Hydrock

McDonalds Pontardawe

SAB Drainage Report

For McDonalds LTD

Date: *16 September 2024*

Doc ref: *PNT-HYD-XX-XX-RP-C-0002*

DOCUMENT CONTROL SHEET

Issued by	Hydrock Consultants Limited 3rd Floor, Wharton Place 13 Wharton Street Cardiff CF10 1GS United Kingdom	T +44 (0)2920 023 665 E cardiff@hydrock.com www.hydrock.com
Client	McDonalds LTD	
Project name	McDonalds Pontardawe	
Title	SAB Drainage Report	
Doc ref	PNT-HYD-XX-XX-RP-C-0002	
Project no.	C-15297	
Status	FOR INFORMATION	
Date	16/09/2024	

Document Production Record		
Issue Number	P02	Name
Prepared by		Jessica Sze-Wing Li - Engineer
Checked by		Chris Stone - Principal Engineer
Approved by		Chris Stone - Principal Engineer

Document Revision Record			
Issue Number	Status	Date	Revision Details
P01	For Information	19/04/2023	First Issue
P02	SAB application	16/09/2024	Updated for SAB resubmission

Hydrock Consultants Limited has prepared this report in accordance with the instructions of the above named client for their sole and specific use. Any third parties who may use the information contained herein do so at their own risk.

CONTENTS

McDonalds Pontardawe 1
1. INTRODUCTION 1
2. EXISTING SITE 2
2.1 Site location 2
2.2 Site description 2
2.3 Existing drainage arrangements 2
2.4 Existing contributing areas and run-off rates 4
3. PROPOSED DEVELOPMENT 5
3.1 Development proposals 5
3.2 Surface water 5
4. CONCLUSION 11

Tables

Table 2.1: Global Greenfield Run-off Rates By Return Period 4
Table 2.2: Peak Discharge Rate for 30mm Rainfall Event 4
Table 3: Proposed Discharge Rates and Betterment 7

Figures

Figure 2.1: Site Location Plan 2
Figure 2.2: Extract of Existing Drainage Plan 3

Appendices

Appendix A - Run-off Calculations
Appendix B - WinDes Design Calculations

1. INTRODUCTION

Hydrock have been commissioned by McDonalds Ltd to provide a SAB drainage design and report for the proposed McDonalds development at Tesco, Pontardawe, Swansea, SA8 3AZ.

The client is seeking to redevelop the current brownfield site and this report is required to support the SAB application submission.

The objectives of the report are to:

- Review and report on the existing drainage arrangements on site for surface water;
- Assess the feasibility of Sustainable Drainage System (SuDS) features within the development to control and discharge surface water runoff to comply with the requirements of the Welsh Government statutory "Sustainable Drainage Systems Standards for Wales" (SDSSW) document 2018; and
- Provide a design for surface water (SuDS) systems including the sizing of storage/attenuation features and design drawings suitable for inclusion in a full application submission to the local authority's SuDS Approval Body (SAB).

The following tasks have been undertaken to complete this report:

- Undertake a desktop investigation of the site's existing surface water drainage arrangements;
- Detail solutions for surface water disposal. This will include calculations, drawings and schedules;
- In preparing the surface water drainage strategy, we will consider inundation of the floodplain and assess flood levels in the location of attenuation features where applicable;
- Determine the area of impermeable surfaces that will be added by the proposed development and determine the equivalent greenfield and brownfield run-off rates for this area;
- Assess the feasibility of using infiltration as a disposal method, based on soakaway test results or any other available information on ground and site conditions provided by the client;
- Design of the storm water storage needed to manage run-off from the site post-development, using drainage design software (WinDes);
- Provide information on the future maintenance requirements of SuDS features; and
- Give details of drainage exceedance. In particular, use topographic information to identify overland flow paths and areas susceptible to surface water ponding.

A number of sources have been used to compile this drainage strategy. Whilst Hydrock believe them to be trustworthy we are unable to guarantee the accuracy of the information that has been provided by others.

This report is based on information available at the time of preparation. Consequently, there is potential for further information to become available. These changes may lead to future alteration to the conclusions drawn in this report for which Hydrock cannot be held responsible.

2. EXISTING SITE

2.1 Site location

Figure 2.1 indicates the site location within the red circle, which is located at Tesco, Pontardawe, Swansea, SA8 3AZ (Approximate Grid Reference X-272293, Y-203501). ©OpenStreetMap contributors.

Figure 2.1: Site Location Plan

2.2 Site description

The site is approximately 0.35 hectares in area with the site comprising of an existing car park. The site is bounded by an existing car park on the south west boundary, private highway on the north west boundary and public highway on the eastern and south east boundaries of the site. The existing car park sits on a raised plateau which is approx. 33.75m AOD and the site falls from south west to north east at a gradient of approximately 1 in 60. The site has allowance for direct vehicle access via the existing access to Tesco Pontardawe which runs along the south western boundary of the site.

A copy of the existing site plan can be found on drawing number PNT-HYD-XX-XX-DR-C-1200 within the drawing package enclosed with the SAB application.

2.3 Existing drainage arrangements

From available mapping information it has been established that the nearest main watercourse is the river Tawe which is approximately 46m north west of the site, this flows north east to south west towards Swansea Bay. However, due to the requirement of crossing third party land between the site and the existing watercourse

and forming a new discharge point to the river is unlikely to be supported by the local authority, it is considered that any direct discharge from the site would not be feasible.

From information received from the pre-SAB response there are public surface water sewers located just outside the site boundary within the highway, and a network of private foul and surface water sewers within the site boundary which currently serves the existing petrol station, Tesco and car park. The existing site's surface water discharges into the existing private surface water sewer located within the proposed site boundary. Asset plans received from Neath Port Talbot County Borough Council have confirmed the extent of the public and private sewers, a copy of the asset plans can be found on document references HDC Pontardawe McDonalds and H363-600 within the drawing package enclosed with the SAB application.

The nearest foul sewer is a private sewer located within the site boundary which flows northeast to southwest within the centre of the site, which already serves the existing petrol station and Tesco to the northeast and south west of the proposed site respectively. Figure 2.2 contains an extract of the Dwr Cymru Welsh Water (DCWW) asset plan for the area with the site boundary shown in green.

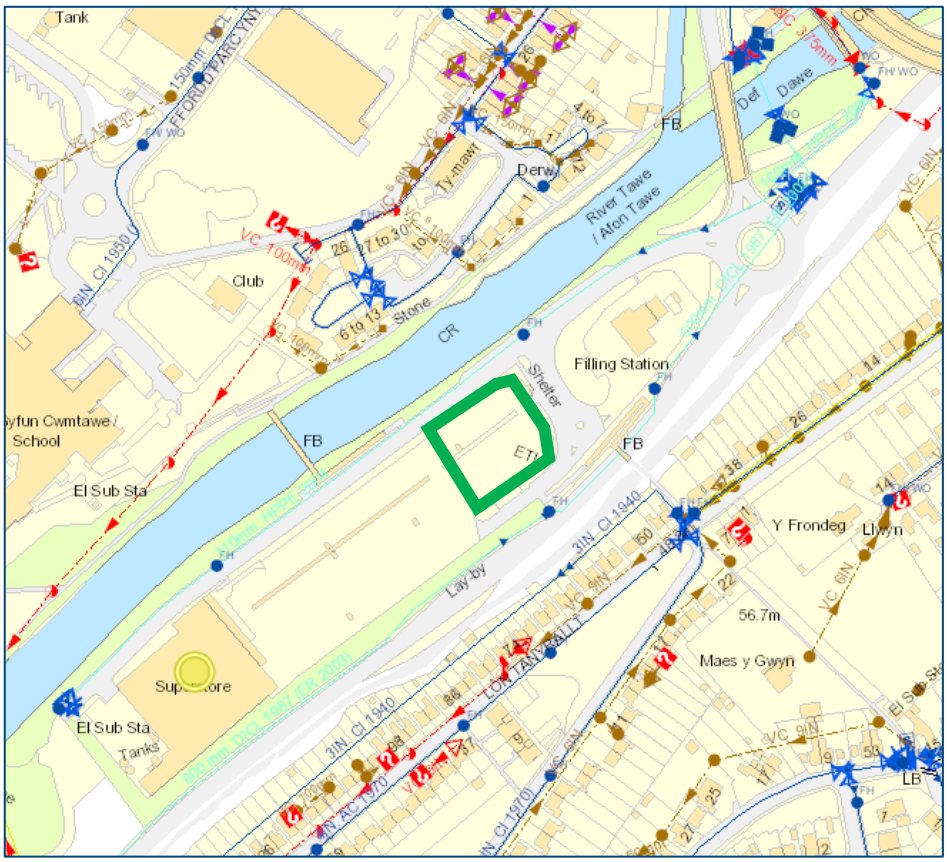

Figure 2.2: Extract of Existing Drainage Plan

2.4 Existing contributing areas and run-off rates

The total site area is circa 0.35 ha. The global greenfield run-off rates have been calculated using the ICP SuDS method and Table 2.1 summarises the runoff rates for each return period (1, 30 & 100). Calculations detailing the derivation of the values in these tables are available in Appendix A.

Table 2.1: Global Greenfield Run-off Rates By Return Period

Return Period	ICP SuDS Method
	Greenfield Run-off Rate (l/s)
1 YRP	2.4
30 YRP	4.7
100 YRP	5.8

As the site is comprised of mostly existing hardstanding (0.30ha), the existing peak discharge rate from the site has been calculated for each return period (1, 30 & 100) using a 30mm rainfall event based on FSR rainfall data. Table 2.2 provides a summary of the runoff rates and calculations detailing the derivation of the values are available in Appendix A.

Table 2.2: Peak Discharge Rate for 30mm Rainfall Event

Return Period	Peak Discharge Rate (l/s)
1 YRP	16.69
30 YRP	41.01
100 YRP	53.52

3. PROPOSED DEVELOPMENT

3.1 Development proposals

For assessment purposes the development is a proposed McDonalds restaurant with associated car parking area. The proposed development will utilise the existing Tesco access road from the local highway located along the southern boundary of the site.

3.2 Surface water

The aim of the surface water drainage strategy is to mimic the natural catchment processes as closely as possible and adopt the principles of water management schemes as stated in section 2 of the SDSSW document. The previous sections of this report have established the current drainage arrangements on site and have also determined the current discharge rates for surface water leaving the site.

From 7th January 2019 the Flood and Water Management Act 2010 (Schedule 3) has been implemented by the Welsh Government which requires any development of more than 1 unit or where the construction area is greater than 100m² to comply with the SuDS Approving Bodies (SAB's) design guidance and ministers' standards which will require all sites to adopt SuDs in their design. The standards are listed below:

- S1 – Surface Water Runoff Destination
- S2 – Surface Water Runoff Hydraulic Control
- S3 – Water Quality
- S4 – Amenity
- S5 – Biodiversity
- S6 – Design of Drainage for Construction, Operation and Maintenance

The Standards listed will need to be met by the design in order to comply with the SDSSW. S1 is a hierarchy standard with standards S2-S6 being fixed.

3.2.1 S1 – Surface Water Runoff Destination

In determining a suitable methodology for disposal of surface water flows from this development, it is necessary to explore the technical options outlined under Standard S1 of the SDSSW 2018 document published by Welsh Government. This states that disposal should be made through the hierarchical approach which are, in order of preference; surface water runoff collected for use, infiltration methods, discharge to surface water body, discharge to a surface water sewer, highway sewer or another drainage system and finally discharge to a combined sewer. Each of these options are considered below.

3.2.1.1 Collected for Use

The suitability of this option will depend on the proposed water usage of the development, if the development has low grey water demand, the collection of water for reuse would not be economical or feasible, however if the demand for grey water is deemed to be high then rainwater harvesting would be an appropriate solution for parts of the development. The use of rainwater harvesting would need to be used in conjunction with one of the below methods of discharge in order to cater for exceedance flows in extreme rainfall events where the rainfall volume exceeds the volume of surface water storage provided by the rainwater harvesting tanks. The development is considered to have potential demand for grey water in the WC's however the proposed building is to comprise of a prefabricated modular building and based on this storing rain water runoff for reuse would not be feasible or economical.

3.2.1.2 Infiltration Methods

Based on the site investigation information which we have received soakaways are not considered suitable for the site. Section 5.9 of the ground investigation report 15297-HYD-XX-XX-RP-GE-1002_S2_P1 states "Soakaways (and infiltration to the ground as part of a Sustainable Urban Drainage System) are considered unsuitable for the site because of the thickness of made ground and the risk of mobilising contaminants within the soils. A positive drainage scheme should be utilised for this development."

3.2.1.3 Discharge to Surface Water Body

Sequentially, the next consideration in the hierarchical approach is discharge to a surface water body. The nearest watercourse is the river Tawe located to the north of the site, forming a new discharge point to the river would be deemed unfeasible and unlikely to be supported by the local authority and Natural Resources Wales (NRW), however as detailed below we are proposing to utilise the existing on-site private surface water system which currently outfalls to the river which will remove the need to construct a new structure on the river bank.

3.2.1.4 Discharge to Surface Water Sewer

Based on the survey information received to date there is an existing private surface water sewer which crosses the centre of the site which currently serves the existing Tesco car park and petrol station and main building further downstream. It is proposed to construct a new manhole on the existing sewer to accept the discharge from site subject to the necessary discharge consents, as the existing pipework currently serves the site area and we are providing betterment over the existing flows there should be capacity within the network to accept the proposed site.

3.2.1.5 Discharge to Combined Sewer

Based on the above information there is no need to consider discharging into a combined public sewer system.

3.2.2 S2 – Surface Water Runoff Hydraulic Control

This standard requires surface water to be managed to prevent as far as possible any discharge from the development for rainfall events of less than 5mm and that the surface water runoff rate and volume for up to a 1 in 100-year return period should be managed to protect people, properties and the receiving water body. Consideration is also required to the risk associated with runoff from events greater than 1 in 100-year return period with mitigating proposals developed for the scheme.

3.2.2.1 Interception of Runoff

Interception will need to be considered under the statutory standards. Interception aims to mimic greenfield runoff conditions by preventing runoff from the majority of all small rainfall events. This can contribute to reducing pollution load to receiving surface water bodies. Meeting the Interception criterion is not expected during particularly wet periods, when permeable surfaces and subsoils are saturated, so a suggested target is that 80% compliance should be achieved during the summer and 50% in winter. Refer to table G2.1 in the SDSSW document for details of interception mechanisms and their assumed compliance with the standards. It is proposed that this scheme will utilise permeable paving and rain gardens to provide suitable levels of interception where possible which have been demonstrated on drawing number PNT-HYD-XX-XX-DR-C-4100. The design is based on the rain gardens and paving systems being lined due to the thickness of made ground and the risk of mobilising

contaminants within the soils as stated in section 5.9 of the ground investigation report 15297-HYD-XX-XX-RP-GE-1002. Therefore, the allowance of any infiltration to occur to help improve the interception on site is not feasible. The proposed SuDS strategy does not provide the required levels of interception stated in the SDSSW. However, given the existing site is brownfield in nature and currently has no allowance for interception, the proposed SuDS strategy still offers betterment over the existing regime even though the required levels of interception are not achieved site wide.

Based on lined bases the following interception ratios can be deemed to be achieved under the guidance in the SDSSW document;

- Rain gardens/Swales, 5 times base area (based on the liner being a minimum 500mm below surface level)
- Permeable paving systems, 1 times base area (serves its own area)

A copy of the interception drawing number PNT-HYD-XX-XX-DR-C-4100 can be found within the drawing package enclosed with the SAB application.

3.2.2.2 Hydraulic Control and Storage

Infiltration has not been accounted for as a means of disposing surface water runoff generated from the development, therefore the discharge volume for the site will not decrease however as described in section 3.2.2.1 the bases of the SuDS features will be lined therefore the opportunity for any minor infiltration to occur to aid interception is not feasible - for the purposes of the storage calculations no volume will be lost to infiltration.

In order to meet the standards this report has adopted the simple approach outlined in the statutory standards of restricting all runoff from each catchment on site for all return periods up to and including the 1 in 100-year event to the current 1 year return period rates as given in table 2.2 of this report which will provide levels of betterment over the existing regime which are listed in table 3 below for each return period, as the proposal will reduce the discharge rate from the site there should be no adverse effect on the downstream pipework as the scheme is providing betterment over the existing regime.

Table 3: Proposed Discharge Rates and Betterment

Return Period	Existing Peak Discharge Rate (l/s)	Proposed Peak Discharge Rate (l/s)	Betterment (l/s)
1 YRP	16.69	11.7	- 4.99 (30%)
30 YRP	44.676	11.7	- 32.976 (73%)
100 YRP	58.297	11.7	- 46.597 (80%)
100 YRP + 40%	81.616	11.7	- 69.916 (85%)

In accordance with statutory guidelines, the development of this site should not increase flood risk elsewhere and as such, all runoff from attenuated areas on site should be contained within the site boundary for up to and including a 1 in 100 year design period storm, plus 40% climate change and urban creep allowance. It is proposed to discharge surface water runoff from the development via gravity to the existing public surface water sewer network which is located within the proposed site boundary, with runoff rates being restricted to the proposed peak discharge rates stated in table 3.

Betterment is being provided via a restricted rate over the existing discharge rates, so there should be no objection to the proposal from the local authority or NRW.

Surface water flows from the proposed development will be attenuated via a flow control chamber and on-site storage provided for surface water runoff for all rainfall events up to and including a 1 in 100 year event with 40% allowance for climate change and urban creep. Given the propose site usage and levels, storage in the form of rain gardens, permeable paving and a cellular storage tank will be provided for storage and interception, with the final discharge from site being controlled by a hydro-brake.

A copy of the detailed design calculations for the proposed system which have been produced using WinDes can be found in Appendix B of this report.

3.2.2.3 Exceedance Flows and Flood Pathways

"It is inevitable that as a result of extreme rainfall the capacities of sewers, covered watercourses and other drainage systems will be exceeded on occasion. Periods of exceedance occur when the rate of surface runoff exceeds the drainage system inlet capacity, when the pipe system becomes overloaded, or when the outfall becomes restricted due to flood levels in the receiving water. Underground conveyance cannot economically or sustainably be built large enough for the most extreme events and, as a result, there will be occasions when surface water runoff will exceed the design capacity of drains. When drainage exceedance capacity is exceeded the excess water (exceedance flow) is conveyed above ground, and will travel along streets and paths, between and through buildings and across open space. Indiscriminate flooding of property can occur when this flow of water is not controlled." (CIRIA C753 The SuDS Manual 2015*).*

Flood-flow pathways have been indicated on drawing number PNT-HYD-XX-XX-DR-C-4400 which convey the overland flows from rainfall events above a 1in100 year return period or failure to suitable areas of open space, such as landscaped areas, car parking areas and other hard surfaced areas in order to protect properties against flooding.

3.2.3 S3 – Water Quality

This standard requires treatment of surface water runoff to prevent negative impacts on the receiving water quality and/or protect downstream drainage systems including sewers. The only exception to this standard is where drainage connects directly to a combined sewer, where the quality requirements are limited to preventing the discharge of oil and sediments to the sewer system.

As the development is connecting to the existing private surface water sewer, we have designed the schemes surface water management strategy for water quality to follow the guiding principles of the SDSSW and use simple, natural processes that promote biodiversity and long-term sustainability. As such, it employs a SuDS management train approach, providing drainage components in series where required.

The possible impact of accidental spills will need to be addressed with the most vulnerable areas to a spill or other pollution incident being any car park areas and access roads, therefore the highway areas and parking will be drained into the permeable paving system or adjacent rain gardens, which will provide a level of treatment for pollution.

Planting within the SuDS features should form part of the water quality strategy. SuDS components like rain gardens and permeable paving provide water quality improvements by reducing sediment and contaminants from runoff either through settlement or biological breakdown of pollutants as part of their interceptor

function, so only robust and tolerant species of planting should be specified. Once these species establish this will decrease the flow rate of water travelling through and filter pollutants and contaminants before entering the downstream network.

The water quality assessment report PNT-HYD-XX-XX-RP-C-0003 for each area of the site can be found in the supporting documents within the SAB application pack.

3.2.4 S4 – Amenity

This standard requires that the design of the surface water management system should maximise amenity benefits.

The primary amenity focus of the SuDS scheme should be to improve the health and well-being of the users. The scheme will need to be based on natural forms that mimic natural landscapes found within the region and the vegetated rain garden planting areas are designed with locally contextual species that will encourage natural colonisation. Other key amenity benefits should include improving air quality around the development, increasing carbon sequestration and improving water quality through removal of pollutants via rain gardens.

A copy of the landscape architect's layout can be found in the drawing package enclosed with this report to form the SAB application.

3.2.5 S5 – Biodiversity

This standard requires that the surface water management system should maximise biodiversity benefits.

The SuDS scheme biodiversity strategy should revolve around the creation of significant and varied habitat to increase the overall biodiversity of the site and ecological value. The inclusion of plant species that will enhance the general eco system and simultaneously act as a water filtration system to clean pollutants and contaminants should be used where possible.

The plant species selected should be both locally contextual and appropriate for the varied habitat zones including primary characteristics that shall ensure:

- Good soil binding and filtration species
- Minimised erosion
- Improved filtration via dense root and stem species
- Tolerance to seasonal variations including droughts and inundations
- Good suspended solids retention
- Pollutant tolerant
- Emergent and pioneering species for natural ecological colonisation
- The creation of diverse, self-sustaining and resilient ecosystems for high species biodiversity
- Support for local and regional habitat strategies

In general, the proposed rain gardens will be the focal habitat areas for the site and will enhance the site over the current site layout by adding areas of water and damp soils. Exposed areas of bio retention areas will attract certain species and shaded areas under adjacent buildings and trees will further enhance the varied ecosystem potential.

A copy of the landscape architect's layout can be found in the drawing package enclosed with this report to form the SAB application.

3.2.6 S6 – Design of Drainage for Construction and Maintenance and Structural Integrity

The surface water drainage system has been designed with the overriding ethos of simplicity in construction, use and maintenance. This then allows a very simple translation from the principles described within standard S6, namely that all elements of the surface water drainage system should be designed so that they can be constructed, as well as maintained and operated "…easily, safely, cost-effectively, in a timely manner, and with the aim of minimising the use of scarce resources and embedded carbon (energy)." (SDSSW).

The proposed system will be managed by the client as they will be the sole landowner and will be managing all the elements within the site boundary, therefore the client's maintenance team will be responsible for the maintenance of all elements of the system to ensure it continues to comply with SuDS standards.

A copy of the required maintenance regime for each element can be found in the supporting document within the SAB application pack. Information with regards to the construction methodology will be provided once a contractor is appointed for the project which include Construction Phasing Plan & Construction Management Plan with the Construction (Design and Management) CDM Regulations File being provided at the end of the project. We would request that this information is conditioned within the SAB approval to be provided by the contractor prior to the commencement of works.

4. CONCLUSION

The aim of the surface water drainage design is to mimic the natural catchment processes as closely as possible and the proposed system has been designed in accordance with the Welsh Government SDSSW document, any local authority's SAB requirements and CIRIA's C753 SuDS Manual as well as meeting the requirements of Building Regulations, Document H.

In determining a suitable methodology for disposal of surface water flows from this development, it is necessary to explore the technical options outlined under Standard S1 in the SDSSW document. Based on the hierarchy it is proposed to discharge surface water runoff from the development to the existing private sewer within the site boundary where the bases of the SuDS features will be lined due to the thickness of made ground and the risk of mobilising contaminants in the ground. Therefore, infiltration will not occur and will not aid interception and discharge volume.

Surface water flows from the proposed development will be attenuated via a flow control chamber and on-site storage provided for surface water runoff for all rainfall events up to and including a 1 in 100 year event with 40% allowance for climate change and urban creep. Given the proposed site usage and levels, storage in the form of rain gardens, permeable paving and a cellular storage tank will be provided for storage and interception, with the final discharge from site being controlled by a hydro-brake chamber.

Betterment over the existing discharge rates for each catchment will be provided as stated in table 3 which should be acceptable to both the local authority and NRW.

The development is considered to have potential demand for grey water in the WC's however the proposed building is to comprise of a prefabricated modular building and based on this storing rainwater runoff for reuse would not be feasible or economical.

Amenity and biodiversity benefits to the site will be provided in the form of rain gardens which will be incorporated throughout the site and also form part of the attenuation storage for the site, these will maximise the available green infrastructure within the development site which will improve air quality and water quality of the site.

All on site surface water drainage systems have been designed and will be constructed to comply with the SDSSW and building regulations requirements.

A full set of design drawings are included with this report to support the SAB application.

Appendix A - Run-off Calculations

ICP SUDS Mean Annual Flood

Input

Return Period (years)	100	SAAR (mm)	1400	Urban	0.000
Area (ha)	0.350	Soil	0.400	Region Number	Region 9

Results	**l/s**
QBAR Rural	2.7
QBAR Urban	2.7
Q100 years	5.8
Q1 year	2.4
Q30 years	4.7
Q100 years	5.8

©1982-2020 Innovyze

Appendix B - WinDes Design Calculations

STORM SEWER DESIGN by the Modified Rational Method

Design Criteria for SW2.SWS

Pipe Sizes SW1 Manhole Sizes SW1

FSR Rainfall Model - England and Wales

Return Period (years)	30	PIMP (%)	100
M5-60 (mm)	19.800	Add Flow / Climate Change (%)	0
Ratio R	0.236	Minimum Backdrop Height (m)	0.200
Maximum Rainfall (mm/hr)	50	Maximum Backdrop Height (m)	0.000
Maximum Time of Concentration (mins)	30	Min Design Depth for Optimisation (m)	1.200
Foul Sewage (l/s/ha)	0.000	Min Vel for Auto Design only (m/s)	0.75
Volumetric Runoff Coeff.	0.750	Min Slope for Optimisation (1:X)	500

Designed with Level Soffits

Network Design Table for SW2.SWS

« - Indicates pipe capacity < flow

PN	Length (m)	Fall (m)	Slope (1:X)	I.Area (ha)	T.E. (mins)	Base Flow (l/s)	k (mm)	HYD SECT	DIA (mm)	Section Type	Auto Design
S1.000	13.582	0.136	99.9	0.003	5.00	0.0	0.600	o	150	Pipe/Conduit	
S1.001	3.597	0.036	99.9	0.003	0.00	0.0	0.600	o	150	Pipe/Conduit	
S1.002	5.876	0.059	99.6	0.003	0.00	0.0	0.600	o	150	Pipe/Conduit	
S1.003	9.390	0.094	99.9	0.003	0.00	0.0	0.600	o	150	Pipe/Conduit	
S2.000	49.228	0.492	100.1	0.006	5.00	0.0	0.600	o	150	Pipe/Conduit	
S1.004	4.603	0.243	18.9	0.006	0.00	0.0	0.600	o	150	Pipe/Conduit	
S1.005	27.491	0.162	169.7	0.047	0.00	0.0	0.600	o	225	Pipe/Conduit	
S3.000	4.366	0.582	7.5	0.000	5.00	0.0	0.600	o	225	Pipe/Conduit	

Network Results Table

PN	Rain (mm/hr)	T.C. (mins)	US/IL (m)	Σ I.Area (ha)	Σ Base Flow (l/s)	Foul (l/s)	Add Flow (l/s)	Vel (m/s)	Cap (l/s)	Flow (l/s)
S1.000	50.00	5.23	32.610	0.003	0.0	0.0	0.0	1.01	17.8	0.4
S1.001	50.00	5.28	32.474	0.006	0.0	0.0	0.0	1.01	17.8	0.8
S1.002	50.00	5.38	32.438	0.009	0.0	0.0	0.0	1.01	17.8	1.2
S1.003	50.00	5.54	32.379	0.012	0.0	0.0	0.0	1.01	17.8	1.6
S2.000	50.00	5.82	32.777	0.006	0.0	0.0	0.0	1.00	17.8	0.8
S1.004	50.00	5.85	32.285	0.024	0.0	0.0	0.0	2.33	41.1	3.2
S1.005	50.00	6.31	31.967	0.071	0.0	0.0	0.0	1.00	39.8	9.6
S3.000	50.00	5.02	32.387	0.000	0.0	0.0	0.0	4.81	191.2	0.0

©1982-2020 Innovyze

Network Design Table for SW2.SWS

PN	Length (m)	Fall (m)	Slope (1:X)	I.Area (ha)	T.E. (mins)	Base Flow (l/s)	k (mm)	HYD SECT	DIA (mm)	Section Type	Auto Design
S1.006	8.966	0.053	170.0	0.000	0.00	0.0	0.600	o	225	Pipe/Conduit	
S4.000	22.437	0.093	241.3	0.000	5.00	0.0	0.600	o	300	Pipe/Conduit	
S5.000	37.761	0.222	170.1	0.078	5.00	0.0	0.600	o	225	Pipe/Conduit	
S5.001	3.787	0.289	13.1	0.000	0.00	0.0	0.600	o	225	Pipe/Conduit	
S1.007	5.048	0.030	168.3	0.000	0.00	0.0	0.600	o	225	Pipe/Conduit	
S6.000	11.175	1.704	6.6	0.008	5.00	0.0	0.600	o	150	Pipe/Conduit	
S7.000	11.574	1.654	7.0	0.028	5.00	0.0	0.600	o	150	Pipe/Conduit	
S1.008	8.365	0.049	170.0	0.000	0.00	0.0	0.600	o	225	Pipe/Conduit	
S8.000	16.564	1.692	9.8	0.007	5.00	0.0	0.600	o	150	Pipe/Conduit	
S9.000	6.088	1.492	4.1	0.019	5.00	0.0	0.600	o	150	Pipe/Conduit	
S8.001	20.268	0.119	170.3	0.000	0.00	0.0	0.600	o	225	Pipe/Conduit	
S8.002	23.415	0.138	170.0	0.000	0.00	0.0	0.600	o	225	Pipe/Conduit	

Network Results Table

PN	Rain (mm/hr)	T.C. (mins)	US/IL (m)	Σ I.Area (ha)	Σ Base Flow (l/s)	Foul (l/s)	Add Flow (l/s)	Vel (m/s)	Cap (l/s)	Flow (l/s)
S1.006	50.00	6.46	31.805	0.071	0.0	0.0	0.0	1.00	39.8	9.6
S4.000	50.00	5.37	31.845	0.000	0.0	0.0	0.0	1.01	71.2	0.0
S5.000	50.00	5.63	32.263	0.078	0.0	0.0	0.0	1.00	39.7	10.6
S5.001	50.00	5.65	32.041	0.078	0.0	0.0	0.0	3.63	144.5	10.6
S1.007	50.00	6.54	31.752	0.149	0.0	0.0	0.0	1.01	40.0	20.2
S6.000	50.00	5.05	33.500	0.008	0.0	0.0	0.0	3.96	70.0	1.1
S7.000	50.00	5.05	33.450	0.028	0.0	0.0	0.0	3.83	67.8	3.8
S1.008	50.00	6.68	31.721	0.185	0.0	0.0	0.0	1.00	39.8	25.1
S8.000	50.00	5.09	33.700	0.007	0.0	0.0	0.0	3.24	57.2	0.9
S9.000	50.00	5.02	33.500	0.019	0.0	0.0	0.0	5.02	88.8	2.6
S8.001	50.00	5.42	31.933	0.026	0.0	0.0	0.0	1.00	39.7	3.5
S8.002	50.00	5.81	31.814	0.026	0.0	0.0	0.0	1.00	39.8	3.5

©1982-2020 Innovyze

Network Design Table for SW2.SWS

PN	Length (m)	Fall (m)	Slope (1:X)	I.Area (ha)	T.E. (mins)	Base Flow (l/s)	k (mm)	HYD SECT	DIA (mm)	Section Type	Auto Design
S10.000	31.420	0.185	170.0	0.047	5.00	0.0	0.600	o	225	Pipe/Conduit	
S11.000	4.545	0.045	101.0	0.009	5.00	0.0	0.600	o	150	Pipe/Conduit	
S11.001	6.383	0.064	99.7	0.008	0.00	0.0	0.600	o	150	Pipe/Conduit	
S11.002	3.199	0.032	100.0	0.009	0.00	0.0	0.600	o	150	Pipe/Conduit	
S12.000	9.048	0.090	100.5	0.009	5.00	0.0	0.600	o	150	Pipe/Conduit	
S11.003	6.339	0.254	25.0	0.009	0.00	0.0	0.600	o	150	Pipe/Conduit	
S10.001	5.719	0.671	8.5	0.000	0.00	0.0	0.600	o	225	Pipe/Conduit	
S1.009	9.079	0.053	171.3	0.000	0.00	0.0	0.600	o	225	Pipe/Conduit	

Network Results Table

PN	Rain (mm/hr)	T.C. (mins)	US/IL (m)	Σ I.Area (ha)	Σ Base Flow (l/s)	Foul (l/s)	Add Flow (l/s)	Vel (m/s)	Cap (l/s)	Flow (l/s)
S10.000	50.00	5.52	32.528	0.047	0.0	0.0	0.0	1.00	39.8	6.4
S11.000	50.00	5.08	32.813	0.009	0.0	0.0	0.0	1.00	17.7	1.2
S11.001	50.00	5.18	32.768	0.017	0.0	0.0	0.0	1.01	17.8	2.3
S11.002	50.00	5.23	32.704	0.026	0.0	0.0	0.0	1.00	17.8	3.5
S12.000	50.00	5.15	32.762	0.009	0.0	0.0	0.0	1.00	17.7	1.2
S11.003	50.00	5.29	32.672	0.044	0.0	0.0	0.0	2.02	35.8	6.0
S10.001	50.00	5.54	32.343	0.091	0.0	0.0	0.0	4.51	179.3	12.3
S1.009	50.00	6.83	31.672	0.302	0.0	0.0	0.0	1.00	39.6«	40.9

Simulation Criteria for SW2.SWS

Volumetric Runoff Coeff	0.950	Additional Flow - % of Total Flow	0.000
Areal Reduction Factor	1.000	MADD Factor * 10m³/ha Storage	2.000
Hot Start (mins)	0	Inlet Coeffiecient	0.800
Hot Start Level (mm)	0	Flow per Person per Day (l/per/day)	0.000
Manhole Headloss Coeff (Global)	0.500	Run Time (mins)	60
Foul Sewage per hectare (l/s)	0.000	Output Interval (mins)	1

Number of Input Hydrographs	0	Number of Storage Structures	6
Number of Online Controls	1	Number of Time/Area Diagrams	0
Number of Offline Controls	0	Number of Real Time Controls	0

Synthetic Rainfall Details

©1982-2020 Innovyze

Synthetic Rainfall Details

Rainfall Model	FSR	Profile Type	Summer
Return Period (years)	30	Cv (Summer)	0.950
Region	England and Wales	Cv (Winter)	0.840
M5-60 (mm)	19.800	Storm Duration (mins)	30
Ratio R	0.236		

©1982-2020 Innovyze

Online Controls for SW2.SWS

Hydro-Brake® Optimum Manhole: S28, DS/PN: S1.009, Volume (m³): 3.8

Unit Reference	MD-SHE-0151-1170-1350-1170
Design Head (m)	1.350
Design Flow (l/s)	11.7
Flush-Flo™	Calculated
Objective	Minimise upstream storage
Application	Surface
Sump Available	Yes
Diameter (mm)	151
Invert Level (m)	31.672
Minimum Outlet Pipe Diameter (mm)	225
Suggested Manhole Diameter (mm)	1200

Control Points	**Head (m)**	**Flow (l/s)**
Design Point (Calculated)	1.350	11.7
Flush-Flo™	0.402	11.7
Kick-Flo®	0.867	9.5
Mean Flow over Head Range	-	10.2

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

Depth (m)	**Flow (l/s)**	**Depth (m)**	**Flow (l/s)**	**Depth (m)**	**Flow (l/s)**	**Depth (m)**	**Flow (l/s)**
0.100	5.4	1.200	11.1	3.000	17.1	7.000	25.7
0.200	10.8	1.400	11.9	3.500	18.4	7.500	26.5
0.300	11.5	1.600	12.7	4.000	19.6	8.000	27.4
0.400	11.7	1.800	13.4	4.500	20.7	8.500	28.2
0.500	11.6	2.000	14.1	5.000	21.8	9.000	29.0
0.600	11.4	2.200	14.7	5.500	22.8	9.500	29.7
0.800	10.3	2.400	15.4	6.000	23.8		
1.000	10.2	2.600	16.0	6.500	24.8		

©1982-2020 Innovyze

Storage Structures for SW2.SWS

Porous Car Park Manhole: S7, DS/PN: S1.005

Infiltration Coefficient Base (m/hr)	0.00000	Width (m)	40.0
Membrane Percolation (mm/hr)	1000	Length (m)	10.0
Max Percolation (l/s)	111.1	Slope (1:X)	45.0
Safety Factor	2.0	Depression Storage (mm)	5
Porosity	0.30	Evaporation (mm/day)	3
Invert Level (m)	32.650	Cap Volume Depth (m)	0.375

Cellular Storage Manhole: S10, DS/PN: S4.000

Invert Level (m)	31.850	Safety Factor	2.0
Infiltration Coefficient Base (m/hr)	0.00000	Porosity	0.95
Infiltration Coefficient Side (m/hr)	0.00000		

Depth (m)	Area (m²)	Inf. Area (m²)	Depth (m)	Area (m²)	Inf. Area (m²)
0.000	120.0	120.0	0.751	0.0	152.9
0.750	120.0	152.9			

Tank or Pond Manhole: S14, DS/PN: S6.000

Invert Level (m) 33.500

Depth (m)	Area (m²)	Depth (m)	Area (m²)
0.000	33.2	0.300	60.8

Tank or Pond Manhole: S15, DS/PN: S7.000

Invert Level (m) 33.450

Depth (m)	Area (m²)	Depth (m)	Area (m²)
0.000	15.7	0.300	35.0

Tank or Pond Manhole: S17, DS/PN: S8.000

Invert Level (m) 33.700

Depth (m)	Area (m²)	Depth (m)	Area (m²)
0.000	18.5	0.300	57.0

Tank or Pond Manhole: S18, DS/PN: S9.000

Invert Level (m) 33.500

©1982-2020 Innovyze

Tank or Pond Manhole: S18, DS/PN: S9.000

Depth (m)	Area (m²)	Depth (m)	Area (m²)
0.000	1.0	0.300	22.3

©1982-2020 Innovyze

Summary of Critical Results by Maximum Level (Rank 1) for SW2.SWS

Simulation Criteria

Areal Reduction Factor 1.000 Additional Flow - % of Total Flow 0.000
Hot Start (mins) 0 MADD Factor * 10m³/ha Storage 2.000
Hot Start Level (mm) 0 Inlet Coeffiecient 0.800
Manhole Headloss Coeff (Global) 0.500 Flow per Person per Day (l/per/day) 0.000
Foul Sewage per hectare (l/s) 0.000

Number of Input Hydrographs 0 Number of Storage Structures 6
Number of Online Controls 1 Number of Time/Area Diagrams 0
Number of Offline Controls 0 Number of Real Time Controls 0

Synthetic Rainfall Details

Rainfall Model FSR Ratio R 0.236
Region England and Wales Cv (Summer) 0.950
M5-60 (mm) 19.800 Cv (Winter) 0.840

Margin for Flood Risk Warning (mm) 500.0
Analysis Timestep 2.5 Second Increment (Extended)
DTS Status ON
DVD Status ON
Inertia Status OFF

Profile(s) Summer and Winter
Duration(s) (mins) 15, 30, 60, 120, 180, 240, 360, 480, 600, 720, 960, 1440, 2160, 2880, 4320, 5760, 7200, 8640
Return Period(s) (years) 100
Climate Change (%) 0

PN	US/MH Name	Storm	Return Period	Climate Change	First (X) Surcharge	First (Y) Flood	First (Z) Overflow	Overflow Act.	Water Level (m)
S1.000	S1	15 Summer	100	+0%					32.639
S1.001	S2	30 Summer	100	+0%					32.567
S1.002	S3	30 Summer	100	+0%					32.564
S1.003	S4	30 Summer	100	+0%	100/15 Summer				32.556
S2.000	S5	15 Summer	100	+0%					32.816
S1.004	S6	30 Summer	100	+0%	100/15 Summer				32.542
S1.005	S7	30 Summer	100	+0%	100/15 Summer				32.524
S3.000	S8	120 Summer	100	+0%					32.465
S1.006	S9	120 Summer	100	+0%	100/15 Summer				32.473
S4.000	S10	120 Summer	100	+0%	100/15 Summer				32.458
S5.000	S11	30 Summer	100	+0%	100/15 Summer				32.587
S5.001	S12	120 Summer	100	+0%	100/15 Summer				32.471
S1.007	S13	120 Summer	100	+0%	100/15 Summer				32.466
S6.000	S14	30 Summer	100	+0%					33.521
S7.000	S15	30 Summer	100	+0%					33.495
S1.008	S16	30 Summer	100	+0%	100/15 Summer				32.491
S8.000	S17	30 Summer	100	+0%					33.722
S9.000	S18	15 Summer	100	+0%					33.534

©1982-2020 Innovyze

Summary of Critical Results by Maximum Level (Rank 1) for SW2.SWS

PN	US/MH Name	Surcharged Depth (m)	Flooded Volume (m³)	Flow / Cap.	Overflow (l/s)	Half Drain Time (mins)	Pipe Flow (l/s)	Status	Level Exceeded
S1.000	S1	-0.121	0.000	0.08			1.3	OK	
S1.001	S2	-0.057	0.000	0.22			2.6	OK	
S1.002	S3	-0.024	0.000	0.25			3.7	OK	
S1.003	S4	0.027	0.000	0.29			4.5	SURCHARGED	
S2.000	S5	-0.111	0.000	0.15			2.6	OK	
S1.004	S6	0.107	0.000	0.30			9.4	SURCHARGED	
S1.005	S7	0.332	0.000	0.74		26	27.2	SURCHARGED	
S3.000	S8	-0.147	0.000	0.01			0.8	OK	
S1.006	S9	0.443	0.000	0.54			17.5	SURCHARGED	
S4.000	S10	0.313	0.000	0.17		83	10.5	SURCHARGED	
S5.000	S11	0.099	0.000	0.82			31.0	SURCHARGED	
S5.001	S12	0.205	0.000	0.24			18.5	SURCHARGED	
S1.007	S13	0.489	0.000	0.39			11.4	SURCHARGED	
S6.000	S14	-0.129	0.000	0.05			2.9	FLOOD RISK	
S7.000	S15	-0.105	0.000	0.20			12.0	FLOOD RISK	
S1.008	S16	0.545	0.000	0.37			11.5	SURCHARGED	
S8.000	S17	-0.128	0.000	0.05			2.8	FLOOD RISK	
S9.000	S18	-0.116	0.000	0.11			8.4	FLOOD RISK	

©1982-2020 Innovyze

Summary of Critical Results by Maximum Level (Rank 1) for SW2.SWS

PN	US/MH Name	Storm	Return Period	Climate Change	First (X) Surcharge	First (Y) Flood	First (Z) Overflow	Overflow Act.	Water Level (m)
S8.001	S19	30 Summer	100	+0%	100/15 Summer				32.628
S8.002	S20	30 Summer	100	+0%	100/15 Summer				32.607
S10.000	S21	30 Summer	100	+0%					32.691
S11.000	S22	15 Summer	100	+0%					32.881
S11.001	S23	15 Summer	100	+0%					32.874
S11.002	S24	15 Summer	100	+0%					32.854
S12.000	S25	15 Summer	100	+0%					32.813
S11.003	S26	15 Summer	100	+0%					32.764
S10.001	S27	30 Summer	100	+0%	100/15 Summer				32.645
S1.009	S28	30 Summer	100	+0%	100/15 Summer				32.584

PN	US/MH Name	Surcharged Depth (m)	Flooded Volume (m³)	Flow / Cap.	Overflow (l/s)	Half Drain Time (mins)	Pipe Flow (l/s)	Status	Level Exceeded
S8.001	S19	0.470	0.000	0.29			10.4	SURCHARGED	
S8.002	S20	0.568	0.000	0.28			10.1	SURCHARGED	
S10.000	S21	-0.062	0.000	0.55			20.3	OK	
S11.000	S22	-0.082	0.000	0.29			3.9	OK	
S11.001	S23	-0.044	0.000	0.51			7.7	OK	
S11.002	S24	0.000	0.000	1.06			11.9	OK	
S12.000	S25	-0.099	0.000	0.25			4.0	OK	
S11.003	S26	-0.058	0.000	0.67			20.0	OK	
S10.001	S27	0.077	0.000	0.30			34.3	SURCHARGED	
S1.009	S28	0.687	0.000	0.36			11.7	SURCHARGED	

©1982-2020 Innovyze

STORM SEWER DESIGN by the Modified Rational Method

Design Criteria for SW2.SWS

Pipe Sizes SW1 Manhole Sizes SW1

FSR Rainfall Model - England and Wales

Return Period (years)	30	PIMP (%)	100
M5-60 (mm)	19.800	Add Flow / Climate Change (%)	0
Ratio R	0.236	Minimum Backdrop Height (m)	0.200
Maximum Rainfall (mm/hr)	50	Maximum Backdrop Height (m)	0.000
Maximum Time of Concentration (mins)	30	Min Design Depth for Optimisation (m)	1.200
Foul Sewage (l/s/ha)	0.000	Min Vel for Auto Design only (m/s)	0.75
Volumetric Runoff Coeff.	0.750	Min Slope for Optimisation (1:X)	500

Designed with Level Soffits

Network Design Table for SW2.SWS

« - Indicates pipe capacity < flow

PN	Length (m)	Fall (m)	Slope (1:X)	I.Area (ha)	T.E. (mins)	Base Flow (l/s)	k (mm)	HYD SECT	DIA (mm)	Section Type	Auto Design
S1.000	13.582	0.136	99.9	0.003	5.00	0.0	0.600	o	150	Pipe/Conduit	
S1.001	3.597	0.036	99.9	0.003	0.00	0.0	0.600	o	150	Pipe/Conduit	
S1.002	5.876	0.059	99.6	0.003	0.00	0.0	0.600	o	150	Pipe/Conduit	
S1.003	9.390	0.094	99.9	0.003	0.00	0.0	0.600	o	150	Pipe/Conduit	
S2.000	49.228	0.492	100.1	0.006	5.00	0.0	0.600	o	150	Pipe/Conduit	
S1.004	4.603	0.243	18.9	0.006	0.00	0.0	0.600	o	150	Pipe/Conduit	
S1.005	27.491	0.162	169.7	0.047	0.00	0.0	0.600	o	225	Pipe/Conduit	
S3.000	4.366	0.582	7.5	0.000	5.00	0.0	0.600	o	225	Pipe/Conduit	

Network Results Table

PN	Rain (mm/hr)	T.C. (mins)	US/IL (m)	Σ I.Area (ha)	Σ Base Flow (l/s)	Foul (l/s)	Add Flow (l/s)	Vel (m/s)	Cap (l/s)	Flow (l/s)
S1.000	50.00	5.23	32.610	0.003	0.0	0.0	0.0	1.01	17.8	0.4
S1.001	50.00	5.28	32.474	0.006	0.0	0.0	0.0	1.01	17.8	0.8
S1.002	50.00	5.38	32.438	0.009	0.0	0.0	0.0	1.01	17.8	1.2
S1.003	50.00	5.54	32.379	0.012	0.0	0.0	0.0	1.01	17.8	1.6
S2.000	50.00	5.82	32.777	0.006	0.0	0.0	0.0	1.00	17.8	0.8
S1.004	50.00	5.85	32.285	0.024	0.0	0.0	0.0	2.33	41.1	3.2
S1.005	50.00	6.31	31.967	0.071	0.0	0.0	0.0	1.00	39.8	9.6
S3.000	50.00	5.02	32.387	0.000	0.0	0.0	0.0	4.81	191.2	0.0

©1982-2020 Innovyze

Network Design Table for SW2.SWS

PN	Length (m)	Fall (m)	Slope (1:X)	I.Area (ha)	T.E. (mins)	Base Flow (l/s)	k (mm)	HYD SECT	DIA (mm)	Section Type	Auto Design
S1.006	8.966	0.053	170.0	0.000	0.00	0.0	0.600	o	225	Pipe/Conduit	
S4.000	22.437	0.093	241.3	0.000	5.00	0.0	0.600	o	300	Pipe/Conduit	
S5.000	37.761	0.222	170.1	0.078	5.00	0.0	0.600	o	225	Pipe/Conduit	
S5.001	3.787	0.289	13.1	0.000	0.00	0.0	0.600	o	225	Pipe/Conduit	
S1.007	5.048	0.030	168.3	0.000	0.00	0.0	0.600	o	225	Pipe/Conduit	
S6.000	11.175	1.704	6.6	0.008	5.00	0.0	0.600	o	150	Pipe/Conduit	
S7.000	11.574	1.654	7.0	0.028	5.00	0.0	0.600	o	150	Pipe/Conduit	
S1.008	8.365	0.049	170.0	0.000	0.00	0.0	0.600	o	225	Pipe/Conduit	
S8.000	16.564	1.692	9.8	0.007	5.00	0.0	0.600	o	150	Pipe/Conduit	
S9.000	6.088	1.492	4.1	0.019	5.00	0.0	0.600	o	150	Pipe/Conduit	
S8.001	20.268	0.119	170.3	0.000	0.00	0.0	0.600	o	225	Pipe/Conduit	
S8.002	23.415	0.138	170.0	0.000	0.00	0.0	0.600	o	225	Pipe/Conduit	

Network Results Table

PN	Rain (mm/hr)	T.C. (mins)	US/IL (m)	Σ I.Area (ha)	Σ Base Flow (l/s)	Foul (l/s)	Add Flow (l/s)	Vel (m/s)	Cap (l/s)	Flow (l/s)
S1.006	50.00	6.46	31.805	0.071	0.0	0.0	0.0	1.00	39.8	9.6
S4.000	50.00	5.37	31.845	0.000	0.0	0.0	0.0	1.01	71.2	0.0
S5.000	50.00	5.63	32.263	0.078	0.0	0.0	0.0	1.00	39.7	10.6
S5.001	50.00	5.65	32.041	0.078	0.0	0.0	0.0	3.63	144.5	10.6
S1.007	50.00	6.54	31.752	0.149	0.0	0.0	0.0	1.01	40.0	20.2
S6.000	50.00	5.05	33.500	0.008	0.0	0.0	0.0	3.96	70.0	1.1
S7.000	50.00	5.05	33.450	0.028	0.0	0.0	0.0	3.83	67.8	3.8
S1.008	50.00	6.68	31.721	0.185	0.0	0.0	0.0	1.00	39.8	25.1
S8.000	50.00	5.09	33.700	0.007	0.0	0.0	0.0	3.24	57.2	0.9
S9.000	50.00	5.02	33.500	0.019	0.0	0.0	0.0	5.02	88.8	2.6
S8.001	50.00	5.42	31.933	0.026	0.0	0.0	0.0	1.00	39.7	3.5
S8.002	50.00	5.81	31.814	0.026	0.0	0.0	0.0	1.00	39.8	3.5

©1982-2020 Innovyze

Network Design Table for SW2.SWS

PN	Length (m)	Fall (m)	Slope (1:X)	I.Area (ha)	T.E. (mins)	Base Flow (l/s)	k (mm)	HYD SECT	DIA (mm)	Section Type	Auto Design
S10.000	31.420	0.185	170.0	0.047	5.00	0.0	0.600	o	225	Pipe/Conduit	
S11.000	4.545	0.045	101.0	0.009	5.00	0.0	0.600	o	150	Pipe/Conduit	
S11.001	6.383	0.064	99.7	0.008	0.00	0.0	0.600	o	150	Pipe/Conduit	
S11.002	3.199	0.032	100.0	0.009	0.00	0.0	0.600	o	150	Pipe/Conduit	
S12.000	9.048	0.090	100.5	0.009	5.00	0.0	0.600	o	150	Pipe/Conduit	
S11.003	6.339	0.254	25.0	0.009	0.00	0.0	0.600	o	150	Pipe/Conduit	
S10.001	5.719	0.671	8.5	0.000	0.00	0.0	0.600	o	225	Pipe/Conduit	
S1.009	9.079	0.053	171.3	0.000	0.00	0.0	0.600	o	225	Pipe/Conduit	

Network Results Table

PN	Rain (mm/hr)	T.C. (mins)	US/IL (m)	Σ I.Area (ha)	Σ Base Flow (l/s)	Foul (l/s)	Add Flow (l/s)	Vel (m/s)	Cap (l/s)	Flow (l/s)
S10.000	50.00	5.52	32.528	0.047	0.0	0.0	0.0	1.00	39.8	6.4
S11.000	50.00	5.08	32.813	0.009	0.0	0.0	0.0	1.00	17.7	1.2
S11.001	50.00	5.18	32.768	0.017	0.0	0.0	0.0	1.01	17.8	2.3
S11.002	50.00	5.23	32.704	0.026	0.0	0.0	0.0	1.00	17.8	3.5
S12.000	50.00	5.15	32.762	0.009	0.0	0.0	0.0	1.00	17.7	1.2
S11.003	50.00	5.29	32.672	0.044	0.0	0.0	0.0	2.02	35.8	6.0
S10.001	50.00	5.54	32.343	0.091	0.0	0.0	0.0	4.51	179.3	12.3
S1.009	50.00	6.83	31.672	0.302	0.0	0.0	0.0	1.00	39.6«	40.9

Simulation Criteria for SW2.SWS

Volumetric Runoff Coeff	0.950	Additional Flow - % of Total Flow	0.000
Areal Reduction Factor	1.000	MADD Factor * 10m³/ha Storage	2.000
Hot Start (mins)	0	Inlet Coeffiecient	0.800
Hot Start Level (mm)	0	Flow per Person per Day (l/per/day)	0.000
Manhole Headloss Coeff (Global)	0.500	Run Time (mins)	60
Foul Sewage per hectare (l/s)	0.000	Output Interval (mins)	1

Number of Input Hydrographs	0	Number of Storage Structures	6
Number of Online Controls	1	Number of Time/Area Diagrams	0
Number of Offline Controls	0	Number of Real Time Controls	0

Synthetic Rainfall Details

©1982-2020 Innovyze

Synthetic Rainfall Details

Rainfall Model	FSR	Profile Type	Summer
Return Period (years)	30	Cv (Summer)	0.950
Region	England and Wales	Cv (Winter)	0.840
M5-60 (mm)	19.800	Storm Duration (mins)	30
Ratio R	0.236		

©1982-2020 Innovyze

Online Controls for SW2.SWS

Hydro-Brake® Optimum Manhole: S28, DS/PN: S1.009, Volume (m³): 3.8

Unit Reference	MD-SHE-0151-1170-1350-1170
Design Head (m)	1.350
Design Flow (l/s)	11.7
Flush-Flo™	Calculated
Objective	Minimise upstream storage
Application	Surface
Sump Available	Yes
Diameter (mm)	151
Invert Level (m)	31.672
Minimum Outlet Pipe Diameter (mm)	225
Suggested Manhole Diameter (mm)	1200

Control Points	**Head (m)**	**Flow (l/s)**
Design Point (Calculated)	1.350	11.7
Flush-Flo™	0.402	11.7
Kick-Flo®	0.867	9.5
Mean Flow over Head Range	-	10.2

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

Depth (m)	**Flow (l/s)**	**Depth (m)**	**Flow (l/s)**	**Depth (m)**	**Flow (l/s)**	**Depth (m)**	**Flow (l/s)**
0.100	5.4	1.200	11.1	3.000	17.1	7.000	25.7
0.200	10.8	1.400	11.9	3.500	18.4	7.500	26.5
0.300	11.5	1.600	12.7	4.000	19.6	8.000	27.4
0.400	11.7	1.800	13.4	4.500	20.7	8.500	28.2
0.500	11.6	2.000	14.1	5.000	21.8	9.000	29.0
0.600	11.4	2.200	14.7	5.500	22.8	9.500	29.7
0.800	10.3	2.400	15.4	6.000	23.8		
1.000	10.2	2.600	16.0	6.500	24.8		

©1982-2020 Innovyze

Storage Structures for SW2.SWS

Porous Car Park Manhole: S7, DS/PN: S1.005

Infiltration Coefficient Base (m/hr)	0.00000	Width (m)	40.0
Membrane Percolation (mm/hr)	1000	Length (m)	10.0
Max Percolation (l/s)	111.1	Slope (1:X)	45.0
Safety Factor	2.0	Depression Storage (mm)	5
Porosity	0.30	Evaporation (mm/day)	3
Invert Level (m)	32.650	Cap Volume Depth (m)	0.375

Cellular Storage Manhole: S10, DS/PN: S4.000

Invert Level (m)	31.850	Safety Factor	2.0
Infiltration Coefficient Base (m/hr)	0.00000	Porosity	0.95
Infiltration Coefficient Side (m/hr)	0.00000		

Depth (m)	Area (m²)	Inf. Area (m²)	Depth (m)	Area (m²)	Inf. Area (m²)
0.000	120.0	120.0	0.751	0.0	152.9
0.750	120.0	152.9			

Tank or Pond Manhole: S14, DS/PN: S6.000

Invert Level (m) 33.500

Depth (m)	Area (m²)	Depth (m)	Area (m²)
0.000	33.2	0.300	60.8

Tank or Pond Manhole: S15, DS/PN: S7.000

Invert Level (m) 33.450

Depth (m)	Area (m²)	Depth (m)	Area (m²)
0.000	15.7	0.300	35.0

Tank or Pond Manhole: S17, DS/PN: S8.000

Invert Level (m) 33.700

Depth (m)	Area (m²)	Depth (m)	Area (m²)
0.000	18.5	0.300	57.0

Tank or Pond Manhole: S18, DS/PN: S9.000

Invert Level (m) 33.500

©1982-2020 Innovyze

Tank or Pond Manhole: S18, DS/PN: S9.000

Depth (m)	Area (m²)	Depth (m)	Area (m²)
0.000	1.0	0.300	22.3

©1982-2020 Innovyze

Summary of Critical Results by Maximum Level (Rank 1) for SW2.SWS

Simulation Criteria

Areal Reduction Factor 1.000 Additional Flow - % of Total Flow 0.000
Hot Start (mins) 0 MADD Factor * 10m³/ha Storage 2.000
Hot Start Level (mm) 0 Inlet Coeffiecient 0.800
Manhole Headloss Coeff (Global) 0.500 Flow per Person per Day (l/per/day) 0.000
Foul Sewage per hectare (l/s) 0.000

Number of Input Hydrographs 0 Number of Storage Structures 6
Number of Online Controls 1 Number of Time/Area Diagrams 0
Number of Offline Controls 0 Number of Real Time Controls 0

Synthetic Rainfall Details

Rainfall Model FSR Ratio R 0.236
Region England and Wales Cv (Summer) 0.950
M5-60 (mm) 19.800 Cv (Winter) 0.840

Margin for Flood Risk Warning (mm) 500.0
Analysis Timestep 2.5 Second Increment (Extended)
DTS Status ON
DVD Status ON
Inertia Status OFF

Profile(s) Summer and Winter
Duration(s) (mins) 15, 30, 60, 120, 180, 240, 360, 480, 600, 720, 960, 1440, 2160, 2880, 4320, 5760, 7200, 8640
Return Period(s) (years) 100
Climate Change (%) 40

PN	US/MH Name	Storm	Return Period	Climate Change	First (X) Surcharge	First (Y) Flood	First (Z) Overflow	Overflow Act.	Water Level (m)
S1.000	S1	180 Summer	100	+40%	100/15 Summer				32.965
S1.001	S2	180 Summer	100	+40%	100/15 Summer				32.964
S1.002	S3	180 Summer	100	+40%	100/15 Summer				32.964
S1.003	S4	180 Summer	100	+40%	100/15 Summer				32.963
S2.000	S5	180 Summer	100	+40%	100/120 Summer				32.964
S1.004	S6	180 Summer	100	+40%	100/15 Summer				32.962
S1.005	S7	180 Summer	100	+40%	100/15 Summer				32.960
S3.000	S8	240 Summer	100	+40%	100/30 Summer				32.956
S1.006	S9	240 Summer	100	+40%	100/15 Summer				32.956
S4.000	S10	180 Summer	100	+40%	100/15 Summer				32.968
S5.000	S11	180 Summer	100	+40%	100/15 Summer				32.994
S5.001	S12	180 Summer	100	+40%	100/15 Summer				32.973
S1.007	S13	180 Summer	100	+40%	100/15 Summer				32.968
S6.000	S14	30 Summer	100	+40%					33.525
S7.000	S15	15 Summer	100	+40%					33.504
S1.008	S16	180 Summer	100	+40%	100/15 Summer				32.978
S8.000	S17	30 Summer	100	+40%					33.727
S9.000	S18	15 Summer	100	+40%					33.540

©1982-2020 Innovyze

Summary of Critical Results by Maximum Level (Rank 1) for SW2.SWS

PN	US/MH Name	Surcharged Depth (m)	Flooded Volume (m³)	Flow / Cap.	Overflow (l/s)	Half Drain Time (mins)	Pipe Flow (l/s)	Status	Level Exceeded
S1.000	S1	0.205	0.000	0.05			0.9	FLOOD RISK	
S1.001	S2	0.340	0.000	0.14			1.7	FLOOD RISK	
S1.002	S3	0.376	0.000	0.17			2.5	FLOOD RISK	
S1.003	S4	0.434	0.000	0.19			3.0	FLOOD RISK	
S2.000	S5	0.037	0.000	0.10			1.7	SURCHARGED	
S1.004	S6	0.527	0.000	0.18			5.4	FLOOD RISK	
S1.005	S7	0.768	0.000	0.45		55	16.7	FLOOD RISK	
S3.000	S8	0.344	0.000	0.00			0.4	SURCHARGED	
S1.006	S9	0.926	0.000	0.42			13.5	SURCHARGED	
S4.000	S10	0.823	0.000	0.17		191	10.5	FLOOD RISK	
S5.000	S11	0.506	0.000	0.55			20.6	FLOOD RISK	
S5.001	S12	0.707	0.000	0.26			19.9	SURCHARGED	
S1.007	S13	0.991	0.000	0.39			11.3	SURCHARGED	
S6.000	S14	-0.125	0.000	0.07			4.2	FLOOD RISK	
S7.000	S15	-0.096	0.000	0.28			17.0	FLOOD RISK	
S1.008	S16	1.032	0.000	0.36			11.4	SURCHARGED	
S8.000	S17	-0.123	0.000	0.08			4.0	FLOOD RISK	
S9.000	S18	-0.110	0.000	0.16			11.7	FLOOD RISK	

©1982-2020 Innovyze

Summary of Critical Results by Maximum Level (Rank 1) for SW2.SWS

PN	US/MH Name	Storm	Return Period	Climate Change	First (X) Surcharge	First (Y) Flood	First (Z) Overflow	Overflow Act.	Water Level (m)
S8.001	S19	120 Summer	100	+40%	100/15 Summer				32.997
S8.002	S20	120 Summer	100	+40%	100/15 Summer				32.989
S10.000	S21	30 Summer	100	+40%	100/15 Summer				33.095
S11.000	S22	30 Summer	100	+40%	100/15 Summer				33.211
S11.001	S23	30 Summer	100	+40%	100/15 Summer				33.202
S11.002	S24	30 Summer	100	+40%	100/15 Summer				33.182
S12.000	S25	30 Summer	100	+40%	100/15 Summer				33.158
S11.003	S26	30 Summer	100	+40%	100/15 Summer				33.143
S10.001	S27	30 Summer	100	+40%	100/15 Summer				33.016
S1.009	S28	120 Summer	100	+40%	100/15 Summer				32.982

PN	US/MH Name	Surcharged Depth (m)	Flooded Volume (m³)	Flow / Cap.	Overflow (l/s)	Half Drain Time (mins)	Pipe Flow (l/s)	Status	Level Exceeded
S8.001	S19	0.839	0.000	0.25			8.8	SURCHARGED	
S8.002	S20	0.950	0.000	0.22			8.1	SURCHARGED	
S10.000	S21	0.342	0.000	0.64			23.7	SURCHARGED	
S11.000	S22	0.248	0.000	0.37			4.9	SURCHARGED	
S11.001	S23	0.284	0.000	0.63			9.4	SURCHARGED	
S11.002	S24	0.328	0.000	1.30			14.6	SURCHARGED	
S12.000	S25	0.246	0.000	0.31			4.8	SURCHARGED	
S11.003	S26	0.321	0.000	0.76			22.8	SURCHARGED	
S10.001	S27	0.448	0.000	0.38			43.8	SURCHARGED	
S1.009	S28	1.085	0.000	0.36			11.7	SURCHARGED	

©1982-2020 Innovyze

STORM SEWER DESIGN by the Modified Rational Method

Design Criteria for SW2.SWS

Pipe Sizes SW1 Manhole Sizes SW1

FSR Rainfall Model - England and Wales

Return Period (years)	30	PIMP (%)	100
M5-60 (mm)	19.800	Add Flow / Climate Change (%)	0
Ratio R	0.236	Minimum Backdrop Height (m)	0.200
Maximum Rainfall (mm/hr)	50	Maximum Backdrop Height (m)	0.000
Maximum Time of Concentration (mins)	30	Min Design Depth for Optimisation (m)	1.200
Foul Sewage (l/s/ha)	0.000	Min Vel for Auto Design only (m/s)	0.75
Volumetric Runoff Coeff.	0.750	Min Slope for Optimisation (1:X)	500

Designed with Level Soffits

Network Design Table for SW2.SWS

« - Indicates pipe capacity < flow

PN	Length (m)	Fall (m)	Slope (1:X)	I.Area (ha)	T.E. (mins)	Base Flow (l/s)	k (mm)	HYD SECT	DIA (mm)	Section Type	Auto Design
S1.000	13.582	0.136	99.9	0.003	5.00	0.0	0.600	o	150	Pipe/Conduit	
S1.001	3.597	0.036	99.9	0.003	0.00	0.0	0.600	o	150	Pipe/Conduit	
S1.002	5.876	0.059	99.6	0.003	0.00	0.0	0.600	o	150	Pipe/Conduit	
S1.003	9.390	0.094	99.9	0.003	0.00	0.0	0.600	o	150	Pipe/Conduit	
S2.000	49.228	0.492	100.1	0.006	5.00	0.0	0.600	o	150	Pipe/Conduit	
S1.004	4.603	0.243	18.9	0.006	0.00	0.0	0.600	o	150	Pipe/Conduit	
S1.005	27.491	0.162	169.7	0.047	0.00	0.0	0.600	o	225	Pipe/Conduit	
S3.000	4.366	0.582	7.5	0.000	5.00	0.0	0.600	o	225	Pipe/Conduit	

Network Results Table

PN	Rain (mm/hr)	T.C. (mins)	US/IL (m)	Σ I.Area (ha)	Σ Base Flow (l/s)	Foul (l/s)	Add Flow (l/s)	Vel (m/s)	Cap (l/s)	Flow (l/s)
S1.000	50.00	5.23	32.610	0.003	0.0	0.0	0.0	1.01	17.8	0.4
S1.001	50.00	5.28	32.474	0.006	0.0	0.0	0.0	1.01	17.8	0.8
S1.002	50.00	5.38	32.438	0.009	0.0	0.0	0.0	1.01	17.8	1.2
S1.003	50.00	5.54	32.379	0.012	0.0	0.0	0.0	1.01	17.8	1.6
S2.000	50.00	5.82	32.777	0.006	0.0	0.0	0.0	1.00	17.8	0.8
S1.004	50.00	5.85	32.285	0.024	0.0	0.0	0.0	2.33	41.1	3.2
S1.005	50.00	6.31	31.967	0.071	0.0	0.0	0.0	1.00	39.8	9.6
S3.000	50.00	5.02	32.387	0.000	0.0	0.0	0.0	4.81	191.2	0.0

©1982-2020 Innovyze

Network Design Table for SW2.SWS

PN	Length (m)	Fall (m)	Slope (1:X)	I.Area (ha)	T.E. (mins)	Base Flow (l/s)	k (mm)	HYD SECT	DIA (mm)	Section Type	Auto Design
S1.006	8.966	0.053	170.0	0.000	0.00	0.0	0.600	o	225	Pipe/Conduit	
S4.000	22.437	0.093	241.3	0.000	5.00	0.0	0.600	o	300	Pipe/Conduit	
S5.000	37.761	0.222	170.1	0.078	5.00	0.0	0.600	o	225	Pipe/Conduit	
S5.001	3.787	0.289	13.1	0.000	0.00	0.0	0.600	o	225	Pipe/Conduit	
S1.007	5.048	0.030	168.3	0.000	0.00	0.0	0.600	o	225	Pipe/Conduit	
S6.000	11.175	1.704	6.6	0.008	5.00	0.0	0.600	o	150	Pipe/Conduit	
S7.000	11.574	1.654	7.0	0.028	5.00	0.0	0.600	o	150	Pipe/Conduit	
S1.008	8.365	0.049	170.0	0.000	0.00	0.0	0.600	o	225	Pipe/Conduit	
S8.000	16.564	1.692	9.8	0.007	5.00	0.0	0.600	o	150	Pipe/Conduit	
S9.000	6.088	1.492	4.1	0.019	5.00	0.0	0.600	o	150	Pipe/Conduit	
S8.001	20.268	0.119	170.3	0.000	0.00	0.0	0.600	o	225	Pipe/Conduit	
S8.002	23.415	0.138	170.0	0.000	0.00	0.0	0.600	o	225	Pipe/Conduit	

Network Results Table

PN	Rain (mm/hr)	T.C. (mins)	US/IL (m)	Σ I.Area (ha)	Σ Base Flow (l/s)	Foul (l/s)	Add Flow (l/s)	Vel (m/s)	Cap (l/s)	Flow (l/s)
S1.006	50.00	6.46	31.805	0.071	0.0	0.0	0.0	1.00	39.8	9.6
S4.000	50.00	5.37	31.845	0.000	0.0	0.0	0.0	1.01	71.2	0.0
S5.000	50.00	5.63	32.263	0.078	0.0	0.0	0.0	1.00	39.7	10.6
S5.001	50.00	5.65	32.041	0.078	0.0	0.0	0.0	3.63	144.5	10.6
S1.007	50.00	6.54	31.752	0.149	0.0	0.0	0.0	1.01	40.0	20.2
S6.000	50.00	5.05	33.500	0.008	0.0	0.0	0.0	3.96	70.0	1.1
S7.000	50.00	5.05	33.450	0.028	0.0	0.0	0.0	3.83	67.8	3.8
S1.008	50.00	6.68	31.721	0.185	0.0	0.0	0.0	1.00	39.8	25.1
S8.000	50.00	5.09	33.700	0.007	0.0	0.0	0.0	3.24	57.2	0.9
S9.000	50.00	5.02	33.500	0.019	0.0	0.0	0.0	5.02	88.8	2.6
S8.001	50.00	5.42	31.933	0.026	0.0	0.0	0.0	1.00	39.7	3.5
S8.002	50.00	5.81	31.814	0.026	0.0	0.0	0.0	1.00	39.8	3.5

©1982-2020 Innovyze

Network Design Table for SW2.SWS

PN	Length (m)	Fall (m)	Slope (1:X)	I.Area (ha)	T.E. (mins)	Base Flow (l/s)	k (mm)	HYD SECT	DIA (mm)	Section Type	Auto Design
S10.000	31.420	0.185	170.0	0.047	5.00	0.0	0.600	o	225	Pipe/Conduit	
S11.000	4.545	0.045	101.0	0.009	5.00	0.0	0.600	o	150	Pipe/Conduit	
S11.001	6.383	0.064	99.7	0.008	0.00	0.0	0.600	o	150	Pipe/Conduit	
S11.002	3.199	0.032	100.0	0.009	0.00	0.0	0.600	o	150	Pipe/Conduit	
S12.000	9.048	0.090	100.5	0.009	5.00	0.0	0.600	o	150	Pipe/Conduit	
S11.003	6.339	0.254	25.0	0.009	0.00	0.0	0.600	o	150	Pipe/Conduit	
S10.001	5.719	0.671	8.5	0.000	0.00	0.0	0.600	o	225	Pipe/Conduit	
S1.009	9.079	0.053	171.3	0.000	0.00	0.0	0.600	o	225	Pipe/Conduit	

Network Results Table

PN	Rain (mm/hr)	T.C. (mins)	US/IL (m)	Σ I.Area (ha)	Σ Base Flow (l/s)	Foul (l/s)	Add Flow (l/s)	Vel (m/s)	Cap (l/s)	Flow (l/s)
S10.000	50.00	5.52	32.528	0.047	0.0	0.0	0.0	1.00	39.8	6.4
S11.000	50.00	5.08	32.813	0.009	0.0	0.0	0.0	1.00	17.7	1.2
S11.001	50.00	5.18	32.768	0.017	0.0	0.0	0.0	1.01	17.8	2.3
S11.002	50.00	5.23	32.704	0.026	0.0	0.0	0.0	1.00	17.8	3.5
S12.000	50.00	5.15	32.762	0.009	0.0	0.0	0.0	1.00	17.7	1.2
S11.003	50.00	5.29	32.672	0.044	0.0	0.0	0.0	2.02	35.8	6.0
S10.001	50.00	5.54	32.343	0.091	0.0	0.0	0.0	4.51	179.3	12.3
S1.009	50.00	6.83	31.672	0.302	0.0	0.0	0.0	1.00	39.6«	40.9

Simulation Criteria for SW2.SWS

Volumetric Runoff Coeff	0.950	Additional Flow - % of Total Flow	0.000
Areal Reduction Factor	1.000	MADD Factor * 10m³/ha Storage	2.000
Hot Start (mins)	0	Inlet Coeffiecient	0.800
Hot Start Level (mm)	0	Flow per Person per Day (l/per/day)	0.000
Manhole Headloss Coeff (Global)	0.500	Run Time (mins)	60
Foul Sewage per hectare (l/s)	0.000	Output Interval (mins)	1

Number of Input Hydrographs	0	Number of Storage Structures	6
Number of Online Controls	1	Number of Time/Area Diagrams	0
Number of Offline Controls	0	Number of Real Time Controls	0

Synthetic Rainfall Details

©1982-2020 Innovyze

Synthetic Rainfall Details

Rainfall Model	FSR	Profile Type	Summer
Return Period (years)	30	Cv (Summer)	0.950
Region	England and Wales	Cv (Winter)	0.840
M5-60 (mm)	19.800	Storm Duration (mins)	30
Ratio R	0.236		

©1982-2020 Innovyze

Online Controls for SW2.SWS

Hydro-Brake® Optimum Manhole: S28, DS/PN: S1.009, Volume (m³): 3.8

Unit Reference	MD-SHE-0151-1170-1350-1170
Design Head (m)	1.350
Design Flow (l/s)	11.7
Flush-Flo™	Calculated
Objective	Minimise upstream storage
Application	Surface
Sump Available	Yes
Diameter (mm)	151
Invert Level (m)	31.672
Minimum Outlet Pipe Diameter (mm)	225
Suggested Manhole Diameter (mm)	1200

Control Points	**Head (m)**	**Flow (l/s)**
Design Point (Calculated)	1.350	11.7
Flush-Flo™	0.402	11.7
Kick-Flo®	0.867	9.5
Mean Flow over Head Range	-	10.2

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

Depth (m)	**Flow (l/s)**	**Depth (m)**	**Flow (l/s)**	**Depth (m)**	**Flow (l/s)**	**Depth (m)**	**Flow (l/s)**
0.100	5.4	1.200	11.1	3.000	17.1	7.000	25.7
0.200	10.8	1.400	11.9	3.500	18.4	7.500	26.5
0.300	11.5	1.600	12.7	4.000	19.6	8.000	27.4
0.400	11.7	1.800	13.4	4.500	20.7	8.500	28.2
0.500	11.6	2.000	14.1	5.000	21.8	9.000	29.0
0.600	11.4	2.200	14.7	5.500	22.8	9.500	29.7
0.800	10.3	2.400	15.4	6.000	23.8		
1.000	10.2	2.600	16.0	6.500	24.8		

©1982-2020 Innovyze

Storage Structures for SW2.SWS

Porous Car Park Manhole: S7, DS/PN: S1.005

Infiltration Coefficient Base (m/hr)	0.00000	Width (m)	40.0
Membrane Percolation (mm/hr)	1000	Length (m)	10.0
Max Percolation (l/s)	111.1	Slope (1:X)	45.0
Safety Factor	2.0	Depression Storage (mm)	5
Porosity	0.30	Evaporation (mm/day)	3
Invert Level (m)	32.650	Cap Volume Depth (m)	0.375

Cellular Storage Manhole: S10, DS/PN: S4.000

Invert Level (m)	31.850	Safety Factor	2.0
Infiltration Coefficient Base (m/hr)	0.00000	Porosity	0.95
Infiltration Coefficient Side (m/hr)	0.00000		

Depth (m)	Area (m²)	Inf. Area (m²)	Depth (m)	Area (m²)	Inf. Area (m²)
0.000	120.0	120.0	0.751	0.0	152.9
0.750	120.0	152.9			

Tank or Pond Manhole: S14, DS/PN: S6.000

Invert Level (m) 33.500

Depth (m)	Area (m²)	Depth (m)	Area (m²)
0.000	33.2	0.300	60.8

Tank or Pond Manhole: S15, DS/PN: S7.000

Invert Level (m) 33.450

Depth (m)	Area (m²)	Depth (m)	Area (m²)
0.000	15.7	0.300	35.0

Tank or Pond Manhole: S17, DS/PN: S8.000

Invert Level (m) 33.700

Depth (m)	Area (m²)	Depth (m)	Area (m²)
0.000	18.5	0.300	57.0

Tank or Pond Manhole: S18, DS/PN: S9.000

Invert Level (m) 33.500

©1982-2020 Innovyze

Tank or Pond Manhole: S18, DS/PN: S9.000

Depth (m)	Area (m²)	Depth (m)	Area (m²)
0.000	1.0	0.300	22.3

©1982-2020 Innovyze

Summary of Critical Results by Maximum Level (Rank 1) for SW2.SWS

Simulation Criteria

Areal Reduction Factor	1.000	Additional Flow - % of Total Flow	0.000
Hot Start (mins)	0	MADD Factor * 10m³/ha Storage	2.000
Hot Start Level (mm)	0	Inlet Coeffiecient	0.800
Manhole Headloss Coeff (Global)	0.500	Flow per Person per Day (l/per/day)	0.000
Foul Sewage per hectare (l/s)	0.000		

Number of Input Hydrographs	0	Number of Storage Structures	6
Number of Online Controls	1	Number of Time/Area Diagrams	0
Number of Offline Controls	0	Number of Real Time Controls	0

Synthetic Rainfall Details

Rainfall Model	FSR	Ratio R	0.236
Region	England and Wales	Cv (Summer)	0.950
M5-60 (mm)	19.800	Cv (Winter)	0.840

Margin for Flood Risk Warning (mm)	500.0
Analysis Timestep	2.5 Second Increment (Extended)
DTS Status	ON
DVD Status	ON
Inertia Status	OFF

Profile(s)	Summer and Winter
Duration(s) (mins)	15, 30, 60, 120, 180, 240, 360, 480, 600, 720, 960, 1440, 2160, 2880, 4320, 5760, 7200, 8640
Return Period(s) (years)	1
Climate Change (%)	0

PN	US/MH Name	Storm	Return Period	Climate Change	First (X) Surcharge	First (Y) Flood	First (Z) Overflow	Overflow Act.	Water Level (m)
S1.000	S1	15 Summer	1	+0%					32.626
S1.001	S2	15 Summer	1	+0%					32.499
S1.002	S3	15 Summer	1	+0%					32.465
S1.003	S4	15 Summer	1	+0%					32.410
S2.000	S5	15 Summer	1	+0%					32.798
S1.004	S6	30 Summer	1	+0%					32.316
S1.005	S7	60 Summer	1	+0%					32.095
S3.000	S8	15 Summer	1	+0%					32.387
S1.006	S9	60 Summer	1	+0%	1/30 Summer				32.081
S4.000	S10	120 Summer	1	+0%					31.918
S5.000	S11	15 Summer	1	+0%					32.346
S5.001	S12	15 Summer	1	+0%					32.097
S1.007	S13	60 Summer	1	+0%	1/15 Summer				32.074
S6.000	S14	30 Summer	1	+0%					33.508
S7.000	S15	15 Summer	1	+0%					33.474
S1.008	S16	60 Summer	1	+0%	1/15 Summer				32.074
S8.000	S17	30 Summer	1	+0%					33.709
S9.000	S18	15 Summer	1	+0%					33.518

©1982-2020 Innovyze

Summary of Critical Results by Maximum Level (Rank 1) for SW2.SWS

PN	US/MH Name	Surcharged Depth (m)	Flooded Volume (m³)	Flow / Cap.	Overflow (l/s)	Half Drain Time (mins)	Pipe Flow (l/s)	Status	Level Exceeded
S1.000	S1	-0.134	0.000	0.03			0.4	OK	
S1.001	S2	-0.125	0.000	0.06			0.8	OK	
S1.002	S3	-0.123	0.000	0.08			1.1	OK	
S1.003	S4	-0.119	0.000	0.09			1.5	OK	
S2.000	S5	-0.129	0.000	0.05			0.8	OK	
S1.004	S6	-0.119	0.000	0.10			3.0	OK	
S1.005	S7	-0.097	0.000	0.20		6	7.3	OK	
S3.000	S8	-0.225	0.000	0.00			0.0	OK	
S1.006	S9	0.051	0.000	0.20			6.4	SURCHARGED	
S4.000	S10	-0.227	0.000	0.06		22	3.9	OK	
S5.000	S11	-0.142	0.000	0.28			10.7	OK	
S5.001	S12	-0.169	0.000	0.14			10.7	OK	
S1.007	S13	0.097	0.000	0.25			7.2	SURCHARGED	
S6.000	S14	-0.142	0.000	0.01			0.7	FLOOD RISK	
S7.000	S15	-0.126	0.000	0.06			3.6	FLOOD RISK	
S1.008	S16	0.128	0.000	0.26			8.2	SURCHARGED	
S8.000	S17	-0.141	0.000	0.01			0.7	FLOOD RISK	
S9.000	S18	-0.132	0.000	0.04			2.6	FLOOD RISK	

©1982-2020 Innovyze

Summary of Critical Results by Maximum Level (Rank 1) for SW2.SWS

PN	US/MH Name	Storm	Return Period	Climate Change	First (X) Surcharge	First (Y) Flood	First (Z) Overflow	Overflow Act.	Water Level (m)
S8.001	S19	60 Summer	1	+0%					32.080
S8.002	S20	60 Summer	1	+0%	1/30 Summer				32.076
S10.000	S21	15 Summer	1	+0%					32.592
S11.000	S22	15 Summer	1	+0%					32.844
S11.001	S23	15 Summer	1	+0%					32.806
S11.002	S24	15 Summer	1	+0%					32.759
S12.000	S25	15 Summer	1	+0%					32.790
S11.003	S26	15 Summer	1	+0%					32.716
S10.001	S27	15 Summer	1	+0%					32.392
S1.009	S28	60 Summer	1	+0%	1/15 Summer				32.071

PN	US/MH Name	Surcharged Depth (m)	Flooded Volume (m^3)	Flow / Cap.	Overflow (l/s)	Half Drain Time (mins)	Pipe Flow (l/s)	Status	Level Exceeded
S8.001	S19	-0.078	0.000	0.07			2.6	OK	
S8.002	S20	0.037	0.000	0.08			2.9	SURCHARGED	
S10.000	S21	-0.161	0.000	0.17			6.5	OK	
S11.000	S22	-0.119	0.000	0.09			1.3	OK	
S11.001	S23	-0.112	0.000	0.15			2.2	OK	
S11.002	S24	-0.095	0.000	0.29			3.2	OK	
S12.000	S25	-0.122	0.000	0.08			1.3	OK	
S11.003	S26	-0.106	0.000	0.18			5.5	OK	
S10.001	S27	-0.176	0.000	0.10			12.1	OK	
S1.009	S28	0.174	0.000	0.36			11.7	SURCHARGED	

©1982-2020 Innovyze

STORM SEWER DESIGN by the Modified Rational Method

Design Criteria for SW2.SWS

Pipe Sizes SW1 Manhole Sizes SW1

FSR Rainfall Model - England and Wales

Return Period (years)	30	PIMP (%)	100
M5-60 (mm)	19.800	Add Flow / Climate Change (%)	0
Ratio R	0.236	Minimum Backdrop Height (m)	0.200
Maximum Rainfall (mm/hr)	50	Maximum Backdrop Height (m)	0.000
Maximum Time of Concentration (mins)	30	Min Design Depth for Optimisation (m)	1.200
Foul Sewage (l/s/ha)	0.000	Min Vel for Auto Design only (m/s)	0.75
Volumetric Runoff Coeff.	0.750	Min Slope for Optimisation (1:X)	500

Designed with Level Soffits

Network Design Table for SW2.SWS

« - Indicates pipe capacity < flow

PN	Length (m)	Fall (m)	Slope (1:X)	I.Area (ha)	T.E. (mins)	Base Flow (l/s)	k (mm)	HYD SECT	DIA (mm)	Section Type	Auto Design
S1.000	13.582	0.136	99.9	0.003	5.00	0.0	0.600	o	150	Pipe/Conduit	
S1.001	3.597	0.036	99.9	0.003	0.00	0.0	0.600	o	150	Pipe/Conduit	
S1.002	5.876	0.059	99.6	0.003	0.00	0.0	0.600	o	150	Pipe/Conduit	
S1.003	9.390	0.094	99.9	0.003	0.00	0.0	0.600	o	150	Pipe/Conduit	
S2.000	49.228	0.492	100.1	0.006	5.00	0.0	0.600	o	150	Pipe/Conduit	
S1.004	4.603	0.243	18.9	0.006	0.00	0.0	0.600	o	150	Pipe/Conduit	
S1.005	27.491	0.162	169.7	0.047	0.00	0.0	0.600	o	225	Pipe/Conduit	
S3.000	4.366	0.582	7.5	0.000	5.00	0.0	0.600	o	225	Pipe/Conduit	

Network Results Table

PN	Rain (mm/hr)	T.C. (mins)	US/IL (m)	Σ I.Area (ha)	Σ Base Flow (l/s)	Foul (l/s)	Add Flow (l/s)	Vel (m/s)	Cap (l/s)	Flow (l/s)
S1.000	50.00	5.23	32.610	0.003	0.0	0.0	0.0	1.01	17.8	0.4
S1.001	50.00	5.28	32.474	0.006	0.0	0.0	0.0	1.01	17.8	0.8
S1.002	50.00	5.38	32.438	0.009	0.0	0.0	0.0	1.01	17.8	1.2
S1.003	50.00	5.54	32.379	0.012	0.0	0.0	0.0	1.01	17.8	1.6
S2.000	50.00	5.82	32.777	0.006	0.0	0.0	0.0	1.00	17.8	0.8
S1.004	50.00	5.85	32.285	0.024	0.0	0.0	0.0	2.33	41.1	3.2
S1.005	50.00	6.31	31.967	0.071	0.0	0.0	0.0	1.00	39.8	9.6
S3.000	50.00	5.02	32.387	0.000	0.0	0.0	0.0	4.81	191.2	0.0

©1982-2020 Innovyze

Network Design Table for SW2.SWS

PN	Length (m)	Fall (m)	Slope (1:X)	I.Area (ha)	T.E. (mins)	Base Flow (l/s)	k (mm)	HYD SECT	DIA (mm)	Section Type	Auto Design
S1.006	8.966	0.053	170.0	0.000	0.00	0.0	0.600	o	225	Pipe/Conduit	
S4.000	22.437	0.093	241.3	0.000	5.00	0.0	0.600	o	300	Pipe/Conduit	
S5.000	37.761	0.222	170.1	0.078	5.00	0.0	0.600	o	225	Pipe/Conduit	
S5.001	3.787	0.289	13.1	0.000	0.00	0.0	0.600	o	225	Pipe/Conduit	
S1.007	5.048	0.030	168.3	0.000	0.00	0.0	0.600	o	225	Pipe/Conduit	
S6.000	11.175	1.704	6.6	0.008	5.00	0.0	0.600	o	150	Pipe/Conduit	
S7.000	11.574	1.654	7.0	0.028	5.00	0.0	0.600	o	150	Pipe/Conduit	
S1.008	8.365	0.049	170.0	0.000	0.00	0.0	0.600	o	225	Pipe/Conduit	
S8.000	16.564	1.692	9.8	0.007	5.00	0.0	0.600	o	150	Pipe/Conduit	
S9.000	6.088	1.492	4.1	0.019	5.00	0.0	0.600	o	150	Pipe/Conduit	
S8.001	20.268	0.119	170.3	0.000	0.00	0.0	0.600	o	225	Pipe/Conduit	
S8.002	23.415	0.138	170.0	0.000	0.00	0.0	0.600	o	225	Pipe/Conduit	

Network Results Table

PN	Rain (mm/hr)	T.C. (mins)	US/IL (m)	Σ I.Area (ha)	Σ Base Flow (l/s)	Foul (l/s)	Add Flow (l/s)	Vel (m/s)	Cap (l/s)	Flow (l/s)
S1.006	50.00	6.46	31.805	0.071	0.0	0.0	0.0	1.00	39.8	9.6
S4.000	50.00	5.37	31.845	0.000	0.0	0.0	0.0	1.01	71.2	0.0
S5.000	50.00	5.63	32.263	0.078	0.0	0.0	0.0	1.00	39.7	10.6
S5.001	50.00	5.65	32.041	0.078	0.0	0.0	0.0	3.63	144.5	10.6
S1.007	50.00	6.54	31.752	0.149	0.0	0.0	0.0	1.01	40.0	20.2
S6.000	50.00	5.05	33.500	0.008	0.0	0.0	0.0	3.96	70.0	1.1
S7.000	50.00	5.05	33.450	0.028	0.0	0.0	0.0	3.83	67.8	3.8
S1.008	50.00	6.68	31.721	0.185	0.0	0.0	0.0	1.00	39.8	25.1
S8.000	50.00	5.09	33.700	0.007	0.0	0.0	0.0	3.24	57.2	0.9
S9.000	50.00	5.02	33.500	0.019	0.0	0.0	0.0	5.02	88.8	2.6
S8.001	50.00	5.42	31.933	0.026	0.0	0.0	0.0	1.00	39.7	3.5
S8.002	50.00	5.81	31.814	0.026	0.0	0.0	0.0	1.00	39.8	3.5

©1982-2020 Innovyze

Network Design Table for SW2.SWS

PN	Length (m)	Fall (m)	Slope (1:X)	I.Area (ha)	T.E. (mins)	Base Flow (l/s)	k (mm)	HYD SECT	DIA (mm)	Section Type	Auto Design
S10.000	31.420	0.185	170.0	0.047	5.00	0.0	0.600	o	225	Pipe/Conduit	
S11.000	4.545	0.045	101.0	0.009	5.00	0.0	0.600	o	150	Pipe/Conduit	
S11.001	6.383	0.064	99.7	0.008	0.00	0.0	0.600	o	150	Pipe/Conduit	
S11.002	3.199	0.032	100.0	0.009	0.00	0.0	0.600	o	150	Pipe/Conduit	
S12.000	9.048	0.090	100.5	0.009	5.00	0.0	0.600	o	150	Pipe/Conduit	
S11.003	6.339	0.254	25.0	0.009	0.00	0.0	0.600	o	150	Pipe/Conduit	
S10.001	5.719	0.671	8.5	0.000	0.00	0.0	0.600	o	225	Pipe/Conduit	
S1.009	9.079	0.053	171.3	0.000	0.00	0.0	0.600	o	225	Pipe/Conduit	

Network Results Table

PN	Rain (mm/hr)	T.C. (mins)	US/IL (m)	Σ I.Area (ha)	Σ Base Flow (l/s)	Foul (l/s)	Add Flow (l/s)	Vel (m/s)	Cap (l/s)	Flow (l/s)
S10.000	50.00	5.52	32.528	0.047	0.0	0.0	0.0	1.00	39.8	6.4
S11.000	50.00	5.08	32.813	0.009	0.0	0.0	0.0	1.00	17.7	1.2
S11.001	50.00	5.18	32.768	0.017	0.0	0.0	0.0	1.01	17.8	2.3
S11.002	50.00	5.23	32.704	0.026	0.0	0.0	0.0	1.00	17.8	3.5
S12.000	50.00	5.15	32.762	0.009	0.0	0.0	0.0	1.00	17.7	1.2
S11.003	50.00	5.29	32.672	0.044	0.0	0.0	0.0	2.02	35.8	6.0
S10.001	50.00	5.54	32.343	0.091	0.0	0.0	0.0	4.51	179.3	12.3
S1.009	50.00	6.83	31.672	0.302	0.0	0.0	0.0	1.00	39.6«	40.9

Simulation Criteria for SW2.SWS

Volumetric Runoff Coeff	0.950	Additional Flow - % of Total Flow	0.000
Areal Reduction Factor	1.000	MADD Factor * 10m³/ha Storage	2.000
Hot Start (mins)	0	Inlet Coeffiecient	0.800
Hot Start Level (mm)	0	Flow per Person per Day (l/per/day)	0.000
Manhole Headloss Coeff (Global)	0.500	Run Time (mins)	60
Foul Sewage per hectare (l/s)	0.000	Output Interval (mins)	1

Number of Input Hydrographs	0	Number of Storage Structures	6
Number of Online Controls	1	Number of Time/Area Diagrams	0
Number of Offline Controls	0	Number of Real Time Controls	0

Synthetic Rainfall Details

©1982-2020 Innovyze

Synthetic Rainfall Details

Rainfall Model	FSR	Profile Type	Summer
Return Period (years)	30	Cv (Summer)	0.950
Region	England and Wales	Cv (Winter)	0.840
M5-60 (mm)	19.800	Storm Duration (mins)	30
Ratio R	0.236		

©1982-2020 Innovyze

Online Controls for SW2.SWS

Hydro-Brake® Optimum Manhole: S28, DS/PN: S1.009, Volume (m³): 3.8

Unit Reference	MD-SHE-0151-1170-1350-1170
Design Head (m)	1.350
Design Flow (l/s)	11.7
Flush-Flo™	Calculated
Objective	Minimise upstream storage
Application	Surface
Sump Available	Yes
Diameter (mm)	151
Invert Level (m)	31.672
Minimum Outlet Pipe Diameter (mm)	225
Suggested Manhole Diameter (mm)	1200

Control Points	**Head (m)**	**Flow (l/s)**
Design Point (Calculated)	1.350	11.7
Flush-Flo™	0.402	11.7
Kick-Flo®	0.867	9.5
Mean Flow over Head Range	-	10.2

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

Depth (m)	**Flow (l/s)**	**Depth (m)**	**Flow (l/s)**	**Depth (m)**	**Flow (l/s)**	**Depth (m)**	**Flow (l/s)**
0.100	5.4	1.200	11.1	3.000	17.1	7.000	25.7
0.200	10.8	1.400	11.9	3.500	18.4	7.500	26.5
0.300	11.5	1.600	12.7	4.000	19.6	8.000	27.4
0.400	11.7	1.800	13.4	4.500	20.7	8.500	28.2
0.500	11.6	2.000	14.1	5.000	21.8	9.000	29.0
0.600	11.4	2.200	14.7	5.500	22.8	9.500	29.7
0.800	10.3	2.400	15.4	6.000	23.8		
1.000	10.2	2.600	16.0	6.500	24.8		

©1982-2020 Innovyze

Storage Structures for SW2.SWS

Porous Car Park Manhole: S7, DS/PN: S1.005

Infiltration Coefficient Base (m/hr)	0.00000	Width (m)	40.0
Membrane Percolation (mm/hr)	1000	Length (m)	10.0
Max Percolation (l/s)	111.1	Slope (1:X)	45.0
Safety Factor	2.0	Depression Storage (mm)	5
Porosity	0.30	Evaporation (mm/day)	3
Invert Level (m)	32.650	Cap Volume Depth (m)	0.375

Cellular Storage Manhole: S10, DS/PN: S4.000

Invert Level (m)	31.850	Safety Factor	2.0
Infiltration Coefficient Base (m/hr)	0.00000	Porosity	0.95
Infiltration Coefficient Side (m/hr)	0.00000		

Depth (m)	Area (m²)	Inf. Area (m²)	Depth (m)	Area (m²)	Inf. Area (m²)
0.000	120.0	120.0	0.751	0.0	152.9
0.750	120.0	152.9			

Tank or Pond Manhole: S14, DS/PN: S6.000

Invert Level (m) 33.500

Depth (m)	Area (m²)	Depth (m)	Area (m²)
0.000	33.2	0.300	60.8

Tank or Pond Manhole: S15, DS/PN: S7.000

Invert Level (m) 33.450

Depth (m)	Area (m²)	Depth (m)	Area (m²)
0.000	15.7	0.300	35.0

Tank or Pond Manhole: S17, DS/PN: S8.000

Invert Level (m) 33.700

Depth (m)	Area (m²)	Depth (m)	Area (m²)
0.000	18.5	0.300	57.0

Tank or Pond Manhole: S18, DS/PN: S9.000

Invert Level (m) 33.500

©1982-2020 Innovyze

Tank or Pond Manhole: S18, DS/PN: S9.000

Depth (m)	Area (m²)	Depth (m)	Area (m²)
0.000	1.0	0.300	22.3

©1982-2020 Innovyze

Summary of Critical Results by Maximum Level (Rank 1) for SW2.SWS

Simulation Criteria

Areal Reduction Factor	1.000	Additional Flow - % of Total Flow	0.000
Hot Start (mins)	0	MADD Factor * 10m³/ha Storage	2.000
Hot Start Level (mm)	0	Inlet Coeffiecient	0.800
Manhole Headloss Coeff (Global)	0.500	Flow per Person per Day (l/per/day)	0.000
Foul Sewage per hectare (l/s)	0.000		

Number of Input Hydrographs	0	Number of Storage Structures	6
Number of Online Controls	1	Number of Time/Area Diagrams	0
Number of Offline Controls	0	Number of Real Time Controls	0

Synthetic Rainfall Details

Rainfall Model	FSR	Ratio R	0.236
Region	England and Wales	Cv (Summer)	0.950
M5-60 (mm)	19.800	Cv (Winter)	0.840

Margin for Flood Risk Warning (mm)	500.0
Analysis Timestep	2.5 Second Increment (Extended)
DTS Status	ON
DVD Status	ON
Inertia Status	OFF

Profile(s)	Summer and Winter
Duration(s) (mins)	15, 30, 60, 120, 180, 240, 360, 480, 600, 720, 960, 1440, 2160, 2880, 4320, 5760, 7200, 8640
Return Period(s) (years)	30
Climate Change (%)	0

PN	US/MH Name	Storm	Return Period	Climate Change	First (X) Surcharge	First (Y) Flood	First (Z) Overflow	Overflow Act.	Water Level (m)
S1.000	S1	15 Summer	30	+0%					32.634
S1.001	S2	15 Summer	30	+0%					32.517
S1.002	S3	15 Summer	30	+0%					32.486
S1.003	S4	30 Summer	30	+0%					32.443
S2.000	S5	15 Summer	30	+0%					32.811
S1.004	S6	30 Summer	30	+0%					32.430
S1.005	S7	30 Summer	30	+0%	30/15 Summer				32.417
S3.000	S8	15 Summer	30	+0%					32.387
S1.006	S9	30 Summer	30	+0%	30/15 Summer				32.347
S4.000	S10	120 Summer	30	+0%	30/30 Summer				32.238
S5.000	S11	15 Summer	30	+0%					32.414
S5.001	S12	15 Summer	30	+0%	30/15 Summer				32.313
S1.007	S13	30 Summer	30	+0%	30/15 Summer				32.287
S6.000	S14	30 Summer	30	+0%					33.518
S7.000	S15	15 Summer	30	+0%					33.489
S1.008	S16	30 Summer	30	+0%	30/15 Summer				32.369
S8.000	S17	30 Summer	30	+0%					33.719
S9.000	S18	15 Summer	30	+0%					33.530

©1982-2020 Innovyze

Summary of Critical Results by Maximum Level (Rank 1) for SW2.SWS

PN	US/MH Name	Surcharged Depth (m)	Flooded Volume (m³)	Flow / Cap.	Overflow (l/s)	Half Drain Time (mins)	Pipe Flow (l/s)	Status	Level Exceeded
S1.000	S1	-0.126	0.000	0.06			1.0	OK	
S1.001	S2	-0.107	0.000	0.18			2.2	OK	
S1.002	S3	-0.102	0.000	0.22			3.3	OK	
S1.003	S4	-0.086	0.000	0.26			4.1	OK	
S2.000	S5	-0.116	0.000	0.12			2.0	OK	
S1.004	S6	-0.005	0.000	0.26			8.1	OK	
S1.005	S7	0.225	0.000	0.58		6	21.5	SURCHARGED	
S3.000	S8	-0.225	0.000	0.00			0.0	OK	
S1.006	S9	0.317	0.000	0.67			21.7	SURCHARGED	
S4.000	S10	0.093	0.000	0.17		61	10.4	SURCHARGED	
S5.000	S11	-0.074	0.000	0.68			25.8	OK	
S5.001	S12	0.047	0.000	0.33			24.9	SURCHARGED	
S1.007	S13	0.310	0.000	0.38			11.1	SURCHARGED	
S6.000	S14	-0.132	0.000	0.03			2.0	FLOOD RISK	
S7.000	S15	-0.111	0.000	0.15			9.4	FLOOD RISK	
S1.008	S16	0.423	0.000	0.36			11.3	SURCHARGED	
S8.000	S17	-0.131	0.000	0.04			2.1	FLOOD RISK	
S9.000	S18	-0.120	0.000	0.09			6.5	FLOOD RISK	

©1982-2020 Innovyze

Summary of Critical Results by Maximum Level (Rank 1) for SW2.SWS

PN	US/MH Name	Storm	Return Period	Climate Change	First (X) Surcharge	First (Y) Flood	First (Z) Overflow	Overflow Act.	Water Level (m)
S8.001	S19	30 Summer	30	+0%	30/15 Summer				32.474
S8.002	S20	30 Summer	30	+0%	30/15 Summer				32.457
S10.000	S21	15 Summer	30	+0%					32.632
S11.000	S22	15 Summer	30	+0%					32.862
S11.001	S23	15 Summer	30	+0%					32.835
S11.002	S24	15 Summer	30	+0%					32.811
S12.000	S25	15 Summer	30	+0%					32.807
S11.003	S26	15 Summer	30	+0%					32.750
S10.001	S27	30 Summer	30	+0%					32.470
S1.009	S28	30 Summer	30	+0%	30/15 Summer				32.439

PN	US/MH Name	Surcharged Depth (m)	Flooded Volume (m^3)	Flow / Cap.	Overflow (l/s)	Half Drain Time (mins)	Pipe Flow (l/s)	Status	Level Exceeded
S8.001	S19	0.316	0.000	0.23			8.1	SURCHARGED	
S8.002	S20	0.418	0.000	0.24			8.6	SURCHARGED	
S10.000	S21	-0.121	0.000	0.42			15.8	OK	
S11.000	S22	-0.101	0.000	0.23			3.1	OK	
S11.001	S23	-0.083	0.000	0.41			6.1	OK	
S11.002	S24	-0.043	0.000	0.85			9.5	OK	
S12.000	S25	-0.105	0.000	0.20			3.1	OK	
S11.003	S26	-0.072	0.000	0.53			16.0	OK	
S10.001	S27	-0.098	0.000	0.25			28.9	OK	
S1.009	S28	0.542	0.000	0.36			11.7	SURCHARGED	

©1982-2020 Innovyze