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**Withington Community Hospital
CDC Scheme**

CCS Project No: HE-014

for

**Manchester University NHS
Foundation Trust & BAM**



Manchester University
NHS Foundation Trust



Surface Water Management Plan

Suite 2, 1st Floor.

XYZ Building

2 Hardman Boulevard

Spinningfields

Manchester, M3 3AQ

(Tel): 0161 832 2274

(E-mail): info@ccs-consulting.co.uk

(Web): www.ccs-consulting.co.uk

Prepared by Mark Symonds

Authorised by Lee Coverley

Issued by Katherine Etchells

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Prepared by.

Mark Symonds

Drainage Consultant / Hydrologist
(t) 0161 832 2274

For and on behalf of CCS Consulting Limited

Approved by:



Lee Coverley BEng (Hons) CEng MStructE

Director - Structural/Civil Engineering

Lee.coverley@ccs-consulting.co.uk

(t) 0161 832 2274

(m) 07970 978 317

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1 Introduction

This surface water management report has been prepared by CCS Consulting in support of a full planning application for a new Endoscopy & Cardiorespiratory Development building at Withington Community Hospital, Manchester, M20 2LR (hereafter referred to as the 'Site').

The report describes and demonstrates how the surface water run-off rate and volume from the post development site will be managed to adhere to National and local planning policy, regulations, and relevant design guidance, which include:

National Planning Policy Framework (NPPF), December 2023 Paragraphs 153-158'

National Planning Practice Guidance (NPPG), released in March 2014 and updated in August 2022.

National Standards for Sustainable Drainage Systems (SuDS) set out by the Department for Environment, Food & Rural Affairs (DEFRA) (2015).

CIRIA (2010) Planning for SuDS – Making it Happen C687.

CIRIA SuDS Manual C753 (2015).

And local policies including:

Manchester City, Salford City and Trafford Councils Level 1 SFRA (May 2010).

Manchester City, Salford City and Trafford Councils Level 2 SFRA (March 2011).

Manchester City Council – Local Flood Risk Management Strategy (March 2014).

Manchester Local Development Framework – Core Strategy Development Plan (July 2012).

Manchester City Council, acting as Lead Local Flood Authority (LLFA), 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.

The report is formatted such that it identifies and references appropriate design parameters, shows by calculation how the proposed drainage strategy can meet the various requirements and ultimately controls, mitigates and reduces future flood risk both on and off site.

2 Planning Policies and Guidance

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

The NPPF (December 2023) 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 153 to 158 Planning for Climate Change.

NPPG, Paragraph 055 (Reference ID:7-055-20220825) 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 056 (Reference ID:7-056-20220825) 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 08 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 Site is part of Withington Community Hospital and is in residential area of West Didsbury, which is approximately 1.5km south-west of Mauldeth Road station, approximately 1km west of Brennage station, and is bound by existing hospital car parking and building leading to Nell Lane the north, Burton Road to the east, Fielden Road to the south, and hospital buildings leading onto Elizabeth Slinger Road to the west. The address of the site is Withington Community Hospital, Manchester, M20 2LR, with co-ordinates for the centre of the site being, Easting: 383735, Northing: 392005.

3.2 Existing Site and Topography

As detailed on the topographical survey in Appendix A, the Site is currently undeveloped and consists of trees, shrubs, and grassed areas, and therefore is deemed to be greenfield. The site has a general fall from the centre towards the Site boundary, where the levels range from approximately 34.24m AOD to approximately 32.49m AOD.

3.3 Proposed Development

The proposed site is shown on the development plans in Appendix B, with a full description of the 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 hospital building to the central / eastern area of the site, with car parking to the west, and pedestrian with soft landscaping throughout.

3.4 Ground Conditions

The ground conditions can be determined by the British Geological Survey (BGS) website, where it shows the Site to have superficial deposits of Glaciofluvial deposits (sands and gravels) over bedrock consisting of Wilmslow Sandstone Formation (sandstone). The BGS website also shows borehole log data adjacent to the Site in Burton Road (see Appendix C), which shows made ground to a depth of 2.20m, over coarse sand to a depth of 3.90m, over clay. The borehole also indicates ground water level rising in the coarse sand layers up to 3.00m bgl.

3.5 Waterbody / Rivers / Canals

There are no known waterbodies, rivers, or canals near to the development site, with the nearest being the river Mersey approximately 250m to the south, and Platt Brook approximately 2.5 km to the north.

3.6 On-Site Drainage and Public Sewers

As detailed on the United Utilities asset plan in Appendix D, there is an 825 x 1200mm surface water sewer in Burton Road (west of site), a 525mm diameter combined water sewer in Burton Road (west of site), and a 300mm diameter combined water sewer in Fielden Road (south of site).

As the site is undeveloped it is believed that there are no drainage networks within the development / site boundary. The topographical survey however identifies existing foul and surface water networks serving the existing hospital building to the north. In particular, and relevant to this report, the topographical survey shows a 225mm diameter surface water network which is believed to discharge to the surface water sewer in Burton Road.

3.7 Surface Water Management Areas

The Site boundary area is approximately **3,090m² / 0.390 ha**.

The pre-development surface water run-off from within the site boundary will discharge off the site at a greenfield rate, with an urban factor of 0.

Surface water run-off from the building, car parking and pedestrian areas equate to **2,400m² / 0.240 ha** and will form the surface water management area, with the surface water run-off from the soft-landscaping areas continuing to discharge off the site at a natural / greenfield rate.

4 Surface Water Management Principles

The surface water for the development site is to be managed so that it adheres to the current national regulations and local authority requirements.

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

DEFRA Non-Statutory Technical Standards for Sustainable Drainage Systems states:

S2 *For greenfield developments, the peak runoff rate from the development to any highway drain, sewer, or surface water body for the 1 in 1 year rainfall event and the 1 in 100-year rainfall event should never exceed the peak greenfield runoff rate for the same event.*

4.5 Volume Control

DEFRA National Non-statutory technical standards for sustainable drainage systems states:

S4 Where reasonably practicable, for greenfield development, the runoff volume from the development to any highway drain, sewer, or surface water body in the 1 in 100-year, 6-hour rainfall event should never exceed the greenfield runoff volume for the same event.

S6 Where it is not reasonably practicable to constrain the volume of runoff to any drain, sewer, or surface water body in accordance with S4 or S5 above, the runoff volume must be discharged at a rate that does not adversely affect flood risk.

4.6 Flood Risk within Development

DEAFRA National Non-statutory technical standards for sustainable drainage systems states:

'S7 The drainage system must be designed so that, unless an area is designated to hold and/or convey water as part of the design, flooding does not occur on any part of the site for a 1 in 30-year rainfall event.

S8 The drainage system must be designed so that, unless an area is designated to hold and/or convey water as part of the design, flooding does not occur during a 1 in 100-year rainfall event in any part of: a building (including a basement); or in any utility plant susceptible to water (e.g. pumping station or electricity substation) within the development.

S9 The design of the site must ensure that, so far as is reasonably practicable, flows resulting from rainfall in excess of a 1 in 100-year rainfall event are managed in exceedance routes that minimise the risks to people and property'.

4.7 Pollution / Water Quality

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 development site design will be such that when SuDS features fail or are exceeded, exceedance flows do not cause flooding of properties on or off site. This is achieved by completely containing the surface water within the drainage system (including areas designed to hold or convey water) for all events up to a 1 in 30-year event. The design of the site ensures that flows from rainfall more than a 1

in 100-year rainfall event are managed in exceedance routes that avoid risk to people and property both on and off site.

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:

Table 1 - Surface Water Run-off Feasibility

Run-Off Destination	Feasible / Required	Description
Discharge to Ground	No	Based on the BGS data, the ground at the development site is consists of made ground over coarse sand and clay layers. Coarse sand is suitable material for infiltration, however, the BGS data identifies ground water to be 3.00m bgl (above clay strata) which is 0.80m below made ground. In accordance with CIRIA 753 Infiltration structures/soakaways are to be at least 1.0m above known known groundwater levels. This will make any infiltration structure / soakaway being within made ground which is not feasible due to ground stability and risk of contamination. Therefore, based on the relatively shallow ground water and the presence of made ground, discharge of surface water to ground is not feasible.
Discharge to Surface Water Body	No	There are no known waterbodies near to the development site, and therefore this is not a feasible discharge destination.
Discharge to Surface Water Sewer	Yes	As the ground is not suitable for infiltration, and there are no known waterbodies near the development site, the only alternative is to discharge the surface water from the post development site into the surface water sewer within Burton Road via the existing 225mm surface water drainage network within the hospital site.

Discharge to Highway or Other Drain	No	There are no known highway drains near to the development site, and therefore this is not a feasible discharge destination.
Discharge to Combined Water Network	No	There are combined water sewers to the west and south of the site. However, as the surface water is to discharge to the surface water sewer, this discharge destination is not required.

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:

Table 2 - SuDS Methods & Requirements

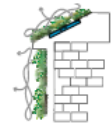
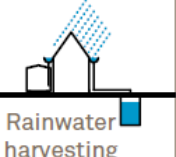
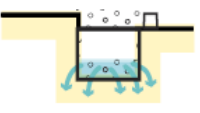
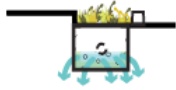
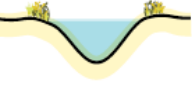
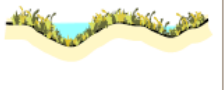
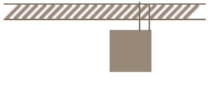
	Description	Setting	Required area
 Green roofs	A planted soil layer is constructed on the roof of a building to create a living surface. Water is stored in the soil layer and absorbed by vegetation.	 Building	Building integrated.
 Rainwater harvesting	Rainwater is collected from the roof of a building 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.

Table 3 - SuDS Methods & Requirements continued

	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 maintenance 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:

Table 4 - SuDS Method Feasibility

SuDS Method	Feasibility	Description
Green Roofs	No	The new building roof has not been structurally designed for the weight of green / living roofs, and therefore it is not a feasible SuDS method.
Rainwater Harvesting	No	Rainwater harvesting for water re-use has not been considered for the development due to the cost of a dual pipe network, and that water supply is crucial to this type of development (hospital / healthcare).
Soakaway	No	Based on the BGS data, the ground at the development site consists of made ground over coarse sand and clay layers. Coarse sand is suitable material for infiltration, however, the BGS data identifies ground water to be 3.00m bgl (above clay strata) which is 0.80m below made ground. In accordance with CIRIA 753 Infiltration structures/soakaways are to be at least 1.0m above known groundwater levels. This will make any infiltration structure / soakaway being within made ground which is not feasible due to ground stability and risk of contamination. Therefore, based on the relatively shallow ground water and the presence of made ground, the use of soakaways is not a feasible SuDS method.

Filter Strips	Yes	There is potential to have filter drains within the soft landscaping areas of the site, which will take the surface water run-off from all the pedestrian areas. The filter drain will not discharge the surface water to ground but will convey the surface water to the main network via perforated pipes within the trench (formed of 20mm no fines aggregate).
Permeable Paving	Yes	There is potential to have permeable paving within the car park areas of the site, which will take the surface water run-off from the car park area. The permeable paving system will not discharge the surface water to ground but will convey the surface water to the main network via perforated pipes within the granular sub-base (formed of 20mm no fines aggregate), and act as attenuation.
Swale / Pond / Bioretention Areas	No	The soft-landing areas throughout the site are relatively small and will be used for new trees and planting. Therefore, there are no suitable areas within the site for swales, ponds, or bioretention areas.
Underground Storage	Yes	The surface water run-off from the development site will be restricted. The restricted rate will be lower than the surface water run-off rate, therefore there will be a requirement to have further underground storage in the form of cellular units

7 Development Greenfield Run-Off Rates and Volume

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 volumes.

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 km ² 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):

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

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

$$Area = 50.00 \text{ ha (required area for calculation)}$$

$$SAAR = 864$$

Soil = 0.450

Urban Factor = 0.00

Region Number = 10

The calculations in Appendix E, show the rate for 50.00ha is 281.0 l/s, but is to be reduced to reflect the surface water management area (0.240 ha) of the development site. Therefore, the QBAR (greenfield run-off) for development area has been calculated to be:

QBAR = 1.35 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:

Table 5 - Storm event growth factors & run-off rates

Storm Event	QBAR	Growth Factor (C753 Table 24.2)	Greenfield Run-off Rate
Q ₁	1.35 l/s	0.87	1.2 l/s
Q ₃₀	1.35 l/s	1.70	2.3 l/s
Q ₁₀₀	1.35 l/s	2.08	2.8 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 FEH 2013, with the results shown in Appendix E.

The FEH 2013 data and variables used to calculate the greenfield run-off volume at the Site location area as follows:

Site Location = GB 383735 392005 SJ 83735 92005

Area = 0.240 ha

SAAR = 839

CWI = 119.230

SPR Host = 47.000

URBTEXT = 0

Based on these calculation results (Appendix E), the greenfield run-off volume for the surface water management area of the Site is:

Q_{100} (6-Hour) = 81.18m³ (338.24m³/ha)

8 Below Ground Drainage Networks and SW Management Calculations

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 summarised in Figure 1 below.

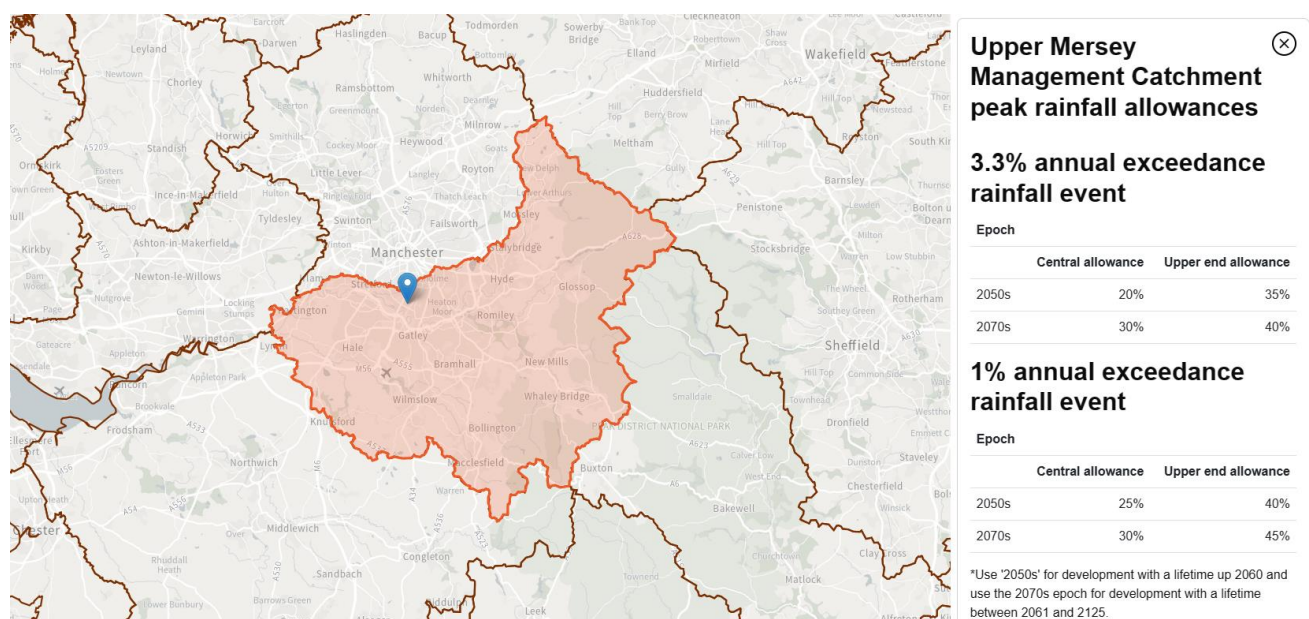


Figure 1 - DEFRAs – Climate Change Allowances

The lifetime of the hospital building is likely to be beyond 2061, and therefore the Epoch 2070's is to be used with Upper End Allowance. Therefore, the climate change allowance for the surface water run-off will be **40%** and **45%** for the 30-year and 100-year storm respectively.

8.2 Surface Water Network Calculations

The calculations to determine the post development surface water run-off rates and required infiltration structure volume, are based on the post development surface water run-off area of 0.240 ha, and the rainfall data given by the FEH 2013.

8.3 Surface Water Drainage Network and Management

As shown on the below ground drainage layout drawing in Appendix F, the proposed surface water main network will consist of 375mm diameter pipes; 1500mm diameter manholes; permeable paving;

filter drains; a 1500mm diameter flow control chamber containing a hydro-brake; and an attenuation tank in the form of cellular units.

The surface water run-off from the new roof areas will discharge to the main network via rainwater pipes with trap gullies; the surface water run-off from the pedestrian area will discharge to the main drainage via filter drains, and the surface water run-off from the car parking areas will discharge to the main drainage via the permeable paving systems.

The surface water network will flow towards the western boundary of the site and will discharge through the cellular units and the flow control chamber prior to connection / discharge to the existing 225mm diameter surface water pipe and subsequently United Utilities surface water sewer in Burton Road.

The surface water will surcharge the drainage network when being restricted and will discharge into cellular units and permeable paving sub-base, where the water will be stored to prevent flooding. Post storm event, the water levels in the SuDS features will drop and flow back to the network and through the control chamber to the surface water system.

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 1.2 l/s for the 1 in 2-year storm event, 2.3 l/s for the 1 in 30-year storm event including 40% allowance / climate change, and 2.8 l/s for the 1 in 100-year storm event including 45% allowance / climate change.

This is to adhere to Ciria document C753 – The SuDS Manual which 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’*.

For this development, and based on the guidance, greenfield rates and greenfield run-off volume, the suitable / minimum size of the flow control opening (hydro-brake opening) is deemed to be 73mm, with a design flow of 2.8 l/s (100-year greenfield rate).

As shown in the output calculation from the MicroDrainage computer software in Appendix G, if the hydro-brake opening is set at 80mm, the design flow at 2.80 l/s, with a design head of 1.200m, the maximum surface water run-off rates for each storm event will be as follows:

Strom	-	Rate	-	Critical Storm Event
Q ₁	-	2.7 l/s	-	15-minute winter storm duration
Q _{30 + CC}	-	2.7 l/s	-	360-minute winter storm duration
Q _{100 + CC}	-	2.8 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	-	Greenfield	-	Post Dev	-	Difference
Q ₁	-	1.2 l/s	-	2.7 l/s	-	Increase
Q ₃₀	-	2.3 l/s	-	2.7 l/s	-	Increase
Q ₁₀₀	-	2.8 l/s	-	2.8 l/s	-	Equivalent

The results show that the post development run-off rates are an increase of the 1-year and 30-year greenfield rates but are equivalent to the 100-year greenfield rate.

Therefore, as the greenfield rates for extreme storms have not been exceeded, the discharge rates are deemed to be acceptable, as they meet the requirements set out in the DEFRA Non-Statutory Technical Standards for Sustainable Drainage Systems (S3).

8.5 Surface Water Run-Off Volume

The surface water run-off volumes for the post development site have also been calculated for 1 in 100-Year the 6-hour duration (Inc. 45% allowance / climate change), using the peak surface water discharge rate, whereas detailed in the MicroDrainage calculation in Appendix G, where the volume equates to:

$$Q_{100 \text{ (6-Hour)}} = 2.8 \text{ l/s} \times (60 \times 60 \times 6) = 60,480 \text{ litres} = \mathbf{60.48m^3}$$

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

Greenfield Volume to Post Development Volume

Strom	-	Greenfield	-	Post Dev	-	Difference
Q ₁₀₀	-	81.18m ³	-	60.48m ³	-	Reduction

The post development surface water run-off volume is a reduction of the greenfield volume for the same storm event and duration.

Therefore, the discharge volume is deemed to be acceptable, as it meets the requirements set out in the DEFRA Non-Statutory Technical Standards for Sustainable Drainage Systems (S4 + S6).

8.6 Surface Water Attenuation Calculations

As stated above, the post development run-off rates are restricted, there will be a requirement for surface water attenuation.

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

Attenuation structure formed of below ground attenuation tank in the form of cellular units, and the sub-base of the permeable paving.

As detailed in the MicroDrainage calculations (Appendix G) and below ground drainage strategy layout (Appendix F) the attenuation volume and details for the SuDS method are as follows:

Cellular Units

Tank Length	-	15.50m
Tank Width	-	11.00m
Tank Area	-	170.50m ²
Tank Depth	-	1.20m
Tank Volume	-	204.60m ³
Tank Porosity	-	0.95
Attenuation Volume	-	194.37m³

Permeable Paving Sub-Base

Sub-Base Area	-	130.00m ²
Sub-Base Depth	-	0.30m
Sub-Base Volume	-	39.00m ³
Sub-Base Porosity	-	0.95
Attenuation Volume	-	11.70m³

The MicroDrainage calculations (Appendix G) show that with surface water network and these SuDS methods and volumes, no flooding will occur for all storms up to and including the 100-year + 45% storm event.

9 Maintenance Requirements

The management and maintenance of the surface water drainage networks and SuDS features will be by estate management of the clinical site, where the maintenance of the drainage and SuDS will form part of the overall site management / landscaping / gardening. The details of the management and maintenance to be carried out is as follows:

9.1 Surface Water Drainage Network, Flow Control and Cellular Units

Table 6 - Flow Control and Cellular Units

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 Filter Drains

Table 7 - Permeable Paving and Filter Drains

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 filter drain and permeable paving or near system (where may cause risk performance)	Monthly
Rainfall infiltration into permeable paving and / or filter drain is ensured working effectively.	As required, but at least twice a year

9.3 Linked and Further Maintenance Activities

The maintenance of the drainage network and SuDS features are to be linked with the wider site maintenance for the new residential landscaped / garden areas.

A log of all maintenance activities is to be kept and made available to the local planning authority (LPA) and / or the Lead Local Flood Authority (LLFA) on request.

10 Surface Water Design Exceedance

In the unlikely event of an extreme storm greater than 100-year + 45% climate change, or poor maintenance of the SuDS features and / or pipework, potential flooding of the drainage network could occur.

Surface water flow paths to follow existing and proposed ground topography, where water will flow towards the development boundaries, and into Burton and Fielden Road.

Flood water will flow away from the proposed building and will not flow directly towards existing dwellings / properties outside the development boundary. The flood water within the roads will be contained due to the road having a gradient (water to flow along road) and upstand kerbs.

11 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.

11.1 Access Road Car Park Areas 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

11.2 Access Road and Car Park Areas Pollutant Mitigation

Mitigation Measures:

Filter Drain and Permeable Paving

Permeable Paving Pollutant Mitigation Indices:

Total Suspended Solid (TSS)	=	0.7
Metals	=	0.6
Hydrocarbons	=	0.7
SuDS Mitigation Indices	=	2.00

The mitigation indices are greater than the pollution hazard index, and therefore suitable water quality is achieved.

12 Development Management and Construction Phase

All existing drainage networks within the development area are to be maintained during construction. The pipe network, cellular units, and flow control chamber are to be the first part of the drainage network to be built. This will ensure that the surface water discharge is suitably restricted without pollutants or flooding.

12.1 Construction Environment Management Plan

Full details of the construction environment management plan (CEMP) must be confirmed by the chosen contractor who have been appointed for the development. Therefore, it is recommended that this is a planning condition, with the assurance that a CEMP will confirm to the requirements of CIRIA 753 – The SuDS Manual – Chapter 31. The construction programming for SuDS, however, for the development site will include:

12.2 Construction Access

The main construction traffic will access the site from the existing roads to be west and south of the site and will ensure that traffic over the proposed cellular units will be avoided.

12.3 Sediments and Traps

Sediment basins and traps are to be installed before any major site earthworks take place, with further sediment traps and silt fences being installed as the earthworks progresses. This will keep sediment contained on site at appropriate locations.

12.4 Run-Off Control Measures

Run-off control measures are to be used in conjunction with sediment traps to divert water around planned earthworks areas to remove silts. Any surface water upstream of the site is to be diverted around the development areas, and to discharge to the existing drainage system. The surface water run-off destination for the diverted surface water will continue as existing.

12.5 Main Surface Water Run-Off Systems

The main drainage network, cellular units, flow control chamber, and outfall to existing drainage network are to be built prior to any phase of construction of site. Surface water from each of the phased area is to discharge to the new drainage network, where the water is adequately restricted, and water quality maintained before discharging to the river. Temporary inlet and outlet protection measures and appropriate silt traps are to be installed to prevent silt ingress into the main drainage network.

12.6 Clearing and Earthworks

Clearing and earthworks will only start when adequate erosion and sediment control measures are in place. Once the development areas are cleared, earthworks will follow immediately to ensure that the ground cover can be re-established quickly. Adjacent land to that being developed will be left undisturbed for as long as possible.

12.7 Surface Stabilisation Measures

Surface stabilisation measures will be applied to completed areas, channels ditches and other disturbed areas after the land is cleared and profiled. Permanent stabilisation measures will be installed as soon as possible after final profiling.

12.8 Construction of Permeable Surfacing

Construction of permeable paving is to be left to the later stages of construction. Unsuitable sediment is to be removed from surfacing prior to installation of sand binder layer and paving.

13 Conclusion / Summary

13.1 SuDS Principles and Discharge Destination

All feasible SuDS methods, and surface water discharge destination have been assessed, with the feasible SuDS methods being permeable paving, filter drains, cellular units and a flow control chamber, and the surface water destination being to a surface water sewer via an existing drainage network.

13.2 Peak Flow Control

The results show that the post development run-off rates are an increase of the 1-year and 30-year greenfield rates but are equivalent to the 100-year greenfield rate. Therefore, as the greenfield rates for extreme storms have not been exceeded, the discharge rates are deemed to be acceptable, as they meet the requirements set out in the DEFRA Non-Statutory Technical Standards for Sustainable Drainage Systems.

13.3 Volume Control

The post development surface water run-off volume is a reduction of the greenfield volume for the same storm event and duration. Therefore, the discharge volume is deemed to be acceptable, as it meets the requirements set out in the DEFRA Non-Statutory Technical Standards for Sustainable Drainage Systems.

13.4 Flood Risk within the Development

The MicroDrainage calculations show that with these SuDS methods and volumes, no flooding will occur for all storms up to and including the 100-year + 45% storm event.

13.5 Maintenance

The management and maintenance of the surface water drainage networks and SuDS features will be by estate management of the clinical site, where the maintenance of the drainage and SuDS will form part of the overall site management / landscaping / gardening.

13.6 Surface Water Design Exceedance

In the unlikely event of an extreme storm greater than 100-year + 45% climate change, or poor maintenance of the SuDS features and / or pipework, potential flooding of the drainage network could occur. Surface water flow paths to follow existing and proposed ground topography, where water will flow towards the development boundaries, and into Burton and Fielden Road.

Flood water will flow away from the proposed building and will not flow directly towards existing dwellings / properties outside the development boundary. The flood water within the roads will be contained due to the road having a gradient (water to flow along road) and upstand kerbs.

13.7 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. The mitigation indices are greater than the pollution hazard index, and therefore suitable water quality is achieved.

13.8 Construction Environment Management Plan

All existing drainage networks within the development area are to be maintained during construction. The pipe network, cellular units, and flow control chamber are to be the first part of the drainage network to be built. This will ensure that the surface water discharge is suitably restricted without pollutants or flooding.

Appendix A - Topographical Survey

Appendix B - Proposed Site Plan



Ground Floor GA Plan
1:100

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P3	STAGE 2 ISSUE
P2	Issued for Information
P1	Issued for Information
REV	DESCRIPTION

28.03.24	MA
22.03.24	MA
19.03.24	MA
DATE	REV BY

CLIENT	Manchester University Hospital NHS Foundation Trust
PROJECT	Cardiorespiratory, Withington Community Hospital

DRAWING	Proposed Site Plan
SCALE	1:100 @ A0
PROJECT	1342-22
CLIENT REF	22162
DRAWN BY	MA
CHECKED BY	SDB
ORIGIN	VOLUME
DAY	WCH127
LEVEL	00
TYPE	DR
ROLE	A
NUMBER	02002
REVISION	P3
SUBMITTAL	INFORMATION

DAY

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Appendix C - British Geological Survey Data

MANCHESTER CITY COUNCIL
CITY ENGINEER AND SURVEYORS DEPARTMENT

57895-2654
8383 9203

SITE INVESTIGATION FOR		DATE COMMENCED	22-2-87
LOCATION	Burton Road	BORING METHOD	Cable Percussive
BOREHOLE No.	2	BORING DIAMETER	150 mm
GRID REFERENCE		SCALE:	1:50 m

DATE	CASING DEPTH (m)	WATER LEVEL MORNING & EVENING	DEPTH OF STRATA BELOW GL	Reduced Level	DESCRIPTION	No. and Type of Sample	SAMPLE DEPTH PENETRATION		No. of Blows	Legend
							From	To		
21-2-87	0.00	DRY	0.40		Bituminous surfacing onto concrete					
			0.70		Brown-black silt, sand, ash, cinders, gravel, brick, clay etc. MADEGROUND	D1	0.50			
			1.40		Very loose grey-brown very gravelly fine to coarse SAND with clay lenses	D2 P1 B1	1.00 1.55 1.80	1.85 2.20	3	
22-2-87			2.20		MADEGROUND					
			2.70		Very loose grey-brown gravelly fine to coarse SAND	P2 B2	2.35 2.70	2.65 3.20	1	
			3.90		Medium-dense brown slightly silty and very gravelly fine to coarse SAND	P3 W1	3.35 3.65	3.65	11	
					Stiff/very stiff brown silty and sandy CLAY with silt and sand laminae and lenses and fine to medium gravel becoming firm/stiff silty and slightly sandy laminated CLAY with occasional fine gravel below 5.20 m and stiff below 6.0 m	D3 U1 D4 U2 D5 U3 D6	4.00 4.30 4.85 5.20 5.75 6.00 6.55	4.75 5.65 6.45		
22-2-87	4.50	DRY	6.55		END OF BOREHOLE					

WATER OBSERVATIONS DURING BORING				WATER LEVEL IN CASED/UNCASED BOREHOLE ON COMPLETION		
DEPTH OF WATER ENTRY (m)	ESTIMATED SEE PAGE	STANDING LEVEL (m)	DEPTH OF CASING WHEN SEALED (m)	DATE	WATER LEVEL	DEPTH OF CASING
3.20	-	3.00	-			
				REMARKS:- Water encountered at 3.20 m rising to 3.00 m after 15 minutes. Borehole dry on completion.		

SAMPLE TEST KEY		D - DISTURBED SAMPLE P - SPT SAMPLE	B - BULK SAMPLE W - WATER SAMPLE	U - UNDISTURBED SAMPLE
-----------------	--	--	-------------------------------------	------------------------

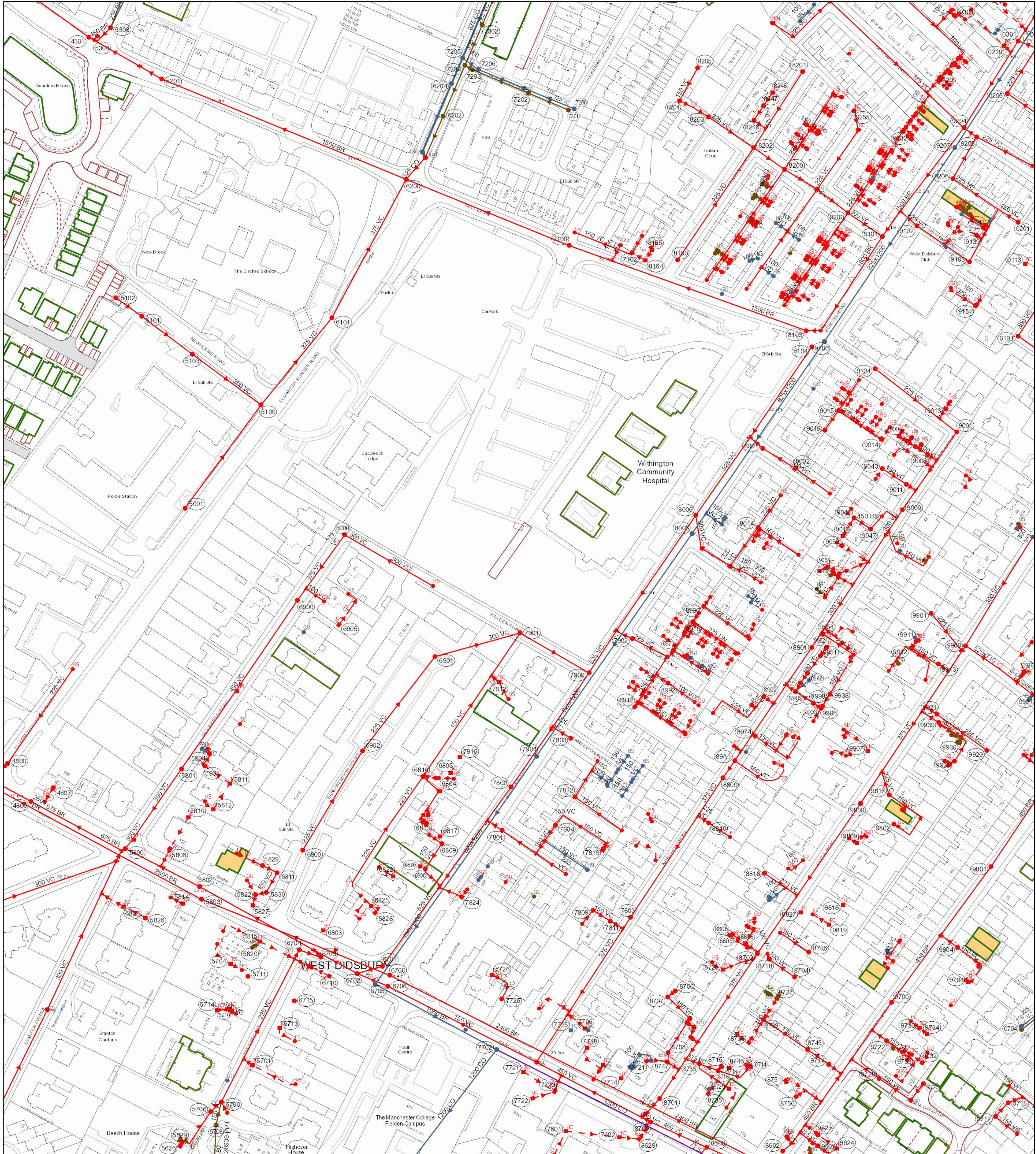
NOTE: WHERE FULL 0.3 PENETRATION HAS NOT BEEN ACHIEVED, THE NUMBER OF BLOWS FOR THE QUOTED PENETRATION IS GIVEN (NOT N - VALUE)

ALL DEPTHS AND REDUCED LEVELS IN (m) UNLESS OTHERWISE STATED

REMARKS

COMMERCIAL
IN CONFIDENCE

Appendix D - United Utilities Asset Plan



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.

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Reho	Cover	Func	Invert	Size x	Size y	Shape	Mat	Length	Grad
8001	31.61	CO	28.43	300		VC	21.05022		
8002	33.18	SW	24.89	825		BR	10.47266	1 in 524	
8003	33.08	CO	25.34	375		VC	10.02015	1 in 285	
8004	33.41	CO	0	150		VC	2.834257		
8005	33.41	CO	30.56	225		VC	5.549199	1 in 7	
8006	33.41	CO	30.56	225		VC	5.587059	1 in 7	
8007	33.41	CO	28.62	300		VC	100.8876	1 in 280	
8008	32.09	CO	28.07	375		VC	3.412462		
8009	32.09	CO	28.07	375		VC	61.84858	1 in 326	
8010	32.09	CO	28.07	375		VC	11.54543		
8011	32.09	CO	28.07	375		VC	13.43007		
8012	32.09	CO	28.07	375		VC	12.15411		
8013	32.09	CO	28.07	375		VC	90.37699	1 in 2086	
8014	32.09	CO	28.07	375		VC	146.0208	1 in 2046	
8015	32.09	CO	28.07	375		VC	64.03745	1 in 940	
8016	32.09	CO	28.07	375		VC	12.64911	1 in 53	
8017	32.09	CO	28.07	375		VC	128.7051	1 in 1170	
8018	32.09	CO	28.07	375		VC	3.873959		
8019	32.09	CO	28.07	375		VC	17.47439		
8020	32.09	CO	28.07	375		VC	9.926783		
8021	32.09	CO	28.07	375		VC	31.05445		
8022	32.09	CO	28.07	375		VC	6.215644		
8023	32.09	CO	28.07	375		VC	6.959341		
8024	32.09	CO	28.07	375		VC	30.00338	1 in 286	
8025	32.09	CO	28.07	375		VC	2.40768		
8026	32.09	CO	28.07	375		VC	4.60148		
8027	32.09	CO	28.07	375		VC	85.60374	1 in 49	
8028	32.09	CO	28.07	375		VC	3.123973		
8029	32.09	CO	28.07	375		VC	4.791372		
8030	32.09	CO	28.07	375		VC	21.04261		
8031	32.09	CO	28.07	375		VC	7.713778		
8032	32.09	CO	28.07	375		VC	3.638474		
8033	32.09	CO	28.07	375		VC	14.26587		
8034	32.09	CO	28.07	375		VC	150.0833	1 in 417	
8035	32.09	CO	28.07	375		VC	19.05572		
8036	32.09	CO	28.07	375		VC	17.11178		
8037	32.09	CO	28.07	375		VC	6.52091		
8038	32.09	CO	28.07	375		VC	59.06038	1 in 295	
8039	32.09	CO	28.07	375		VC	64.14047	1 in 114	
8040	32.09	CO	28.07	375		VC	65.04888	1 in 140	
8041	32.09	CO	28.07	375		VC	27.24909		
8042	32.09	CO	28.07	375		VC	17.20465	1 in 246	
8043	32.09	CO	28.07	375		VC	6.65864	1 in 15	
8044	32.09	CO	28.07	375		VC	34.78199		
8045	32.09	CO	28.07	375		VC	35.22083	1 in 50	
8046	32.09	CO	28.07	375		VC	92.13034		
8047	32.09	CO	28.07	375		VC	7.130762		
8048	32.09	CO	28.07	375		VC	6.387374		
8049	32.09	CO	28.07	375		VC	21.9079		
8050	32.09	CO	28.07	375		VC	12.04159	1 in 5	
8051	32.09	CO	28.07	375		VC	12.04159	1 in 696	
8052	32.09	CO	28.07	375		VC	130.1761		
8053	32.09	CO	28.07	375		VC	8.506868		
8054	32.09	CO	28.07	375		VC	30.64482		
8055	32.09	CO	28.07	375		VC	1.720775		
8056	32.09	CO	28.07	375		VC	12.54253		
8057	32.09	CO	28.07	375		VC	56.60389	1 in 5660	
8058	32.09	CO	28.07	375		VC	6.94021		
8059	32.09	CO	28.07	375		VC	92.35857	1 in 138	
8060	32.09	CO	28.07	375		VC	5.079626		
8061	32.09	CO	28.07	375		VC	1.04784		
8062	32.09	CO	28.07	375		VC	7.611504		
8063	32.09	CO	28.07	375		VC	3.479422		
8064	32.09	CO	28.07	375		VC	75.54448		
8065	32.09	CO	28.07	375		VC	5.102233		
8066	32.09	CO	28.07	375		VC	18.38478		
8067	32.09	CO	28.07	375		VC	26.41669		
8068	32.09	CO	28.07	375		VC	6.138181		
8069	32.09	CO	28.07	375		VC	11.50908		
8070	32.09	CO	28.07	375		VC	10.46995		
8071	32.09	CO	28.07	375		VC	6.256584		
8072	32.09	CO	28.07	375		VC	12.96276		
8073	32.09	CO	28.07	375		VC	1.387729		
8074	32.09	CO	28.07	375		VC	5.784556		
8075	32.09	CO	28.07	375		VC	223.7074	1 in 2337	
8076	32.09	CO	28.07	375		VC	11.50096		
8077	32.09	CO	28.07	375		VC	104.561	1 in 1307	
8078	32.09	CO	28.07	375		VC	20.59129	1 in 168	
8079	32.09	CO	28.07	375		VC	24.26864		
8080	32.09	CO	28.07	375		VC	128.999	1 in 289	
8081	32.09	CO	28.07	375		VC	70.80254		
8082	32.09	CO	28.07	375		VC	112.108	1 in 510	
8083	32.09	CO	28.07	375		VC	43.78187		
8084	32.09	CO	28.07	375		VC	34.0147		
8085	32.09	CO	28.07	375		VC	8.807624		
8086	32.09	CO	28.07	375		VC	49.80314	1 in 70	
8087	32.09	CO	28.07	375		VC	101.8442	1 in 196	
8088	32.09	CO	28.07	375		VC	7.798248		
8089	32.09	CO	28.07	375		VC	11.6019	1 in 3	
8090	32.09	CO	28.07	375		VC	5.837942		
8091	32.09	CO	28.07	375		VC	8.602325	1 in 21	
8092	32.09	CO	28.07	375		VC	53.83729	1 in 88	
8093	32.09	CO	28.07	375		VC	17.18688		
8094	32.09	CO	28.07	375		VC	1.700394		
8095	32.09	CO	28.07	375		VC	29.98889		
8096	32.09	CO	28.07	375		VC	70.10715	1 in 2337	
8097	32.09	CO	28.07	375		VC	10.99521		
8098	32.09	CO	28.07	375		VC	14.50222		
8099	32.09	CO	28.07	375		VC	49.88557		
8100	32.09	CO	28.07	375		VC	34.05365		
8101	32.09	CO	28.07	375		VC	34.05365		
8102	32.09	CO	28.07	375		VC	34.05365		
8103	32.09	CO	28.07	375		VC	34.05365		
8104	32.09	CO	28.07	375		VC	34.05365		
8105	32.09	CO	28.07	375		VC	34.05365		
8106	32.09	CO	28.07	375		VC	34.05365		
8107	32.09	CO	28.07	375		VC	34.05365		
8108	32.09	CO	28.07	375		VC	34.05365		
8109	32.09	CO	28.07	375		VC	34.05365		
8110	32.09	CO	28.07	375		VC	34.05365		
8111	32.09	CO	28.07	375		VC	34.05365		
8112	32.09	CO	28.07	375		VC	34.05365		
8113	32.09	CO	28.07	375		VC	34.05365		
8114	32.09	CO	28.07	375		VC	34.05365		
8115	32.09	CO	28.07	375		VC	34.05365		
8116	32.09	CO	28.07	375		VC	34.05365		
8117	32.09	CO	28.07	375		VC	34.05365		
8118	32.09	CO	28.07	375		VC	34.05365		
8119	32.09	CO	28.07	375		VC	34.05365		
8120	32.09	CO	28.07	375		VC	34.05365		
8121	32.09	CO	28.07	375		VC	34.05365		
8122	32.09	CO	28.07	375		VC	34.05365		
8123	32.09	CO	28.07	375		VC	34.05365		
8124	32.09	CO	28.07	375		VC	34.05365		
8125	32.09	CO	28.07	375		VC	34.05365		
8126	32.09	CO	28.07	375		VC	34.05365		
8127	32.09	CO	28.07	375		VC	34.05365		
8128	32.09	CO	28.07	375		VC	34.05365		
8129	32.09	CO	28.07	375		VC	34.05365		
8130	32.09	CO	28.07	375		VC	34.05365		
8131	32.09	CO	28.07	375		VC	34.05365		
8132	32.09	CO	28.07	375		VC	34.05365		
8133	32.09	CO	28.07	375		VC	34.05365		
8134	32.09	CO	28.07	375		VC	34.05365		
8135	32.09	CO	28.07	375		VC	34.05365		
8136	32.09	CO	28.07	375		VC	34.05365		
8137	32.09	CO	28.07	375		VC	34.05365		
8138	32.09	CO	28.07	375		VC	34.05365		
8139	32.09	CO	28.07	375		VC	34.05365		
8140	32.09	CO	28.07	375		VC	34.05365		
8141	32.09	CO	28.07	375		VC	34.05365		
8142	32.09	CO	28.07	375		VC	34.05365		
8143	32.09	CO	28.07	375		VC	34.05365		
8144	32.09	CO	28.07	375		VC	34.05365		
8145	32.09	CO	28.07	375		VC	34.05365		
8146	32.09	CO	28.07	375		VC	34.05365		
8147	32.09	CO	28.07	375		VC	34.05365		
8148	32.09	CO	28.07	375					

Appendix E - Greenfield Run-Off Rates and Volume Calculations

Flo Consult UK Ltd		Page 1
4 Market Square	Withington CH	
Old Amersham	Greenfield Run-Off	
Buckinghamshire, HP7 0DQ	Rate Calculations	
Date 19/01/2023	Designed by MDS	
File	Checked by MDS	
Innovyze	Source Control 2020.1	

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

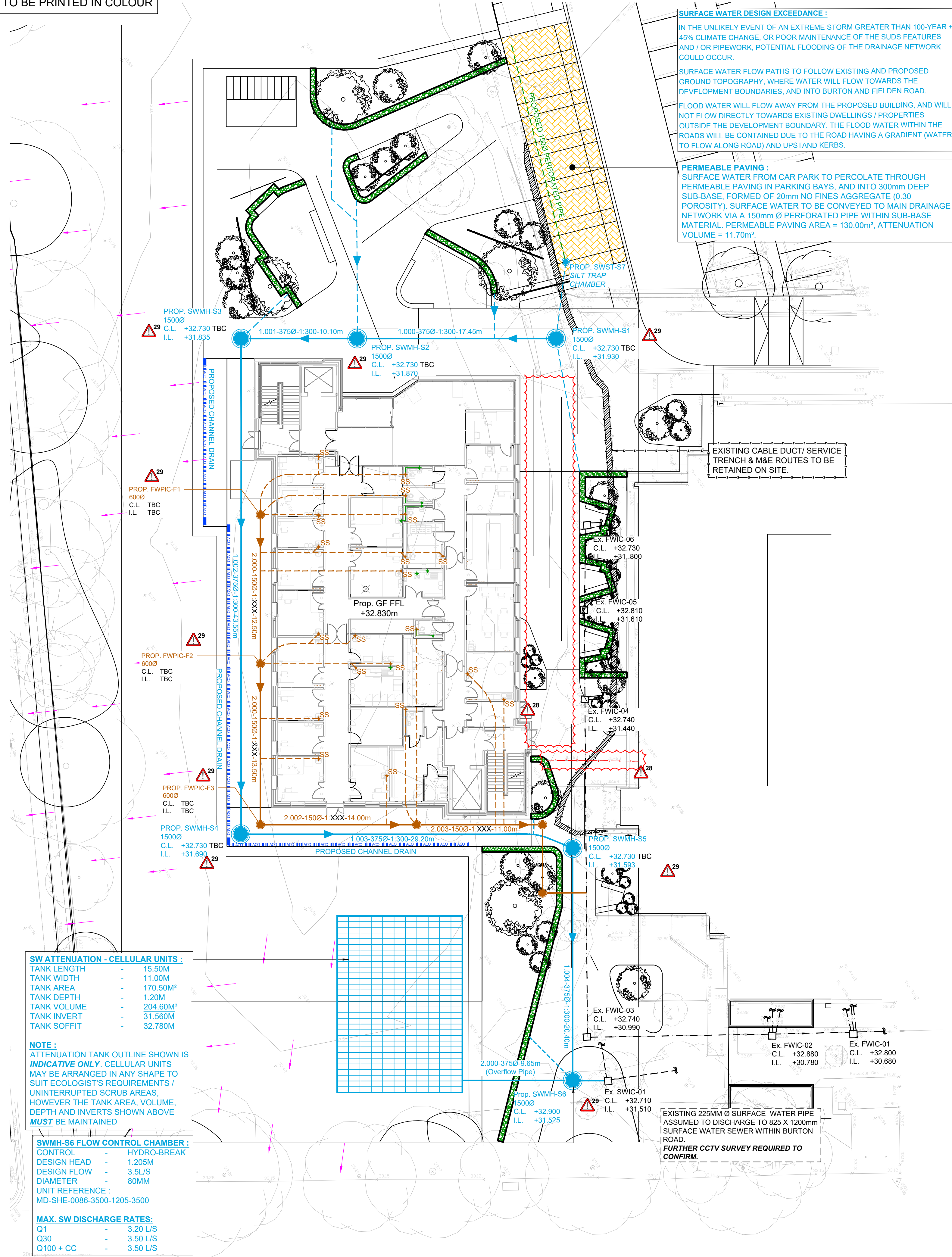
Results 1/s

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

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Flo Consult UK Ltd		Page 1																										
4 Market Square	Withington CDC																											
Old Amersham	Greenfiled Run-Off																											
Buckinghamshire, HP7 0DQ	Volume Calculation																											
Date 22/04/2024	Designed by MDS																											
File	Checked by MDS																											
Innovyze		Source Control 2020.1.3																										
<u>Greenfield Runoff Volume</u> FEH Data <table> <tr> <td>Return Period (years)</td> <td>100</td> </tr> <tr> <td>Storm Duration (mins)</td> <td>360</td> </tr> <tr> <td>FEH Rainfall Version</td> <td>2013</td> </tr> <tr> <td>Site Location</td> <td>GB 383735 392005 SJ 83735 92005</td> </tr> <tr> <td>Data Type</td> <td>Point</td> </tr> <tr> <td>Areal Reduction Factor</td> <td>1.00</td> </tr> <tr> <td>Area (ha)</td> <td>0.240</td> </tr> <tr> <td>SAAR (mm)</td> <td>839</td> </tr> <tr> <td>CWI</td> <td>119.230</td> </tr> <tr> <td>SPR Host</td> <td>47.000</td> </tr> <tr> <td>URBEXT (USER)</td> <td>0.0000</td> </tr> </table> Results <table> <tr> <td>Percentage Runoff (%)</td> <td>50.13</td> </tr> <tr> <td>Greenfield Runoff Volume (m³)</td> <td>81.178</td> </tr> </table>			Return Period (years)	100	Storm Duration (mins)	360	FEH Rainfall Version	2013	Site Location	GB 383735 392005 SJ 83735 92005	Data Type	Point	Areal Reduction Factor	1.00	Area (ha)	0.240	SAAR (mm)	839	CWI	119.230	SPR Host	47.000	URBEXT (USER)	0.0000	Percentage Runoff (%)	50.13	Greenfield Runoff Volume (m³)	81.178
Return Period (years)	100																											
Storm Duration (mins)	360																											
FEH Rainfall Version	2013																											
Site Location	GB 383735 392005 SJ 83735 92005																											
Data Type	Point																											
Areal Reduction Factor	1.00																											
Area (ha)	0.240																											
SAAR (mm)	839																											
CWI	119.230																											
SPR Host	47.000																											
URBEXT (USER)	0.0000																											
Percentage Runoff (%)	50.13																											
Greenfield Runoff Volume (m³)	81.178																											
©1982-2020 Innovyze																												

Appendix F - Below Ground Drainage Strategy Layout and Details



HAZARD & WARNING NOTES:

- 01 EXCAVATION WORKS IN THE VICINITY OF EXISTING SERVICES. KNOWN BELOW GROUND SERVICES AND OBSTRUCTIONS.
- 02 REQUIREMENT FOR GAS PROTECTION MEASURES.
- 06 DRAINAGE WORKS EXCAVATION. DURING THE INSTALLATION OF NEW DRAINAGE RUNS. POTENTIAL WORKS IN CONFINED SPACES. DANGER TO OPERATIVES WORKING ON SITE FROM SEWAGE.
- 16 MECHANICAL & ELECTRICAL (M&E) DESIGN IN ABEYANCE. AWAITING PROPOSED RISER, LOUVRE, AND ABOVE GROUND DRAINAGE REQUIREMENTS.
- 23 SURFACE WATER MANAGEMENT PLAN (SWMP) TO BE REVISED FOLLOWING SCHEME RELAUNCH/ REVISED PROPOSALS AND CONFIRM FLOOD RISK REQUIREMENTS. PENDING INSTRUCTION FROM BAM/ RECEIPT OF REVISED EXTERNAL WORKS PROPOSALS.
- 28 EXISTING HV CABLE/ DUCT IDENTIFIED ON SITE. PROPOSED REROUTING WORKS (DESIGN & DETAILING) TO BE CONFIRMED BY ELECTRICITY NORTH WEST (ENW) PRIOR TO CONSTRUCTION. BELOW GROUND DRAINAGE DESIGN/ EXTERNAL WORKS SUBJECT TO CHANGE FOLLOW RECEIPT OF PROPOSALS.
- 29 ALL EXTERNAL WORKS LEVELS TO BE CONFIRMED BY LANDSCAPE ARCHITECT. PROPOSED BELOW GROUND DRAINAGE ARRANGEMENT SUBJECT TO CHANGE FOLLOW RECEIPT OF LEVELS & FURTHER COORDINATION WITH EXISTING INVERT LEVELS.

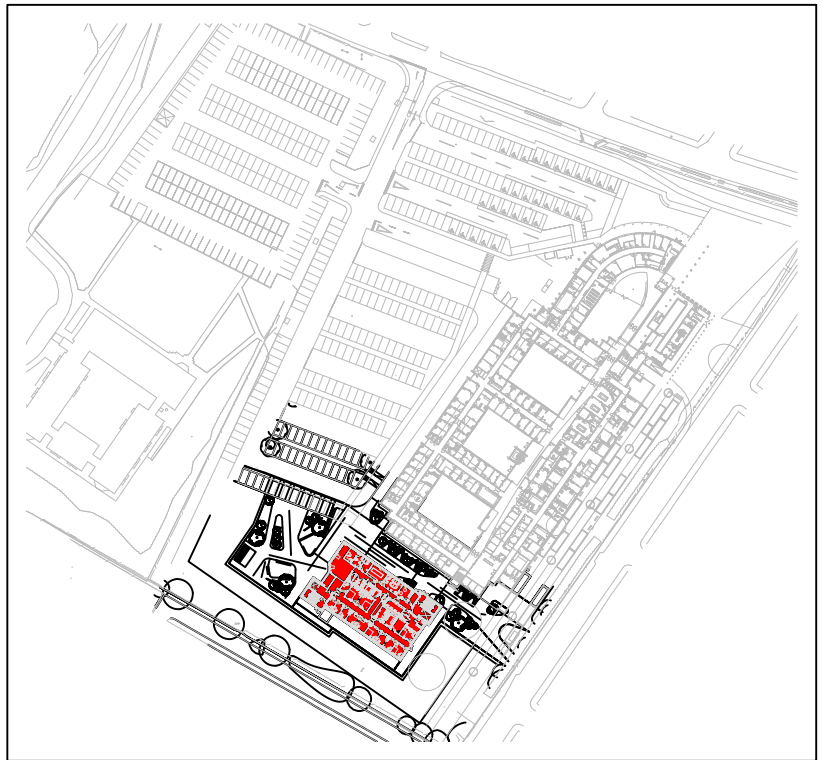
Drainage Legend

- Denotes Development Boundary
- Denotes Existing Combined Drain
- Denotes Existing Foul Water Drain
- Denotes Existing Surface Water Drain
- Denotes Redundant Drain - To be Removed/ Capped - Usage as Per Existing Line Types
- Denotes Proposed Combined Drain
- Denotes Proposed Primary Foul Water Drain
- Denotes Proposed Secondary Foul Water Drain - All Runs to be 100Ø U.N.O.
- Denotes Proposed Surface Water Drain
- Denotes Proposed Secondary Surface Water Drain - All Runs to be 100Ø U.N.O.
- Denotes Proposed Channel/ Slot Drain
- Denotes Proposed Foul Water Pump Rising Main
- Denotes Proposed Surface Water Pump Rising Main
- Denotes Proposed Foul Water Drain to be Installed & Capped to Allow for Future Connection
- Denotes Proposed Surface Water Drain to be Installed & Capped to Allow for Future Connection
- Denotes Proposed Filter Drain/ Rain Garden
- Denotes Exceedance Flow Routes
- Denotes Existing RWP/ SVP - As Noted (Shown Indicatively - Final Locations TBC on Site)
- Denotes Proposed FW Ground Floor Penetration (Shown Indicatively - Final Locations as per Architects Set Out)
- Denotes Proposed RWP Location As Provided by Architect (Shown Indicatively - Final Locations as per Architects Set Out)
- Denotes Above Ground Foul Water Drain (Proposed) - Shown Indicatively Final Arrangement TBC by M&E Contractor
- MH Denotes Manhole Location
- PPIC Denotes Inspection Chamber Location
- FG Denotes Foul Water Gully Location
- SVP Denotes Soil Vent Pipe Location
- SS Denotes Stub Stack Location
- G Denotes Gully
- RE Denotes Rodding Eye Location
- BIG Denotes Back Inlet Gully
- BD Denotes Back Drop Location
- WB Denotes Proposed Water Butt
- F.A. Denotes Pipe/ Penetration From Above.
- A.G. Denotes Pipe Run Above Ground Floor Level
- AAV Denotes Air Admittance Valve - Final Spec. / Details TBC by M&E Contractor.
- Denotes Existing Below Ground LV Cable/ Ducting
- Denotes Existing Below Ground HV Cable/ Ducting

notes :

1. IF THIS DRAWING HAS BEEN RECEIVED ELECTRONICALLY IT IS THE RECIPIENTS RESPONSIBILITY TO PRINT THE DOCUMENT TO THE CORRECT SCALE
2. ALL DIMENSIONS ARE IN MILLIMETRES UNLESS STATED OTHERWISE. IT IS RECOMMENDED THAT INFORMATION IS NOT SCALED OFF THIS DRAWING
3. THIS DRAWING SHOULD BE READ IN CONJUNCTION WITH ALL OTHER RELEVANT DRAWINGS AND SPECIFICATIONS
4. ANY DISCREPANCIES NOTED ON SITE ARE TO BE REPORTED TO THE ENGINEER IMMEDIATELY.

KEYPLAN



P1	ISSUED FOR COMMENT	22.04.24	MDS	LC
REV.	DESCRIPTION	DATE	DRW.	CHK.



APPOINTED PARTY LOGO/INFORMATION



PROJECT
CDC - CARDIORESPIRATORY,
WITHINGTON COMMUNITY HOSPITAL

TITLE
PROPOSED BELOW GROUND
DRAINAGE PLAN

STATUS S1	PURPOSE OF ISSUE FOR COMMENTS
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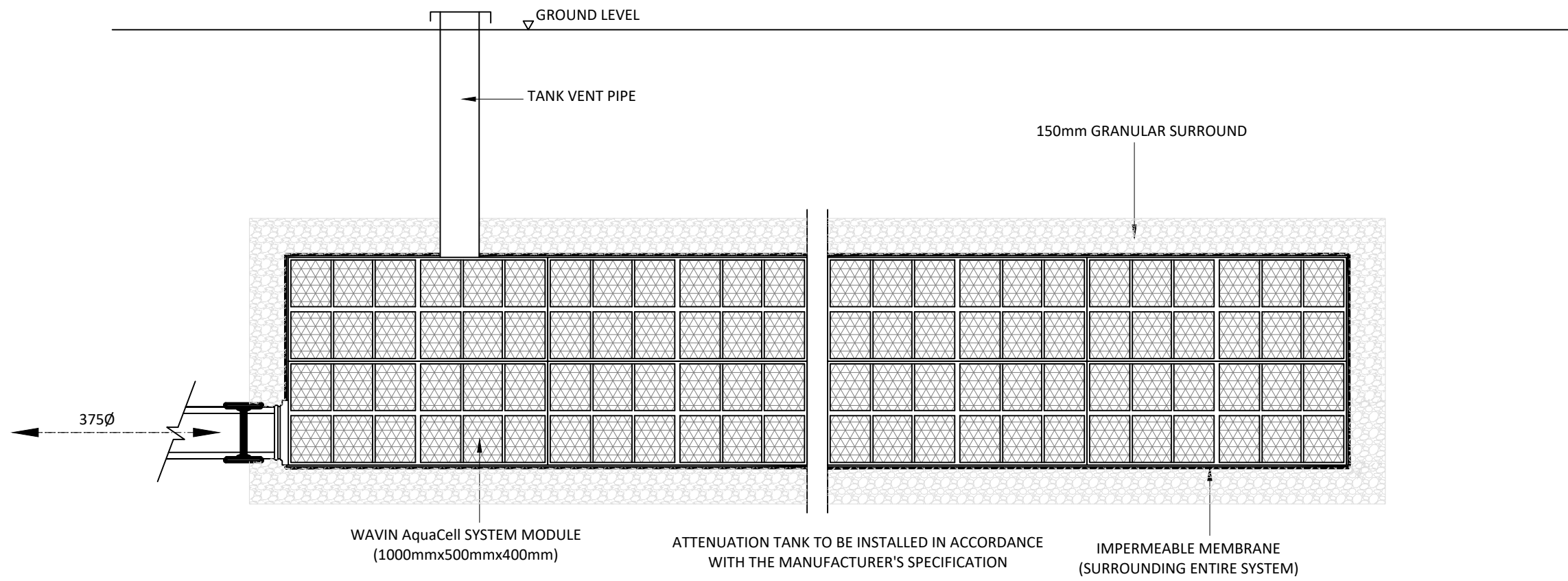
DRAWN BY JF	CHECKED BY KLE	DATE APRIL '24
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SCALE (@A1) AS SHOWN	PROJECT NUMBER HE-014
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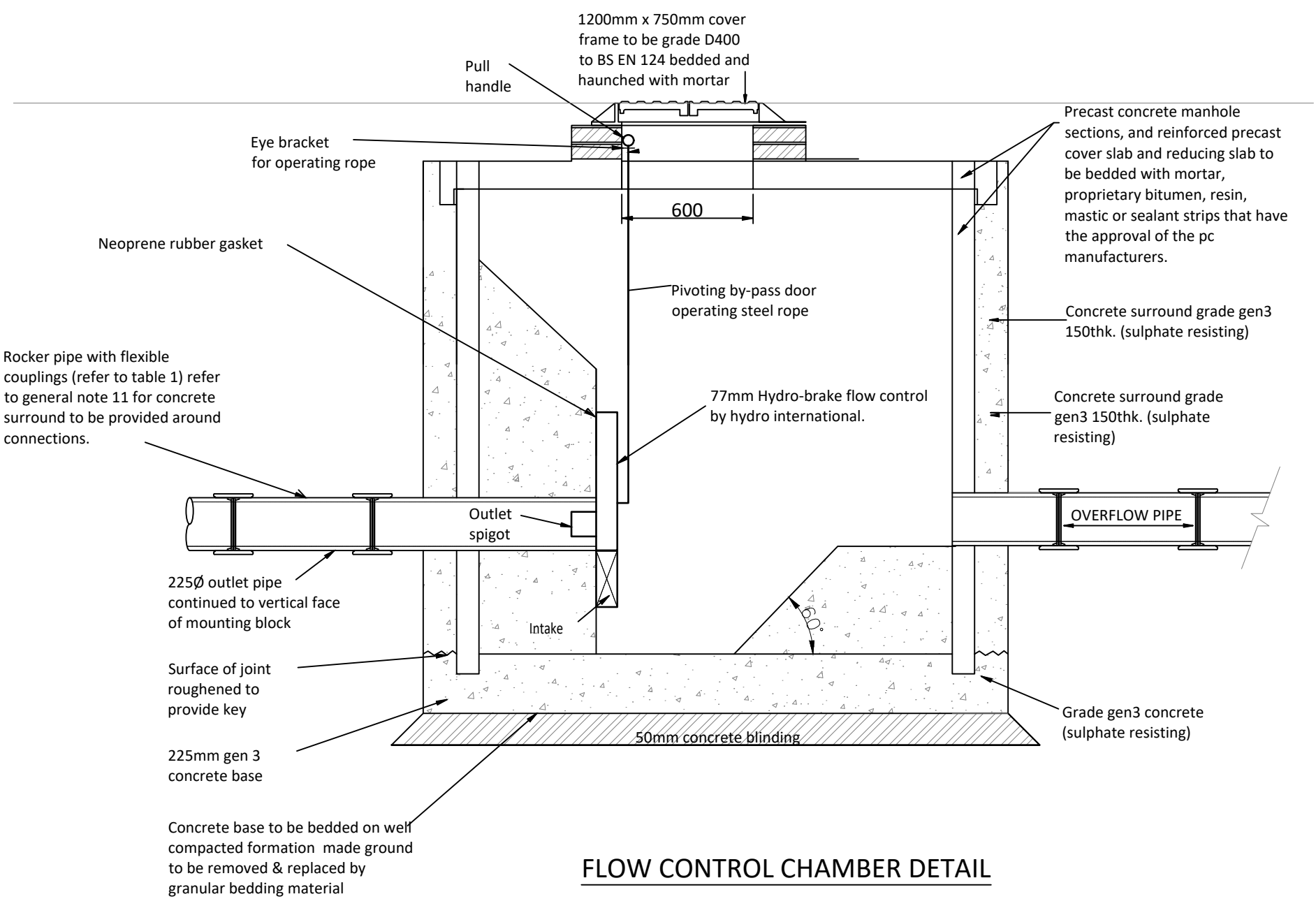
FILE DRAWING NUMBER 22182-CCS - WCH127- XX- DR - S - 93000	REV. P1
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notes :

1. IF THIS DRAWING HAS BEEN RECEIVED ELECTRONICALLY IT IS THE RECIPIENTS RESPONSIBILTY TO PRINT THE DOCUMENT TO THE CORRECT SCALE
2. ALL DIMENSIONS ARE IN MILLIMETRES UNLESS STATED OTHERWISE. IT IS RECOMMENDED THAT INFORMATION IS NOT SCALED OFF THIS DRAWING
3. THIS DRAWING SHOULD BE READ IN CONJUNCTION WITH ALL OTHER RELEVANT DRAWINGS AND SPECIFICATIONS
4. ANY DISCREPANCIES NOTED ON SITE ARE TO BE REPORTED TO THE ENGINEER IMMEDIATELY.

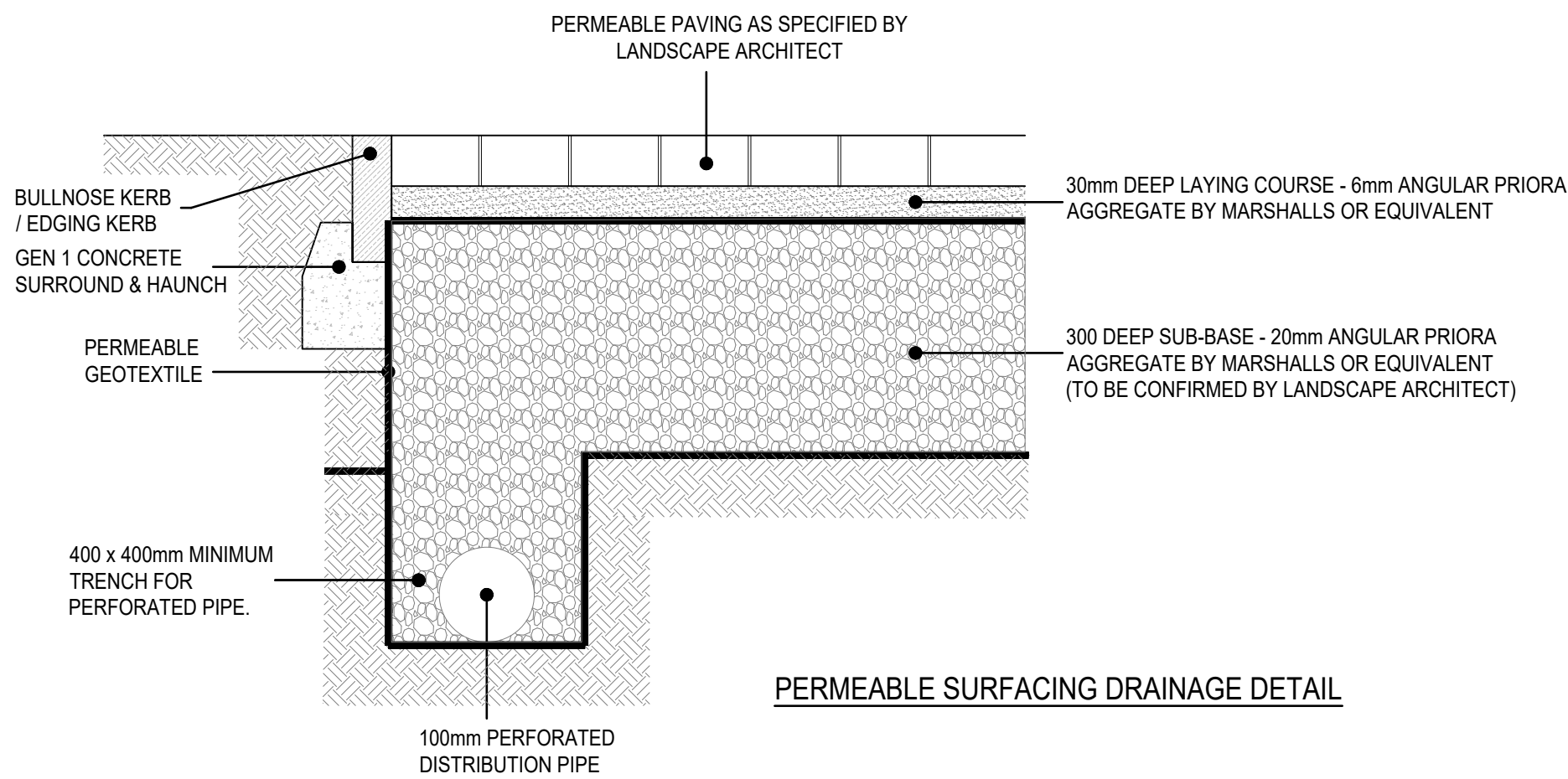
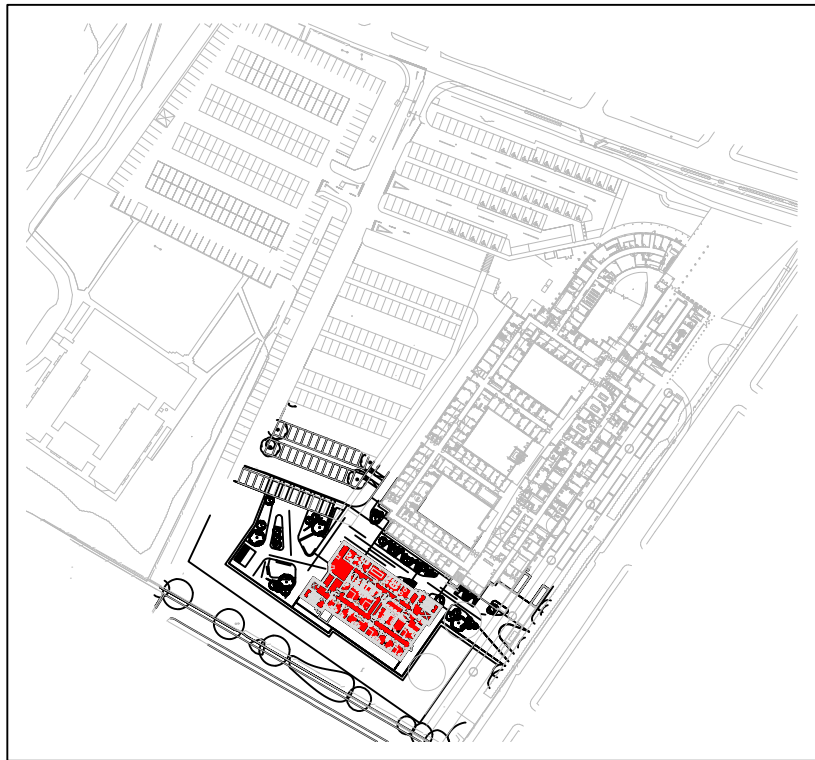


TYPICAL ATTENUATION TANK DETAIL



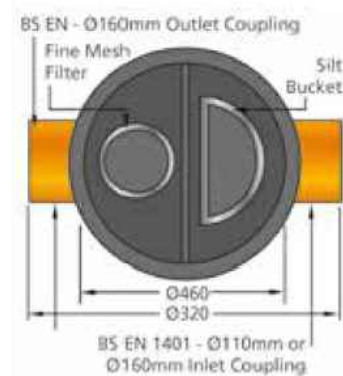
FLOW CONTROL CHAMBER DETAIL

KEYPLAN

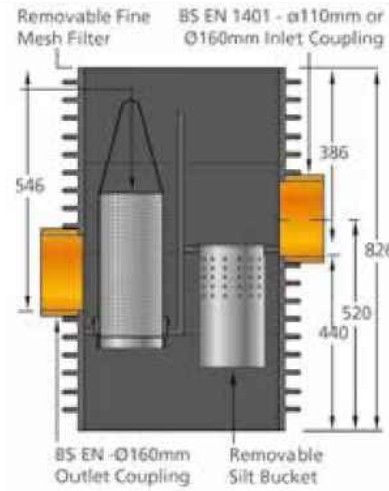
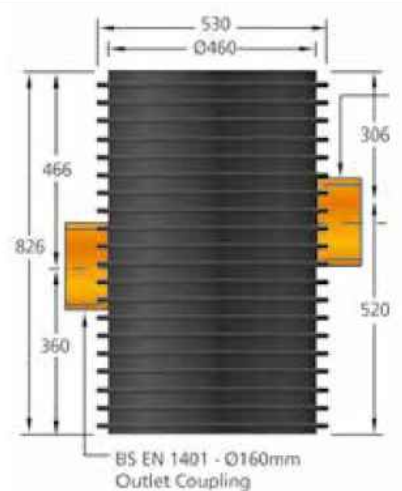


PERMEABLE SURFACING DRAINAGE DETAIL

Advanced Silt Trap



SILT TRAP DETAIL



P1	ISSUED FOR COMMENT	22.04.24	MDS	LC
REV.	DESCRIPTION	DATE	DRW.	CHK.



APPOINTED PARTY LOGO/INFORMATION



PROJECT
CDC - CARDIORESPIRATORY,
WITHINGTON COMMUNITY HOSPITAL

TITLE
PROPOSED BELOW GROUND
DRAINAGE DETAILS

STATUS S1	PURPOSE OF ISSUE FOR COMMENTS
--------------	----------------------------------

DRAWN BY JF	CHECKED BY KLE	DATE APRIL '24
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SCALE (@A1) N.T.S	PROJECT NUMBER HE-014
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FILE DRAWING NUMBER 22182-CCS - WCH127- XX- DR - S - 93001	REV. P1
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Appendix G - Surface Water Network / Management Calculations

Flo Consult UK Ltd		Page 1
4 Market Square Old Amersham Buckinghamshire, HP7 0DQ	WITHINGTON CDC SURFACE WATER NETWORK / MANAGEMENT CALCS	
Date 22/04/2024	Designed by MDS	
File Withington - SW Network ...	Checked by MDS	
Innovyze	Network 2020.1.3	
STORM SEWER DESIGN by the Modified Rational Method Design Criteria for Storm Pipe Sizes STANDARD Manhole Sizes STANDARD FEH Rainfall Model Return Period (years) FEH Rainfall Version Site Location GB 383735 392005 SJ 83735 92005 Data Type Maximum Rainfall (mm/hr) Maximum Time of Concentration (mins) Foul Sewage (l/s/ha) Volumetric Runoff Coeff. PIMP (%) Add Flow / Climate Change (%) Minimum Backdrop Height (m) Maximum Backdrop Height (m) Min Design Depth for Optimisation (m) Min Vel for Auto Design only (m/s) Min Slope for Optimisation (1:X) Designed with Level Soffits Time Area Diagram for Storm Time Area (mins) (ha) Time Area (mins) (ha) 0-4 0.157 4-8 0.083 Total Area Contributing (ha) = 0.240 Total Pipe Volume (m³) = 14.706		
Network Design Table for Storm PN Length Fall Slope I.Area T.E. Base k HYD DIA Section Type Auto (m) (m) (1:X) (ha) (mins) Flow (l/s) (mm) SECT (mm) Design		
Network Results Table PN Rain T.C. US/IL Σ I.Area Σ Base Foul Add Flow Vel Cap Flow (mm/hr) (mins) (m) (ha) Flow (l/s) (l/s) (l/s) (m/s) (l/s) (l/s)		
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Flo Consult UK Ltd		Page 3
4 Market Square Old Amersham Buckinghamshire, HP7 0DQ	WITHINGTON CDC SURFACE WATER NETWORK / MANAGEMENT CALCS	
Date 22/04/2024	Designed by MDS	
File Withington - SW Network ...	Checked by MDS	
Innovyze	Network 2020.1.3	

Manhole Schedules for Storm

MH Name	MH CL (m)	MH Depth (m)	MH Connection	MH Diam., L*W (mm)	PN	Pipe Out Invert Level (m)	Diameter (mm)	PN	Pipes In Invert Level (m)	Diameter (mm)	Backdrop (mm)
S1	32.730	0.800	Open Manhole	1500	1.000	31.930	375				
S2	32.730	0.860	Open Manhole	1500	1.001	31.870	375	1.000	31.870	375	
S3	32.730	0.895	Open Manhole	1500	1.002	31.835	375	1.001	31.835	375	
S4	32.730	1.040	Open Manhole	1500	1.003	31.690	375	1.002	31.690	375	
S5	32.730	1.137	Open Manhole	1500	1.004	31.593	375	1.003	31.593	375	
S6	33.000	1.440	Open Manhole	1500	2.000	31.560	375				
S7	32.900	1.375	Open Manhole	1500	1.005	31.525	375	1.004	31.525	375	
								2.000	31.525	375	
EX SWIC-01	32.710	1.200	Open Manhole	0		OUTFALL		1.005	31.510	375	

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

Flo Consult UK Ltd		Page 5
4 Market Square Old Amersham Buckinghamshire, HP7 0DQ	WITHINGTON CDC SURFACE WATER NETWORK / MANAGEMENT CALCS	
Date 22/04/2024	Designed by MDS	
File Withington - SW Network ...	Checked by MDS	
Innovyze		Network 2020.1.3
<u>Simulation Criteria for Storm</u> Volumetric Runoff Coeff 0.750 Additional Flow - % of Total Flow 45.000 Areal Reduction Factor 1.000 MADD Factor * 10m³/ha Storage 2.000 Hot Start (mins) 0 Inlet Coefficient 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) 60 Foul Sewage per hectare (l/s) 0.000 Output Interval (mins) 1 Number of Input Hydrographs 0 Number of Offline Controls 0 Number of Time/Area Diagrams 0 Number of Online Controls 1 Number of Storage Structures 2 Number of Real Time Controls 0 <u>Synthetic Rainfall Details</u> Rainfall Model FEH Return Period (years) 100 FEH Rainfall Version 2013 Site Location GB 383735 392005 SJ 83735 92005 Data Type Point Summer Storms Yes Winter Storms Yes Cv (Summer) 0.750 Cv (Winter) 0.840 Storm Duration (mins) 30		
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Flo Consult UK Ltd			Page 6																																																																																																																																																																				
4 Market Square Old Amersham Buckinghamshire, HP7 0DQ		WITHINGTON CDC SURFACE WATER NETWORK / MANAGEMENT CALCS																																																																																																																																																																					
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Innovyze			Network 2020.1.3																																																																																																																																																																				
<u>Online Controls for Storm</u> <u>Hydro-Brake® Optimum Manhole: S7, DS/PN: 1.005, Volume (m³): 5.4</u> <table><tr><td>Unit Reference</td><td colspan="5">MD-SHE-0077-2800-1200-2800</td></tr><tr><td>Design Head (m)</td><td colspan="5">1.200</td></tr><tr><td>Design Flow (l/s)</td><td colspan="5">2.8</td></tr><tr><td>Flush-Flo™</td><td colspan="5">Calculated</td></tr><tr><td>Objective</td><td colspan="5">Minimise upstream storage</td></tr><tr><td>Application</td><td colspan="5">Surface</td></tr><tr><td>Sump Available</td><td colspan="5">Yes</td></tr><tr><td>Diameter (mm)</td><td colspan="5">77</td></tr><tr><td>Invert Level (m)</td><td colspan="5">31.525</td></tr><tr><td>Minimum Outlet Pipe Diameter (mm)</td><td colspan="5">100</td></tr><tr><td>Suggested Manhole Diameter (mm)</td><td colspan="5">1200</td></tr></table> <table><tr><th colspan="2">Control Points</th><th>Head (m)</th><th>Flow (l/s)</th><th colspan="2">Control Points</th><th>Head (m)</th><th>Flow (l/s)</th></tr><tr><td colspan="2">Design Point (Calculated)</td><td>1.200</td><td>2.8</td><td colspan="2">Kick-Flo®</td><td>0.683</td><td>2.2</td></tr><tr><td colspan="2">Flush-Flo™</td><td>0.336</td><td>2.7</td><td colspan="2">Mean Flow over Head Range</td><td>-</td><td>2.4</td></tr></table> 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 <table><tr><th>Depth (m)</th><th>Flow (l/s)</th><th>Depth (m)</th><th>Flow (l/s)</th><th>Depth (m)</th><th>Flow (l/s)</th><th>Depth (m)</th><th>Flow (l/s)</th></tr><tr><td>0.100</td><td>2.1</td><td>1.200</td><td>2.8</td><td>3.000</td><td>4.3</td><td>7.000</td><td>6.4</td></tr><tr><td>0.200</td><td>2.6</td><td>1.400</td><td>3.0</td><td>3.500</td><td>4.6</td><td>7.500</td><td>6.6</td></tr><tr><td>0.300</td><td>2.7</td><td>1.600</td><td>3.2</td><td>4.000</td><td>4.9</td><td>8.000</td><td>6.8</td></tr><tr><td>0.400</td><td>2.7</td><td>1.800</td><td>3.4</td><td>4.500</td><td>5.2</td><td>8.500</td><td>7.0</td></tr><tr><td>0.500</td><td>2.6</td><td>2.000</td><td>3.5</td><td>5.000</td><td>5.4</td><td>9.000</td><td>7.2</td></tr><tr><td>0.600</td><td>2.4</td><td>2.200</td><td>3.7</td><td>5.500</td><td>5.7</td><td>9.500</td><td>7.3</td></tr><tr><td>0.800</td><td>2.3</td><td>2.400</td><td>3.8</td><td>6.000</td><td>5.9</td><td></td><td></td></tr><tr><td>1.000</td><td>2.6</td><td>2.600</td><td>4.0</td><td>6.500</td><td>6.1</td><td></td><td></td></tr></table>						Unit Reference	MD-SHE-0077-2800-1200-2800					Design Head (m)	1.200					Design Flow (l/s)	2.8					Flush-Flo™	Calculated					Objective	Minimise upstream storage					Application	Surface					Sump Available	Yes					Diameter (mm)	77					Invert Level (m)	31.525					Minimum Outlet Pipe Diameter (mm)	100					Suggested Manhole Diameter (mm)	1200					Control Points		Head (m)	Flow (l/s)	Control Points		Head (m)	Flow (l/s)	Design Point (Calculated)		1.200	2.8	Kick-Flo®		0.683	2.2	Flush-Flo™		0.336	2.7	Mean Flow over Head Range		-	2.4	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	0.100	2.1	1.200	2.8	3.000	4.3	7.000	6.4	0.200	2.6	1.400	3.0	3.500	4.6	7.500	6.6	0.300	2.7	1.600	3.2	4.000	4.9	8.000	6.8	0.400	2.7	1.800	3.4	4.500	5.2	8.500	7.0	0.500	2.6	2.000	3.5	5.000	5.4	9.000	7.2	0.600	2.4	2.200	3.7	5.500	5.7	9.500	7.3	0.800	2.3	2.400	3.8	6.000	5.9			1.000	2.6	2.600	4.0	6.500	6.1		
Unit Reference	MD-SHE-0077-2800-1200-2800																																																																																																																																																																						
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Minimum Outlet Pipe Diameter (mm)	100																																																																																																																																																																						
Suggested Manhole Diameter (mm)	1200																																																																																																																																																																						
Control Points		Head (m)	Flow (l/s)	Control Points		Head (m)	Flow (l/s)																																																																																																																																																																
Design Point (Calculated)		1.200	2.8	Kick-Flo®		0.683	2.2																																																																																																																																																																
Flush-Flo™		0.336	2.7	Mean Flow over Head Range		-	2.4																																																																																																																																																																
Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)																																																																																																																																																																
0.100	2.1	1.200	2.8	3.000	4.3	7.000	6.4																																																																																																																																																																
0.200	2.6	1.400	3.0	3.500	4.6	7.500	6.6																																																																																																																																																																
0.300	2.7	1.600	3.2	4.000	4.9	8.000	6.8																																																																																																																																																																
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