ROGER MULLARKEY & ASSOCIATES
CONSULTING STRUCTURAL and CIVIL ENGINEERS

ENGINEERING INFRASTRUCTURE REPORT & STORMWATER IMPACT ASSESSMENT for a Mixed-Used Development at Greenfields, Mantua Rd.(L6310), Swords, Co. Dublin

PROJECT: **GREENFIELDS LRD, SWORDS - 2412**
CLIENT: **JACKIE GREENE CONSTRUCTION LTD.**
DATE: **MAY 2026**
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ISSUED BY: **ROGER MULLARKEY**

DUNCREEVAN,
KILCOCK,
Co.KILDARE
Ph: 01 6103755
Mob: 087 2324917
Email: info@rmullarkey.ie
Web www.rmullarkey.ie

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1.0 Introduction

1.1 This document relates to the Drainage & Water Infrastructure design, including the Storm Water Impact Assessment, for a proposed mixed-use development located on lands at Greenfields, Mantua Rd (L6310), Swords, Co. Dublin.

1.2 We, Roger Mullarkey & Associates, on behalf Jackie Greene Construction Ltd., have prepared the drainage and water supply infrastructure report to accompany the suite of other drawings and documentation relating to a mixed-use development at the above noted address.

1.3 The site application area is c.2.2Ha and is currently greenfield.

1.4 The proposed development will consist of 289No. residential units plus a c.418m^2 Creche and c.701m^2 Commercial area. Please refer to Thornton O'Connor for a full development description.

2.0 Key Objectives

2.1 This document relates to the Drainage and Water Infrastructure engineering that incorporates the design, background, and detail of the following aspects;

- Road & Block Levels
- Sustainable Drainage Systems (SuDS)
- Storm Water Impact Assessment
- Attenuation
- Foul Water
- Potable Drinking Water Infrastructure

2.2 Aspects relating to the Flood Risk Assessment are detailed in a separate document entitled the Site-Specific Flood Risk Assessment and the reader is referred to that report for further information in that regards.

2.3 Roads access and traffic/transportation assessments are contained in the separate submission documentation by NRB Consulting Engineers included in the overall planning submission.

2.4 Reference should be made to all drainage drawings and designs included in the appendix of this report and all other consultant's reports and drawings as part of the overall application documentation.

3.0 Site Location & Topography

3.1 The lands are located at Mantua Road L6310, Swords, Co. Dublin just west of the M1 motorway and east of Swords town.

Fig. 1 – Site Location

3.2 The site extends to some c.2.2Ha under this application and the land is greenfield.

3.3 The topography generally is gentle sloping towards the centre of the site with downwards gradients ranging between 1/30 to 1/80. A site survey drawing is included in the application and can be viewed as background on the drawing RMA Dwg.No.2412/01 and is summarised in Fig. 2 below.

Fig.2 - Topography

3.4 As part of the preparation for the planning application, research into the existing site ground conditions were undertaken. Investigations undertaken included trial hole opening for soakaway testing. Refer to a summary of the site investigation results included in Appendix 11.7 of this report.

3.5 The site is bounded to the north and west by an access road serving existing industrial/retail parks, to the east by a heavily vegetated embankment leading to the M1 motorway and to the south by an existing public road (L6310).

3.6 A Road & Block design has been prepared as part of this application and reference should be made to Dwg.No.2412/01 in this regards.

3.7 The proposed road gradients vary between 1/125 (0.8%) and 1/25 (4%) and are in accordance with the DOELG Recommendations for Site Development Works for Housing Areas and the Dept. Of Transport's Design Manual for Urban Roads and Streets (DMURS) documentation.

3.8 The site zoning is classified as MRE Zoning – Metro and Rail Economic Corridor.

3.9 The development is intended to remain as private and under the control of a management company.

3.10 Foul water drainage is to be in accordance with the Uisce Éireann Code of Practice for Wastewater Infrastructure. Uisce Éireann have issued a Confirmation of Feasibility (CDS25000867 - 21/07/25) approval noting that connection is feasible without upgrades.

4.0 Existing Drainage & Water Services

4.1 Records drawings were obtained from Uisce Éireann(UÉ)/FCC in preparation for this planning application and are included in the appendix of this document.

4.2 There are no known public foul drainage services on the subject lands. There are existing private foul drainage systems in the surrounding area but the proposed development intends to construct a new foul pumping station on the site to cater for the development with a rising main extending to the Seatown road roundabout at the R132 Dublin Road.

4.3 The proposed developments drinking water supply connection will be into the existing 150mm Uisce Éireann watermain immediately adjacent to the site boundary on the west side. Uisce Éireann have issued a Confirmation of Feasibility noting that a water connection is feasible subject to upgrades. Refer to Appendix 11.3.

4.4 There is an existing 900mm S/W pipeline laid parallel to the eastern site boundary, refer to Dwg.2412/02 for location of same. This pipe currently drains the Swords Business park to the south of the proposed development and also drains the public road (L6310) between. A remnant alignment of what was the Gaybrook watercourse remains on the on the site but this has been diverted some c.30 years ago into the above noted 900mm culvert and the ditch remains “dry” with no upstream flows entering the site. This has been confirmed by both topographical, physical observation and CCTV survey. Refer to Dwg.2412/10 for detail of this existing 900mm S/W culvert and to Fig 3 below for an illustration of same.

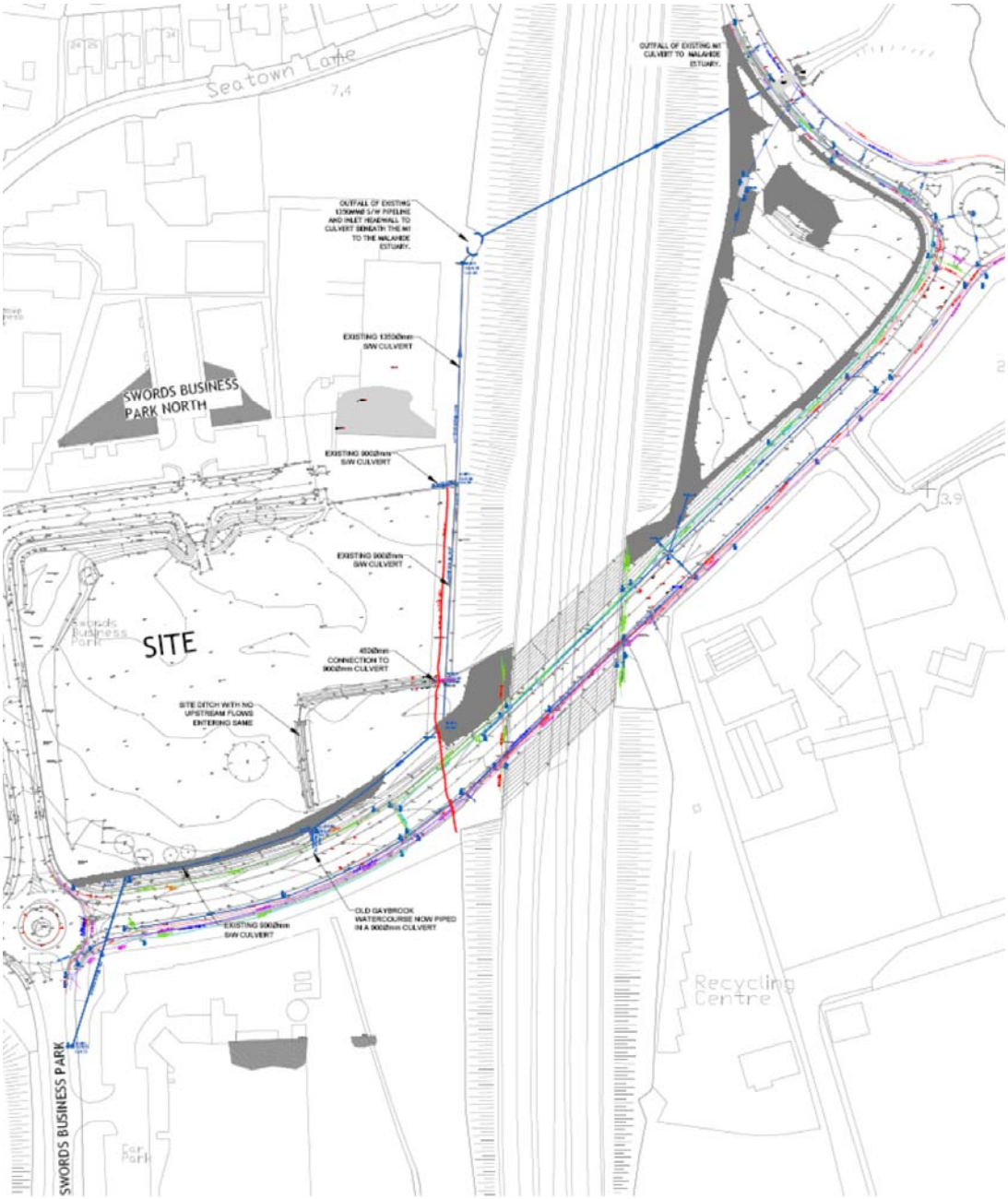


Fig.3 – Existing S/W Culvert

4.5 There is an existing below ground 38kV ESB electricity cable route along the eastern boundary of the site, laid in parallel to the existing 900mm S/W culvert.

5.0 Key Design Reference Documents

5.1 As part of the design of the storm water network and SuDS components, the following documentation were the principal references;

- Fingal Development Plan 2023 – 2029
- CIRIA Report c753 "The SuDS Manual" 2015
- Greater Dublin Strategic Drainage Study (GDSDS) 2005
- FCC Appendix 11 SuDS Guidance Document
- The Greater Dublin Regional Code of Practice for Drainage Works
- DOELG Recommendations for Site Development Works for Housing Areas.
- UÉ/FCC Drainage Records maps
- Available OPW flood maps and reports (from *floodinfo.ie*)
- OPW Eastern CFRAM study
- OPW PFRM mapping
- Geological Survey of Ireland (GSI) website
- Teagasc soils data sets
- Ordnance Survey mapping
- Topographical survey
- Site Investigation Soakaway report
- Site walkover visits
- Discussions with FCC Drainage Department

6.0 STORMWATER IMPACT ASSESSMENT

6.1 The design of the storm water network has been carried out in accordance with and in conjunction with the requirements of Fingal County Councils Drainage Department as were ascertained during pre-planning consultations.

6.2 It is proposed to outfall the attenuated surface water from the proposed development into the existing 900mm surface water culvert located on the subject site along the eastern boundary. Refer to Dwg.No. 2412/02 for alignment of the surface water infrastructure.

6.3 The surface water drainage design has been carried out in accordance with the Greater Dublin Regional Code of Practice, the GDSDS and the CIRIA Report c753 "The SuDS Manual" 2015. Attenuation and SuDS are included in the design.

6.4 As is recommended, the HR Wallingford UKSuDS Greenfield runoff rate estimation tool was used to calculate the Qbar for the site. The overall S/W outfall rate (Qbar) from the proposed development has been

calculated using to be 6.24l/s . The HR Wallingford Qbar calculations are included in Appendix 11.1 of this report.

6.5 The soil type used in the calculation has been determined to be Type 3 based on a number of different sources of data such as the site specific site investigation trial holes, the soakaway tests, the Winter Rainfall Acceptance Potential (WRAP) – the Wallingford Procedure Volume 3 Maps, the Flood Studies Report (FSR - NERC, 1975), Transport Infrastructure Ireland (TII, formerly NRA) – Drainage of Runoff from Natural Catchments 2015, HR Wallingford website, the site specific topographical survey as well as site visits by the design engineer. The following paragraphs provide context and detail behind the choosing of the SOIL Type 3 for the Qbar calculation.

6.6 Site investigations have revealed that sub surface soil conditions on this site are known to be sandy gravelly silty CLAY. A soakaway testing report is included in the Appendix 11.7 of this report and the result of which determined that the site is not suitable for soakaway design.

6.7 A review of the Geological Survey of Ireland website http://www.gsi.ie and that of the Teagasc sub specific http://gis.teagasc.ie/soils/map.php websites both of which provide publicly available soils and bedrock datasets.

6.8 SOIL indices (1 to 5) are defined in the Flood Studies Report (NERC, 1975). The index broadly describes the maximum runoff potential and was derived by a consideration of soil permeability and topographic slope, see Table 4 below;

FSR Soil Indices	
Soil Type 1	Well drained permeable sandy or loamy soils and shallower analogues over highly permeable limestone, chalk, sandstone, and related drifts. Earth peat soils drained by dykes and pumps Less permeable loamy over clayey soils on plateaux adjacent to very permeable soils in valleys
Soil Type 2	Very permeable soils with shallow ground water Permeable soils over rock or fragipan, commonly on slopes in western Britain associated with smaller areas of less permeable wet soils. Moderately permeable soils, some with slowly permeable sub-soils
Soil Type 3	Relatively impermeable soils in boulder and sedimentary clays, and in alluvium. Permeable soils with shallow ground water in low lying areas. Mixed areas of impermeable and permeable soils in approximately equal proportions.
Soil Type 4	Clayey, or loamy over clayey soils with an impermeable layer at shallow depth.
Soil Type 5	Soils of wet uplands with peaty or humose surface horizons and impermeable layers at shallow depth Deep raw peat associated with gentle upland slopes or basin sites Bare rock cliffs and screes (iv) shallow, permeable rocky soils on steep slopes.
Based on the above definitions a SOIL Type 3 or 4 could be chosen for this site	

Fig.4 – FSR Soil Indices

6.9 From the FSR table, reproduced in in Fig.5 below, showing the noted drainage and slope classes, the **Soil type could be interpolated between a type 4 and a type 3**.

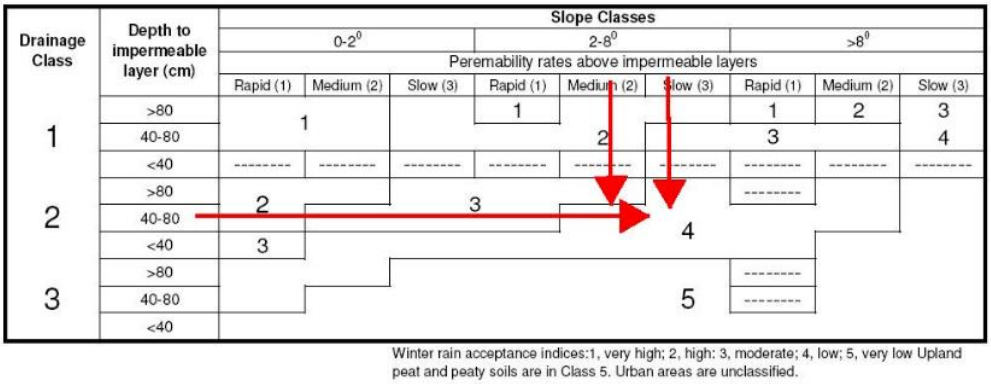


Fig.5 – Soil Type Table

6.10 Reference to the Transport Infrastructure Ireland -TII publication Drainage of Runoff from Natural Catchments 2015, Volume 4 Sections 2 of the Design Manual for Roads and Bridges (DMRB) the following table was noted (Fig.6);

General soil description	Runoff potential	Soil class
Well drained sandy, loamy or earthy peat soils Less permeable loamy soils over clayey soils on plateaux adjacent to very permeable soils in valleys	Very low	S_1
Very permeable soils (e.g. gravel, sand) with shallow groundwater Permeable soils over rocks Moderately permeable soils some with slowly permeable subsoils	Low	S_2
Very fine sands, silts and sedimentary clays Permeable soils (e.g. gravel, sand) with shallow groundwater in low lying areas Mixed areas of permeable and impermeable soils in similar proportions	Moderate	S_3
Clayey or loamy soils	High	S4
Soils of the wet uplands: Bare rocks or cliffs Shallow, permeable rocky soils on steep slopes Peats with impermeable layers at shallow depth	Very high	S_5

Fig.6 – TII Soil Class

6.11 Based on interpretation of each of the above data sets a Soil Type 3 or 4 could be reasonably be interpreted. A **Type 3 soil** was chosen as appropriate for this site. The decision to choose a type 3 is deemed as conservative and yields a lower outfall rate than of a soil type 4.

6.12 From the GDSDS Table 6.7, shown in Fig.7 below, using a Soil value of 3 equates to an SPR value of 0.37. The SPR value of 0.37 was used in the HR Wallingford Qbar calculator to override the default higher SPR value of 0.53.

SOIL	SPR value (% runoff)
1	0.1
2	0.3
3	0.37
4	0.47
5	0.53

Fig.7 – GDSDS SPR Values

6.13 Using the recommended HR Wallingford UK SuDS calculation tool the resultant **Qbar = 6.24 l/s**. Refer to Appendix 11.1 for the calculation sheet.

6.14 The surface water drainage infrastructure for the development will collect the rainfall on the site and convey the storm water run-off via intensive green roofs, bioretention areas, drained tree pits, filter swales, permeable paving, underground pipes, manholes and direct towards a vortex flow restricting devices, Hydrobrake or similar.

6.15 The retained storm water flows will be stored in 2No. below ground void arched system, such as the CubicM3 system and 1No.open detention basin. Refer to Dwg.No.2412/02 for the S/W drainage general arrangement and to 2412/06 for details of the attenuation storage facilities provided.

6.16 Due to the constrained nature of the proposed development and requirement to provide useable open space for the residents, it is proposed to use 2No.below ground attenuation storage areas between Blocks A/B and B/C in the privately managed landscaped open space areas. Bio-retention features are contained in these areas to replicate natural drainage characteristics and fulfil the SuDS principles. 1No.open detention basin is also provided where the site is less constrained. All areas are to be landscaped as per the CSR landscape architects specifications.

6.17 Replicating the natural characteristics and providing amenity/biodiversity has been achieved in the SuDS elements included in

this application. A full SuDS treatment train approach has been implemented in accordance with the CIRIA SuDS Manual as described in detail in Chapter 7 of this report, summarised as follows;

- Intensive Green Roofs
- Permeable paving to all parking spaces
- Tree pits
- Bio-Retention areas
- Filter Swales
- Silt-trap/catchpit manholes
- Hydrobrake limiting flow to the drained area Qbar greenfield rate
- Detention basin and stone lined voided arch retention storage

6.18 The surface water drainage design has been carried out in accordance with the Greater Dublin Regional Code of Practice, the GDSDS and the CIRIA Report c753 "The SuDS Manual" 2015. A SuDS treatment train and attenuation are included in the design.

6.19 The SuDS management train approach to designing the storm water network has been applied for this development and is specifically discussed in Chapter 7.

6.20 The MicroDrainage software was used to generate attenuation storage estimate for storm events for 2 year, 30 year and 100 year return events over multiple time periods. In accordance with the FCC Stormwater management Policy, an allowance for an increased rainfall due to climate change of 20% was applied in the drainage design model. Furthermore, the Cv values are set to 1.0 in Microdrainage software model and are visible in the calculations included in Appendix 12.1 of this report.

6.21 In accordance with the Greater Dublin Regional Code of Practice for Drainage Works (GDSDS) and in consultation with FCC drainage Department and in accordance with the FCC Stormwater Management Policy, the surface water drainage infrastructure was designed to the parameters as outlined in Fig 8 below;

Time of entry	**6mins**
Return periods for pipework	2 years- no surcharge
	Q30 15min no flooding
	Q100 15min – storage in designated areas only
Climate Change	20%
Min.velocity	1m/s
Max.velocity	3m/s
Min.sewer size for TIC	225mm diameter
Pipe friction (Ks)	0.6mm
Minimum pipe depth	1.2m below roads 0.9m in open/grassed spaces
Standard Annual Average Rainfall (SAAR)	735mm (Met Eireann data)
M5-60	15.3mm
Ratio r (M5-60/M5-2Day)	0.277
SPR Value	0.37
Total Site Outfall Rate	**Qbar = 6.24 l/s** (based on HR Wallingford Qbar – refer Chapter 8)
Attenuation storage	Q30 – no flooding on site Q100 – flooding on site, 500mm freeboard to FFLs, flood routing plan.
Paved Area Runoff percentage	95% from roofs to drains 95% from roads and paths not drained to SuDS features 70% from roads and paths drained to SuDS elements 80% from intensive green roof 55% parking permeable paving areas and locally drained paths 20% grassland

Fig 8 – S/W Design Parameters

6.22 In accordance with best practice, the internal drainage system has been designed as a completely separate foul and surface water system.

6.23 The freeboard between each separate storage location top water level (TWL) and the lowest floor slab draining to that tank is greater than the

GDSDS minimum of 0.5m. A summary of the freeboards is given in Fig.9 below;

FREEBOARD SUMMARY				
Storage No.	**TWL (mOD)**	**FFL (mOD)**	**Freeboard (m)**	**Pass/Fail**
1	5.22mOD	6.15mOD	0.93m	PASS
2	5.23mOD	6.15mOD	0.92m	PASS
3	5.16mOD	6.15mOD	0.99m	PASS

Fig 9 - Freeboard Summary

6.24 In accordance with the GDSDS, the four principal design criteria as set out in section 6.3.4 of Volume 2 are summarized as follows;

- **Criterion 1** - River water quality protection
- **Criterion 2** – River regime protection
- **Criterion 3** – Level of service (flooding) for the site
- **Criterion 4** – River Flood protection

6.25 **Criterion 1** has been complied with by inclusion of **Interception** of at least 5mm of rainfall to prevent runoff to the receiving water. As per the GDSDS guidelines, the interception is to capture the first 5mm of rainfall from 80% of Paved Drained Area.

6.26 Interception will achieved be within the voids of the stone base of the permeable paving, in the intensive green roof substrate, in the tree pits, bio-retention areas, in the filter swales, in the stone base of the attenuation storage and in the detention basin where the inlet to the Hydrobrake manholes is set 50mm above the basin bed levels. As per the parameters laid out in the GDSDS the interception volume was calculated and is summarised in the following table 3. Refer to Appendix 11.9 for detailed calculations.

INTERCEPTION - Seatown Road, Swords							
Paved Surfaces connected to the drainage system (Ha) =	1.17*0.8	0.9376	Volume of Interception Required (m^3)		Gross Paved Area x 5mm x 0.8 (GDSDS E2.1.1 - Criterion 1)	37.5	
Volume of Interception Provided (m^3)	**Length**	**Width (m)**	**Area (m^2)**	**Quantity**	**Stone Depth (m)**	**Void Ratio**	**Volume (m^3)**
Voids of stone below Attenuation Tank			350		0.3	0.4	42.0
Voids of stone below Permeable Paving overflow			1,688		0.15	0.3	76.0
Green Roof Intensive			2,797		0.2	0.1	55.9
Detention Basin 50mm storage			340		0.05	1	17.0
Tree Pits			14	8	0.1	1	11.2
Bio-Retention			198		0.075	1	14.9
Voids of stone below Filter Swales	120	0.75	90		0.15	0.4	5.4
					Volume of Interception Provided (m^3) =		**222.4**
					Volume of Interception Required (m^3) =		**37.5**
					Interception provided > Required		**OK**

Fig.10 Catchment Interception Summary

6.27 **Criterion 2** is complied with in applying the total Qbar outfall rate of 6.24 l/s and providing more than the required volume of attenuation storage (Required Q100+20%= 507m^3 – v- Provided 514m^3) in the void arch systems and Detention Basin.

6.28 **Criterion 3** is satisfied with as each of the 4No.sub-criterion design objectives have been met as per Fig.11 below;

Sub-criterion	*Design objective*	*Satisfied*
3.1	No flooding on site for the Q30 except where specifically planned	**OK**
3.2	No internal property flooding for site critical duration storm event.	**OK**
3.3	No internal property flooding satisfied as 500mm freeboard to house FFL's is achieved.	**OK**
3.4	No flooding of adjacent areas unless specific routing planned for the Q100 + 20% climate change	**OK**
Refer to the MicroDrainage surface water model results (Q1-Q100+20%) included in the appendix of this report for further detail		

Fig.11 – Sub-criterion

6.29 **Criterion 4** River flood protection is satisfied under sub-criterion 4.3 in accordance with the application of the maximum Qbar (6.24 l/s) and therefore long-term storage is not required.

6.30 An exceedance flow routing plan can be viewed on Dwg.No.2412/11 included with this submission.

6.31 Based on the drained area Qbar and the paved area factors identified in Fig.8 above and using the MicroDrainage software, a drainage model was generated for multiple storm events and return periods of 2, 30 and 100 years plus 20% Climate Change. The attenuated storage provided is a combination of the interception volume provided plus the storage volume itself. Drainage model results for the attenuation are included in Appendix 11.11 of this report and are summarised in Fig.12 below.

ATTENUATION STORAGE SUMMARY						
	Flow control limit (l/s)	**Volume Required (m^3)**			**Volume Provided (m^3) and Top Water Level**	
		Q2+20% CC	**Q30+20% CC**	**Q100 +20% CC**	**Tank Storage Volume Provided (m^3)**	**TWL**
1	6.0	33	80	119	**145**	5.22mOD
2	6.0	56	112	126	**155**	5.23mOD
3	**6.24**	96	194	262	**>262**	5.16mOD
Total Storage PROVIDED					**>562m^3**	
The total storage provided > required (507m^3)						

Fig.12 – Storage Volume Summary

6.32 It is noted that there is **additional interception storage** volume of c.229-38= **191m^3** (refer to Fig.10 above) that has not been subtracted from the required attenuation volume nor has it been added to the available storage volume and is therefore considered to be a safer and more conservative approach to attenuation storage estimation.

6.33 Refer to Dwg.No.'s 2412/02 for layout of the attenuation system and to Dwg.No.2412/06 for details of same.

7.0 Sustainable Drainage Systems - SuDS

7.0.1 SuDS addresses the water quality, water quantity, amenity, and biodiversity by the management of surface water run off in a sequence of treatment processes along the drainage infrastructure network.

7.0.2 The SuDS philosophy is illustrated in the GDSDS Volume 3 Section 6.3 as the "SuDS triangle", shown below. The principle is to reduce the storm water run-off through managed processes, improve the quality of the run-off and to replicate the natural characteristics of the rainfall run off.

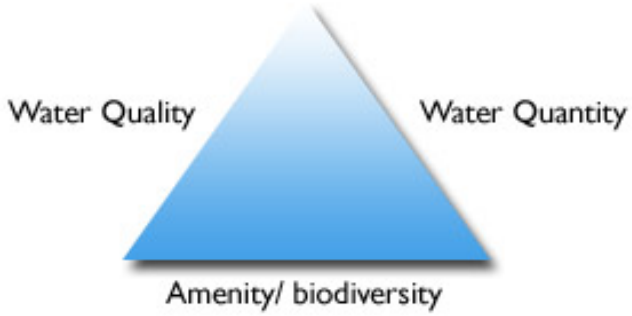


Fig.13 – The SuDS Triangle

7.0.3 Replicating the natural characteristics and providing amenity/biodiversity has been achieved in the SuDS elements included in this application. A full SuDS treatment train approach has been implemented in accordance with the CIRIA SuDS Manual, summarised as follows;

- Intensive Green Roofs provided
- Permeable paving to all parking spaces
- Tree pits
- Bio-Retention areas
- Filter Swales
- Silt-trap/catchpit manholes
- Hydrobrake limiting flow to the drained area Qbar greenfield rate
- Stone lined voided arch retention storage
- Open detention Basins

With the inclusion of these measures, it is proposed that the SuDS treatment of the run-off has been adequately addressed.

7.0.4 The SuDS management train approach to designing the storm water network has been applied in this proposed developments design, similar in principle to Fig.14 below.

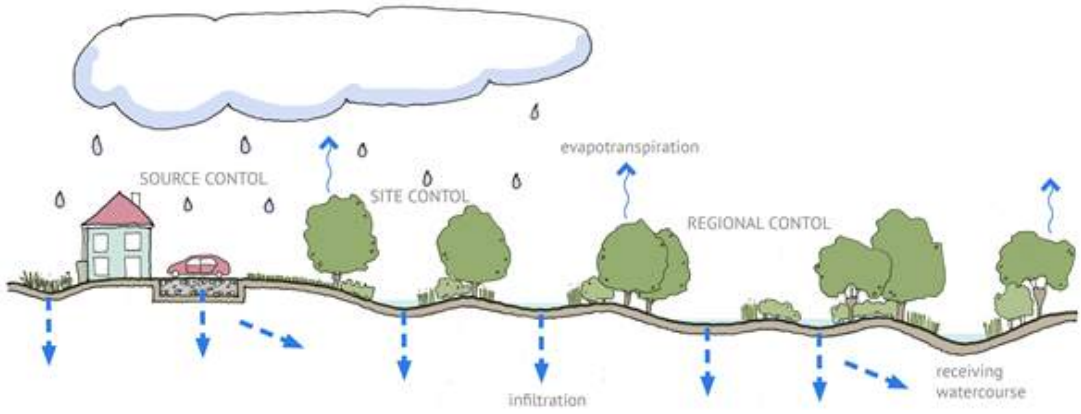


Fig.14 – Treatment Train

7.1 Source control

7.1.1 Source Control aims to detain or infiltrate runoff as close as possible to the point of origin.

7.1.2 The site investigation soakaway test results (see appendix 11.7) suggest that the underlying soils limit infiltration of surface water flows. Even if the infiltration is limited there is still scope to provide some level of storage, time delay and treatment as the surface water flows through the SuDS features provided.

7.1.3 It is proposed to use **tree pits (8No.)** to collect run-off from the cambered road surface. The use of these tree pits will provide treatment of the run-off, will encourage run off to infiltrate directly to ground and will also provide interception storage below the high-level connection to the main S/W drainage. Any run-off that cannot infiltrate to ground will overflow to the high-level drain and connect to the main drainage system. The surface water runoff rate is also attenuated using these tree pits.

7.1.4 The road cambers roads are to be constructed to drain flow into these tree pits to maximize the drained area into SuDS treatment & interception. The road cambers are shown on Dwg.No.'s 2412/01 and further illustrated on Dwg.No.2412/07.

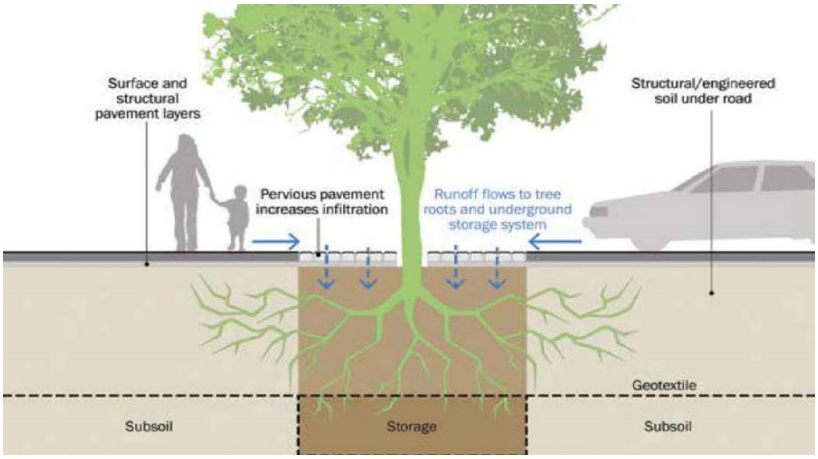


Fig.15 – Tree Pit (ex. SuDS Manual fig.19.3)

7.1.5 A PAF of 0.7 (70%) will apply to areas or paths/roads draining to these tree pits and bio-retention areas. Refer Dwg.No.'s 2412/02 for location and to Dwg.No.2412/07 for details.

7.1.6 It is proposed to use **permeable paving** surfacing to the private carparking spaces units and the road/paths remaining in control of a management company. This allows for the rainfall to percolate through open joints in the pavement and be strained through the unwoven geo-textile membrane beneath the paved surface. This method of surface water collection will improve water quality and prevent excessive sedimentation. There is a natural interception, attenuation and storage of surface waters flowing through the permeable paving system and an outfall pipe is provided 150mm above the bottom of the system to drain the overflow filtered/attenuated run off into the main drainage system.

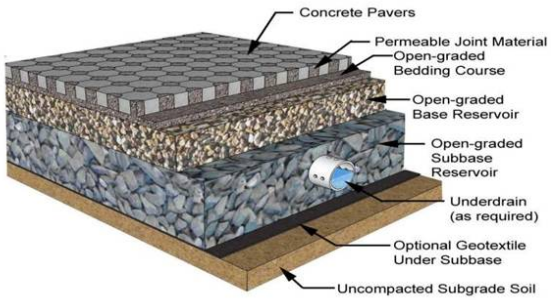


Fig.16 – Permeable Paving

7.1.7 In providing permeable paving systems on the site, a run-off rate of 55% (0.55 paved area factor applied) has been applied in the surface water calculations. Refer to Dwg.No.2412/07 for details.

7.1.8 In accordance with the CIRIA SuDS Manual 2015, **green roofs** can be used to treat and attenuate runoff in their substrate and support root uptake of water with appropriate planting and are an integral part of source control on a site. Green roofs can increase the indigenous biodiversity and is an environmentally encouraging design strategy, which is in accordance with the objectives as specified in the Greater Dublin Strategic Drainage Strategy (GDSDS) and Appendix 11 of the Fingal Development Plan 2023-2029.

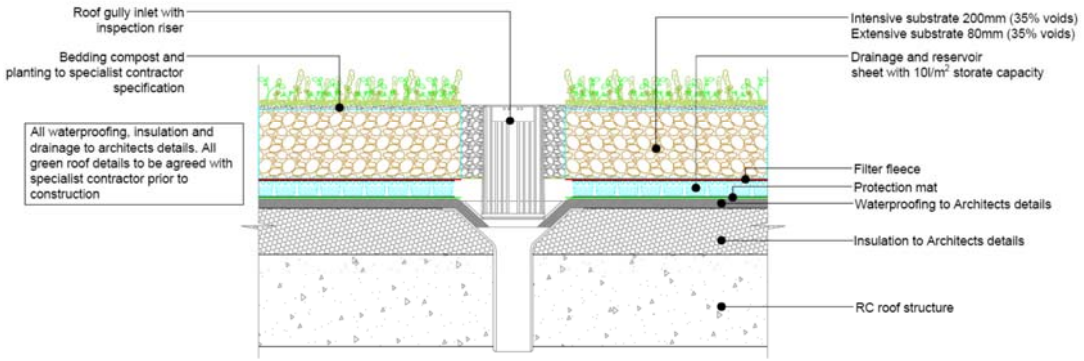


Fig.17 –Intensive Green Roof (ex.Dwg.2412/07)

7.1.9 Intensive Green roofs are proposed to all the flat roofs of the apartment blocks. In providing the green roof system, a run-off rate of 80% (0.80 paved area factor applied) has been applied in the surface water calculations for the Intensive Green Roofs.

7.1.10 Access for maintenance of the green roofs will be via a cherry picker where stairs access is not feasible. Detailed cross sections of the proposed roof build-up are shown on Dwg.No.2412/07 included in the submission.

7.1.11 An important aspect of Source Control is reducing pollution by prevention of chemicals and other pollutants from coming into contact with rainfall runoff. In this respect, it is proposed that the management company will be provided with information regarding the appropriate usage of the proposed drainage system.

7.1.12 Regular maintenance of all SuDS features by the development management team is required to protect runoff and prevention of blockages until such a stage that the Local Authority take in charge the project. The following inexhaustive monitoring measures are to be implemented;

- Checking for any blockages in roof drainage inlets
- Maintaining grass levels and removing debris from the tree-pit areas
- Maintaining grass levels and removing any debris from the filter swales and bio-retention elements
- Cleaning of the joints of the permeable paving to prevent moss/silt build-up
- Clearing road gullies if required
- Checking of silt traps on the filter drains if required
- Checking and clearing the silt trap upstream of the attenuation storage
- Checking of the flow control device to ensure blockages do not occur
- Periodic inspection of the storage chambers and de-silting if required

7.2 Site Control

7.2.1 Site control in the treatment train process involves the reduction in volume and rate of surface runoff run off and provide some treatment of the runoff.

7.2.2 Bio-Retention areas are provided on the site to collect rainwater from rainwater down pipes and serve as a method of site control that reduces harmful chemical pollutants and sediment reaching the piped network. These pollutants are trapped in the bio-retention medium upstream of outfalling to the piped network. These features reduce the surface water runoff rate and attenuate flows locally, therefore reducing stress on downstream facilities. These bio-retention areas also facilitate interception of the "first flush" of rainfall. Fig.18 below from the CIRIA SuDS Manual illustrates the principle.

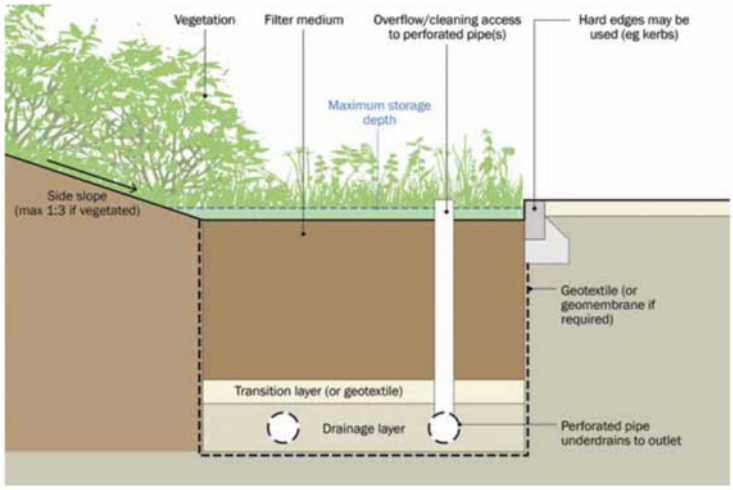


Fig.18 – Bioretention

7.2.3 A Silt-trap/catchpit manhole is provided upstream of the underground attenuation storage systems which will remove sediments and silts and forms part of the site control methodology used in the proposed development.

7.2.4 **Filter swales** are a method of site control that reduces harmful chemical pollutants and sediment reaching the piped network. These pollutants are trapped in the grassed areas leading to the filter strip. Filter swales reduce the surface water runoff rate and attenuate flows locally, therefore reducing stress on downstream facilities. Filter swales also facilitate interception of the "first flush" of rainfall. Fig.19 below from the CIRIA SuDS Manual illustrates the principle.

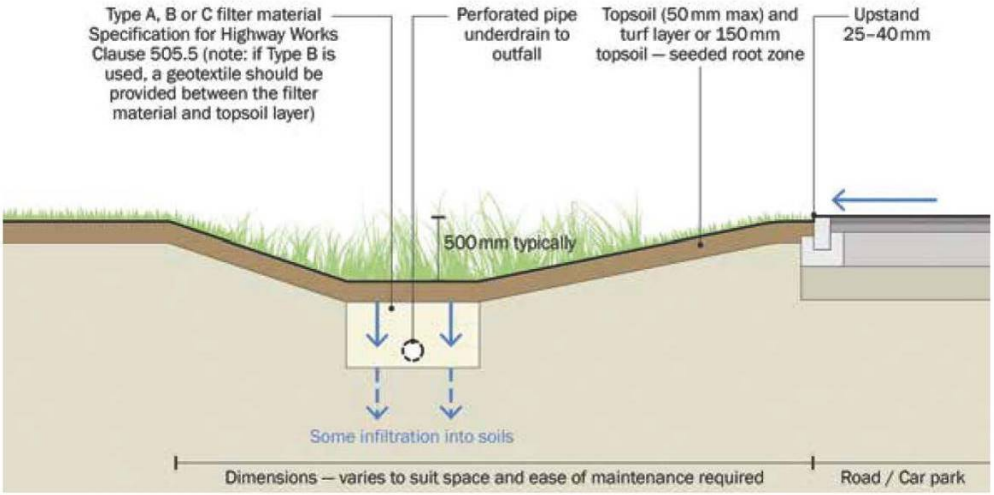


Fig.19– Filter Swale

7.2.3 As part of the site control it is proposed to construct 6 No. **filter swales** at specified locations which will allow surface water runoff from roads to be intercepted and infiltrate to ground. In the event the ground is saturated, there are also positive drainage connections from the filter swales into the piped network. Refer to Dwg.No.'s 2412/02 for proposed locations of the filter swales and to Dwg.2412/07 for details of this proposal.

7.2.4 In providing the filter swales, a run-off rate of 70% (0.7 paved area factor applied) has been applied in the surface water calculations as was agreed in principle with the FCC Drainage Department as part of the pre-planning discussions.

7.3 Regional Control

7.3.1 Regional control comprises of treatment facilities to reduce pollutants from runoff and control the surface water runoff rate to pre-development rates.

7.3.2 As part of the overall regional control for the site it is proposed to use a 2No.void arched **attenuation system**, such as the CubicM3 (Fig.20) and 1No.open Detention basin (Fig.21)

Fig.20 – StormTech Attenuation System

Fig.21 – Bio-Diversity Landscape Detention Basins

7.3.3 The flow rate of the run-off outfalling from the attenuation systems is to be controlled using vortex control devices such as Hydrobrake vortex control device.

7.3.4 Interception of the "*first flush*" of rainfall is captured upstream of the outfalls and can infiltrate to ground where possible. The interception storage will be within the substrate of the green roof systems, in the stone base of the permeable paving, in the in the filtration medium of the bio-retention features, in the tree pits, in the detention basins (where the outlets are to be set 50mm above the bed levels) and in the stone base of the attenuation storage areas. As per the parameters laid out in the GDSDS the interception volume was calculated for the site as per Fig.10

7.4 Water Quality Management

7.4.1 The SuDS Manual sets out objectives and methods for evaluating the pollution hazards from runoff generated from different types of land use and the level of treatment required.

7.4.2 The SuDS Management Train approach has been adopted to evaluate, categorise and treat the runoff to minimise the risk of contaminants discharging from the site to the receiving watercourse.

7.4.3 Managing the water quality has been achieved for this proposed mixed-use development has been achieved by providing interception of >5mm depth rainfall events as has been outlined in detail in this report.

7.5 SuDS Summary

7.5.1 Replicating the natural characteristics and providing amenity/biodiversity will be encouraged by creating the roadside tree pits, bio-retention areas, swales, green roofs and open detention basin.

7.5.2 The overall site surface water runoff rate has been restricted to the greenfield runoff rate, Qbar (6.24 l/s) and the recommended HR Wallingford UK SuDS calculations for same can be viewed in Appendix 11.1 of this report. Refer also to Section 6 for background on the determination of the soil type used in the Qbar calculation.

7.5.3 Refer to the appendix and to Dwg. No's 2412/02 & 06 & 07 for the drainage layout and SuDS features details.

7.5.4 In providing the above noted features it is proposed that the SuDS treatment of the run-off has been adequately addressed.

8.0 S/W Design Conclusion

8.1 The S/W outfalls are described in detail in Section 6 of this report.

8.2 Full SuDS treatment train approach has been implemented in accordance with the CIRIA SuDS Manual as described in Section 7 above.

8.3 A thorough examination of the site characteristics were undertaken in determination of the soil type and greenfield run off rate as described in Section 6 above.

8.4 The drainage design and attenuation storage volumes have been determined using an industry standard computer modelling software program MicroDrainage, for designing drainage networks as described in Section 6 above and are included in Appendix 11.11 of this report. Climate change of 20% has been applied in the design and is detailed in Section 6 above.

8.5 A Site-Specific Flood Risk Assessment was completed and is included in the application as a separate report.

8.6 Pre-planning consultations were held with the FCC Drainage Department and their requirements were ascertained and complied with in this document and the accompanying drawings.

9.0 Wastewater Infrastructure

9.1 Foul drainage records drawings were obtained from Uisce Éireann/FCC in preparation for this planning application and are included in Appendix 11.6 of this document.

9.2 A Pre-Connection Enquiry Form application (PCEA) was submitted to Uisce Éireann (IW) and a Confirmation of Feasibility (CoF) was received from IW (ref.CDS25000867) noting that a foul connection is "*feasible without infrastructure upgrade*". A copy of the IW Confirmation of Feasibility letter can be viewed in Appendix 11.3 of this report.

9.3 A foul pumping station is proposed to service this application and is to pump the effluent in a 100mm diameter rising main along the L6310 "Mantua Road" to outfall into the existing UÉ network (750mm trunk sewer) in the R132 Dublin Road roundabout c.644m from the pumping station location. Refer to Dwg.2412/03 for the Foul Drainage GA and to Dwg.2412/09 for details of the pumping station.

9.4 The pumping station is located at the required separation distances from existing neighbouring buildings and the proposed residential blocks. The pumping station is fully below ground level with only 2No.above ground kiosks visible. A 24hour overflow storage chamber is provided in the design.

9.5 The foul infrastructure is to remain privately managed but the proposed pumping station is to be taken-in-charge by Uisce Éireann. The minimum sewer diameter is to be 225mm and the foul drains/sewers are to be in accordance with the Uisce Éireann Code of Practice for Wastewater Infrastructure 2025.

Foul Sewer Design Criteria	
Min.velocity	0.75m/s
Max.velocity	3m/s
Min.sewer size for TIC	225mm diameter
Pipe friction (Ks)	1.5mm
Minimum pipe depth	1.2m below roads 0.9m in open/grassed spaces
Ave.Occupancy	2.7 persons/unit
Residential loading/person/day	150 l/day

Fig.22 – Foul Sewer Design Criteria

9.6 Design estimates for the foul water loading are as per Fig.23 below and refer to Appendix 11.10 for the pumping station and rising main calculations;

Foul Wastewater Calculations for TOTAL SITE

SWORDS					
New Network – DOMESTIC AND COMMERCIAL Wastewater Flows					
Usage	*Quantity*	*Occupancy (h)*	*Population (P)*	*Consumption (G) (l/h/day)*	*Loading (PxG)(l/day)*
Residential	289 Units	2.7No./Unit	780	150	117,000
Commercial/ Retail	701m^2	1 per 5m^2	140	50	7,000
Crèche	418m^2	1child/5m^2 + Staff (20%) + support accommodation	102	50	5,100
Total =					**129,100 l/day**
Flowrate per 24 hr day (l/s)					**1.63/s**
Growth Rate				1	1
Infiltration (I)				10%	0.16
Dry Weather Flow				**PG + I**	**1.63 l/s**
Peaking Factor ($Pf_{Dom.Ind}$)				4.5	
Design Foul Flow (l/s)				**Pf_{DomInd} x PG**	**8.07 l/s**
Misconnection Allowance (SW)				1.5%	0.01l/s
Design Flow (l/s)					**8.1 l/s**

Based on Uisce Éireann Code of Practice Wastewater Infrastructure (Rev 3 Aug'25)

Fig.23 – Residential & Commercial Wastewater Calculations

10.0 Site Potable Watermain

10.1 Water infrastructure records drawings were obtained from Uisce Éireann/FCC in preparation for this planning application and are included in Appendix 11.6 of this document.

10.2 A Pre-Connection Enquiry Form application (PCEA) was submitted to Uisce Éireann (IW) and a Confirmation of Feasibility (CoF) was received from IW (ref.CDS25000867) noting that a water connection is "*feasible subject to upgrades*". The upgrades requested by UÉ relate pipe networks remote from the subject site and UÉ have requested that the Applicant agree to fund these works which are to be reviewed at connection application stage. A copy of the IW Confirmation of Feasibility letter can be viewed in Appendix 11.3 of this report.

10.3 There is an existing 150mmØ diameter water supply main located immediately adjacent to the west and northern boundary of the site. The new connection is proposed to the west side of the application lands at the site entrance.

10.4 Each apartment block within the development is to be provided with a boundary box for a separate metered connection as per Uisce Eireann requirements. The type and configuration of the water meter is to be agreed with Uisce Éireann in advance of construction commencing at the development.

10.5 Refer to Dwg.No.2412/04 for the watermain layout.

10.6 In accordance with best practice, the use of water conservation appliances in the buildings are to be employed as part of this scheme to reduce the water demand. Although the consumption of treated water depends a lot on the behaviour of consumers, demand on the network is limited in the scheme by incorporating water saving tap valves, eco-flush toilet system and water saving appliances.

10.7 All watermain layout and details are to be in accordance with the Uisce Éireann Code of Practice for Water Infrastructure 2025 and the Water Infrastructure Standard details 2025.

10.8 Estimates of the water demand for the site were carried out using the guidelines in accordance with the UÉ COP for Water Infrastructure 2025 publication and are shown in Fig.24 below and in Appendix 11.10;

Water Demand Calculations for TOTAL SITE

New Network – DOMESTIC & COMMERCIAL Water Demand								
Usage	**Quantity**	**Occupancy**	**Population**	**Consumption (l//h/day)**	**Ave. Daily Domestic Demand (l/day)**	**Ave. Daily(12/24 hr) Demand (l/s)**	**Ave. Day/Peak Week (l/s)**	**Peak Hour Water Demand (l/s)**
Resi'	289 Units	2.7 No./Unit	780	150	117,000	1.35	1.69	8.5
Commercial/Retail	701m^2	1 per 5m^2	140	50	7,000	0.16	0.2	1
Crèche	419m^2	1child/5m^2 + Staff (20%) + support accommodation	102	50	5,100	0.12	0.148	0.74
						Combined Domestic & Commercial Total =	2.04	
Peak Hour Water Demand (Domestic & Commercial)								**10.24l/s**

Based on Uisce Éireann Code of Practice for Water Infrastructure (Rev 3 Aug'25)

Fig.24 – Combined Residential & Commercial Water Demand Calculations

11.0 APPENDIX

Appendix 11.1

UK SuDS Qbar Calculations

Greenfield runoff rate estimation tool

www.uksuds.com | Greenfield runoff rate estimation tool (https://www.uksuds.com/)

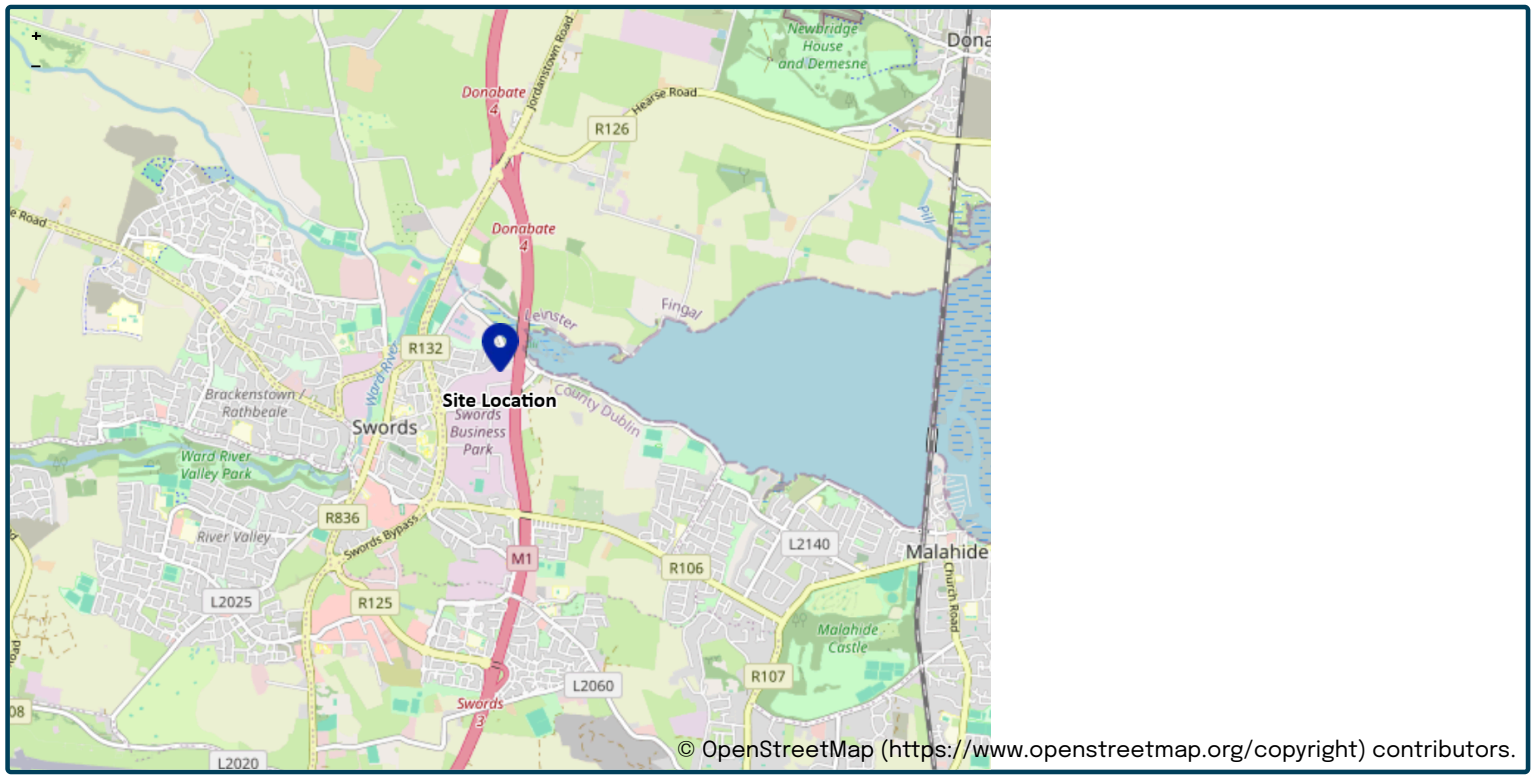
This is an estimation of the greenfield runoff rates that are used to meet normal best practice criteria in line with Environment Agency guidance “Rainfall runoff management for developments”, SC030219 (2013), the SuDS Manual C753 (CIRIA, 2015) and the non-statutory standards for SuDS (Defra, 2015).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

Project details

Date	14/08/2025
Calculated by	Roger Mullarkey
Reference	Swords
Model version	2.1.2

Location

Site name	Seatown Rd
Site location	Swords



Site easting (Irish Grid)	319216
Site northing (Irish Grid)	247221
Site easting (Irish Transverse Mercator)	719142
Site northing (Irish Transverse Mercator)	747244

Site details

Total site area (ha)	1.98 ha

Greenfield runoff

Method

Method	IH124

IH124

	My value		Map value
SAAR (mm)	758 mm		897
How should SPR be derived?	WRAP soil type		
WRAP soil type	3		2
SPR	0.37		
QBar (IH124) (l/s)	6.24 l/s		

Growth curve factors

	My value		Map value
Hydrological region	12		12
1 year growth factor	0.85		
2 year growth factor	0.95		
10 year growth factor	1.72		
30 year growth factor	2.13		
100 year growth factor	2.61		
200 year growth factor	2.86		

Results

Method	IH124
Flow rate 1 year (l/s)	5.3 l/s
Flow rate 2 year (l/s)	5.9 l/s
Flow rate 10 years (l/s)	10.7 l/s
Flow rate 30 years (l/s)	13.3 l/s
Flow rate 100 years (l/s)	16.3 l/s
Flow rate 200 years (l/s)	17.9 l/s

Please note runoff estimation is subject to significant uncertainty. Results are therefore normally reported to only 1 decimal place. Where 2 decimal places are provided, this does not indicate accuracy to this level, it has been adopted to prevent 'zero' figures from being reported. Outputs less than 0.01 l/s are reported as 0.01 l/s.

Disclaimer

Appendix 11.2

Met Éireann Data

Met Eireann
Return Period Rainfall Depths for sliding Durations
Irish Grid: Easting: 319200, Northing: 247231,

	Interval		Years									
DURATION	6months,	1year,	2,	3,	4,	5,	10,	20,	30,	50,	75,	100,	120,
5 mins	2.4,	3.4,	4.0,	4.7,	5.3,	5.7,	7.1,	8.6,	9.7,	11.1,	12.4,	13.4,	14.0,
10 mins	3.4,	4.8,	5.5,	6.6,	7.4,	8.0,	9.9,	12.0,	13.5,	15.5,	17.3,	18.6,	19.6,
15 mins	4.0,	5.6,	6.5,	7.8,	8.7,	9.4,	11.6,	14.1,	15.8,	18.2,	20.3,	21.9,	23.0,
30 mins	5.3,	7.3,	8.4,	10.0,	11.1,	12.0,	14.7,	17.8,	19.8,	22.7,	25.2,	27.1,	28.4,
1 hours	7.0,	9.5,	10.9,	12.9,	14.2,	15.3,	18.6,	22.4,	24.8,	28.2,	31.2,	33.5,	35.1,
2 hours	9.2,	12.4,	14.1,	16.6,	18.3,	19.5,	23.6,	28.1,	31.1,	35.1,	38.7,	41.4,	43.3,
3 hours	10.8,	14.5,	16.4,	19.3,	21.1,	22.6,	27.1,	32.2,	35.4,	40.0,	43.9,	46.9,	48.9,
4 hours	12.2,	16.2,	18.3,	21.4,	23.4,	25.0,	30.0,	35.4,	38.9,	43.8,	48.0,	51.2,	53.4,
6 hours	14.3,	18.9,	21.3,	24.8,	27.1,	28.8,	34.4,	40.5,	44.4,	49.8,	54.4,	58.0,	60.4,
9 hours	16.8,	22.1,	24.8,	28.8,	31.3,	33.3,	39.5,	46.3,	50.6,	56.6,	61.7,	65.7,	68.3,
12 hours	18.9,	24.7,	27.7,	31.9,	34.7,	36.9,	43.6,	50.9,	55.6,	62.0,	67.5,	71.7,	74.5,
18 hours	22.3,	28.9,	32.2,	37.0,	40.2,	42.6,	50.1,	58.2,	63.4,	70.5,	76.6,	81.2,	84.2,
24 hours	25.0,	32.2,	35.9,	41.1,	44.5,	47.1,	55.3,	64.0,	69.6,	77.2,	83.7,	88.6,	91.9,
2 days	30.7,	38.8,	42.9,	48.7,	52.5,	55.3,	64.2,	73.6,	79.6,	87.6,	94.5,	99.7,	103.1,
3 days	35.4,	44.4,	48.8,	55.1,	59.2,	62.3,	71.8,	81.8,	88.1,	96.6,	103.9,	109.3,	112.9,
4 days	39.6,	49.3,	54.1,	60.8,	65.2,	68.4,	78.5,	89.2,	95.8,	104.7,	112.3,	118.0,	121.8,
6 days	47.1,	58.1,	63.4,	71.0,	75.8,	79.4,	90.5,	102.2,	109.4,	119.1,	127.3,	133.5,	137.5,
8 days	53.9,	65.9,	71.8,	80.0,	85.2,	89.2,	101.2,	113.7,	121.5,	131.9,	140.7,	147.2,	151.5,
10 days	60.2,	73.2,	79.5,	88.4,	94.0,	98.2,	111.0,	124.4,	132.6,	143.6,	152.9,	159.8,	164.4,
12 days	66.1,	80.1,	86.8,	96.2,	102.2,	106.6,	120.3,	134.4,	143.1,	154.6,	164.4,	171.6,	176.4,
16 days	77.3,	92.9,	100.4,	110.8,	117.4,	122.4,	137.4,	152.8,	162.4,	175.0,	185.6,	193.5,	198.6,
20 days	87.8,	104.9,	113.1,	124.5,	131.7,	137.0,	153.3,	170.0,	180.2,	193.8,	205.2,	213.6,	219.1,
25 days	100.2,	119.1,	128.1,	140.6,	148.4,	154.2,	171.9,	190.0,	201.1,	215.8,	228.0,	237.1,	243.0,

NOTES:
These values are derived from a Depth Duration Frequency (DDF) Model update 2023
For details refer to:
'Mateus C., and Coonan, B. 2023. Estimation of point rainfall frequencies in Ireland. Technical Note No. 68. Met Eireann',
Available for download at:
http://hdl.handle.net/2262/102417

Seatown Rd, Swords
319000E 247213N
M5/60 = 15.3mm
r=0.277 (M5-60/M2day-60)
SAAR = 735

Appendix 11.3

Uisce Éireann CoF

CONFIRMATION OF FEASIBILITY

Brian Greene
Jackie Greene Construction LTD
Verdant House
Fortfield Square
College Drive
Dublin

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

21 July 2025

Our Ref: CDS25000867 Pre-Connection Enquiry Swords Business park, Seatown Road, Dublin, Co.Dublin

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 302 unit(s) at Swords Business park, Seatown Road, Dublin, Co.Dublin, (the **Development)**.

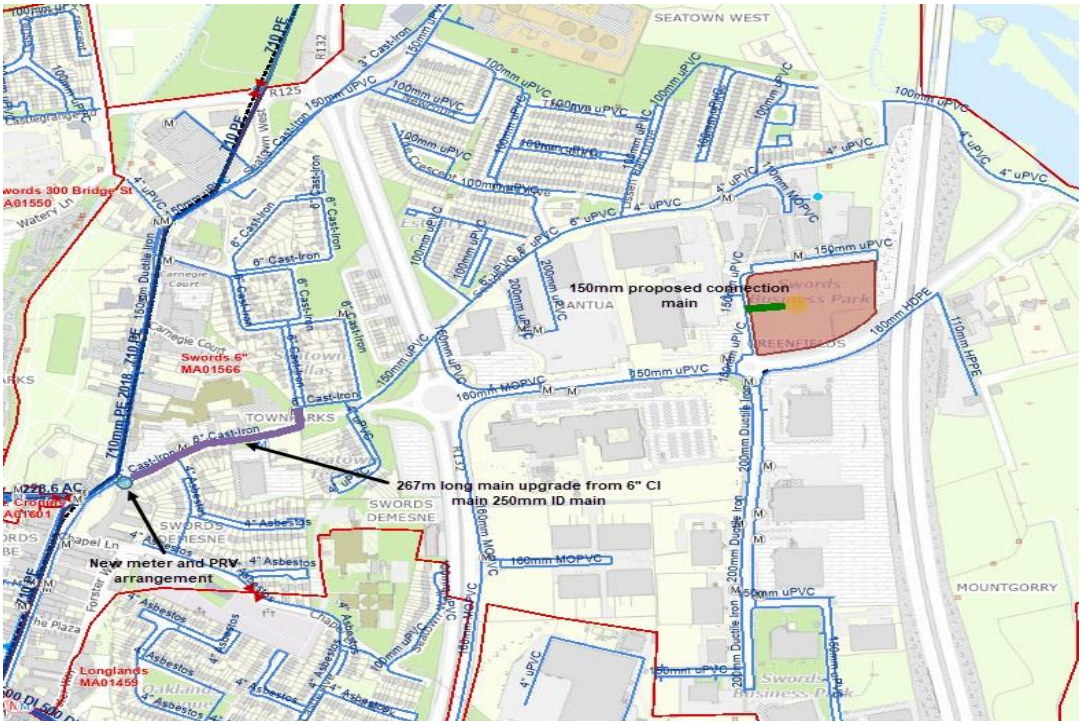
Based upon the details provided we can advise the following regarding connecting to the networks;

- **Water Connection** - Feasible subject to upgrades

- In order to accommodate the proposed connection at the development, upgrade works are required to the existing water network These upgrade works are not currently on Uisce Éireann investment plan therefore, the applicant will be required to fund these local network upgrades. At connection application stage, the network upgrade requirements will be reviewed, and you will be provided with a quote for these works. Please find below the upgrade options:

- Option 1- Connect 500mm trunk main to 150mm uPVC parallel main with a 150mm new main for 270m and install a new meter and PRV arrangement in connection point. Close valve near Seatown Road roundabout. (Please see figure below).

- Option 2- Install a new meter and PRV arrangement at West end of Seatown Road on 6" Cast Iron main and replace downstream CI main with 250mm main for 267m length. (Please find figure below).



- **Wastewater Connection - ** Feasible without infrastructure upgrade by Uisce Éireann
- Please bear in mind that pumping may be required .

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

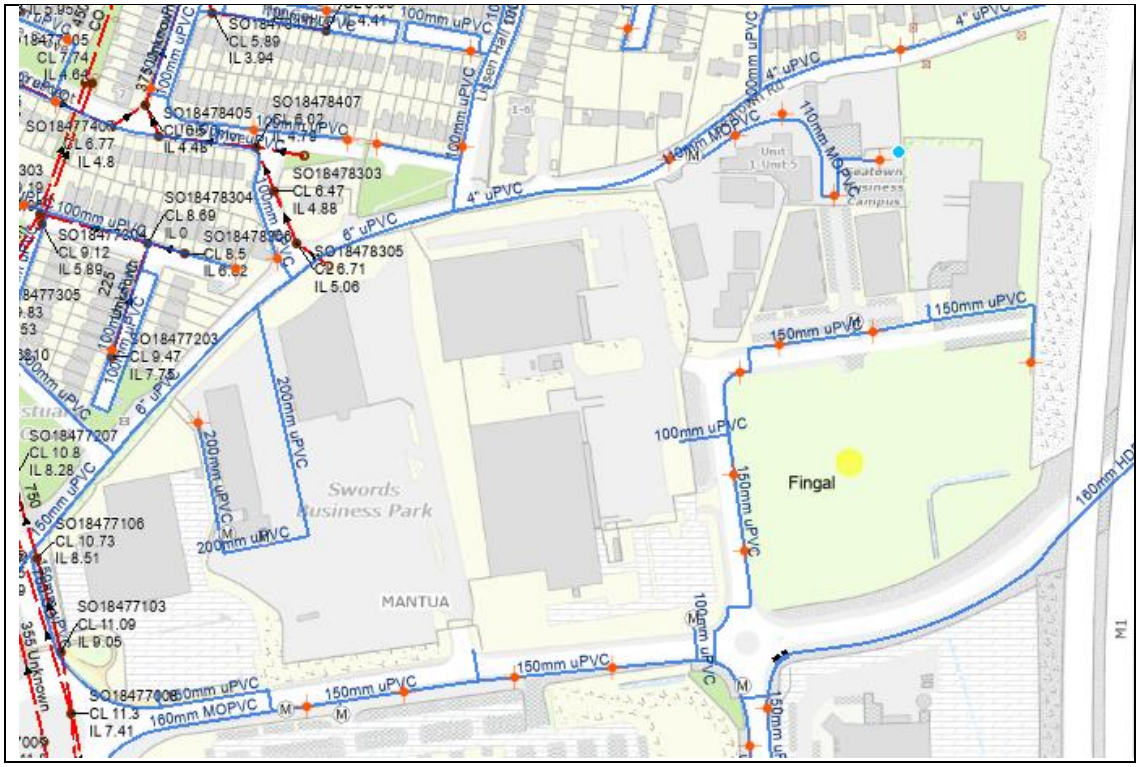
Section A - What is important to know?

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



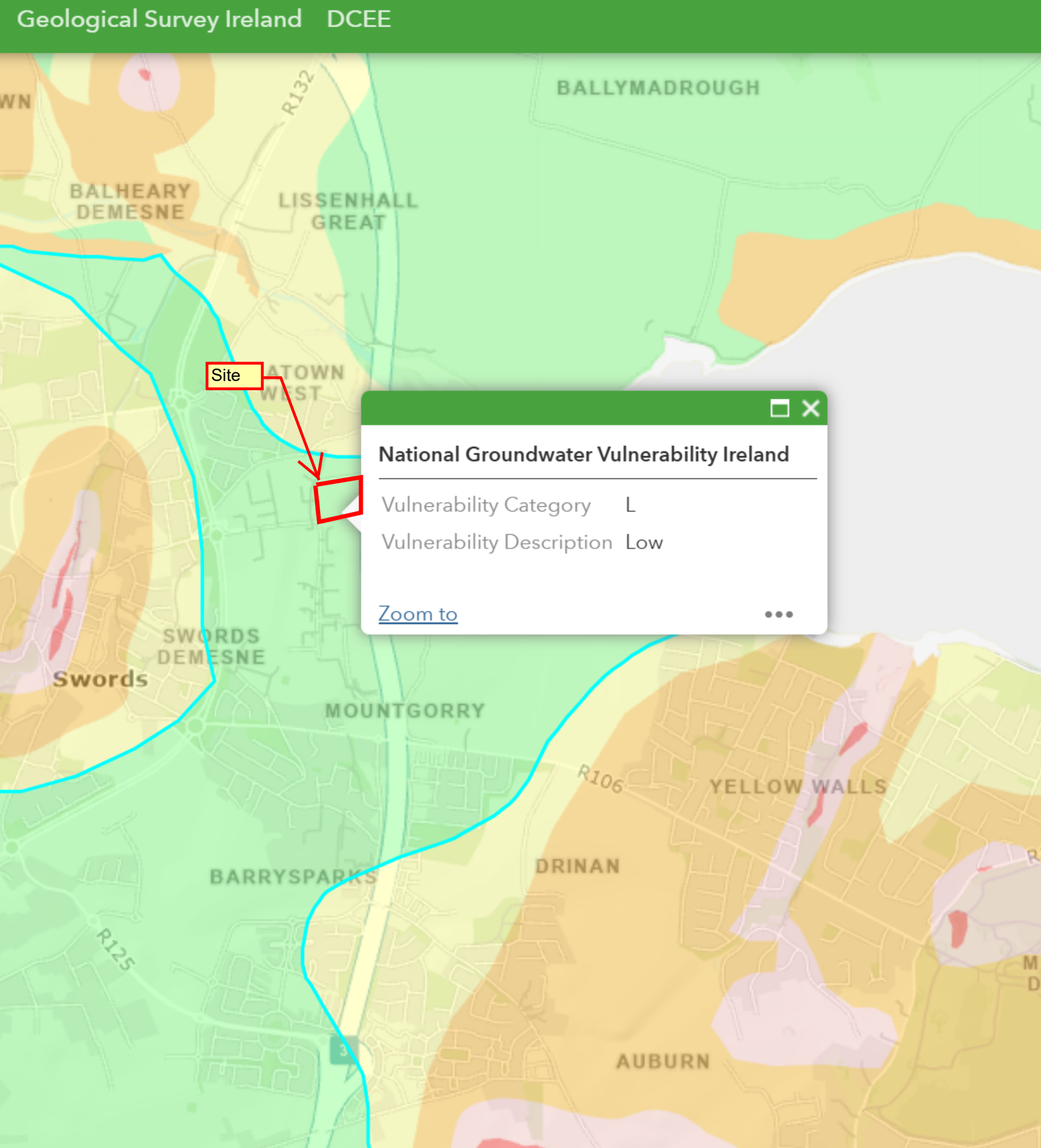
Reproduced from the Ordnance Survey of Ireland by Permission of the Government. License No. 3-3-34

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.

Appendix 11.4

GSI Mapping Data


Geological Survey Ireland
DCEE
BALLYMADROUGH
R132
BALHEARY DEMESNE
LISSENHALL GREAT
Site
ATOWN WEST
National Groundwater Vulnerability Ireland
Vulnerability Category L
Vulnerability Description Low
Zoom to
SWORDS DEMESNE
Swords
MOUNTGORRY
R106
YELLOW WALLS
DRINAN
BARRYSPARKS
R125
AUBURN

Results

Keep Previous Results

National Soils Hydrology Map

Poorly Drained

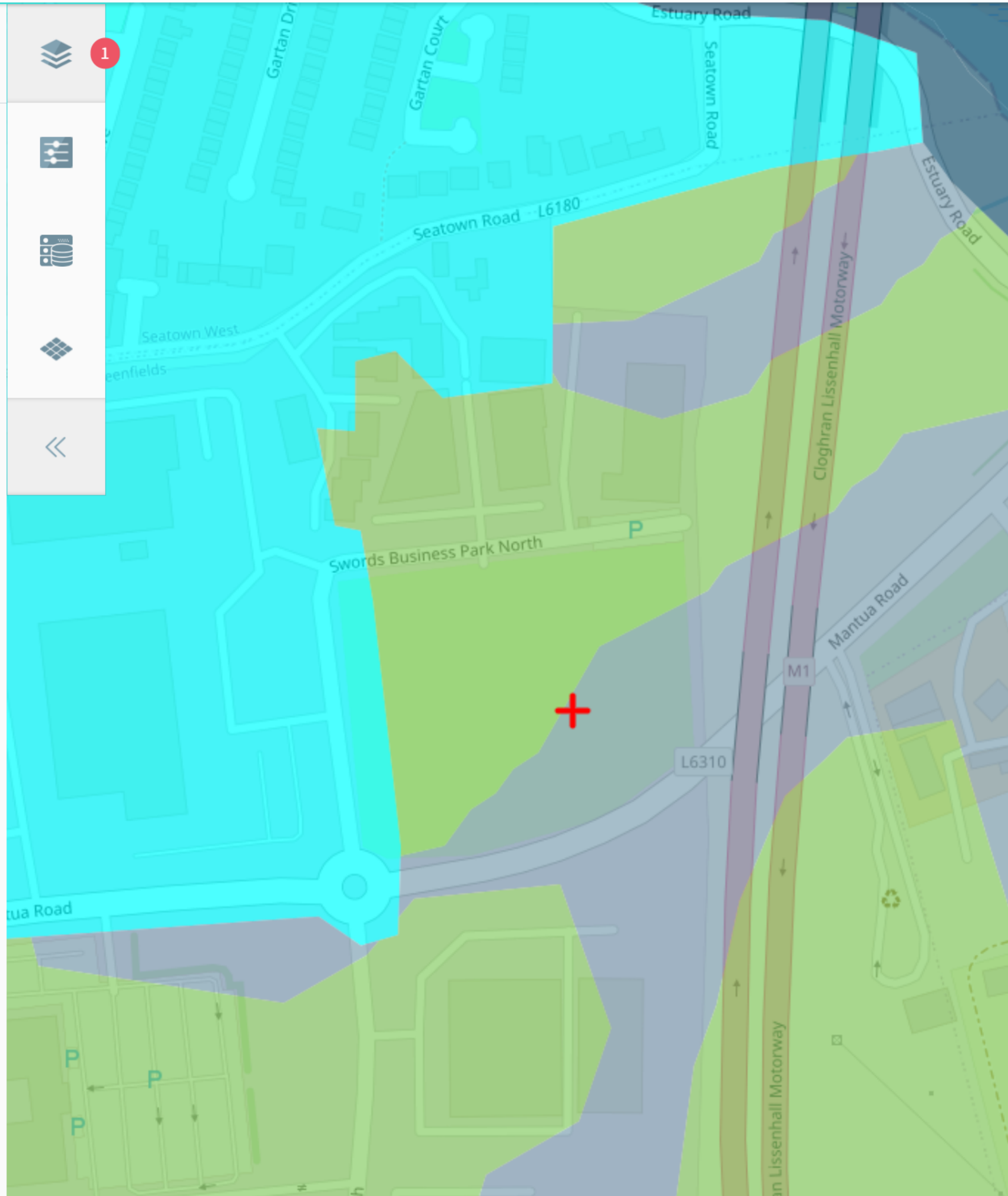
CATEGORY	Poorly Drained
SOILDRAINAGECLASS	Poor
PAR_MAT	TLs
IFS_SOIL	BminPD
IFS_CODE	32

National Soils Hydrology Map

Well Drained

CATEGORY	Well Drained
SOILDRAINAGECLASS	Well
PAR_MAT	TLs
IFS_SOIL	BminDW
IFS_CODE	12

EXPORT



Results

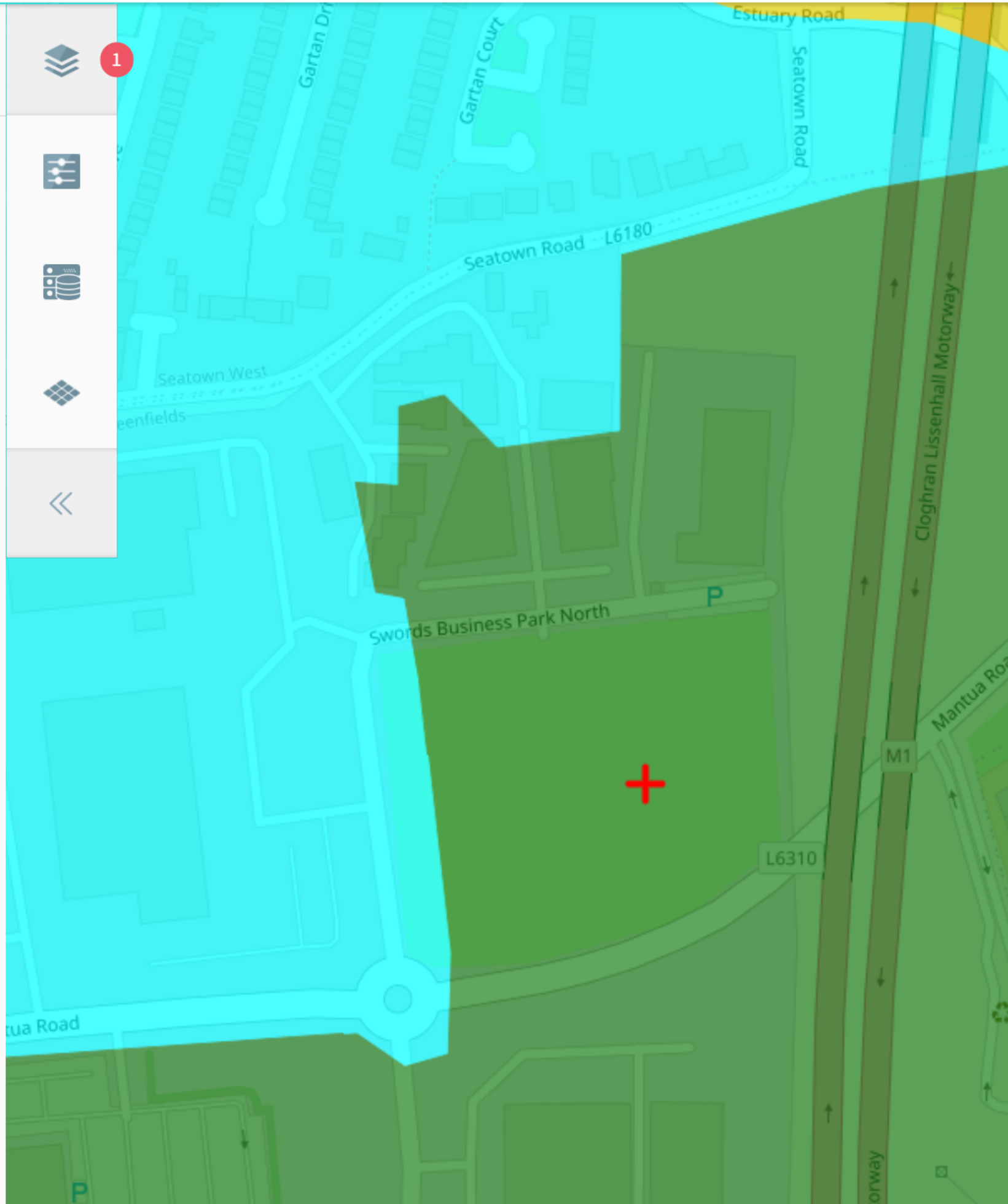
Keep Previous Results

Subsoils

11274.95805

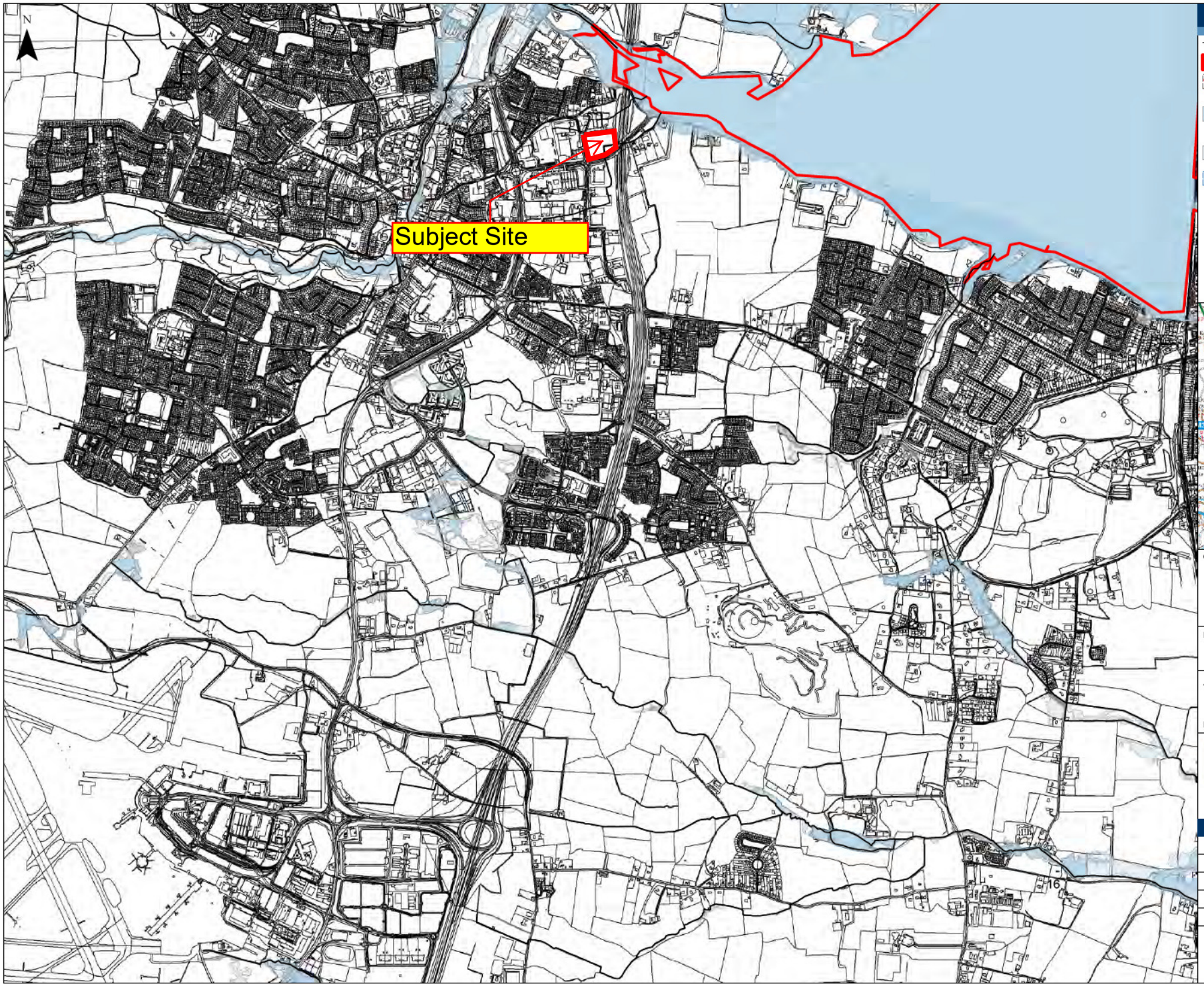
PERIMETER	11274.95805
PAR_MAT	TLs
COUNTY	DUBLIN
CATEGORY	Till type
DESCRIPT	Limestone till (Carboniferous)
TEXTURE	Variable
Class	Tills (diamictons)
PlainEnglish	The subsoil is a till type. Till is sediment deposited by or from glacier ice.

EXPORT



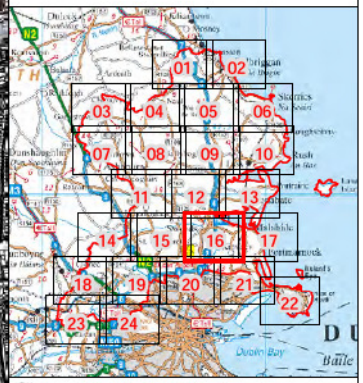
Appendix 11.5

OPW PRFA Mapping and Report



Legend

- Watercourses
- Fingal County Boundary
- Defended Area
- Flood Zone A - 1% AEP (Fluvial) or 0.5% AEP (Coastal) Flood Extent (1 in 100 chance in any given year)
- Flood Zone B - 0.1% AEP Flood Extent (1 in 1000 chance in any given year)
- Indicative Flood Extents



Client

Comhairle Contae Fhine Gall
Fingal County Council

Project

Strategic Flood Risk Assessment

Title

Flood Zone Mapping

Figure Map 16 of 24

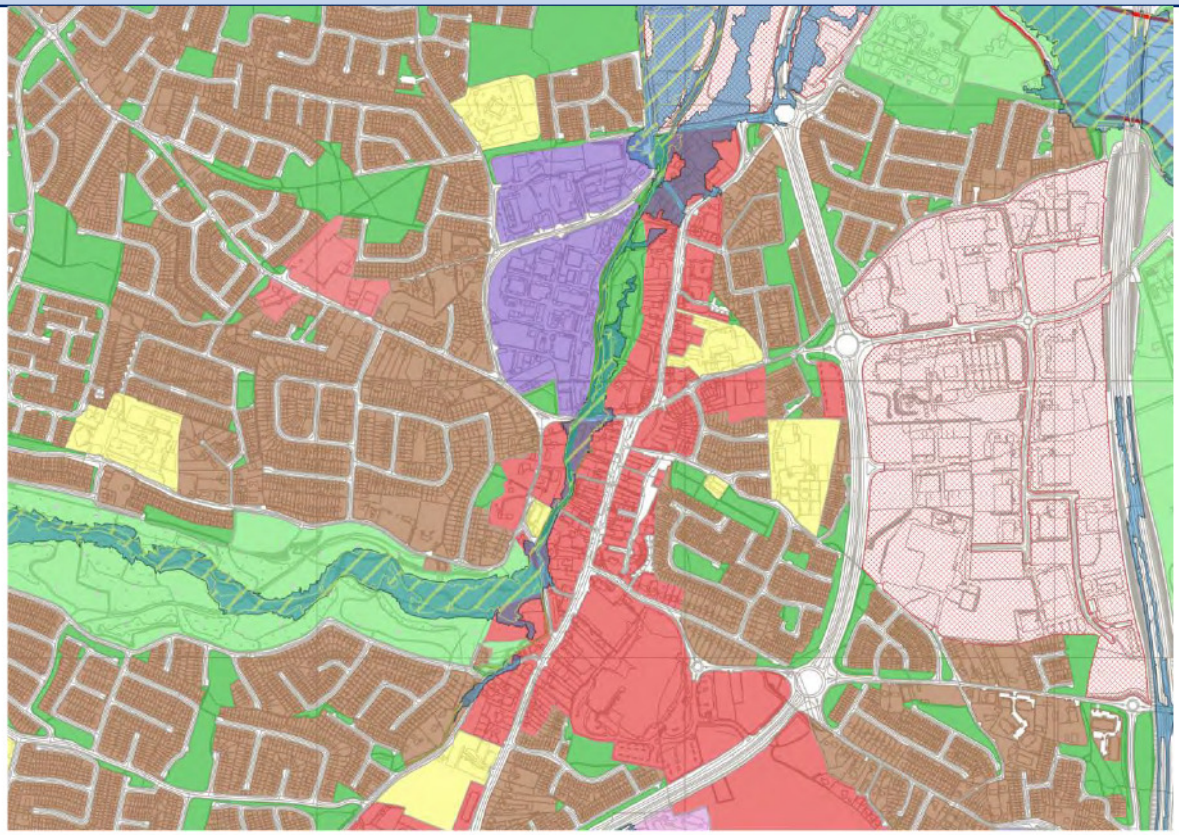
RPS

West Pier Business Campus,
Dun Laoghaire,
Co Dublin,
Ireland.

Tel: +353 (0) 1 4882900
Fax: +353 (0) 1 2835676
Email: ireland@rpsgroup.com
Web Page: rpsgroup.com/ireland

Issue Details

Drawn By: BT	Project No. MDW0716
Checked By: BC	File Ref: MDW0716arc0001D03
Approved By: PM	
Scale: 1: 20,000 @ A3	Drawing No. Rev:
Date: 08/03/2017	Arc0001 A01

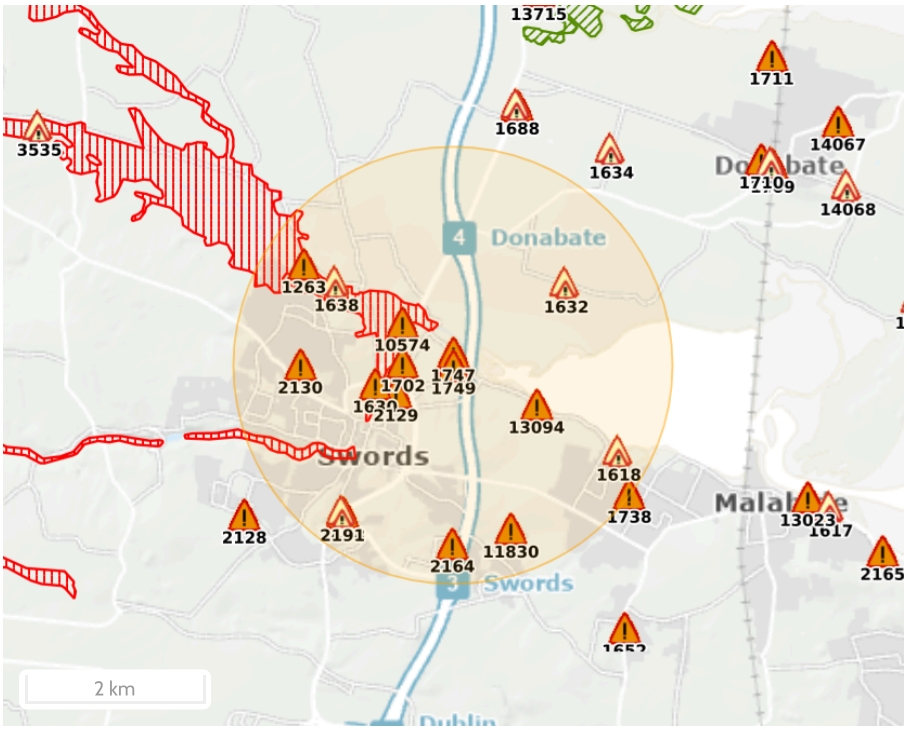
Development SWORDS TOWN	
	
Criteria 1	Swords is the county town of Fingal and it is a long established area and very well developed.
Criteria 2	The existing zoning remains compatible with the long established use and existing residential developments.
Criteria 3	A portion of the zoned lands is at risk. A detailed site specific FRA is to be carried out and submitted with any planning application to address flood risk, propose mitigation measures and assign appropriate development. Further flood risk assessment will also take place as part of the Masterplan process. Site Specific FRA should address the following: ▪ Apply sequential approach should be applied through site planning and should avoid encroachment onto, or loss of, the flood plain. ▪ Highly Vulnerable Development shall not be permitted in Flood Zone A or B. ▪ Development in Flood Zone A should be either open space or water compatible. ▪ FRA should address residual risk of culvert blockage (where applicable), increased flood extents under climate change scenarios and pluvial risk which should be aimed at setting finished floor levels. ▪ Compensatory storage for development that results in a loss of floodplain must be provided on a level for level basis s and the land given to storage must be land which does not flood in the 1% AEP flood event.
Conclusion **Pass.** It is recommended that any proposals for future development of this land will be subject to a site specific FRA to ensure that development is appropriate and satisfies Criteria 3 of the Justification Test.	

Past Flood Event Local Area Summary Report

Report Produced: **20/10/2025 16:54**

This Past Flood Event Summary Report summarises all past flood events within 2.5 kilometres of the map centre.

This report has been downloaded from www.floodinfo.ie (the "**Website**"). The users should take account of the restrictions and limitations relating to the content and use of the Website that are explained in the Terms and Conditions. It is a condition of use of the Website that you agree to be bound by the disclaimer and other terms and conditions set out on the Website and to the privacy policy on the Website.



Map Legend

- Single Flood Event
- Recurring Flood Event
- Past Flood Event Extents
- Drainage Districts Benefited Lands*
- Land Commission Benefited Lands*
- Arterial Drainage Schemes Benefited Lands*

* Important: These maps do not indicate flood hazard or flood extent. Their purpose and scope is explained on Floodinfo.ie

18 Results

	Name (Flood_ID)	Start Date	Event Location
1.	N1 at Roundabout at Fingallions Nov 2002 (ID-1702)	13/11/2002	Exact Point
	Additional Information: Reports (1) Press Archive (0)		
2.	Mill View Lawn Malahide Feb 2002 (ID-1738)	01/02/2002	Exact Point
	Additional Information: Reports (1) Press Archive (0)		
3.	Estuary Road Swords Feb 2002 (ID-1747)	01/02/2002	Approximate Point
	Additional Information: Reports (1) Press Archive (0)		
4.	Gartan Court Swords Feb 2002 (ID-1749)	01/02/2002	Exact Point
	Additional Information: Reports (1) Press Archive (0)		
5.	Seatown Villas Swords Nov 1982 (ID-2129)	05/11/1982	Exact Point
	Additional Information: Reports (1) Press Archive (0)		
6.	Pine Grove Park Swords Nov 1982 (ID-2130)	05/11/1982	Exact Point
	Additional Information: Reports (1) Press Archive (0)		

	Name (Flood_ID)	Start Date	Event Location
7.	Melrose Park Oct 2002 (ID-2164)	19/10/2002	Exact Point
	Additional Information: Reports (1) Press Archive (0)		
8.	Pinnock Hill Nov 2002 (ID-2191)	14/11/2002	Exact Point
	Additional Information: Reports (1) Press Archive (0)		
9.	Pinnock Hill October 2002 (ID-1468)	19/10/2002	Exact Point
	Additional Information: Reports (4) Press Archive (0)		
10.	Pinnock Hill Swords Recurring (ID-1459)	n/a	Exact Point
	Additional Information: Reports (7) Press Archive (0)		
11.	Bisset Strand and Estuary Road Malahide Recurring (ID-1618)	n/a	Exact Point
	Additional Information: Reports (4) Press Archive (0)		
12.	Ballymadrough Donabate Recurring (ID-1632)	n/a	Approximate Point
	Additional Information: Reports (2) Press Archive (0)		
13.	Balheary Road Swords Recurring (ID-1638)	n/a	Exact Point
	Additional Information: Reports (2) Press Archive (0)		
14.	Broadmeadow Swords August 1986 (ID-1263)	24/08/1986	Approximate Point
	Additional Information: Reports (1) Press Archive (0)		
15.	Ward North Street Swords Nov 2002 (ID-1630)	13/11/2002	Exact Point
	Additional Information: Reports (4) Press Archive (3)		
16.	Ward Swords Co.Dublin August 2008 (ID-10574)	08/08/2008	Approximate Point
	Additional Information: Reports (1) Press Archive (0)		
17.	Flooding at Kinsealy Court, Swords, Co. Dublin (ID-11830)	24/11/2011	Approximate Point
	Additional Information: Reports (1) Press Archive (0)		
18.	Flooding at Malahide on 03/02/2014 (ID-13094)	03/02/2014	Approximate Point
	Additional Information: Reports (0) Press Archive (0)		

Appendix 11.6

Uisce Éireann Records Maps

Appendix 11.6

Uisce Éireann Records Maps

Appendix 11.7

Soakaway Test Report

S.I. Ltd Contract No: 6550

Client:	Jackie Greene Construction
Engineer:	Roger Mullarkey & Associates
Contractor:	Site Investigations Ltd

Seatown Road,
Swords, Co. Dublin
Site Investigation Report

Prepared by:

.....

Stephen Letch

Issue Date:	05/09/2025
Status	Final
Revision	0

Contents:

Appendices:

1. Introduction

On the instructions of Roger Mullarkey & Associates, Site Investigations Ltd (SIL) was appointed to complete a ground investigation at Seatown Road, Swords, Co. Dublin. The investigation was to complete a series of soakaway tests on behalf of the Client, Jackie Greene Construction, and was completed in August 2025.

This report presents the factual geotechnical data obtained from the fieldworks with interpretation of the ground conditions discussed.

2. Fieldwork

All fieldwork was carried out in accordance with BS 5930:2015, Engineers Ireland GI Specification and Related Document 2nd Edition 2016 and Eurocode 7: Geotechnical Design. The fieldworks comprised the following:

- 2 No. soakaway tests

2.1. Soakaway Tests

2 No. soakaway tests were excavated and logged by SIL geotechnical engineer. BRE Special Digest 365 stipulates that the pit should be filled three times and that the final cycle is used to provide the infiltration rate. The time taken for the water level to fall from 75% volume to 25% volume is required to calculate the rate of infiltration. However, if the water level does not fall at a steady rate, then the test is deemed to have failed and the area is unsuitable for storm water drainage.

The soakaway test results and photographs are presented in Appendix 1.

2.2. Surveying

A survey of the exploratory hole locations was completed upon completion of the fieldworks using a GeoMax GPS Rover. The data is supplied along with a site plan in Appendix 2.

3. Recommendations and Conclusions

Please note the following caveats:

The recommendations given, and opinions expressed in this report are based on the findings as detailed in the laboratory test results. No responsibility can be accepted for adjacent unexpected conditions that have not been revealed by the exploratory holes.

3.1. Soakaway Tests

The soakaway tests failed the specification as the water level did not fall sufficiently enough to complete the test. The BRE Digest stipulates that the pit should half empty within 24hrs, and extrapolation indicates this condition would not be satisfied. The tests were terminated at the end of the first (of a possible three) fill/empty cycle since further testing would give even slower fall rates due to increased soil saturation.

Appendix 1

Soakaway Test Results and Photographs

SOAKAWAY TEST

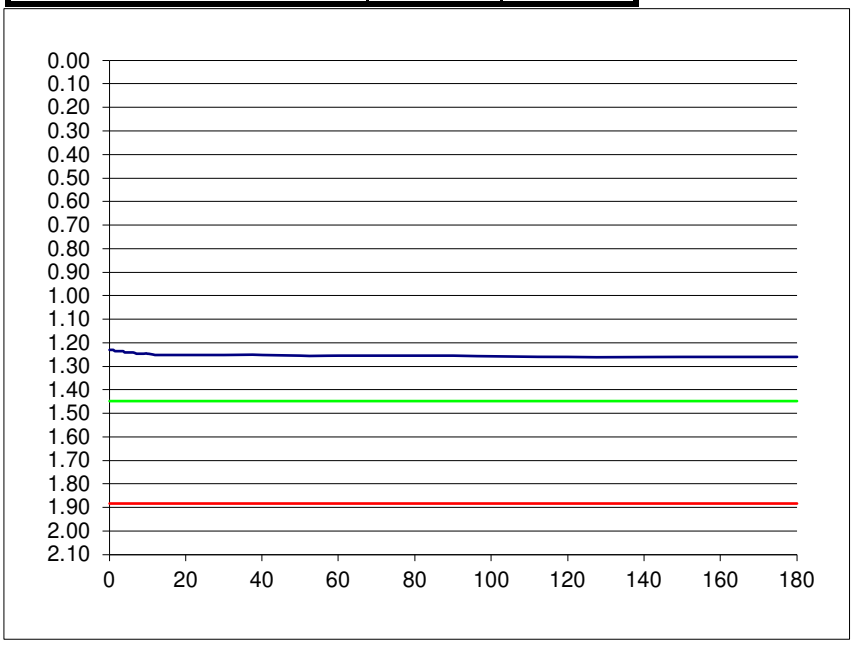
Project Reference:	6550
Contract name:	Seatown Road
Location:	Swords, Co. Dublin
Test No:	SA01
Date:	07/08/2025

Ground Conditions

From	To	
0.00	0.20	TOPSOIL.
0.20	0.60	Soft light brown sandy slightly gravelly silty CLAY.
0.60	1.30	Firm light brown grey sandy slightly gravelly silty CLAY with low cobble content.
1.30	1.80	Firm grey brown sandy slightly gravelly silty CLAY with low cobble content.
1.80	2.10	Grey silty sandy GRAVEL with medium cobble and low boulder content.

Elapsed Time (mins)	Fall of Water (m)
0	1.23
0.5	1.23
1	1.23
1.5	1.24
2	1.24
2.5	1.24
3	1.24
3.5	1.24
4	1.24
4.5	1.24
5	1.24
6	1.24
7	1.25
8	1.25
9	1.25
10	1.25
12	1.25
14	1.25
16	1.25
18	1.25
20	1.25
25	1.25
30	1.25
40	1.25
50	1.26
60	1.26
75	1.26
90	1.26
120	1.26
150	1.26
180	1.26

Pit Dimensions (m)		
Length (m)	3.40	m
Width (m)	0.60	m
Depth	2.10	m
Water		
Start Depth of Water	1.23	m
Depth of Water	0.87	m
75% Full	1.45	m
25% Full	1.88	m
75%-25%	0.44	m
Volume of water (75%-25%)	**0.89**	m3
Area of Drainage	**16.80**	m2
Area of Drainage (75%-25%)	**5.52**	m2
Time		
75% Full	N/A	min
25% Full	N/A	min
Time 75% to 25%	**N/A**	min
Time 75% to 25% (sec)	**N/A**	sec



f = **Fail** m/min or **Fail** m/s

SOAKAWAY TEST

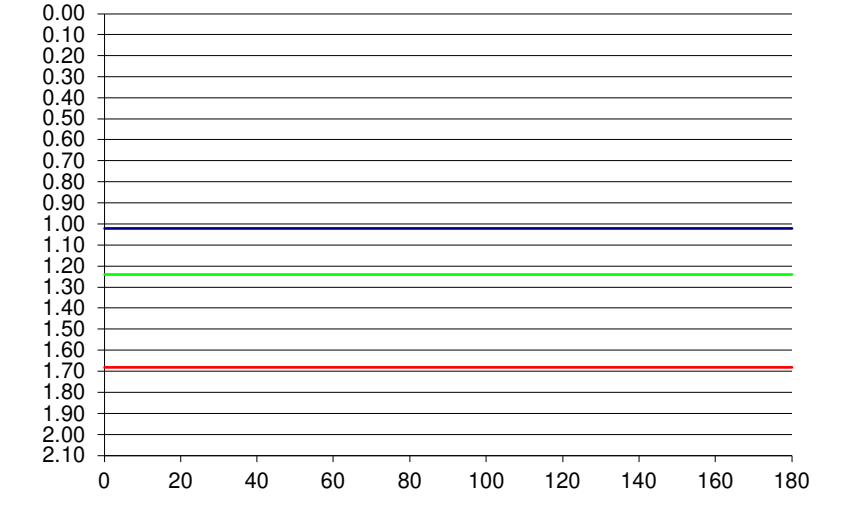
Project Reference:	6550
Contract name:	Seatown Road
Location:	Swords, Co. Dublin
Test No:	SA02
Date:	07/08/2025

Ground Conditions

From	To	
0.00	0.05	TOPSOIL.
0.05	0.30	MADE GROUND: grey brown sandy gravelly silty clay with low cobble content and some timber fragments.
0.30	1.60	Firm light brown sandy slightly gravelly silty CLAY with low cobble content.
1.60	1.90	Stiff grey brown slightly sandy gravelly silty CLAY with high cobble and low boulder content.
1.90		Obstruction - possible boulders - pit terminated and test completed.

Elapsed Time (mins)	Fall of Water (m)
0	1.02
0.5	1.02
1	1.02
1.5	1.02
2	1.02
2.5	1.02
3	1.02
3.5	1.02
4	1.02
4.5	1.02
5	1.02
6	1.02
7	1.02
8	1.02
9	1.02
10	1.02
12	1.02
14	1.02
16	1.02
18	1.02
20	1.02
25	1.02
30	1.02
40	1.02
50	1.02
60	1.02
75	1.02
90	1.02
120	1.02
150	1.02
180	1.02

Pit Dimensions (m)		
Length (m)	3.60	m
Width (m)	0.60	m
Depth	1.90	m
Water		
Start Depth of Water	1.02	m
Depth of Water	0.88	m
75% Full	1.24	m
25% Full	1.68	m
75%-25%	0.44	m
Volume of water (75%-25%)	**0.95**	m3
Area of Drainage	**15.96**	m2
Area of Drainage (75%-25%)	**5.86**	m2
Time		
75% Full	N/A	min
25% Full	N/A	min
Time 75% to 25%	**N/A**	min
Time 75% to 25% (sec)	**N/A**	sec



f = **Fail** m/min or **Fail** m/s

SA01 Sidewall

SA01 Spoil

SA02 Sidewall

SA02 Spoil

Appendix 2

Survey Data

Survey Data

Location	Irish Transverse Mercator		Elevation	Irish National Grid	
	Easting	Northing		Easting	Northing
Soakaway Tests					
SA01	719102.593	747254.082	5.65	319177.540	247230.669
SA02	719181.749	747293.752	6.13	319256.712	247270.348

Site Investigations Ltd
The Grange
12th Lock Road
Lucan
Co. Dublin
T: 01 6108768
e: info@siteinvestigations.ie

Contract No:	6550	Client:	Jackie Greene Construction
Contract Name:	Seatown Road	Engineer:	Roger Mullarkey & Associates
Location:	Swords, Co. Dublin	Scale:	1:750
Title:	Site Plan	Drawn By:	SL

Legend Key

Locations By Type - IP

Appendix 11.8

StormTech Calculations

StormTech® Subsurface Stormwater Management

The advanced design of StormTech s chambers allows stormwater professionals to create more profitable, environmentally sound installations. Compared with other subsurface systems, StormTech s innovative chambers offer lower overall installed costs, superior design flexibility and enhanced long-term performance.

Superior Design Flexibility for Optimal Land Use

StormTech chambers are ideal for commercial, municipal and residential applications. One of the key advantages of the StormTech chamber system is design flexibility. StormTech chambers can be configured into beds or trenches, in centralized or decentralized layouts to fit on nearly any site.

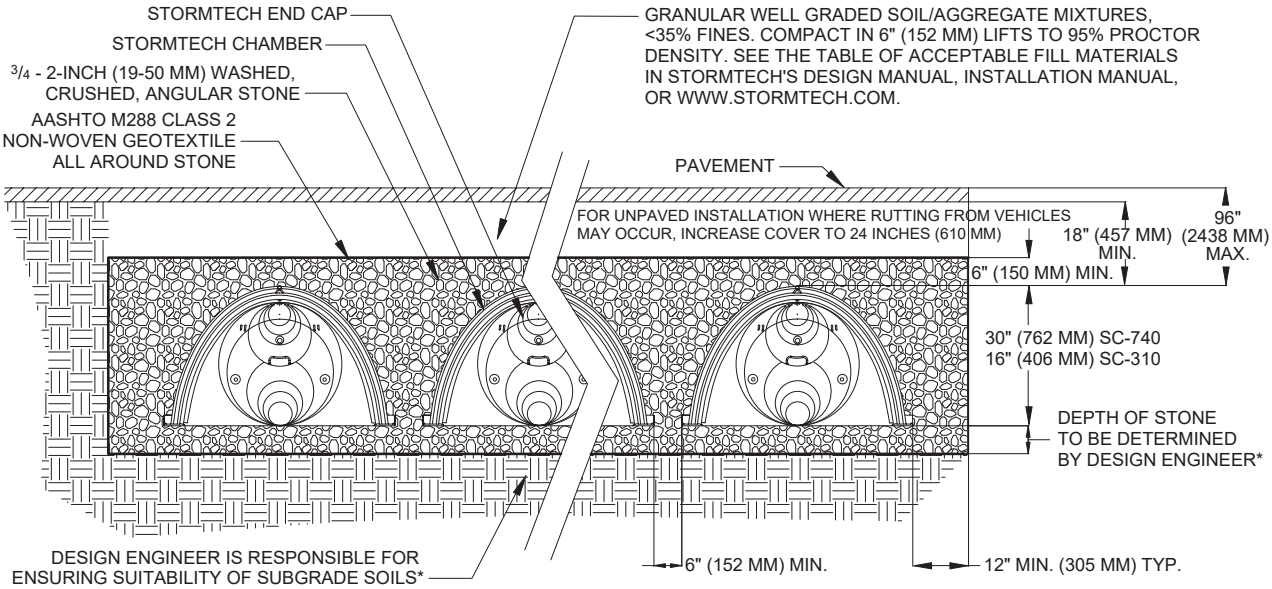
L to R: SC-310 chamber and SC-740 chamber

Product Features and Benefits

The advanced features and innovative technology of StormTech chambers streamline installations while lowering overall installed costs. StormTech chambers offer these unique advantages:

- Lightweight, two people can install chambers quickly and easily, saving time and money
- Extensive product research & development and rigorous testing ensure long term reliability and performance
- Versatile product design accommodates a wide range of site constraints with cost-effective system designs
- The chamber length can be cut in 6.5" (165 mm) increments – reducing waste and optimizing the use of available space
- Injection molded polypropylene ensures precise control of wall thickness and product consistency
- Isolator Row – a patent pending technique to inexpensively enhance total suspended solids (TSS) removal and provide easy access for inspection and maintenance
- Corrugated Arch Design – a proven geometry for structural integrity under H-20 live loads and deep burial loads, also provides high storage capacity

Typical Cross Section Detail (not to scale)



Detention-Retention-Recharge

The StormTech SC-740 chamber optimizes storage volumes in relatively small footprints by providing 2.2 ft^3/ft^2 (0.67 m^3/m^2) (minimum) of storage. This can decrease excavation, backfill and associated costs. The StormTech SC-310 chamber is ideal for systems requiring low-rise and wide-span solutions. The chamber allows the storage of large volumes, 1.3 ft^3/ft^2 (0.4 m^3/m^2) (minimum), at minimum depths.

StormTech SC-740 Chamber
(not to scale)

Nominal Chamber Specifications

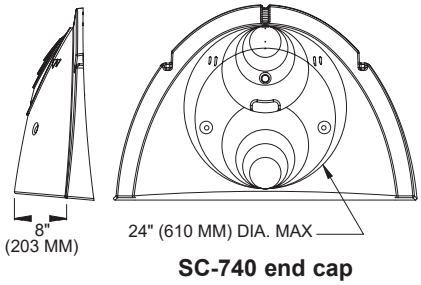
Size (L x W x H)
85.4" x 51.0" x 30.0"
(2169 x 1295 x 762 mm)

Chamber Storage
45.9 ft^3 (1.30 m^3)

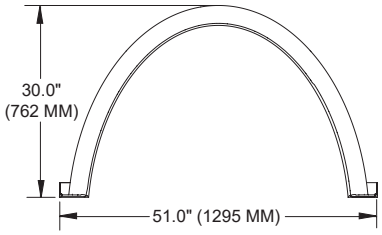
Minimum Installed Storage*
74.9 ft^3 (2.12 m^3)

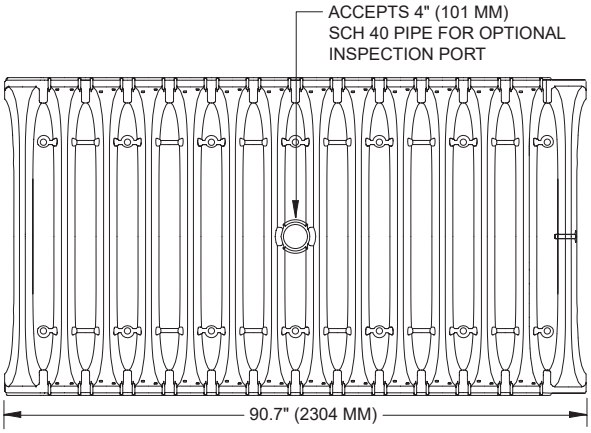
Weight
74.0 lbs (33.6 kg)

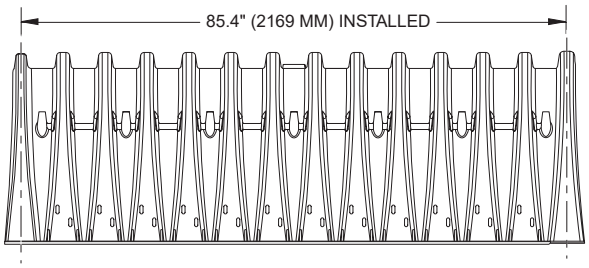
Shipping
30 chambers/pallet
60 end caps/pallet
12 pallets/truck



SC-740 end cap







SC-740 chamber

StormTech SC-310 Chamber
(not to scale)

Nominal Chamber Specifications

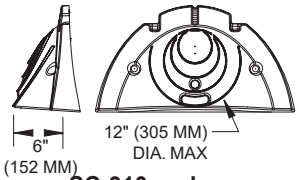
Size (L x W x H)
85.4" x 34.0" x 16.0"
(2169 x 864 x 406 mm)

Chamber Storage
14.7 ft^3 (0.42 m^3)

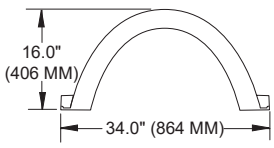
Minimum Installed Storage*
31.0 ft^3 (0.88 m^3)

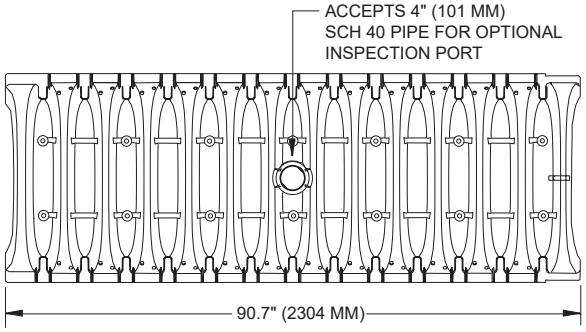
Weight
37.0 lbs (16.8 kg)

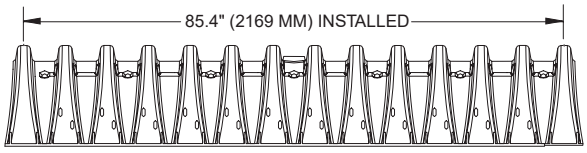
Shipping
41 chambers/pallet
108 end caps/pallet
18 pallets/truck



SC-310 end cap







SC-310 chamber

*This assumes a minimum of 6 inches (152 mm) of stone below, above and between chamber rows.

Advanced Structural Performance for Greater Long-Term Reliability

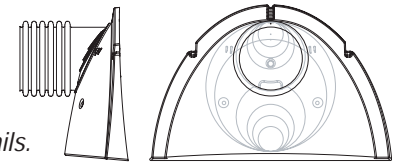
StormTech developed a state of the art chamber design through:

- Collaboration with world-renowned experts of buried drainage structures to develop and evaluate the structural testing program and product design
- Designing chambers to exceed AASHTO LRFD design specifications for HS-20 live loads and deep burial earth loads
- Subjecting the chambers to rigorous full scale testing, under severe loading conditions to verify the AASHTO safety factors for live load and deep burial applications

StormTech continues to conduct research and consult with outside experts to meet customer needs for alternative backfill materials, designs for special loadings and other technical solutions.

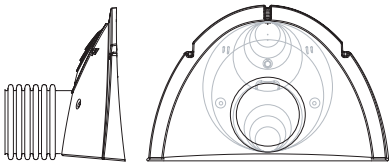
Technical Assistance

StormTech s technical support staff is available to provide assistance to engineers, contractors and developers. Please contact one of our engineers or product managers to discuss your particular application. A wide variety of technical support material is available in print, electronic media or from our website at www.stormtech.com. For any questions, please call StormTech at 888-892-2694.



Fabricated End Caps

Contact StormTech for details.



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STORMTECH Stormwater Management System Design Tool

ver: Jan18

PROJECT REF:	Swords
LOCATION:	TANK 1
DATE:	April'26
CREATED BY:	RM

SYSTEM PARAMETERS

Required Total Storage	119	m^3
Stormtech chamber model	SC740	
Filtration Permeable Geo or Impermeable Geo	Filter geo	
Number of Isolator Rows (IR)	1	

SITE PARAMETERS

Stone Porosity	40%		
Excavation Batter Angle (degrees)	90	°	*Minimum Requirement*
Stone Above Chambers	0.35	m	*0.15*
Stone Below Chambers	0.3	m	*0.15*
In-between Row Spacing	0.15	m	*0.15*
Additional Storage outside Excavation. E.g manholes, Header Pipe	5	m^3	

HEADER PIPE

Is Header pipe required within excavation	No	
Orientation of Header Pipe	Parrallel to IR	
Diameter of Header Pipe	0.6	m
Length of Header Pipe	0	m

CHAMBER SYSTEM DIMENSIONS

	Calculated	Adopted	
Number of Rows		7	ea
Number of units per Row		7	ea
System Installed Storage Depth (effective storage depth)	1.410		m
Tank overall installed Width at base	10.57	10.5	m
Tank overall installed Length at Base	15.89	17	m
Total Effective System Storage	138.9	144.9	m^3

STORMTECH SYSTEM DETAIL

StormTech Chamber Model	SC740	
Unit Width	1.295	m
Unit Length	2.17	m
Unit Height	0.76	m
Min Cover Over System	0.3	m
Max Cover Over Chamber (see StormTech for greater cover)	2.4	m
Chamber Internal Storage Vol.	1.3	m^3
Header Pipe Internal Storage Vol in Excavation	0.0	m^3

STONE AND EXCAVATION DETAIL

Volume of Dig for System	252	m^3
Width at base	10.50	m
Width at top	10.50	m
Length at base	17.00	m
Length at top	17.00	m
Depth Of System	1.41	m
Area of Dig at Base of System	179	m^2
Area of Dig at Top of System	179	m^2
Void Ratio	58%	
Stone Requirement - m3	187	m^3
Stone Requirement - tonne	307	tonne

STORMTECH Stormwater Management System Design Tool

ver: Jan18

PROJECT REF:	Swords
LOCATION:	TANK 2
DATE:	April'26
CREATED BY:	RM

SYSTEM PARAMETERS

Required Total Storage	126	m^3
Stormtech chamber model	SC740	
Filtration Permeable Geo or Impermeable Geo	Filter geo	
Number of Isolator Rows (IR)	1	

SITE PARAMETERS

Stone Porosity	40%		
Excavation Batter Angle (degrees)	90	°	*Minimum Requirement*
Stone Above Chambers	0.35	m	*0.15*
Stone Below Chambers	0.3	m	*0.15*
In-between Row Spacing	0.15	m	*0.15*
Additional Storage outside Excavation. E.g manholes, Header Pipe	5	m^3	

HEADER PIPE

Is Header pipe required within excavation	No	
Orientation of Header Pipe	Parrallel to IR	
Diameter of Header Pipe	0.6	m
Length of Header Pipe	0	m

CHAMBER SYSTEM DIMENSIONS

	Calculated	Adopted	
Number of Rows		7	ea
Number of units per Row		7	ea
System Installed Storage Depth (effective storage depth)	1.410		m
Tank overall installed Width at base	10.57	11.5	m
Tank overall installed Length at Base	15.89	17	m
Total Effective System Storage	138.9	154.5	m^3

STORMTECH SYSTEM DETAIL

StormTech Chamber Model	SC740	
Unit Width	1.295	m
Unit Length	2.17	m
Unit Height	0.76	m
Min Cover Over System	0.3	m
Max Cover Over Chamber (see StormTech for greater cover)	2.4	m
Chamber Internal Storage Vol.	1.3	m^3
Header Pipe Internal Storage Vol in Excavation	0.0	m^3

STONE AND EXCAVATION DETAIL

Volume of Dig for System	276	m^3
Width at base	11.50	m
Width at top	11.50	m
Length at base	17.00	m
Length at top	17.00	m
Depth Of System	1.41	m
Area of Dig at Base of System	196	m^2
Area of Dig at Top of System	196	m^2
Void Ratio	56%	
Stone Requirement - m3	211	m^3
Stone Requirement - tonne	346	tonne

Appendix 11.9

Interception Calculations

INTERCEPTION - Seatown Road, Swords

Paved Surfaces connected to the drainage system (Ha) =	1.17*0.8	0.9376	Volume of Interception Required (m^3)	37.5	Gross Paved Area x 5mm x 0.8 (GDSDS E2.1.1 - Criterion 1)

Volume of Interception Provided (m^3)	Length	Width (m)	Area (m^2)	Quantity	Stone Depth (m)	Void Ratio	Volume (m^3)
Voids of stone below Attenuation Tank			350		0.3	0.4	42.0
Voids of stone below Permeable Paving overflow			1,688		0.15	0.3	76.0
Green Roof Intensive			2,797		0.2	0.1	55.9
Detention Basin 50mm storage			340		0.05	1	17.0
Tree Pits			14	8	0.1	1	11.2
Bio-Retention			198		0.075	1	14.9
Voids of stone below Filter Swales	120	0.75	90		0.15	0.4	5.4

Volume of Interception Provided (m^3) =	**222.4**
Volume of Interception Required (m^3) =	**37.5**
Interception provided > Required	**OK**

Appendix 11.10

Foul Drainage and Water Demand Calculations

Foul flow estimates – Domestic

SWORDS					
New Network - DOMESTIC Wastewater Flows					
Usage	**Quantity**	**Occupancy (h)**	**Population (P)**	**Consumption (G) (l/h/day)**	**Loading (PxG)(l/day)**
Residential	289 Units	2.7No./Unit	780	150	117,000
				Total =	**116,640 l/day**
				Flowrate per day (l/s)	**1.35 l/s**
				Growth Rate	1
				Infiltration (I)	10%
				Dry Weather Flow	**PG + I**
				Peaking Factor (Pf_{Dom})	4.5
				Design Foul Flow (l/s)	**Pf_{Dom} x PG**
				Misconnection Allowance (SW)	1.5%
				Design Flow (l/s)	**6.73 l/s**

Based on Irish Water Code of Practice Wastewater Infrastructure (Rev 3 Aug'25)

Residential Wastewater Calculations

Foul flow estimates – Commercial

SWORDS					
New Network – COMMERCIAL Wastewater Flows					
Usage	*Quantity*	*Occupancy (h)*	*Population (P)*	*Consumption (G) (l/h/day)*	*Loading (PxG)(l/day)*
Commercial/ Retail	701m^2	1 per 5m^2	140	50	7,000
Crèche	418m^2	1child/5m^2 + Staff (20%) + support accommodation	102	50	5,100
Total =					**12,100 l/day**

Flowrate per 12 hr day (l/s)		**0.28 l/s**
Growth Rate	1	1
Infiltration (I)	10%	0.03
Dry Weather Flow	**PG + I**	**0.3 l/s**
Peaking Factor ($Pf_{Dom.Ind}$)	6	
Design Foul Flow (l/s)	**Pf_{DomInd} x PG**	**1.8 l/s**
Misconnection Allowance (SW)	1.5%	0.01l/s
Design Flow (l/s)		**0.19 l/s**

Based on Irish Water Code of Practice Wastewater Infrastructure (Rev 3 Aug'25)

Commercial Wastewater Calculations

Foul flow estimates into Pumping Station

SWORDS					
New Network – DOMESTIC AND COMMERCIAL Wastewater Flows					
Usage	*Quantity*	*Occupancy (h)*	*Population (P)*	*Consumption (G) (l/h/day)*	*Loading (PxG)(l/day)*
Residential	289 Units	2.7No./Unit	777.6	150	116,640
Commercial/ Retail	701m^2	1 per 5m^2	140	50	7,000
Crèche	418m^2	1child/5m^2 + Staff (20%) + support accommodation	102	50	5,100
Total =					**129,100 l/day**

Flowrate per 24 hr day (l/s)		**1.63/s**
Growth Rate	1	1
Infiltration (I)	10%	0.15
Dry Weather Flow	**PG + I**	**1.7 l/s**
Peaking Factor ($Pf_{Dom.Ind)}$	4.5	
Design Foul Flow (l/s)	**Pf_{DomInd} x PG**	**7.65 l/s**
Misconnection Allowance (SW)	1.5%	0.02l/s
Design Flow (l/s)		**7.7 l/s**

Based on Irish Water Code of Practice Wastewater Infrastructure (Rev 3 Aug'25)

Pumping Station Details

Inflow DWF (288 Resi + Commercial + creche) = 1.63 l/s

Sump Area = 2 x 2.5m = 5m^2 – Refer to Dwg.2412/09

Invert of sump = 0.10mOD; Inlet Invert = 2.10mOD

Overflow Storage

Overflow Storage Capacity Required			
DWF (l/s)	**Storage Time (hrs)**	**Calculation**	**Volume (m^3)**
1.7	24	1.7 x 24 x 60 x 60	147
		Total Overflow Storage Required =	**147m^3**

Inlet to overflow storage chamber = 2.70mOD

Outlet return from overflow storage into sump chamber = 0.6mOD

Overflow storage chamber depth = 2.7 – 0.6 = 2.1m

Volume of Storage in Sump Chamber = 2.5m x 2m x 2.1m = 10.5m^3

Area of storage chamber = 147-10.5m^3 / 2.1 = 65m^2 = **c.67m^2 provided plan**

Pump Starts per Hour

Pump cut-in level = 1.30mOD; Pumps cut-out level = 0.30mOD

Volume in sump at 1.0m depth = 5m^2 x 1.0 = **5.0 m^3**

Pumps to be rated to maintain Velocity in rising main @ **1.2m/s**

Diameter of rising main to be 100mm Ø

Volume in 100mm Ø rising main per m run = πr^2 x 1m = **0.0078m^3**

Volume pumped in 1s (flowrate) = 1.2 m/s x 0.0078m^3 = 9.36 l

Time taken to pump (outflow) 5.0 m^3 = 5000 / 9.36 = **8.9 min**

Time taken to fill (inflow) 5.0 m^3 @ DWF = 5.0 x 10^3 / 1.63 = 3067 s = **51.1 min**

Therefore pump cycle time = inflow time + outflow time = 8.9+51.1 = 60**min**

Cycles per hour = 60 / 60 = 1.0 starts per hour < 10 therefore OK

Time Taken to Clear Rising Main

Length of rising main = 644m

Volume of rising main = 644x 0.0078 = 5 m^3

Volume pumped in 1 cycle = 5.0m^3 = 5m^3 ; therefore rising main is cleared during each hourly pump cycle which is **< 6hrs therefore OK**

Water Demand Calculations

New Network – DOMESTIC Water Demand								
Usage	**Quantity**	**Occupancy**	**Population**	**Consumption (l//h/day)**	**Ave. Daily Domestic Demand (l/day)**	**Ave. Daily Domestic Demand (l/s)**	**Ave. Day/Peak Week (l/s)**	**Peak Hour Water Demand (l/s)**
Resi'	289 Units	2.7 No./Unit	780	150	117,000	1.35	1.69	**8.5 l/s**
Peak Hour Water Demand (Domestic)								**8.5 /s**

Based on Irish Water Code of Practice for Water Infrastructure (Rev 3 Aug'25)

New Network – COMMERCIAL Water Demand								
Usage	**Quantity**	**Occupancy**	**Population**	**Consumption (l//h/day)**	**Ave. Daily Domestic Demand (l/day)**	**Ave. Daily(12hr) Domestic Demand (l/s)**	**Ave. Day/Peak Week (l/s)**	**Peak Hour Water Demand (l/s)**
Commercial/Retail	701m^2	1 per 5m^2	140	50	7,000	0.16	0.2	1.0
Crèche	418m^2	1child/5m^2 + Staff (20%) + support accommodation	102	50	5,100	0.12	0.148	0.74
Peak Hour Water Demand (Commercial)								**1.7l/s**

Based on Irish Water Code of Practice for Water Infrastructure (Rev 3 Aug'25)

New Network – DOMESTIC & COMMERCIAL Water Demand								
Usage	**Quantity**	**Occupancy**	**Population**	**Consumption (l//h/day)**	**Ave. Daily Domestic Demand (l/day)**	**Ave. Daily(12hr) Domestic Demand (l/s)**	**Ave. Day/Peak Week (l/s)**	**Peak Hour Water Demand (l/s)**
Resi'	289 Units	2.7 No./Unit	780	150	117,0000	1.35	1.69	8.5
Commercial/Retail	701m^2	1 per 5m^2	140	50	7,000	0.16	0.2	1
Crèche	418m^2	1child/5m^2 + Staff (20%) + support accommodation	102	50	5,100	0.12	0.148	0.74
						Combined Domestic & Commercial Total =	2.0	
Peak Hour Water Demand (Domestic & Commercial)								**10.2l/s**

Based on Irish Water Code of Practice for Water Infrastructure (Rev 3 Aug'25)

Appendix 11.11

Surface Water Drainage 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)	15.300	Add Flow / Climate Change (%)	0
Ratio R	0.277	Minimum Backdrop Height (m)	0.200
Maximum Rainfall (mm/hr)	50	Maximum Backdrop Height (m)	1.500
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.	1.000	Min Slope for Optimisation (1:X)	150

Designed with Level Soffits

Time Area Diagram for Storm

Time (mins)	Area (ha)	Time (mins)	Area (ha)	Time (mins)	Area (ha)
0-4	0.392	4-8	0.582	8-12	0.043

Total Area Contributing (ha) = 1.017

Total Pipe Volume (m^3) = 30.346

Network Design Table for Storm

« - Indicates pipe capacity < flow

PN	Length (m)	Fall (m)	Slope (1:X)	I.Area (ha)	T.E. (mins)	Base Flow (l/s)	k (mm)	HYD SECT	DIA (mm)	Section Type	Auto Design
1.000	31.605	0.263	120.0	0.087	6.00	0.0	0.600	o	225	Pipe/Conduit	
1.001	27.463	0.229	120.0	0.077	0.00	0.0	0.600	o	225	Pipe/Conduit	
2.000	31.777	0.265	120.0	0.064	6.00	0.0	0.600	o	225	Pipe/Conduit	
2.001	26.921	0.135	200.0	0.083	0.00	0.0	0.600	o	300	Pipe/Conduit	
2.002	18.926	0.140	135.0	0.078	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)
1.000	41.83	6.44	4.860	0.087	0.0	0.0	0.0	1.19	47.4	13.1
1.001	40.84	6.83	4.597	0.164	0.0	0.0	0.0	1.19	47.4	24.2
2.000	41.82	6.44	5.000	0.064	0.0	0.0	0.0	1.19	47.4	9.7
2.001	40.78	6.85	4.660	0.147	0.0	0.0	0.0	1.11	78.3	21.7
2.002	40.09	7.13	4.510	0.225	0.0	0.0	0.0	1.12	44.7	32.6

Network Design Table for Storm

PN	Length (m)	Fall (m)	Slope (1:X)	I.Area (ha)	T.E. (mins)	Base Flow (l/s)	k (mm)	HYD SECT	DIA (mm)	Section Type	Auto Design
1.002	32.138	0.179	180.0	0.078	0.00	0.0	0.600	o	300	Pipe/Conduit	
3.000	32.461	0.271	120.0	0.078	6.00	0.0	0.600	o	225	Pipe/Conduit	
3.001	24.985	0.125	200.0	0.041	0.00	0.0	0.600	o	300	Pipe/Conduit	
3.002	11.770	0.078	150.0	0.029	0.00	0.0	0.600	o	225	Pipe/Conduit	
1.003	33.082	0.184	180.0	0.097	0.00	0.0	0.600	o	300	Pipe/Conduit	
1.004	28.382	0.158	180.0	0.078	0.00	0.0	0.600	o	300	Pipe/Conduit	
1.005	13.220	0.066	200.0	0.031	0.00	0.0	0.600	o	450	Pipe/Conduit	
4.000	33.122	0.330	100.3	0.092	6.00	0.0	0.600	o	225	Pipe/Conduit	
5.000	9.372	0.094	100.0	0.016	6.00	0.0	0.600	o	225	Pipe/Conduit	
4.001	16.268	0.163	100.0	0.014	0.00	0.0	0.600	o	225	Pipe/Conduit	
6.000	13.218	0.131	100.9	0.026	6.00	0.0	0.600	o	225	Pipe/Conduit	
6.001	7.396	0.074	100.0	0.012	0.00	0.0	0.600	o	225	Pipe/Conduit	
6.002	15.315	0.153	100.0	0.007	0.00	0.0	0.600	o	225	Pipe/Conduit	
4.002	27.014	0.135	200.0	0.021	0.00	0.0	0.600	o	450	Pipe/Conduit	
1.006	6.347	0.025	254.7	0.009	0.00	0.0	0.600	o	450	Pipe/Conduit	

Network Results Table

PN	Rain (mm/hr)	T.C. (mins)	US/IL (m)	Σ I.Area (ha)	Σ Base Flow (l/s)	Foul (l/s)	Add Flow (l/s)	Vel (m/s)	Cap (l/s)	Flow (l/s)
1.002	39.03	7.59	4.300	0.467	0.0	0.0	0.0	1.17	82.6	65.8
3.000	41.80	6.45	4.740	0.078	0.0	0.0	0.0	1.19	47.4	11.7
3.001	40.83	6.83	4.390	0.119	0.0	0.0	0.0	1.11	78.3	17.6
3.002	40.37	7.01	4.270	0.148	0.0	0.0	0.0	1.07	42.4	21.6
1.003	38.01	8.06	4.120	0.712	0.0	0.0	0.0	1.17	82.6«	97.8
1.004	37.19	8.46	3.940	0.790	0.0	0.0	0.0	1.17	82.6«	106.1
1.005	36.89	8.62	3.620	0.821	0.0	0.0	0.0	1.43	228.1	109.4
4.000	41.88	6.42	4.550	0.092	0.0	0.0	0.0	1.31	51.9	13.9
5.000	42.71	6.12	4.330	0.016	0.0	0.0	0.0	1.31	52.0	2.4
4.001	41.33	6.63	4.220	0.121	0.0	0.0	0.0	1.31	52.0	18.1
6.000	42.57	6.17	4.420	0.026	0.0	0.0	0.0	1.30	51.8	3.9
6.001	42.31	6.26	4.289	0.038	0.0	0.0	0.0	1.31	52.0	5.8
6.002	41.78	6.46	4.220	0.045	0.0	0.0	0.0	1.31	52.0	6.8
4.002	40.54	6.94	3.800	0.187	0.0	0.0	0.0	1.43	228.1	27.4
1.006	36.73	8.70	3.560	1.017	0.0	0.0	0.0	1.27	201.9	134.9

Network Design Table for Storm

PN	Length (m)	Fall (m)	Slope (1:X)	I.Area (ha)	T.E. (mins)	Base Flow (l/s)	k (mm)	HYD SECT	DIA (mm)	Section Type	Auto Design
1.007	13.268	0.074	180.0	0.000	0.00	0.0	0.600	o	225	Pipe/Conduit	
1.008	20.357	0.113	180.0	0.000	0.00	0.0	0.600	o	225	Pipe/Conduit	
1.009	12.922	0.072	180.0	0.000	0.00	0.0	0.600	o	375	Pipe/Conduit	

Network Results Table

PN	Rain (mm/hr)	T.C. (mins)	US/IL (m)	Σ I.Area (ha)	Σ Base Flow (l/s)	Foul (l/s)	Add Flow (l/s)	Vel (m/s)	Cap (l/s)	Flow (l/s)
1.007	36.29	8.93	3.510	1.017	0.0	0.0	0.0	0.97	38.6«	134.9
1.008	35.66	9.28	3.440	1.017	0.0	0.0	0.0	0.97	38.6«	134.9
1.009	35.38	9.44	3.320	1.017	0.0	0.0	0.0	1.35	148.8	134.9

Area Summary for Storm

Pipe Number	PIMP Type	PIMP Name	PIMP (%)	Gross Area (ha)	Imp. Area (ha)	Pipe Total (ha)
1.000	User	-	55	0.011	0.006	0.006
	User	-	55	0.017	0.009	0.016
	User	-	70	0.018	0.013	0.028
	User	-	70	0.006	0.005	0.033
	User	-	70	0.003	0.002	0.035
	User	-	80	0.011	0.009	0.044
	User	-	20	0.027	0.005	0.050
	User	-	80	0.007	0.006	0.056
	User	-	80	0.012	0.009	0.065
	User	-	80	0.006	0.004	0.069
	User	-	95	0.003	0.003	0.072
	User	-	95	0.009	0.008	0.081
	User	-	70	0.007	0.005	0.086
	User	-	70	0.001	0.001	0.087
1.001	User	-	55	0.012	0.006	0.006
	User	-	55	0.000	0.000	0.007
	User	-	70	0.021	0.014	0.021
	User	-	70	0.001	0.001	0.022
	User	-	70	0.001	0.001	0.022
	User	-	70	0.003	0.002	0.025
	User	-	70	0.002	0.002	0.026
	User	-	20	0.022	0.004	0.031
	User	-	20	0.001	0.000	0.031
	User	-	20	0.002	0.000	0.031
	User	-	20	0.002	0.000	0.032
	User	-	20	0.001	0.000	0.032
	User	-	20	0.001	0.000	0.032
	User	-	20	0.002	0.000	0.033
	User	-	20	0.007	0.001	0.034
	User	-	20	0.015	0.003	0.037
	User	-	20	0.001	0.000	0.037
	User	-	20	0.001	0.000	0.037
	User	-	95	0.022	0.021	0.058
	User	-	20	0.097	0.019	0.077
2.000	User	-	70	0.012	0.008	0.008
	User	-	70	0.002	0.002	0.010
	User	-	80	0.028	0.022	0.032
	User	-	80	0.030	0.024	0.056
	User	-	20	0.028	0.006	0.062
	User	-	20	0.012	0.002	0.064
2.001	User	-	70	0.016	0.011	0.011
	User	-	70	0.023	0.016	0.027
	User	-	70	0.003	0.002	0.029
	User	-	70	0.001	0.001	0.030
	User	-	70	0.001	0.001	0.031
	User	-	80	0.022	0.018	0.049
	User	-	80	0.004	0.003	0.052
	User	-	20	0.023	0.005	0.056
	User	-	95	0.017	0.016	0.072
	User	-	95	0.011	0.011	0.083
2.002	User	-	70	0.018	0.013	0.013
	User	-	70	0.001	0.001	0.014
	User	-	80	0.023	0.019	0.032
	User	-	80	0.007	0.006	0.038

Area Summary for Storm

Pipe Number	PIMP Type	PIMP Name	PIMP (%)	Gross Area (ha)	Imp. Area (ha)	Pipe Total (ha)
	User	-	80	0.011	0.009	0.047
	User	-	20	0.028	0.006	0.053
	User	-	20	0.019	0.004	0.056
	User	-	20	0.004	0.001	0.057
	User	-	95	0.022	0.021	0.078
1.002	User	-	55	0.018	0.010	0.010
	User	-	55	0.017	0.009	0.019
	User	-	70	0.011	0.008	0.027
	User	-	80	0.004	0.003	0.030
	User	-	80	0.006	0.004	0.034
	User	-	95	0.013	0.012	0.046
	User	-	70	0.012	0.008	0.054
	User	-	20	0.042	0.008	0.063
	User	-	70	0.019	0.013	0.076
	User	-	70	0.002	0.002	0.078
3.000	User	-	70	0.009	0.006	0.006
	User	-	70	0.007	0.005	0.011
	User	-	70	0.020	0.014	0.025
	User	-	80	0.025	0.020	0.044
	User	-	80	0.031	0.025	0.069
	User	-	20	0.006	0.001	0.070
	User	-	20	0.017	0.003	0.074
	User	-	20	0.016	0.003	0.077
	User	-	20	0.004	0.001	0.078
3.001	User	-	70	0.015	0.010	0.010
	User	-	70	0.001	0.001	0.011
	User	-	20	0.018	0.004	0.015
	User	-	95	0.017	0.017	0.031
	User	-	95	0.011	0.010	0.041
3.002	User	-	70	0.005	0.003	0.003
	User	-	70	0.001	0.001	0.004
	User	-	80	0.010	0.008	0.012
	User	-	80	0.012	0.009	0.021
	User	-	20	0.028	0.006	0.027
	User	-	20	0.007	0.001	0.028
	User	-	20	0.004	0.001	0.029
1.003	User	-	70	0.013	0.009	0.009
	User	-	80	0.006	0.005	0.014
	User	-	80	0.013	0.010	0.024
	User	-	80	0.013	0.011	0.035
	User	-	95	0.034	0.032	0.067
	User	-	70	0.023	0.016	0.083
	User	-	20	0.006	0.001	0.085
	User	-	20	0.062	0.012	0.097
1.004	User	-	55	0.009	0.005	0.005
	User	-	70	0.001	0.001	0.006
	User	-	70	0.023	0.016	0.022
	User	-	70	0.001	0.000	0.023
	User	-	20	0.008	0.002	0.024
	User	-	20	0.003	0.001	0.025
	User	-	20	0.013	0.003	0.027
	User	-	20	0.008	0.002	0.029
	User	-	20	0.018	0.004	0.032
	User	-	80	0.047	0.038	0.070

Area Summary for Storm

Pipe Number	PIMP Type	PIMP Name	PIMP (%)	Gross Area (ha)	Imp. Area (ha)	Pipe Total (ha)
	User	-	70	0.006	0.004	0.075
	User	-	70	0.002	0.002	0.076
	User	-	20	0.006	0.001	0.078
1.005	User	-	55	0.006	0.003	0.003
	User	-	55	0.007	0.004	0.007
	User	-	20	0.001	0.000	0.008
	User	-	20	0.002	0.000	0.008
	User	-	20	0.002	0.000	0.008
	User	-	20	0.001	0.000	0.009
	User	-	20	0.003	0.001	0.009
	User	-	20	0.056	0.011	0.020
	User	-	70	0.016	0.011	0.031
4.000	User	-	55	0.014	0.008	0.008
	User	-	55	0.017	0.009	0.017
	User	-	55	0.009	0.005	0.022
	User	-	55	0.008	0.004	0.026
	User	-	80	0.024	0.019	0.046
	User	-	80	0.003	0.002	0.048
	User	-	80	0.012	0.009	0.057
	User	-	20	0.002	0.000	0.057
	User	-	20	0.004	0.001	0.058
	User	-	20	0.002	0.000	0.059
	User	-	70	0.024	0.017	0.075
	User	-	95	0.018	0.017	0.092
5.000	User	-	95	0.013	0.012	0.012
	User	-	20	0.017	0.003	0.015
	User	-	20	0.002	0.000	0.016
4.001	User	-	55	0.006	0.004	0.004
	User	-	70	0.014	0.010	0.013
	User	-	20	0.001	0.000	0.013
	User	-	20	0.001	0.000	0.014
6.000	User	-	55	0.012	0.007	0.007
	User	-	55	0.013	0.007	0.014
	User	-	70	0.017	0.012	0.026
6.001	User	-	55	0.012	0.007	0.007
	User	-	70	0.008	0.005	0.012
6.002	User	-	95	0.008	0.007	0.007
4.002	User	-	55	0.006	0.003	0.003
	User	-	55	0.005	0.003	0.006
	User	-	70	0.016	0.011	0.018
	User	-	20	0.003	0.001	0.018
	User	-	20	0.006	0.001	0.020
	User	-	70	0.002	0.001	0.021
	User	-	20	0.001	0.000	0.021
1.006	User	-	20	0.043	0.009	0.009
1.007	-	-	100	0.000	0.000	0.000
1.008	-	-	100	0.000	0.000	0.000
1.009	-	-	100	0.000	0.000	0.000
				Total	Total	Total
				1.878	1.017	1.017

Free Flowing Outfall Details for Storm

Outfall Pipe Number	Outfall Name	C. Level (m)	I. Level (m)	Min I. Level (m)	D,L (mm)	W (mm)
1.009		5.100	3.248	0.000	0	0

Online Controls for Storm

Hydro-Brake® Optimum Manhole: 5, DS/PN: 2.002, Volume (m³): 3.7

Unit Reference	MD-SHE-0086-3000-0750-3000
Design Head (m)	0.750
Design Flow (l/s)	3.0
Flush-Flo™	Calculated
Objective	Minimise upstream storage
Application	Surface
Sump Available	Yes
Diameter (mm)	86
Invert Level (m)	4.510
Minimum Outlet Pipe Diameter (mm)	100
Suggested Manhole Diameter (mm)	1200

Control Points	Head (m)	Flow (l/s)	Control Points	Head (m)	Flow (l/s)
Design Point (Calculated)	0.750	3.0	Kick-Flo®	0.488	2.5
Flush-Flo™	0.222	3.0	Mean Flow over Head Range	-	2.6

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

Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)
0.100	2.6	0.800	3.1	2.000	4.7	4.000	6.5	7.000	8.5
0.200	3.0	1.000	3.4	2.200	4.9	4.500	6.9	7.500	8.8
0.300	3.0	1.200	3.7	2.400	5.1	5.000	7.3	8.000	9.1
0.400	2.8	1.400	4.0	2.600	5.3	5.500	7.6	8.500	9.3
0.500	2.5	1.600	4.3	3.000	5.7	6.000	7.9	9.000	9.6
0.600	2.7	1.800	4.5	3.500	6.1	6.500	8.2	9.500	9.9

Hydro-Brake® Optimum Manhole: 10, DS/PN: 3.002, Volume (m³): 3.6

Unit Reference	MD-SHE-0086-3000-0750-3000
Design Head (m)	0.750
Design Flow (l/s)	3.0
Flush-Flo™	Calculated
Objective	Minimise upstream storage
Application	Surface
Sump Available	Yes
Diameter (mm)	86
Invert Level (m)	4.270
Minimum Outlet Pipe Diameter (mm)	100
Suggested Manhole Diameter (mm)	1200

Control Points	Head (m)	Flow (l/s)	Control Points	Head (m)	Flow (l/s)
Design Point (Calculated)	0.750	3.0	Kick-Flo®	0.488	2.5
Flush-Flo™	0.222	3.0	Mean Flow over Head Range	-	2.6

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

Hydro-Brake® Optimum Manhole: 10, DS/PN: 3.002, Volume (m³): 3.6

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	2.6	0.800	3.1	2.000	4.7	4.000	6.5	7.000	8.5
0.200	3.0	1.000	3.4	2.200	4.9	4.500	6.9	7.500	8.8
0.300	3.0	1.200	3.7	2.400	5.1	5.000	7.3	8.000	9.1
0.400	2.8	1.400	4.0	2.600	5.3	5.500	7.6	8.500	9.3
0.500	2.5	1.600	4.3	3.000	5.7	6.000	7.9	9.000	9.6
0.600	2.7	1.800	4.5	3.500	6.1	6.500	8.2	9.500	9.9

Hydro-Brake® Optimum Manhole: 16, DS/PN: 1.007, Volume (m³): 4.1

Unit Reference	MD-SHE-0114-6250-1200-6250
Design Head (m)	1.200
Design Flow (l/s)	6.3
Flush-Flo™	Calculated
Objective	Minimise upstream storage
Application	Surface
Sump Available	Yes
Diameter (mm)	114
Invert Level (m)	3.510
Minimum Outlet Pipe Diameter (mm)	150
Suggested Manhole Diameter (mm)	1200

Control Points	Head (m)	Flow (l/s)	Control Points	Head (m)	Flow (l/s)
Design Point (Calculated)	1.200	6.2	Kick-Flo®	0.750	5.0
Flush-Flo™	0.351	6.2	Mean Flow over Head Range	-	5.4

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	4.0	0.800	5.2	2.000	7.9	4.000	11.0	7.000	14.4
0.200	5.9	1.000	5.7	2.200	8.3	4.500	11.6	7.500	14.9
0.300	6.2	1.200	6.2	2.400	8.6	5.000	12.2	8.000	15.3
0.400	6.2	1.400	6.7	2.600	9.0	5.500	12.8	8.500	15.8
0.500	6.1	1.600	7.1	3.000	9.6	6.000	13.4	9.000	16.2
0.600	5.9	1.800	7.6	3.500	10.3	6.500	13.9	9.500	16.6

Storage Structures for Storm

Tank or Pond Manhole: 5, DS/PN: 2.002

Invert Level (m) 4.550

Depth (m)	Area (m²)	Depth (m)	Area (m²)	Depth (m)	Area (m²)
0.000	175.0	0.700	175.0	0.710	0.0

Tank or Pond Manhole: 10, DS/PN: 3.002

Invert Level (m) 4.300

Depth (m)	Area (m²)	Depth (m)	Area (m²)	Depth (m)	Area (m²)
0.000	175.0	0.700	175.0	0.710	0.0

Tank or Pond Manhole: 16, DS/PN: 1.007

Invert Level (m) 4.300

Depth (m)	Area (m²)	Depth (m)	Area (m²)	Depth (m)	Area (m²)	Depth (m)	Area (m²)
0.000	300.0	0.250	300.0	1.000	300.0	1.250	350.0

2 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 3 Number of Storage Structures 3 Number of Real Time Controls 0

Synthetic Rainfall Details

Rainfall Model FSR M5-60 (mm) 15.300 Cv (Summer) 1.000
Region Scotland and Ireland Ratio R 0.277 Cv (Winter) 1.000

Margin for Flood Risk Warning (mm) 150.0 DVD Status OFF
Analysis Timestep Coarse 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)	2, 30, 100
Climate Change (%)	20, 20, 20

PN	US/MH Name	Event	US/CL (m)	Water Level (m)	Surcharged Depth (m)	Flooded Volume (m³)	Flow / Cap.	Overflow (l/s)	Maximum Vol (m³)	Maximum Velocity (m/s)
1.000	1	15 minute 2 year Summer I+20%	6.950	4.949	-0.136	0.000	0.34		0.095	1.0
1.001	2	30 minute 2 year Summer I+20%	6.520	4.736	-0.086	0.000	0.59		0.347	1.1
2.000	3	15 minute 2 year Summer I+20%	6.050	5.076	-0.149	0.000	0.25		0.080	0.9
2.001	4	15 minute 2 year Summer I+20%	6.100	4.781	-0.179	0.000	0.34		0.155	0.9
2.002	5	360 minute 2 year Summer I+20%	6.200	4.733	-0.002	0.000	0.07		33.142	0.6
1.002	6	30 minute 2 year Summer I+20%	6.050	4.636	0.036	0.000	0.45		1.606	1.0
3.000	8	15 minute 2 year Summer I+20%	6.000	4.823	-0.142	0.000	0.30		0.089	1.0
3.001	9	720 minute 2 year Winter I+20%	6.000	4.610	-0.080	0.000	0.04		0.429	0.5
3.002	10	720 minute 2 year Summer I+20%	6.000	4.610	0.115	0.000	0.07		56.130	0.6
1.003	11	720 minute 2 year Summer I+20%	6.000	4.610	0.190	0.000	0.15		3.143	0.7
1.004	12	720 minute 2 year Summer I+20%	6.150	4.605	0.365	0.000	0.19		3.005	0.7
1.005	13	360 minute 2 year Winter I+20%	5.950	4.601	0.531	0.000	0.09		3.313	0.3
4.000	14	15 minute 2 year Summer I+20%	6.000	4.637	-0.138	0.000	0.33		0.093	1.1
5.000	15	720 minute 2 year Summer I+20%	5.530	4.600	0.045	0.000	0.01		0.300	0.3
4.001	15	720 minute 2 year Summer I+20%	5.750	4.600	0.155	0.000	0.08		1.737	0.6
6.000	17	720 minute 2 year Summer I+20%	5.670	4.600	-0.045	0.000	0.02		0.198	0.6
6.001	18	720 minute 2 year Summer I+20%	5.550	4.600	0.086	0.000	0.03		0.808	0.5
6.002	19	720 minute 2 year Summer I+20%	5.550	4.599	0.154	0.000	0.03		0.675	0.5
4.002	16	720 minute 2 year Summer I+20%	5.640	4.599	0.349	0.000	0.03		2.291	0.4
1.006	14	360 minute 2 year Winter I+20%	5.850	4.600	0.590	0.000	0.18		7.460	0.3
1.007	16	360 minute 2 year Winter I+20%	5.850	4.613	0.878	0.000	0.18		96.130	0.7
1.008	17	240 minute 2 year Summer I+20%	5.700	3.507	-0.158	0.000	0.18		0.147	0.6
1.009	18	5760 minute 2 year Winter I+20%	5.500	3.379	-0.316	0.000	0.06		0.133	0.6

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

PN	US/MH Name	Pipe Flow (l/s)	Status
1.000	1	15.0	OK
1.001	2	26.0	OK
2.000	3	11.1	OK
2.001	4	24.3	OK
2.002	5	2.7	OK
1.002	6	34.1	SURCHARGED
3.000	8	13.4	OK
3.001	9	2.6	OK
3.002	10	2.5	SURCHARGED
1.003	11	11.7	SURCHARGED
1.004	12	14.2	SURCHARGED
1.005	13	15.7	SURCHARGED
4.000	14	15.9	OK
5.000	15	0.4	SURCHARGED
4.001	15	3.6	SURCHARGED
6.000	17	0.8	OK
6.001	18	1.0	SURCHARGED
6.002	19	1.2	SURCHARGED
4.002	16	5.4	SURCHARGED
1.006	14	21.9	SURCHARGED
1.007	16	6.1	SURCHARGED
1.008	17	6.1	OK
1.009	18	5.9	OK

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 3 Number of Storage Structures 3 Number of Real Time Controls 0

Synthetic Rainfall Details

Rainfall Model	FSR	M5-60 (mm)	15.300
Region	Scotland and Ireland	Ratio R	0.277
Cv (Summer)	1.000		
Cv (Winter)	1.000		

Margin for Flood Risk Warning (mm) 150.0 DVD Status OFF
Analysis Timestep Coarse 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)	2, 30, 100
Climate Change (%)	20, 20, 20

PN	US/MH Name	Event	US/CL (m)	Water Level (m)	Surcharged Depth (m)	Flooded Volume (m³)	Flow / Cap.	Overflow (l/s)	Maximum Vol (m³)	Maximum Velocity (m/s)
1.000	1	15 minute 30 year Summer I+20%	6.950	5.543	0.458	0.000	0.63		0.767	1.1
1.001	2	15 minute 30 year Summer I+20%	6.520	5.453	0.631	0.000	1.01		2.171	1.2
2.000	3	30 minute 30 year Summer I+20%	6.050	5.107	-0.118	0.000	0.45		0.115	1.1
2.001	4	720 minute 30 year Summer I+20%	6.100	4.989	0.029	0.000	0.11		0.985	0.6
2.002	5	480 minute 30 year Winter I+20%	6.200	4.991	0.256	0.000	0.07		79.503	0.6
1.002	6	15 minute 30 year Summer I+20%	6.050	5.212	0.612	0.000	0.79		2.774	1.0
3.000	8	600 minute 30 year Winter I+20%	6.000	4.925	-0.040	0.000	0.07		0.204	0.7
3.001	9	600 minute 30 year Winter I+20%	6.000	4.924	0.234	0.000	0.07		1.812	0.5
3.002	10	600 minute 30 year Winter I+20%	6.000	4.924	0.429	0.000	0.04		111.598	0.4
1.003	11	15 minute 30 year Summer I+20%	6.000	5.083	0.663	0.000	1.08		3.690	1.2
1.004	12	480 minute 30 year Winter I+20%	6.150	4.913	0.673	0.000	0.25		3.353	0.7
1.005	13	480 minute 30 year Winter I+20%	5.950	4.921	0.851	0.000	0.12		3.771	0.4
4.000	14	600 minute 30 year Winter I+20%	6.000	4.909	0.134	0.000	0.08		0.400	0.7
5.000	15	600 minute 30 year Winter I+20%	5.530	4.906	0.351	0.000	0.01		0.646	0.2
4.001	15	600 minute 30 year Winter I+20%	5.750	4.906	0.461	0.000	0.10		2.365	0.5
6.000	17	600 minute 30 year Winter I+20%	5.670	4.905	0.260	0.000	0.02		0.543	0.6
6.001	18	600 minute 30 year Winter I+20%	5.550	4.905	0.391	0.000	0.04		1.169	0.3
6.002	19	600 minute 30 year Winter I+20%	5.550	4.905	0.460	0.000	0.04		1.021	0.3
4.002	16	600 minute 30 year Winter I+20%	5.640	4.904	0.654	0.000	0.04		2.727	0.3
1.006	14	480 minute 30 year Winter I+20%	5.850	4.924	0.914	0.000	0.23		7.923	0.3
1.007	16	480 minute 30 year Winter I+20%	5.850	4.936	1.201	0.000	0.20		193.585	0.7
1.008	17	480 minute 30 year Winter I+20%	5.700	3.508	-0.157	0.000	0.19		0.151	0.6
1.009	18	600 minute 30 year Winter I+20%	5.500	3.380	-0.315	0.000	0.06		0.136	0.6

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

PN	US/MH Name	Pipe Flow (l/s)	Status
1.000	1	28.2	SURCHARGED
1.001	2	44.4	SURCHARGED
2.000	3	20.2	OK
2.001	4	7.9	SURCHARGED
2.002	5	2.6	SURCHARGED
1.002	6	59.5	SURCHARGED
3.000	8	3.2	OK
3.001	9	4.8	SURCHARGED
3.002	10	1.6	SURCHARGED
1.003	11	81.8	SURCHARGED
1.004	12	18.8	SURCHARGED
1.005	13	20.2	SURCHARGED
4.000	14	3.7	SURCHARGED
5.000	15	0.6	SURCHARGED
4.001	15	4.6	SURCHARGED
6.000	17	1.0	SURCHARGED
6.001	18	1.4	SURCHARGED
6.002	19	1.6	SURCHARGED
4.002	16	7.0	SURCHARGED
1.006	14	28.2	SURCHARGED
1.007	16	6.6	SURCHARGED
1.008	17	6.6	OK
1.009	18	6.7	OK

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 3 Number of Storage Structures 3 Number of Real Time Controls 0

Synthetic Rainfall Details

Rainfall Model	FSR	M5-60 (mm)	15.300
Region	Scotland and Ireland	Ratio R	0.277
Cv (Summer)	1.000		
Cv (Winter)	1.000		

Margin for Flood Risk Warning (mm) 150.0 DVD Status OFF
Analysis Timestep Coarse 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)	2, 30, 100
Climate Change (%)	20, 20, 20

PN	US/MH Name	Event	US/CL (m)	Water Level (m)	Surcharged Depth (m)	Flooded Volume (m³)	Flow / Cap.	Overflow (l/s)	Maximum Vol (m³)
1.000	1	30 minute 100 year Summer I+20%	6.950	6.283	1.198	0.000	0.75		1.604
1.001	2	30 minute 100 year Summer I+20%	6.520	6.135	1.313	0.000	1.28		2.943
2.000	3	720 minute 100 year Winter I+20%	6.050	5.219	-0.006	0.000	0.07		0.242
2.001	4	720 minute 100 year Winter I+20%	6.100	5.218	0.258	0.000	0.09		1.827
2.002	5	720 minute 100 year Winter I+20%	6.200	5.217	0.482	0.000	0.07		119.335
1.002	6	30 minute 100 year Summer I+20%	6.050	5.760	1.160	0.000	1.02		3.394
3.000	8	960 minute 100 year Winter I+20%	6.000	5.219	0.254	0.000	0.07		0.537
3.001	9	480 minute 100 year Winter I+20%	6.000	5.228	0.538	0.000	0.10		2.186
3.002	10	480 minute 100 year Winter I+20%	6.000	5.232	0.737	0.000	0.04		126.103
1.003	11	30 minute 100 year Summer I+20%	6.000	5.560	1.140	0.000	1.38		4.230
1.004	12	30 minute 100 year Summer I+20%	6.150	5.199	0.959	0.000	1.76		3.676
1.005	13	480 minute 100 year Winter I+20%	5.950	5.164	1.094	0.000	0.14		4.119
4.000	14	720 minute 100 year Winter I+20%	6.000	5.147	0.372	0.000	0.08		0.669
5.000	15	720 minute 100 year Winter I+20%	5.530	5.145	0.590	0.000	0.01		0.916
4.001	15	720 minute 100 year Winter I+20%	5.750	5.145	0.700	0.000	0.11		2.635
6.000	17	720 minute 100 year Winter I+20%	5.670	5.145	0.500	0.000	0.02		0.814
6.001	18	720 minute 100 year Winter I+20%	5.550	5.144	0.630	0.000	0.04		1.440
6.002	19	720 minute 100 year Winter I+20%	5.550	5.144	0.699	0.000	0.04		1.291
4.002	16	720 minute 100 year Winter I+20%	5.640	5.143	0.893	0.000	0.04		3.070
1.006	14	480 minute 100 year Winter I+20%	5.850	5.163	1.153	0.000	0.28		8.266
1.007	16	480 minute 100 year Winter I+20%	5.850	5.162	1.427	0.000	0.21		261.841
1.008	17	480 minute 100 year Winter I+20%	5.700	3.510	-0.155	0.000	0.20		0.156
1.009	18	720 minute 100 year Winter I+20%	5.500	3.383	-0.312	0.000	0.07		0.143

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

PN	US/MH Name	Maximum Velocity (m/s)	Pipe Flow (l/s)	Status
1.000	1	1.1	33.4	SURCHARGED
1.001	2	1.4	56.1	SURCHARGED
2.000	3	0.7	3.0	OK
2.001	4	0.6	6.6	SURCHARGED
2.002	5	0.6	2.8	SURCHARGED
1.002	6	1.1	76.7	SURCHARGED
3.000	8	0.7	2.9	SURCHARGED
3.001	9	0.6	7.2	SURCHARGED
3.002	10	0.4	1.5	SURCHARGED
1.003	11	1.5	104.6	SURCHARGED
1.004	12	1.9	131.6	SURCHARGED
1.005	13	0.4	24.5	SURCHARGED
4.000	14	0.7	4.1	SURCHARGED
5.000	15	0.2	0.6	SURCHARGED
4.001	15	0.5	5.2	SURCHARGED
6.000	17	0.5	1.1	SURCHARGED
6.001	18	0.3	1.5	SURCHARGED
6.002	19	0.4	1.8	SURCHARGED
4.002	16	0.4	7.9	SURCHARGED
1.006	14	0.3	35.1	SURCHARGED
1.007	16	0.7	7.1	SURCHARGED
1.008	17	0.7	7.1	OK
1.009	18	0.6	7.2	OK

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)	15.300	Add Flow / Climate Change (%)	0
Ratio R	0.277	Minimum Backdrop Height (m)	0.200
Maximum Rainfall (mm/hr)	50	Maximum Backdrop Height (m)	1.500
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.	1.000	Min Slope for Optimisation (1:X)	150

Designed with Level Soffits

Free Flowing Outfall Details for Storm

Outfall Pipe Number	Outfall Name	C. Level (m)	I. Level (m)	Min I. Level (m)	D,L (mm)	W (mm)
1.009		5.100	3.248	0.000	0	0

Online Controls for Storm

Hydro-Brake® Optimum Manhole: 5, DS/PN: 2.002, Volume (m³): 3.7

Unit Reference	MD-SHE-0014-1000-0750-1000
Design Head (m)	0.750
Design Flow (l/s)	0.1
Flush-Flo™	Calculated
Objective	Minimise upstream storage
Application	Surface
Sump Available	Yes
Diameter (mm)	14
Invert Level (m)	4.510
Minimum Outlet Pipe Diameter (mm)	75
Suggested Manhole Diameter (mm)	1200

Control Points	Head (m)	Flow (l/s)	Control Points	Head (m)	Flow (l/s)
Design Point (Calculated)	0.750	0.1	Kick-Flo®	0.128	0.0
Flush-Flo™	0.059	0.1	Mean Flow over Head Range	-	0.1

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	0.1	0.800	0.1	2.000	0.1	4.000	0.2	7.000	0.3
0.200	0.1	1.000	0.1	2.200	0.2	4.500	0.2	7.500	0.3
0.300	0.1	1.200	0.1	2.400	0.2	5.000	0.2	8.000	0.3
0.400	0.1	1.400	0.1	2.600	0.2	5.500	0.2	8.500	0.3
0.500	0.1	1.600	0.1	3.000	0.2	6.000	0.2	9.000	0.3
0.600	0.1	1.800	0.1	3.500	0.2	6.500	0.2	9.500	0.3

Hydro-Brake® Optimum Manhole: 10, DS/PN: 3.002, Volume (m³): 3.6

Unit Reference	MD-SHE-0014-1000-0750-1000
Design Head (m)	0.750
Design Flow (l/s)	0.1
Flush-Flo™	Calculated
Objective	Minimise upstream storage
Application	Surface
Sump Available	Yes
Diameter (mm)	14
Invert Level (m)	4.270
Minimum Outlet Pipe Diameter (mm)	75
Suggested Manhole Diameter (mm)	1200

Control Points	Head (m)	Flow (l/s)	Control Points	Head (m)	Flow (l/s)
Design Point (Calculated)	0.750	0.1	Kick-Flo®	0.128	0.0
Flush-Flo™	0.059	0.1	Mean Flow over Head Range	-	0.1

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: 10, DS/PN: 3.002, Volume (m³): 3.6

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	0.1	0.800	0.1	2.000	0.1	4.000	0.2	7.000	0.3
0.200	0.1	1.000	0.1	2.200	0.2	4.500	0.2	7.500	0.3
0.300	0.1	1.200	0.1	2.400	0.2	5.000	0.2	8.000	0.3
0.400	0.1	1.400	0.1	2.600	0.2	5.500	0.2	8.500	0.3
0.500	0.1	1.600	0.1	3.000	0.2	6.000	0.2	9.000	0.3
0.600	0.1	1.800	0.1	3.500	0.2	6.500	0.2	9.500	0.3

Hydro-Brake® Optimum Manhole: 16, DS/PN: 1.007, Volume (m³): 4.1

Unit Reference	MD-SHE-0013-1000-1200-1000
Design Head (m)	1.200
Design Flow (l/s)	0.1
Flush-Flo™	Calculated
Objective	Minimise upstream storage
Application	Surface
Sump Available	Yes
Diameter (mm)	13
Invert Level (m)	3.510
Minimum Outlet Pipe Diameter (mm)	75
Suggested Manhole Diameter (mm)	1200

Control Points	Head (m)	Flow (l/s)	Control Points	Head (m)	Flow (l/s)
Design Point (Calculated)	1.200	0.1	Kick-Flo®	0.115	0.0
Flush-Flo™	0.050	0.0	Mean Flow over Head Range	-	0.1

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	0.0	0.800	0.1	2.000	0.1	4.000	0.2	7.000	0.2
0.200	0.0	1.000	0.1	2.200	0.1	4.500	0.2	7.500	0.2
0.300	0.1	1.200	0.1	2.400	0.1	5.000	0.2	8.000	0.2
0.400	0.1	1.400	0.1	2.600	0.1	5.500	0.2	8.500	0.2
0.500	0.1	1.600	0.1	3.000	0.1	6.000	0.2	9.000	0.2
0.600	0.1	1.800	0.1	3.500	0.2	6.500	0.2	9.500	0.2

Storage Structures for Storm

Tank or Pond Manhole: 5, DS/PN: 2.002

Invert Level (m) 4.550

Depth (m)	Area (m²)	Depth (m)	Area (m²)	Depth (m)	Area (m²)
0.000	175.0	0.700	175.0	0.710	0.0

Tank or Pond Manhole: 10, DS/PN: 3.002

Invert Level (m) 4.300

Depth (m)	Area (m²)	Depth (m)	Area (m²)	Depth (m)	Area (m²)
0.000	175.0	0.700	175.0	0.710	0.0

Tank or Pond Manhole: 16, DS/PN: 1.007

Invert Level (m) 4.300

Depth (m)	Area (m²)	Depth (m)	Area (m²)	Depth (m)	Area (m²)	Depth (m)	Area (m²)
0.000	300.0	0.250	300.0	1.000	300.0	1.250	350.0

2 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 3 Number of Storage Structures 3 Number of Real Time Controls 0

Synthetic Rainfall Details

Rainfall Model	FSR	M5-60 (mm)	15.300
Region	Scotland and Ireland	Ratio R	0.277
Cv (Summer)	1.000		
Cv (Winter)	1.000		

Margin for Flood Risk Warning (mm) 150.0 DVD Status OFF
Analysis Timestep Coarse Inertia Status OFF
DTS Status ON

Profile(s)	Summer and Winter
Duration(s) (mins)	120
Return Period(s) (years)	2, 30, 100
Climate Change (%)	20, 20, 20

PN	US/MH Name	Event	US/CL (m)	Water Level (m)	Surcharged Depth (m)	Flooded Volume (m³)	Flow / Cap.	Overflow (l/s)	Maximum Vol (m³)	Maximum Velocity (m/s)
1.000	1	120 minute 2 year Summer I+20%	6.950	4.926	-0.159	0.000	0.19		0.069	0.9
1.001	2	120 minute 2 year Summer I+20%	6.520	4.700	-0.122	0.000	0.35		0.194	1.0
2.000	3	120 minute 2 year Summer I+20%	6.050	5.054	-0.171	0.000	0.14		0.055	0.9
2.001	4	120 minute 2 year Summer I+20%	6.100	4.782	-0.178	0.000	0.20		0.157	0.8
2.002	5	120 minute 2 year Summer I+20%	6.200	4.794	0.059	0.000	0.00		44.183	0.0
1.002	6	120 minute 2 year Summer I+20%	6.050	4.606	0.006	0.000	0.27		1.409	0.7
3.000	8	120 minute 2 year Summer I+20%	6.000	4.801	-0.164	0.000	0.17		0.063	0.9
3.001	9	120 minute 2 year Summer I+20%	6.000	4.471	-0.219	0.000	0.16		0.087	0.8
3.002	10	120 minute 2 year Winter I+20%	6.000	4.471	-0.024	0.000	0.00		30.999	0.0
1.003	11	120 minute 2 year Summer I+20%	6.000	4.608	0.188	0.000	0.38		3.139	0.7
1.004	12	120 minute 2 year Summer I+20%	6.150	4.622	0.382	0.000	0.48		3.024	0.7
1.005	13	120 minute 2 year Summer I+20%	5.950	4.635	0.565	0.000	0.22		3.361	0.3
4.000	14	120 minute 2 year Summer I+20%	6.000	4.615	-0.160	0.000	0.18		0.067	1.0
5.000	15	120 minute 2 year Summer I+20%	5.530	4.601	0.046	0.000	0.03		0.301	0.3
4.001	15	120 minute 2 year Summer I+20%	5.750	4.618	0.173	0.000	0.22		1.819	0.6
6.000	17	120 minute 2 year Summer I+20%	5.670	4.589	-0.056	0.000	0.06		0.185	0.7
6.001	18	120 minute 2 year Summer I+20%	5.550	4.603	0.089	0.000	0.09		0.813	0.3
6.002	19	120 minute 2 year Summer I+20%	5.550	4.615	0.170	0.000	0.08		0.693	0.5
4.002	16	120 minute 2 year Summer I+20%	5.640	4.623	0.373	0.000	0.08		2.325	0.4
1.006	14	120 minute 2 year Summer I+20%	5.850	4.642	0.632	0.000	0.42		7.520	0.3
1.007	16	120 minute 2 year Summer I+20%	5.850	4.655	0.920	0.000	0.00		108.799	0.0
1.008	17	120 minute 2 year Winter I+20%	5.700	3.436	-0.229	0.000	0.00		0.000	0.0
1.009	18	120 minute 2 year Summer I+20%	5.500	3.320	-0.375	0.000	0.00		0.000	0.0

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

PN	US/MH Name	Pipe Flow (l/s)	Status
1.000	1	8.4	OK
1.001	2	15.4	OK
2.000	3	6.3	OK
2.001	4	13.9	OK
2.002	5	0.0	SURCHARGED
1.002	6	20.7	SURCHARGED
3.000	8	7.6	OK
3.001	9	11.2	OK
3.002	10	0.0	OK
1.003	11	29.1	SURCHARGED
1.004	12	36.0	SURCHARGED
1.005	13	36.5	SURCHARGED
4.000	14	9.0	OK
5.000	15	1.4	SURCHARGED
4.001	15	10.1	SURCHARGED
6.000	17	2.5	OK
6.001	18	3.5	SURCHARGED
6.002	19	3.7	SURCHARGED
4.002	16	15.7	SURCHARGED
1.006	14	52.2	SURCHARGED
1.007	16	0.0	SURCHARGED
1.008	17	0.0	OK
1.009	18	0.0	OK

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 3 Number of Storage Structures 3 Number of Real Time Controls 0

Synthetic Rainfall Details

Rainfall Model	FSR	M5-60 (mm)	15.300
Region	Scotland and Ireland	Ratio R	0.277
Cv (Summer)	1.000		
Cv (Winter)	1.000		

Margin for Flood Risk Warning (mm) 150.0 DVD Status OFF
Analysis Timestep Coarse Inertia Status OFF
DTS Status ON

Profile(s)	Summer and Winter
Duration(s) (mins)	120
Return Period(s) (years)	2, 30, 100
Climate Change (%)	20, 20, 20

PN	US/MH Name	Event	US/CL (m)	Water Level (m)	Surcharged Depth (m)	Flooded Volume (m³)	Flow / Cap.	Overflow (l/s)	Maximum Vol (m³)	Maximum Velocity (m/s)
1.000	1	120 minute 30 year Summer I+20%	6.950	5.096	0.011	0.000	0.31		0.262	1.0
1.001	2	120 minute 30 year Summer I+20%	6.520	5.056	0.234	0.000	0.55		1.695	1.0
2.000	3	120 minute 30 year Summer I+20%	6.050	5.076	-0.149	0.000	0.25		0.080	1.0
2.001	4	120 minute 30 year Summer I+20%	6.100	4.976	0.016	0.000	0.35		0.915	0.8
2.002	5	120 minute 30 year Summer I+20%	6.200	4.985	0.250	0.000	0.00		78.472	0.0
1.002	6	120 minute 30 year Summer I+20%	6.050	4.939	0.339	0.000	0.47		2.466	0.8
3.000	8	120 minute 30 year Summer I+20%	6.000	4.824	-0.141	0.000	0.30		0.089	1.0
3.001	9	120 minute 30 year Summer I+20%	6.000	4.561	-0.129	0.000	0.28		0.274	0.9
3.002	10	120 minute 30 year Summer I+20%	6.000	4.597	0.102	0.000	0.00		53.884	0.0
1.003	11	120 minute 30 year Summer I+20%	6.000	4.917	0.497	0.000	0.65		3.503	0.8
1.004	12	120 minute 30 year Summer I+20%	6.150	4.924	0.684	0.000	0.81		3.366	0.9
1.005	13	120 minute 30 year Summer I+20%	5.950	4.933	0.863	0.000	0.38		3.788	0.4
4.000	14	120 minute 30 year Summer I+20%	6.000	4.910	0.135	0.000	0.32		0.402	1.0
5.000	15	120 minute 30 year Summer I+20%	5.530	4.897	0.342	0.000	0.05		0.636	0.3
4.001	15	120 minute 30 year Summer I+20%	5.750	4.915	0.470	0.000	0.38		2.374	0.7
6.000	17	120 minute 30 year Summer I+20%	5.670	4.884	0.239	0.000	0.08		0.520	0.7
6.001	18	120 minute 30 year Summer I+20%	5.550	4.900	0.386	0.000	0.13		1.164	0.3
6.002	19	120 minute 30 year Summer I+20%	5.550	4.911	0.466	0.000	0.13		1.028	0.5
4.002	16	120 minute 30 year Summer I+20%	5.640	4.920	0.670	0.000	0.14		2.751	0.5
1.006	14	120 minute 30 year Summer I+20%	5.850	4.940	0.930	0.000	0.76		7.946	0.6
1.007	16	120 minute 30 year Summer I+20%	5.850	4.953	1.218	0.000	0.00		198.678	0.0
1.008	17	120 minute 30 year Summer I+20%	5.700	3.436	-0.229	0.000	0.00		0.000	0.0
1.009	18	120 minute 30 year Summer I+20%	5.500	3.320	-0.375	0.000	0.00		0.000	0.0

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

PN	US/MH Name	Pipe Flow (l/s)	Status
1.000	1	13.9	SURCHARGED
1.001	2	24.4	SURCHARGED
2.000	3	11.2	OK
2.001	4	24.9	SURCHARGED
2.002	5	0.0	SURCHARGED
1.002	6	35.8	SURCHARGED
3.000	8	13.5	OK
3.001	9	19.9	OK
3.002	10	0.0	SURCHARGED
1.003	11	49.5	SURCHARGED
1.004	12	60.8	SURCHARGED
1.005	13	65.0	SURCHARGED
4.000	14	15.5	SURCHARGED
5.000	15	2.1	SURCHARGED
4.001	15	17.6	SURCHARGED
6.000	17	3.8	SURCHARGED
6.001	18	4.8	SURCHARGED
6.002	19	5.8	SURCHARGED
4.002	16	26.3	SURCHARGED
1.006	14	93.2	SURCHARGED
1.007	16	0.0	SURCHARGED
1.008	17	0.0	OK
1.009	18	0.0	OK

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 3 Number of Storage Structures 3 Number of Real Time Controls 0

Synthetic Rainfall Details

Rainfall Model		FSR M5-60 (mm) 15.300	Cv (Summer) 1.000
Region	Scotland and Ireland	Ratio R 0.277	Cv (Winter) 1.000

Margin for Flood Risk Warning (mm) 150.0 DVD Status OFF
Analysis Timestep Coarse Inertia Status OFF
DTS Status ON

Profile(s)	Summer and Winter
Duration(s) (mins)	120
Return Period(s) (years)	2, 30, 100
Climate Change (%)	20, 20, 20

PN	US/MH Name	Event	US/CL (m)	Water Level (m)	Surcharged Depth (m)	Flooded Volume (m³)	Flow / Cap.	Overflow (l/s)	Maximum Vol (m³)
1.000	1	120 minute 100 year Summer I+20%	6.950	5.446	0.361	0.000	0.39		0.657
1.001	2	120 minute 100 year Summer I+20%	6.520	5.387	0.565	0.000	0.73		2.097
2.000	3	120 minute 100 year Summer I+20%	6.050	5.087	-0.138	0.000	0.33		0.093
2.001	4	120 minute 100 year Summer I+20%	6.100	5.105	0.145	0.000	0.45		1.541
2.002	5	120 minute 100 year Summer I+20%	6.200	5.115	0.380	0.000	0.00		101.424
1.002	6	120 minute 100 year Summer I+20%	6.050	5.223	0.623	0.000	0.64		2.787
3.000	8	120 minute 100 year Summer I+20%	6.000	4.837	-0.128	0.000	0.39		0.104
3.001	9	120 minute 100 year Summer I+20%	6.000	4.670	-0.020	0.000	0.37		0.716
3.002	10	120 minute 100 year Summer I+20%	6.000	4.680	0.185	0.000	0.00		68.713
1.003	11	120 minute 100 year Summer I+20%	6.000	5.143	0.723	0.000	0.85		3.759
1.004	12	120 minute 100 year Summer I+20%	6.150	5.136	0.896	0.000	1.07		3.605
1.005	13	120 minute 100 year Summer I+20%	5.950	5.149	1.079	0.000	0.50		4.097
4.000	14	120 minute 100 year Summer I+20%	6.000	5.131	0.356	0.000	0.39		0.652
5.000	15	120 minute 100 year Summer I+20%	5.530	5.108	0.553	0.000	0.06		0.874
4.001	15	120 minute 100 year Summer I+20%	5.750	5.126	0.681	0.000	0.52		2.614
6.000	17	120 minute 100 year Summer I+20%	5.670	5.081	0.436	0.000	0.11		0.742
6.001	18	120 minute 100 year Summer I+20%	5.550	5.099	0.585	0.000	0.19		1.389
6.002	19	120 minute 100 year Summer I+20%	5.550	5.122	0.677	0.000	0.17		1.267
4.002	16	120 minute 100 year Summer I+20%	5.640	5.133	0.883	0.000	0.18		3.055
1.006	14	120 minute 100 year Summer I+20%	5.850	5.154	1.144	0.000	0.99		8.253
1.007	16	120 minute 100 year Summer I+20%	5.850	5.156	1.421	0.000	0.00		259.822
1.008	17	120 minute 100 year Winter I+20%	5.700	3.436	-0.229	0.000	0.00		0.000
1.009	18	120 minute 100 year Summer I+20%	5.500	3.320	-0.375	0.000	0.00		0.000

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

PN	US/MH Name	Maximum Velocity (m/s)	Pipe Flow (l/s)	Status
1.000	1	1.0	17.5	SURCHARGED
1.001	2	1.0	32.3	SURCHARGED
2.000	3	1.0	14.5	OK
2.001	4	0.8	31.6	SURCHARGED
2.002	5	0.0	0.0	SURCHARGED
1.002	6	0.8	48.1	SURCHARGED
3.000	8	1.1	17.5	OK
3.001	9	0.8	25.8	OK
3.002	10	0.0	0.0	SURCHARGED
1.003	11	0.9	64.4	SURCHARGED
1.004	12	1.1	80.1	SURCHARGED
1.005	13	0.5	85.0	SURCHARGED
4.000	14	1.0	19.2	SURCHARGED
5.000	15	0.4	2.7	SURCHARGED
4.001	15	0.8	23.8	SURCHARGED
6.000	17	0.7	4.9	SURCHARGED
6.001	18	0.3	7.1	SURCHARGED
6.002	19	0.5	7.9	SURCHARGED
4.002	16	0.5	35.5	SURCHARGED
1.006	14	0.8	122.3	SURCHARGED
1.007	16	0.0	0.0	SURCHARGED
1.008	17	0.0	0.0	OK
1.009	18	0.0	0.0	OK