



Surface Water Drainage & SuDS Assessment

Bristol & West Arcade,
173-175 Friar Street,
27-32 Market Place,
Reading, RG1 2DG

20th October 2020

Ref: 8/1664

Prepared for:
Savills on behalf of
Sonic Star Properties Limited

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**Bristol & West Arcade, 173-175 Friar Street, 27-32 Market Place, Reading
RG1 2EA***Report Reference:* 8/1664*Version* G*Date originated:* 20th October 2017*Prepared by:* Clancy Consulting Limited
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REVISION	REASON FOR ISSUE	DATE OF ISSUE
A	Draft-Issued for comment	20 th October 2017
B	Amount of Units Updated Along With Foul Flows	20 th October 2017
C	Drainage Strategy Updated	30 th October 2017
D	Drainage Strategy and Foul Flows Updated	9 th February 2018
E	Comments Incorporated	15 th February 2018
F	Drainage strategy and comments updated	27 th August 2020
G	Updated to comments	8 th October 2020
H	Updated to comments	20 th October 2020

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1.0 INTRODUCTION

1.1 General

- 1.1.1 This report has been prepared on instructions received from Savills on behalf of their client Sonic Star Properties Limited and relates to the proposed redevelopment of the Bristol & West Arcade, 173-175 Friar Street, 27-32 Market Place, Reading, RG1 2DG.
- 1.1.2 The site at the address 173-175 Friar Street and 27-32 Market Place currently comprises of vacant retail and office space. It is proposed to redevelop the site to provide a 182-bedroom hotel, 8 residential units, pub and flexible commercial spaces. The site at the address 27-32 Market Place currently comprises of retail spaces, a pub and a bank.
- 1.1.3 This report sets out the results of a Sustainable Drainage Assessment required by the Local Planning Authority in support of the planning application for this development. The assessment has been carried out in accordance with the general principals set out in National Planning Policy Framework and Technical Guidance published in April 2015.
- 1.1.4 This report is prepared solely for the benefit of the Client. This report may not be assigned without prior written permission from Clancy Consulting.
- 1.1.5 This report is for Planning Application purposes only. Detailed design of drainage, specialist engineers will be required prior to construction.

1.2 Background Information

- 1.2.1 Following recent consultation, planning guidance was issued which came into force on 6 April 2015 and concerns all major developments.

This guidance sets out the following main points;

LPAs will be required to consider SuDS in connection with planning applications, rather than a separate local government body.

Lead Local Flood Authorities (LLFAs) will become statutory consultees on surface water management regarding planning applications. LPAs must satisfy themselves that operational standards and maintenance are provided for the lifespan of the development using for example planning conditions or Section 106 agreements. The operation and on-going maintenance of SuDS must also be economical.

A clear set of non-statutory technical standards for SuDS has been produced by the Government working closely with the Environment Agency, local authorities and developers to reduce the risk of surface water flooding, improve water quality and the environment and to ensure that SuDS are robust, safe and affordable. They should be read in conjunction with a Planning Practice Guide which is now available on line. The Technical Guidance previously published has now been replaced with a Web based Practice Guide – Flood Risk and Coastal Change.

2.0 LOCAL POLICY

- 2.1 The report has been structured to follow the general principals set out in the Technical Guidance published in March 2012.
- 2.2 The methodology for this FRA has comprised a desktop study and liaison with the Environment Agency (EA), liaison with Reading Borough Council drainage team and reference has also been made to relevant plans including plans showing the location of local sewers.
- 2.3 Sources of information
- Flood map from the Environment Agency (EA)
 - Topographical Survey
 - Thames Water Asset Plans (TW)
 - Location data from Street Map
 - British Geology Survey Infiltration SuDS GeoReport (BGS)
 - Architects Drawings from Rodić Davidson Architects (RDA)

3.1 Location

OS X (Eastings)	471692
OS Y (Northings)	173487
Nearest Post Code	RG1 2DG
Lat (WGS84)	N51:27:21 (51.455833)
Long (WGS84)	W0:58:10 (-0.969569)
LR	SU716734 / SU7169273487
mX	-107931
mY	6668884

3.2.1 The overall site is approximately 1,968m² and has frontages on both Market Place and Friar Street. The site has been subject to a small area of partially demolition at the rear of the building opposite Friar Street, the rest of the site is currently fully developed and entirely covered with roofed area.

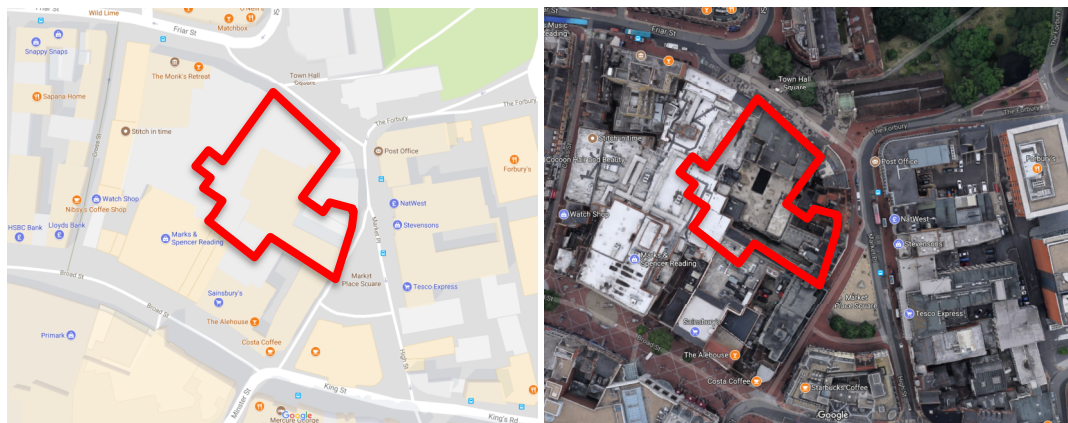


Figure 1 - Site Plan (Google Maps)

3.2.3 A topographic survey of the existing buildings is provided in Appendix A.

3.3 Existing Drainage

- 3.3.1 Public Sewer records for the site have been obtained from Thames Water. These indicate that there is a network of foul and surface water sewers running from Friar Street to Market Place. The foul sewer and the surface water sewer are routed further in to the south.

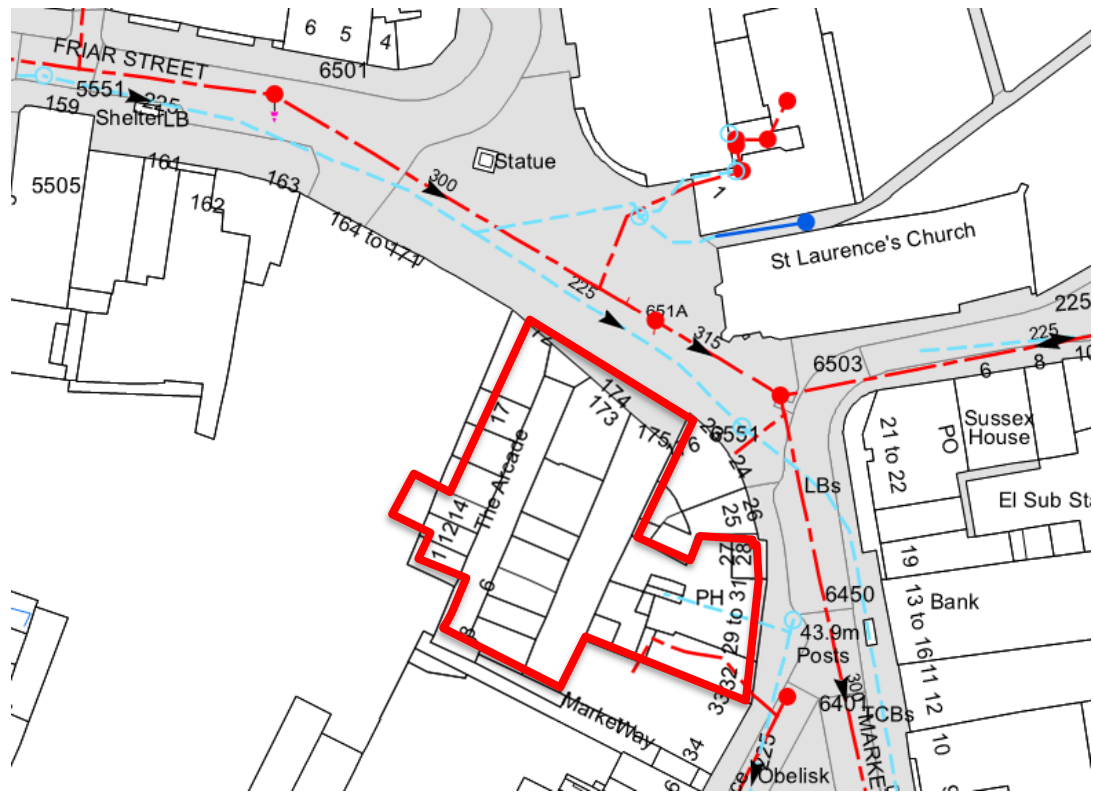


Figure 2 - Asset Plan (TW)

- 3.3.2 We have no mapping for the existing drainage system on site but there are numerous down pipes noted to each of the elevations.

3.4 Ground Conditions and Geology

- 3.4.1 Data has been obtained from the British Geological Survey

The underlying geology is described as follows;
 Superficial – Taplow Gravel Member - Sand and Gravel
 Bedrock – Seaford Chalk Formation and Newhaven Chalk Formation (undifferentiated) - Chalk

There is a made ground up to a depth of 1.0-2.0 m deep noted through information available in the vicinity of the site. This shall be confirmed through site investigation work to be undertaken in the detailed design phase of the project

3.5 Development Proposals

- 3.5.1 The proposal is to provide 182 bedroom hotel, 8 residential units, pub and flexible commercial spaces. The building footprint at ground level occupies approximately 84% of the site area. There is a public walking route through the site located in the

centre of the development which is also impermeable making the total impermeable area of the occupied site to a 100% of the total site area.



Figure 3 - Ground Floor Development Proposals (Norr)



Figure 4 - Ground floor plan for Market Place (Rodric Davidson Architects)

4.0 SURFACE WATER DRAINAGE STRATEGY

4.1 Surface Water Disposal Hierarchy

The disposal of surface water should be considered in the following order of priority;

1. Infiltration into the subsoil via soakaways or permeable paving.
2. Discharge to a water course or the sea.
3. Discharge to a surface water sewer.
4. Discharge to a combined sewer.

If it is not possible to discharge to a soakaway, then surface water should be controlled with the use of Sustainable Drainage Systems (SuDS) and considered using the SuDS Hierarchy.

4.2 SuDS Hierarchy

Most Sustainable	SUDS technique	Flood Reduction	Pollution Reduction	Landscape & Wildlife Benefit
↑	Living roofs	✓	✓	✓
	Basins and ponds	✓	✓	✓
	- Constructed wetlands			
	- Balancing ponds			
	- Detention basins			
	- Retention ponds			
	Filter strips and swales	✓	✓	✓
↓	Infiltration devices	✓	✓	✓
	- soakaways			
	- infiltration trenches and basins			
	Permeable surfaces and filter drains	✓	✓	
Least Sustainable	- gravelled areas			
	- solid paving blocks			
	- porous paviers			
	Tanked systems	✓		
	- over-sized pipes/tanks			
	- storms cells			

4.3 Disposal Strategy

Infiltration

Infiltration for this development will not be possible due to the space constraints.

It is necessary to position soakaways at least 5m from building structures to prevent potential damage to the structure by weakening sub-soils close to foundations. There is no space on this site to locate a soakaway at least 5m from the building.

Water Course

The Holy Brook is approximately 125m from the site, but it is enclosed with a culvert in this location so access will not be practicable, and it would mean crossing 3rd party land for access.

Surface water Sewer

It is likely that the existing drainage system discharges to the surface water sewer network adjacent to the site. The intention will be to re-use these connections or make new connections from the development.

4.4 SuDS Strategy

Living Roof

One hundred percent of the site receiving surface water is roof area or upper level courtyard deck.

The most sustainable solution to control run-off at its source is to provide living or green roof areas. These roof areas retain part of the rainwater, slow down the speed of run-off and also reduce water pollution.

Green roof areas are being proposed as highlighted on the drawings. This accounts for 732m² or approximately 36% of the site area. Other areas are not suitable due to the need for sloping roofs for architectural reasons or they are required for more frequent maintenance access to plant and solar panels.

Whilst a green roof will attenuate flow rates for smaller storm events, for the 1 in 100 year plus 40% climate change designed storm event the green roof has been ignored in the storage calculations.

Ponds/ Basins and Swales.

There is no space on site to provide these systems.

Attenuation tank

An attenuation tank provided below ground is a viable SuDS option available for this site.

Surface water that overflows into the attenuation tank will be discharged into the existing surface water sewer on Friar street at a restricted rate of 15 l/s via a flow restricting hydrobrake MD-SHE-0172-1500-1200-1200 manhole. Please refer to Appendix A for the drainage layout.

A typical detail of the attenuation tank with incoming flow from the top is as shown below:

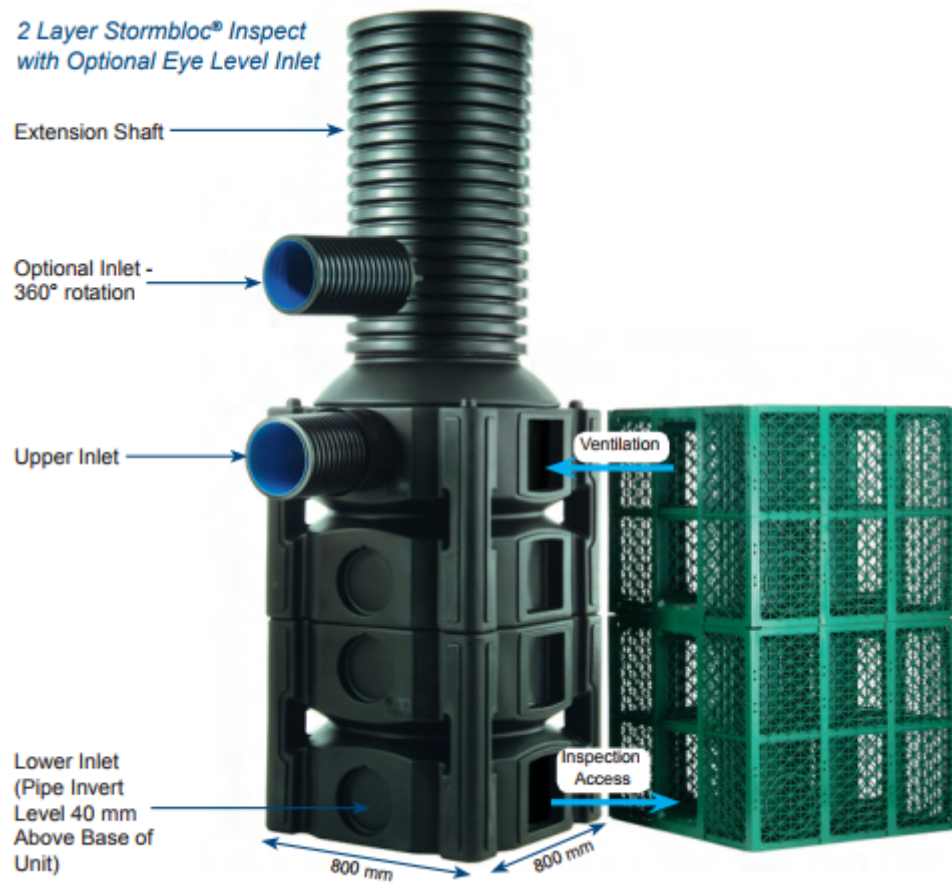


Figure 5 - Below Ground Attenuation

5.0 SuDS TECHNICAL STANDARD REQUIREMENTS

5.1 Peak Flow

5.1.1 S3 For developments which were previously developed, the peak runoff rate from the development to any drain, sewer or surface water body for the 1 in 1 year rainfall event and the 1 in 100 year rainfall event must be as close as reasonably practicable to the greenfield runoff rate from the development for the same rainfall event, but should never exceed the rate of discharge from the development prior to redevelopment for that event.

5.1.2 Refer to calculations in Appendix B.

The Existing 1 in 1-year run-off for the site is 31.5 l/s

The Existing 1 in 100-year run-off for the site is 127.2 l/s

The greenfield run-off rate (Qbar) for the site is 0.1 l/s

It is proposed to control the surface water run-off to 15 litres per second. This will provide a 50% reduction in the existing surface water run off rate.

Storage will be provided for all storm events up to and including the 1 in 100 year event with an allowance for climate change.

The volume of surface water storage required for this site for the 1 in 100-year event plus climate change based on a discharge flow rate of 15 litres per second is approximately 38-67m³. It is proposed that this volume shall be stored below the ground floor slab in the open courtyard area.

A Source Control calculation has also been completed to ensure that the attenuation tank would be sufficient for the development.

The calculations state that the highest level that the surface water would reach for a 1 in 100 year storm event with the addition of 40% for climate change is 0.9m of the 1.2m deep tank. This shows that the tank will be appropriate size for the proposed development.

5.2 Volume Control

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

The green roof area will reduce the volume of surface water run-off from those areas.

A 50% reduction of existing flow rate is being aimed for the discharge flow rate from this site.

5.3 Flood Risk within the Development

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.

It is proposed to design the below ground storage system for the 1 in 100 year plus climate event as there is no practical storage place for water above ground.

The building floor levels shall be designed to be raised slightly higher than the surrounding ground level to prevent water ingress in the building during extreme flood events.

An exceedance flow route has also been provisionally created as per SK001, this is to be confirmed with the proposed levels designer.

5.4 Structural Integrity

S10 Components must be designed to ensure structural integrity of the drainage system and any adjacent structures or infrastructure under anticipated loading conditions over the design life of the development taking into account the requirement for reasonable levels of maintenance.

S11 The materials, including products, components, fittings or naturally occurring materials, which are specified by the designer, must be of a suitable nature and quality for their intended use.

The detailed design of the system and product selection for the storage and pipe solution will be made at the detailed design stage upon consideration of all the site constraints. There are numerous products available for attenuation storage of water below ground and the right product is chosen for the final loading conditions.

5.5 Designing for Maintenance considerations

S12 Pumping should only be used to facilitate drainage for those parts of the site where it is not reasonably practicable to drain water by gravity.

Pumps will be required from the basement for foul water drainage.

5.6 Construction

S13 The mode of construction of any communication with an existing sewer or drainage system must be such that the making of the communication would not be prejudicial to the structural integrity and functionality of the sewerage or drainage system.

S14 Damage to the drainage system resulting from associated construction activities must be minimised and must be rectified before the drainage system is considered to be completed.

A pre development enquiry shall be submitted to Thames Water for the connection to the public sewer.

6.0 FOUL WATER DRAINAGE

- 6.1. The proposed development consists of a 182 bedroom hotel.

The total number of discharge units are unknown, it is estimated that there shall be approximately 190 WC's, 192 basins, 16 kitchen sinks, 4 dishwashers, 10 showers and 172 baths within the hotel as per the latest architectural plans. The peak flow for foul from the development shall be 17.8l/s and the estimated daily flow rate shall be 2.5l/s. Final foul system loading to be confirmed at detailed design stage.

- 6.2 While the increase in the daily flow rates shall be minimal, a pre-development enquiry shall need to be submitted to Thames water to confirm flows and connections.

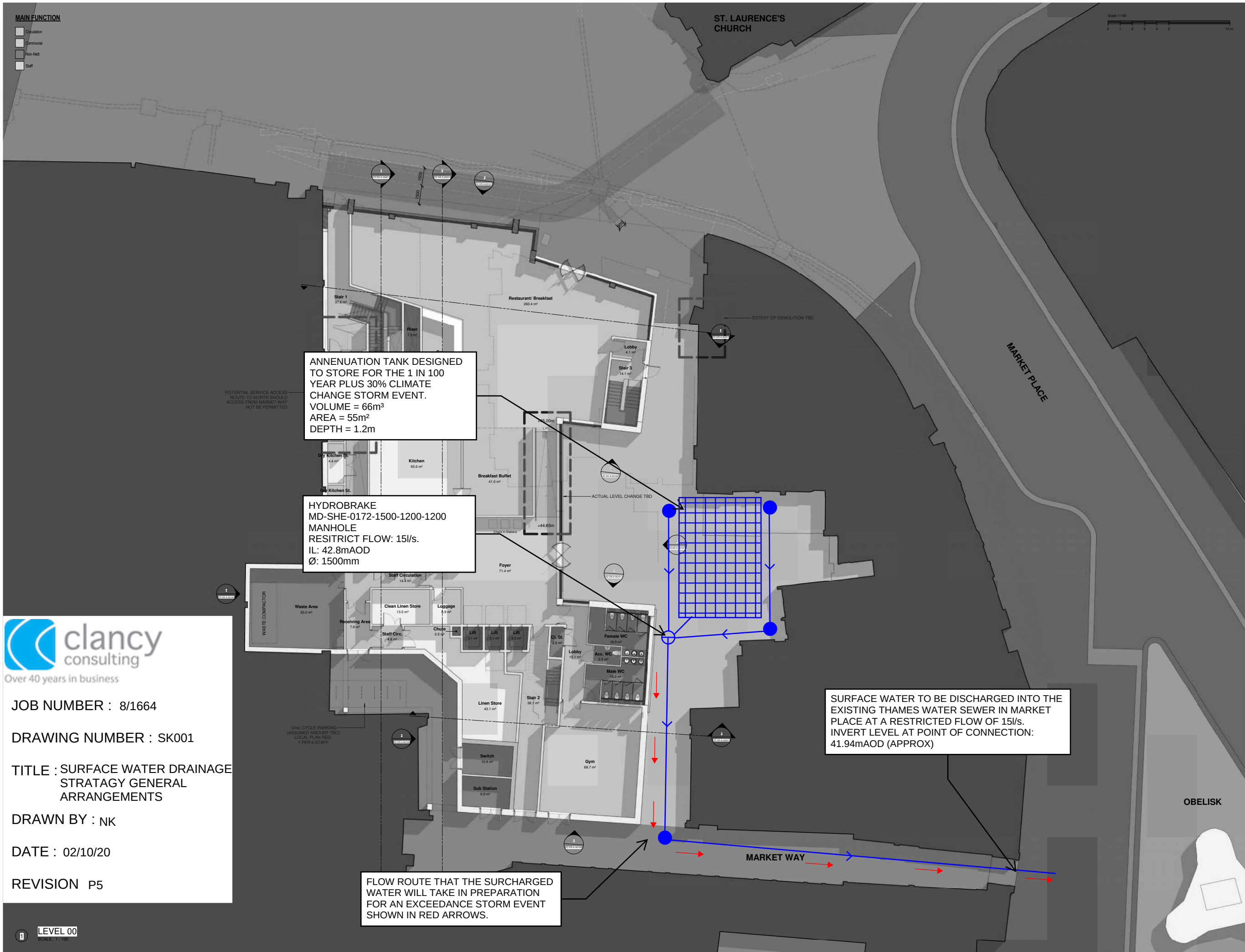
7.0 CONCLUSIONS AND RECOMMENDATIONS

- 7.1 This report gives details of the Drainage and SuDS Assessment, which has been carried out in relation to the proposed development at Bristol & West Arcade, 173-175 Friar Street, 27-32 Market Place, Reading.
- 7.2 The existing site is currently 100% impermeable and discharges surface water run-off to the public surface water sewer system.
- 7.3 The proposed development provides an opportunity to reduce local area flood risk by controlling surface water on site. Following the SuDS and water disposal hierarchy it has been determined that surface water will be controlled using green roof areas and flow controls with storage areas within the public walk through area paving before being discharged to the public surface water sewer system.
- 7.4 The proposed system will be designed to control surface water run-off for all storms up to and including the 100 year plus climate change event.
- 7.5 The proposed system will be designed to meet the Sustainable Drainage Systems Non-statutory technical standards for sustainable drainage systems, March 2015.
- 7.6 Foul Water rates are likely to increase slightly as a result of the development. Further consultation with Thames Water shall be required to check final capacity in the public system.

APPENDIX A

- Existing Topographical Survey
- Surface Water Storage & Drainage Strategy





JOB NUMBER : 8/1664

DRAWING NUMBER : SK001

TITLE : SURFACE WATER DRAINAGE STRATEGY GENERAL ARRANGEMENTS

DRAWN BY : NK

DATE : 02/10/20

REVISION P5

DATE	REVISION	REV'D BY	CHK'D BY
19.02.20	First Issue	1	PB
25.02.20	Revised in accordance with installer feedback	2	PB
11.03.20	Pre-app meeting & Hotel comment updates	3	PB
19.03.20	Alternate facade to avoid services affecting lift, lift and lift layouts	4	PB
31.03.20	Basement level & slab depth updated	5	PB

NOTE: FLOOR LAYOUTS, RATIOS AND FLOOR TO FLOOR HEIGHTS BASED ON ESTABLISHED LEONARDO REQUIREMENTS	
THIS DRAWING IS SUBJECT TO FULL VERIFICATION BY MEASURED AND STRUCTURAL SURVEY, ENGINEERING DESIGN, CORRELATION OF BOUNDARIES, EASEMENTS AND COVENANTS, FLOOD RISK ASSESSMENT SERVICES AND UTILITIES, TOPOGRAPHICAL SURVEY, ECOLOGY ASSESSMENT, PLANNING/ BUILDING CONTROLS AND HIGHWAYS APPROVAL. NOTE THESE ADDITIONAL REQUIREMENTS ARE NOT EXHAUSTIVE.	
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Keyplan	
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PROPERTY SERVICES	
Project	FRIAR STREET, READING
Drawing Title	GA PLAN - LEVEL 00
Sheet Status	SO - WORK IN PROGRESS
Project No.	IANC20-0005-99
Drawing No.	12345-NOR-B1-00-DR-A-00000
Rev.	5

APPENDIX B

- Calculations

Clancy Consulting Ltd		Page 1
Queens House 123-129 Queens Road Norwich NR1 3PS	BRISTOL AND WEST ARCADE READING, RG1 2DG GREENFIELD RUN OFF RATE	
Date 16/10/2017 File	Designed by JC Checked by JG	
Micro Drainage		
Source Control 2016.1.1		
ICP SUDS Mean Annual Flood Input Return Period (years) 1 SAAR (mm) 700 Urban 0.000 Area (ha) 0.197 Soil 0.150 Region Number Region 6 Results 1/s QBAR Rural 0.1 QBAR Urban 0.1 Q1 year 0.1 Q1 year 0.1 Q30 years 0.2 Q100 years 0.3		
©1982-2016 XP Solutions		

 Clancy Consulting Ltd Queens House, 123-129 Queens Road, Norwich, NR1 3PL.	Project BRISTOL AND WEST ARCADE				Job no. 8/1664	
	Calcs for EXISITNG 1 IN 100 YEAR RUN-OFF RATE				Start page no./Revision 1	
	Calcs by JC	Calcs date 16/10/2017	Checked by JG	Checked date	Approved by GS	Approved date

DESIGN RAINFALL

In accordance with the Wallingford Procedure

Tedds calculation version 2.0.00

Design rainfall intensity

Location of catchment area	London
Storm duration	D = 5 min
Return period	Period = 100 yr
Ratio 60 min to 2 day rainfall of 5 yr return period	r = 0.440
5-year return period rainfall of 60 minutes duration	M5_60min = 20.0 mm
Increase of rainfall intensity due to global warming	pclimate = 30 %
Factor Z1 (Wallingford procedure)	Z1 = 0.39
Rainfall for 5min storm with 5 year return period	M5_5mini = Z1 × M5_60min × (1 + pclimate) = 10.1 mm
Factor Z2 (Wallingford procedure)	Z2 = 1.91
Rainfall for 5min storm with 100 year return period	M100_5min = Z2 × M5_5mini = 19.2 mm
Design rainfall intensity	I _{max} = M100_5min / D = 230.5 mm/hr

Maximum surface water runoff

Catchment area	A _{catch} = 1986 m ²
Percentage of area that is impermeable	p = 100 %
Maximum surface water runoff	Q _{max} = A _{catch} × p × I _{max} = 127.2 l/s

 Clancy Consulting Ltd Queens House, 123-129 Queens Road, Norwich, NR1 3PL.	Project BRISTOL AND WEST ARCADE				Job no. 8/1664	
	Calcs for EXISITNG 1 IN 1 YEAR RUN-OFF RATE				Start page no./Revision 1	
	Calcs by JC	Calcs date 16/10/2017	Checked by JG	Checked date	Approved by GS	Approved date

DESIGN RAINFALL

In accordance with the Wallingford Procedure

Tedds calculation version 2.0.00

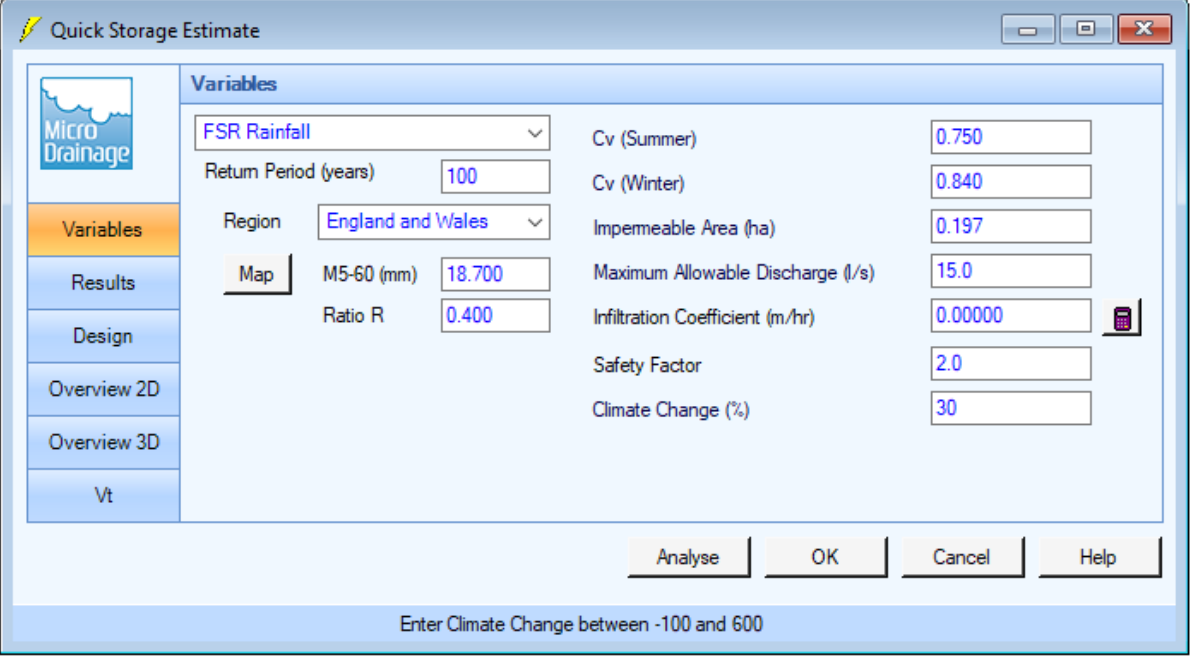
Design rainfall intensity

Location of catchment area	London
Storm duration	D = 5 min
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Ratio 60 min to 2 day rainfall of 5 yr return period	r = 0.440
5-year return period rainfall of 60 minutes duration	M5_60min = 20.0 mm
Increase of rainfall intensity due to global warming	pclimate = 0 %
Factor Z1 (Wallingford procedure)	Z1 = 0.39
Rainfall for 5min storm with 5 year return period	M5_5mini = Z1 × M5_60min = 7.7 mm
Factor Z2 (Wallingford procedure)	Z2 = 0.61
Rainfall for 5min storm with 1 year return period	M1_5min = Z2 × M5_5mini = 4.8 mm
Design rainfall intensity	I _{max} = M1_5min / D = 57.0 mm/hr

Maximum surface water runoff

Catchment area	A _{catch} = 1986 m ²
Percentage of area that is impermeable	p = 100 %
Maximum surface water runoff	Q _{max} = A _{catch} × p × I _{max} = 31.5 l/s

Bristol & West Arcade- Storage volume calculation required for a 1 in 100 year + climate change event



Micro Drainage Quick Storage Estimate

Variables

FSR Rainfall (dropdown)

Return Period (years): 100

Region: England and Wales (dropdown)

Map

M5-60 (mm): 18.700

Ratio R: 0.400

Cv (Summer): 0.750

Cv (Winter): 0.840

Impervious Area (ha): 0.197

Maximum Allowable Discharge (l/s): 15.0

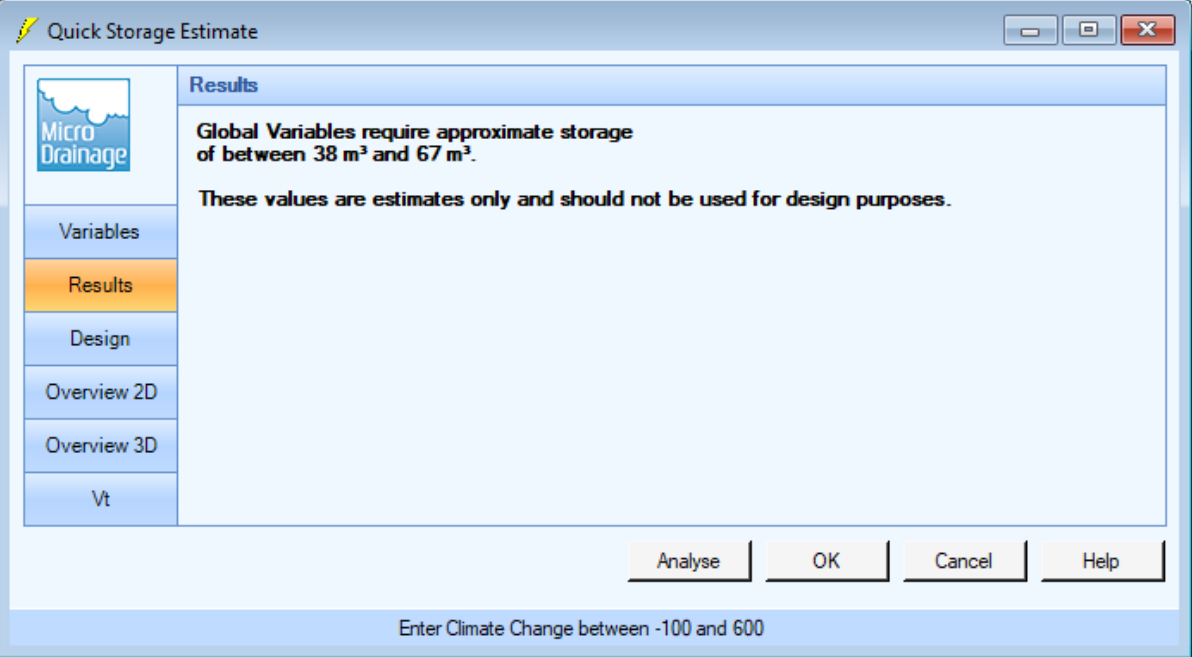
Infiltration Coefficient (m/hr): 0.00000

Safety Factor: 2.0

Climate Change (%): 30

Analyse OK Cancel Help

Enter Climate Change between -100 and 600



Micro Drainage Quick Storage Estimate

Results

Global Variables require approximate storage of between 38 m³ and 67 m³.

These values are estimates only and should not be used for design purposes.

Analyse OK Cancel Help

Enter Climate Change between -100 and 600

 Queens House, 123-129 Queens Road, Norwich, Norfolk, NR1 3PL TEL: 01603 305190	Contract Title Urmston Market / Housing			Contract No. 1/20306	
	Part of Structure Foul Drainage Loading			Calculation Sheet No: Rev	
	Drawing ref:	Check By:	Date 09/02/2018	Calcs By: JP	Date 09/02/2018

Foul System Loading

Type III System to BS EN 12056-2 (as reference in clause NA 2.1.2 of BS EN 752)

Appliance Type	DU l/s	Number of Appliances	Total No. of Units
Wash basin, bidet	0.3	108	32.4
Shower without plug	0.4	81	32.4
Shower with plug	1.3		0
Single urinal with cistern	0.4		0
Urinal with flushing valve	0.5		0
Slab urinal	0.2	4	0.8
Bath	1.3	27	35.1
Kitchen sink	1.3	44	57.2
Dishwasher (household)	0.2	44	8.8
Washing machine up to 6 kg	0.6		0
Washing machine up to 12 kg	1.2	44	52.8
WC with 6,0 l cistern	1.5	111	166.5
WC with 7,5 l cistern	1.8		0
WC with 9,0 l cistern	2.0		0
Floor gully DN 50	0.8		0
Floor gully DN 70	1.5		0
Floor gully DN 100	2.0		0
		Σ DU	386

Frequency Factor

Usage of appliances	K
Intermittent use, e.g. in dwelling, guesthouse, office	0.5
Frequent use, e.g. in hospital, school, restaurant, hotel	0.7
Congested use, e.g. in toilets and/or showers open to public	1
Special use, e.g. Laboratory	1.2

Frequency Factor **0.7**

Foul Flow Rate **13.8** l/s