Client:

O'Flynn Construction Unlimited Company

Project:

Proposed Residential Development at Spa Glen, Mallow, Co. Cork.

Report:

Services Infrastructure Report

BARRY & PARTNERS

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SECTION 1: INTRODUCTION

1.1 Scope of the Report

This Services Infrastructure Report outlines the proposed means of servicing the proposed residential development with roads/access/parking, wastewater collection and disposal, stormwater management and disposal and water supply infrastructure. A flood risk assessment has been prepared separately by ARUP on behalf of the Applicant and their submission should be consulted for such details.

This report should be read in conjunction with the engineering drawings which illustrate the servicing proposals and with the submissions by other members of the Applicant's design team.

1.2 Site Location

The proposed development is located at Spa Glen, Mallow, Co. Cork on a circa 7.9-hectare site, approximately 1.5km to the northeast of Mallow town centre, see Figure 1.1. The N72 forms the southern boundary of the site, the L5331 the western and northern boundaries and the Hazel Brooke estate adjoins the eastern boundary of the site. The site topography generally falls from north (approx. 68.50 m OD) to south (approx. 52 m OD).

Figure 1-1: Site Location

SECTION 2: ROADS/TRAFFIC/TRANSPORT

2.1 Roads and Entrance Design

There will be two entrances to the development, each from the existing public road, L5331, known as the Spa Glen, immediately to the north of the site.

Each entrance will provide 59m sightlines in each direction at a setback of 2.4m from the public road edge in line with the requirements of the Design Manual for Urban Roads and Streets (DMURS).

Internal roads will be between 4.5m and 5.5m in width with 1.8m and 2.0m wide footpaths provided throughout the development.

A new 3.5m wide footpath and cycleway is to be provided by the Applicant along the L5331 on the northern boundary of the development site. This footpath/cycleway diverts into the site in the middle section of the site where an existing private property interrupts the frontage with the public road.

The northern boundary of the proposed development has been set-back (southwards) to allow for the future provision of a 6.3m carriageway along the L5331 and a 3.5m wide cycleway/footpath along the northern side of the L5331.

Because it is likely that the proposed development will be progressed (subject to planning) before the future provision of a 2.0m footpath and 1.5m cycleway along the northern side of the Ballyviniter Road (by Cork County Council) there will need to be an interim arrangement put in place by Cork County Council when the proposed footpath and cycleway along the southern side of the Ballyviniter Road is provided as part of the proposed development.

It is suggested that the Ballyviniter Road could be lined along the northern side such that the line of the future cycleway is line-marked to delineate the new road edge on an interim basis, with suitable tapers in the middle section of the road where the existing dwelling boundary on the southern side of the road will interrupt the line of the widened road.

The 6.3m wide road and 3.5m cycleway/footpath would be provided along the southern side of the Ballyviniter Road as shown on the planning application drawings.

On the eastern side of the proposed western entrance to the proposed development the 3.5m cycleway/footpath along the southern side of the Ballyviniter Road could be temporarily terminated and cyclists/pedestrians directed to travel through the development until the footpath/cycleway is extended across the front of the existing private dwelling immediately in the central section of the road frontage on this southern side of the Ballyviniter Road.

Similarly, on the western side of the proposed eastern entrance to the proposed development the 3.5m cycleway/footpath could be temporarily terminated and cyclists/pedestrians directed through the development.

These interim measures would have to be agreed with Cork County Council as part of a construction stage agreement and we suggest that agreement on these interim measures can be addressed by way of a suitably worded planning condition.

A through-route for cars between the proposed two entrances is provided but is such that it will not be an attractive or easy through-route, to discourage "rat-runs" through the development. This through route is provided for emergency and maintenance access situations.

The layout does not include long straight sections of road and is such that a residential environment will be created immediately on entry.

DMURS principles are applied to the internal designs whereby cul-de-sac areas are created as homezones with narrow carriageways with raised surfaces and alternative surface treatments to enhance pedestrian priority and to assist with reducing vehicle speeds in these areas. A number of raised junctions are also

provided to ensure safety and pedestrian priority is achieved at these junctions. Reduced corner radii at junctions will also assist with vehicle speed control.

Full provision for pedestrian permeability is provided throughout the development with interconnecting links from the main entrances on the L5331 through the development and with two links to the adjacent Hazelbrook development on the east.

There are four uncontrolled shared cycle/pedestrian crossings of the L5331 proposed to facilitate safe crossing of the L5331. Three of these crossings are to the north to facilitate connections to the Tinley Park and Cairn Woods developments which will in turn facilitate safe access to the intended future active travel/greenway route further to the north.

The L5331 crossing to the west of the development will enable a connection to the planned Spa Glen Amenity Walkway to the Town Centre and will facilitate connections to existing pedestrian facilities to the west of the development site.

These crossings are to be uncontrolled, but they can be upgraded to Toucan crossings if required at a later date, by Cork County Council, when planned active travel or other cycle infrastructure is developed in the area which would merit the upgrading of these crossings.

The proposed crossing to the west of the development and all internal pedestrian crossing areas will be raised with provision of tactile paving in accordance with best practise.

The development also includes a bicycle and pedestrian trail running east-west across the southern section of the site to provide connections to existing development on the eastern and western side of the site.

Improvements to the junction of the L5331 with the N72 are proposed as part of the development and a signalised junction is proposed to improve the safety of this existing junction. The Applicant owns the lands to the south of this junction so the proposed junction improvements can be completed without impact on third-party lands. Designs for this junction improvement are attached with this application submission.

Full details of this proposed junction improvement are included in the Traffic and Transport Assessment (TTA) which accompanies the planning submission.

This junction improvement proposal has been discussed with the Cork National Roads Design Office and their requirements have been incorporated into the design. This junction is located in an 80 kph area and the design has been completed with provision of 160m sightlines at the junction and minimum 160m forward visibility along the N72. See the attached drawings illustrating these design proposals.

2.2 Traffic and Transport Assessment/Road Safety Audit

A Traffic and Transport Assessment (TTA) has been carried out in support of the planning application and is included with the application documentation.

The scope of this assessment was agreed with Cork County Council engineers in pre-planning discussions and the details of this scope are set out in the TTA for your information.

A Stage 1/2 Road Safety Audit has been carried by approved auditors and is also attached with this planning application.

The findings of the audit have been considered by the applicant and design team and the Feedback Form details the design responses to the various issues raised.

2.3 Connectivity

Pedestrian permeability will be provided throughout the development with pedestrian links to existing residential developments to the north and east and connectivity to existing pedestrian infrastructure to the west towards Mallow Town centre. Full connectivity to planned active travel infrastructure to the north and

west is also provided. These connections provide access to existing public transport infrastructure, generally to the west of the development site.

Cycle connectivity to existing and planned active travel and greenways to the north and west is also provided for in the design by way of the proposed crossings of the L5331 at four locations as illustrated on the application drawings.

Bicycle and pedestrian facilities within the proposed development will link to existing and proposed walkways and amenity routes to the east and west and will be a valuable amenity for the area.

A Technical Note on connectivity is included with the planning application submission which describes in detail how connectivity to existing and planned pedestrian, cycle and public transport infrastructure is achieved.

The TTA also addresses the issue of the connectivity of the development to existing and planned transport infrastructure.

SECTION 3: WASTEWATER COLLECTION & DISPOSAL

3.1 Existing Wastewater Network

Uisce Eireann drainage records show that there is an existing 225mmØ foul sewer located in the N72 road, south-west of the site and it is proposed to connect foul drainage from the proposed development to this existing sewer at two locations as shown on Drawing No's. 22201-JBB-XX-XX-DR-CD-00024, 00025, 00026 & 00027.

The proposed foul connections do not impact on the existing culvert which carries the Spa Stream under the N72 with the two connection points located east of this culvert. Therefore, there are no alterations or modification required to this culvert to serve the proposed development.

3.2 Pre-Connection Enquiry Stage

Following a Pre-Connection Enquiry, Uisce Eireann (UE) issued a Confirmation of Feasibility (COF), stating that the site can be serviced by its water and wastewater infrastructure network. This COF is included in Appendix 1. The COF confirms that the proposed development can be serviced by existing infrastructure in the area without the need for upgrades to this infrastructure.

3.3 Design Acceptance Stage

The proposed designs were progressed in accordance with Uisce Eireann's Code of Practice for Wastewater Infrastructure and were submitted to Uisce Eireann for review and consideration for design acceptance as per the requirement of the LRD process. A Statement of Design Acceptance was issued by Uisce Eireann and is included in Appendix 1.

The wastewater collection system is designed to ensure self-cleansing velocities will be achieved on all pipe runs. The pipes proposed as part of this design have been sized in accordance with Table 3.1, an extract from IW-CDS-5030-03 (Revision 2 2020).

Manholes will be constructed on all pipe-runs at changes in sewer direction, changes in gradient, at significant sewer connections and at a maximum spacing of 90m for 225mm diameter pipes and above and 75m for 150mm diameter pipes. The gravity wastewater sewers have been designed using MicroDrainage design software and the outputs are included in Appendix 2 of this report. The foul sewer layout plans are attached on Drawing No's. 22201-JBB-XX-XX-DR-CD-00024, 00025, 00026 & 00027.

Table 3-1: Foul Sewer Size/Gradient Criteria

No. of Dwellings	Pipe Diameter	Minimum Gradient
2 to 9	150mm (or 225mm)	1:60
10 to 20		1:150
21 to 210	225mm	1:300
211 to 250		1:200
351 to 330		1:100
331 to 450	300mm	1:300
451 to 565		1:200
566 to 655		1:150
656 to 830		1:100

SECTION 4: STORMWATER MANAGEMENT & DISPOSAL

4.1 Existing Hydrology

The Spa Stream flows through the southwest corner of the site. This watercourse is prone to flooding and has been mapped on CFRAMS, see below. The flood levels and flood extent in this area has been modelled by ARUP and the results of this site-specific flood modelling have been referenced in the design of the development. The proposed development has been designed with this flood constraint in mind.

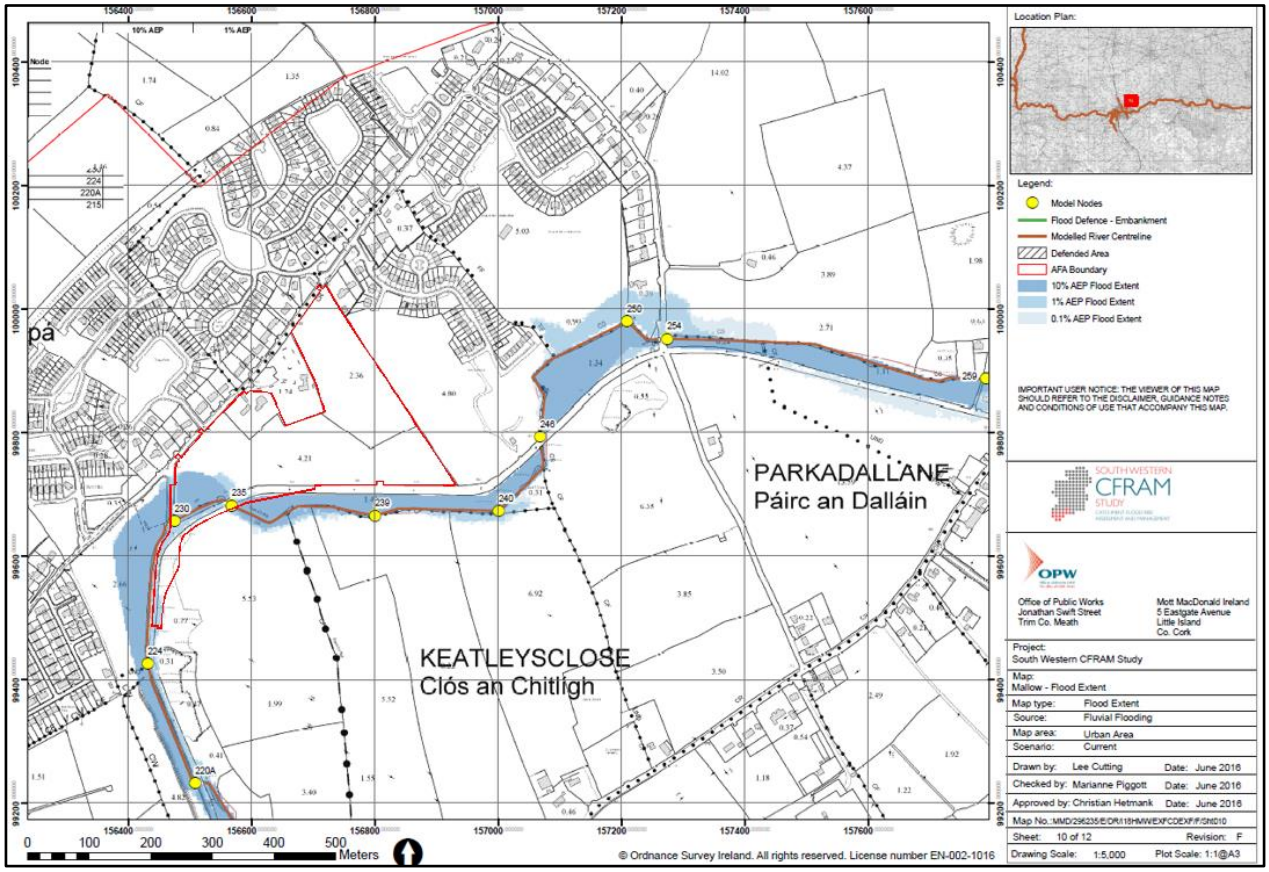


Figure 4-1: CFRAMS Mapping

4.2 Greenfield Runoff

The total developed site area will be 6.14 hectares, which excludes proposed green areas and basin/wetland areas. The greenfield runoff rate from the developed area has been estimated initially using the HR Wallingford Greenfield runoff estimation online tool which classifies the soils in the area as Type 4 (report attached in Appendix 3). The online tool calculated a Qbar figure of 51.7 l/s (equivalent to 8.42 l/sec/ha). However, at this stage of the design and due to the flooding issues in the locality, and, to ensure that a robust and conservative approach is taken we have made the conservative assumption that the soil will be Type 3, which results in a reduced Qbar figure of 30.76l/s (equivalent to 5.01 l/sec/ha).

A summary of the design values output by the HR Wallingford Greenfield runoff estimation online tool is shown below:

Table 4-1: HR Wallingford Design Value Outputs

Design Criteria	Actual Value	Edited Value
Catchment Area (ha)	6.14	6.14
Soil Type	4	3
SPR	0.47	0.30
SAAR (mm)	1126	1126
1 year factor	0.85	0.85
30-year factor	1.65	1.65
100-year factor	1.95	1.95

4.3 Proposed Development Surface Water Management System

The proposed surface water management system is designed, as much as is feasible, in accordance with the principles of Sustainable Drainage Systems (SUDS) as embodied in the recommendations of the Greater Dublin Strategic Drainage Study (GDSDS).

The GDSDS addresses the issue of sustainability by requiring designs to comply with a set of drainage criteria which aim to minimise the impact of urbanisation by replicating the runoff characteristics of a greenfield site. The criteria provide a consistent approach to addressing both rate and volume of runoff as well as ensuring the environment is protected from pollution that is washed off roads and buildings. These drainage design criteria are as follows:

- Criterion 1 - River Water Quality Protection
- Criterion 2 - River Regime Protection
- Criterion 3 - Flood Risk Assessment
- Criterion 4 - River Flood Protection

The requirements of SUDS are typically addressed by provision of the following:

- Interception storage
- Treatment storage (not required if interception storage is provided)
- Attenuation storage
- Long term storage (not required if growth factors are not applied to QBAR when designing attenuation storage, i.e., extended attenuation storage design)

In this case interception storage and attenuation storage is provided.

4.3.1 Layout of the Proposed Network

The proposed surface water network will include a storm drainage pipe network, attenuation storage structures and several SuDS features, including nature-based features, which will aid the reduction of runoff volumes by slowing surface water flows, providing the opportunity for evapotranspiration and providing the opportunity for infiltration to ground. Both the interception and attenuation storage requirements of GDSDS will be sufficiently met.

An assessment of the potential SUDS measures that could be incorporated within the site was conducted using the SUDS Manual, CIRIA 753 as guidance. The following SUDS features have been identified as applicable and will be provided within the proposed scheme:

- Swales: Will run alongside road edges where practical and will receive sheet runoff from the development's roads and footpaths. The swales will be shallow landscaped depressions at the surface with a drainage layer beneath and will be utilized to convey surface water flows while facilitating slowing of surface water flows, the opportunity for evapotranspiration and providing the opportunity for infiltration to ground.

- Bioretention Areas: Will be provided at certain locations across the development and will receive runoff from the development's roads and footpaths. The bioretention areas will consist of shallow landscaped depressions at the surface with a drainage layer beneath.
- Dry Basins: Basins will be used at the southern, lower end of the site to convey and where possible temporarily store runoff during extreme runoff events. A number of the open green areas located along the southern edge of the development will be used as dry basins.
- StormTech Attenuation Tanks: will be required to manage the volume of runoff expected from the development. However, the size of the tanks and number required will be reduced due to the implementation of the various SUDS features described above.
- Wetland: The south-western corner of the site is a flood risk area as set-out in the flood risk assessment report accompanying this planning submission and as identified in CFRAMS mapping of the area. In this context no development is proposed in this area and no surface water storage for the development is planned in this area. This area however will be retained as an open space area which can also serve as a biodiversity area which is addressed by other submissions included with the planning application.

The SUDS features will be designed to work in sequence thereby creating a management/treatment train. The proposed SUDS layout is included on the overall stormwater layout drawings, see Drawing No. 22201-JBB-XX-XX-DR-CD-00030, 00031, 00032 & 00033.

Manholes will be constructed on all pipe-runs at changes in sewer direction, changes in gradients, at significant sewer connections and at a maximum spacing of 90m on all straight sections of pipework. The surface water sewers have been designed using MicroDrainage design software and the outputs are included in Appendix 4 of this report.

A hydrobrake flow-control device will be installed in the manholes immediately downstream of the attenuation areas to control the discharge to that of the pre-development greenfield discharge described above.

The surface areas contributing to the drainage network of the development have been split up and tabulated below:

Table 4-2: Breakdown of Contributing Surface Areas

Development Form	Area (ha)
Overall Developed Area	6.14
Swales	0.08
Bioretention Areas	0.15
Dry Basins	0.27
Impermeable Area (Roofs, Roads)	3.54
Positively Drained Area	4.07
Area Without Formal Drainage	2.07

4.3.2 Interception Storage

In accordance with the requirements of GDSGS, at least 5mm, and preferably 10mm, of interception storage should be provided on site, where runoff to the receiving water can be prevented. It has been assumed that where the rainfall falls on green areas there will be no runoff occurring for the first 5mm - 10mm.

For this development the total catchment area for calculation of interception requirements (swales, bioretention areas, dry basins, wetlands & permeable areas) is 6.14ha (61,400m²) as per Table 4.2 above. This results in a required interception storage volume of 307m³ (61,400 X 0.005) The proposed interception storage will be provided by swales, bioretention areas, dry basins, wetlands and within the stone base of the StormTech attenuation tanks.

Swales, bioretention areas, dry basins are proposed across the development, for a total area of 5,000m². The drainage pipe within the gravel bed for these areas will be set at 50mm above the bed formation giving (assuming 30% voids in this stone) an interception volume of approximately 75m³.

The proposed StormTech attention tanks have a surface area of 1,776m². Interception storage will be provided within the base of the tanks for a depth of 300mm depth of stone below the StormTech Chambers. Assuming this stone has a void ratio of 43%, the total interception storage volume provided is 229m³.

Rear gardens of proposed houses also provide some interception storage which is not included in the above calculations which is a conservative approach.

The overall interception storage volume provided is therefore 304m³ which represents approximately 5mm of interception storage which is equal to the required minimum provision as detailed above.

4.3.3 Attenuation Storage

The proposed rate of surface water discharge from the development will be limited to Qbar, as described in Section 4.2. The Qbar figure assumed for design is a conservatively low figure as described earlier. Attenuation storage will be provided principally by StormTech attenuation chambers which will cater for the 100-year storm event with a 20% climate change allowance added. The proposed basins at the southern edge of the site will also provide attenuation storage for extreme events and will provide nature-based storage as required by Cork County Council. The proposed surface water network has been split into two catchments, A and B, see Figure 4.2.

These catchments will work separately with discharges to the basins on the southern side of the site but there will be a controlled discharge from the upstream Cathcment A attenuation system to the downstream Catchment B system, so the downstream system receives the controlled flow from the upstream hydrobrake as well as flow from the surface water runoff generated within its own catchment. The discharge rate from the downstream hydrobrake is the sum of the rates calculated for the contributing catchments.

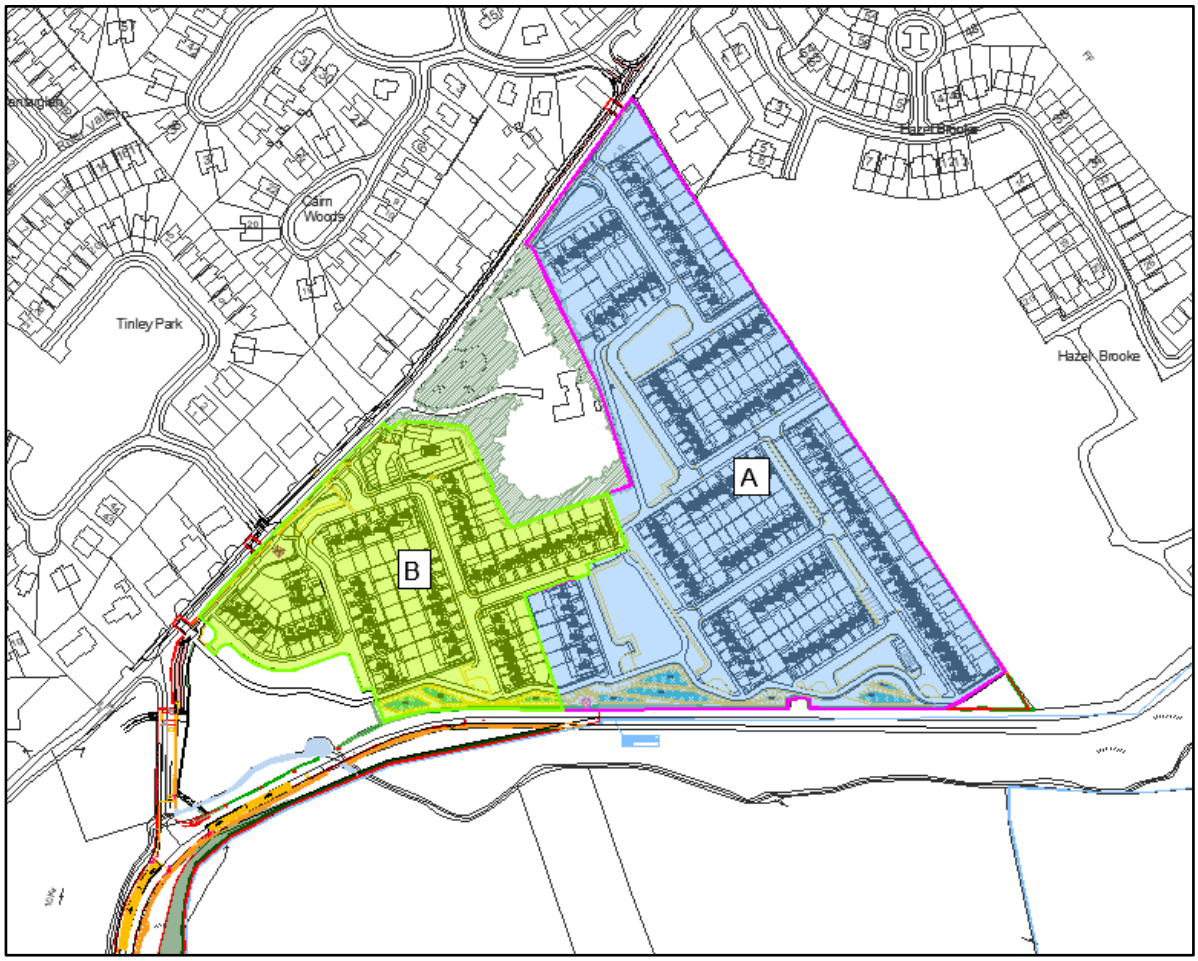


Figure 4-2: Surface Water Catchments

The various nature-based SUDS components being proposed as part of the development will provide some attenuation, reduce flow rates and will disperse surface water runoff via evapotranspiration and infiltration. To account for these contributions, we have assumed a reduction in runoff volume from the various contributing surfaces based on runoff coefficients (Cv). The following Cv figures have been informed by South Dublin County Council's – "Sustainable Drainage Explanatory Design & Evaluation Guide".

Table 4-3: Coefficients of Volumetric Runoff

Contributing Surface	Runoff coefficient (Cv)
Roads	0.90
Roofs	0.95
Where Roads Runoff to SuDS Feature	0.70

Preliminary attenuation volume calculations, based on the above criteria, are summarised in Table 3.3. (See Appendix 5 for detailed calculations)

Table 4-4: Summary of Attenuation Requirements

Ref.	Catchment Area (ha)	QBar (l/s)	Max. Outfall Rate (l/s)	Required Storage Volume 100yr +20% C.C. (m^3)
A	4.04	20.2	20.2	1075
B	2.10	10.5	30.5	580

4.3.4 Water Quality

The proposed development is residential and therefore is considered a low-level pollution hazard. Where possible, surface water runoff will be directed to the SUDS features as mentioned above and will therefore benefit from their pollutant removal qualities. However, to ensure water quality standards are met, a hydrocarbon interceptor is proposed upstream of the final StormTech attenuation tank. Additionally, grit sumps will be provided in the final manhole upstream of the two attenuation storage areas and hydrocarbon interceptor and grit chambers will be provided in all road gullies to capture grit high up in the treatment train.

Simple Index Approach

The effectiveness of the chosen SUDS components to achieve water quality can be assessed using the 'simple index approach' as described in CIRIA C753.

The simple index approach designates risk indices to the various areas of development to determine their possible pollutant contribution. Similarly, the SUDS features are designated mitigation indices and if the mitigation indices are larger than the risk indices the water quality objectives are considered satisfied.

Table 4-5: Pollution Hazard Indices for Different Land Uses

Land Use	Pollution Hazard Level	Total Suspended Solids (TSS)	Metals	Hydrocarbons
Residential roofs	Very Low	0.2	0.2	0.05
Driveways, car parks, low traffic roads	Low	0.5	0.4	0.4

As can be seen in Table 4.6 below the total mitigation potential of the SUDS features far outweigh the contamination risks. Secondary (or further) stages in the treatment train are assigned 50% of the stated treatment indices value.

Table 4-6: Indicative SuDS Mitigation Indices for Discharges to Surface Waters

SuDS Component	TSS	Metals	Hydrocarbons
Swale	0.5	0.6	0.6
Bioretention	0.8	0.8	0.8
Dry Basins	0.5	0.5	0.6
Wetlands	0.8	0.8	0.8
Petrol Interceptor	0.4	0.4	0.4

4.3.5 Amenity and Biodiversity

Meeting amenity and biodiversity standards is important in creating attractive, pleasant, and liveable urban areas while maintaining biodiversity and contributing to a net biodiversity gain.

The proposed SUDS features within this development will not only be aesthetically pleasing, they will also assist in the creation of liveable habitats for nature by retaining rainfall at source where possible and creating open space areas, along the southern side of the site particularly, which will contribute to achieving biodiversity enhancement .

The landscape design and ecological consultants on the design team address this biodiversity provision in their planning application submissions and incorporate the proposed lined basin areas at the southern end of the site, the swales and bioretention areas within the development and the wetland area at the south-western corner of the site which will remain undeveloped as a flood storage area.

Typical details for the construction of the SUDS features are shown on the attached drawings and described and assessed in detail by other members of the Applicant's design team.

4.4 Conveyance of Surface Water Outflow to Final Discharge Location

The final controlled discharge will via a pipe/headwall arrangement discharging to open ground at the southwest corner of the site. This outfall will be set at a level that is above the 0.1% AEP flood level and outside of the 0.1% AEP flood extent (as per the CFRAMS and ARUP flood mapping for the Spa Stream) to ensure that the outfall will continue to operate even in extreme rainfall events.

SECTION 5: WATER SUPPLY

5.1 Existing Watermain Network

Uisce Eireann water distribution records show that there is an existing 150mmØ uPVC watermain located in the public road L5331, known as the Spa Glen, immediately to the north of the site

5.2 Pre-Connection Enquiry Stage

Following a Pre-Connection Enquiry, Uisce Eireann have issued a Confirmation of Feasibility (COF) confirming that the site can be serviced by its water infrastructure network. This COF is included in Appendix 1.

The COF confirms that the proposed development can be serviced by existing infrastructure in the area without the need for upgrades to this infrastructure.

5.3 Design Acceptance Stage

The proposed design for water supply infrastructure within the development was progressed in accordance with Uisce Eireann's Code of Practice for Water Infrastructure and was submitted to Uisce Eireann for review and consideration for design acceptance as per the requirement of the LRD process. A Statement of Design Acceptance was issued by Uisce Eireann and is included in Appendix 1.

To serve the development a connection will be made to the existing 150mmØ uPVC watermain and a network of 150mmØ and 100mmØ diameter watermains will be provided to serve the 186 units.

Fire hydrants will be provided such that each residential unit will be within 46m of a hydrant and these hydrants will be provided to be fully accessible to the fire service. The creche will be subject to later Fire Safety Certificate applications and the provision of appropriate water supply for firefighting of this building will be addressed in this application.

Appendix 1:

IRISH WATER - CONFIRMATION OF FEASIBILITY & STATEMENT OF DESIGN ACCEPTANCE

CONFIRMATION OF FEASIBILITY

Uisce Éireann
Bosca OP 448
Oifig Sheachadta na
Cathrach Theas
Cathair Chorcaí

Uisce Éireann
PO Box 448
South City
Delivery Office
Cork City

www.water.ie

Diarmuid O' Brien

JB Barry & Partners
3 Eastgate, Eastgate Business Park
Little Island
Co. Cork
T45KH74

30 January 2024

Our Ref: CDS22005360 Pre-Connection Enquiry
Ballyviniter, Mallow, Cork

Dear Applicant/Agent,

We have completed the review of the Pre-Connection Enquiry.

Uisce Éireann has reviewed the pre-connection enquiry in relation to a Water & Wastewater connection for a Multi/Mixed Use Development of 189 unit(s) at Ballyviniter, Mallow, Cork, (the **Development)**.

Based upon the details provided we can advise the following regarding connecting to the networks;

- **Water Connection** - Feasible without infrastructure upgrade by Irish Water
- **Wastewater Connection** - Feasible without infrastructure upgrade by Irish Water

This letter does not constitute an offer, in whole or in part, to provide a connection to any Uisce Éireann infrastructure. Before the Development can be connected to our network(s) you must submit a connection application and be granted and sign a connection agreement with Uisce Éireann.

As the network capacity changes constantly, this review is only valid at the time of its completion. As soon as planning permission has been granted for the

Development, a completed connection application should be submitted. The connection application is available at www.water.ie/connections/get-connected/

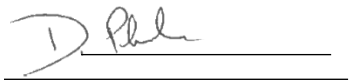
Where can you find more information?

- **Section A -** What is important to know?
- **Section B -** Details of Uisce Éireann's Network(s)

This letter is issued to provide information about the current feasibility of the proposed connection(s) to Uisce Éireann's network(s). This is not a connection offer and capacity in Uisce Éireann's network(s) may only be secured by entering into a connection agreement with Uisce Éireann.

For any further information, visit **www.water.ie/connections**, **email newconnections@water.ie** or contact 1800 278 278**.**

Yours sincerely,



Dermot Phelan
Connections Delivery Manager

Section A - What is important to know?

What is important to know?	Why is this important?
Do you need a contract to connect?	• Yes, a contract is required to connect. This letter does not constitute a contract or an offer in whole or in part to provide a connection to Uisce Éireann's network(s). • Before the Development can connect to Uisce Éireann's network(s), you must submit a connection application and be granted and sign a connection agreement with Uisce Éireann.
When should I submit a Connection Application?	• A connection application should only be submitted after planning permission has been granted.
Where can I find information on connection charges?	• Uisce Éireann connection charges can be found at: https://www.water.ie/connections/information/charges/
Who will carry out the connection work?	• All works to Uisce Éireann's network(s), including works in the public space, must be carried out by Uisce Éireann*. *Where a Developer has been granted specific permission and has been issued a connection offer for Self-Lay in the Public Road/Area, they may complete the relevant connection works
Fire flow Requirements	• The Confirmation of Feasibility does not extend to fire flow requirements for the Development. Fire flow requirements are a matter for the Developer to determine. • **What to do?** - Contact the relevant Local Fire Authority
Plan for disposal of storm water	• The Confirmation of Feasibility does not extend to the management or disposal of storm water or ground waters. • **What to do?** - Contact the relevant Local Authority to discuss the management or disposal of proposed storm water or ground water discharges.
Where do I find details of Uisce Éireann's network(s)?	• Requests for maps showing Uisce Éireann's network(s) can be submitted to: datarequests@water.ie

What are the design requirements for the connection(s)?	• The design and construction of the Water & Wastewater pipes and related infrastructure to be installed in this Development shall comply with ***the Uisce Éireann Connections and Developer Services Standard Details and Codes of Practice,*** available at www.water.ie/connections
Trade Effluent Licensing	• Any person discharging trade effluent** to a sewer, must have a Trade Effluent Licence issued pursuant to section 16 of the Local Government (Water Pollution) Act, 1977 (as amended). • More information and an application form for a Trade Effluent License can be found at the following link: https://www.water.ie/business/trade-effluent/about/ **trade effluent is defined in the Local Government (Water Pollution) Act, 1977 (as amended)

Section B – Details of Uisce Éireann's Network(s)

The map included below outlines the current Uisce Éireann infrastructure adjacent the Development: To access Uisce Éireann Maps email datarequests@water.ie

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Note: The information provided on the included maps as to the position of Uisce Éireann's underground network(s) is provided as a general guide only. The information is based on the best available information provided by each Local Authority in Ireland to Uisce Éireann.

Whilst every care has been taken in respect of the information on Uisce Éireann's network(s), Uisce Éireann assumes no responsibility for and gives no guarantees, undertakings or warranties concerning the accuracy, completeness or up to date nature of the information provided, nor does it accept any liability whatsoever arising from or out of any errors or omissions. This information should not be solely relied upon in the event of excavations or any other works being carried out in the vicinity of Uisce Éireann's underground network(s). The

onus is on the parties carrying out excavations or any other works to ensure the exact location of Uisce Éireann’s underground network(s) is identified prior to excavations or any other works being carried out. Service connection pipes are not generally shown but their presence should be anticipated.

Ray Sheehan
J. B. Barry & Partners
3 Eastgate Road
Eastgate Business Park
Little Island
Co. Cork
T45 KH74

Uisce Éireann
Bosca OP 448
Oifig Sheachadta na
Cathrach Theas
Cathair Chorcaí

Uisce Éireann
PO Box 448
South City
Delivery Office
Cork City

www.water.ie

8 February 2024

Re: Design Submission for Ballyvinter, Mallow, Co. Cork (the "Development") (the "Design Submission") / Connection Reference No: CDS24000034

Dear Ray Sheehan,

Many thanks for your recent Design Submission.

We have reviewed your proposal for the connection(s) at the Development. Based on the information provided, which included the documents outlined in Appendix A to this letter, Uisce Éireann has no objection to your proposals.

This letter does not constitute an offer, in whole or in part, to provide a connection to any Uisce Éireann infrastructure. Before you can connect to our network you must sign a connection agreement with Uisce Éireann. This can be applied for by completing the connection application form at www.water.ie/connections. Uisce Éireann's current charges for water and wastewater connections are set out in the Water Charges Plan as approved by the Commission for Regulation of Utilities (CRU)(https://www.cru.ie/document_group/irish-waters-water-charges-plan-2018/).

You the Customer (including any designers/contractors or other related parties appointed by you) is entirely responsible for the design and construction of all water and/or wastewater infrastructure within the Development which is necessary to facilitate connection(s) from the boundary of the Development to Uisce Éireann's network(s) (the "**Self-Lay Works**"), as reflected in your Design Submission. Acceptance of the Design Submission by Uisce Éireann does not, in any way, render Uisce Éireann liable for any elements of the design and/or construction of the Self-Lay Works.

If you have any further questions, please contact your Uisce Éireann representative:
Name: James King
Email: james.king@water.ie

Yours sincerely,

Dermot Phelan
Connections Delivery Manager

Appendix A

Document Title & Revision

- 22201-JBB-XX-XX-DS-CU-00018_Water_Design_Submission_P02
- 22201-JBB-XX-XX-DS-CD-00019_Wastewater_Design_Submission_P02
- 22201-JBB-XX-XX-CA-CE-00017_Water_and_Wastewater_Demand_Calculations_P05
- 22201-JBB-XX-XX-DR-CE-00012_Site_Location_Map_P01
- 22201-JBB-XX-XX-DR-CU-00020_Proposed_Watermain_Layout_(Overall)_P06
- 22201-JBB-XX-XX-DR-CU-00021_Proposed_Watermain_Layout_(Sheet_1)_P06
- 22201-JBB-XX-XX-DR-CU-00022_Proposed_Watermain_Layout_(Sheet_2)_P07
- 22201-JBB-XX-XX-DR-CU-00023_Proposed_Watermain_Layout_(Sheet_3)_P07
- 22201-JBB-XX-XX-DR-CD-00024_Proposed_Wastewater_Layout_(Overall)_P06
- 22201-JBB-XX-XX-DR-CD-00025_Proposed_Wastewater_Layout_(Sheet_1)_P05
- 22201-JBB-XX-XX-DR-CD-00026_Proposed_Wastewater_Layout_(Sheet_2)_P06
- 22201-JBB-XX-XX-DR-CD-00027_Proposed_Wastewater_Layout_(Sheet_3)_P08
- 22201-JBB-XX-XX-CA-CD-00029_MicroDrainage_Foul_Sewer_Long_Sections_P03

*For further information, visit **www.water.ie/connections***

Notwithstanding any matters listed above, the Customer (including any appointed designers/contractors, etc.) is entirely responsible for the design and construction of the Self-Lay Works. Acceptance of the Design Submission by Uisce Éireann will not, in any way, render Uisce Éireann liable for any elements of the design and/or construction of the Self-Lay Works.

Appendix 2:

FOUL SEWER – MICRODRAINAGE CALCULATIONS

FOUL SEWERAGE DESIGN

Design Criteria for Foul - Main

Pipe Sizes STANDARD Manhole Sizes STANDARD

Industrial Flow (l/s/ha)	0.00	Add Flow / Climate Change (%)	0
Industrial Peak Flow Factor	0.00	Minimum Backdrop Height (m)	0.200
Flow Per Person (l/per/day)	150.00	Maximum Backdrop Height (m)	4.000
Persons per House	2.70	Min Design Depth for Optimisation (m)	1.200
Domestic (l/s/ha)	0.00	Min Vel for Auto Design only (m/s)	0.75
Domestic Peak Flow Factor	6.00	Min Slope for Optimisation (1:X)	500

Designed with Level Soffits

Network Design Table for Foul - Main

PN	Length (m)	Fall (m)	Slope (1:X)	Area (ha)	Houses	Base Flow (l/s)	k (mm)	HYD SECT	DIA (mm)	Section Type	Auto Design
F1.000	9.157	0.229	40.0	0.000	2	0.0	1.500	o	150	Pipe/Conduit	
F2.000	43.723	0.729	60.0	0.000	6	0.0	1.500	o	150	Pipe/Conduit	
F1.001	60.144	0.401	150.0	0.000	8	0.0	1.500	o	150	Pipe/Conduit	
F3.000	26.126	0.435	60.0	0.000	5	0.0	1.500	o	150	Pipe/Conduit	
F4.000	13.153	0.219	60.0	0.000	3	0.0	1.500	o	150	Pipe/Conduit	
F3.001	26.161	0.436	60.0	0.000	2	0.0	1.500	o	150	Pipe/Conduit	
F1.002	13.418	0.067	200.0	0.000	1	0.0	1.500	o	225	Pipe/Conduit	
F1.003	30.398	0.152	200.0	0.000	5	0.0	1.500	o	225	Pipe/Conduit	
F1.004	7.262	0.036	201.7	0.000	0	0.0	1.500	o	225	Pipe/Conduit	

Network Results Table

PN	US/IL (m)	Σ Area (ha)	Σ Base Flow (l/s)	Σ Hse	Add Flow (l/s)	P.Dep (mm)	P.Vel (m/s)	Vel (m/s)	Cap (l/s)	Flow (l/s)
F1.000	66.650	0.000	0.0	2	0.0	6	0.26	1.39	24.5	0.1
F2.000	66.200	0.000	0.0	6	0.0	10	0.33	1.13	20.0	0.2
F1.001	65.471	0.000	0.0	16	0.0	20	0.33	0.71	12.6	0.5
F3.000	66.200	0.000	0.0	5	0.0	9	0.31	1.13	20.0	0.1
F4.000	66.550	0.000	0.0	3	0.0	7	0.26	1.13	20.0	0.1
F3.001	65.765	0.000	0.0	10	0.0	13	0.39	1.13	20.0	0.3
F1.002	64.995	0.000	0.0	27	0.0	24	0.33	0.81	32.2	0.8
F1.003	64.928	0.000	0.0	32	0.0	26	0.35	0.81	32.2	0.9
F1.004	64.776	0.000	0.0	32	0.0	26	0.35	0.81	32.1	0.9

Network Design Table for Foul - Main

PN	Length (m)	Fall (m)	Slope (1:X)	Area (ha)	Houses	Base Flow (l/s)	k (mm)	HYD SECT	DIA (mm)	Section Type	Auto Design
F1.005	7.262	0.036	200.0	0.000	0	0.0	1.500	o	225	Pipe/Conduit	
F1.006	75.590	0.779	97.0	0.000	8	0.0	1.500	o	225	Pipe/Conduit	
F5.000	46.695	1.000	46.7	0.000	10	0.0	1.500	o	150	Pipe/Conduit	
F1.007	40.102	1.823	22.0	0.000	1	0.0	1.500	o	225	Pipe/Conduit	
F1.008	56.359	2.450	23.0	0.000	8	0.0	1.500	o	225	Pipe/Conduit	
F1.009	6.701	0.177	37.9	0.000	0	0.0	1.500	o	225	Pipe/Conduit	
F6.000	75.260	3.400	22.1	0.000	16	0.0	1.500	o	150	Pipe/Conduit	
F1.010	49.755	2.262	22.0	0.000	6	0.0	1.500	o	225	Pipe/Conduit	
F7.000	24.232	0.404	60.0	0.000	5	0.0	1.500	o	150	Pipe/Conduit	
F7.001	62.817	1.256	50.0	0.000	8	0.0	1.500	o	150	Pipe/Conduit	
F7.002	61.217	1.224	50.0	0.000	10	0.0	1.500	o	225	Pipe/Conduit	
F8.000	41.832	0.279	149.9	0.000	14	0.0	1.500	o	150	Pipe/Conduit	
F7.003	59.267	2.694	22.0	0.000	8	0.0	1.500	o	225	Pipe/Conduit	
F7.004	35.411	0.459	77.1	0.000	0	0.0	1.500	o	225	Pipe/Conduit	
F1.011	25.482	1.158	22.0	0.000	0	0.0	1.500	o	225	Pipe/Conduit	

Network Results Table

PN	US/IL (m)	Σ Area (ha)	Σ Base Flow (l/s)	Σ Hse	Add Flow (l/s)	P.Dep (mm)	P.Vel (m/s)	Vel (m/s)	Cap (l/s)	Flow (l/s)
F1.005	64.740	0.000	0.0	32	0.0	26	0.35	0.81	32.2	0.9
F1.006	64.704	0.000	0.0	40	0.0	24	0.48	1.17	46.3	1.1
F5.000	65.000	0.000	0.0	10	0.0	12	0.42	1.28	22.7	0.3
F1.007	63.925	0.000	0.0	51	0.0	19	0.87	2.45	97.5	1.4
F1.008	62.102	0.000	0.0	59	0.0	21	0.90	2.40	95.4	1.7
F1.009	59.652	0.000	0.0	59	0.0	23	0.76	1.87	74.3	1.7
F6.000	62.950	0.000	0.0	16	0.0	13	0.64	1.87	33.0	0.5
F1.010	59.475	0.000	0.0	81	0.0	24	1.01	2.45	97.6	2.3
F7.000	65.400	0.000	0.0	5	0.0	9	0.31	1.13	20.0	0.1
F7.001	64.996	0.000	0.0	13	0.0	14	0.45	1.24	21.9	0.4
F7.002	63.665	0.000	0.0	23	0.0	16	0.51	1.63	64.6	0.6
F8.000	60.720	0.000	0.0	14	0.0	18	0.32	0.71	12.6	0.4
F7.003	60.366	0.000	0.0	45	0.0	18	0.84	2.45	97.5	1.3
F7.004	57.672	0.000	0.0	45	0.0	24	0.54	1.31	52.0	1.3
F1.011	56.703	0.000	0.0	126	0.0	29	1.15	2.45	97.5	3.5

Network Design Table for Foul - Main

PN	Length (m)	Fall (m)	Slope (1:X)	Area (ha)	Houses	Base Flow (l/s)	k (mm)	HYD SECT	DIA (mm)	Section Type	Auto Design
F9.000	81.034	3.960	20.5	0.000	10	0.0	1.500	o	150	Pipe/Conduit	
F10.000	63.413	2.030	31.2	0.000	11	0.0	1.500	o	150	Pipe/Conduit	
F9.001	30.382	1.000	30.4	0.000	5	0.0	1.500	o	225	Pipe/Conduit	
F11.000	46.484	3.099	15.0	0.000	6	0.0	1.500	o	150	Pipe/Conduit	
F11.001	30.055	0.501	60.0	0.000	0	0.0	1.500	o	150	Pipe/Conduit	
F11.002	15.389	0.256	60.0	0.000	0	0.0	1.500	o	150	Pipe/Conduit	
F11.003	21.128	0.352	60.0	0.000	0	0.0	1.500	o	150	Pipe/Conduit	
F11.004	22.452	0.374	60.0	0.000	4	0.0	1.500	o	150	Pipe/Conduit	
F9.002	61.825	1.422	43.5	0.000	0	0.0	1.500	o	225	Pipe/Conduit	
F12.000	10.952	0.365	30.0	0.000	0	0.2	1.500	o	150	Pipe/Conduit	
F12.001	4.996	0.167	29.9	0.000	0	0.0	1.500	o	150	Pipe/Conduit	
F12.002	15.800	0.527	30.0	0.000	0	0.0	1.500	o	150	Pipe/Conduit	
F12.003	41.694	1.390	30.0	0.000	6	0.0	1.500	o	150	Pipe/Conduit	
F12.004	9.907	0.450	22.0	0.000	0	0.0	1.500	o	150	Pipe/Conduit	
F12.005	7.054	0.321	22.0	0.000	0	0.0	1.500	o	150	Pipe/Conduit	
F12.006	13.488	0.613	22.0	0.000	0	0.0	1.500	o	150	Pipe/Conduit	
F12.007	43.121	1.000	43.1	0.000	6	0.0	1.500	o	150	Pipe/Conduit	

Network Results Table

PN	US/IL (m)	Σ Area (ha)	Σ Base Flow (l/s)	Σ Hse	Add Flow (l/s)	P.Dep (mm)	P.Vel (m/s)	Vel (m/s)	Cap (l/s)	Flow (l/s)
F9.000	61.030	0.000	0.0	10	0.0	10	0.56	1.94	34.3	0.3
F10.000	59.100	0.000	0.0	11	0.0	11	0.50	1.57	27.8	0.3
F9.001	56.995	0.000	0.0	26	0.0	15	0.63	2.09	83.0	0.7
F11.000	59.550	0.000	0.0	6	0.0	7	0.52	2.27	40.1	0.2
F11.001	56.451	0.000	0.0	6	0.0	10	0.33	1.13	20.0	0.2
F11.002	55.950	0.000	0.0	6	0.0	10	0.33	1.13	20.0	0.2
F11.003	55.694	0.000	0.0	6	0.0	10	0.33	1.13	20.0	0.2
F11.004	55.341	0.000	0.0	10	0.0	13	0.39	1.13	20.0	0.3
F9.002	54.892	0.000	0.0	36	0.0	19	0.62	1.74	69.3	1.0
F12.000	59.850	0.000	0.2	0	0.0	9	0.44	1.60	28.3	0.2
F12.001	59.485	0.000	0.2	0	0.0	9	0.44	1.61	28.4	0.2
F12.002	59.318	0.000	0.2	0	0.0	9	0.44	1.60	28.3	0.2
F12.003	58.791	0.000	0.2	6	0.0	12	0.54	1.60	28.3	0.4
F12.004	57.401	0.000	0.2	6	0.0	11	0.60	1.87	33.1	0.4
F12.005	56.951	0.000	0.2	6	0.0	11	0.60	1.87	33.1	0.4
F12.006	56.630	0.000	0.2	6	0.0	11	0.60	1.87	33.1	0.4
F12.007	56.017	0.000	0.2	12	0.0	16	0.54	1.34	23.6	0.5

Network Design Table for Foul - Main

PN	Length (m)	Fall (m)	Slope (1:X)	Area (ha)	Houses	Base Flow (l/s)	k (mm)	HYD SECT	DIA (mm)	Section Type	Auto Design
F13.000	19.917	0.332	60.0	0.000	4	0.0	1.500	o	150	Pipe/Conduit	
F13.001	9.114	0.152	60.0	0.000	0	0.0	1.500	o	150	Pipe/Conduit	
F13.002	10.622	0.177	60.0	0.000	0	0.0	1.500	o	150	Pipe/Conduit	
F13.003	9.212	0.154	59.8	0.000	0	0.0	1.500	o	150	Pipe/Conduit	
F13.004	30.735	0.512	60.0	0.000	4	0.0	1.500	o	150	Pipe/Conduit	
F12.008	31.138	0.158	197.1	0.000	4	0.0	1.500	o	225	Pipe/Conduit	
F9.003	44.907	0.367	122.4	0.000	0	0.0	1.500	o	225	Pipe/Conduit	

Network Results Table

PN	US/IL (m)	Σ Area (ha)	Σ Base Flow (l/s)	Σ Hse	Add Flow (l/s)	P.Dep (mm)	P.Vel (m/s)	Vel (m/s)	Cap (l/s)	Flow (l/s)
F13.000	55.030	0.000	0.0	4	0.0	8	0.29	1.13	20.0	0.1
F13.001	54.698	0.000	0.0	4	0.0	8	0.29	1.13	20.0	0.1
F13.002	54.546	0.000	0.0	4	0.0	8	0.29	1.13	20.0	0.1
F13.003	54.369	0.000	0.0	4	0.0	8	0.29	1.13	20.0	0.1
F13.004	54.215	0.000	0.0	8	0.0	12	0.36	1.13	20.0	0.2
F12.008	53.628	0.000	0.2	24	0.0	26	0.35	0.82	32.5	0.9
F9.003	53.470	0.000	0.2	60	0.0	33	0.52	1.04	41.2	1.9

Free Flowing Outfall Details for Foul - Main

Outfall Pipe Number	Outfall Name	C. Level (m)	I. Level (m)	Min I. Level (m)	D,L (mm)	W (mm)
F1.011	F.EX1	56.970	55.545	0.000	0	0

Free Flowing Outfall Details for Foul - Main

Outfall Pipe Number	Outfall Name	C. Level (m)	I. Level (m)	Min I. Level (m)	D,L (mm)	W (mm)
F9.003	F.EX2	54.530	53.103	0.000	0	0

Appendix 3:

HR WALLINGFORD GREENFIELD RUNOFF ESTIMATION

Greenfield runoff rate estimation for sites

www.uksuds.com | Greenfield runoff tool

Calculated by:	Ray Sheehan
Site name:	Spa Glen
Site location:	Mallow

This is an estimation of the greenfield runoff rates that are used to meet normal best practice criteria in line with Environment Agency guidance "Rainfall runoff management for developments", SC030219 (2013) , the SuDS Manual C753 (Ciria, 2015) and the non-statutory standards for SuDS (Defra, 2015). This information on greenfield runoff rates may be the basis for setting consents for the drainage of surface water runoff from sites.

Site Details

Latitude:	52.14862° N
Longitude:	8.6334° W
Reference:	3695600227
Date:	Jan 26 2024 16:37

Runoff estimation approach

IH124

Site characteristics

Total site area (ha): 6.14

Methodology

Q_{BAR} estimation method:	Calculate from SPR and SAAR
SPR estimation method:	Calculate from SOIL type

Soil characteristics

	Default	Edited
SOIL type:	4	3
HOST class:	N/A	N/A
SPR/SPRHOST:	0.47	0.37

Hydrological characteristics

	Default	Edited
SAAR (mm):	1126	1126
Hydrological region:	13	13
Growth curve factor 1 year:	0.85	0.85
Growth curve factor 30 years:	1.65	1.65
Growth curve factor 100 years:	1.95	1.95
Growth curve factor 200 years:	2.15	2.15

Notes

(1) Is Q_{BAR} < 2.0 l/s/ha?

When Q_{BAR} is < 2.0 l/s/ha then limiting discharge rates are set at 2.0 l/s/ha.

(2) Are flow rates < 5.0 l/s?

Where flow rates are less than 5.0 l/s consent for discharge is usually set at 5.0 l/s if blockage from vegetation and other materials is possible. Lower consent flow rates may be set where the blockage risk is addressed by using appropriate drainage elements.

(3) Is SPR/SPRHOST ≤ 0.3?

Where groundwater levels are low enough the use of soakaways to avoid discharge offsite would normally be preferred for disposal of surface water runoff.

Greenfield runoff rates

	Default	Edited

Q_{BAR} (l/s):	51.7	30.76
1 in 1 year (l/s):	43.94	26.15
1 in 30 years (l/s):	85.3	50.76
1 in 100 year (l/s):	100.81	59.98
1 in 200 years (l/s):	111.15	66.14

Appendix 4:

SURFACE WATER - MICRODRAINAGE CALCULATIONS

STORM SEWER DESIGN by the Modified Rational Method

Design Criteria for Storm

Pipe Sizes STANDARD Manhole Sizes STANDARD

FSR Rainfall Model - Scotland and Ireland

Return Period (years)	2	PIMP (%)	100
M5-60 (mm)	17.800	Add Flow / Climate Change (%)	0
Ratio R	0.250	Minimum Backdrop Height (m)	0.200
Maximum Rainfall (mm/hr)	50	Maximum Backdrop Height (m)	4.000
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)	1.00
Volumetric Runoff Coeff.	0.750	Min Slope for Optimisation (1:X)	500

Designed with Level Soffits

Time Area Diagram for Storm

Time (mins)	Area (ha)	Time (mins)	Area (ha)	Time (mins)	Area (ha)
0-4	0.786	4-8	2.076	8-12	0.336

Total Area Contributing (ha) = 3.198

Total Pipe Volume (m³) = 110.246

Network Design Table for Storm

PN	Length (m)	Fall (m)	Slope (1:X)	I.Area (ha)	T.E. (mins)	Base Flow (l/s)	k (mm)	HYD SECT	DIA (mm)	Section Type	Auto Design
S1.000	15.379	0.481	32.0	0.058	4.00	0.0	0.600	o	225	Pipe/Conduit	
S2.000	40.340	0.403	100.0	0.093	4.00	0.0	0.600	o	225	Pipe/Conduit	
S1.001	63.446	0.317	200.0	0.153	0.00	0.0	0.600	o	300	Pipe/Conduit	
S3.000	26.124	0.401	65.1	0.059	4.00	0.0	0.600	o	225	Pipe/Conduit	
S4.000	10.217	0.051	200.0	0.000	4.00	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	4.11	67.420	0.058	0.0	0.0	0.0	2.32	92.3	7.9
S2.000	50.00	4.51	66.540	0.093	0.0	0.0	0.0	1.31	52.0	12.6
S1.001	49.33	5.47	66.062	0.304	0.0	0.0	0.0	1.11	78.3	40.6
S3.000	50.00	4.27	67.220	0.059	0.0	0.0	0.0	1.62	64.5	8.0
S4.000	50.00	4.18	66.870	0.000	0.0	0.0	0.0	0.92	36.6	0.0

Network Design Table for Storm

PN	Length (m)	Fall (m)	Slope (1:X)	I.Area (ha)	T.E. (mins)	Base Flow (l/s)	k (mm)	HYD SECT	DIA (mm)	Section Type	Auto Design
S3.001	22.858	0.114	200.0	0.044	0.00	0.0	0.600	o	225	Pipe/Conduit	
S1.002	10.716	0.054	200.0	0.019	0.00	0.0	0.600	o	300	Pipe/Conduit	
S1.003	30.045	0.150	200.0	0.055	0.00	0.0	0.600	o	300	Pipe/Conduit	
S1.004	6.745	0.034	200.0	0.023	0.00	0.0	0.600	o	300	Pipe/Conduit	
S1.005	8.406	0.042	200.0	0.000	0.00	0.0	0.600	o	300	Pipe/Conduit	
S1.006	72.896	1.461	49.9	0.154	0.00	0.0	0.600	o	300	Pipe/Conduit	
S5.000	43.876	0.219	200.0	0.128	4.00	0.0	0.600	o	225	Pipe/Conduit	
S1.007	42.602	1.936	22.0	0.027	0.00	0.0	0.600	o	300	Pipe/Conduit	
S1.008	59.059	3.108	19.0	0.132	0.00	0.0	0.600	o	300	Pipe/Conduit	
S1.009	3.799	0.200	19.0	0.000	0.00	0.0	0.600	o	300	Pipe/Conduit	
S6.000	75.093	3.241	23.2	0.257	4.00	0.0	0.600	o	225	Pipe/Conduit	
S1.010	39.677	2.088	19.0	0.090	0.00	0.0	0.600	o	300	Pipe/Conduit	
S7.000	38.835	1.387	28.0	0.128	4.00	0.0	0.600	o	225	Pipe/Conduit	
S7.001	43.147	0.539	80.0	0.004	0.00	0.0	0.600	o	225	Pipe/Conduit	
S7.002	21.706	0.328	66.2	0.000	0.00	0.0	0.600	o	225	Pipe/Conduit	
S1.011	13.048	0.687	19.0	0.027	0.00	0.0	0.600	o	300	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)
S3.001	50.00	4.68	66.819	0.104	0.0	0.0	0.0	0.92	36.6	14.0
S1.002	48.80	5.63	65.744	0.427	0.0	0.0	0.0	1.11	78.3	56.4
S1.003	47.39	6.08	65.691	0.482	0.0	0.0	0.0	1.11	78.3	61.9
S1.004	47.09	6.18	65.541	0.505	0.0	0.0	0.0	1.11	78.3	64.4
S1.005	46.72	6.31	65.507	0.505	0.0	0.0	0.0	1.11	78.3	64.4
S1.006	45.22	6.85	65.465	0.659	0.0	0.0	0.0	2.23	157.7	80.6
S5.000	50.00	4.79	64.500	0.128	0.0	0.0	0.0	0.92	36.6	17.3
S1.007	44.66	7.06	64.004	0.813	0.0	0.0	0.0	3.37	238.0	98.4
S1.008	43.98	7.34	62.067	0.945	0.0	0.0	0.0	3.62	256.1	112.6
S1.009	43.94	7.35	58.959	0.945	0.0	0.0	0.0	3.62	256.1	112.6
S6.000	50.00	4.46	62.150	0.257	0.0	0.0	0.0	2.73	108.5	34.8
S1.010	43.49	7.54	58.759	1.292	0.0	0.0	0.0	3.62	256.1	152.2
S7.000	50.00	4.26	59.000	0.128	0.0	0.0	0.0	2.48	98.7	17.4
S7.001	50.00	4.75	57.613	0.132	0.0	0.0	0.0	1.46	58.2	17.9
S7.002	50.00	4.98	57.074	0.132	0.0	0.0	0.0	1.61	64.0	17.9
S1.011	43.35	7.60	56.671	1.451	0.0	0.0	0.0	3.62	256.1	170.4

Network Design Table for Storm

PN	Length (m)	Fall (m)	Slope (1:X)	I.Area (ha)	T.E. (mins)	Base Flow (l/s)	k (mm)	HYD SECT	DIA (mm)	Section Type	Auto Design
S8.000	24.029	0.240	100.0	0.085	4.00	0.0	0.600	o	225	Pipe/Conduit	
S8.001	82.524	1.719	48.0	0.174	0.00	0.0	0.600	o	225	Pipe/Conduit	
S8.002	78.993	3.301	23.9	0.211	0.00	0.0	0.600	o	225	Pipe/Conduit	
S8.003	12.652	0.063	200.8	0.023	0.00	0.0	0.600	o	300	Pipe/Conduit	
S8.004	89.599	3.454	25.9	0.000	0.00	0.0	0.600	o	300	Pipe/Conduit	
S9.000	41.945	4.100	10.2	0.127	4.00	0.0	0.600	o	225	Pipe/Conduit	
S9.001	42.525	1.597	26.6	0.000	0.00	0.0	0.600	o	225	Pipe/Conduit	
S8.005	19.092	0.740	25.8	0.000	0.00	0.0	0.600	o	300	Pipe/Conduit	
S1.012	71.741	0.120	600.0	0.000	0.00	0.0	0.600	o	600	Pipe/Conduit	
S1.013	42.650	0.213	200.2	0.000	0.00	0.0	0.600	o	300	Pipe/Conduit	
S1.014	16.807	0.084	200.0	0.022	0.00	0.0	0.600	o	300	Pipe/Conduit	
S10.000	78.166	4.009	19.5	0.204	4.00	0.0	0.600	o	225	Pipe/Conduit	
S11.000	17.220	0.297	58.0	0.018	4.00	0.0	0.600	o	225	Pipe/Conduit	
S11.001	16.550	0.083	200.0	0.055	0.00	0.0	0.600	o	225	Pipe/Conduit	
S12.000	10.904	0.341	32.0	0.043	4.00	0.0	0.600	o	225	Pipe/Conduit	
S12.001	4.155	0.208	20.0	0.000	0.00	0.0	0.600	o	225	Pipe/Conduit	
S12.002	15.793	0.564	28.0	0.031	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)
S8.000	50.00	4.31	65.900	0.085	0.0	0.0	0.0	1.31	52.0	11.5
S8.001	50.00	5.03	65.660	0.258	0.0	0.0	0.0	1.89	75.3	35.0
S8.002	49.15	5.52	63.940	0.469	0.0	0.0	0.0	2.69	106.8	62.5
S8.003	48.53	5.71	60.565	0.492	0.0	0.0	0.0	1.11	78.2	64.7
S8.004	47.05	6.20	60.502	0.492	0.0	0.0	0.0	3.10	219.1	64.7
S9.000	50.00	4.17	62.200	0.127	0.0	0.0	0.0	4.11	163.6	17.1
S9.001	50.00	4.45	58.100	0.127	0.0	0.0	0.0	2.55	101.2	17.1
S8.005	46.76	6.30	56.428	0.619	0.0	0.0	0.0	3.11	219.7	78.4
S1.012	40.69	8.81	55.388	2.070	0.0	0.0	0.0	0.99	279.0	228.1
S1.013	50.00	4.64	55.268	0.000	13.7	0.0	0.0	1.11	78.3	13.7
S1.014	50.00	4.89	55.055	0.022	13.7	0.0	0.0	1.11	78.3	16.7
S10.000	50.00	4.44	61.520	0.204	0.0	0.0	0.0	2.98	118.4	27.7
S11.000	50.00	4.17	59.370	0.018	0.0	0.0	0.0	1.72	68.4	2.5
S11.001	50.00	4.47	59.073	0.073	0.0	0.0	0.0	0.92	36.6	9.9
S12.000	50.00	4.08	60.320	0.043	0.0	0.0	0.0	2.32	92.3	5.8
S12.001	50.00	4.10	59.979	0.043	0.0	0.0	0.0	2.94	116.9	5.8
S12.002	50.00	4.21	59.772	0.074	0.0	0.0	0.0	2.48	98.7	10.1

Network Design Table for Storm

PN	Length (m)	Fall (m)	Slope (1:X)	I.Area (ha)	T.E. (mins)	Base Flow (l/s)	k (mm)	HYD SECT	DIA (mm)	Section Type	Auto Design
S11.002	14.390	0.072	200.0	0.030	0.00	0.0	0.600	o	225	Pipe/Conduit	
S11.003	5.577	0.028	200.0	0.000	0.00	0.0	0.600	o	225	Pipe/Conduit	
S11.004	65.865	1.379	47.8	0.192	0.00	0.0	0.600	o	225	Pipe/Conduit	
S10.001	36.221	1.112	32.6	0.120	0.00	0.0	0.600	o	300	Pipe/Conduit	
S1.015	16.015	0.080	200.0	0.015	0.00	0.0	0.600	o	375	Pipe/Conduit	
S1.016	40.978	0.198	206.6	0.000	0.00	0.0	0.600	o	375	Pipe/Conduit	
S13.000	10.040	0.456	22.0	0.036	4.00	0.0	0.600	o	225	Pipe/Conduit	
S13.001	10.866	0.494	22.0	0.011	0.00	0.0	0.600	o	225	Pipe/Conduit	
S13.002	6.529	0.297	22.0	0.011	0.00	0.0	0.600	o	225	Pipe/Conduit	
S13.003	13.587	0.618	22.0	0.049	0.00	0.0	0.600	o	225	Pipe/Conduit	
S13.004	46.326	1.195	38.8	0.099	0.00	0.0	0.600	o	225	Pipe/Conduit	
S14.000	18.900	0.095	198.9	0.060	4.00	0.0	0.600	o	225	Pipe/Conduit	
S14.001	10.213	0.051	200.0	0.005	0.00	0.0	0.600	o	225	Pipe/Conduit	
S14.002	8.540	0.043	200.0	0.004	0.00	0.0	0.600	o	225	Pipe/Conduit	
S14.003	9.879	0.049	200.0	0.009	0.00	0.0	0.600	o	225	Pipe/Conduit	
S14.004	30.037	0.150	200.0	0.057	0.00	0.0	0.600	o	225	Pipe/Conduit	
S13.005	35.588	0.178	200.0	0.056	0.00	0.0	0.600	o	300	Pipe/Conduit	
S13.006	8.201	0.046	179.5	0.000	0.00	0.0	0.600	o	300	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)
S11.002	50.00	4.73	58.990	0.178	0.0	0.0	0.0	0.92	36.6	24.1
S11.003	50.00	4.83	58.918	0.178	0.0	0.0	0.0	0.92	36.6	24.1
S11.004	49.53	5.41	58.891	0.370	0.0	0.0	0.0	1.90	75.4	49.6
S10.001	48.81	5.62	57.436	0.694	0.0	0.0	0.0	2.76	195.4	91.8
S1.015	48.15	5.83	54.896	0.732	13.7	0.0	0.0	1.28	141.1	109.1
S1.016	46.53	6.38	54.816	0.732	13.7	0.0	0.0	1.26	138.8	109.1
S13.000	50.00	4.06	58.470	0.036	0.0	0.0	0.0	2.80	111.4	4.9
S13.001	50.00	4.12	58.014	0.047	0.0	0.0	0.0	2.80	111.4	6.4
S13.002	50.00	4.16	57.520	0.058	0.0	0.0	0.0	2.80	111.4	7.8
S13.003	50.00	4.24	57.223	0.107	0.0	0.0	0.0	2.80	111.4	14.5
S13.004	50.00	4.61	56.605	0.206	0.0	0.0	0.0	2.11	83.8	27.9
S14.000	50.00	4.34	55.380	0.060	0.0	0.0	0.0	0.92	36.7	8.1
S14.001	50.00	4.53	55.285	0.065	0.0	0.0	0.0	0.92	36.6	8.8
S14.002	50.00	4.68	55.234	0.069	0.0	0.0	0.0	0.92	36.6	9.3
S14.003	50.00	4.86	55.191	0.078	0.0	0.0	0.0	0.92	36.6	10.5
S14.004	49.55	5.40	55.142	0.134	0.0	0.0	0.0	0.92	36.6	18.0
S13.005	47.83	5.94	54.917	0.396	0.0	0.0	0.0	1.11	78.3	51.3
S13.006	47.47	6.05	54.739	0.396	0.0	0.0	0.0	1.17	82.7	51.3

Network Design Table for Storm

PN	Length (m)	Fall (m)	Slope (1:X)	I.Area (ha)	T.E. (mins)	Base Flow (l/s)	k (mm)	HYD SECT	DIA (mm)	Section Type	Auto Design
S1.017	1.841	0.011	165.0	0.000	0.00	0.0	0.600	o	450	Pipe/Conduit	
S1.018	5.117	0.026	196.8	0.000	0.00	0.0	0.600	o	300	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)
S1.017	46.47	6.40	54.543	1.128	13.7	0.0	0.0	1.58	251.3	155.6
S1.018	50.00	4.08	54.532	0.000	20.4	0.0	0.0	1.12	79.0	20.4

Area Summary for Storm

Pipe Number	PIMP Type	PIMP Name	PIMP (%)	Gross Area (ha)	Imp. Area (ha)	Pipe Total (ha)
1.000	Classification	Roads	90	0.039	0.035	0.035
	Classification	Roofs	95	0.025	0.023	0.058
2.000	Classification	Roofs	95	0.054	0.051	0.051
	Classification	Roads	90	0.025	0.022	0.074
	Classification	Roads to SuDS	70	0.027	0.019	0.093
1.001	Classification	Roads	90	0.092	0.083	0.083
	Classification	Roofs	95	0.074	0.070	0.153
3.000	Classification	Roads to SuDS	70	0.005	0.004	0.004
	Classification	Roads	90	0.019	0.017	0.021
	Classification	Roofs	95	0.040	0.038	0.059
4.000	-	-	100	0.000	0.000	0.000
3.001	Classification	Roads	90	0.023	0.021	0.021
	Classification	Roofs	95	0.025	0.023	0.044
1.002	Classification	Roads	90	0.011	0.009	0.009
	Classification	Roofs	95	0.010	0.009	0.019
1.003	Classification	Roofs	95	0.029	0.028	0.028
	Classification	Roads	90	0.030	0.027	0.055
1.004	Classification	Roads	90	0.012	0.010	0.010
	Classification	Roofs	95	0.013	0.013	0.023
1.005	-	-	100	0.000	0.000	0.000
1.006	Classification	Roads to SuDS	70	0.056	0.040	0.040
	Classification	Roads	90	0.057	0.051	0.091
	Classification	Roofs	95	0.066	0.063	0.154
5.000	Classification	Roofs	95	0.016	0.015	0.015
	Classification	Roads	90	0.076	0.068	0.083
	Classification	Roofs	95	0.048	0.045	0.128
1.007	Classification	Roofs	95	0.015	0.015	0.015
	Classification	Roads	90	0.013	0.012	0.027
1.008	Classification	Roads to SuDS	70	0.026	0.018	0.018
	Classification	Roads	90	0.057	0.051	0.070
	Classification	Roofs	95	0.066	0.063	0.132
1.009	-	-	100	0.000	0.000	0.000
6.000	Classification	Roads	90	0.152	0.137	0.137
	Classification	Roofs	95	0.063	0.060	0.197
	Classification	Roofs	95	0.063	0.060	0.257
1.010	Classification	Roofs	95	0.056	0.053	0.053
	Classification	Roads	90	0.041	0.037	0.090
7.000	Classification	Roofs	95	0.064	0.061	0.061
	Classification	Roads	90	0.057	0.052	0.112
	Classification	Roads to SuDS	70	0.023	0.016	0.128
7.001	Classification	Roads to SuDS	70	0.006	0.004	0.004
7.002	-	-	100	0.000	0.000	0.000
1.011	Classification	Roads to SuDS	70	0.038	0.027	0.027
8.000	Classification	Roofs	95	0.046	0.044	0.044
	Classification	Roads	90	0.041	0.037	0.080
	Classification	Roads to SuDS	70	0.006	0.004	0.085
8.001	Classification	Roads to SuDS	70	0.016	0.012	0.012
	Classification	Roads	90	0.085	0.076	0.088
	Classification	Roofs	95	0.090	0.086	0.174
8.002	Classification	Roofs	95	0.123	0.117	0.117
	Classification	Roads	90	0.086	0.078	0.195
	Classification	Roads to SuDS	70	0.023	0.016	0.211
8.003	Classification	Roads to SuDS	70	0.033	0.023	0.023
8.004	-	-	100	0.000	0.000	0.000
9.000	Classification	Roofs	95	0.062	0.059	0.059

Area Summary for Storm

Pipe Number	PIMP Type	PIMP Name	PIMP (%)	Gross Area (ha)	Imp. Area (ha)	Pipe Total (ha)
	Classification	Roads	90	0.059	0.053	0.112
	Classification	Roads to SuDS	70	0.021	0.014	0.127
9.001	-	-	100	0.000	0.000	0.000
8.005	-	-	100	0.000	0.000	0.000
1.012	-	-	100	0.000	0.000	0.000
1.013	-	-	100	0.000	0.000	0.000
1.014	Classification	Roofs	95	0.016	0.015	0.015
	Classification	Roads	90	0.008	0.007	0.022
10.000	Classification	Roofs	95	0.104	0.099	0.099
	Classification	Roads	90	0.088	0.079	0.178
	Classification	Roads	90	0.029	0.027	0.204
11.000	Classification	Roads	90	0.020	0.018	0.018
11.001	Classification	Roads	90	0.032	0.029	0.029
	Classification	Roofs	95	0.028	0.026	0.055
12.000	Classification	Roofs	95	0.045	0.043	0.043
12.001	-	-	100	0.000	0.000	0.000
12.002	Classification	Roads to SuDS	70	0.025	0.018	0.018
	Classification	Roads to SuDS	70	0.007	0.005	0.023
	Classification	Roads to SuDS	70	0.012	0.008	0.031
11.002	Classification	Roads	90	0.020	0.018	0.018
	Classification	Roofs	95	0.013	0.013	0.030
11.003	-	-	100	0.000	0.000	0.000
11.004	Classification	Roads	90	0.114	0.102	0.102
	Classification	Roofs	95	0.049	0.047	0.149
	Classification	Roofs	95	0.046	0.043	0.192
10.001	Classification	Roofs	95	0.031	0.030	0.030
	Classification	Roofs	95	0.038	0.036	0.066
	Classification	Roads	90	0.060	0.054	0.120
1.015	Classification	Roads to SuDS	70	0.022	0.015	0.015
1.016	-	-	100	0.000	0.000	0.000
13.000	Classification	Roads	90	0.017	0.015	0.015
	Classification	Roofs	95	0.022	0.021	0.036
13.001	Classification	Roads to SuDS	70	0.009	0.006	0.006
	Classification	Roads	90	0.005	0.005	0.011
13.002	Classification	Roads	90	0.012	0.011	0.011
13.003	Classification	Roofs	95	0.028	0.026	0.026
	Classification	Roads	90	0.025	0.023	0.049
13.004	Classification	Roads	90	0.061	0.055	0.055
	Classification	Roofs	95	0.046	0.044	0.099
14.000	Classification	Roofs	95	0.029	0.028	0.028
	Classification	Roads	90	0.035	0.032	0.060
14.001	Classification	Roads	90	0.006	0.005	0.005
14.002	Classification	Roads	90	0.005	0.004	0.004
14.003	Classification	Roads	90	0.010	0.009	0.009
14.004	Classification	Roads	90	0.032	0.029	0.029
	Classification	Roofs	95	0.029	0.028	0.057
13.005	Classification	Roofs	95	0.031	0.030	0.030
	Classification	Roads	90	0.017	0.016	0.045
	Classification	Roads to SuDS	70	0.015	0.010	0.056
13.006	-	-	100	0.000	0.000	0.000
1.017	-	-	100	0.000	0.000	0.000
1.018	-	-	100	0.000	0.000	0.000
				Total	Total	Total
				3.547	3.198	3.198

Free Flowing Outfall Details for Storm

Outfall Pipe Number	Outfall Name	C. Level (m)	I. Level (m)	Min I. Level (m)	D,L (mm)	W (mm)
S1.018	S	56.320	54.506	0.000	0	0

Simulation Criteria for Storm

Volumetric Runoff Coeff	0.750	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 Offline Controls 0	Number of Time/Area Diagrams 0
Number of Online Controls 2	Number of Storage Structures 2	Number of Real Time Controls 0

Synthetic Rainfall Details

Rainfall Model	FSR	Profile Type	Summer
Return Period (years)	2	Cv (Summer)	0.750
Region	Scotland and Ireland	Cv (Winter)	0.840
M5-60 (mm)	17.800	Storm Duration (mins)	30
Ratio R	0.250		

Online Controls for Storm

Hydro-Brake® Optimum Manhole: S31, DS/PN: S1.013, Volume (m³): 24.0

Unit Reference	MD-SHE-0190-2020-1680-2020
Design Head (m)	1.680
Design Flow (l/s)	20.2
Flush-Flo™	Calculated
Objective	Minimise upstream storage
Application	Surface
Sump Available	Yes
Diameter (mm)	190
Invert Level (m)	55.268
Minimum Outlet Pipe Diameter (mm)	225
Suggested Manhole Diameter (mm)	1500

Control Points	Head (m)	Flow (l/s)	Control Points	Head (m)	Flow (l/s)
Design Point (Calculated)	1.680	20.2	Kick-Flo®	1.072	16.3
Flush-Flo™	0.495	20.2	Mean Flow over Head Range	-	17.5

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)	Depth (m)	Flow (l/s)
0.100	6.6	0.800	19.4	2.000	22.0	4.000	30.6	7.000	40.1
0.200	17.4	1.000	17.6	2.200	23.0	4.500	32.4	7.500	41.4
0.300	19.4	1.200	17.2	2.400	23.9	5.000	34.1	8.000	42.8
0.400	20.0	1.400	18.5	2.600	24.9	5.500	35.7	8.500	44.0
0.500	20.2	1.600	19.7	3.000	26.7	6.000	37.2	9.000	45.3
0.600	20.1	1.800	20.9	3.500	28.7	6.500	38.7	9.500	46.5

Hydro-Brake® Optimum Manhole: S58, DS/PN: S1.018, Volume (m³): 3.0

Unit Reference	MD-SHE-0229-3050-1680-3050
Design Head (m)	1.680
Design Flow (l/s)	30.5
Flush-Flo™	Calculated
Objective	Minimise upstream storage
Application	Surface
Sump Available	Yes
Diameter (mm)	229
Invert Level (m)	54.532
Minimum Outlet Pipe Diameter (mm)	300
Suggested Manhole Diameter (mm)	1800

Control Points	Head (m)	Flow (l/s)	Control Points	Head (m)	Flow (l/s)
Design Point (Calculated)	1.680	30.5	Kick-Flo®	1.115	25.1
Flush-Flo™	0.511	30.5	Mean Flow over Head Range	-	26.3

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

Hydro-Brake® Optimum Manhole: S58, DS/PN: S1.018, Volume (m³): 3.0

Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)
0.100	7.6	0.800	29.5	2.000	33.2	4.000	46.3	7.000	60.7
0.200	23.0	1.000	27.6	2.200	34.7	4.500	49.0	7.500	62.8
0.300	29.1	1.200	26.0	2.400	36.2	5.000	51.6	8.000	64.8
0.400	30.2	1.400	28.0	2.600	37.6	5.500	54.0	8.500	66.7
0.500	30.5	1.600	29.8	3.000	40.3	6.000	56.3	9.000	68.6
0.600	30.4	1.800	31.5	3.500	43.4	6.500	58.6	9.500	70.4

Storage Structures for Storm

Cellular Storage Manhole: S31, DS/PN: S1.013

Invert Level (m) 55.268 Safety Factor 2.0
Infiltration Coefficient Base (m/hr) 0.00000 Porosity 0.67
Infiltration Coefficient Side (m/hr) 0.00000

Depth (m)	Area (m²)	Inf. Area (m²)	Depth (m)	Area (m²)	Inf. Area (m²)	Depth (m)	Area (m²)	Inf. Area (m²)
0.000	955.0	0.0	0.900	955.0	0.0	1.681	0.0	0.0
0.100	955.0	0.0	1.000	955.0	0.0	1.900	0.0	0.0
0.200	955.0	0.0	1.100	955.0	0.0	2.000	0.0	0.0
0.300	955.0	0.0	1.200	955.0	0.0	2.100	0.0	0.0
0.400	955.0	0.0	1.300	955.0	0.0	2.200	0.0	0.0
0.500	955.0	0.0	1.400	955.0	0.0	2.300	0.0	0.0
0.600	955.0	0.0	1.500	955.0	0.0	2.400	0.0	0.0
0.700	955.0	0.0	1.600	955.0	0.0	2.500	0.0	0.0
0.800	955.0	0.0	1.680	955.0	0.0			

Cellular Storage Manhole: S58, DS/PN: S1.018

Invert Level (m) 54.606 Safety Factor 2.0
Infiltration Coefficient Base (m/hr) 0.00000 Porosity 0.67
Infiltration Coefficient Side (m/hr) 0.00000

Depth (m)	Area (m²)	Inf. Area (m²)	Depth (m)	Area (m²)	Inf. Area (m²)	Depth (m)	Area (m²)	Inf. Area (m²)
0.000	520.0	0.0	0.900	520.0	0.0	1.681	0.0	0.0
0.100	520.0	0.0	1.000	520.0	0.0	1.900	0.0	0.0
0.200	520.0	0.0	1.100	520.0	0.0	2.000	0.0	0.0
0.300	520.0	0.0	1.200	520.0	0.0	2.100	0.0	0.0
0.400	520.0	0.0	1.300	520.0	0.0	2.200	0.0	0.0
0.500	520.0	0.0	1.400	520.0	0.0	2.300	0.0	0.0
0.600	520.0	0.0	1.500	520.0	0.0	2.400	0.0	0.0
0.700	520.0	0.0	1.600	520.0	0.0	2.500	0.0	0.0
0.800	520.0	0.0	1.680	520.0	0.0			

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

Simulation Criteria

Areal Reduction Factor	1.000	Additional Flow - % of Total Flow	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 Offline Controls 0 Number of Time/Area Diagrams 0
Number of Online Controls 2 Number of Storage Structures 2 Number of Real Time Controls 0

Synthetic Rainfall Details

Rainfall Model	FSR	M5-60 (mm)	17.900
Region	Scotland and Ireland	Ratio R	0.250
Cv (Summer)	0.750		
Cv (Winter)	0.840		

Margin for Flood Risk Warning (mm) 300.0 DVD Status OFF
Analysis Timestep Fine Inertia Status OFF
DTS Status ON

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, 10080
Return Period(s) (years)	1, 30, 100
Climate Change (%)	20, 20, 20

PN	US/MH Name	Storm	Return Period	Climate Change	First (X) Surcharge	First (Y) Flood	First (Z) Overflow	Overflow Act.	Water Level (m)	Surcharged Depth (m)	Flooded Volume (m³)
S1.000	S1	15 Winter	1	+20%	100/15 Summer				67.469	-0.176	0.000
S2.000	S2	15 Winter	1	+20%	30/15 Summer				66.622	-0.143	0.000
S1.001	S3	15 Winter	1	+20%	30/15 Summer				66.222	-0.140	0.000
S3.000	S4	15 Winter	1	+20%	100/15 Winter				67.278	-0.167	0.000
S4.000	S5	15 Winter	1	+20%	100/15 Summer				66.916	-0.179	0.000
S3.001	S6	15 Winter	1	+20%	100/15 Summer				66.921	-0.123	0.000
S1.002	S7	15 Winter	1	+20%	30/15 Summer				65.967	-0.078	0.000
S1.003	S8	15 Winter	1	+20%	30/15 Summer				65.929	-0.062	0.000
S1.004	S9	15 Winter	1	+20%	30/15 Summer				65.840	0.000	0.000
S1.005	S10	15 Winter	1	+20%	30/15 Summer				65.741	-0.066	0.000
S1.006	S11	15 Winter	1	+20%	30/15 Winter				65.612	-0.153	0.000
S5.000	S12	15 Winter	1	+20%	30/15 Summer				64.620	-0.105	0.000
S1.007	S13	15 Winter	1	+20%	30/15 Winter				64.137	-0.167	0.000
S1.008	S14	15 Winter	1	+20%	30/15 Summer				62.205	-0.162	0.000
S1.009	S15	15 Winter	1	+20%	30/15 Summer	100/15 Summer			59.188	-0.071	0.000
S6.000	S16	15 Winter	1	+20%	100/15 Summer				62.245	-0.130	0.000
S1.010	S17	15 Winter	1	+20%	30/15 Summer				58.929	-0.130	0.000
S7.000	S18	15 Winter	1	+20%					59.069	-0.156	0.000
S7.001	S19	15 Winter	1	+20%	30/15 Summer				57.706	-0.132	0.000
S7.002	S20	15 Winter	1	+20%	30/15 Summer				57.164	-0.135	0.000
S1.011	S21	15 Winter	1	+20%	30/15 Summer				56.873	-0.098	0.000
S8.000	S22	15 Winter	1	+20%	30/15 Summer				65.979	-0.146	0.000
S8.001	S23	15 Winter	1	+20%	30/15 Summer				65.767	-0.117	0.000
S8.002	S24	15 Winter	1	+20%	30/15 Summer	100/15 Summer			64.061	-0.104	0.000
S8.003	S25	15 Winter	1	+20%	30/15 Summer				60.798	-0.066	0.000
S8.004	S26	15 Winter	1	+20%					60.610	-0.191	0.000
S9.000	S27	15 Winter	1	+20%					62.252	-0.173	0.000

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

PN	US/MH Name	Flow / Cap.	Overflow (l/s)	Half Drain Time (mins)	Pipe Flow (l/s)	Status	Level Exceeded
S1.000	S1	0.11			8.9	OK	
S2.000	S2	0.28			13.9	OK	
S1.001	S3	0.53			39.4	OK	
S3.000	S4	0.15			9.0	OK	
S4.000	S5	0.01			0.2	OK	
S3.001	S6	0.42			14.0	OK	
S1.002	S7	0.88			54.2	OK	
S1.003	S8	0.83			59.2	OK	
S1.004	S9	1.02			57.4	OK	
S1.005	S10	0.97			57.1	OK	
S1.006	S11	0.47			71.7	OK	
S5.000	S12	0.55			19.3	OK	
S1.007	S13	0.41			90.4	OK	
S1.008	S14	0.43			104.2	OK	
S1.009	S15	0.93			103.7	OK	4
S6.000	S16	0.37			39.1	OK	
S1.010	S17	0.60			143.4	OK	
S7.000	S18	0.21			19.5	OK	
S7.001	S19	0.35			19.6	OK	
S7.002	S20	0.34			19.6	OK	
S1.011	S21	0.79			164.9	OK	
S8.000	S22	0.27			12.9	OK	
S8.001	S23	0.45			33.0	OK	
S8.002	S24	0.55			57.4	OK	3
S8.003	S25	0.95			59.7	OK	
S8.004	S26	0.28			60.3	OK	
S9.000	S27	0.12			19.3	OK	

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

PN	US/MH Name	Storm	Return Period	Climate Change	First (X) Surcharge	First (Y) Flood	First (Z) Overflow	Overflow Act.	Water Level (m)	Surcharged Depth (m)
S9.001	S28	15 Winter	1	+20%					58.168	-0.157
S8.005	S29	15 Winter	1	+20%	100/15 Summer				56.560	-0.168
S1.012	S30	15 Winter	1	+20%	30/15 Summer				55.850	-0.138
S1.013	S31	360 Winter	1	+20%	1/60 Winter				55.722	0.154
S1.014	S32	240 Winter	1	+20%	30/15 Summer				55.169	-0.186
S10.000	S33	15 Winter	1	+20%					61.599	-0.146
S11.000	S34	15 Summer	1	+20%	30/15 Summer				59.401	-0.194
S11.001	S35	15 Winter	1	+20%	30/15 Summer	100/15 Winter			59.165	-0.133
S12.000	S36	15 Summer	1	+20%	100/15 Winter				60.364	-0.181
S12.001	S37	15 Summer	1	+20%	100/15 Summer				60.027	-0.177
S12.002	S38	15 Winter	1	+20%	100/15 Summer				59.823	-0.174
S11.002	S39	15 Winter	1	+20%	30/15 Summer				59.133	-0.083
S11.003	S40	15 Winter	1	+20%	30/15 Summer				59.077	-0.066
S11.004	S41	15 Winter	1	+20%	30/15 Summer				59.020	-0.096
S10.001	S42	15 Winter	1	+20%	30/15 Summer				57.585	-0.152
S1.015	S43	15 Winter	1	+20%	30/15 Summer				55.158	-0.113
S1.016	S44	15 Winter	1	+20%	30/15 Summer				55.054	-0.137
S13.000	S45	15 Winter	1	+20%					58.505	-0.190
S13.001	S46	15 Winter	1	+20%					58.053	-0.185
S13.002	S47	15 Winter	1	+20%					57.568	-0.176
S13.003	S48	15 Winter	1	+20%					57.280	-0.168
S13.004	S49	15 Winter	1	+20%	100/15 Summer				56.694	-0.137
S14.000	S50	15 Winter	1	+20%	30/15 Summer				55.460	-0.145
S14.001	S51	15 Winter	1	+20%	30/15 Summer				55.372	-0.138
S14.002	S52	15 Winter	1	+20%	30/15 Summer				55.325	-0.134
S14.003	S53	15 Winter	1	+20%	30/15 Summer				55.287	-0.129
S14.004	S54	15 Winter	1	+20%	30/15 Summer				55.257	-0.110
S13.005	S55	15 Winter	1	+20%	30/15 Summer				55.100	-0.116
S13.006	S56	480 Winter	1	+20%	30/15 Summer				55.028	-0.011
S1.017	S57	480 Winter	1	+20%	1/240 Winter				55.026	0.033
S1.018	S58	480 Winter	1	+20%	1/30 Winter				55.023	0.191

PN	US/MH Name	Flooded Volume (m^3)	Flow / Cap.	Overflow (l/s)	Half Drain Time (mins)	Pipe Flow (l/s)	Status	Level Exceeded
S9.001	S28	0.000	0.20			19.3	OK	
S8.005	S29	0.000	0.40			75.3	OK	
S1.012	S30	0.000	0.93			235.3	OK	
S1.013	S31	0.000	0.28		192	20.2	SURCHARGED	
S1.014	S32	0.000	0.31			20.5	OK	
S10.000	S33	0.000	0.27			30.9	OK	
S11.000	S34	0.000	0.05			2.8	OK	
S11.001	S35	0.000	0.28			9.2	OK	1
S12.000	S36	0.000	0.08			6.6	OK	
S12.001	S37	0.000	0.10			6.6	OK	
S12.002	S38	0.000	0.12			10.3	OK	
S11.002	S39	0.000	0.72			23.1	OK	
S11.003	S40	0.000	0.83			22.8	OK	
S11.004	S41	0.000	0.61			44.5	OK	
S10.001	S42	0.000	0.49			87.4	OK	
S1.015	S43	0.000	0.82			91.0	OK	

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

PN	US/MH Name	Flooded Volume (m^3)	Flow / Cap.	Overflow (l/s)	Half Drain Time (mins)	Pipe Flow (l/s)	Status	Level Exceeded
S1.016	S44	0.000	0.71			90.2	OK	
S13.000	S45	0.000	0.06			5.5	OK	
S13.001	S46	0.000	0.07			6.9	OK	
S13.002	S47	0.000	0.11			8.1	OK	
S13.003	S48	0.000	0.14			14.0	OK	
S13.004	S49	0.000	0.32			25.9	OK	
S14.000	S50	0.000	0.27			9.0	OK	
S14.001	S51	0.000	0.31			9.5	OK	
S14.002	S52	0.000	0.34			10.1	OK	
S14.003	S53	0.000	0.37			11.2	OK	
S14.004	S54	0.000	0.51			17.4	OK	
S13.005	S55	0.000	0.68			49.0	OK	
S13.006	S56	0.000	0.16			9.8	OK	
S1.017	S57	0.000	0.36			46.9	SURCHARGED	
S1.018	S58	0.000	0.58		216	30.4	SURCHARGED	

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

Simulation Criteria

Areal Reduction Factor	1.000	Additional Flow - % of Total Flow	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 Offline Controls 0 Number of Time/Area Diagrams 0
Number of Online Controls 2 Number of Storage Structures 2 Number of Real Time Controls 0

Synthetic Rainfall Details

Rainfall Model	FSR	M5-60 (mm) 17.900	Cv (Summer) 0.750
Region	Scotland and Ireland	Ratio R 0.250	Cv (Winter) 0.840

Margin for Flood Risk Warning (mm) 300.0 DVD Status OFF
Analysis Timestep Fine Inertia Status OFF
DTS Status ON

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, 10080
Return Period(s) (years)	1, 30, 100
Climate Change (%)	20, 20, 20

PN	US/MH Name	Storm	Return Period	Climate Change	First (X) Surcharge	First (Y) Flood	First (Z) Overflow	Overflow Act.	Water Level (m)	Surcharged Depth (m)	Flooded Volume (m³)
S1.000	S1	15 Winter	30	+20%	100/15 Summer				67.495	-0.150	0.000
S2.000	S2	15 Winter	30	+20%	30/15 Summer				67.202	0.437	0.000
S1.001	S3	15 Winter	30	+20%	30/15 Summer				67.125	0.763	0.000
S3.000	S4	15 Winter	30	+20%	100/15 Winter				67.310	-0.135	0.000
S4.000	S5	15 Winter	30	+20%	100/15 Summer				67.013	-0.082	0.000
S3.001	S6	15 Winter	30	+20%	100/15 Summer				67.014	-0.030	0.000
S1.002	S7	15 Winter	30	+20%	30/15 Summer				66.826	0.782	0.000
S1.003	S8	15 Winter	30	+20%	30/15 Summer				66.662	0.671	0.000
S1.004	S9	15 Winter	30	+20%	30/15 Summer				66.272	0.432	0.000
S1.005	S10	15 Winter	30	+20%	30/15 Summer				66.044	0.238	0.000
S1.006	S11	15 Winter	30	+20%	30/15 Winter				65.820	0.055	0.000
S5.000	S12	15 Winter	30	+20%	30/15 Summer				64.821	0.096	0.000
S1.007	S13	15 Winter	30	+20%	30/15 Winter				64.432	0.128	0.000
S1.008	S14	15 Winter	30	+20%	30/15 Summer				63.196	0.829	0.000
S1.009	S15	15 Winter	30	+20%	30/15 Summer	100/15 Summer			61.138	1.879	0.000
S6.000	S16	15 Winter	30	+20%	100/15 Summer				62.312	-0.063	0.000
S1.010	S17	15 Winter	30	+20%	30/15 Summer				60.520	1.460	0.000
S7.000	S18	15 Winter	30	+20%					59.108	-0.117	0.000
S7.001	S19	15 Winter	30	+20%	30/15 Summer				58.077	0.238	0.000
S7.002	S20	15 Winter	30	+20%	30/15 Summer				57.902	0.604	0.000
S1.011	S21	15 Winter	30	+20%	30/15 Summer				57.803	0.832	0.000
S8.000	S22	15 Winter	30	+20%	30/15 Summer				66.285	0.160	0.000
S8.001	S23	15 Winter	30	+20%	30/15 Summer				66.239	0.354	0.000
S8.002	S24	15 Winter	30	+20%	30/15 Summer	100/15 Summer			64.910	0.744	0.000
S8.003	S25	15 Winter	30	+20%	30/15 Summer				61.011	0.146	0.000
S8.004	S26	15 Winter	30	+20%					60.662	-0.140	0.000
S9.000	S27	15 Winter	30	+20%					62.280	-0.145	0.000

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

PN	US/MH Name	Flow / Cap.	Overflow (l/s)	Half Drain Time (mins)	Pipe Flow (l/s)	Status	Level Exceeded
S1.000	S1	0.24			19.8	OK	
S2.000	S2	0.57			27.9	SURCHARGED	
S1.001	S3	0.96			71.6	SURCHARGED	
S3.000	S4	0.34			20.1	OK	
S4.000	S5	0.02			0.6	OK	
S3.001	S6	1.00			33.5	OK	
S1.002	S7	1.71			105.1	SURCHARGED	
S1.003	S8	1.64			116.4	SURCHARGED	
S1.004	S9	2.14			120.4	SURCHARGED	
S1.005	S10	2.04			120.4	SURCHARGED	
S1.006	S11	0.99			149.5	SURCHARGED	
S5.000	S12	1.21			42.1	SURCHARGED	
S1.007	S13	0.84			186.7	SURCHARGED	
S1.008	S14	0.84			204.0	SURCHARGED	
S1.009	S15	1.91			214.5	SURCHARGED	4
S6.000	S16	0.82			86.3	OK	
S1.010	S17	1.14			271.4	SURCHARGED	
S7.000	S18	0.46			43.4	OK	
S7.001	S19	0.73			40.6	SURCHARGED	
S7.002	S20	0.57			33.1	SURCHARGED	
S1.011	S21	1.49			308.5	SURCHARGED	
S8.000	S22	0.56			26.7	SURCHARGED	
S8.001	S23	0.92			67.2	SURCHARGED	
S8.002	S24	1.08			112.5	SURCHARGED	3
S8.003	S25	1.87			117.6	SURCHARGED	
S8.004	S26	0.56			117.6	OK	
S9.000	S27	0.28			42.9	OK	

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

PN	US/MH Name	Storm	Return Period	Climate Change	First (X) Surcharge	First (Y) Flood	First (Z) Overflow	Overflow Act.	Water Level (m)	Surcharged Depth (m)
S9.001	S28	15 Winter	30	+20%					58.205	-0.120
S8.005	S29	15 Winter	30	+20%	100/15 Summer				56.703	-0.025
S1.012	S30	600 Winter	30	+20%	30/15 Summer				56.408	0.420
S1.013	S31	600 Winter	30	+20%	1/60 Winter				56.402	0.834
S1.014	S32	600 Winter	30	+20%	30/15 Summer				55.815	0.459
S10.000	S33	15 Winter	30	+20%					61.646	-0.099
S11.000	S34	15 Winter	30	+20%	30/15 Summer				59.928	0.333
S11.001	S35	15 Winter	30	+20%	30/15 Summer	100/15 Winter			59.922	0.624
S12.000	S36	15 Winter	30	+20%	100/15 Winter				60.385	-0.160
S12.001	S37	15 Summer	30	+20%	100/15 Summer				60.052	-0.153
S12.002	S38	15 Winter	30	+20%	100/15 Summer				59.925	-0.071
S11.002	S39	15 Winter	30	+20%	30/15 Summer				59.892	0.677
S11.003	S40	15 Winter	30	+20%	30/15 Summer				59.790	0.647
S11.004	S41	15 Winter	30	+20%	30/15 Summer				59.723	0.607
S10.001	S42	15 Winter	30	+20%	30/15 Summer				57.790	0.053
S1.015	S43	600 Winter	30	+20%	30/15 Summer				55.795	0.524
S1.016	S44	600 Winter	30	+20%	30/15 Summer				55.781	0.590
S13.000	S45	15 Winter	30	+20%					58.524	-0.171
S13.001	S46	15 Winter	30	+20%					58.076	-0.163
S13.002	S47	15 Summer	30	+20%					57.597	-0.148
S13.003	S48	15 Summer	30	+20%					57.319	-0.129
S13.004	S49	15 Winter	30	+20%	100/15 Summer				56.768	-0.063
S14.000	S50	15 Winter	30	+20%	30/15 Summer				55.874	0.269
S14.001	S51	15 Winter	30	+20%	30/15 Summer				55.845	0.335
S14.002	S52	15 Winter	30	+20%	30/15 Summer				55.826	0.367
S14.003	S53	15 Winter	30	+20%	30/15 Summer				55.810	0.394
S14.004	S54	15 Winter	30	+20%	30/15 Summer				55.792	0.425
S13.005	S55	600 Winter	30	+20%	30/15 Summer				55.766	0.550
S13.006	S56	600 Winter	30	+20%	30/15 Summer				55.763	0.724
S1.017	S57	600 Winter	30	+20%	1/240 Winter				55.762	0.769
S1.018	S58	600 Winter	30	+20%	1/30 Winter				55.759	0.927

PN	US/MH Name	Flooded Volume (m^3)	Flow / Cap.	Overflow (l/s)	Half Drain Time (mins)	Pipe Flow (l/s)	Status	Level Exceeded
S9.001	S28	0.000	0.44			42.8	OK	
S8.005	S29	0.000	0.81			154.6	OK	
S1.012	S30	0.000	0.35			87.9	SURCHARGED	
S1.013	S31	0.000	0.28		430	20.2	SURCHARGED	
S1.014	S32	0.000	0.31			20.9	SURCHARGED	
S10.000	S33	0.000	0.60			68.7	OK	
S11.000	S34	0.000	0.12			7.3	SURCHARGED	
S11.001	S35	0.000	0.72			23.3	SURCHARGED	1
S12.000	S36	0.000	0.19			14.6	OK	
S12.001	S37	0.000	0.23			14.6	OK	
S12.002	S38	0.000	0.29			25.2	OK	
S11.002	S39	0.000	1.38			44.1	SURCHARGED	
S11.003	S40	0.000	1.74			47.6	SURCHARGED	
S11.004	S41	0.000	1.18			86.2	SURCHARGED	
S10.001	S42	0.000	1.03			185.1	SURCHARGED	
S1.015	S43	0.000	0.45			49.8	SURCHARGED	

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

PN	US/MH Name	Flooded Volume (m^3)	Flow / Cap.	Overflow (l/s)	Half Drain Time (mins)	Pipe Flow (l/s)	Status	Level Exceeded
S1.016	S44	0.000	0.39			49.5	SURCHARGED	
S13.000	S45	0.000	0.13			12.3	OK	
S13.001	S46	0.000	0.17			16.0	OK	
S13.002	S47	0.000	0.26			19.6	OK	
S13.003	S48	0.000	0.38			36.3	OK	
S13.004	S49	0.000	0.86			69.1	OK	
S14.000	S50	0.000	0.55			18.0	SURCHARGED	
S14.001	S51	0.000	0.56			17.1	SURCHARGED	
S14.002	S52	0.000	0.70			20.7	SURCHARGED	
S14.003	S53	0.000	0.80			24.3	SURCHARGED	
S14.004	S54	0.000	1.01			34.4	SURCHARGED	
S13.005	S55	0.000	0.22			15.9	SURCHARGED	
S13.006	S56	0.000	0.26			15.7	SURCHARGED	
S1.017	S57	0.000	0.50			65.0	SURCHARGED	
S1.018	S58	0.000	0.58		430	30.5	SURCHARGED	

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

Simulation Criteria

Areal Reduction Factor	1.000	Additional Flow - % of Total Flow	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 Offline Controls 0 Number of Time/Area Diagrams 0
Number of Online Controls 2 Number of Storage Structures 2 Number of Real Time Controls 0

Synthetic Rainfall Details

Rainfall Model	FSR	M5-60 (mm) 17.900	Cv (Summer) 0.750
Region	Scotland and Ireland	Ratio R 0.250	Cv (Winter) 0.840

Margin for Flood Risk Warning (mm) 300.0 DVD Status OFF
Analysis Timestep Fine Inertia Status OFF
DTS Status ON

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, 10080
Return Period(s) (years)	1, 30, 100
Climate Change (%)	20, 20, 20

PN	US/MH Name	Storm	Return Period	Climate Change	First (X) Surcharge	First (Y) Flood	First (Z) Overflow	Overflow Act.	Water Level (m)	Surcharged Depth (m)	Flooded Volume (m³)
S1.000	S1	15 Winter	100	+20%	100/15 Summer				67.888	0.243	0.000
S2.000	S2	15 Winter	100	+20%	30/15 Summer				67.946	1.181	0.000
S1.001	S3	15 Winter	100	+20%	30/15 Summer				67.864	1.502	0.000
S3.000	S4	15 Winter	100	+20%	100/15 Winter				67.616	0.171	0.000
S4.000	S5	15 Winter	100	+20%	100/15 Summer				67.582	0.487	0.000
S3.001	S6	15 Winter	100	+20%	100/15 Summer				67.588	0.544	0.000
S1.002	S7	15 Winter	100	+20%	30/15 Summer				67.547	1.502	0.000
S1.003	S8	15 Winter	100	+20%	30/15 Summer				67.388	1.397	0.000
S1.004	S9	15 Winter	100	+20%	30/15 Summer				67.014	1.173	0.000
S1.005	S10	15 Winter	100	+20%	30/15 Summer				66.797	0.990	0.000
S1.006	S11	15 Winter	100	+20%	30/15 Winter				66.588	0.823	0.000
S5.000	S12	15 Winter	100	+20%	30/15 Summer				65.272	0.547	0.000
S1.007	S13	15 Winter	100	+20%	30/15 Winter				65.167	0.863	0.000
S1.008	S14	15 Winter	100	+20%	30/15 Summer				63.887	1.520	0.000
S1.009	S15	15 Winter	100	+20%	30/15 Summer	100/15 Summer			61.673	2.414	2.960
S6.000	S16	15 Winter	100	+20%	100/15 Summer				63.290	0.915	0.000
S1.010	S17	15 Winter	100	+20%	30/15 Summer				61.199	2.140	0.000
S7.000	S18	15 Winter	100	+20%					59.126	-0.099	0.000
S7.001	S19	15 Winter	100	+20%	30/15 Summer				58.638	0.800	0.000
S7.002	S20	15 Winter	100	+20%	30/15 Summer				58.316	1.017	0.000
S1.011	S21	15 Winter	100	+20%	30/15 Summer				58.138	1.168	0.000
S8.000	S22	15 Winter	100	+20%	30/15 Summer				67.112	0.987	0.000
S8.001	S23	15 Winter	100	+20%	30/15 Summer				67.059	1.174	0.000
S8.002	S24	15 Winter	100	+20%	30/15 Summer	100/15 Summer			65.372	1.207	2.218
S8.003	S25	15 Winter	100	+20%	30/15 Summer				61.045	0.181	0.000
S8.004	S26	15 Winter	100	+20%					60.669	-0.132	0.000
S9.000	S27	15 Winter	100	+20%					62.293	-0.132	0.000

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

PN	US/MH Name	Flow / Cap.	Overflow (l/s)	Half Drain Time (mins)	Pipe Flow (l/s)	Status	Level Exceeded
S1.000	S1	0.31			24.9	SURCHARGED	
S2.000	S2	0.58			28.4	FLOOD RISK	
S1.001	S3	1.11			83.2	SURCHARGED	
S3.000	S4	0.44			26.1	SURCHARGED	
S4.000	S5	0.14			4.1	SURCHARGED	
S3.001	S6	1.17			39.2	SURCHARGED	
S1.002	S7	1.76			108.1	SURCHARGED	
S1.003	S8	1.69			120.5	SURCHARGED	
S1.004	S9	2.16			121.3	SURCHARGED	
S1.005	S10	2.02			119.6	SURCHARGED	
S1.006	S11	1.04			156.6	SURCHARGED	
S5.000	S12	1.45			50.7	SURCHARGED	
S1.007	S13	0.86			190.5	SURCHARGED	
S1.008	S14	0.88			213.2	FLOOD RISK	
S1.009	S15	2.11			236.4	FLOOD	4
S6.000	S16	0.88			92.9	SURCHARGED	
S1.010	S17	1.21			287.4	SURCHARGED	
S7.000	S18	0.60			56.4	OK	
S7.001	S19	0.82			45.3	SURCHARGED	
S7.002	S20	0.75			43.5	SURCHARGED	
S1.011	S21	1.62			336.7	SURCHARGED	
S8.000	S22	0.58			27.5	FLOOD RISK	
S8.001	S23	0.97			71.3	FLOOD RISK	
S8.002	S24	1.15			119.2	FLOOD	3
S8.003	S25	2.00			126.0	SURCHARGED	
S8.004	S26	0.60			126.5	OK	
S9.000	S27	0.36			55.7	OK	

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

PN	US/MH Name	Storm	Return Period	Climate Change	First (X) Surcharge	First (Y) Flood	First (Z) Overflow	Overflow Act.	Water Level (m)	Surcharged Depth (m)
S9.001	S28	15 Winter	100	+20%					58.223	-0.102
S8.005	S29	15 Winter	100	+20%	100/15 Summer				56.928	0.200
S1.012	S30	480 Winter	100	+20%	30/15 Summer				56.814	0.826
S1.013	S31	480 Winter	100	+20%	1/60 Winter				56.808	1.240
S1.014	S32	720 Winter	100	+20%	30/15 Summer				56.179	0.824
S10.000	S33	15 Winter	100	+20%					61.670	-0.075
S11.000	S34	15 Winter	100	+20%	30/15 Summer				60.516	0.921
S11.001	S35	15 Winter	100	+20%	30/15 Summer	100/15 Winter			60.501	1.203
S12.000	S36	15 Winter	100	+20%	100/15 Winter				60.563	0.018
S12.001	S37	15 Winter	100	+20%	100/15 Summer				60.547	0.343
S12.002	S38	15 Winter	100	+20%	100/15 Summer				60.541	0.545
S11.002	S39	15 Winter	100	+20%	30/15 Summer				60.512	1.297
S11.003	S40	15 Winter	100	+20%	30/15 Summer				60.445	1.302
S11.004	S41	15 Winter	100	+20%	30/15 Summer				60.403	1.287
S10.001	S42	15 Winter	100	+20%	30/15 Summer				58.210	0.473
S1.015	S43	720 Winter	100	+20%	30/15 Summer				56.159	0.888
S1.016	S44	720 Winter	100	+20%	30/15 Summer				56.144	0.953
S13.000	S45	15 Winter	100	+20%					58.532	-0.163
S13.001	S46	15 Winter	100	+20%					58.085	-0.154
S13.002	S47	15 Summer	100	+20%					57.609	-0.135
S13.003	S48	15 Summer	100	+20%					57.334	-0.114
S13.004	S49	15 Winter	100	+20%	100/15 Summer				57.135	0.304
S14.000	S50	15 Winter	100	+20%	30/15 Summer				56.288	0.683
S14.001	S51	15 Winter	100	+20%	30/15 Summer				56.256	0.746
S14.002	S52	15 Winter	100	+20%	30/15 Summer				56.234	0.775
S14.003	S53	15 Winter	100	+20%	30/15 Summer				56.213	0.797
S14.004	S54	15 Winter	100	+20%	30/15 Summer				56.188	0.821
S13.005	S55	720 Winter	100	+20%	30/15 Summer				56.130	0.913
S13.006	S56	720 Winter	100	+20%	30/15 Summer				56.126	1.087
S1.017	S57	720 Winter	100	+20%	1/240 Winter				56.124	1.130
S1.018	S58	720 Winter	100	+20%	1/30 Winter				56.121	1.289

PN	US/MH Name	Flooded Volume (m^3)	Flow / Cap.	Overflow (l/s)	Half Drain Time (mins)	Pipe Flow (l/s)	Status	Level Exceeded
S9.001	S28	0.000	0.58			55.6	OK	
S8.005	S29	0.000	0.92			174.6	SURCHARGED	
S1.012	S30	0.000	0.50			127.3	SURCHARGED	
S1.013	S31	0.000	0.28		448	20.2	SURCHARGED	
S1.014	S32	0.000	0.31			21.0	SURCHARGED	
S10.000	S33	0.000	0.77			89.2	OK	
S11.000	S34	0.000	0.15			9.2	FLOOD RISK	
S11.001	S35	1.235	0.92			29.8	FLOOD	1
S12.000	S36	0.000	0.24			18.9	SURCHARGED	
S12.001	S37	0.000	0.28			17.8	SURCHARGED	
S12.002	S38	0.000	0.31			27.4	SURCHARGED	
S11.002	S39	0.000	1.75			55.9	FLOOD RISK	
S11.003	S40	0.000	2.18			59.7	FLOOD RISK	
S11.004	S41	0.000	1.28			93.7	SURCHARGED	
S10.001	S42	0.000	1.20			216.1	SURCHARGED	
S1.015	S43	0.000	0.49			53.9	SURCHARGED	

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

PN	US/MH Name	Flooded Volume (m^3)	Flow / Cap.	Overflow (l/s)	Half Drain Time (mins)	Pipe Flow (l/s)	Status	Level Exceeded
S1.016	S44	0.000	0.42			53.7	SURCHARGED	
S13.000	S45	0.000	0.17			16.0	OK	
S13.001	S46	0.000	0.22			20.8	OK	
S13.002	S47	0.000	0.33			25.5	OK	
S13.003	S48	0.000	0.49			47.1	OK	
S13.004	S49	0.000	0.99			79.0	SURCHARGED	
S14.000	S50	0.000	0.58			19.1	SURCHARGED	
S14.001	S51	0.000	0.65			20.0	FLOOD RISK	
S14.002	S52	0.000	0.84			25.0	FLOOD RISK	
S14.003	S53	0.000	1.01			30.7	FLOOD RISK	
S14.004	S54	0.000	1.25			42.8	SURCHARGED	
S13.005	S55	0.000	0.23			16.9	SURCHARGED	
S13.006	S56	0.000	0.27			16.8	FLOOD RISK	
S1.017	S57	0.000	0.55			70.3	SURCHARGED	
S1.018	S58	0.000	0.58		660	30.5	SURCHARGED	

Appendix 5:

ATTENUATION ESTIMATES, STORAGE TANK SIZING

CATCHMENT A

Summary of Results for 100 year Return Period (+20%)

Half Drain Time : 453 minutes.

Storm Event	Max Level (m)	Max Depth (m)	Max Infiltration (l/s)	Max Control (l/s)	Max Σ Outflow (l/s)	Max Volume (m³)	Status
15 min Summer	56.011	0.447	0.0	20.2	20.2	340.0	O K
30 min Summer	56.185	0.621	0.0	20.2	20.2	472.3	O K
60 min Summer	56.360	0.796	0.0	20.2	20.2	605.4	O K
120 min Summer	56.538	0.974	0.0	20.2	20.2	740.8	O K
180 min Summer	56.638	1.074	0.0	20.2	20.2	817.1	O K
240 min Summer	56.701	1.137	0.0	20.2	20.2	864.5	O K
360 min Summer	56.761	1.197	0.0	20.2	20.2	910.6	O K
480 min Summer	56.783	1.219	0.0	20.2	20.2	926.8	O K
600 min Summer	56.793	1.229	0.0	20.2	20.2	934.7	O K
720 min Summer	56.796	1.232	0.0	20.2	20.2	936.9	O K
960 min Summer	56.790	1.226	0.0	20.2	20.2	932.0	O K
1440 min Summer	56.749	1.185	0.0	20.2	20.2	901.0	O K
2160 min Summer	56.652	1.088	0.0	20.2	20.2	827.6	O K
2880 min Summer	56.524	0.960	0.0	20.2	20.2	729.7	O K
4320 min Summer	56.298	0.734	0.0	20.2	20.2	557.8	O K
5760 min Summer	56.119	0.555	0.0	20.2	20.2	421.8	O K
7200 min Summer	55.989	0.425	0.0	20.1	20.1	323.5	O K
8640 min Summer	55.899	0.335	0.0	19.7	19.7	255.1	O K
10080 min Summer	55.838	0.274	0.0	19.0	19.0	208.3	O K
15 min Winter	56.067	0.503	0.0	20.2	20.2	382.6	O K
30 min Winter	56.264	0.700	0.0	20.2	20.2	532.2	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
15 min Summer	90.250	0.0	349.2	25
30 min Summer	63.260	0.0	492.3	39
60 min Summer	41.518	0.0	655.2	68
120 min Summer	26.558	0.0	839.2	126
180 min Summer	20.289	0.0	962.1	186
240 min Summer	16.721	0.0	1057.5	244
360 min Summer	12.702	0.0	1205.2	360
480 min Summer	10.437	0.0	1320.7	432
600 min Summer	8.959	0.0	1417.0	494
720 min Summer	7.906	0.0	1500.5	560
960 min Summer	6.490	0.0	1642.0	694
1440 min Summer	4.911	0.0	1861.7	976
2160 min Summer	3.708	0.0	2119.1	1392
2880 min Summer	3.035	0.0	2312.2	1784
4320 min Summer	2.286	0.0	2609.4	2512
5760 min Summer	1.869	0.0	2850.2	3224
7200 min Summer	1.598	0.0	3046.8	3896
8640 min Summer	1.407	0.0	3217.5	4584
10080 min Summer	1.263	0.0	3368.1	5248
15 min Winter	90.250	0.0	392.0	25
30 min Winter	63.260	0.0	552.2	39

Summary of Results for 100 year Return Period (+20%)

Storm Event	Max Level (m)	Max Depth (m)	Max Infiltration (l/s)	Max Control (l/s)	Max Σ Outflow (l/s)	Max Volume (m³)	Status
60 min Winter	56.464	0.900	0.0	20.2	20.2	684.1	O K
120 min Winter	56.674	1.110	0.0	20.2	20.2	843.8	O K
180 min Winter	56.789	1.225	0.0	20.2	20.2	931.5	O K
240 min Winter	56.861	1.297	0.0	20.2	20.2	986.0	O K
360 min Winter	56.939	1.375	0.0	20.2	20.2	1045.3	O K
480 min Winter	56.970	1.406	0.0	20.2	20.2	1069.0	O K
600 min Winter	56.976	1.412	0.0	20.2	20.2	1074.0	O K
720 min Winter	56.975	1.411	0.0	20.2	20.2	1073.1	O K
960 min Winter	56.962	1.398	0.0	20.2	20.2	1063.2	O K
1440 min Winter	56.891	1.327	0.0	20.2	20.2	1009.1	O K
2160 min Winter	56.734	1.170	0.0	20.2	20.2	889.5	O K
2880 min Winter	56.516	0.952	0.0	20.2	20.2	724.3	O K
4320 min Winter	56.161	0.597	0.0	20.2	20.2	454.1	O K
5760 min Winter	55.937	0.373	0.0	19.9	19.9	283.5	O K
7200 min Winter	55.816	0.252	0.0	18.7	18.7	191.7	O K
8640 min Winter	55.764	0.200	0.0	17.4	17.4	151.7	O K
10080 min Winter	55.744	0.180	0.0	15.7	15.7	137.1	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
60 min Winter	41.518	0.0	734.3	68
120 min Winter	26.558	0.0	940.3	126
180 min Winter	20.289	0.0	1077.9	182
240 min Winter	16.721	0.0	1184.8	240
360 min Winter	12.702	0.0	1350.2	352
480 min Winter	10.437	0.0	1479.4	460
600 min Winter	8.959	0.0	1587.3	558
720 min Winter	7.906	0.0	1680.8	584
960 min Winter	6.490	0.0	1839.1	738
1440 min Winter	4.911	0.0	2084.6	1054
2160 min Winter	3.708	0.0	2373.6	1516
2880 min Winter	3.035	0.0	2590.1	1912
4320 min Winter	2.286	0.0	2923.6	2636
5760 min Winter	1.869	0.0	3192.5	3280
7200 min Winter	1.598	0.0	3412.8	3888
8640 min Winter	1.407	0.0	3604.2	4416
10080 min Winter	1.263	0.0	3773.6	5152

Rainfall Details

Rainfall Model	FSR	Winter Storms	Yes
Return Period (years)	100	Cv (Summer)	0.750
Region	Scotland and Ireland	Cv (Winter)	0.840
M5-60 (mm)	17.700	Shortest Storm (mins)	15
Ratio R	0.250	Longest Storm (mins)	10080
Summer Storms	Yes	Climate Change %	+20

Time Area Diagram

Total Area (ha) 2.120

Time (mins) From:	To:	Area (ha)	Time (mins) From:	To:	Area (ha)	Time (mins) From:	To:	Area (ha)
0	4	0.707	4	8	0.707	8	12	0.707

Model Details

Storage is Online Cover Level (m) 57.600

Cellular Storage Structure

Invert Level (m) 55.564 Safety Factor 2.0
Infiltration Coefficient Base (m/hr) 0.00000 Porosity 0.67
Infiltration Coefficient Side (m/hr) 0.00000

Depth (m)	Area (m²)	Inf. Area (m²)	Depth (m)	Area (m²)	Inf. Area (m²)	Depth (m)	Area (m²)	Inf. Area (m²)
0.000	1135.0	0.0	0.900	1135.0	0.0	1.681	0.0	0.0
0.100	1135.0	0.0	1.000	1135.0	0.0	1.900	0.0	0.0
0.200	1135.0	0.0	1.100	1135.0	0.0	2.000	0.0	0.0
0.300	1135.0	0.0	1.200	1135.0	0.0	2.100	0.0	0.0
0.400	1135.0	0.0	1.300	1135.0	0.0	2.200	0.0	0.0
0.500	1135.0	0.0	1.400	1135.0	0.0	2.300	0.0	0.0
0.600	1135.0	0.0	1.500	1135.0	0.0	2.400	0.0	0.0
0.700	1135.0	0.0	1.600	1135.0	0.0	2.500	0.0	0.0
0.800	1135.0	0.0	1.680	1135.0	0.0			

Hydro-Brake® Optimum Outflow Control

Unit Reference	MD-SHE-0190-2020-1680-2020
Design Head (m)	1.680
Design Flow (l/s)	20.2
Flush-Flo™	Calculated
Objective	Minimise upstream storage
Application	Surface
Sump Available	Yes
Diameter (mm)	190
Invert Level (m)	55.564
Minimum Outlet Pipe Diameter (mm)	225
Suggested Manhole Diameter (mm)	1500

Control Points	Head (m)	Flow (l/s)	Control Points	Head (m)	Flow (l/s)
Design Point (Calculated)	1.680	20.2	Kick-Flo®	1.072	16.3
Flush-Flo™	0.495	20.2	Mean Flow over Head Range	-	17.5

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)	Depth (m)	Flow (l/s)
0.100	6.6	0.800	19.4	2.000	22.0	4.000	30.6	7.000	40.1
0.200	17.4	1.000	17.6	2.200	23.0	4.500	32.4	7.500	41.4
0.300	19.4	1.200	17.2	2.400	23.9	5.000	34.1	8.000	42.8
0.400	20.0	1.400	18.5	2.600	24.9	5.500	35.7	8.500	44.0
0.500	20.2	1.600	19.7	3.000	26.7	6.000	37.2	9.000	45.3
0.600	20.1	1.800	20.9	3.500	28.7	6.500	38.7	9.500	46.5

CATCHMENT B

Summary of Results for 100 year Return Period (+20%)

Half Drain Time : 465 minutes.

Storm Event	Max Level (m)	Max Depth (m)	Max Infiltration (l/s)	Max Control (l/s)	Max Σ Outflow (l/s)	Max Volume (m³)	Status
15 min Summer	55.023	0.415	0.0	10.4	10.4	180.9	O K
30 min Summer	55.185	0.577	0.0	10.5	10.5	251.3	O K
60 min Summer	55.347	0.739	0.0	10.5	10.5	322.0	O K
120 min Summer	55.512	0.904	0.0	10.5	10.5	393.8	O K
180 min Summer	55.604	0.996	0.0	10.5	10.5	433.9	O K
240 min Summer	55.664	1.056	0.0	10.5	10.5	460.1	O K
360 min Summer	55.725	1.117	0.0	10.5	10.5	486.5	O K
480 min Summer	55.746	1.138	0.0	10.5	10.5	495.5	O K
600 min Summer	55.755	1.147	0.0	10.5	10.5	499.4	O K
720 min Summer	55.757	1.149	0.0	10.5	10.5	500.5	O K
960 min Summer	55.751	1.143	0.0	10.5	10.5	497.7	O K
1440 min Summer	55.714	1.106	0.0	10.5	10.5	481.7	O K
2160 min Summer	55.622	1.014	0.0	10.5	10.5	441.5	O K
2880 min Summer	55.507	0.899	0.0	10.5	10.5	391.7	O K
4320 min Summer	55.303	0.695	0.0	10.5	10.5	302.7	O K
5760 min Summer	55.140	0.532	0.0	10.5	10.5	231.6	O K
7200 min Summer	55.019	0.411	0.0	10.4	10.4	178.9	O K
8640 min Summer	54.933	0.325	0.0	10.2	10.2	141.6	O K
10080 min Summer	54.872	0.264	0.0	9.8	9.8	114.8	O K
15 min Winter	55.075	0.467	0.0	10.5	10.5	203.6	O K
30 min Winter	55.258	0.650	0.0	10.5	10.5	283.2	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
15 min Summer	90.250	0.0	187.1	25
30 min Summer	63.260	0.0	263.4	40
60 min Summer	41.518	0.0	349.3	68
120 min Summer	26.558	0.0	447.3	126
180 min Summer	20.289	0.0	512.7	186
240 min Summer	16.721	0.0	563.5	244
360 min Summer	12.702	0.0	642.2	362
480 min Summer	10.437	0.0	703.6	452
600 min Summer	8.959	0.0	754.9	510
720 min Summer	7.906	0.0	799.4	574
960 min Summer	6.490	0.0	874.8	704
1440 min Summer	4.911	0.0	992.0	986
2160 min Summer	3.708	0.0	1128.0	1404
2880 min Summer	3.035	0.0	1230.9	1788
4320 min Summer	2.286	0.0	1389.4	2516
5760 min Summer	1.869	0.0	1516.8	3232
7200 min Summer	1.598	0.0	1621.5	3904
8640 min Summer	1.407	0.0	1712.5	4592
10080 min Summer	1.263	0.0	1793.0	5256
15 min Winter	90.250	0.0	209.9	25
30 min Winter	63.260	0.0	295.3	39

Summary of Results for 100 year Return Period (+20%)

Storm Event	Max Level (m)	Max Depth (m)	Max Infiltration (l/s)	Max Control (l/s)	Max Σ Outflow (l/s)	Max Volume (m³)	Status
60 min Winter	55.444	0.836	0.0	10.5	10.5	364.0	O K
120 min Winter	55.639	1.031	0.0	10.5	10.5	448.9	O K
180 min Winter	55.748	1.140	0.0	10.5	10.5	496.5	O K
240 min Winter	55.816	1.208	0.0	10.5	10.5	526.3	O K
360 min Winter	55.892	1.284	0.0	10.5	10.5	559.1	O K
480 min Winter	55.924	1.316	0.0	10.5	10.5	573.1	O K
600 min Winter	55.932	1.324	0.0	10.5	10.5	576.8	O K
720 min Winter	55.929	1.321	0.0	10.5	10.5	575.2	O K
960 min Winter	55.918	1.310	0.0	10.5	10.5	570.5	O K
1440 min Winter	55.856	1.248	0.0	10.5	10.5	543.4	O K
2160 min Winter	55.713	1.105	0.0	10.5	10.5	481.4	O K
2880 min Winter	55.513	0.905	0.0	10.5	10.5	394.2	O K
4320 min Winter	55.189	0.581	0.0	10.5	10.5	253.1	O K
5760 min Winter	54.979	0.371	0.0	10.4	10.4	161.7	O K
7200 min Winter	54.859	0.251	0.0	9.7	9.7	109.4	O K
8640 min Winter	54.792	0.184	0.0	9.0	9.0	80.1	O K
10080 min Winter	54.762	0.154	0.0	8.3	8.3	67.1	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
60 min Winter	41.518	0.0	391.4	68
120 min Winter	26.558	0.0	501.1	126
180 min Winter	20.289	0.0	574.4	182
240 min Winter	16.721	0.0	631.2	240
360 min Winter	12.702	0.0	719.3	352
480 min Winter	10.437	0.0	788.1	462
600 min Winter	8.959	0.0	845.6	566
720 min Winter	7.906	0.0	895.4	602
960 min Winter	6.490	0.0	979.8	748
1440 min Winter	4.911	0.0	1110.7	1062
2160 min Winter	3.708	0.0	1263.5	1524
2880 min Winter	3.035	0.0	1378.7	1932
4320 min Winter	2.286	0.0	1556.6	2640
5760 min Winter	1.869	0.0	1698.9	3288
7200 min Winter	1.598	0.0	1816.2	3960
8640 min Winter	1.407	0.0	1918.2	4584
10080 min Winter	1.263	0.0	2008.7	5152

Rainfall Details

Rainfall Model	FSR	Winter Storms	Yes
Return Period (years)	100	Cv (Summer)	0.750
Region	Scotland and Ireland	Cv (Winter)	0.840
M5-60 (mm)	17.700	Shortest Storm (mins)	15
Ratio R	0.250	Longest Storm (mins)	10080
Summer Storms	Yes	Climate Change %	+20

Time Area Diagram

Total Area (ha) 1.128

Time (mins) From:	To:	Area (ha)	Time (mins) From:	To:	Area (ha)	Time (mins) From:	To:	Area (ha)
0	4	0.376	4	8	0.376	8	12	0.376

Model Details

Storage is Online Cover Level (m) 56.600

Cellular Storage Structure

Invert Level (m) 54.608 Safety Factor 2.0
Infiltration Coefficient Base (m/hr) 0.00000 Porosity 0.67
Infiltration Coefficient Side (m/hr) 0.00000

Depth (m)	Area (m²)	Inf. Area (m²)	Depth (m)	Area (m²)	Inf. Area (m²)	Depth (m)	Area (m²)	Inf. Area (m²)
0.000	650.0	0.0	0.900	650.0	0.0	1.681	0.0	0.0
0.100	650.0	0.0	1.000	650.0	0.0	1.900	0.0	0.0
0.200	650.0	0.0	1.100	650.0	0.0	2.000	0.0	0.0
0.300	650.0	0.0	1.200	650.0	0.0	2.100	0.0	0.0
0.400	650.0	0.0	1.300	650.0	0.0	2.200	0.0	0.0
0.500	650.0	0.0	1.400	650.0	0.0	2.300	0.0	0.0
0.600	650.0	0.0	1.500	650.0	0.0	2.400	0.0	0.0
0.700	650.0	0.0	1.600	650.0	0.0	2.500	0.0	0.0
0.800	650.0	0.0	1.680	650.0	0.0			

Hydro-Brake® Optimum Outflow Control

Unit Reference	MD-SHE-0139-1050-1680-1050
Design Head (m)	1.680
Design Flow (l/s)	10.5
Flush-Flo™	Calculated
Objective	Minimise upstream storage
Application	Surface
Sump Available	Yes
Diameter (mm)	139
Invert Level (m)	54.608
Minimum Outlet Pipe Diameter (mm)	225
Suggested Manhole Diameter (mm)	1500

Control Points	Head (m)	Flow (l/s)	Control Points	Head (m)	Flow (l/s)
Design Point (Calculated)	1.680	10.5	Kick-Flo®	1.030	8.3
Flush-Flo™	0.490	10.5	Mean Flow over Head Range	-	9.2

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)	Depth (m)	Flow (l/s)
0.100	5.0	0.800	10.0	2.000	11.4	4.000	15.8	7.000	20.7
0.200	9.2	1.000	8.7	2.200	11.9	4.500	16.7	7.500	21.4
0.300	10.1	1.200	9.0	2.400	12.4	5.000	17.6	8.000	22.1
0.400	10.4	1.400	9.6	2.600	12.9	5.500	18.4	8.500	22.7
0.500	10.5	1.600	10.3	3.000	13.8	6.000	19.2	9.000	23.3
0.600	10.4	1.800	10.8	3.500	14.9	6.500	20.0	9.500	24.0