Project

Slate Wharf
Castlefield, Manchester

Title

Surface Water Management Report

Project No

C13955

Date

September 2021

Revision

B

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1. Introduction

Northern Structural Services have produced this surface water management report to support a drainage design and to discharge Planning Condition 15, for a residential development at Slate Wharf, Castlefield, Manchester, which states:

'No development shall take place until surface water drainage works have been implemented in accordance with Non-Statutory Technical Standards for Sustainable Drainage Systems (March 2015) or any subsequent replacements national standards and details that have been submitted to and approved in writing by the Local Planning Authority. In order to discharge the above drainage condition the following additional information has to be provided:

- *Details of surface water attenuation that offers a reduction in surface water runoff rate in line with the Manchester Trafford and Salford Strategic Flood Risk Assessment;*
- *Runoff volume in the 1 in 100 year, 6 hours rainfall shall be constrained to a value as close as is reasonably practicable to the greenfield runoff volume for the same event, but never to exceed the runoff volume from the development site prior to redevelopment;*
- *Evidence that the drainage system has been designed (unless an area is designated to hold and/or convey water as part of the design) so that flooding does not occur during a 1 in 100 year rainfall event in any part of a building;*
- *Assessment of overland flow routes for extreme events that is diverted away from buildings (including basements). Overland flow routes need to be designed to convey the flood water in a safe manner in the event of a blockage or exceedance of the proposed drainage system capacity. The flood water should be routed away from the buildings and towards the less vulnerable areas i.e. open spaces, car parks and roads. A layout with overland flow routes needs to be presented.*
- *Where surface water is connected to the public sewer, agreement in principle from United Utilities is required that there is adequate spare capacity in the existing system taking future development requirements into account. An email of acceptance of proposed flows and/or new connection will suffice.*
- *Where surface water is connected to the Bridgewater Canal, agreement in principle from Bridgewater Canal Company is required. An email of acceptance of proposed flows and/or new connection will suffice.*
- *Hydraulic calculation of the proposed drainage system;*
- *Construction details of flow control and SuDS elements.*

Reason - To promote sustainable development, secure proper drainage and to manage the risk of flooding and pollution. This condition is imposed in light of national policies within the NPPF and NPPG and local policies EN08 and EN14'.

Therefore, Manchester City Council, acting as Lead Local Flood Authority (LLFA), and United Utilities (local water authority), need to be satisfied that the design and drainage principles of the proposed development will address the surface water management and risk of flooding within the site; will ensure that the drainage is managed and maintained for its lifetime to prevent flooding; and will ensure that the development will not increase the risk of flooding to neighbouring land and property.

2. National Policies and Water Management Guidance

2.1. National Planning Policy Framework (NPPF) and National Planning Practice Guidance (NPPG)

The NPPF 2019 sets out the Government's planning policies for England and how these should be applied. It provides a framework within which locally prepared plans for housing and other development can be produced. This document is used to form this surface water management report, with particular attention to Paragraphs 149 to 154 Planning for Climate Change, and Paragraphs 155 to 165 Planning for Flood Risk.

NPPG, Paragraph 051 states that sustainable drainage systems (SuDS) are designed to control surface water run off close to where it falls and mimic natural drainage as closely as possible, where they provide opportunities to reduce the causes and impacts of flooding; remove pollutants from urban run-off at source; and to combine water management with green space with benefits for amenity, recreation, and wildlife.

Further to this NPPG, Paragraph 080 states that the aim should be to discharge surface run off as high up the following hierarchy of drainage options as reasonably practicable which (in order) are into the ground (infiltration); to a surface water body; to a surface water sewer, highway drain, or another drainage system; to a combined sewer.

2.2. Flood and Water Management Act

The Flood and Water Management Act takes forward some of the proposals from three previous strategy documents published by the UK Government - Future Water (2008), Making Space for Water (2008) and the UK Government's response to the Sir Michael Pitt's Review of the summer 2007 floods. In doing so it gives the EA a strategic overview role for flood risk, and gives local authorities responsibility for preparing and putting in place strategies for managing flood risk from groundwater, surface water and ordinary watercourses in their areas.

2.3. Manchester Local Development Framework – Core Strategy Development Plan

Relevant Policy EN 8 states:

'All new development will be expected to be adaptable to climate change in terms of the design, layout, siting, and function of both buildings and associated external spaces. In achieving developments which are adaptable to climate change developers should minimise flood risk by appropriate siting, drainage, and treatment of surface areas to ensure rainwater permeability, and will be permitted to use green infrastructure elements such as green roofs'.

Relevant Policy EN 14 states:

'All new development should minimise surface water run-off, including through Sustainable Drainage Systems (SUDS) and the appropriate use of Green Infrastructure. Developers should have regard to the surface water run-off rates in the SFRA User Guide. In CDAs, evidence to justify the surface water run-off approach / rates will be required'.

Relevant Policy EN 17 states:

'Development should avoid any adverse impact on water quality, including during the construction phase, and wherever possible should seek to enhance water quality, both chemical and ecological; Development should minimise surface water run-off from development and associated roads, and maximise the use of appropriate sustainable drainage systems, to minimise groundwater contamination, and to avoid pollutants reaching watercourses; Development close to a watercourse should also ensure that waste or litter cannot enter the watercourse from the site; Development should, where feasible and appropriate, seek to open up any culverted or hidden watercourse beneath the site to improve the ecological status of that watercourse'.

3. Site Setting and Description

3.1. Site Location

The development site is in a residential area to the south-west of Manchester city centre, is approximately 350m west of Deansgate train station, and is bound by a residential building and car park to the north; hardstanding area and towpath leading to the Bridgewater Canal directly to the east; Slate Wharf and a public house to the south; and Slate Wharf to the west.

The full address of the development site is Castlefield Green Slate Wharf, Castlefield, Manchester, with the nearest postcode being M15 4ST, and the co-ordinates of the centre of the site being: Easting: 38305, Northing: 397500.

3.2. Existing Site and Topography

As detailed on the topographical survey plan in Appendix A, the site is currently developed and consists of grassed areas with a footpath to the north. Therefore, the development is deemed to be on a greenfield site.

In terms of levels, the site has general falls from north-west to south-east, with the high point along the north-west boundary being approximately 27.60m AOD, and the low-point along the south-east boundary being approximately 25.80m AOD

3.3. Proposed Development

The proposed site plan is shown in Appendix B, with a full description of the development site being stated by the Architect. In brief, and in relation to this surface water management report, the proposed development is to build a new residential building consisting of 24 apartments. The new building will cover most of the development area, with exception to a pedestrian access routes to the north and south, landscaping areas along the northern and eastern perimeter of the building, and an open green space to the south-east of the site.

3.4. Ground Conditions

Preliminary ground investigation found that the site consists of loose made ground with lots of brick, rubble inclusions, which lies on a concrete slab across much of the site at approx. 0.6m below ground level, over sandstone bedrock at an average of c.1.0m below ground level (varies from 0.8 – 1.2m). Therefore, based on the presence made ground, over a concrete slab and sandstone bedrock, it is deemed that the ground is not suitable for surface water infiltration.

3.5. Existing Drainage / Sewers

As detailed on the United Utilities asset plan in Appendix C, there is a 300mm diameter surface water sewer within Slate Wharf (south-west of site), which flows in an east to west direction, at a depth of apprixmtely1.50m (invert level 25.160). There a no known drainage networks within the development site area

3.6. Waterbodies

The nearest waterbody the development is the Bridge Water Canal located to the east of the development site. Based the topographical survey (Appendix A), the canal water level is estimated to be 25.800m AOD.

3.7. Development Areas

The overall development area is approximately 1060m² / 0.106 ha, with the pre-development site consists of grassed areas and a footpath, and therefore is deemed as a greenfield with an urban factor of 0.

The post development areas will consist of the new residential dwelling, and pedestrian access routes which equates to approximately 700m² / 0.070 ha, as well as the landscape and open green space grass areas equating to approximately 360m² / 0.036 ha. The surface water run-off from the landscape and open green space area is to continue to discharge of the site at a natural / greenfield rate, and is not included in the surface water management calculations. The surface water management area, therefore, equates to **0.070 ha.**

4. Surface Water Management Principles

4.1. Run-Off Destination

Surface water run-off is to discharge to one or more of the following in the order of priority shown: Discharge into the ground (infiltration); Discharge to a surface water body; Discharge to a surface water sewer, highway drain or other drain; Discharge to combined sewer.

4.2. The Management Train

A concept fundamental to implementing a successful SuDS scheme is the management train. This is a sequence of SuDS components that serve to reduce run-off rates and volumes and reduce pollution. The hierarchy of techniques that are to be used for the surface water management of the development are: Prevention - Prevention of run-off by good site design and reduction of impermeable areas; Source Control - Dealing with water where and when it falls (e.g. infiltration techniques); Site Control - Management of water in the local area (e.g. swales, detention basins); Regional Control - Management of run-off from sites (e.g. balancing ponds, wetlands).

4.3. Design Principles

The design principles for the surface water management of the development will be to: Ensure that people, property and critical infrastructure are protected from flooding; Ensure that the development does not increase flood risk off site; Ensure that SuDS can be economically maintained for the development.

4.4. Peak Surface Water Flow

The peak surface water flow from the post development site will adhere to the NPPF guidance, and Manchester City, Salford City and Trafford Councils Level 2 Hybrid SFRA – Guidance Notes May 2011, which states that:

'Development should aim to deliver Greenfield runoff on Greenfield sites up to a 1 in 100-year storm event, considering climate change'.

4.5. Surface Water Run-Off Volume

The surface water run-off volume is to adhere to Condition 15 of the planning consent notice, which states:

Run-off *volume in the 1 in 100-year, 6 hours rainfall shall be constrained to a value as close as is reasonably practicable to the greenfield runoff volume for the same event, but never to exceed the run-off volume from the development site prior to redevelopment.*

4.6. Flood Risk

The prevention of flood risk is to adhere to Condition 15 of the planning consent notice, which states:

Evidence that the drainage system has been designed so that flooding does not occur during a 1 in 100-year rainfall event in any part of a building.

4.7. Pollution

The SuDS design for the development site will ensure that the quality of any receiving water body is not adversely affected and preferably enhanced in accordance with Ciria SuDS Manual C753, Chapter 4.

4.8. Designing for Exceedance

The design for exceedance is to adhere to Condition 15 of the planning consent notice, which states:

'Assessment of overland flow routes for extreme events that is diverted away from buildings. Overland flow routes need to be designed to convey the flood water in a safe manner in the event of a blockage or exceedance of the proposed drainage system capacity. The flood water should be routed away from the buildings and towards the less vulnerable areas i.e. open spaces, car parks and roads. A layout with overland flow routes needs to be presented'.

5. Surface Water Run-Off Destination

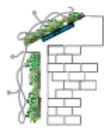
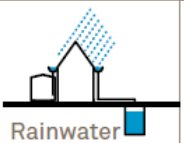
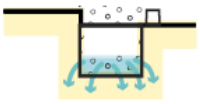
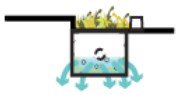
The destination of the surface water run-off from the post development site has been assessed against the prioritisation set by the Approved Document H (2010). The feasibility of the surface water run-off to the priority receptors are as follows:

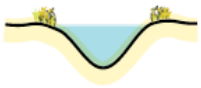
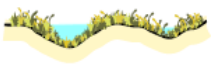
Run-Off Destination	Feasible	Description
Discharge to Ground	No	Preliminary ground investigation found that the site consists of loose made ground, which lies on a concrete slab across much of the site, over sandstone bedrock. Therefore, based on the presence made ground, over a concrete slab and sandstone bedrock, it is deemed that the ground is not suitable surface water discharge to ground.
Discharge to Surface Water Body	No	The nearest waterbody to the development site is the Bridgewater Canal to the east. However, discharge to the canal is not feasible due to: The water level of the canal being relatively high compared to the development site, and therefore surcharging the drainage network, limited surface water attenuation / storage options which is likely to lead to either high discharge rate or flooding; There being 3rd party land for the surface water network to cross, which is unlikely to be approved due to the disruptive nature and damage to protective areas; The velocity of any surface water discharge being too great, and therefore the requirement for a very wide outfall.
Discharge to Surface Water Sewer	**Yes**	As the ground is not suitable for infiltration, and discharge to the waterbody (canal) is not feasible, the only alternative is to discharge to the 300mm diameter surface water sewer within Slate Wharf. In a pre-development response letter / email in April 2021 (refer to Appendix D) United Utilities have stated if the surface water cannot discharge to ground or waterbody, then it can discharge to the 300mm sewer at a peak rate of 5.0 l/s.
Discharge to Highway Drain or Other	No	There are no know highway drains near the development site, and therefore discharge to a highway drain is not a feasible destination.
Discharge to Combined Water Sewer	No	There are no know combined water sewers near the development site, and therefore discharge to a combined water sewer is not a feasible destination.

6. SuDS Feasibility

To reduce the surface water run-off to the greenfield rate, SuDS methods are to be introduced to the post development design.

SuDS methods as per the Sustainable Drainage System (SuDS) hierarchy, and the Non-Statutory Technical Standards for Sustainable Drainage Systems – March 2015, that can be used are detailed below:

	Description	Setting	Required area
 Green roofs	A planted soil layer is constructed on the roof of a building to create a living surface. Water is stored in the soil layer and absorbed by vegetation.	 Building	Building integrated.
 Rainwater harvesting	Rainwater is collected from the roof of a building or from other paved surfaces and stored in an overground or underground tank for treatment and reuse locally. Water could be used for toilet flushing and irrigation.	 Building	Water storage (underground or above ground).
 Soakaway	A soakaway is designed to allow water to quickly soak into permeable layers of soil. Constructed like a dry well, an underground pit is dug filled with gravel or rubble. Water can be piped to a soakaway where it will be stored and allowed to gradually seep into the ground.	 Open space	Dependant on runoff volumes and soils.
 Filter Strip	Filter strips are grassed or planted areas that runoff is allowed to run across to promote infiltration and cleansing.	 Open space	Minimum length 5 metres.
Permeable paving	Paving which allows water to soak through. Can be in the form of paving blocks with gaps between solid blocks or porous paving where water filters through the block itself. Water can be stored in the sub-base beneath or allowed to infiltrate into ground below.	 Street/open space	Can typically drain double its area.
 Bioretention area	A vegetated area with gravel and sand layers below designed to channel, filter and cleanse water vertically. Water can infiltrate into the ground below or drain to a perforated pipe and be conveyed elsewhere. Bioretention systems can be integrated with tree-pits or gardens.	 Street/open space	Typically surface area is 5-10% of drained area with storage below.

	Description	Setting	Required area
 Swale	Swales are vegetated shallow depressions designed to convey and filter water. These can be 'wet' where water gathers above the surface, or 'dry' where water gathers in a gravel layer beneath. Can be lined or unlined to allow infiltration.	 Street/open space	Account for width to allow safe maintenancce typically 2-3 metres wide.
 Hardscape storage	Hardscape water features can be used to store run-off above ground within a constructed container. Storage features can be integrated into public realm areas with a more urban character.	 Open space	Could be above or below ground and sized to storage need.
 Pond / Basin	Ponds can be used to store and treat water. 'Wet' ponds have a constant body of water and run-off is additional, while 'dry' ponds are empty during periods without rainfall. Ponds can be designed to allow infiltration into the ground or to store water for a period of time before discharge.	 Open space	Dependant on runoff volumes and soils.
 Wetland	Wetlands are shallow vegetated water bodies with a varying water level. Specially selected plant species are used to filter water. Water flows horizontally and is gradually treated before being discharged. Wetlands can be integrated with a natural or hardscape environment.	 Open space	Typically 5-15% of drainage area to provide good treatment.
 Underground storage	Water can be stored in tanks, gravel or plastic crates beneath the ground to provide attenuation.	 Open space	Dependant on runoff volumes and soils.

The feasibility of the above SuDS methods for the post developed site are summarised in the table below:

SuDS Method	Feasible Use	Description
Living Roofs	No	The proposed dwelling has not been structurally designed for living / green roof systems. Therefore, this is not a suitable SuDS method.
Rainwater Harvesting	**Yes**	Due to the cost of dual pipework for a full rainwater harvesting system, and the annual rainfall yield is less than the annual water demand (apartment building), this is deemed unfeasible method. However, rainwater harvesting butts can be installed at rainwater pipe locations, where the SW can be used for irrigation.
Soakaway	No	Preliminary ground investigation found that the site consists of loose made ground, which lies on a concrete slab across much of the site, over sandstone bedrock. Therefore, based on the presence made ground, over a concrete slab and sandstone bedrock, it is deemed that the use of soakaways are not feasible.
Filter Drains	**Yes**	A filter drain system can be formed below the planting area to the east of the site, which will take the surface water urn-off from the terrace areas. The surface water will not discharge to ground (for reasons stated above), but will be conveyed via a

		perforated pipe from the granular filled trench, and into the main drainage network. A filter drain system will reduce the surface water run-off rate from the terrace areas, and will act as a pollutant control.
Permeable Surfacing	**Yes**	A permeable paving system can be formed in the pedestrian areas to the south of the site. The surface water will not discharge to ground (for reasons stated above), but will be conveyed via a perforated pipe from the sub-base of the paving system, and into the main drainage network. A permeable paving will reduce the surface water run-off rate from the pedestrian areas, act as attenuation, and will act as a pollutant control.
Bioretention area / Swales / Ponds	No	The external soft landscaping areas are either to be used for planting, or are to be formed to be used for recreation / amenity spaces. Therefore, due to limited space when the development, the use of bioretention areas, swales or ponds is not feasible.
Hardscape Storage	**Yes**	Hardscape Storage can be formed in the pedestrian areas to the north of the site. The surface water will not filter through the paving surface, but will have a sub-base that will act as attenuation. The surface water is to distributed through the sub-base material via perforated pipes, with water surcharging the pipes and sub-base during extreme storm events.
Underground Storage	**Yes**	The surface water run-off from the development site will be restricted to as low as possible with a suitably sized flow control opening. The rate will be lower than the surface water run-off rate, therefore there will be a requirement to have below ground attenuation in the form of the drainage network and cellular units, to prevent flooding.

7. Development Greenfield Run-Off Rate and Volumes

To minimise the surface water run-off from the new development areas of the site, it is preferred that the post development surface water run-off be restricted to the equivalent greenfield run-off rate and volume for the post development area.

7.1. Greenfield Run-Off Rate

The Flood Estimation Handbook (FEH) is often used for the calculation of the greenfield run-off rate, however, relevant documents state that to calculate the greenfield run-off rates on small catchments less than 25km², the IH 124 QBAR equation (and the equation for the instantaneous time to peak for the unit hydrograph approach) is to be used. The IH method is based on the Flood Studies Report (FSR) approach and is developed for use on catchments less than 25km². It yields the Mean Annual Maximum Flood (QBAR). This reference also recommends the use Ciria C753 Table 24.2 to generate Growth Factors. These are used to convert QBAR to different return periods for different regions in the UK.

The input variables to establish QBAR are:

Return Period (years)	Results based on a range of return periods and the specified RP;
Area	Catchment Area (ha) which is adjusted to km2 for use in the equation;
SAAR	Average annual rainfall in mm (1941-1970) from FSR figure II.3.1;
Soil	Procedure Volume 3. Soil classes 1 to 5 have Soil Index values of 0.15, 0.3, 0.4, 0.45 and 0.5 respectively;
Urban	Proportion of area urbanised expressed as a decimal;
Region Number	Region number of the catchment based on FSR Figure I.2.4.

QBAR(l/s)

The output variables to establish QBAR are calculated using the following formula (equation yields m³/s):

QBAR = 0.00108 x AREA$^{0.89}$ x SAAR$^{1.17}$ x SOIL$^{2.17}$

The IH 124 Variables (taken from FSR) that are specific to this site are as follows:

Area	=	50.00 ha
SAAR	=	864
Soil	=	0.450
Urban Factor	=	0.00
Region Number	=	10

Based on these variables, and the calculation results provided by the MicroDrainage computer software (Appendix E), the QBAR for a 50.00ha catchment area is:

$QBAR_{Rural}$ = 281.00 l/s

This figure is for the catchment area of 50.00 ha, and is to be reduced to reflect the surface water catchment area (0.070 ha) of the development site. Therefore, the QBAR (greenfield run-off) for development area has been calculated to be:

$QBAR_{Rural}$ = **0.39 l/s (5.62 l/s/ha)**

Ciria C753 Table 24.2 identifies the growth factors for each of the storm events, based on the known QBAR figure. The growth factors from the table vary depending on the site location. In this case hydrometric area (Region Number) is 10.

Based on the figures shown in the table, the growth factors, and the existing greenfield run-off rates for each of the storm events for the development areas of the site are as follows:

Storm Event	QBAR	Growth Factor (C753 Table 24.2)	Greenfield Run-off Rate
Q_1	0.39 l/s	0.87	**0.3 l/s**
Q_{30}	0.39 l/s	1.70	**0.7 l/s**
Q_{100}	0.39 l/s	2.08	**0.8 l/s**

7.2. Greenfield Run-Off Volume

The greenfield run-off volume for the 100-year, 6-hour storm event has also been calculated in the MicroDrainage software using the data from the Flood Estimation Handbook (FEH), with the results shown in Appendix E.

The FEH data and variables used to calculate the greenfield run-off volume at the development site locations are as follows:

Site Location = GB 383050 397550 SJ 83050 97550

C (1km) = -0.026

D1 (1km) = 0.341

D2(1km) = 0.373

D3 (1km) = 0.331

E (1km) = 0.303

F (1km) = 2.448

Areal Reduction Factor = 1.000

Area = 6453.250 ha

SAAR = 1009

CWI = 123.385

SPR Host = 36.030

URBTEXT = 0.00

Based on these variables, and the calculation results provided by the MicroDrainage computer software (Appendix E), the greenfield run-off volume for the overall catchment area at the site location is:

$Q_{100\ (6\text{-}Hour)}$ = 1,807,492.567m³

This figure is for the catchment area of 6453.252 ha, and is to be reduced to reflect the surface water catchment area of the development site which is 0.070 ha. Therefore, the greenfield run-off volume for the development site area has been calculated to be:

$Q_{100\ (6\text{-}Hour)}$ = **19.60m³ (280.09m³/ha)**

8. Drainage Networks and Surface Water Management Calculation

8.1. Climate Change

The NPPF makes it a planning requirement to account for climate change in the proposed design. The recommended allowances are taken from the Environment Agency guidance (Table 2) summarised in Table 4 below.

Applies across all of England	Total change anticipated for the 2020's	Total change anticipated for the 2050's	Total change anticipated for the 2080's
Upper End	10%	20%	**40%**
Central	5%	10%	20%

The baseline year is 1961 to 1990. It is anticipated the life span of the proposed residential building will be approximately 80 years, and therefore will fall at least into the 2080's and will have rainfall intensity increase of 40%.

8.2. Surface Water Network Calculations

The FEH data and variables used to calculate the required below ground attenuation network and attenuation volumes at the development site are as follows:

SW Management Area = 0.070 ha

Site Location = GB 383050 397550 SJ 83050 97550

C (1km) = -0.026

D1 (1km) = 0.341

D2(1km) = 0.373

D3 (1km) = 0.331

E (1km) = 0.303

F (1km) = 2.448

8.3. Surface Water Drainage Network

As shown on the below ground drainage layout drawing in Appendix F, the proposed surface water network will consist of 150mm diameter pipes; 100mm diameter perforated pipes; 460mm diameter inspection chambers; a 1200mm diameter flow control chamber containing a hydro-brake; a permeable paving system; and a shallow swale / pond.

The surface water run-off from the roof areas will discharge to the main network via rainwater pipes; the surface water run-off from the southern pedestrian access area will discharge to the main network via permeable surfacing system; the surface water run-off form the eastern terrace areas will discharge to the main network via filter drains; and surface water run-off from the northern pedestrian access area will discharge to the main network via channel drains.

The main surface water network will flow to the south of the site where the surface water will discharge through the flow control chamber and into the 300mm diameter sewer in Slate Wharf, via manhole Ref: UU 0401.

Surface water is to be restricted by the flow control prior to the discharge to the sewer, with restricted surface water surcharging the network and being attenuated within the drainage network, permeable paving sub-base, hardscape storage sub-base, and attenuation tank in the form of cellular units.

8.4. Surface Water Run-Off Rate

For the surface water run-off from the development site to be at the greenfield run-off rate, they are to be restricted to 0.3 l/s for the 1 in 1-year storm event; 0.7 l/s for the 1 in 30-year storm event, and 0.8 l/s for the 1 in 100-year storm event including 40% rainfall intensity increase (climate change).

United Utilities have stated (see correspondence in Appendix D) that the maximum discharge to the 300mm diameter surface water sewer in Slate Wharf is 5.0 l/s.

An assessment of the suitable flow control opening, and subsequent surface water discharge needs to assessed, where Ciria document C753 – The SuDS Manual states that: *'the flow controls / orifice design should be designed so that it has simplicity on operation, and has resistance to clogging, blocking or mechanical failure'.*

The flow control (hydro-brake) therefore is to be a suitable diameter where the surface water run-off discharge form the development area of the site is as close to the greenfield rates as possible, and will be a size where the likelihood of blockage and subsequent flooding is reduced.

Due to the greenfield run-off rates being extremely low, a suitable flow control cannot be sized to restrict the post development run-off to the required rates. Therefore, based on the guidance and industry knowledge, the suitable / minimum size of the flow control opening is deemed to be 40mm.

As shown in the surface water network / management calculation produced in the MicroDrainage computer software (Appendix G), if the hydro-brake opening is set at 40mm, the maximum surface water run-off rates for each storm event will be as follows:

Strom	**-**	**Rate**	**-**	**Critical Storm Event**
Q_1	**-**	**0.6 l/s**	-	15-minute winter storm duration
Q_{30}	**-**	**0.6 l/s**	-	15-minute winter storm duration
Q_{100}	**-**	**0.8 l/s**	-	480-minute winter storm duration

A summary of the post development surface water run-off rates compared to the greenfield rates are as follows:

Greenfield Rate to Post Development Rate

Strom	**-**	**QBAR**	**-**	**Post Dev**	**-**	**Difference**
Q_1	-	0.3 l/s	-	0.6 l/s	-	2.00 x Greenfield
Q_{30}	-	0.7 l/s	-	0.6 l/s	-	**Equivalent Greenfield**
Q_{100}	-	0.8 l/s	-	0.8 l/s	-	**Equivalent Greenfield**

The surface water run-off rates are greater than the 1-year greenfield rate but is the equivalent of the 30-year and 100-year greenfield rate.

Therefore, the surface water run-off from the post development site adheres to the Manchester City, Salford City and Trafford Councils SFRA, and subsequent Planning Condition 15 requirements, which is deemed to be acceptable.

8.5. Surface Water Run-Off Volume

The surface water run-off volumes for the post development site can be calculated for 1 in 100-Year the 6-hour duration (Inc. 40% RII), based on the peak discharge rate of 0.8 l/s, where:

$Q_{100\ (6\text{-hour})}$ - 0.8 l/s x (60 x 60 x 6) - 17,280 litres - **17.28m³**

A summary of the post development surface water run-off volume compared to the greenfield volumes are as follows:

Greenfield Volume to Post Development Volume

Strom	**-**	**Greenfield**	**-**	**Post Dev**	**-**	**Difference**
Q_{100}	-	19.60m³	-	17.28m³	-	0.88 x Greenfield (22% betterment)

The surface water run-off volume for the 100-year, 6-hour storm event is a 22% betterment of the greenfield run-off volume. Therefore, the surface water run-off volume from the post development site adheres to the Planning Condition 15 requirements, which is deemed to be acceptable.

8.6. Surface Water Network and Attenuation Calculations

As the positively drained areas of the post development site are being restricted, there will be a requirement for below ground attenuation to prevent flooding.

Ciria SuDS Manual 2015, Paragraph 10.2.4 where it states that: *'Exceedance flows (i.e. flows more than those for which the system is designed) should be managed safely in above-ground space such that risks to people and property are acceptable'.*

The surface water attenuation for the development site will be within the drainage network, sub-base of the permeable paving hardscape storage, and cellular units. As detailed in the MicroDrainage calculations (Appendix G), and below ground drainage layout (Appendix F), the attenuation volume for the SuDS method is as follows:

Attenuation Tank (Cellular Units)

Tank Area	-	64.50m²
Tank Depth	-	0.80m
Tank Porosity	-	0.95
Maximum Tank Volume	-	49.00m³ (51.60m³ total volume)

Permeable Paving Sub-Base

Paving Area	-	10.00m²
Sub-Base Depth	-	0.30m
Sub-Base Porosity	-	0.30
Max. Sub-Base Volume	-	0.90m³

Hardscape Storage Sub-Base

Paving Area	-	64.00m²
Sub-Base Depth	-	0.45m
Sub-Base Porosity	-	0.30
Max. Sub-Base Volume	-	8.64m³

The surface water network / management (MicroDrainage) calculations in Appendix G, shows that with the proposed drainage network and SuDs attenuation methods of permeable paving / hardscape storage sub-base and cellular units, no flooding will occur for all storms up to and including the 1 in 100-year event + 40% climate change.

9. Maintenance Requirements

Details of the maintenance required, and the parties to carry out the maintenance of all drainage aspects, to ensure that the SuDS methods are working affectively, and subsequently reducing the risk of flooding on the site are as follows:

The management and maintenance of the surface water drainage networks and SuDS features will be by contractors appointed by the estate managers of the residential development, where payments of the works will form part of the property deeds and / or rental agreements. The maintenance of the drainage and SuDS will form part of the overall site management / landscaping / gardening, and will be carried out as follows:

9.1. Drainage Network and Cellular Units

The required maintenance for the drainage network will be as follows:

Operation	Frequency
Inspect and identify any areas that are not operating correctly, if required, take remedial actions	Monthly for 3 months, then six monthlies
Debris removal from manholes (where may cause risk performance)	Monthly
Where rainfall into network from above, check surface or filter for blockage or silt, algae, or other matter by jetting	As required, but at least twice a year
Remove sediment from pipework by jetting.	Annually or as required
Repair/check all inlets, outlets, and overflow pipes	As required
Inspect/check all inlets, outlets, and overflow pipes to ensure that they are in good condition and operating as designed	Annually and after large storms

9.2. Permeable Paving and Hardscape Storage System

The required maintenance for the permeable paving system will be as follows:

Operation	Frequency
Inspect and identify any areas that are not operating correctly, if required, take remedial actions	Monthly for 3 months, then six monthlies
Debris removal from on surface of paving system (where may cause risk performance)	Monthly
Where rainfall infiltration into paving ensure working effectively.	As required, but at least twice a year

10. Water Quality

The level of water treatment is to be assessed against the details set out in Ciria SuDS Manual C753. Chapter 26 sets out the Pollution Hazard Indices for different land classifications, and how to calculate that against the SuDS mitigation indices to show suitable levels of treatment.

Roof Pollutant Hazard

C753 Table 26.2 Pollution Hazard Level = Very Low

C753 Table 26.2 Pollution Hazard Index:

- Total Suspended Solid (TSS) = 0.2
- Metals = 0.2
- Hydrocarbons = 0.05

Pollution Hazard Index = **0.45**

Pedestrian and Terrace Area Pollutant Hazard

C753 Table 26.2 Pollution Hazard Level = Low

C753 Table 26.2 Pollution Hazard Index:

- Total Suspended Solid (TSS) = 0.5
- Metals = 0.4
- Hydrocarbons = 0.4

Pollution Hazard Index = **1.30**

Roof, Pedestrian and Terrace Area Pollutant Mitigation

Mitigation Measures:

- Paving Sub-Base and Filter Drains

Paving Sub-Base and Pollutant Mitigation Indices

- Total Suspended Solid (TSS) = 0.7
- Metals = 0.7
- Hydrocarbons = 0.5

SuDS Mitigation Indices = **1.90**

11. Designed Exceedance Event

If an extreme storm greater than the designed 1 in 100-year + 40% climate change were to occur, there is a potential for the network to flood. Flood water will follow the topography of the post and pre-development site, where it will flow away from the proposed residential building, towards the south-east boundary and into the Bridgewater Canal. The flood water will not flow towards any existing dwelling / properties near the site, and therefore will not increase the risk of flooding to the proposed dwelling or to neighbouring land and property.

Appendix A Topographical Survey

ISSUE				
Rev	Description	By	Chk	Date
01	Planning	PG	MJG	14/10/16

All dimensions to be as noted (to be checked on site prior to manufacture). Do not scale of this drawing. Report any discrepancies to the Architect / CA immediately.

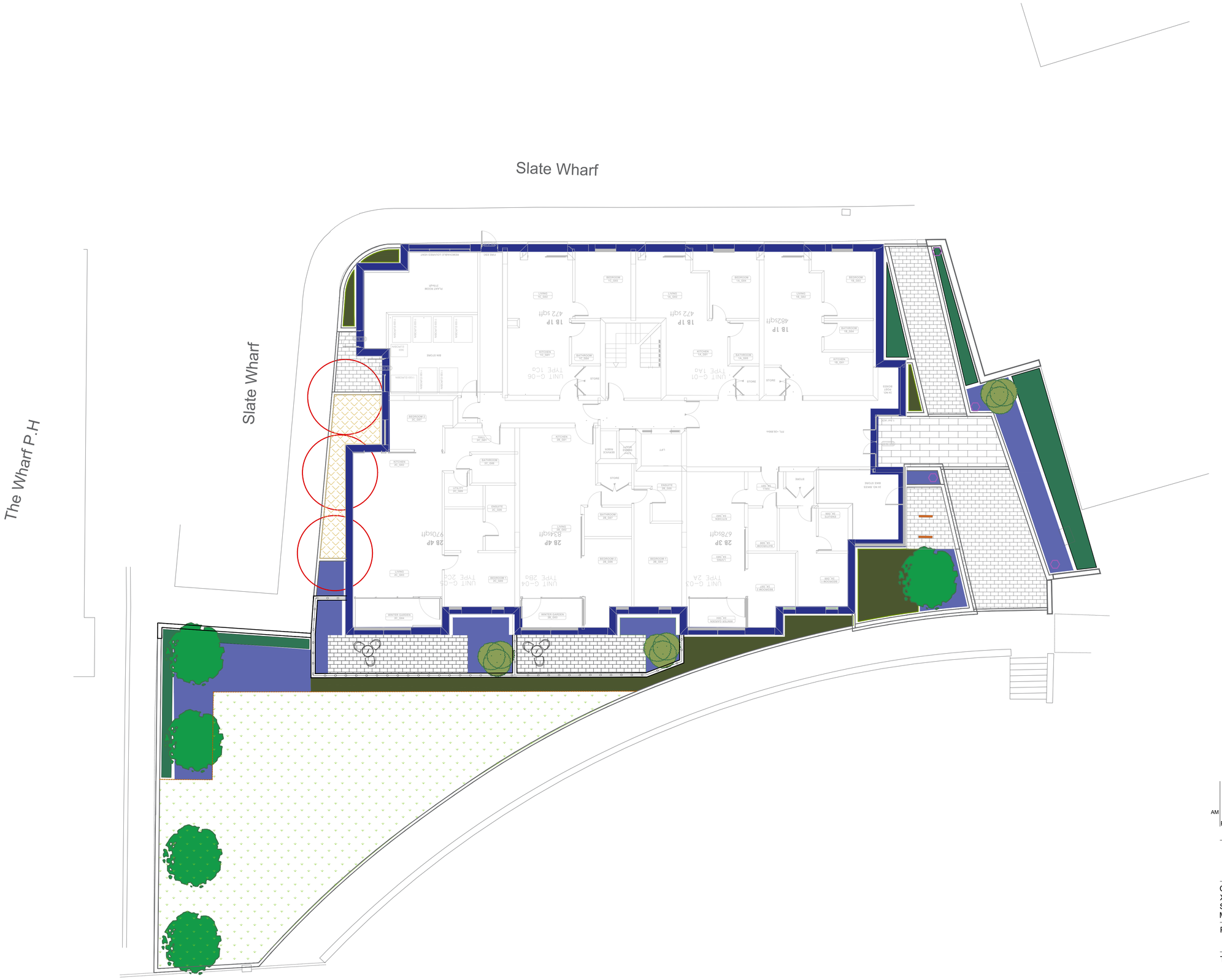
Project	Plot G, Castlefield	Project No.	15-22	Rev.	01
		Dwg. No.	P_L(--)012	By	PG
Title	Site Topographical Survey	Date	March 16	Chk.	MJG
		Scale	1:100 @ A1	App.	00

GA STUDIO

mail@gastudio.co.uk
www.gastudio.co.uk
tel. 0161 835 3538

Architects / Masterplanning / Urban Design

Appendix B Proposed Site Plans



NOTES:

DO NOT SCALE. Use figured dimensions only.

The Contractor is requested to check all dimensions before the work is put to hand.

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All discrepancies to be reported to the landscape architect before manufacture or construction.

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KEY

Proposed Development

Existing trees to be removed.

Hard Landscape

P01 Slate Plank Paving
Size - 600 x 200 x 40mm
Colour - Slate Grey
Finish - Gritblasted

P02 Yorkstone
Size - 300 x 100 x 40mm
Colour - Buff
Finish - Flamed

P03 Flexible Porous Paving
50% recycled rubber tyres 50% stone aggregate
Colour - Black/Buff

E01 Granite Kerb (Raised)
Size - 200 x 250 x 900mm
Colour - Buff
Finish - Flamed

E02 Granite Kerb (Flush)
Size - 150 x 200 x 900mm
Colour - Buff
Finish - Flamed

E03 Steel Edging
Finish - TBC

B01 Boundary Wall with Railing
Size - 600mm brick wall with stone coping,1000mm railing
Colour - brick to match building; railing to match window RAL no 7021 Black Grey

B02 Boundary Wall
Size - 600mm brick wall with stone coping
Colour - brick to match building

Street Furniture

F03 Cycle Stand
Size - 800 x 715 mm

L01 Lighting Column/bollard
Spec TBC
Location TBC

Soft Landscape

T01 Street Tree
Extra heavy standard trees, with a height of 3.5-4.5m and minimum clear stem of 1.75m

T02 Garden MS Tree
Multistem, with a height of 3-4m.

H01 Formal Hedge Planting
Native species hedge planting. Planted in 2 staggered rows, 350mm apart with 4no. plants per m.

PT01 Ornamental Garden
Planting swathes to front gardens including ornamental grasses, shrubs, bulbs and flowering perennials.

PT02 Shrub Planting
Block planting of flowering, evergreen shrubs maintained at 0.9m high provide green buffer.

PT03 Meadow Planting
Meadow established with turf for faster establishment

NORTH

Rev	Description	Date
AM	D01 First issue for comment	25 08 21

CW Studio Ltd

CW Studio
XYZ Building, 1st Floor
Spinningfields
Manchester M3 3AQ

Tel: 0161 464 3895
info@cwstudio.co.uk

Project
Slate Wharf

Title
Landscape Proposals

Date
August 2021

Issued for
Comment

Drawing No.
2113-CWS-XX-GF-DR-L-101

Scale
1:100 @ A1

Rev. No.
D01

IMPORTANT NOTES:

DRAFT

REVISION	DATE	DESCRIPTION

CLIENT: PRESTBURY ESTATES

PROJECT: SLATE WHARF

ADDRESS: SLATE WHARF, MANCHESTER, M15 4ST

DRAWING TITLE: PROPOSED GROUND FLOOR PLAN

SCALE: 1:50@A1 DATE: JULY 2021

DRAWING NO: A615_T_100

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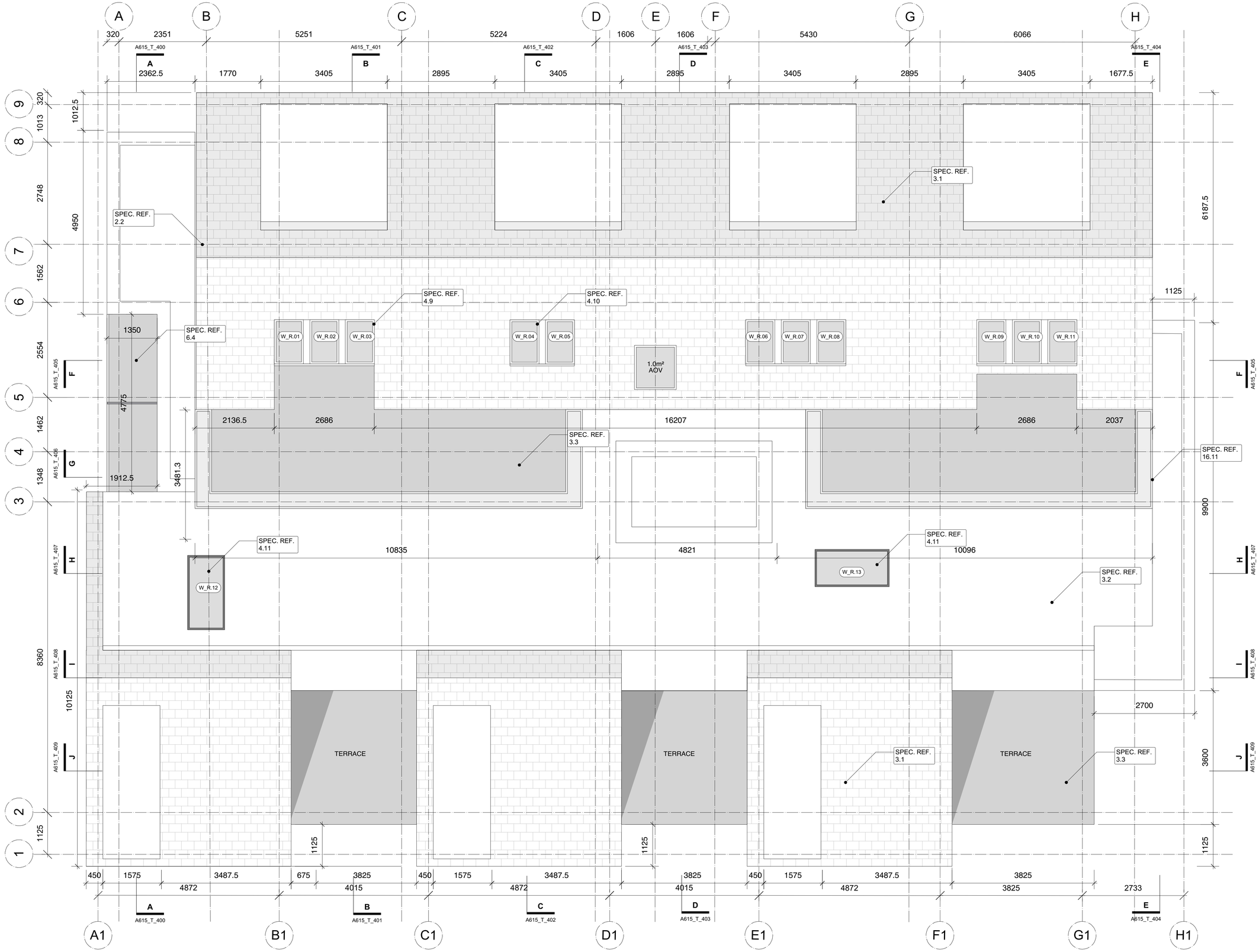

IMPORTANT NOTES:

DRAFT

REVISION	DATE	DESCRIPTION

CLIENT: PRESTBURY ESTATES

PROJECT: SLATE WHARF

ADDRESS: SLATE WHARF, MANCHESTER, M15 4ST

DRAWING TITLE: PROPOSED ROOF PLAN

SCALE: 1:50@A1 | DATE: JULY 2021

DRAWING NO: A615_T_105

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REVISION	DATE	DESCRIPTION

CLIENT: PRESTBURY ESTATES

PROJECT: SLATE WHARF

ADDRESS: SLATE WHARF, MANCHESTER, M15 4ST

DRAWING TITLE: PROPOSED SOUTH ELEVATION

SCALE: 1:50@A1 | DATE: JULY 2021

DRAWING NO: A615_T_301

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IMPORTANT NOTES:

DRAFT

REVISION	DATE	DESCRIPTION

CLIENT: PRESTBURY ESTATES

PROJECT: SLATE WHARF

ADDRESS: SLATE WHARF, MANCHESTER, M15 4ST

DRAWING TITLE: PROPOSED WEST ELEVATION

SCALE: 1:50@A1 | DATE: JULY 2021

DRAWING NO: A615_T_302

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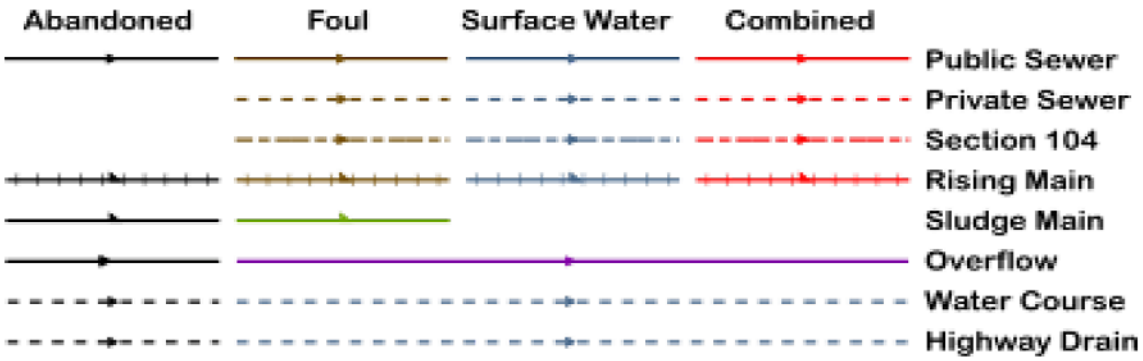
Appendix C United Utilities Asset Plan

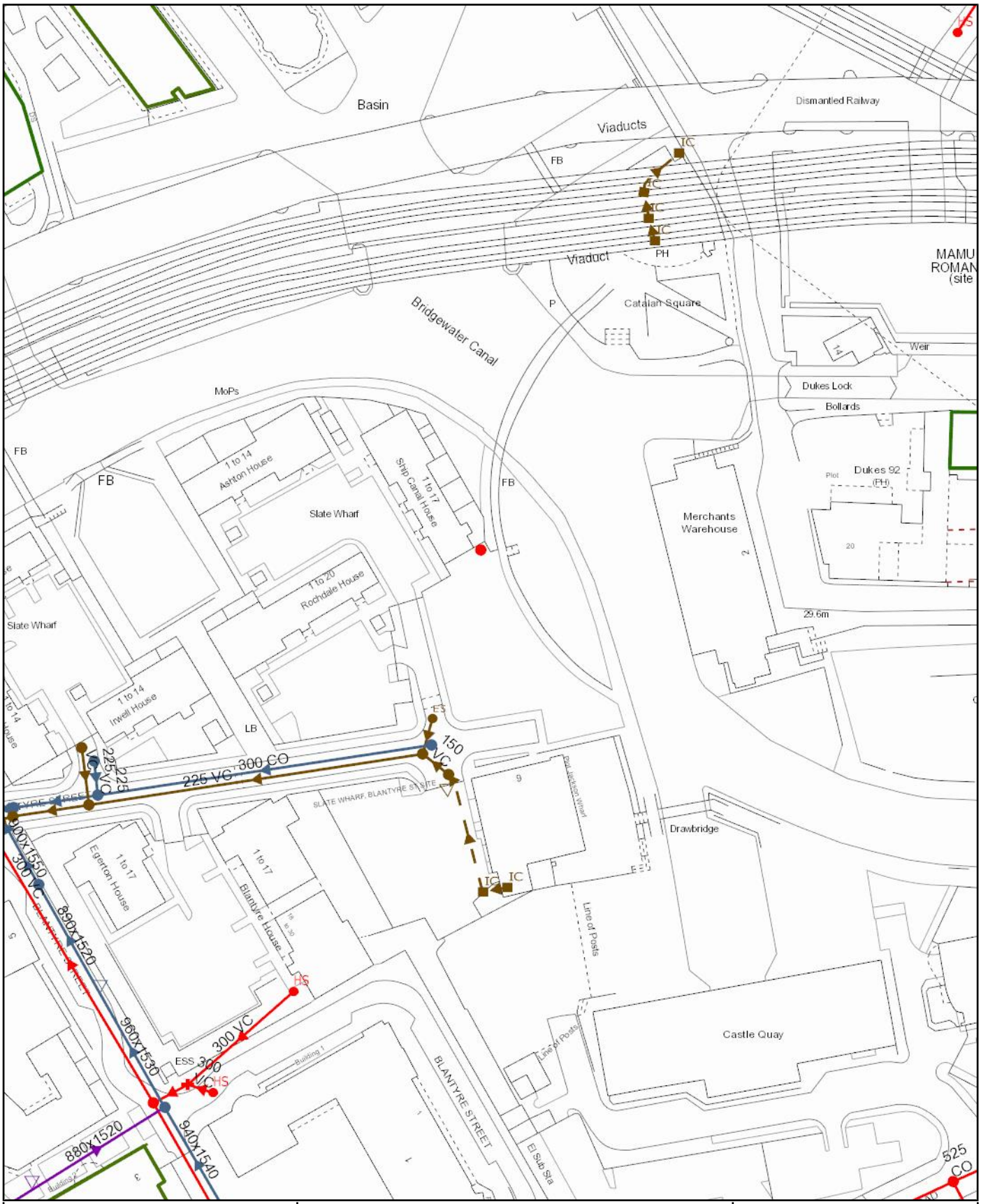
United Utilities
Water for the North West

Wastewater Symbology



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

- Manhole
- HS Head of System
- ES Extent of Survey
- RE Rodding Eye
- IN Inlet
- DP Discharge Point
- HY Vortex
- PE Penstock
- WO Washout Chamber
- VA Valve
- AV Air Valve
- NRV Non Return Valve
- SO Soakaway
- GU Gully
- CA Cascade
- FM Flow Meter
- HA Hatch Box
- OI Oil Interceptor
- SM Summit
- DS Drop Shaft
- OP Orifice Plate
- Side Entry Manhole
- Outfall
- Screen Chamber
- IC Inspection Chamber
- Bifurcation Chamber
- LH Lamp Hole
- T Junction / Saddle
- CA Catchpit
- VC Valve Chamber
- Vent Column
- Vortex Chamber
- Penstock Chamber
- T Network Storage Tank
- V Sewer Overflow
- WwTW Ww Treatment Works
- Ww Pumping Station
- ST Septic Tank
- CK Control Kiosk
- Change of Characteristic



Scale:	1:1250	**SEWER RECORDS**	United Utilities Water for the North West
Date:	25/05/2021		
Address or Site Reference:	16 MANSON AVENUE, MANCHESTER, M15 4FT		
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.

Appendix D United Utilities Correspondence

Mark Symonds

From: Perry, Graham <Graham.Perry@uuplc.co.uk>
Sent: 19 April 2021 18:15
To: Dave Mason
Cc: Wastewater Developer Services
Subject: Pre Development Enquiry for : Plot G Castlefield Basin Blantyre Street Manchester UU Reference Number : 4200038821
Attachments: wastewater_predevelopment_enquiry_2016_web_acc16.pdf; 113617_FO_2016-DECISION_NOTICE-1593865[1].pdf; Site Plan.pdf; Greenfield Run-Off Rate.pdf

Hello Dave

Pre Development Enquiry for: Plot G Castlefield Basin Blantyre Street Manchester UU Reference Number : 4200038821

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 3723223 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 225mm diameter public foul water sewer within Blantyre Street located to the west 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.

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.

Waterbody

If an evidence based assessment has been carried out and confirms that infiltration is not feasible, we recommend that you contact the Lead Local Flood Authority and/or Environment Agency to discuss a point of discharge to the canal which is to the east of the proposed site.

We would encourage you to identify and engage with any third party landowner and riparian owner to agree access and discharge rights to the water body if this is not in your ownership.

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 300mm diameter public surface water sewer within Blantyre Street located west of the proposed site at a pass forward flow to be agreed by the Lead Local Flood Authority. United Utilities request that any agreed rate does not exceed 5 l/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 pubic sewerage network under any circumstances

Sewer Adoptions

You have indicated on your application form that you intend to put the sewers forward for adoption (including any SuDS components that can come within the meaning of a sewer).

United Utilities assess adoption applications based on the current Design & Construction Guidance and local practices which have now replaced 'Sewers For Adoption 6th Edition'.

We recommend that you submit a pre design assessment to the sewer adoption mailbox (SewerAdoptions@uuplc.co.uk) stating pre design assessment in the title

Please refer to link**s** below to obtain further guidance:

https://www.unitedutilities.com/builders-developers/larger-developments/wastewater/sewer-adoptions/

Site drainage must be designed in accordance with Building Regulations, National Planning Policy, and local flood authority guidelines, we would recommend that you speak and make suitable agreements with the relevant statutory bodies.

If you intend to put forward your wastewater assets for adoption by United Utilities, the proposed detail design will be subject to a technical appraisal by an Adoption Engineer as we need to be sure that the proposals meets the requirements set out in the Design & Construction Guidance. The proposed design should give consideration to long term operability and give United Utilities a safe and cost effective proposal for the lifetime of the assets. In these cases, we strongly recommend that no construction commences until the detailed drainage design, submitted as part of the Section 104 application, has been assessed and accepted in writing by United Utilities. Any work carried out prior to the technical assessment being approved is done entirely at the developer's own risk and could be subject to change.

Codes For Adoption

The new Codes for Adoption are outlined on the Water UK Website. The link below takes you to their webpage:

https://www.water.org.uk/technical-guidance/developers-services/codes-for-adoption/

A free copy of the new Design & Construction Guidance can be downloaded via the link below**:**

https://www.water.org.uk/wp-content/uploads/2020/03/SSG-App-C-Des-Con-Guide-v-2-100320-C.pdf

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. 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/larger-developments/wastewater/sewer-connections/

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,

Graham Perry

Graham Perry
Development Engineer
Developer Services
M: 07557 577548
T: 01925 679405
unitedutilities.com

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Appendix E Greenfield Run-Off Rates and Volume Calculation

IH 124 Mean Annual Flood

Input

Return Period (years)	1	Soil	0.450
Area (ha)	50.000	Urban	0.000
SAAR (mm)	864	Region Number	Region 10

Results l/s

QBAR Rural	281.0
QBAR Urban	281.0
Q1 year	244.5
Q1 year	244.5
Q2 years	261.7
Q5 years	334.4
Q10 years	387.8
Q20 years	441.8
Q25 years	460.8
Q30 years	476.4
Q50 years	519.8
Q100 years	584.5
Q200 years	663.1
Q250 years	688.4
Q1000 years	854.2

Greenfield Runoff Volume

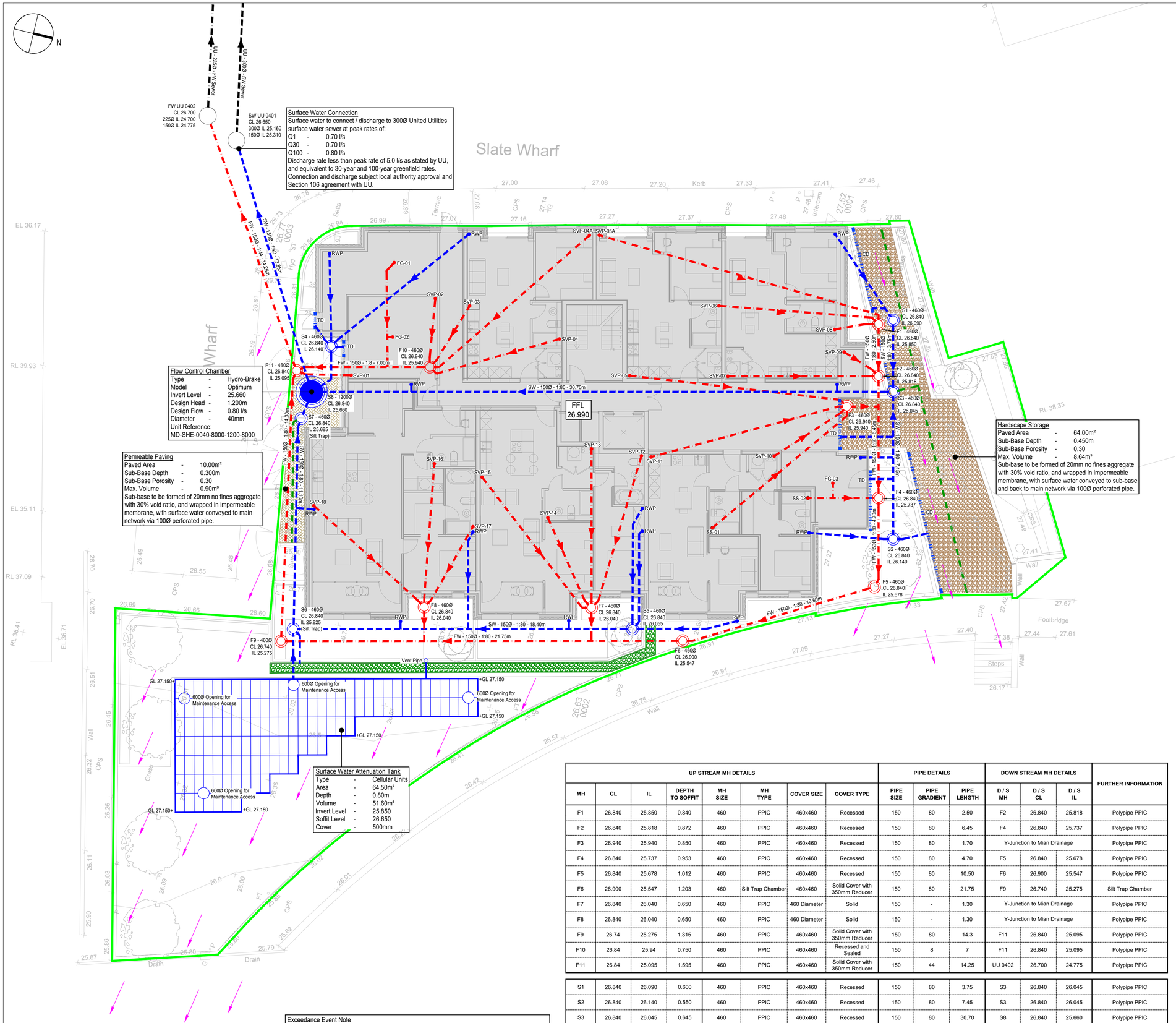
FEH Data

Return Period (years)	100
Storm Duration (mins)	360
FEH Rainfall Version	1999
Site Location	GB 383050 397550 SJ 83050 97550
C (1km)	-0.026
D1 (1km)	0.341
D2 (1km)	0.373
D3 (1km)	0.331
E (1km)	0.303
F (1km)	2.448
Areal Reduction Factor	1.00
Area (ha)	6453.250
SAAR (mm)	1009
CWI	123.385
SPR Host	36.030
URBEXT (USER)	0.0000

Results

Percentage Runoff (%)	40.41
Greenfield Runoff Volume (m^3)	1807492.576

Appendix F Below Ground Drainage Layout and Details



Exceedance Event Note

If an extreme storm greater than the designed 1 in 100-year + 40% climate change were to occur, there is a potential for the network to flood.

Flood water will follow the topography of the post and pre-development site, where it will flow away from the proposed residential building, towards the south-east boundary and into the Bridgewater Canal.

The flood water will not flow towards any existing dwelling / properties near the site, and therefore will not increase the risk of flooding to the proposed dwelling or to neighbouring land and property.

UP STREAM MH DETAILS								PIPE DETAILS			DOWN STREAM MH DETAILS			FURTHER INFORMATION
MH	CL	IL	DEPTH TO SOFFIT	MH SIZE	MH TYPE	COVER SIZE	COVER TYPE	PIPE SIZE	PIPE GRADIENT	PIPE LENGTH	D / S MH	D / S CL	D / S IL	
F1	26.840	25.850	0.840	460	PPIC	460x460	Recessed	150	80	2.50	F2	26.840	25.818	Polypipe PPIC
F2	26.840	25.818	0.872	460	PPIC	460x460	Recessed	150	80	6.45	F4	26.840	25.737	Polypipe PPIC
F3	26.940	25.940	0.850	460	PPIC	460x460	Recessed	150	80	1.70	Y-Junction to Mian Drainage			Polypipe PPIC
F4	26.840	25.737	0.953	460	PPIC	460x460	Recessed	150	80	4.70	F5	26.840	25.678	Polypipe PPIC
F5	26.840	25.678	1.012	460	PPIC	460x460	Recessed	150	80	10.50	F6	26.900	25.547	Polypipe PPIC
F6	26.900	25.547	1.203	460	Silt Trap Chamber	460x460	Solid Cover with 350mm Reducer	150	80	21.75	F9	26.740	25.275	Silt Trap Chamber
F7	26.840	26.040	0.650	460	PPIC	460 Diameter	Solid	150	-	1.30	Y-Junction to Mian Drainage			Polypipe PPIC
F8	26.840	26.040	0.650	460	PPIC	460 Diameter	Solid	150	-	1.30	Y-Junction to Mian Drainage			Polypipe PPIC
F9	26.74	25.275	1.315	460	PPIC	460x460	Solid Cover with 350mm Reducer	150	80	14.3	F11	26.840	25.095	Polypipe PPIC
F10	26.84	25.94	0.750	460	PPIC	460x460	Recessed and Sealed	150	8	7	F11	26.840	25.095	Polypipe PPIC
F11	26.84	25.095	1.595	460	PPIC	460x460	Solid Cover with 350mm Reducer	150	44	14.25	UU 0402	26.700	24.775	Polypipe PPIC

S1	26.840	26.090	0.600	460	PPIC	460x460	Recessed	150	80	3.75	S3	26.840	26.045	Polypipe PPIC
S2	26.840	26.140	0.550	460	PPIC	460x460	Recessed	150	80	7.45	S3	26.840	26.045	Polypipe PPIC
S3	26.840	26.045	0.645	460	PPIC	460x460	Recessed	150	80	30.70	S8	26.840	25.660	Polypipe PPIC
S4	26.840	26.140	0.550	460	PPIC	460x460	Recessed	150	4	2.00	S8	26.840	25.660	Polypipe PPIC
S5	26.840	26.055	0.635	460	PPIC	460x460	Solid	150	80	18.40	S6	26.840	25.825	Polypipe PPIC
S6	26.840	25.825	0.865	460	PPIC	460x460	Solid	150	80	11.10	S7	26.840	25.685	Polypipe PPIC
S7	26.840	25.685	1.005	460	PPIC	460x460	Recessed	150	80	2.00	S8	26.840	25.660	Polypipe PPIC
S8	26.840	25.660	1.030	1200	Flow Control	750x750	Recessed	150	40	13.85	UU 0401	26.650	25.310	Flow Control Chamber

General Drainage Notes:

Existing details shown on this drawing including kerblines, existing drains, chambers, sewers, pipework, stub connections where new connections, diversions or abandonment are shown, invert levels and pipe sizes shall be checked and confirmed to the engineer prior to the commencement of any works. Any discrepancies shall be reported to the engineer for action prior to any new construction.

All drainage works shall be carried out in accordance with the requirements of the local authority and in conjunction with all relevant British Standards and Codes of Practice

All drainage shall comply with the typical drainage construction details and the requirements of BS EN 752.

Access covers and frames shall comply with the loadings specified and to BS EN 124 and kitemarked or if recessed covers are specified then in accordance with FACTA association equivalent.

The proposed building outlines shown on this drawing are for information only. Refer to Architects plans for precise location setting out information and details.

All underslab drainage shall be clear of foundations unless shown otherwise with long radius bends kept to a minimum and used where unavoidable.

All private drainage pipework for foul and surface water systems have been designed on the basis of UPVC to BS EN 1401-1, unless noted otherwise.

Where new drainage is situated within 5 metres of new or existing trees the pipework shall be encased in concrete to reduce the risk of root ingress.

Concrete encasement of the pipework shall be required where the vertical clearance between two pipes crossing is less than 300mm.

All existing drainage shall be assumed to be 'live' and shall be maintained at all times during the works. Existing drainage shall be reconnected to the new drainage system unless proven to be redundant for abandonment. All existing drainage to be abandoned shall be sealed by appropriate means.

Upon completion all new drainage installation together with any existing drainage retained shall be jetted and CCTV surveyed upon completion. Contractor to ensure that the drainage system is fully operational, free of excess debris/silt and all identified faults rectified.

HEALTH & SAFETY: The works shall be carried out by specialist competent and experienced contractors. All operatives shall have received full and appropriate training with appropriate qualifications for the operations they are required to undertake. All work shall be carried out in accordance with the relevant Health & Safety Regulations.

Site Specific Drainage Notes:

Proposed rainwater and foul down pipe locations to be confirmed prior to the commencement of any drainage works.

All external levels and subsequent cover levels of proposed drainage network to be conformed by Architect prior to commencement of any drainage works.

Existing sewer size, levels and location to be confirmed prior to commencement of any drainage work.

Surface and foul water discharge to United Utilities sewers subject to local authority approval, and Section 106 agreement with United Utilities. No drainage work to commence until approval notices are given.

All foul water pipes to be 100Ø, and all surface water pipes to be 150Ø unless shown otherwise.

Foul water down pipes to have invert level of 750mm below finished floor level, unless stated otherwise.

Foul pipes can be laid at a gradient of 1 in 40 unless stated otherwise.

Rainwater pipes to have invert level of 450mm below finished floor level, unless stated otherwise.

Rainwater pipes to be laid at a minimum gradient of 1 in 80 unless stated otherwise.

Drainage Specifications

Foul water pipes to be Polypipe to BS EN 1401-1 or similar

Surface water pipes to be Polypipe Ridgidrain or similar

Manholes to be PCC by FP McCann or similar

Flow control to be Hydro-Brakes by Hydro International

Inspection chambers to be Polypipe or similar

Threshold and Channel drain by ACO or similar

Drainage Key:

- Surface Water Drainage
- Foul Water Drainage
- Perforated Pipe
- Existing SW Sewer
- Existing FW Sewer
- RWP — Rainwater Pipe
- CD — Channel Drain
- TD — Threshold Drain
- SVP / SS — Soil Vent Pipe / Stub Stack
- Filter Drain
- Permeable Paving
- Paving with Sub-Base Attenuation
- Exceednce Flow Route
- Development Baoundary

PRELIMINARY

SLATE WHARF
CASTLEFIELD

Scale: 1:100 @ A1
Drawn by: MDS
Date: Aug '21

Drawing No.: C 13955/30

BELOW GROUND DRAINAGE LAYOUT

NORTHERN STRUCTURAL SERVICES
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Macclesfield
Cheshire SK10 1AU
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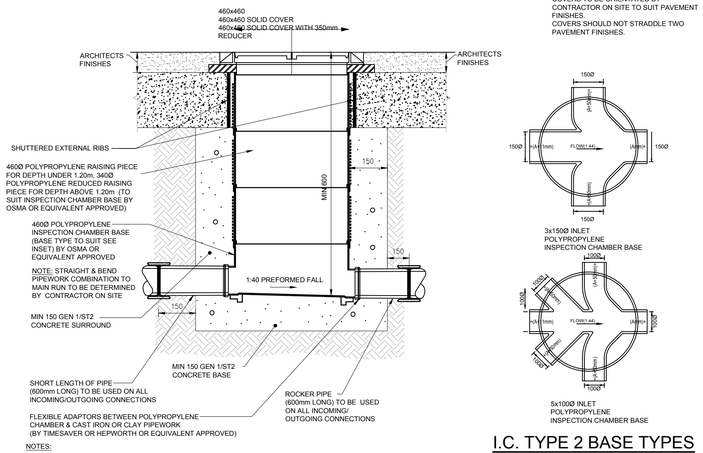


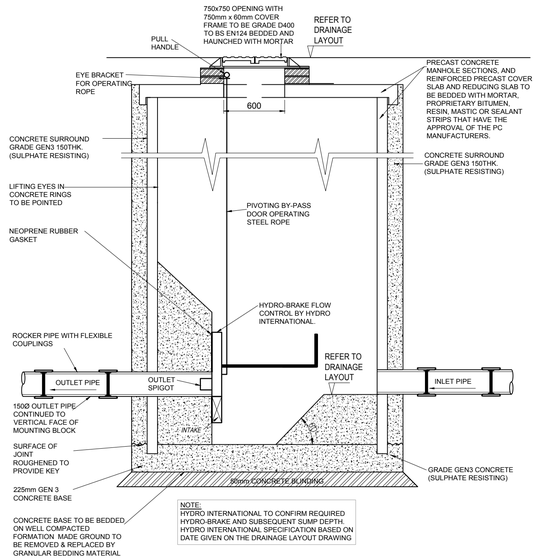
NOTES:

1. THIS CHAMBER IS NOT TO BE USED UNDER HEAVY VEHICULAR AREAS.
2. MAXIMUM INCOMING/OUTGOING PIPE DIAMETER SHALL BE 100 OR 150Ø.

NOTE:
COVERS TO BE ORIENTATED BY CONTRACTOR ON SITE TO SUIT PAVEMENT FINISHES.
COVERS SHOULD NOT STRADDLE TWO PAVEMENT FINISHES.

I.C. TYPE 2 BASE TYPES

PPIC POLYPROPYLENE INSPECTION CHAMBER



NOTE:
HYDRO INTERNATIONAL TO CONFIRM REQUIRED HYDRO-BRAKE AND SUBSEQUENT SUMP DEPTH. HYDRO INTERNATIONAL SPECIFICATION BASED ON DATE GIVEN ON THE DRAINAGE LAYOUT DRAWING

FLOW CONTROL MANHOLE DETAIL

CONTROL MANHOLE NOTES

ALL DIMENSION ARE IN MILLIMETERS

PRECAST CONCRETE UNITS TO BE BS5911 PART .200 AND TO BE CONSTRUCTED WITH A MINIMUM CLASS 3 SULPHATE RISISTING CEMENT.

ALL INSITU CONCRETE TO BE CLASS STANDARD MIX ST4 (GRADE C20) IN ACCORDANCE WITH SECTION 4 OF BS5328 PART 2.

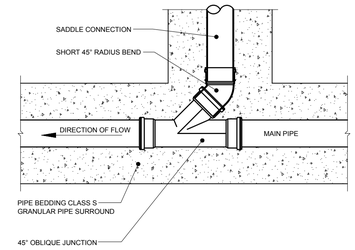
MATERIALS FOR JOINTING MANHOLE RINGS TO BE A RUBBER BITUMEN COMPOUND OF APPROVED MANUFACTURER 'TOKSTRIP' OR SIMILAR.

ALL BRICKWORK TO BE CLASS B ENGINEERING -2 COURSES MIN:4 COURSES MAX; 225mm THICK - BS5628 PART 3.

20mm THICK GRANOLITHIC CONCRETE BENCHING TO BE BROUGHT UP TO A DENSE SMOOTH FACE NEATLY SHAPED AND FINISHED TO ALL BRANCH CONNECTIONS. WHERE BENCHING IS LESS THAN 450mm WIDE, SLOPE TO BE 1:10; MORE THAN 450mm, 1:30

PIPES ENTERING MANHOLES TO HAVE A FLEXIBLE JOINT AS CLOSE AS FEASIBLE TO OUTSIDE FACE OF ANY STRUCTURE INTO WHICH THE PIPE IS BUILT IN ORDER TO FACILITATE MOVEMENT OF THE JOINT.

THE LENGTH OF THE NEXT PIPE (ROCKER PIPELINES, BEDDING, LAYING AND JOINTING OF PIPES AND BACKFILLING OF TRENCHES SHALL BE IN ACCORDANCE WITH THE W.S.A.SPEC 'SEWERS FOR ADOPTION' - 6TH EDITION TOGETHER WITH ANY LOCAL AUTHORITY REQUIREMENTS.



TYPICAL 45° PIPE JUNCTION CONNECTION DETAIL

MIN. GRANULAR SURROUND		
PIPE Ø (C) (mm)	D1 (mm)	D2 (mm)
100	150	450
150	150	600
225	150	700
300	150	850
375	200	1050
450	200	1150
525	200	1200
600	200	1350
675	200	1450
750	200	1500

TO BE USED UNDER:

1. VEHICULAR AREAS WHERE COVER TO PIPE SOFFIT IS GREATER THAN 900mm.
2. ALL NON-VEHICULAR AREAS WHERE COVER TO PIPE SOFFIT IS GREATER THAN 600mm.

NOTE:
ALL PIPEWORK SHALL HAVE FLEXIBLE COUPLINGS

CLASS S PIPE BEDDING & SURROUND (TO BE USED FOR PLASTIC, VITRIFIED CLAY & CONCRETE PIPEWORK)

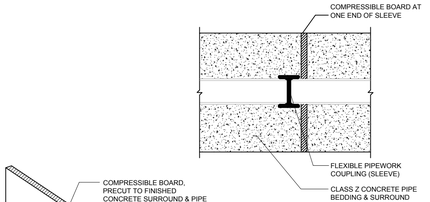
MIN. CONCRETE ENCASEMENT		
PIPE Ø (C) (mm)	D1 (mm)	D2 (mm)
100-600	150	150
675	150	170
750	150	190
825	150	210
900	150	225
975	150	250
1050	150	270
1200	170	300
1350	180	350
1500	200	375
1650	220	420

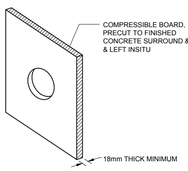
TO BE USED UNDER:

1. VEHICULAR AREAS WHERE COVER TO PIPE SOFFIT IS EQUAL TO OR LESS THAN 900mm.
2. ALL NON-VEHICULAR AREAS WHERE COVER TO PIPE SOFFIT IS EQUAL TO OR LESS THAN 600mm.

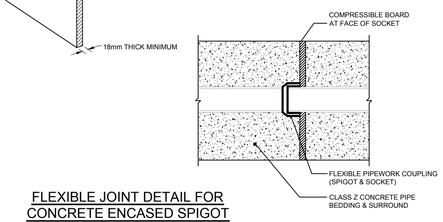
NOTE:
ALL PIPEWORK WITH CLASS Z (GEN 3/ST4) CONCRETE SURROUND SHALL HAVE FLEXIBLE COUPLINGS WITH FLEXI-BOARDS ON ALL JOINTS (REFER TO DETAIL D8)

CLASS Z PIPE BEDDING & SURROUND (TO BE USED FOR PLASTIC, VITRIFIED CLAY & CONCRETE PIPEWORK)



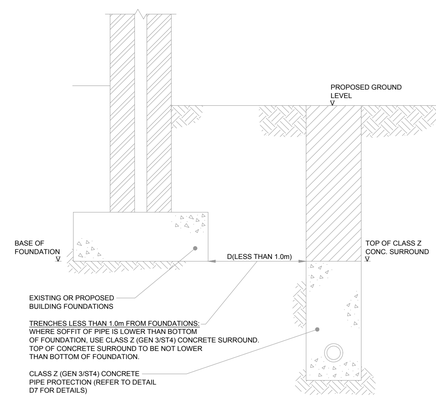


FLEXIBLE JOINT DETAIL FOR CONCRETE ENCASED SLEEVE JOINTED PIPES

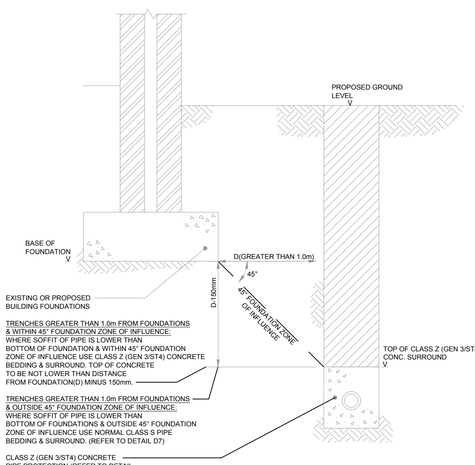


FLEXIBLE JOINT DETAIL FOR CONCRETE ENCASED SPIGOT & SOCKET JOINTED PIPES

FLEXIBLE JOINT DETAIL FOR CONCRETE ENCASED PIPES (TO B.S. 1142)



DRAINAGE TRENCH LESS THAN 1.0m FROM EXISTING/PROPOSED FOUNDATIONS



DRAINAGE TRENCH GREATER THAN 1.0m FROM EXISTING/PROPOSED FOUNDATIONS

PIPE PROTECTION ADJACENT TO EXISTING/PROPOSED FOUNDATIONS

PRELIMINARY

SLATE WHARF
CASTLEFIELD

Scale:	N.T.S	Drawing No.:
Drawn by:	MDS	C 13955/31
Date:	Aug '21	

BELOW GROUND DRAINAGE DETAILS
SHEET 1

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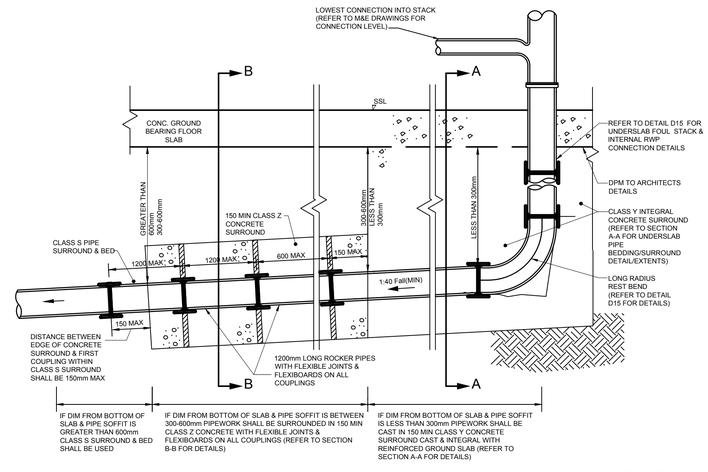
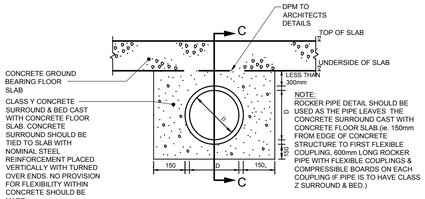
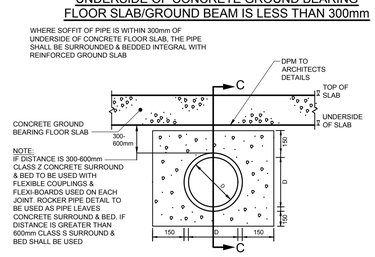


SECTION C-C

NOTES:
1. THIS DETAIL SHALL ONLY BE USED UNDER AREAS OF GROUND BEARING SLAB WHERE UNDER SLAB PIPEWORK CAN BE SUPPORTED BY UNDER SLAB FILL MATERIAL.
2. CONNECTION INTO INTERNAL MANHOLE OR MAIN UNDER SLAB RUN OR EXIT THROUGH FOUNDATION EDGE DETAIL AS PER DETAIL D (REFER TO DRAINAGE PLAN)

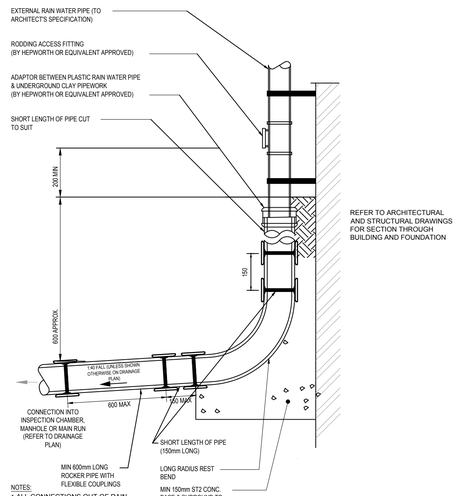


SECTION A-A
WHERE DISTANCE BETWEEN PIPE SOFFIT & UNDERSIDE OF CONCRETE GROUND BEARING FLOOR SLAB/GROUND BEAM IS LESS THAN 300mm



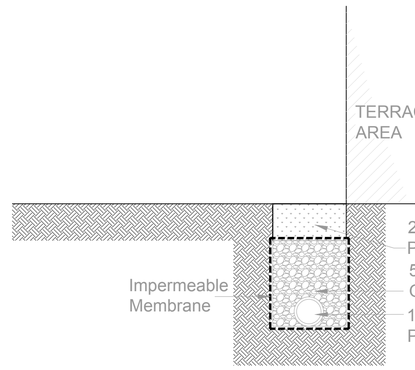
SECTION B-B
WHERE DISTANCE BETWEEN PIPE SOFFIT & UNDERSIDE OF CONCRETE GROUND BEARING FLOOR SLAB/GROUND BEAM IS GREATER THAN 300mm

TYPICAL UNDERSLAB PIPE BEDDING DETAILS FOR PIPEWORK UNDER GROUND BEARING SLAB (FOR ALL UNDER SLAB PIPE DEPTHS)

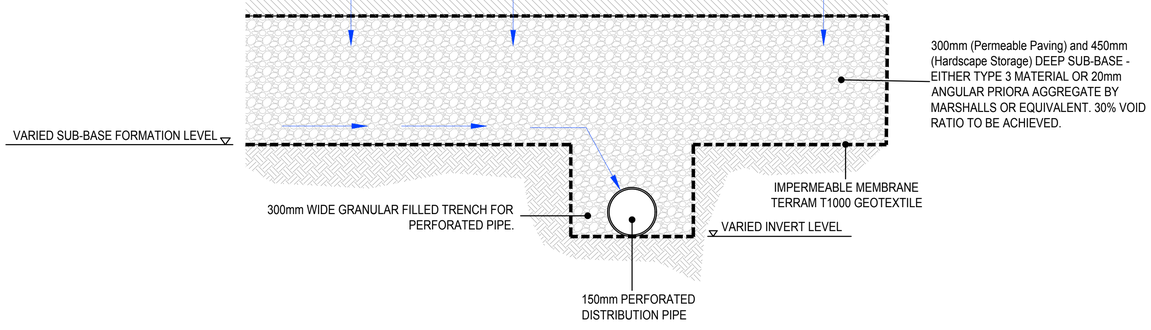


NOTES:
1. ALL CONNECTIONS OUT OF RAIN WATER PIPE CONNECTION TO HAVE CLASS Z CONC. SURROUND WITH FLEXIBLE COUPLINGS & FLEXIBOARDS ON ALL COUPLINGS WHERE COVER TO PIPE SOFFIT IS EQUAL TO OR LESS THAN 900mm UNDER MEDIUM/LIGHT VEHICULAR AREAS & EQUAL TO OR LESS THAN 600mm UNDER NON-VEHICULAR AREAS.

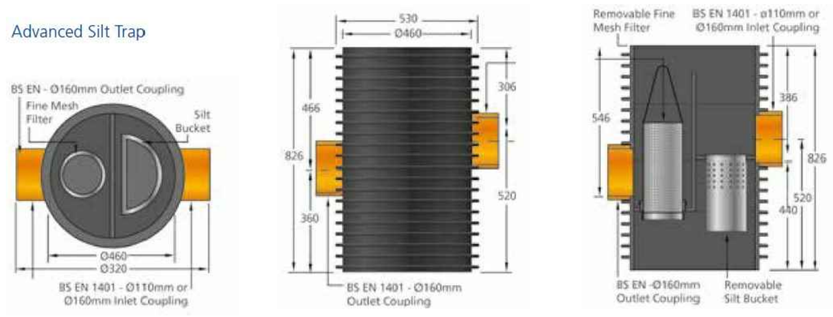
TYPICAL RODDABLE RAIN WATER PIPE CONNECTION



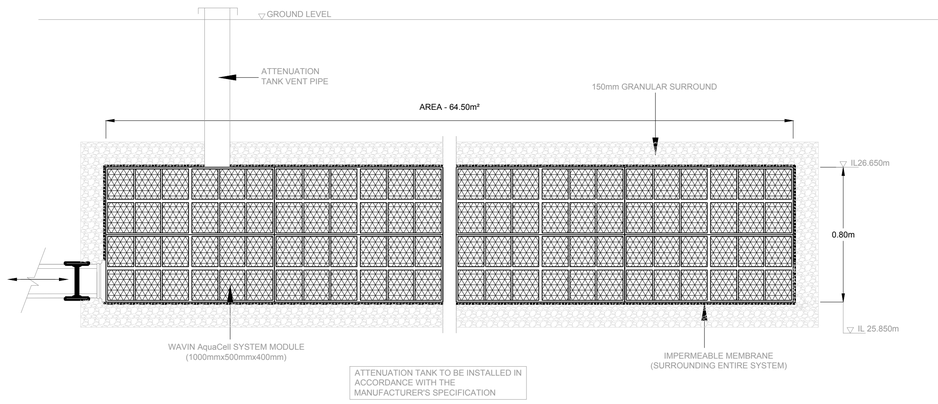
Filter Drain Detail



PERMEABLE PAVING AND HARDSCAPE STORAGE DETAIL



SILT TRAP CHAMBER DETAIL



ATTENUATION TANK DETAIL

PRELIMINARY

SLATE WHARF
CASTLEFIELD

Scale:	N.T.S	Drawing No.:	C 13955/32
Drawn by:	MDS		
Date:	Aug '21		

BELOW GROUND DRAINAGE DETAILS
SHEET 2

NORTHERN STRUCTURAL SERVICES
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www.northernstructuralservices.co.uk

Appendix G Surface Water Network / Management Calculations

STORM SEWER DESIGN by the Modified Rational Method

Design Criteria for Storm

Pipe Sizes STANDARD Manhole Sizes STANDARD

FEH Rainfall Model

Return Period (years)	100
FEH Rainfall Version	1999
Site Location	GB 383050 397550 SJ 83050 97550
C (1km)	-0.026
D1 (1km)	0.341
D2 (1km)	0.373
D3 (1km)	0.331
E (1km)	0.303
F (1km)	2.448
Maximum Rainfall (mm/hr)	50
Maximum Time of Concentration (mins)	30
Foul Sewage (l/s/ha)	0.000
Volumetric Runoff Coeff.	0.750
PIMP (%)	100
Add Flow / Climate Change (%)	40
Minimum Backdrop Height (m)	0.000
Maximum Backdrop Height (m)	0.000
Min Design Depth for Optimisation (m)	1.200
Min Vel for Auto Design only (m/s)	1.00
Min Slope for Optimisation (1:X)	500

Designed with Level Soffits

Time Area Diagram for Storm

Time (mins)	Area (ha)	Time (mins)	Area (ha)
0-4	0.060	4-8	0.010

Total Area Contributing (ha) = 0.070

Total Pipe Volume (m³) = 1.524

Network Design Table for Storm

PN	Length (m)	Fall (m)	Slope (1:X)	I.Area (ha)	T.E. (mins)	Base Flow (l/s)	k (mm)	HYD SECT	DIA (mm)	Section Type	Auto Design

Network Results Table

PN	Rain (mm/hr)	T.C. (mins)	US/IL (m)	Σ I.Area (ha)	Σ Base Flow (l/s)	Foul (l/s)	Add Flow (l/s)	Vel (m/s)	Cap (l/s)	Flow (l/s)

Network Design Table for Storm

PN	Length (m)	Fall (m)	Slope (1:X)	I.Area (ha)	T.E. (mins)	Base Flow (l/s)	k (mm)	HYD SECT	DIA (mm)	Section Type	Auto Design
1.000	3.750	0.045	83.3	0.004	5.00	0.0	0.600	o	150	Pipe/Conduit	
2.000	7.450	0.095	78.4	0.006	5.00	0.0	0.600	o	150	Pipe/Conduit	
1.001	30.700	0.385	79.7	0.016	0.00	0.0	0.600	o	150	Pipe/Conduit	
3.000	18.400	0.230	80.0	0.008	5.00	0.0	0.600	o	150	Pipe/Conduit	
3.001	11.100	0.140	79.3	0.010	0.00	0.0	0.600	o	150	Pipe/Conduit	
3.002	1.000	0.025	40.0	0.009	0.00	0.0	0.600	o	150	Pipe/Conduit	
1.002	13.850	0.350	39.6	0.017	0.00	0.0	0.600	o	150	Pipe/Conduit	

Network Results Table

PN	Rain (mm/hr)	T.C. (mins)	US/IL (m)	Σ I.Area (ha)	Σ Base Flow (l/s)	Foul (l/s)	Add Flow (l/s)	Vel (m/s)	Cap (l/s)	Flow (l/s)
1.000	50.00	5.06	26.090	0.004	0.0	0.0	0.2	1.10	19.5	0.8
2.000	50.00	5.11	26.140	0.006	0.0	0.0	0.3	1.14	20.1	1.1
1.001	50.00	5.56	26.045	0.026	0.0	0.0	1.4	1.13	19.9	4.9
3.000	50.00	5.27	26.055	0.008	0.0	0.0	0.4	1.12	19.9	1.5
3.001	50.00	5.44	25.825	0.018	0.0	0.0	1.0	1.13	20.0	3.4
3.002	50.00	5.45	25.685	0.027	0.0	0.0	1.5	1.60	28.2	5.1
1.002	50.00	5.71	25.660	0.070	0.0	0.0	3.8	1.60	28.4	13.3

Manhole Schedules for Storm

MH Name	MH CL (m)	MH Depth (m)	MH Connection	MH Diam.,L*W (mm)	Pipe Out PN	Pipe Out Invert Level (m)	Pipe Out Diameter (mm)	Pipes In PN	Pipes In Invert Level (m)	Pipes In Diameter (mm)	Backdrop (mm)
S1	26.840	0.750	Open Manhole	460	1.000	26.090	150				
S2	26.840	0.700	Open Manhole	460	2.000	26.140	150				
S3	26.840	0.795	Open Manhole	460	1.001	26.045	150	1.000	26.045	150	
								2.000	26.045	150	
S5	26.840	0.785	Open Manhole	460	3.000	26.055	150				
S6	26.840	1.015	Open Manhole	460	3.001	25.825	150	3.000	25.825	150	
S7	26.840	1.155	Open Manhole	460	3.002	25.685	150	3.001	25.685	150	
S8	26.840	1.180	Open Manhole	1200	1.002	25.660	150	1.001	25.660	150	
								3.002	25.660	150	
UU 0401	26.650	1.340	Open Manhole	0		OUTFALL		1.002	25.310	150	

No coordinates have been specified, layout information cannot be produced.

PIPELINE SCHEDULES for Storm

Upstream Manhole

PN	Hyd Sect	Diam (mm)	MH Name	C.Level (m)	I.Level (m)	D.Depth (m)	MH Connection	MH DIAM., L*W (mm)
1.000	o	150	S1	26.840	26.090	0.600	Open Manhole	460
2.000	o	150	S2	26.840	26.140	0.550	Open Manhole	460
1.001	o	150	S3	26.840	26.045	0.645	Open Manhole	460
3.000	o	150	S5	26.840	26.055	0.635	Open Manhole	460
3.001	o	150	S6	26.840	25.825	0.865	Open Manhole	460
3.002	o	150	S7	26.840	25.685	1.005	Open Manhole	460
1.002	o	150	S8	26.840	25.660	1.030	Open Manhole	1200

Downstream Manhole

PN	Length (m)	Slope (1:X)	MH Name	C.Level (m)	I.Level (m)	D.Depth (m)	MH Connection	MH DIAM., L*W (mm)
1.000	3.750	83.3	S3	26.840	26.045	0.645	Open Manhole	460
2.000	7.450	78.4	S3	26.840	26.045	0.645	Open Manhole	460
1.001	30.700	79.7	S8	26.840	25.660	1.030	Open Manhole	1200
3.000	18.400	80.0	S6	26.840	25.825	0.865	Open Manhole	460
3.001	11.100	79.3	S7	26.840	25.685	1.005	Open Manhole	460
3.002	1.000	40.0	S8	26.840	25.660	1.030	Open Manhole	1200
1.002	13.850	39.6	UU 0401	26.650	25.310	1.190	Open Manhole	0

Free Flowing Outfall Details for Storm

Outfall Pipe Number	Outfall Name	C. Level (m)	I. Level (m)	Min I. Level (m)	D,L (mm)	W (mm)
1.002	UU 0401	26.650	25.310	25.310	0	0

Simulation Criteria for Storm

Volumetric Runoff Coeff	0.840	Additional Flow - % of Total Flow	40.000
Areal Reduction Factor	1.000	MADD Factor * 10m³/ha Storage	1.000
Hot Start (mins)	0	Inlet Coeffiecient	0.800
Hot Start Level (mm)	0	Flow per Person per Day (l/per/day)	0.000
Manhole Headloss Coeff (Global)	0.500	Run Time (mins)	960
Foul Sewage per hectare (l/s)	0.000	Output Interval (mins)	8

Number of Input Hydrographs	0	Number of Storage Structures	3
Number of Online Controls	1	Number of Time/Area Diagrams	0
Number of Offline Controls	0	Number of Real Time Controls	0

Synthetic Rainfall Details

Rainfall Model	FEH
Return Period (years)	100
FEH Rainfall Version	1999
Site Location	GB 383050 397550 SJ 83050 97550
C (1km)	-0.026
D1 (1km)	0.341
D2 (1km)	0.373
D3 (1km)	0.331
E (1km)	0.303
F (1km)	2.448
Summer Storms	No
Winter Storms	Yes
Cv (Summer)	0.750
Cv (Winter)	0.840
Storm Duration (mins)	480

Online Controls for Storm

Hydro-Brake® Optimum Manhole: S8, DS/PN: 1.002, Volume (m³): 1.9

Unit Reference	MD-SHE-0040-8000-1200-8000
Design Head (m)	1.200
Design Flow (l/s)	0.8
Flush-Flo™	Calculated
Objective	Minimise upstream storage
Application	Surface
Sump Available	Yes
Diameter (mm)	40
Invert Level (m)	25.660
Minimum Outlet Pipe Diameter (mm)	75
Suggested Manhole Diameter (mm)	1200

Control Points	Head (m)	Flow (l/s)
Design Point (Calculated)	1.200	0.8
Flush-Flo™	0.175	0.6
Kick-Flo®	0.353	0.5
Mean Flow over Head Range	-	0.6

The hydrological calculations have been based on the Head/Discharge relationship for the Hydro-Brake® Optimum as specified. Should another type of control device other than a Hydro-Brake Optimum® be utilised then these storage routing calculations will be invalidated

Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)
0.100	0.5	1.200	0.8	3.000	1.2	7.000	1.8
0.200	0.6	1.400	0.9	3.500	1.3	7.500	1.8
0.300	0.5	1.600	0.9	4.000	1.4	8.000	1.9
0.400	0.5	1.800	1.0	4.500	1.4	8.500	1.9
0.500	0.5	2.000	1.0	5.000	1.5	9.000	2.0
0.600	0.6	2.200	1.0	5.500	1.6	9.500	2.0
0.800	0.7	2.400	1.1	6.000	1.7		
1.000	0.7	2.600	1.1	6.500	1.7		

Storage Structures for Storm

Porous Car Park Manhole: S3, DS/PN: 1.001

Infiltration Coefficient Base (m/hr)	0.00000	Width (m)	6.4
Membrane Percolation (mm/hr)	1000	Length (m)	10.0
Max Percolation (l/s)	17.8	Slope (1:X)	0.0
Safety Factor	2.0	Depression Storage (mm)	5
Porosity	0.30	Evaporation (mm/day)	3
Invert Level (m)	26.390	Cap Volume Depth (m)	0.450

Cellular Storage Manhole: S6, DS/PN: 3.001

Invert Level (m)	25.850	Safety Factor	2.0
Infiltration Coefficient Base (m/hr)	0.00000	Porosity	0.95
Infiltration Coefficient Side (m/hr)	0.00000		

Depth (m)	Area (m²)	Inf. Area (m²)	Depth (m)	Area (m²)	Inf. Area (m²)
0.000	64.5	0.0	2.600	0.0	0.0
0.200	64.5	0.0	2.800	0.0	0.0
0.400	64.5	0.0	3.000	0.0	0.0
0.600	64.5	0.0	3.200	0.0	0.0
0.800	64.5	0.0	3.400	0.0	0.0
1.000	0.0	0.0	3.600	0.0	0.0
1.200	0.0	0.0	3.800	0.0	0.0
1.400	0.0	0.0	4.000	0.0	0.0
1.600	0.0	0.0	4.200	0.0	0.0
1.800	0.0	0.0	4.400	0.0	0.0
2.000	0.0	0.0	4.600	0.0	0.0
2.200	0.0	0.0	4.800	0.0	0.0
2.400	0.0	0.0	5.000	0.0	0.0

Porous Car Park Manhole: S7, DS/PN: 3.002

Infiltration Coefficient Base (m/hr)	0.00000	Width (m)	1.0
Membrane Percolation (mm/hr)	1000	Length (m)	10.0
Max Percolation (l/s)	2.8	Slope (1:X)	0.0
Safety Factor	2.0	Depression Storage (mm)	5
Porosity	0.30	Evaporation (mm/day)	3
Invert Level (m)	26.340	Cap Volume Depth (m)	0.300

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

Simulation Criteria

Areal Reduction Factor	1.000	Additional Flow - % of Total Flow	40.000
Hot Start (mins)	0	MADD Factor * 10m³/ha Storage	1.000
Hot Start Level (mm)	0	Inlet Coeffiecient	0.800
Manhole Headloss Coeff (Global)	0.500	Flow per Person per Day (l/per/day)	0.000
Foul Sewage per hectare (l/s)	0.000		

Number of Input Hydrographs	0	Number of Storage Structures	3
Number of Online Controls	1	Number of Time/Area Diagrams	0
Number of Offline Controls	0	Number of Real Time Controls	0

Synthetic Rainfall Details

Rainfall Model	FEH
FEH Rainfall Version	1999
Site Location	GB 383050 397550 SJ 83050 97550
C (1km)	-0.026
D1 (1km)	0.341
D2 (1km)	0.373
D3 (1km)	0.331
E (1km)	0.303
F (1km)	2.448
Cv (Summer)	0.750
Cv (Winter)	0.840

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

Profile(s)	Summer and Winter
Duration(s) (mins)	15, 30, 60, 120, 240, 360, 480, 960, 1440
Return Period(s) (years)	1, 30, 100
Climate Change (%)	0, 0, 40

WARNING: Half Drain Time has not been calculated as the structure is too full.

PN	US/MH Name	Storm	Return Period	Climate Change	First (X) Surcharge	First (Y) Flood	First (Z) Overflow	Overflow Act.	Water Level (m)
1.000	S1	15 Winter	1	+0%	30/15 Summer				26.113
2.000	S2	15 Winter	1	+0%	30/15 Summer				26.164
1.001	S3	15 Winter	1	+0%	30/15 Summer				26.093
3.000	S5	15 Winter	1	+0%	30/60 Winter				26.083
3.001	S6	240 Winter	1	+0%	30/15 Summer				25.969
3.002	S7	15 Winter	1	+0%	1/15 Summer				26.021
1.002	S8	15 Winter	1	+0%	1/15 Summer				26.044

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

PN	US/MH Name	Surcharged Depth (m)	Flooded Volume (m^3)	Flow / Cap.	Overflow (l/s)	Half Drain Time (mins)	Pipe Flow (l/s)	Status	Level Exceeded
1.000	S1	-0.127	0.000	0.05			0.7	OK	
2.000	S2	-0.126	0.000	0.06			1.1	OK	
1.001	S3	-0.102	0.000	0.22		7	4.2	OK	
3.000	S5	-0.122	0.000	0.08			1.4	OK	
3.001	S6	-0.006	0.000	0.05		146	0.9	OK	
3.002	S7	0.186	0.000	0.09			1.0	SURCHARGED	
1.002	S8	0.234	0.000	0.02			0.6	SURCHARGED	

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

Simulation Criteria

Areal Reduction Factor	1.000	Additional Flow - % of Total Flow	40.000
Hot Start (mins)	0	MADD Factor * 10m³/ha Storage	1.000
Hot Start Level (mm)	0	Inlet Coeffiecient	0.800
Manhole Headloss Coeff (Global)	0.500	Flow per Person per Day (l/per/day)	0.000
Foul Sewage per hectare (l/s)	0.000		

Number of Input Hydrographs	0	Number of Storage Structures	3
Number of Online Controls	1	Number of Time/Area Diagrams	0
Number of Offline Controls	0	Number of Real Time Controls	0

Synthetic Rainfall Details

Rainfall Model	FEH
FEH Rainfall Version	1999
Site Location	GB 383050 397550 SJ 83050 97550
C (1km)	-0.026
D1 (1km)	0.341
D2 (1km)	0.373
D3 (1km)	0.331
E (1km)	0.303
F (1km)	2.448
Cv (Summer)	0.750
Cv (Winter)	0.840

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

Profile(s)	Summer and Winter
Duration(s) (mins)	15, 30, 60, 120, 240, 360, 480, 960, 1440
Return Period(s) (years)	1, 30, 100
Climate Change (%)	0, 0, 40

WARNING: Half Drain Time has not been calculated as the structure is too full.

PN	US/MH Name	Storm	Return Period	Climate Change	First (X) Surcharge	First (Y) Flood	First (Z) Overflow	Overflow Act.	Water Level (m)
1.000	S1	15 Winter	30	+0%	30/15 Summer				26.435
2.000	S2	15 Winter	30	+0%	30/15 Summer				26.440
1.001	S3	15 Winter	30	+0%	30/15 Summer				26.431
3.000	S5	360 Winter	30	+0%	30/60 Winter				26.295
3.001	S6	360 Winter	30	+0%	30/15 Summer				26.295
3.002	S7	240 Winter	30	+0%	1/15 Summer				26.325
1.002	S8	240 Winter	30	+0%	1/15 Summer				26.338

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

PN	US/MH Name	Surcharged Depth (m)	Flooded Volume (m^3)	Flow / Cap.	Overflow (l/s)	Half Drain Time (mins)	Pipe Flow (l/s)	Status	Level Exceeded
1.000	S1	0.195	0.000	0.17			2.2	SURCHARGED	
2.000	S2	0.150	0.000	0.19			3.3	SURCHARGED	
1.001	S3	0.236	0.000	0.65		4	12.4	SURCHARGED	
3.000	S5	0.090	0.000	0.03			0.6	SURCHARGED	
3.001	S6	0.320	0.000	0.06			1.1	SURCHARGED	
3.002	S7	0.490	0.000	0.15			1.6	SURCHARGED	
1.002	S8	0.528	0.000	0.02			0.6	SURCHARGED	

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

Simulation Criteria

Areal Reduction Factor	1.000	Additional Flow - % of Total Flow	40.000
Hot Start (mins)	0	MADD Factor * 10m³/ha Storage	1.000
Hot Start Level (mm)	0	Inlet Coeffiecient	0.800
Manhole Headloss Coeff (Global)	0.500	Flow per Person per Day (l/per/day)	0.000
Foul Sewage per hectare (l/s)	0.000		

Number of Input Hydrographs	0	Number of Storage Structures	3
Number of Online Controls	1	Number of Time/Area Diagrams	0
Number of Offline Controls	0	Number of Real Time Controls	0

Synthetic Rainfall Details

Rainfall Model	FEH
FEH Rainfall Version	1999
Site Location	GB 383050 397550 SJ 83050 97550
C (1km)	-0.026
D1 (1km)	0.341
D2 (1km)	0.373
D3 (1km)	0.331
E (1km)	0.303
F (1km)	2.448
Cv (Summer)	0.750
Cv (Winter)	0.840

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

Profile(s)	Summer and Winter
Duration(s) (mins)	15, 30, 60, 120, 240, 360, 480, 960, 1440
Return Period(s) (years)	1, 30, 100
Climate Change (%)	0, 0, 40

WARNING: Half Drain Time has not been calculated as the structure is too full.

PN	US/MH Name	Storm	Return Period	Climate Change	First (X) Surcharge	First (Y) Flood	First (Z) Overflow	Overflow Act.	Water Level (m)
1.000	S1	480 Winter	100	+40%	30/15 Summer				26.830
2.000	S2	480 Winter	100	+40%	30/15 Summer				26.830
1.001	S3	480 Winter	100	+40%	30/15 Summer				26.830
3.000	S5	480 Winter	100	+40%	30/60 Winter				26.830
3.001	S6	480 Winter	100	+40%	30/15 Summer				26.829
3.002	S7	480 Winter	100	+40%	1/15 Summer				26.828
1.002	S8	480 Winter	100	+40%	1/15 Summer				26.828

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

PN	US/MH Name	Surcharged Depth (m)	Flooded Volume (m^3)	Flow / Cap.	Overflow (l/s)	Half Drain Time (mins)	Pipe Flow (l/s)	Status	Level Exceeded
1.000	S1	0.590	0.000	0.03			0.4	FLOOD RISK	
2.000	S2	0.540	0.000	0.04			0.6	FLOOD RISK	
1.001	S3	0.635	0.000	0.14		282	2.6	FLOOD RISK	
3.000	S5	0.625	0.000	0.04			0.8	FLOOD RISK	
3.001	S6	0.854	0.000	0.10			1.7	FLOOD RISK	
3.002	S7	0.993	0.000	0.08			0.9	FLOOD RISK	
1.002	S8	1.018	0.000	0.03			0.8	FLOOD RISK	