

**Ginnell Farm, Rochdale**

**Drainage Strategy**

**April 2025**

**Fairway Building & Remedial  
Contractors Ltd**

AMA Project Number: 22997

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# 1 INTRODUCTION

## 1.1 OVERVIEW

- 1.1.1 This Drainage Strategy (DS) has been provided at the request of Fairway Building Remedial Contractors Ltd, hereafter referred to as “the client”, to assess the possible ways of discharging surface and foul water from the site while analysing the flood risks associated with the proposed development of Ginnell Farm, Rochdale, hereafter referred to as “the site”.
- 1.1.2 The purpose of this Drainage Strategy is to:
- ▶ Investigate and define any potential drainage impacts associated with the site;
  - ▶ Conceptually determine and define necessary surface water management controls to ensure no exacerbation of flood risk on the site or to external receptors due to any increase in surface water run-off; and
  - ▶ Recommend appropriate and necessary mitigation measures and additional assessments that may be required to progress the sustainable development of the site.
- 1.1.3 The Drainage Strategy comprises the following:
- ▶ A desktop review of publicly available information, including information from the Environment Agency (EA) and Rochdale Metropolitan Borough Council who are the Lead Local Flood Authority (LLFA) for the proposed development area; and
  - ▶ An assessment and outline design of hydraulic controls and drainage requirements and drainage elements required to support the development of the site.
- 1.1.4 This report further details the methodologies employed within this study and provides recommendations as to any further work or investigations required to support the development of the site through the planning application process.

## 1.2 REGULATORY POLICY AND LEGISLATION

- 1.2.1 This assessment has been carried out in line with the current Government legislation, the National Planning Policy Framework (NPPF) 2023.
- 1.2.2 It has been assessed with reference to the following documents and legislative guidelines:
- ▶ CIRIA 753 The SUDS Manual V6 (2016);
  - ▶ DEFRA “Flood Risk Assessment Guidance for New Developments” (2006);
  - ▶ DEFRA “Surface Water Management Plan Technical Guidance” (2010);
  - ▶ BS 8533 2011 Assessing & Managing Flood Risk in Development Code of Practice (2011);
  - ▶ BS 8582:2013 Code of practice for surface water management for development Sites (2013);
  - ▶ National Planning Practice Guidance (2012 – updated 2016);
  - ▶ C624 Development and Flood Risk – Guidance for the Construction Industry’ (2004);
  - ▶ Design and Construction Guidance for Sewage Sector (DCGSS) (2020);
  - ▶ Planning Policy Guidance – Flood Risk and Climate Change (2014 and as amended).
- 1.2.3 In addition to the above, this report has also been informed by the following documents:
- ▶ Rochdale Adopted Core Strategy 2016

## 1.3 SCOPE OF DETAILED DRAINAGE STRATEGY

- 1.3.1 Surface water run-off must be effectively managed to ensure that there is no exacerbation of potential surface water flooding issues on the site, or at any external receptors, due to any potential increases in surface water run-off rates and volumes.

- 1.3.2 The drainage hierarchy will be applied in determining the most suitable type and point of discharge of surface waters run-off from impermeable areas on the site. This will ensure that surface water is sustainably managed on the site, and that there is no exacerbation of flood risk elsewhere as a result of undertaking the development. This will be undertaken in accordance with industry best practice principles and guidance, such as the C753 SUDS Manual (2016), Design and Construction Guidance for Sewage Sector (DCGSS) (2020) and applicable sections of the Planning Policy Guidance (PPG).
- 1.3.3 Any increase in surface water run-off rate associated with the development of the site must also be managed in accordance with the guidelines set by LPA, the LLFA for the area.
- 1.3.4 The Drainage Strategy will identify potential opportunities and locations for attenuation infrastructure, as well as potential connection points and provide calculations of permissible discharge rates for run-off generated on site.
- 1.3.5 The Drainage Strategy therefore aims to provide surety that any drainage provided as part of the project development can safely and appropriately convey all flows from the site to appropriate discharge locations. This is to ensure sustainable and safe operation within the site, as well as ensuring sustainable operation of any receiving infrastructure. These assessments have been undertaken in accordance with prescribed best practice and building codes, including prioritising the incorporation of SuDS, where appropriate and practicable for the management of surface water.
- 1.3.6 Following the completion of a final site masterplan the drainage scheme proposed within this report should be reassessed to ensure surface water run-off and foul water drainage can be appropriately managed in accordance with best practise and local and national standard requirements.

## 2 METHODOLOGY

### 2.1 INTRODUCTION

- 2.1.1 This report aims to demonstrate that the proposed development is sustainable and will not be impacted by or exacerbate flood risk elsewhere through the development of the site. This assessment will account for the effects of climate change, as well as identifying further opportunities to reduce the probability and consequences of flooding within the site locality.
- 2.1.2 This report aims to identify constraints and opportunities for the site based on the development proposals provided by the client in [Appendix A](#) and provide recommendations for the sustainable provision of drainage and mitigation of any potential flood risk for the site.
- 2.1.3 The assessment methodology is as follows:
- ▶ Desktop review of the geology, hydrology, and other pertinent environmental characteristics of the site, and how these affect flood risk of the proposed development and site drainage.
  - ▶ Produce indicative design calculations for the Drainage Strategy to determine the requirements for developing the site's surface water drainage and providing adequate storage in line with local planning policy and guidance. This will include the presentation of drawings with an indicative layout for any additional drainage and attenuation infrastructure located on the site.
  - ▶ Review the findings from the above and advise on the suitability of developing the site for the proposed development in consideration of the applicable flood risk and drainage and comment on limitations and opportunities for the site, with recommendations of further mitigation where applicable and appropriate.

## 3 PROJECT BACKGROUND

### 3.1 DEVELOPMENT DESCRIPTION AND LOCATION

- 3.1.1 Andrew Moseley Associates (AMA) was appointed by Fairway Building Remedial Contractors Ltd to provide a Drainage Strategy in support of a residential development, located at Ginnell Farm Avenue, Balderstone, Milnrow, Rochdale, Greater Manchester, OL16 4GF at NGR: SD 91296 10831.
- 3.1.2 The proposed development is located in the area of Balderstone, approximately 1.4 miles southeast of the centre of Rochdale. Proposals for the site are for residential use, consisting of nine dwellings, with associated hardstanding, landscaping and infrastructure. A site layout can be found in [Appendix A](#).
- 3.1.3 The Local Planning Authority for this development is Rochdale Metropolitan Borough Council who are also the Lead Local Flood Authority for the area.
- 3.1.4 This report has been prepared in accordance with the National Planning Policy Framework (NPPF) and the accompanying technical guidance to assess all forms of flooding including the management of surface water on-site.
- 3.1.5 The site is referenced in [Table 3-1](#) and [Figure 3-1](#) below.

**Table 3-1 Site Context**

| Site Name        | Ginnell Farm                                                                                                                                                                                                                                                                                                                              |
|------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Location         | Rochdale                                                                                                                                                                                                                                                                                                                                  |
| NGR (approx..)   | SD 91296 10831                                                                                                                                                                                                                                                                                                                            |
| General Locality | The site is located on previously developed brownfield land and borders Ginnell Farm Avenue to the north, Broad Lane to the east, the M62 to the south, and residential development to the west.<br>Pedestrian and vehicular access to the site is provided via the existing access from Broad Lane, in the southeast corner of the site. |
| Development Type | Residential                                                                                                                                                                                                                                                                                                                               |
| EA Flood Zone    | Flood Zone 1                                                                                                                                                                                                                                                                                                                              |

Figure 3-1 Site Location Plan



## 3.2 TOPOGRAPHY

- 3.2.1 A topographic survey provided by the client and undertaken by Topographical.co.uk (Ref: S2171\_2D.TOPO-A2\_H) shows ground levels at the site are shown to be in the region of 170.4 to 175.2 m Above Ordnance Datum (m AOD). The topographic survey can be seen in [Appendix B](#).
- 3.2.2 Further review of topographical data shows site levels to be lowest along the northern boundary of the site, while greatest levels are located in the southeast corner of the site. A general fall in gradient from south to north is observed across the site.

## 3.3 GEOLOGY AND GROUND CONDITIONS

- 3.3.1 British Geological Survey (BGS) Open Geoscience website indicates that the entire site is underlain by Pennine Lower Coal Measures Formation – Mudstone, siltstone and sandstone with overlying superficial deposits of Hummocky (moundy) Glacial Deposits, Devensian - Diamicton.
- 3.3.2 The BGS website information indicates that there are no borehole records located within close proximity to the site.
- 3.3.3 As indicated by aerial imagery, the site consists of an existing agricultural and residential development, with areas of hardstanding which make up approximately 40% of the site.
- 3.3.4 Information obtained from the Cranfield University's Soilscape website indicates that the site is located in an area classified as being Soilscape 10, which is defined as having freely draining slightly acid sandy soils.

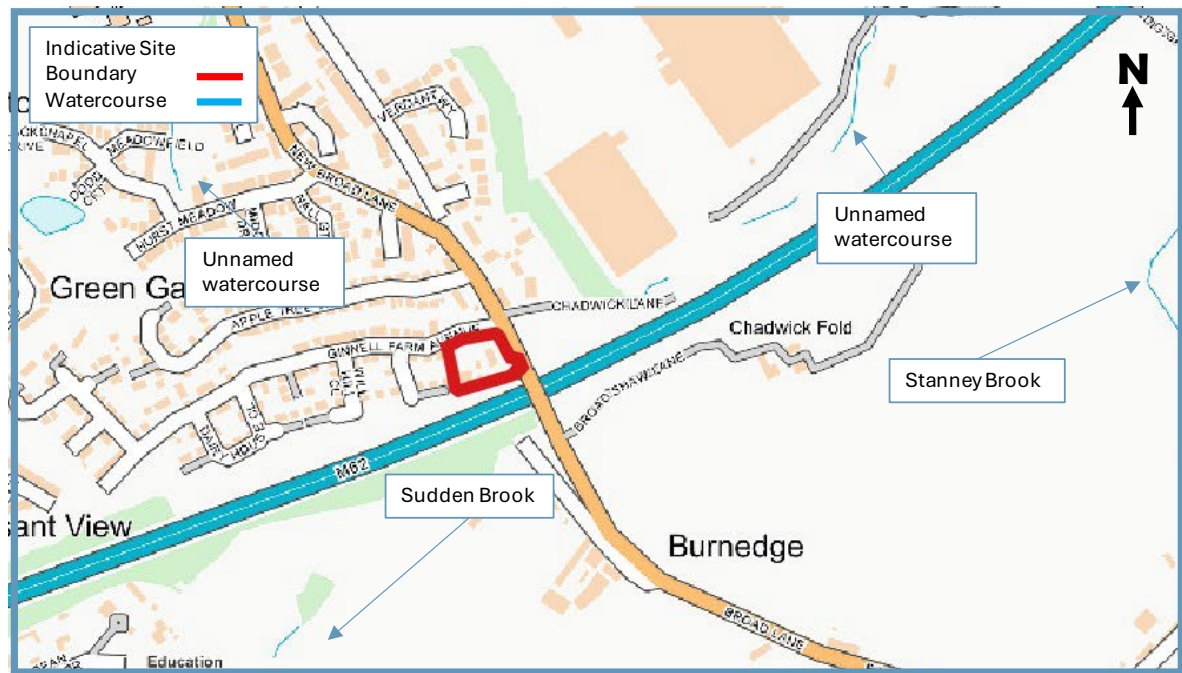
## 3.4 HYDROGEOLOGY

- 3.4.1 According to the Department for Environment, Food and Rural Affairs (DEFRA) MAGIC map, the site is indicated as not being located in a Groundwater Source Protection Zone (SPZ), as defined by the Environment Agency (EA) for the protection of a potable groundwater supply.
- 3.4.2 The site is located in an area of medium to high groundwater vulnerability and located above a Secondary A bedrock aquifer, and a Secondary A superficial aquifer.

### 3.5 HYDROLOGY

- 3.5.1 The Sudden Brook is situated 420m to the southwest of the site and flows in a northerly direction with regard to the site. The Stanney Brook is situated 740m to the east of the site at its closest point and also flows in a northerly direction with regard to the site. Further to this, there are also two unnamed watercourses located approximately 400m northeast of the site, and 380m northwest of the site, as shown in [Figure 3-2](#).
- 3.5.2 The EA's Catchment Data Explorer website indicates that the site resides within the Roch Irk Medlock operational catchment and the Roch (Spodden to Irwell) sub catchment.

**Figure 3-2 Watercourse Location**



## 4 FOUL WATER DRAINAGE

### 4.1 INTRODUCTION

- 4.1.1 It is proposed to install a new foul drainage system to serve the proposed residential development.
- 4.1.2 The foul water system will be designed and constructed in accordance with the current Building Regulations, BS EN:752 'Drainage and Sewer Systems Outside Buildings', the Local Authority Building Control specifications and requirements, Sewers for Adoption 7th Edition and the Civil Engineering Specification for the Water Industry.

### 4.2 EXISTING SEWERS

- 4.2.1 AMA attained a United Utilities pre-development enquiry and sewer maps which can be seen in [Appendix C](#). They have stated no information regarding public sewers located within the site boundary.
- 4.2.2 As the site currently consists of an agricultural and residential development, it is likely that there is existing drainage infrastructure located within the site boundary. A CCTV Drainage Survey should be undertaken to confirm what infrastructure exists, and if there are existing connections into the public sewer network that could be utilised within the drainage of the proposed development.

### 4.3 FOUL WATER DISCHARGE RATES

- 4.3.1 The estimate design Dry Weather Flow (DWF) generated by the proposed development, based on a gravity system, has been calculated as 0.42 litres per second.
- 4.3.2 This figure is based on nine dwellings at 4,000 litres per dwelling as prescribed in Sewers for Adoption.

### 4.4 FOUL WATER CAPACITY AND POINT OF CONNECTION

- 4.4.1 United Utilities have advised that foul water can discharge to the existing 150mm foul water sewer located to the northwest of the site, located within Ginnell Farm Avenue, at an unrestricted rate. They have not advised of any known capacity issues with the public sewer network in the area which would hinder development at the site.
- 4.4.2 No depth/level information is available for these sewers and therefore further survey work in the form of a drainage CCTV and tracing survey will be required to confirm whether a gravity connection will be feasible.
- 4.4.3 Any proposed connection onto the public recorded sewers will require a S106 connection application.

## 5 SURFACE WATER DRAINAGE STRATEGY

### 5.1 INTRODUCTION

- 5.1.1 The National Planning Policy Framework (NPPF) and accompanying Technical Guidance indicate that surface water run-off should be controlled as near to its source as possible through a sustainable drainage approach to surface water management.
- 5.1.2 Consideration should therefore firstly be given to using sustainable drainage (SuDS) techniques including soakaways, infiltration trenches, permeable pavements, grassed swales, ponds and wetlands to reduce flood risk by attenuating the rate and quantity of surface water run-off from a site. This approach can also offer other benefits in terms of promoting groundwater recharge, water quality improvement and amenity enhancements. Approved document Part H of the Building Regulations (2015) sets out a hierarchy for the disposal of surface water which encourages a SuDS approach.

### 5.2 OVERVIEW AND CONCEPT

- 5.2.1 As detailed in [Section 3.1](#), development proposals for the site consist of residential use, consisting of nine dwellings with associated hardstanding, landscaping, and infrastructure. The site plan shows the developable area of the site to be restricted to the red line boundary, as shown in [Appendix A](#), with an approximate total developable area of 0.36 ha.
- 5.2.2 Review of the site plan shows proposals to consist of an approximate total impermeable area of 0.17 ha, which equates to approximately 47% of the total proposed developable area. The contributing areas have been identified within the Drainage Layout Drawing, in [Appendix D](#).
- 5.2.3 It is considered that green open space and landscaped areas will not produce or contribute run-off to the surface water management infrastructure proposed as part of this strategy. This has been taken into account when deriving the impermeable area for the site.

### 5.3 PRE-DEVELOPMENT SURFACE WATER RUN OFF

#### Brownfield

- 5.3.1 As the site is a previously developed, brownfield site, with an existing agricultural structure pre-development surface water drainage will be based upon the Modified Rational Method (MRM). Based on the redevelopment of the existing site, it is noted that there may be requirements to improve the surface water drainage to effectively drain the site.
- 5.3.2 As discussed previously in this report, the total site area marked out by the red line boundary found in [Appendix A](#) is 0.36 ha with a total impermeable area of 0.06 ha. The pre-development surface water run-off will be based upon the existing impermeable area 0.06 ha. Therefore:
  - ▶ The total impermeable area (Pre-Development) of the site is 0.06 ha.
  - ▶ The estimated peak flow rate for the site for a 50 mm / event is defined below using the Modified Rational Equation method.
- 5.3.3  $Q = C i A$
- 5.3.4 Where:
  - ▶  $Q$  = Flow rate in m<sup>3</sup>/ sec
  - ▶  $C$  = site impermeability or run-off coefficient = estimated as 100% or 1
  - ▶  $i$  = rainfall intensity = 50 mm/hr
  - ▶  $A$  = impermeable site area producing run-off = 0.06 ha or 600 m<sup>2</sup>
- 5.3.5 The peak run-off rate using the above defined equation would therefore be:

▶  $Q = 1.00 \times 50 \times 0.06$  (impermeable area in ha)  $\times 2.78 = 8.34$  l/s

- 5.3.6 As shown above, the peak run-off rate for the site using the modified rational method is estimated to be 8.34 l/s. Best practice requirements would be to provide a 30% betterment on this estimated run-off rate.
- 5.3.7 Provision of suitable controls for the management of the on-site surface water run-off may be developed in conjunction with the future masterplan and existing site levels, especially if the footprints of development change meaning an increase in impermeable areas. Additional investigation would then need to be undertaken to determine if the site required betterment and attenuation.

## 5.4 GROUNDWATER PROTECTION

- 5.4.1 The proposed development site is not identified as being within a groundwater source protection zone (SPZ), as such no special measures are required to prevent risk to drinking water supplies.

## 5.5 METHODS OF SURFACE WATER MANAGEMENT

- 5.5.1 There are three methods that have been reviewed for the management and discharge of surface water which are detailed below; these may be applied individually or collectively to form a complete strategy. They should be applied in the order of priority as listed:
- ▶ Discharge via Infiltration
  - ▶ Discharge to a Watercourse
  - ▶ Discharge to Surface Water Sewer or Highway Drain
  - ▶ Discharge to Public Sewer

## 5.6 INFILTRATION

- 5.6.1 Any impermeable areas that can drain to a soakaway or an alternative method of infiltration would significantly improve the sustainability of any surface water systems.
- 5.6.2 The British Geological Society (BGS) Geology of Britain Viewer indicates that the entire site is underlain by Pennine Lower Coal Measures Formation – Mudstone, siltstone and sandstone with overlying superficial deposits of Hummocky (moundy) Glacial Deposits, Devensian - Diamicton.
- 5.6.3 Information obtained from the Cranfield University's Soilscape website indicates that the site is in an area classified as being Soilscape 10, which is defined as freely draining slightly acid sandy soils.
- 5.6.4 From a desktop review of the geology and soil at the site, it is believed that infiltration would not be an acceptable way of discharging surface water from the site.

## 5.7 WATERCOURSE

- 5.7.1 As discussed in [Section 3.5](#) there are no watercourses located within close proximity to the site. Therefore, it would not be possible to discharge surface water from the site into a watercourse.

## 5.8 PUBLIC SEWERS

- 5.8.1 As a last resort and following the hierarchy of surface water, disposal discharge to the public sewer system may need to be considered.
- 5.8.2 In the United Utilities pre development enquiry ([Appendix C](#)) they state that the drainage hierarchy should be followed. However, if other options were discounted, United Utilities would consider a connection into the 225mm diameter public surface water sewer within Ginnell Farm Avenue located to the northwest of the site, with the discharge rate not exceeding 5.0 l/s.
- 5.8.3 Therefore, it would be possible to discharge surface water from the site into a public sewer.

- 5.8.4 AMA contacted the LLFA regarding the proposed outfall of surface water from the site however, at the time of writing this report, no response has been received. This correspondence can be found in [Appendix E](#).

## 5.9 PROPOSED DISCHARGE RATES

- 5.9.1 Surface water from the site will be discharged via a connection into the United Utilities surface water sewer.
- 5.9.2 As the site will be drained by discharging surface water into the public sewer, surface water will be restricted to 5.0 l/s, as requested by United Utilities.
- 5.9.3 Typically, any discharge rate less than 5.0 l/s is prone to blockage and will create maintenance issues because of the small size of the orifice required. Where the greenfield discharge suggests a discharge rate of less than 3.0 l/s the figure of 3.0 l/s shall be used to reduce the risk of blockages. This would need to be confirmed by the approving authority.

## 5.10 ATTENUATION REQUIREMENTS

- 5.10.1 As discussed earlier, the site will be drained into the public sewer at a restricted discharge rate of 5.0 l/s. Therefore, attenuation will have to be provided.
- 5.10.2 Causeway Flow drainage design software has been used to estimate the maximum storage volume required on-site for the 100-year storm event plus 40% (30% allowance for climate change and 10% for urban creep). The results of these calculations can be found in [Appendix F](#).
- 5.10.3 The results below are based on an attenuation tank location in the northeast of the site.
- 5.10.4 A Drainage Layout Drawing can be found in [Appendix D](#).

### Total Impermeable Area

- 5.10.5 This volume is based on using an attenuation tank with a discharge rate of 5.0 l/s. The details on the attenuation of the tank can be found in [Table 5-1](#) below.

**Table 5-1 Attenuation Volume**

| Gross Areas (ha) | Max Discharge (L/S) | Impermeable Area (ha) | Q100+40% Volume (M³) |
|------------------|---------------------|-----------------------|----------------------|
| 0.36             | 5.0                 | 0.17                  | 96                   |

## 5.11 DRAINAGE NETWORK

- 5.11.1 A network hydraulic model has been developed so as to assess the conveyance requirements for the proposed drainage strategy. This includes a combination of surface water pipes, manholes and gullies, which will direct surface water run-off from impermeable areas to the attenuation tank located in the northeast of the site. This will ensure that surface water flows from the site are internally managed before they leave the site and further reduce the potential for impact elsewhere.
- 5.11.2 The final surface water drainage network servicing the site should ideally consist of permeable paving to limit the run-off from any paved areas, whilst extending time of concentration for discharge to the accompanying drainage network.
- 5.11.3 For any portion of the network crossing a highway or an area to be trafficked by heavy grade vehicles (HGV's), a minimum cover requirement of 1.20 m below cover level should be provided where practically possible for the internal drainage network to satisfy Sewers for Adoption standards.
- 5.11.4 Proposals for the drainage network are to be discharged to the United Utilities surface water sewer located to the north of the site in Ginnell Farm Avenue, subject to agreement with United Utilities.

## 6 SUSTAINABLE DRAINAGE SYSTEMS

### 6.1 INTRODUCTION

- 6.1.1 Where possible, Sustainable drainage (SuDS) systems/techniques should be used to drain the site of surface water run-off. These could be in the form of permeable paving, rainwater harvesting, ponds, and other above ground green systems. Swales could also be incorporated into the layout to convey surface run-off rather than below ground pipes (which tend to have a higher velocity).

### 6.2 SUSTAINABLE DRAINAGE (OVERVIEW)

- 6.2.1 Drainage systems can contribute to sustainable development and improve urban design, by balancing the different issues that influence the development of communities. Approaches to manage surface water that take account of water quantity (flooding), water quality (pollution) and amenity issues are collectively referred to as Sustainable Drainage Systems (SuDS).
- 6.2.2 SuDS mimic nature and typically manage rainfall close to where it falls. SuDS can be designed to slow water down (attenuate) before it enters streams, rivers, and other watercourses, they provide areas to store water in natural contours and can be used to allow water to soak (infiltrate) into the ground or evaporated from surface water and lost or transpired from vegetation (known as evapotranspiration).
- 6.2.3 SUDS are technically regarded a sequence of management practices, control structures and strategies designed to drain surface water efficiently and sustainably, while minimising pollution and managing the impact on water quality of local water bodies.
- 6.2.4 SuDS are more sustainable than traditional drainage methods because they:
- ▶ Manage run-off volumes and flow rates from hard surfaces, reducing the impact of urbanisation on flooding,
  - ▶ Protect or enhance water quality (reducing pollution from run-off),
  - ▶ Protect natural flow regimes in watercourses,
  - ▶ Are sympathetic to the environment and the needs of the local community,
  - ▶ Provide an attractive habitat for wildlife in urban watercourses,
  - ▶ Provide opportunities for evapotranspiration from vegetation and surface water,
  - ▶ Encourage natural groundwater/aquifer recharge (where appropriate),
  - ▶ Create better places to live, work and play.

### 6.3 SUDS PRINCIPLES

- 6.3.1 Sustainable drainage is a departure from the traditional approach to draining sites. There are some key principles that influence the planning and design process enabling SuDS to mimic natural drainage by:
- ▶ Storing run-off and releasing it slowly (attenuation)
  - ▶ Allowing water to soak into the ground (infiltration)
  - ▶ Slowly transporting (conveying) water on the surface
  - ▶ Filtering out pollutants
  - ▶ Allowing sediments to settle out by controlling the flow of the water
- 6.3.2 The above was replicated from [www.susdrain.org](http://www.susdrain.org)

## 6.4 SUDS TECHNIQUES

6.4.1 The following table is a list of SuDS features that may/may not be feasible for the proposed site.

**Table 6-1** SuDS Feasibility Table

| SuDS Technique                           | Can they be feasibly incorporated into the site? | Comments                                                                                                                     |
|------------------------------------------|--------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------|
| Green Roofs                              | ✗                                                | The sloping roofs of the proposed development would not permit a green roof design.                                          |
| Basins and Ponds                         | ✗                                                | The proposed development could not be designed to incorporate these elements due to site constraints such as the topography. |
| Filter Strips, Swales, and Bio-Retention | ✗                                                | The proposed development could not be designed to incorporate these elements due to site constraints.                        |
| Infiltration Techniques                  | ✗                                                | Desktop review of the available data indicate that infiltration would not be feasible at the site.                           |
| Permeable Surfaces and Tree Pits         | ✓                                                | Surfacing of the external areas could be in a permeable material, such as permeable paved access roads and driveways.        |
| Rainwater Harvesting                     | ✓                                                | New roofs could be directed to rainwater harvesting tanks for reuse.                                                         |

## 7 SUDS MAINTENANCE PLAN

### 7.1 SURFACE WATER DRAINAGE MAINTENANCE AND MANAGEMENT SCHEDULE

#### Attenuation Tank Maintenance Schedule

Table 7-1 Attenuation Tank Maintenance Schedule

| Maintenance Schedule | Required Action                                                                                                         | Frequency                                                   |
|----------------------|-------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------|
| Regular Maintenance  | Inspect and identify areas that are not operating correctly. If required, take remedial action.                         | Monthly for the first 3 months of operation, then annually. |
|                      | Recover debris from catchment surface area where it may cause risk to performance.                                      | Monthly                                                     |
|                      | Remove sediment and debris from pre-tank system.                                                                        | Annually                                                    |
| Remedial Actions     | Repair inlets/outlets/vents/overflows.                                                                                  | As necessary                                                |
| Monitoring           | Inspect all inlets/outlets and upstream drainage system to ensure they are in good condition and operating as designed. | Annually                                                    |
|                      | Survey inside of tank for sediment and build up and remove if necessary.                                                | Every 5 years                                               |

#### Hydrobrake Manhole Maintenance Schedule

Table 7-2 Hydrobrake Manhole Maintenance Schedule

| Maintenance Schedule | Required Action                                                              | Frequency                                     |
|----------------------|------------------------------------------------------------------------------|-----------------------------------------------|
| Regular Maintenance  | Remove sediment and debris from flow control chambers and upstream manholes. | Monthly for first 12 months, then 6 monthly.  |
| Remedial Actions     | Replace or clean hydrobrake if performance deteriorates or failure occurs.   | As necessary                                  |
| Monitoring           | Check flow control to ensure emptying is occurring.                          | Quarterly and post high intensity storm event |

#### Gullies Maintenance Schedule

Table 7-3 Gullies Maintenance Schedule

| Maintenance Schedule | Required Action                                            | Frequency |
|----------------------|------------------------------------------------------------|-----------|
| Regular Maintenance  | Remove sediment and debris from gullies and channel drain. | Quarterly |

## 8 SUMMARY

- 8.1.1 The site is in an area identified as having a low probability of flooding on the EA Flood Map and is located in Flood Zone 1.
- 8.1.2 As with any drainage system, blockages within the surface water sewer systems constructed to serve the development has the potential to cause flooding or disruption. Any drainage systems which are not to be offered for adoption to either the Water Company or the Local Authority will have a suitable maintenance regime scheduled, and an appropriate management company appointed to carry out the works.
- 8.1.3 The primary option for surface water disposal is to use a connection into the public sewer system.
- 8.1.4 From a desktop review of ground conditions on site, infiltration is deemed to be an unsuitable method of draining surface water from the site.
- 8.1.5 There is not a suitable watercourse in the vicinity of the site which could be utilised to dispose of surface water from the site.
- 8.1.6 There is a suitable public sewer in the vicinity of the site which could be utilised to dispose of the surface water. It is proposed that surface water will discharge through a connection into the 225mm surface water sewer located to the north of the site, in Ginnell Farm Avenue.
- 8.1.7 Attenuation is required as the means of surface water disposal is through a connection into the public sewer system. Furthermore, there will be a restricted discharge limit of 5.0 l/s as specified by United Utilities.
- 8.1.8 There is a formal point of connection into a United Utilities public foul water sewer in close proximity to the site. Foul water domestic waste can discharge to the 150 mm diameter public foul sewer recorded in Ginnell Farm Avenue, at a point to the northwest of the site.

## 9 LIMITATIONS

- 9.1.1 This report has been prepared for exclusive use by Fairway Building & Remedial Contractors Ltd for the purpose of assisting them in evaluating the potential constraints imposed by flood risk and drainage in making a Planning Application.
- 9.1.2 AMA accepts no liability for any use of this document other than by its client and only for the purposes, stated in the document, for which it was prepared and provided. No person other than the client may copy (in whole or in part) use or rely on the contents of this document, without the prior written permission of AMA. Any advice, opinions or recommendations within this document should be read and relied upon only in the context of the document as a whole.
- 9.1.3 AMA has endeavoured to assess all information provided to them during this appraisal. The report summarises from several external sources and cannot offer any guarantees or warranties for the completeness or accuracy of information relied upon.
- 9.1.4 This report has been undertaken with the assumption that the site will be developed in accordance with the above proposals without significant change. The conclusions resulting from this study are not necessarily indicative of future conditions or operating practices at or adjacent to the site.
- 9.1.5 A topographic survey has been completed for the site and was supplied to AMA by the client. AMA accepts no liability for the accuracy of this survey, and it is recommended that it is verified on-site prior to the commencement of any construction work.
- 9.1.6 Existing drainage information is based on third party survey data and record information which is considered to be incomplete. It is therefore recommended that a FULL drainage investigation survey is commissioned to establish the precise alignment, level, and condition of ALL existing drainage within the development site to inform the masterplan and future detailed design proposals.

## APPENDICES

Appendix A Proposed Site Layout Plan

Appendix B Topographic Survey

Appendix C United Utilities Pre-Development Enquiry

Appendix D Drainage Layout Drawing

Appendix E Correspondence with the LLFA

Appendix F Causeway Flow Calculations



***Appendix A***  
***Proposed Site Layout Plan***

- NOTES:
1. Do not scale from this drawing.
  2. All dimensions to be checked on site by the Contractor and such dimensions to be their responsibility.
  3. Report all drawing errors and omissions to the Architect.

CLIENT:  
LPP Developments NW Ltd

PROJECT TITLE:  
Ginnell Farm  
Rochdale

DRAWING TITLE / LOCATION:  
Proposed Site Layout  
Plot Layouts and Boundaries

|            |            |         |
|------------|------------|---------|
| SCALE @ A1 | DATE       |         |
| 1:100      | 14/01/2025 |         |
| PROJECT #  | DRAWN      | CHECKED |
| A448       | RH         | CH      |

| PROJECT  | ORIGIN                  | PHASE | LEVEL | TYPE | ROLE | NO. # |
|----------|-------------------------|-------|-------|------|------|-------|
| A448     | MAS                     | DD    | XX    | DR   | A    | 102   |
| STATUS   | SUITABILITY DESCRIPTION |       |       |      |      |       |
| S2       | For Information         |       |       |      |      |       |
| REVISION |                         |       |       |      |      |       |
| P1       |                         |       |       |      |      |       |

| REV | DESCRIPTION    | BY | DATE     |
|-----|----------------|----|----------|
| P1  | Planning Issue | RH | 10/04/25 |

SCALE 1:100 (m)

0 1 2 3 4 5





***Appendix B***  
***Topographic Survey***

| Coordinate reference system                                                                                                                                                     |            |            |         |
|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------|------------|---------|
| This survey uses an arbitrary grid at a scale factor of 1 and relates to the Ordnance Survey National Grid. Please use the station table below to re-establish the onsite grid. |            |            |         |
| Stations                                                                                                                                                                        |            |            |         |
| Name                                                                                                                                                                            | Easting    | Northing   | Level   |
| PK1                                                                                                                                                                             | 391320.928 | 410864.281 | 170.954 |
| PK2                                                                                                                                                                             | 391346.980 | 410817.314 | 174.766 |
| PK3                                                                                                                                                                             | 391333.012 | 410811.244 | 173.490 |
| PK4                                                                                                                                                                             | 391311.644 | 410807.535 | 173.418 |
| PK5                                                                                                                                                                             | 391307.517 | 410821.672 | 172.766 |

| Stations |            |            |         |
|----------|------------|------------|---------|
| Name     | Easting    | Northing   | Level   |
| PK1      | 391320.928 | 410864.281 | 170.954 |
| PK2      | 391346.980 | 410817.314 | 174.766 |
| PK3      | 391333.012 | 410811.244 | 173.490 |
| PK4      | 391311.644 | 410807.535 | 173.418 |
| PK5      | 391307.517 | 410821.672 | 172.766 |



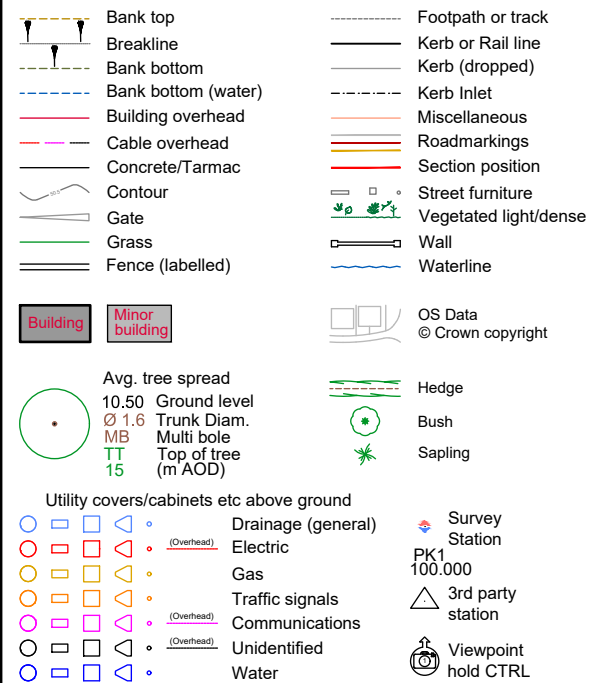
## Notes

This drawing should be used for the intended purpose only. Background mapping should be used as a guide only & remotely surveyed features such as offsite buildings and heights should be used as a guide.

Features may be omitted where obscured or inaccessible at the time of the survey. Identification of utility/statutory authority plant and apparatus has been made by visual inspection only. All dimensions should be checked on site prior to design and construction. Unless stated, boundaries have been surveyed according to a physical definition and no assumption or representation is given in respect of legal boundary position.

© 2024 Topographical Ltd

| Legend      |                       |      |                          |
|-------------|-----------------------|------|--------------------------|
| Topographic |                       |      |                          |
| AV          | Air Valve             | MKG  | Marker post gas          |
| BB          | Belisha beacon        | MKOF | Marker post oil/fuel     |
| Bk          | Bounding post/peg     | MKU  | Marker unidentified      |
| BH          | Borehole              | MKW  | Marker post water        |
| Bo          | Bollard               | Plnv | Pipe invert level        |
| Bus         | Bus Stop              | PM   | Parking meter            |
| Com.        | Comms. point          | PR   | Pipe riser               |
| C           | Comms. cabinet        | PJ   | Point unidentified       |
| CCTV        | Closed circuit tv     | RA   | Rodding access           |
| CP          | Crossing point        | RBoI | Reflective bollard       |
| CPS         | Concrete paving slabs | RP   | Rainwater pipe           |
| C           | Camber                | Sag  | Overhead sag cable       |
| DCL         | Drainage cover level  | SoI  | Soft level               |
| DR          | Duct riser            | SP   | Sign post                |
| Elec        | Electric fence        | ST   | Stop tap                 |
| E Cab       | Electricity cabinet   | SV   | Stop valve               |
| G           | Earth rod             | SV   | Stay                     |
| FH          | Fire hydrant          | Tac  | Tactile paving           |
| FS          | Flag staff            | TH   | Top of hedge             |
| G           | Gully                 | ThL  | Threshold level          |
| Gas         | Gas unidentified      | Tf   | Top of fence             |
| GCab        | Gas cabinet           | TL   | Traffic light            |
| GL          | Ground light          | TPW  | Top of parapet wall      |
| GM          | Gas meter             | TS   | Traffic signals          |
| GP          | Guide post            | TT   | Top of tree              |
| GV          | Gas valve             | TV   | Top of vegetation        |
| IboI        | Illuminated bollard   | Tw   | Top of wall              |
| Inv         | Invert level          | UCB  | Unidentified cabinet     |
| ISgn        | Illuminated sign      | UCL  | Unidentified cover level |
| ISgn        | Illuminated sign post | UP   | Utility pole             |
| KI          | Kerb inset            | VP   | Vent pipe                |
| LB          | Letter box            | WCL  | Water cover level        |
| LC          | Lighting column       | WL   | Water level              |
| MK          | Marker post comms.    | WR   | Water riser              |
| MKD         | Marker post drainage  | WO   | Wash out                 |
| MKE         | Marker post electric  | WU   | Water unidentified       |



| Revisions |              |     |       |
|-----------|--------------|-----|-------|
| REV:      | DESCRIPTION: | BY: | DATE: |
| STATUS:   |              |     |       |

SURVEYOR: **TOPOGRAPHICAL**  
.co.uk  
 Regulated by RICS

CLIENT: **Fairway Building & Remedial Contractors Ltd**

|             |                   |
|-------------|-------------------|
| CONSULTANT: | Northern Planners |
|-------------|-------------------|

SITE: Ginnell Farm Ave, Broad Lane  
Rochdale, OL16 4PU

|        |                    |
|--------|--------------------|
| TITLE: | Topographic Survey |
|--------|--------------------|

|                       |                            |                            |                   |
|-----------------------|----------------------------|----------------------------|-------------------|
| SCALE AT A2:<br>1:200 | SURVEY DATE:<br>23.09.2024 | ISSUE DATE:<br>25.09.2024  | QA REF:<br>QA3281 |
| PROJECT REF:<br>P2164 | MODEL REF:<br>S3281 2D     | LAYOUT REF:<br>1.TOPO-A2 H |                   |





***Appendix C***  
***United Utilities Pre-Development***  
***Enquiry***

Jasmine Ellenor

15  
15 St Pauls St,  
Leeds, United Kingdom  
LS1 2JG

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](mailto:propertysearches@uuplc.co.uk)**

**Your Ref: 22997 - Ginnell Farm Avenue  
Our Ref: UUPS-ORD-632242  
Date: 19/02/2025**

**Dear Sirs**

**Location: 1 GINNELL FARM AVENUE, ROCHDALE, OL16 4GF**

I acknowledge with thanks your request dated 12/02/2025 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

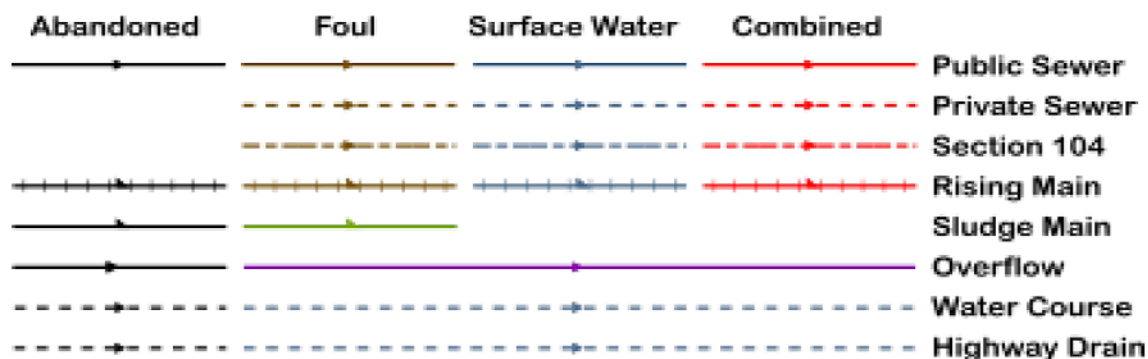
## TERMS AND CONDITIONS - WASTEWATER AND WATER DISTRIBUTION PLANS

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

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



# SEWER RECORDS

### Address or Site Reference

1 GINNELL FARM AVENUE,  
ROCHDALE,  
OL16 4GF

**Scale:** 1:2500  
**Date:** 19/02/2025

Printed by: Property Searches

The position of the underground apparatus shown on this plan is approximate only and is given in accordance with the best information currently available. United Utilities Water will not accept liability for any loss or damage caused by the actual position being different from those shown.

Crown copyright and database rights 2023  
Ordnance Survey 100022432. Unauthorised  
reproduction will infringe these copyrights.

**From:** [seweradoptions@uuplc.co.uk](mailto:seweradoptions@uuplc.co.uk)  
**To:** [Jasmine Ellenor](#)  
**Subject:** RE: Wastewater Pre-Development Enquiry - Ginnell Farm Avenue, Rochdale 06341416  
**Date:** 23 September 2024 14:06:31

---

Good morning Jasmine,

**Pre Development Enquiry for: Ginnell Farm Avenue, Milnrow, Rochdale, OL16 4GF      UU**  
**Reference Number : 06341416**

We have carried out an assessment of your application which is based on the information provided. This pre-development advice on your drainage strategy will be valid for 12 months. Your drainage strategy will need to be reviewed by other competent authorities as part of the planning process, and we advise that you carry out the necessary site investigations to confirm the viability of your proposals.

If your investigations require access to our public sewer network, we ask that you contact our network engineers with a request for an access certificate via our main contact telephone number 0345 6723 723 or refer to the link below:

<https://www.unitedutilities.com/builders-developers/working-near-our-assets/>

#### **Foul Water**

Foul flow from this site will be allowed to drain into the public foul water/combined sewer system.

Our preferred point of discharge would be to the 150mm diameter public foul water sewer within Ginnell Farm Avenue located to the Northwest of your proposed development at an unrestricted rate.

If you are able to identify an alternative, more suitable point of discharge, we request that you contact us at your earliest convenience so that we can assess suitability.

In accordance with our infrastructure plans we may ask you to change your point of connection. Therefore, please contact us when you are ready to formalise your drainage proposals, we would suggest before you submit for Full Planning.

#### **Surface Water**

All surface water flow from the proposed development should drain in-line with the drainage hierarchy, as outlined in Paragraph 80, (Reference ID: 7-080-20150323), of the National Planning Practice Guidance. We also recommend you prioritise the use of multi-functional sustainable drainage systems for the management of surface water in accordance with national planning policy.

*Generally, the aim should be to discharge surface run off as high up the following hierarchy of drainage options as reasonably practicable.*

This is outlined as follows, in order of priority:

1. **into the ground (infiltration);**
2. **to a surface waterbody;**
3. **to a surface water sewer or highway drain;**
4. **to a combined sewer.**

For guidance, The **North West SuDS Pro-Forma** provides information on the appropriate evidence required at each stage of the hierarchy, to demonstrate how each level has been discounted.

The Lead Local Flood Authority has responsibility for all surface water drainage concerns and their input to your proposal is critical. You should also consider whether it is necessary to discuss your proposal with the Environment Agency, or Internal Drainage Board (if operating in your area).

The Local Planning Authority are the determining authority for any application for planning permission and the appropriate authority for determining cost viability of a proposed drainage scheme, such assessments are outside of the jurisdiction of United Utilities.

#### **Highway Drainage**

If an evidence-based assessment has been carried out and confirms that infiltration is not

feasible, we recommend that you investigate the possibility of draining surface water to the highway drain where this ultimately discharges to a watercourse, by contacting the relevant Highway Authority.

### **Public Sewer**

In accordance with the hierarchy of drainage options within the National Planning Practice Guidance, both discharge to ground via infiltration and discharge to a waterbody should be discounted prior to consideration of discharging surface water to the public sewer system. Evidence should be provided to demonstrate how these have been discounted, as outlined in the North West SuDS pro-forma.

Once evidence is provided as outlined above, United Utilities will consider a connection to the 225mm diameter public surface water sewer within Ginnell Farm Avenue located North west at a pass forward flow to be agreed by the Lead Local Flood Authority. United Utilities request that any agreed rate does not exceed 5l/s.

As a Water Company, we have no obligation to accept highway drainage into our public sewer network. However, should your proposals include runoff from highways, we would request that consideration is given to SuDS components that deliver source control are incorporated within the design of the scheme to reduce the volume and frequency of discharges of these flows to the public sewer.

### **Levels**

For low-lying sites, (where the ground level of the site or the level of a basement is below the ground level at the point where the drainage connects to the public sewer), care should be taken to ensure that the property is not at increased risk of flooding. If these circumstances exist, we recommend that you contact us to discuss further. It could affect the detailed design of your site and result in the need to incorporate appropriate mitigating measures in your drainage scheme.

### **Land drainage / Overland flows / track drainage**

United Utilities have no obligation, and furthermore we do not accept land drainage, overland flows or track drainage into the public sewerage network under any circumstances

### **Existing Wastewater Assets Crossing the Site**

We have reviewed our records and can confirm that there does not appear to be any charted public sewers located within the boundary of proposed development. However, due to the accuracy of the records and the public sewer transfer legislation in 2011, not all public sewers are shown on our records so we would ask that you proceed with caution and carry out your own site investigation works. If any uncharted sewers are identified while carrying out your works, we would ask that you contact United Utilities at the earliest opportunity so that we can offer guidance and update our records.

### **Existing Water Assets Crossing the Site**

It is the developer responsibility to identify utilities on-site. Where clean water assets are shown on our records, we recommend that you contact our Water Pre-Development Team, via the following email address: [DeveloperServicesWater@uuplc.co.uk](mailto:DeveloperServicesWater@uuplc.co.uk). Further information for this service can be found on our website via the link below:

<https://www.unitedutilities.com/builders-developers/larger-developments/pre-development/water-pre-dev/>

### **Connection Application**

Although we may discuss and agree discharge points and rates in principle, please be aware that you will have to apply for a formal sewer connection. This is so that we can assess the method of construction, Health & Safety requirements and to ultimately inspect the connection when it is made. Details of the application process and the form itself can be obtained from our website by following the link below:

<https://www.unitedutilities.com/builders-developers/wastewater-services/sewer-connections/sewer-connection/>

We recommend that the detailed design should confirm the locations of all utilities in the area and ensure that any proposed drainage solution considers routing and clash checks where required.

If we can be of any further assistance please don't hesitate to contact us further.

Kind regards,

Eireann Thompson  
Developer Engineer  
Developer Services & Metering  
Mobex: 07553074138  
unitedutilities.com

Did you know we now have a live chat facility available to you Mon to Friday 8 -5pm. You just click on the orange live chat box on our webpage and one of our advisors will be ready to chat to you and help you with your enquiry <https://www.unitedutilities.com/builders-developers/> or you can email us at [developerserviceswater@uuplc.co.uk](mailto:developerserviceswater@uuplc.co.uk)

**If you have received a great service today why not tell us?**  
**Visit: [unitedutilities.com/wow](https://www.unitedutilities.com/wow)**

----- Original Message -----

**From:** seweradoptions@uuplc.co.uk [seweradoptions@uuplc.co.uk]

**Sent:** 19/09/2024 14:10

**To:** jasmine@amatp.co.uk

**Subject:** RE: Wastewater Pre-Development Enquiry - Ginnell Farm Avenue, Rochdale 06341416

Good Afternoon

**PRE DEVELOPMENT APPLICATION AT GINNELL FARM : – UU Ref 06341416**

Please accept this email as receipt of your application received on 19/09/2024 for the above development. This has now been logged on our system and the job reference is 06341416 we would ask that you quote this reference in all future correspondence.

I have reviewed your application (and attachments) and can confirm this is suitable to be passed to Lana Jaundrell for technical assessment. You will receive their response within on or before 03/10/2024.

Kind regards

Emily Stockley  
Customer Advisor Advanced  
Developer Services & Metering  
Customer Services  
T: 0345 026 8989 option 4  
unitedutilities.com



Customer Advisor Advanced  
Developer Services & Metering  
Customer Services  
T: 0345 026 8989 option 4  
unitedutilities.com

If you feel you have received a good service from myself, please can you take two minutes to fill in the survey below. This will be much appreciated



Visit: <https://unitedutilities.thewowawards.co.uk/nominate>

----- Original Message -----

**From:** Jasmine Ellenor [jasmine@amatp.co.uk]

**Sent:** 19/09/2024 09:58

**To:** seweradoptions@uuplc.co.uk

**Subject:** Wastewater Pre-Development Enquiry - Ginnell Farm Avenue, Rochdale

Dear Sir/Madam,

Please see attached the wastewater pre-development enquiry form and the site location plan for a residential development located at Ginnell Farm, Rochdale.

We are yet to receive further plans/topographic survey from the client however, if this is required we can provide this at a later date.

If you require any further information, please let me know and thank you in advance

Best Regards

**Jasmine Ellenor**

*BSc Grad.CIWEM*

**Graduate Flood Risk and Drainage Engineer**

**Office:** 0113 418 2615

**Mobile:** 0774 266 82520

**Web:** [www.amatp.co.uk](http://www.amatp.co.uk)

[\[Image is no longer available\]](#)

**Andrew Moseley Associates Ltd, 15 St Pauls Street, Leeds, LS1 2JG**



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***Appendix D***  
***Drainage Layout Drawing***

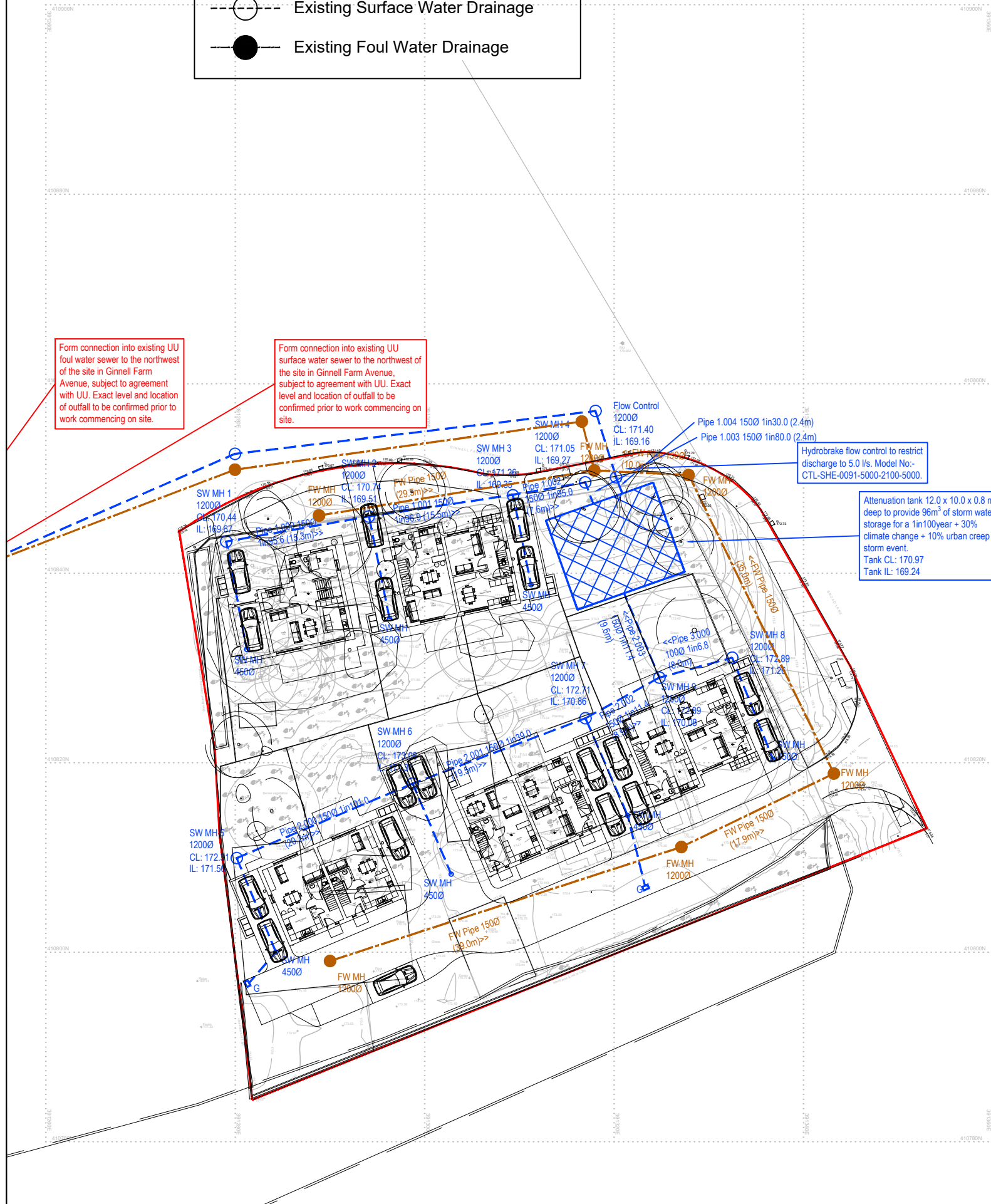


**Key:**

-  Proposed Surface Water Drainage
-  Proposed Foul Water Drainage
-  Existing Surface Water Drainage
-  Existing Foul Water Drainage

Form connection into existing UU foul water sewer to the northwest of the site in Ginnell Farm Avenue, subject to agreement with UU. Exact level and location of outfall to be confirmed prior to work commencing on site.

Form connection into existing UU surface water sewer to the northwest of the site in Ginnell Farm Avenue, subject to agreement with UU. Exact level and location of outfall to be confirmed prior to work commencing on site.



**Drainage Strategy**

**Surface Water**

Flow restriction 5.0 l/s.

The proposed impermeable area is 0.17 ha. Based on a flow restriction of 5.0 l/s and modeling using Causeway Flow software, the attenuation requirement for a 1in100year + 30% climate change + 10% urban creep storm event is **96m<sup>3</sup>**.

Attenuation is provided via **ATTENUATION TANK 12.0 x 10.0 x 0.8m DEEP**. Flows will be restricted via Hydrobrake model no:- CTL-SHE-0091-5000-2100-5000.

**Foul Water**

Foul water from the proposed development will discharge to the UU foul water sewer located to the northwest of the site in Ginnell Farm Avenue, subject to agreement with UU.

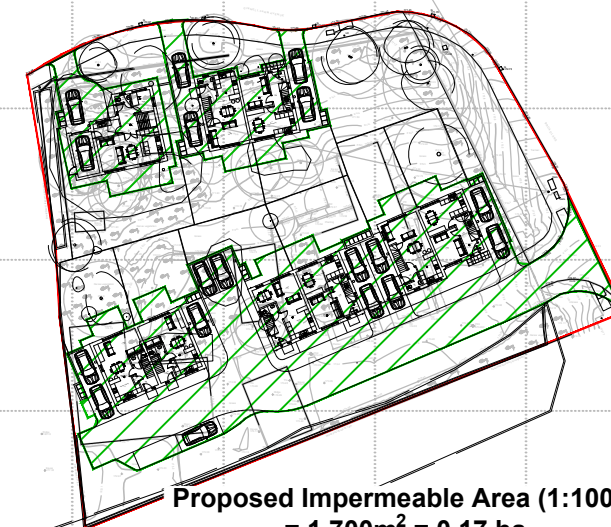
**Notes**

Exact levels and locations of outfalls to the public sewer network should be confirmed prior to work commencing on site. Pumping may be required if a gravity connection is not achievable.

A CCTV drainage survey of the existing drainage on site should be undertaken to confirm any existing outfalls from the site.



**Existing Impermeable Area (1:1000)**  
**= 607 m<sup>2</sup> = 0.06 ha**



**Proposed Impermeable Area (1:1000)**  
**= 1,700m<sup>2</sup> = 0.17 ha**

|                                                                                                                                                                                                                                                             |                            |                     |    |
|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------|---------------------|----|
|                                                                                                                                                                                                                                                             |                            |                     |    |
| P02                                                                                                                                                                                                                                                         | Updated Site Layout        | 11.04.25            | JE |
| P01                                                                                                                                                                                                                                                         | Preliminary Issue          | 19.02.25            | JE |
|  <b>ANDREW MOSELEY ASSOCIATES</b> <div>Transport &amp; Infrastructure Consultants<br/>15 St Paul's Street<br/>Second Floor<br/>Leeds LS1 2JG<br/>www.amatp.co.uk</div> |                            |                     |    |
| Project:<br><b>Ginnell Farm, Rochdale</b>                                                                                                                                                                                                                   |                            |                     |    |
| Client:<br><b>Fairway Building &amp; Remedial Contractors Ltd</b>                                                                                                                                                                                           |                            |                     |    |
| Drawing:<br><b>Drainage Layout Drawing</b>                                                                                                                                                                                                                  |                            |                     |    |
| Drawn By:<br><b>JE</b>                                                                                                                                                                                                                                      | Date:<br><b>11.04.2025</b> |                     |    |
| Checked:<br><b>TM</b>                                                                                                                                                                                                                                       | Scale:<br><b>1:500</b>     | Paper:<br><b>A3</b> |    |
| Drawing No.<br><b>AMA-22997-DS-001</b>                                                                                                                                                                                                                      |                            | Rev.<br><b>P02</b>  |    |



***Appendix E***  
***Correspondence with the LLFA***

**From:** [Jasmine Ellenor](#)  
**To:** ["strategic.planning@rochdale.gov.uk"](mailto:strategic.planning@rochdale.gov.uk)  
**Subject:** Ginnell Farm, Rochdale - Drainage Strategy  
**Date:** 12 February 2025 15:20:56  
**Attachments:** [image001.gif](#)  
[LOCATION PLAN.pdf](#)

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Dear Sir/Madam,

Hope you are well. I am emailing regarding a drainage strategy that AMA are undertaking for a proposed residential development located at Land at Ginnell Farm Avenue, Balderstone, Milnrow, Rochdale, OL16 4GF at NGR: SD 91296 10831 (see attached location plan).

From a desktop study of ground conditions at the site, infiltration testing has been discounted as an option for draining surface water from the site. Further to this, there are no watercourses located within the vicinity of the site which we are aware of. Therefore, we are proposing an outfall to the United Utilities surface water sewer located to the north of the site in Ginnell Farm Avenue at a restricted discharge rate of 5.0 l/s, as requested by United Utilities. Please can you confirm that the LLFA is accepting of this proposal?

Thank you in advance and if you require any further information please let me know!

Kind Regards

**Jasmine Ellenor**  
*BSc Grad.CIWEM*  
**Flood Risk and Drainage Engineer**

**Office:** 0113 418 2615

**Mobile:** 0774 266 8250

**Web:** [www.amatp.co.uk](http://www.amatp.co.uk)

**Andrew Moseley Associates Ltd, 15 St Pauls Street, Leeds, LS1 2JG**



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Andrew Moseley Associates Limited, a limited company registered in England & Wales with registered number 10876561

and registered office: 15 St Pauls Street, Leeds, LS1 2JG.



***Appendix F***  
***Causeway Flow Calculations***

### Design Settings

|                       |                   |                                      |               |
|-----------------------|-------------------|--------------------------------------|---------------|
| Rainfall Methodology  | FSR               | Maximum Time of Concentration (mins) | 30.00         |
| Return Period (years) | 100               | Maximum Rainfall (mm/hr)             | 50.0          |
| 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               | 0.300             | Preferred Cover Depth (m)            | 1.200         |
| CV                    | 1.000             | Include Intermediate Ground          | ✓             |
| Time of Entry (mins)  | 5.00              | Enforce best practice design rules   | ✓             |

### Nodes

| Name         | Area<br>(ha) | T of E<br>(mins) | Cover<br>Level<br>(m) | Diameter<br>(mm) | Depth<br>(m) |
|--------------|--------------|------------------|-----------------------|------------------|--------------|
| MH 1         | 0.019        | 5.00             | 170.440               | 1200             | 0.770        |
| MH 2         | 0.019        | 5.00             | 170.740               | 1200             | 1.230        |
| MH 3         | 0.019        | 5.00             | 171.260               | 1200             | 1.910        |
| MH 4         | 0.019        | 5.00             | 171.050               | 1200             | 1.780        |
| MH 5         | 0.019        | 5.00             | 172.310               | 1200             | 0.750        |
| MH 6         | 0.019        | 5.00             | 173.080               | 1200             | 1.720        |
| MH 7         | 0.019        | 5.00             | 172.710               | 1200             | 1.850        |
| MH 8         | 0.019        | 5.00             | 172.890               | 1200             | 1.630        |
| MH 9         | 0.019        | 5.00             | 172.890               | 1200             | 2.810        |
| Tank         | 0.000        | 5.00             | 170.970               | 1200             | 1.730        |
| Flow Control | 0.000        | 5.00             | 171.400               | 1200             | 2.240        |

### Links

| Name  | US<br>Node | DS<br>Node   | Length<br>(m) | ks (mm) /<br>n | US IL<br>(m) | DS IL<br>(m) | Fall<br>(m) | Slope<br>(1:X) | Dia<br>(mm) | T of C<br>(mins) | Rain<br>(mm/hr) |
|-------|------------|--------------|---------------|----------------|--------------|--------------|-------------|----------------|-------------|------------------|-----------------|
| 1.000 | MH 1       | MH 2         | 15.300        | 0.600          | 169.670      | 169.510      | 0.160       | 95.6           | 150         | 5.24             | 50.0            |
| 1.001 | MH 2       | MH 3         | 15.500        | 0.600          | 169.510      | 169.350      | 0.160       | 96.9           | 150         | 5.49             | 50.0            |
| 1.002 | MH 3       | MH 4         | 7.600         | 0.600          | 169.350      | 169.270      | 0.080       | 95.0           | 150         | 5.62             | 50.0            |
| 1.003 | MH 4       | Tank         | 2.400         | 0.600          | 169.270      | 169.240      | 0.030       | 80.0           | 150         | 5.66             | 50.0            |
| 2.000 | MH 5       | MH 6         | 20.200        | 0.600          | 171.560      | 171.360      | 0.200       | 101.0          | 150         | 5.34             | 50.0            |
| 2.001 | MH 6       | MH 7         | 19.500        | 0.600          | 171.360      | 170.860      | 0.500       | 39.0           | 150         | 5.66             | 50.0            |
| 2.002 | MH 7       | MH 9         | 8.900         | 0.600          | 170.860      | 170.080      | 0.780       | 11.4           | 150         | 5.81             | 50.0            |
| 3.000 | MH 8       | MH 9         | 8.000         | 0.600          | 171.260      | 170.080      | 1.180       | 6.8            | 100         | 5.13             | 50.0            |
| 2.003 | MH 9       | Tank         | 9.600         | 0.600          | 170.080      | 169.240      | 0.840       | 11.4           | 150         | 5.97             | 50.0            |
| 1.004 | Tank       | Flow Control | 2.400         | 0.600          | 169.240      | 169.160      | 0.080       | 30.0           | 150         | 5.97             | 50.0            |

| Name  | Vel<br>(m/s) | Cap<br>(l/s) | Flow<br>(l/s) | US<br>Depth<br>(m) | DS<br>Depth<br>(m) | Σ Area<br>(ha) | Σ Add<br>Inflow<br>(l/s) | Pro<br>Depth<br>(mm) | Pro<br>Velocity<br>(m/s) |
|-------|--------------|--------------|---------------|--------------------|--------------------|----------------|--------------------------|----------------------|--------------------------|
| 1.000 | 1.028        | 18.2         | 3.4           | 0.620              | 1.080              | 0.019          | 0.0                      | 44                   | 0.792                    |
| 1.001 | 1.021        | 18.0         | 6.9           | 1.080              | 1.760              | 0.038          | 0.0                      | 64                   | 0.953                    |
| 1.002 | 1.031        | 18.2         | 10.3          | 1.760              | 1.630              | 0.057          | 0.0                      | 81                   | 1.061                    |
| 1.003 | 1.125        | 19.9         | 13.7          | 1.630              | 1.580              | 0.076          | 0.0                      | 92                   | 1.212                    |
| 2.000 | 1.000        | 17.7         | 3.4           | 0.600              | 1.570              | 0.019          | 0.0                      | 45                   | 0.776                    |
| 2.001 | 1.616        | 28.6         | 6.9           | 1.570              | 1.700              | 0.038          | 0.0                      | 50                   | 1.334                    |
| 2.002 | 2.999        | 53.0         | 10.3          | 1.700              | 2.660              | 0.057          | 0.0                      | 45                   | 2.334                    |
| 3.000 | 2.988        | 23.5         | 3.4           | 1.530              | 2.710              | 0.019          | 0.0                      | 26                   | 2.150                    |
| 2.003 | 2.997        | 53.0         | 17.2          | 2.660              | 1.580              | 0.095          | 0.0                      | 59                   | 2.685                    |
| 1.004 | 1.845        | 32.6         | 30.9          | 1.580              | 2.090              | 0.171          | 0.0                      | 117                  | 2.092                    |

Pipeline Schedule

| Link  | Length<br>(m) | Slope<br>(1:X) | Dia<br>(mm) | Link<br>Type | US CL<br>(m) | US IL<br>(m) | US Depth<br>(m) | DS CL<br>(m) | DS IL<br>(m) | DS Depth<br>(m) |
|-------|---------------|----------------|-------------|--------------|--------------|--------------|-----------------|--------------|--------------|-----------------|
| 1.000 | 15.300        | 95.6           | 150         | Circular     | 170.440      | 169.670      | 0.620           | 170.740      | 169.510      | 1.080           |
| 1.001 | 15.500        | 96.9           | 150         | Circular     | 170.740      | 169.510      | 1.080           | 171.260      | 169.350      | 1.760           |
| 1.002 | 7.600         | 95.0           | 150         | Circular     | 171.260      | 169.350      | 1.760           | 171.050      | 169.270      | 1.630           |
| 1.003 | 2.400         | 80.0           | 150         | Circular     | 171.050      | 169.270      | 1.630           | 170.970      | 169.240      | 1.580           |
| 2.000 | 20.200        | 101.0          | 150         | Circular     | 172.310      | 171.560      | 0.600           | 173.080      | 171.360      | 1.570           |
| 2.001 | 19.500        | 39.0           | 150         | Circular     | 173.080      | 171.360      | 1.570           | 172.710      | 170.860      | 1.700           |
| 2.002 | 8.900         | 11.4           | 150         | Circular     | 172.710      | 170.860      | 1.700           | 172.890      | 170.080      | 2.660           |
| 3.000 | 8.000         | 6.8            | 100         | Circular     | 172.890      | 171.260      | 1.530           | 172.890      | 170.080      | 2.710           |
| 2.003 | 9.600         | 11.4           | 150         | Circular     | 172.890      | 170.080      | 2.660           | 170.970      | 169.240      | 1.580           |
| 1.004 | 2.400         | 30.0           | 150         | Circular     | 170.970      | 169.240      | 1.580           | 171.400      | 169.160      | 2.090           |

| Link  | US<br>Node | Dia<br>(mm) | Node<br>Type | MH<br>Type | DS<br>Node   | Dia<br>(mm) | Node<br>Type | MH<br>Type |
|-------|------------|-------------|--------------|------------|--------------|-------------|--------------|------------|
| 1.000 | MH 1       | 1200        | Manhole      | Adoptable  | MH 2         | 1200        | Manhole      | Adoptable  |
| 1.001 | MH 2       | 1200        | Manhole      | Adoptable  | MH 3         | 1200        | Manhole      | Adoptable  |
| 1.002 | MH 3       | 1200        | Manhole      | Adoptable  | MH 4         | 1200        | Manhole      | Adoptable  |
| 1.003 | MH 4       | 1200        | Manhole      | Adoptable  | Tank         | 1200        | Manhole      | Adoptable  |
| 2.000 | MH 5       | 1200        | Manhole      | Adoptable  | MH 6         | 1200        | Manhole      | Adoptable  |
| 2.001 | MH 6       | 1200        | Manhole      | Adoptable  | MH 7         | 1200        | Manhole      | Adoptable  |
| 2.002 | MH 7       | 1200        | Manhole      | Adoptable  | MH 9         | 1200        | Manhole      | Adoptable  |
| 3.000 | MH 8       | 1200        | Manhole      | Adoptable  | MH 9         | 1200        | Manhole      | Adoptable  |
| 2.003 | MH 9       | 1200        | Manhole      | Adoptable  | Tank         | 1200        | Manhole      | Adoptable  |
| 1.004 | Tank       | 1200        | Manhole      | Adoptable  | Flow Control | 1200        | Manhole      | Adoptable  |

Manhole Schedule

| Node | CL<br>(m) | Depth<br>(m) | Dia<br>(mm) | Connections            | Link  | IL<br>(m) | Dia<br>(mm) |
|------|-----------|--------------|-------------|------------------------|-------|-----------|-------------|
| MH 1 | 170.440   | 0.770        | 1200        | <div><div></div></div> |       |           |             |
|      |           |              |             | 0                      | 1.000 | 169.670   | 150         |
| MH 2 | 170.740   | 1.230        | 1200        | <div><div></div></div> | 1     | 1.000     | 169.510     |
|      |           |              |             | 0                      | 1.001 | 169.510   | 150         |
| MH 3 | 171.260   | 1.910        | 1200        | <div><div></div></div> | 1     | 1.001     | 169.350     |
|      |           |              |             | 0                      | 1.002 | 169.350   | 150         |
| MH 4 | 171.050   | 1.780        | 1200        | <div><div></div></div> | 1     | 1.002     | 169.270     |
|      |           |              |             | 0                      | 1.003 | 169.270   | 150         |
| MH 5 | 172.310   | 0.750        | 1200        | <div><div></div></div> |       |           |             |
|      |           |              |             | 0                      | 2.000 | 171.560   | 150         |
| MH 6 | 173.080   | 1.720        | 1200        | <div><div></div></div> | 1     | 2.000     | 171.360     |
|      |           |              |             | 0                      | 2.001 | 171.360   | 150         |

Manhole Schedule

| Node         | CL<br>(m) | Depth<br>(m) | Dia<br>(mm) | Connections                            | Link                    | IL<br>(m)                     | Dia<br>(mm)       |
|--------------|-----------|--------------|-------------|----------------------------------------|-------------------------|-------------------------------|-------------------|
| MH 7         | 172.710   | 1.850        | 1200        | <div>1</div>                           | 2.001                   | 170.860                       | 150               |
| MH 8         | 172.890   | 1.630        | 1200        | <div>0</div>                           | 2.002                   | 170.860                       | 150               |
| MH 9         | 172.890   | 2.810        | 1200        | <div>0</div> <div>1</div> <div>2</div> | 3.000<br>3.000<br>2.002 | 171.260<br>170.080<br>170.080 | 100<br>100<br>150 |
| Tank         | 170.970   | 1.730        | 1200        | <div>0</div> <div>1</div> <div>2</div> | 2.003<br>2.003<br>1.003 | 170.080<br>169.240<br>169.240 | 150<br>150<br>150 |
| Flow Control | 171.400   | 2.240        | 1200        | <div>0</div> <div>1</div>              | 1.004<br>1.004          | 169.240<br>169.160            | 150<br>150        |

Simulation Settings

|                      |                   |                            |        |
|----------------------|-------------------|----------------------------|--------|
| Rainfall Methodology | FSR               | Analysis Speed             | Normal |
| FSR Region           | England and Wales | Skip Steady State          | x      |
| M5-60 (mm)           | 20.000            | Drain Down Time (mins)     | 240    |
| Ratio-R              | 0.300             | Additional Storage (m³/ha) | 20.0   |
| Summer CV            | 1.000             | Check Discharge Rate(s)    | x      |
| Winter CV            | 1.000             | Check Discharge Volume     | x      |

Storm Durations

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

| Return Period<br>(years) | Climate Change<br>(CC %) | Additional Area<br>(A %) | Additional Flow<br>(Q %) |
|--------------------------|--------------------------|--------------------------|--------------------------|
| 1                        | 0                        | 0                        | 0                        |
| 30                       | 0                        | 0                        | 0                        |
| 100                      | 30                       | 10                       | 0                        |

Node Flow Control Online Hydro-Brake® Control

|                          |         |                         |                                |
|--------------------------|---------|-------------------------|--------------------------------|
| Flap Valve               | x       | Objective               | (HE) Minimise upstream storage |
| Replaces Downstream Link | ✓       | Sump Available          | ✓                              |
| Invert Level (m)         | 169.160 | Product Number          | CTL-SHE-0091-5000-2100-5000    |
| Design Depth (m)         | 2.100   | 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)          | 169.240 |
| Side Inf Coefficient (m/hr) | 0.00000 | Porosity      | 1.00 | Time to half empty (mins) |         |



| Depth<br>(m) | Area<br>(m <sup>2</sup> ) | Inf Area<br>(m <sup>2</sup> ) | Depth<br>(m) | Area<br>(m <sup>2</sup> ) | Inf Area<br>(m <sup>2</sup> ) | Depth<br>(m) | Area<br>(m <sup>2</sup> ) | Inf Area<br>(m <sup>2</sup> ) |
|--------------|---------------------------|-------------------------------|--------------|---------------------------|-------------------------------|--------------|---------------------------|-------------------------------|
| 0.000        | 120.0                     | 0.0                           | 0.800        | 120.0                     | 0.0                           | 0.801        | 0.0                       | 0.0                           |

**Results for 1 year Critical Storm Duration. Lowest mass balance: 99.72%**

| Node Event        | US Node      | Peak (mins) | Level (m) | Depth (m) | Inflow (l/s) | Node Vol (m³) | Flood (m³) | Status |
|-------------------|--------------|-------------|-----------|-----------|--------------|---------------|------------|--------|
| 15 minute summer  | MH 1         | 10          | 169.711   | 0.041     | 3.1          | 0.0673        | 0.0000     | OK     |
| 15 minute summer  | MH 2         | 10          | 169.570   | 0.060     | 6.1          | 0.0869        | 0.0000     | OK     |
| 15 minute summer  | MH 3         | 11          | 169.433   | 0.083     | 9.1          | 0.1105        | 0.0000     | OK     |
| 15 minute summer  | MH 4         | 10          | 169.366   | 0.096     | 11.9         | 0.1293        | 0.0000     | OK     |
| 15 minute summer  | MH 5         | 10          | 171.602   | 0.042     | 3.1          | 0.0688        | 0.0000     | OK     |
| 15 minute summer  | MH 6         | 10          | 171.409   | 0.049     | 6.1          | 0.0661        | 0.0000     | OK     |
| 15 minute summer  | MH 7         | 10          | 170.902   | 0.042     | 9.1          | 0.0560        | 0.0000     | OK     |
| 15 minute summer  | MH 8         | 10          | 171.285   | 0.025     | 3.1          | 0.0335        | 0.0000     | OK     |
| 15 minute summer  | MH 9         | 10          | 170.144   | 0.064     | 15.2         | 0.0809        | 0.0000     | OK     |
| 120 minute summer | Tank         | 82          | 169.363   | 0.123     | 14.4         | 14.8593       | 0.0000     | OK     |
| 120 minute summer | Flow Control | 82          | 169.361   | 0.201     | 8.8          | 0.2275        | 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 summer            | MH 1         | 1.000        | MH 2         | 3.0           | 0.577          | 0.167    | 0.0809        |                    |
| 15 minute summer            | MH 2         | 1.001        | MH 3         | 6.0           | 0.726          | 0.332    | 0.1282        |                    |
| 15 minute summer            | MH 3         | 1.002        | MH 4         | 9.0           | 0.832          | 0.495    | 0.0830        |                    |
| 15 minute summer            | MH 4         | 1.003        | Tank         | 12.0          | 1.588          | 0.606    | 0.0205        |                    |
| 15 minute summer            | MH 5         | 2.000        | MH 6         | 3.0           | 0.673          | 0.171    | 0.0910        |                    |
| 15 minute summer            | MH 6         | 2.001        | MH 7         | 6.0           | 1.337          | 0.210    | 0.0877        |                    |
| 15 minute summer            | MH 7         | 2.002        | MH 9         | 9.0           | 1.732          | 0.170    | 0.0497        |                    |
| 15 minute summer            | MH 8         | 3.000        | MH 9         | 3.1           | 0.941          | 0.131    | 0.0271        |                    |
| 15 minute summer            | MH 9         | 2.003        | Tank         | 15.2          | 3.130          | 0.287    | 0.0567        |                    |
| 120 minute summer           | Tank         | 1.004        | Flow Control | 8.8           | 0.648          | 0.271    | 0.0396        |                    |
| 120 minute summer           | Flow Control | Hydro-Brake® |              | 3.7           |                |          |               | 29.0               |

**Results for 30 year Critical Storm Duration. Lowest mass balance: 99.72%**

| Node Event        | US Node      | Peak (mins) | Level (m) | Depth (m) | Inflow (l/s) | Node Vol (m³) | Flood (m³) | Status     |
|-------------------|--------------|-------------|-----------|-----------|--------------|---------------|------------|------------|
| 15 minute summer  | MH 1         | 12          | 169.742   | 0.071     | 7.6          | 0.1161        | 0.0000     | OK         |
| 15 minute summer  | MH 2         | 11          | 169.728   | 0.218     | 15.1         | 0.3134        | 0.0000     | SURCHARGED |
| 30 minute summer  | MH 3         | 19          | 169.627   | 0.277     | 19.0         | 0.3680        | 0.0000     | SURCHARGED |
| 180 minute summer | MH 4         | 136         | 169.598   | 0.328     | 10.7         | 0.4407        | 0.0000     | SURCHARGED |
| 15 minute summer  | MH 5         | 10          | 171.630   | 0.069     | 7.6          | 0.1138        | 0.0000     | OK         |
| 15 minute summer  | MH 6         | 10          | 171.442   | 0.082     | 15.1         | 0.1113        | 0.0000     | OK         |
| 15 minute summer  | MH 7         | 11          | 170.928   | 0.068     | 22.5         | 0.0909        | 0.0000     | OK         |
| 15 minute summer  | MH 8         | 10          | 171.299   | 0.039     | 7.6          | 0.0534        | 0.0000     | OK         |
| 15 minute summer  | MH 9         | 10          | 170.186   | 0.106     | 37.5         | 0.1347        | 0.0000     | OK         |
| 180 minute summer | Tank         | 136         | 169.598   | 0.357     | 24.5         | 43.2986       | 0.0000     | SURCHARGED |
| 180 minute summer | Flow Control | 136         | 169.595   | 0.435     | 7.2          | 0.4918        | 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 summer            | MH 1         | 1.000        | MH 2         | 7.5           | 0.711          | 0.413    | 0.1980        |                    |
| 15 minute summer            | MH 2         | 1.001        | MH 3         | 13.3          | 0.805          | 0.737    | 0.2729        |                    |
| 30 minute summer            | MH 3         | 1.002        | MH 4         | 18.6          | 1.058          | 1.022    | 0.1338        |                    |
| 180 minute summer           | MH 4         | 1.003        | Tank         | 10.5          | 0.951          | 0.528    | 0.0423        |                    |
| 15 minute summer            | MH 5         | 2.000        | MH 6         | 7.5           | 0.838          | 0.424    | 0.1805        |                    |
| 15 minute summer            | MH 6         | 2.001        | MH 7         | 14.9          | 1.685          | 0.521    | 0.1721        |                    |
| 15 minute summer            | MH 7         | 2.002        | MH 9         | 22.3          | 2.233          | 0.422    | 0.0940        |                    |
| 15 minute summer            | MH 8         | 3.000        | MH 9         | 7.6           | 1.268          | 0.322    | 0.0427        |                    |
| 15 minute summer            | MH 9         | 2.003        | Tank         | 37.6          | 3.395          | 0.710    | 0.1328        |                    |
| 180 minute summer           | Tank         | 1.004        | Flow Control | 7.2           | 0.630          | 0.221    | 0.0423        |                    |
| 180 minute summer           | Flow Control | Hydro-Brake® |              | 4.0           |                |          |               | 75.9               |

**Results for 100 year +30% CC +10% A Critical Storm Duration. Lowest mass balance: 99.72%**

| Node Event        | US Node      | Peak (mins) | Level (m) | Depth (m) | Inflow (l/s) | Node Vol (m³) | Flood (m³) | Status     |
|-------------------|--------------|-------------|-----------|-----------|--------------|---------------|------------|------------|
| 30 minute summer  | MH 1         | 20          | 170.440   | 0.770     | 13.2         | 1.2888        | 0.0000     | FLOOD RISK |
| 180 minute winter | MH 2         | 176         | 170.385   | 0.875     | 7.0          | 1.2876        | 0.0000     | SURCHARGED |
| 180 minute winter | MH 3         | 176         | 170.385   | 1.035     | 10.0         | 1.3971        | 0.0000     | SURCHARGED |
| 180 minute winter | MH 4         | 176         | 170.385   | 1.115     | 13.4         | 1.5225        | 0.0000     | SURCHARGED |
| 15 minute summer  | MH 5         | 12          | 171.754   | 0.194     | 14.0         | 0.3273        | 0.0000     | SURCHARGED |
| 15 minute summer  | MH 6         | 12          | 171.660   | 0.300     | 28.3         | 0.4116        | 0.0000     | SURCHARGED |
| 15 minute summer  | MH 7         | 12          | 171.290   | 0.430     | 38.3         | 0.5833        | 0.0000     | SURCHARGED |
| 15 minute summer  | MH 8         | 11          | 171.334   | 0.074     | 14.0         | 0.1024        | 0.0000     | OK         |
| 30 minute summer  | MH 9         | 19          | 170.849   | 0.768     | 58.8         | 0.9836        | 0.0000     | SURCHARGED |
| 180 minute winter | Tank         | 176         | 170.384   | 1.144     | 31.0         | 97.3535       | 0.0000     | SURCHARGED |
| 180 minute winter | Flow Control | 176         | 170.382   | 1.222     | 7.5          | 1.3815        | 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) |
|-----------------------------|--------------|--------------|--------------|---------------|----------------|----------|---------------|--------------------|
| 30 minute summer            | MH 1         | 1.000        | MH 2         | 9.9           | 0.719          | 0.546    | 0.2694        |                    |
| 180 minute winter           | MH 2         | 1.001        | MH 3         | 6.4           | 0.703          | 0.354    | 0.2729        |                    |
| 180 minute winter           | MH 3         | 1.002        | MH 4         | 9.8           | 0.607          | 0.536    | 0.1338        |                    |
| 180 minute winter           | MH 4         | 1.003        | Tank         | 13.1          | 1.045          | 0.660    | 0.0423        |                    |
| 15 minute summer            | MH 5         | 2.000        | MH 6         | 14.3          | 0.934          | 0.812    | 0.3556        |                    |
| 15 minute summer            | MH 6         | 2.001        | MH 7         | 25.0          | 1.743          | 0.875    | 0.3433        |                    |
| 15 minute summer            | MH 7         | 2.002        | MH 9         | 35.2          | 2.043          | 0.663    | 0.1567        |                    |
| 15 minute summer            | MH 8         | 3.000        | MH 9         | 13.7          | 1.853          | 0.582    | 0.0561        |                    |
| 30 minute summer            | MH 9         | 2.003        | Tank         | 56.5          | 3.212          | 1.068    | 0.1690        |                    |
| 180 minute winter           | Tank         | 1.004        | Flow Control | 7.5           | 0.594          | 0.229    | 0.0423        |                    |
| 180 minute winter           | Flow Control | Hydro-Brake® |              | 4.0           |                |          |               | 86.6               |



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