://www.uksuds.com/terms-conditions>). The outputs from this tool have been used to estimate Greenfield runoff rates. The use of these results is the responsibility of the users of this tool. No liability will be accepted by HR Wallingford, the Environment Agency, Centre for Ecology and Hydrology, Wallingford Hydrosolutions or any other organisation for the use of these data in the design or operational characteristics of any drainage scheme.

Design Settings

Rainfall Methodology	FSR	Maximum Time of Concentration (mins)	30.00
Return Period (years)	10	Maximum Rainfall (mm/hr)	150.0
Additional Flow (%)	0	Minimum Velocity (m/s)	1.00
FSR Region	England and Wales	Connection Type	Level Soffits
M5-60 (mm)	20.000	Minimum Backdrop Height (m)	0.200
Ratio-R	0.400	Preferred Cover Depth (m)	1.200
CV	0.750	Include Intermediate Ground	✓
Time of Entry (mins)	4.00	Enforce best practice design rules	x

Adoptable Manhole Type

Max Width (mm)	Diameter (mm)	Max Width (mm)	Diameter (mm)
374	1200	749	1500
499	1350	900	1800

>900 Link+900 mm

Max Depth (m)	Diameter (mm)	Max Depth (m)	Diameter (mm)
1.500	1050	99.999	1200

Circular Link Type

Shape	Circular	Auto Increment (mm)	75
Barrels	1	Follow Ground	x

Available Diameters (mm)

100 | 150

Nodes

Name	Area (ha)	T of E (mins)	Cover Level (m)	Diameter (mm)	Depth (m)
SW01	0.065	4.00	130.720	450	0.720
SW02			130.720	450	0.870
SW03	0.020	4.00	130.720	450	1.170
TANK	0.020	4.00	130.650	100	1.140
CHANNEL	0.062	4.00	130.400	300	0.850
SW04	0.025	4.00	130.720	1200	1.250
EX MH			130.720	1200	1.290

Links

Name	US Node	DS Node	Length (m)	ks (mm) / n	US IL (m)	DS IL (m)	Fall (m)	Slope (1:X)	Dia (mm)	T of C (mins)	Rain (mm/hr)
1.000	SW01	SW02	24.000	0.600	130.000	129.850	0.150	160.0	225	4.39	109.7
1.001	SW02	SW03	46.000	0.600	129.850	129.550	0.300	153.3	225	5.12	103.2
1.002	SW03	TANK	6.000	0.600	129.550	129.510	0.040	150.0	225	5.21	102.4
1.003	TANK	SW04	6.000	0.600	129.510	129.470	0.040	150.0	225	5.30	101.7
2.000	CHANNEL	SW04	14.000	0.600	129.550	129.470	0.080	175.0	225	4.24	111.1
1.004	SW04	EX MH	6.000	0.600	129.470	129.430	0.040	150.0	150	5.43	101.0

Name	Vel (m/s)	Cap (l/s)	Flow (l/s)	US Depth (m)	DS Depth (m)	Σ Area (ha)	Σ Add Inflow (l/s)	Pro Depth (mm)	Pro Velocity (m/s)
1.000	1.031	41.0	19.3	0.495	0.645	0.065	0.0	109	1.015
1.001	1.053	41.9	18.2	0.645	0.945	0.065	0.0	103	1.015
1.002	1.065	42.3	23.6	0.945	0.915	0.085	0.0	120	1.093
1.003	1.065	42.3	28.9	0.915	1.025	0.105	0.0	137	1.144
2.000	0.985	39.2	18.7	0.625	1.025	0.062	0.0	109	0.974
1.004	0.818	14.5	52.6	1.100	1.140	0.192	0.0	150	0.833

Pipeline Schedule

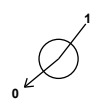
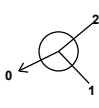
Link	Length (m)	Slope (1:X)	Dia (mm)	Link Type	US CL (m)	US IL (m)	US Depth (m)	DS CL (m)	DS IL (m)	DS Depth (m)
1.000	24.000	160.0	225	Circular	130.720	130.000	0.495	130.720	129.850	0.645
1.001	46.000	153.3	225	Circular	130.720	129.850	0.645	130.720	129.550	0.945
1.002	6.000	150.0	225	Circular	130.720	129.550	0.945	130.650	129.510	0.915
1.003	6.000	150.0	225	Circular	130.650	129.510	0.915	130.720	129.470	1.025
2.000	14.000	175.0	225	Circular	130.400	129.550	0.625	130.720	129.470	1.025
1.004	6.000	150.0	150	Circular	130.720	129.470	1.100	130.720	129.430	1.140

Link	US Node	Dia (mm)	Node Type	MH Type	DS Node	Dia (mm)	Node Type	MH Type
1.000	SW01	450	Manhole	Adoptable	SW02	450	Manhole	Adoptable
1.001	SW02	450	Manhole	Adoptable	SW03	450	Manhole	Adoptable
1.002	SW03	450	Manhole	Adoptable	TANK	100	Manhole	Adoptable
1.003	TANK	100	Manhole	Adoptable	SW04	1200	Manhole	Adoptable
2.000	CHANNEL	300	Manhole	Adoptable	SW04	1200	Manhole	Adoptable
1.004	SW04	1200	Manhole	Adoptable	EX MH	1200	Manhole	Adoptable

Manhole Schedule

Node	Easting (m)	Northing (m)	CL (m)	Depth (m)	Dia (mm)	Connections	Link	IL (m)	Dia (mm)
SW01	-0.667	61.525	130.720	0.720	450				
						0	1.000	130.000	225
SW02	20.859	78.814	130.720	0.870	450				
						0	1.001	129.850	225
						1	1.001	129.550	225
SW03	44.927	55.424	130.720	1.170	450				
						0	1.002	129.550	225
						1	1.001	129.550	225

Manhole Schedule

Node	Easting (m)	Northing (m)	CL (m)	Depth (m)	Dia (mm)	Connections	Link	IL (m)	Dia (mm)	
TANK	35.944	43.898	130.650	1.140	100		1	1.002	129.510	225
							0	1.003	129.510	225
CHANNEL	33.740	22.034	130.400	0.850	300					
							0	2.000	129.550	225
SW04	23.062	33.220	130.720	1.250	1200		1	2.000	129.470	225
							2	1.003	129.470	225
							0	1.004	129.470	150
EX MH	13.062	28.305	130.720	1.290	1200		1	1.004	129.430	150

Simulation Settings

Rainfall Methodology	FSR	Analysis Speed	Normal
Rainfall Events	Singular	Skip Steady State	x
FSR Region	England and Wales	Drain Down Time (mins)	240
M5-60 (mm)	20.000	Additional Storage (m³/ha)	20.0
Ratio-R	0.400	Starting Level (m)	
Summer CV	0.750	Check Discharge Rate(s)	x
Winter CV	0.840	Check Discharge Volume	x

Storm Durations

15 | 30 | 60 | 120 | 180 | 240 | 360 | 480 | 600 | 720 | 960 | 1440

Return Period (years)	Climate Change (CC %)	Additional Area (A %)	Additional Flow (Q %)
1	0	0	0
30	0	0	0
100	30	0	0

Node SW04 Online Hydro-Brake® Control

Flap Valve	x	Objective	(HE) Minimise upstream storage
Replaces Downstream Link	x	Sump Available	✓
Invert Level (m)	129.470	Product Number	CTL-SHE-0103-5000-1200-5000
Design Depth (m)	1.200	Min Outlet Diameter (m)	0.150
Design Flow (l/s)	5.0	Min Node Diameter (mm)	1200

Node TANK Depth/Area Storage Structure

Base Inf Coefficient (m/hr)	0.00000	Safety Factor	2.0	Invert Level (m)	129.510
Side Inf Coefficient (m/hr)	0.00000	Porosity	0.95	Time to half empty (mins)	104

Depth (m)	Area (m²)	Inf Area (m²)	Depth (m)	Area (m²)	Inf Area (m²)	Depth (m)	Area (m²)	Inf Area (m²)
0.000	144.0	144.0	0.400	144.0	161.0	0.401	0.0	161.0

Approval Settings

Node Size	✓	Minimum Full Bore Velocity (m/s)	
Node Losses	✓	Maximum Full Bore Velocity (m/s)	3.000
Link Size	✓	Proportional Velocity	✓
Minimum Diameter (mm)	150	Return Period (years)	
Link Length	✓	Minimum Proportional Velocity (m/s)	0.750
Maximum Length (m)	100.000	Maximum Proportional Velocity (m/s)	3.000
Coordinates	✓	Surcharged Depth	✓
Accuracy (m)	1.000	Return Period (years)	
Crossings	✓	Maximum Surcharged Depth (m)	0.100
Cover Depth	✓	Flooding	✓
Minimum Cover Depth (m)		Return Period (years)	30
Maximum Cover Depth (m)	3.000	Time to Half Empty	x
Backdrops	✓	Discharge Rates	✓
Minimum Backdrop Height (m)		Discharge Volume	✓
Maximum Backdrop Height (m)	1.500	100 year 360 minute (m ³)	
Full Bore Velocity	✓		

Rainfall

Event	Peak Intensity (mm/hr)	Average Intensity (mm/hr)	Event	Peak Intensity (mm/hr)	Average Intensity (mm/hr)
1 year 15 minute summer	109.521	30.991	30 year 180 minute winter	34.645	13.715
1 year 15 minute winter	76.857	30.991	30 year 240 minute summer	41.604	10.995
1 year 30 minute summer	71.439	20.215	30 year 240 minute winter	27.641	10.995
1 year 30 minute winter	50.133	20.215	30 year 360 minute summer	31.221	8.034
1 year 60 minute summer	48.435	12.800	30 year 360 minute winter	20.295	8.034
1 year 60 minute winter	32.179	12.800	30 year 480 minute summer	24.324	6.428
1 year 120 minute summer	30.053	7.942	30 year 480 minute winter	16.160	6.428
1 year 120 minute winter	19.966	7.942	30 year 600 minute summer	19.756	5.404
1 year 180 minute summer	23.233	5.979	30 year 600 minute winter	13.498	5.404
1 year 180 minute winter	15.102	5.979	30 year 720 minute summer	17.490	4.687
1 year 240 minute summer	18.475	4.882	30 year 720 minute winter	11.754	4.687
1 year 240 minute winter	12.274	4.882	30 year 960 minute summer	14.215	3.743
1 year 360 minute summer	14.169	3.646	30 year 960 minute winter	9.416	3.743
1 year 360 minute winter	9.210	3.646	30 year 1440 minute summer	10.161	2.723
1 year 480 minute summer	11.185	2.956	30 year 1440 minute winter	6.829	2.723
1 year 480 minute winter	7.431	2.956	100 year +30% CC 15 minute summer	453.359	128.285
1 year 600 minute summer	9.182	2.511	100 year +30% CC 15 minute winter	318.147	128.285
1 year 600 minute winter	6.274	2.511	100 year +30% CC 30 minute summer	297.655	84.226
1 year 720 minute summer	8.203	2.199	100 year +30% CC 30 minute winter	208.881	84.226
1 year 720 minute winter	5.513	2.199	100 year +30% CC 60 minute summer	199.275	52.662
1 year 960 minute summer	6.768	1.782	100 year +30% CC 60 minute winter	132.393	52.662
1 year 960 minute winter	4.483	1.782	100 year +30% CC 120 minute summer	120.330	31.800
1 year 1440 minute summer	4.949	1.326	100 year +30% CC 120 minute winter	79.945	31.800
1 year 1440 minute winter	3.326	1.326	100 year +30% CC 180 minute summer	90.748	23.353
30 year 15 minute summer	268.706	76.035	100 year +30% CC 180 minute winter	58.989	23.353
30 year 15 minute winter	188.566	76.035	100 year +30% CC 240 minute summer	70.550	18.644
30 year 30 minute summer	174.929	49.499	100 year +30% CC 240 minute winter	46.872	18.644
30 year 30 minute winter	122.757	49.499	100 year +30% CC 360 minute summer	52.629	13.543
30 year 60 minute summer	116.589	30.811	100 year +30% CC 360 minute winter	34.210	13.543
30 year 60 minute winter	77.459	30.811	100 year +30% CC 480 minute summer	40.838	10.792
30 year 120 minute summer	70.438	18.615	100 year +30% CC 480 minute winter	27.132	10.792
30 year 120 minute winter	46.797	18.615	100 year +30% CC 600 minute summer	33.061	9.043
30 year 180 minute summer	53.298	13.715	100 year +30% CC 600 minute winter	22.589	9.043

Rainfall

Event	Peak Intensity (mm/hr)	Average Intensity (mm/hr)	Event	Peak Intensity (mm/hr)	Average Intensity (mm/hr)
100 year +30% CC 720 minute summer	29.188	7.823	100 year +30% CC 960 minute winter	15.643	6.219
100 year +30% CC 720 minute winter	19.616	7.823	100 year +30% CC 1440 minute summer	16.765	4.493
100 year +30% CC 960 minute summer	23.616	6.219	100 year +30% CC 1440 minute winter	11.267	4.493

Results for 1 year Critical Storm Duration. Lowest mass balance: 99.89%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m ³)	Flood (m ³)	Status
15 minute summer	SW01	10	130.077	0.077	9.7	0.1506	0.0000	OK
15 minute winter	SW02	10	129.922	0.072	9.7	0.0115	0.0000	OK
15 minute summer	SW03	10	129.644	0.094	12.4	0.0470	0.0000	OK
120 minute winter	TANK	88	129.612	0.102	6.7	13.9875	0.0000	OK
15 minute summer	CHANNEL	9	129.637	0.087	9.2	0.1324	0.0000	OK
15 minute summer	SW04	9	129.631	0.160	13.5	0.2457	0.0000	SURCHARGED
15 minute summer	EX MH	10	129.481	0.051	3.6	0.0000	0.0000	OK

Link Event (Upstream Depth)	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m ³)	Discharge Vol (m ³)
15 minute summer	SW01	1.000	SW02	9.7	0.866	0.237	0.2737	
15 minute winter	SW02	1.001	SW03	9.4	0.742	0.225	0.6000	
15 minute summer	SW03	1.002	TANK	12.5	1.486	0.296	0.0565	
120 minute winter	TANK	1.003	SW04	2.5	-0.189	0.059	0.1315	
15 minute summer	CHANNEL	2.000	SW04	9.8	0.486	0.251	0.3104	
15 minute summer	SW04	1.004	EX MH	3.6	0.657	0.248	0.0327	10.2

Results for 30 year Critical Storm Duration. Lowest mass balance: 99.89%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
15 minute winter	SW01	10	130.129	0.129	23.8	0.2528	0.0000	OK
15 minute winter	SW02	10	129.972	0.122	23.8	0.0193	0.0000	OK
120 minute winter	SW03	94	129.775	0.225	9.3	0.1126	0.0000	OK
120 minute winter	TANK	94	129.775	0.264	15.2	36.2782	0.0000	SURCHARGED
120 minute winter	CHANNEL	94	129.774	0.224	6.8	0.3431	0.0000	OK
120 minute winter	SW04	94	129.774	0.304	9.2	0.4657	0.0000	SURCHARGED
120 minute winter	EX MH	94	129.490	0.060	4.9	0.0000	0.0000	OK

Link Event (Upstream Depth)	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m³)	Discharge Vol (m³)
15 minute winter	SW01	1.000	SW02	23.8	1.057	0.581	0.5443	
15 minute winter	SW02	1.001	SW03	23.6	0.973	0.565	1.1168	
120 minute winter	SW03	1.002	TANK	8.5	0.873	0.201	0.2385	
120 minute winter	TANK	1.003	SW04	4.7	-0.209	0.111	0.2386	
120 minute winter	CHANNEL	2.000	SW04	6.5	0.348	0.165	0.5565	
120 minute winter	SW04	1.004	EX MH	4.9	0.709	0.337	0.0412	58.0

Results for 100 year +30% CC Critical Storm Duration. Lowest mass balance: 99.89%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
60 minute winter	SW01	45	130.480	0.479	19.8	0.9422	0.0000	FLOOD RISK
60 minute winter	SW02	45	130.461	0.611	19.7	0.0972	0.0000	FLOOD RISK
180 minute winter	SW03	112	130.427	0.877	11.7	0.4392	0.0000	FLOOD RISK
180 minute winter	TANK	112	130.421	0.911	20.5	55.1154	0.0000	FLOOD RISK
180 minute winter	CHANNEL	112	130.400	0.850	18.2	1.3005	14.9697	FLOOD
180 minute winter	SW04	112	130.413	0.943	16.0	1.4435	0.0000	SURCHARGED
60 minute summer	EX MH	87	129.491	0.061	5.0	0.0000	0.0000	OK

Link Event (Upstream Depth)	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m³)	Discharge Vol (m³)
60 minute winter	SW01	1.000	SW02	19.7	1.013	0.482	0.9545	
60 minute winter	SW02	1.001	SW03	19.7	0.761	0.471	1.8295	
180 minute winter	SW03	1.002	TANK	11.3	0.907	0.266	0.2386	
180 minute winter	TANK	1.003	SW04	13.7	0.344	0.323	0.2386	
180 minute winter	CHANNEL	2.000	SW04	-12.4	-0.312	-0.317	0.5568	
180 minute winter	SW04	1.004	EX MH	5.0	0.714	0.346	0.0420	93.0