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RESIDENTIAL DEVELOPMENT IN BALLINCOLLIG, CORK

RESPONSE TO B.3.2

DATE 02/04/2025

REVISION 3

JOB NO. 6767

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DOCUMENT CONTROL

PROJECT NAME: RESIDENTIAL DEVELOPMENT IN BALLINCOLLIG, CORK

PROJECT NUMBER: 6767

REVISION	DATE	FILE NAME:	Response to B.3.2		
0	23.01.2024	DESCRIPTION:	Submission to CCC		
			PREPARED	CHECKED	APPROVED
		INITIAL	SO'D	CO'S	SO'D
		DATE	23.01.2024	23.01.2024	23.01.2024
1	05.11.2024	FILE NAME:	Response to B.3.2		
		DESCRIPTION:	Submission to CCC		
			PREPARED	CHECKED	APPROVED
		INITIAL	SO'D	SO'D	SO'D
		DATE	05.11.2024	05.11.2024	05.11.2024
2	04.03.2025	FILE NAME:	Response to B.3.2		
		DESCRIPTION:			
			PREPARED	CHECKED	APPROVED
		INITIAL	SO'D	SO'D	SO'D
		DATE	04.03.2025	04.03.2025	04.03.2025
3	02.04.2025	FILE NAME:	Response to B.3.2		
		DESCRIPTION:	Submission to CCC		
			PREPARED	CHECKED	APPROVED
		INITIAL	SO'D	SO'D	SO'D
		DATE	02.04.2025	02.04.2025	02.04.2025
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		DESCRIPTION:			
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Contents

1 Introduction

Denis O'Sullivan & Associates have been engaged as Consulting Engineers for the proposed residential development in Ballincollig Cork.

This response in in relation to a questionnaire issued by Cork City Council in relation to the provision of social Housing. The following paragraphs specifically address subsection B.3.2 in relation to the consideration of SUDS in the proposed development. It should be read in conjunction with the architect's drawings, specifications and architectural statements.

1.1 Site Location

The subject site (currently brownfield) is located within the City boundary.. The site is directly bound on the north and east by a residential development and south and west by industrial units. A snapshot of the application boundary and the surrounding environment is outlined in Figure 1 below.

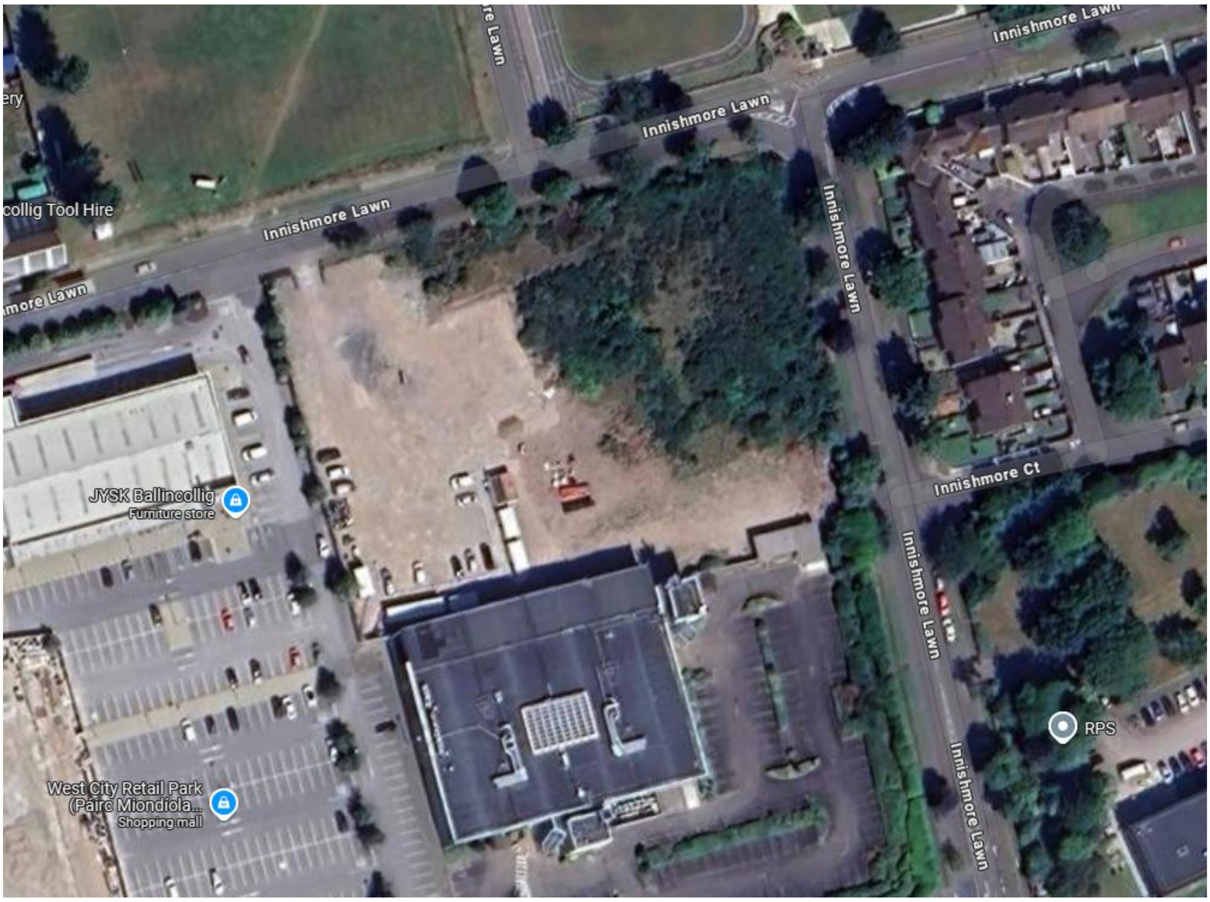


Figure 1

1.2 Scope of Assessment

This report deals with the following aspects associated with this development:

- Existing Site

- Site Investigations
- Soil Type Classification
- Storm Water Drainage Design
- Sustainable urban Drainage Systems (SuDS)
- Flood Risk Assessment and Exceedance Flows
- SuDS Maintenance

1.3 Site Topography

The topography of the site has gentle slope from the southwest in a northeasterly. A full Topographical feature and level survey has been completed. Figure 1.3 shows a snip of the topographical survey.

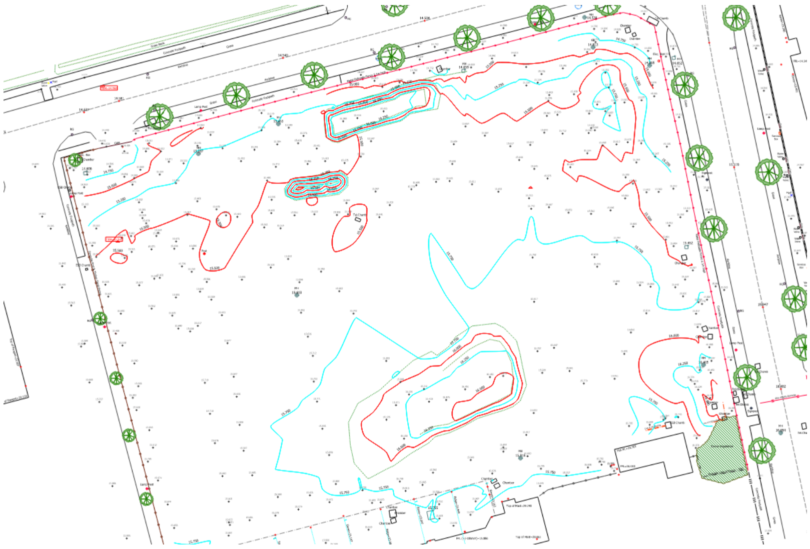


Figure 1.3 – Site Topography

1.4 Existing Hydrological Environment

The site is within hydrometric area19 (Lee, Cork Harbour and Youghal Bay). Hydrometric area No19 includes the surface catchment drained by the River Lee and all streams entering tidal water in Cork Harbour and Youghal Bay and between Knockaverry and Templebreedy..

1.5 Proposed Development

The proposed development consists of the construction of 56 residential units within the vacant brown field site in Ballincollig Cork The overall development consists of 1no. 4 bed townhouse, 17no. 3 bed townhouses, 7no. 3 bed DUPLEX units, 12no. 2 bed DUPLEX units, 7no. 2 bed apartment units and 12no. 1 bed apartment units. Vehicular access to the proposed development will be provided via 2 no. entrances combined with pedestrian entrances also. Ancillary site works include the provision of bicycle parking and bin storage facilities serving the proposed development

1.6 *Principle Design Considerations*

During the design of the storm water drainage for the proposed site, including SuDS, the following key documents / standards were taken into consideration.

- *Cork City Council Development Plan specifically*

Section 9.8 of Chapter 9 – Environmental Infrastructure of the Cork City Development Plan

"The traditional method of disposing of surface water runoff from impermeable surfaces such as roofs, roads and carparks is collection and redirection to drainage systems. This can result in localised flooding, higher waste treatment costs and the transfer of contaminants (such as oil from carparks) directly to water courses, resulting in pollution and affecting a river's ability to recharge naturally. Sustainable Urban Drainage Systems (SUDS) offer a more integrated approach to rainwater management. It involves a method of replicating the natural characteristics of rainfall runoff from any site, ensuring water is infiltrated or conveyed more slowly to the drainage system and ultimately to water courses via permeable paving, swales, green roofs, rain water harvesting, detention basins, ponds and wetlands. Chapter 5 Climate and Environment includes more detail in terms of the types of SUDS that can be used to achieve these goals. Where appropriate and possible, Cork City Council will encourage the use of SUDS and will prepare guidance on how SUDS can be applied to developments over the period of the plan."

- *CIRIA report C753 The SuDS Manual-v6*
- *Greater Dublin Strategic Drainage Study (GDSDS)*
- *Nature-based Solutions to the Management of Rainwater and Surface Water Runoff in Urban Areas Water Sensitive Urban Design - Best Practice Interim Guidance Document, (CDP Objective 9.4) - The Department of Housing, Local Government and Heritage.*
- *Inland Fisheries Irelands Planning for Watercourses in the Urban Area – (CDP Para 11.221)- IFI*

2 *Surface Water Design Overview*

The completed development site is a mix of soft landscaping and hard paving or roofing.

The runoff from the entire developed site will discharge to the existing storm network on Innismore lawn. The increased runoff flows will be attenuated to greenfield runoff rates prior to discharging to the existing sewer network. There are no anticipated negative impacts from the proposed design methodology.

Discharge from the site will be at one location on Innismore lawn.

The proposed storm water drainage system has been designed to cater for all surface water runoff from all hard surfaces within the proposed development including roadways, roofs, parking areas and green areas etc. The development has been considered as one catchment area.

The proposed surface water drainage network will collect surface water runoff from the site via a piped network prior to discharging off site via the attenuation tanks, flow control devices and separator arrangement. Final discharge rates will be at Qbar greenfield run-off rates.

Prior to entering the system, the stormwater generated will be treated through a number of nature-based solutions in line with adopted SuDS measures.

The storm sewer network was designed using Innovyze Micro Drainage modelling software. Outputs from the storm sewer design can be found in the Appendices of the Infrastructure Report.

Refer to DOSA Drawing Series No.'s 6767-0020 to 6767-0021 for details of the proposed surface water network and Suds measures.

All flow velocities within the network fall within the limits of 0.75 and 3m/sec as set out in "Recommendations for Site Development Works" as published by the Department of Environment. The storm water network and attenuation tank are designed to accommodate the 100-year return period plus an additional 20% to account for the effects of climate change.

2.1 Proposed Sustainable Urban Drainage (SuDS) Strategy

For the proposed development, a "SuDS triangle" was utilised to ensure all three functions are provided for within the SuDS strategy.

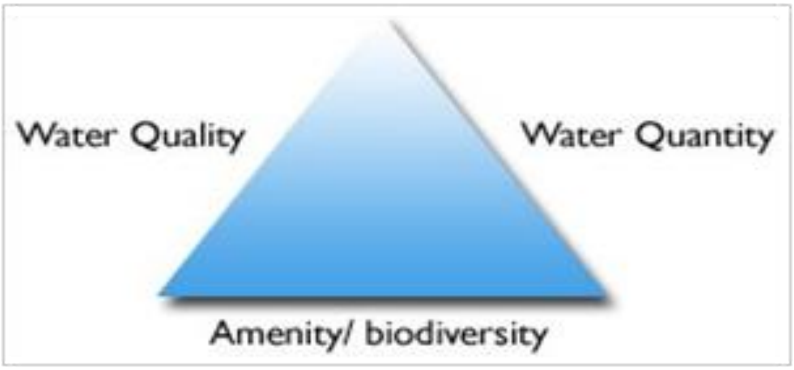


Figure 2.1– SuDS Triangle

By considering the three functions of the triangle, a SuDS system will allow for water quality treatment through natural processes by.

- Encouraging infiltration (where appropriate) and attenuating peak flows.
- Improving water quality by providing treatment to storm water prior to discharge.
- Providing habitat and function where possible for those using the area (including wildlife).

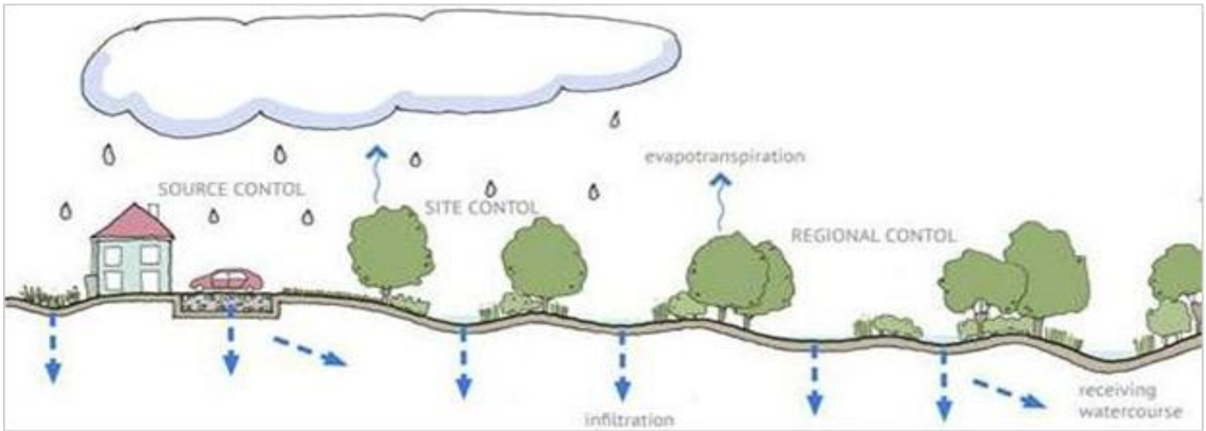


Figure 2.2– SuDS Treatment Train

The principles of a SuDS treatment train were used during the design of the surface water drainage system. The treatment train as illustrated in the image below provides an understanding of prevention and source control to reduced water run-off from a site and improve water quality.

Criterion 1: River Water Quality Protection

Satisfied by providing stormwater attenuation tanks and treatment of surface water run-off by SUDS features such full retention fuel/oil separators at surface water discharge points.

Criterion 2: River Regime Protection

Satisfied by attenuating surface water run-off in association with flow control devices prior to discharge off site at Greenfield runoff rate. Site critical duration storm used to assess attenuation volume.

Criterion 3: Level of Service (Flooding) for the Site

Satisfied by reviewing available flood hazard information (e.g., Lee CFRAM Study relating to the site's proximity to tidal and fluvial flood plains (up to 1 in 100-year flood event).

Criterion 4: River Flood Protection

Satisfied by attenuating surface water discharge to greenfield runoff rates, addressing flood risk associated with the 1 in 100-year storm and avoiding development in flood plains.

Following a comprehensive review of the design of the storm water drainage system we considered all options under the SuDS guidance policies referred to in the Greater Dublin Drainage Strategy. A preliminary feasibility of the applicable SuDS Techniques was conducted. The preliminary analysis indicated that the following techniques were suitable Attenuation Tanks, Basins, Permeable Paving, Soakaways, Swales and Rainwater Harvesting.

Each proposal was examined and evaluated on its merits / suitability under site specific constraints for use in the proposed development site. Our design approach summary is as follows:

2.2 SuDS Appraisal

The SUDS selection process used for this site is in accordance with SUDS selection flow chart, Volume 3, Section 6.5, Figure 48 of the GDSDS. The characteristics of the site are used to select the various SUDS techniques that would be applicable.

The purpose of this report is to prepare a Sustainable Drainage Strategy (SDS) for the overall development area. This includes:

- Provide a clear, creative, cost-effective and innovative SuDS which would be adopted for the main infrastructure design and by future designers on a site specific basis;
- Identify suitable locations for different types of SuDS;
- Identify key amenity features & potential habitats, such as wetlands or ponds;
- Set out all mitigation measures required for each area of the site, including confirmation of the minimum finished floor levels and ground levels throughout the study area & the maximum discharge rates from the developed sites;

- Identify the route, inverts & outfalls of the proposed main drainage system serving the developed area, including interfaces with existing or future foul trunk mains, rising mains or other utilities;
- Set out firm and clear requirements in relation to the incorporation of SuDS in both the development

2.3 Consideration of SuDS Techniques in Karst Areas

This site potentially has areas which are prone karstification as the subject area is underlain by Waulsortian mudbank; Pale-grey massive limestone. This may lead to instability issues within these areas if water is encouraged to infiltrate these areas. Further site investigation is recommended to assess the risk of unstable/karstified subsurface. A number of issues can arise when implementing a SuDS scheme on a site that may be prone to subsurface soil or rock instability. These issues arise mainly due to the effects of SuDS components that encourage water infiltration. Water infiltration into the ground can cause instability in poorly consolidated soils because the water can wash out the soil or cause it to compact. Also, rocks such as the limestone and sandstones found in this area may slowly dissolve over time. Water from infiltration systems can also cause slope or retaining wall failure, because water pressure may increase in the soil behind the slope or wall. SuDS for sites where there are soils or rocks prone to instability should not use infiltration as a runoff destination, and it may be necessary to line systems to prevent any water infiltrating the ground. This will depend on the risks associated with any potential instability and the likely volume of water discharging to the infiltration device when compared to natural exposure to rainfall on the same area. A small amount of infiltration to provide interception may not be a problem. An appropriate risk assessment may need to be carried out on a case by case basis.

In endeavouring to design a system having regard to the recommendations for Suds proposal for Residential Developments, the following methodologies are being implemented as part of a SuDS treatment train approach

2.4 Review of SUDS Techniques

In reviewing the design of the storm water drainage system, all options under the SUDS guidance policies referred to in the Greater Dublin Drainage Strategy were reviewed. A preliminary feasibility of the applicable SUDS Techniques was carried out using the facility on the website of Irishsuds.ie (Guidance and Tools).

The SUDS selection process used for this site is in accordance with SUDS selection flow chart, Volume 3, Section 6.5, Figure 48 of the GDSDS. The characteristics of the site are utilised to select the various SUDS techniques that would be applicable.

The following methodologies are being considered as part of a SuDS treatment train approach:

- Permeable Pavement - utilised within car parking areas
- Underground Attenuation -below the open space area
- Flow control device (e.g. hydrobrake) - installed at the outfall manhole of each catchment
- Petrol Interceptor - installed downstream of each flow control device manhole.
- Filtration trenches
- Tree pits

- Rain gardens

The preliminary analysis indicated that the following techniques were possibly suitable. Filter trenches , Permeable Paving, Soakaways and Rainwater Harvesting. Each proposal was examined and evaluated on its merits / suitability under site specific constraints for use in the proposed development site. Our design approach summary is as follows:

2.5 Attenuation tanks

Whilst Suds measures are to be utilised within the proposed development and acknowledging that attenuation tanks are a last resort, site investigations have concluded that they are the most suitable solution due to the presence of the Karst substrata. This in combination with the restricted land surface area required for SUDs measures justifies the inclusion of the attenuation tank within the development.

The proposed attenuation system attenuates surface water to restrict the outflow to the equivalent of the existing agricultural runoff. This ensures the development will not give rise to any impact downstream of the site. It is the council's preference not to use proprietary modular systems, so it is proposed to use reinforced concrete underground tanks.

The site is relatively level. The most suitable location of such a technique would be on a low lying relatively flat plain .

These systems will be impermeable and no infiltration of the runoff to the ground is proposed. These systems will be used under the large open spaces within the development. Elements such as filter drains, tree pits, rain gardens, whilst having a reducing effect of the attenuation volumes required have been ignored from the stormwater network and attenuation volume design. The use of same are added benefits to the overall system

The concrete attenuation tank will be designed for trafficable loads for maintenance

2.5.1 Rain Gardens/Bioretention Tree Pit

Rain Gardens/Bioretention Tree pits are small, planted areas with stormwater controls that collect and treat stormwater runoff. Shallow landscaped basins make use of soils and vegetation to remove pollutants. This treated runoff shall be collected in these basins and form part of a wider SuDS approach for the areas adjacent to the access road within the development.

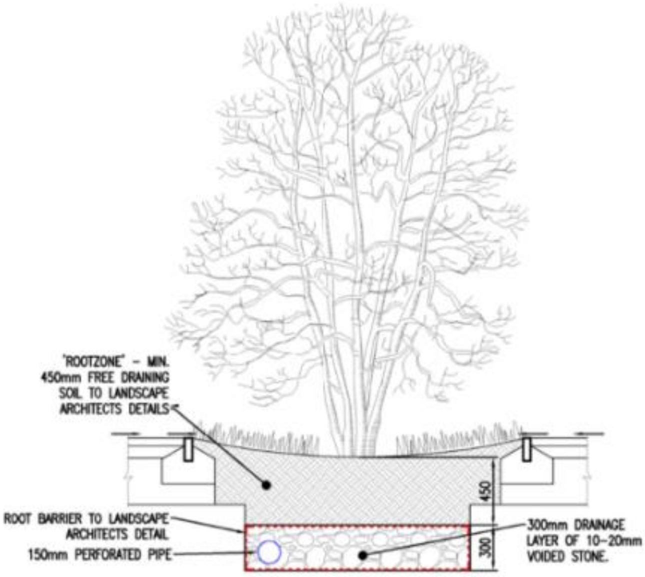


Figure 2.5– Typical Raingarden/Bioretention Tree Pit Arrangement

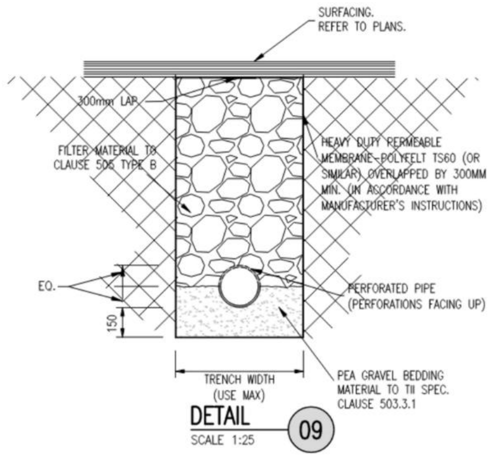
The proposed raingardens are included on the SuDS drawings series 6767_0021. It is proposed to include them along the main access road and along green areas within the development. Theoretically the installation of these Raingarden/Bioretention tree pits in public areas contribute to a possible volumetric reduction in required attenuation in the overall development , however they have been omitted from providing any reduction in these attenuated volume requirements.

2.6 *Permeable Paving (Exfiltration Method)*

Permeable pavement reduces the overall impermeable area of the hard-standing area, which would potentially reduce the impact of the discharge and improve the quality of the effluent from the proposed development. All car parking areas within the proposed development will be located within the public realm to be taken in charge. As advised by Cork City council, permeable paving is not permitted within these regions, therefore suds measures will be omitted from the development

2.6.1 Filter Drain

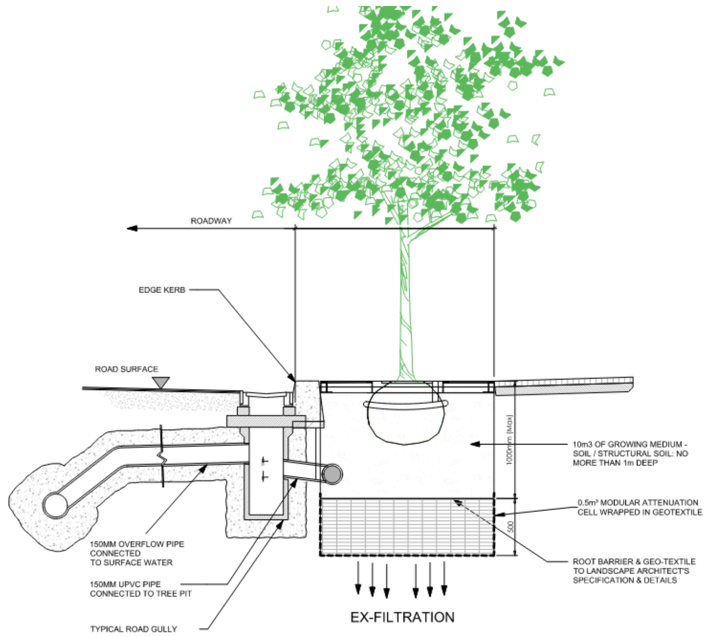
Trenches filled with permeable material and a perforated collection pipe at the invert with an optional permeable 'sandy' topsoil at surface. These can treat, convey and attenuate runoff at source, and can infiltrate to the ground where the subgrade is suitable. These systems will allow some form of storage for small rainfall events and can result in water evaporation and adsorption in small quantities, therefore there will be less run-off from these areas in small rainfall events thus mimicking the natural response for this catchment. These will be located along the proposed green area and will allow groundwater to recharge to its natural state.



TYPICAL FILTER DRAIN DETAIL

2.6.2 *Tree Pits*

Trees can be planted within a range of infiltration SuDS components to improve their performance, as root growth and decomposition increase soil infiltration capacity. Alternatively, they can be used as standalone within soil-filled tree pits, tree planters or structural soils, collecting and storing runoff and providing treatment via filtration and phytoremediation. Tree pits and planters will be designed to collect and attenuate runoff by providing additional storage within the underlying structure. The soils around trees can also be used to filter out pollutants from runoff directly. Tree pits are proposed to be in green space areas to treat and control runoff, while at the same time providing amenity value to adjacent pedestrian, and residential zones. It is also proposed, where possible to fit tree pits along the estate road to drain and treat surface water runoff from the road network. This will allow for treatment of first flush and low flows while high flows will discharge into the surface water network during extreme rainfall events. Rainwater gullies will still be provided downstream of any tree pit to drain runoff during an extreme rainfall event.



Tree Pit Detail

2.6.3 Swales

Broad, shallow drainage channels covered in grass which can treat, convey, and attenuate runoff, at source, and can infiltrate to the ground where the subgrade is suitable. Swales can also promote biodiversity.

Due to difficulties in long term maintenance and the topography and bedrock of the site along with the confined nature and density of the development it is proposed to omit swales from the submission and proceed with more compact and more suitable alternatives as detailed in this report and associated drawings.

2.7 Rainwater Harvesting

In relation to rainwater harvesting a dual plumbing system would be required for each individual unit thus providing a grey water system. This has a significant added cost to each unit. An alternative is to provide a water butt with each individual dwelling. This could be located to the rear of each unit and will be used to collect rainwater from the roof via the downpipes. Water re-use from this method is in reality restricted to watering landscaping.

2.7.1 SuDS Components Affected by Site Specific Investigations

The results of the site-specific site investigations resulted in the following components being omitted from design consideration due predominantly to the presence of Karst

- Permeable Paving
- Ponds & Wetlands
- Swales

2.7.2 Management Train

The management train commences with source control through the provision of rain-water butts (potentially) in the rear gardens. This will also reduce the water consumption required of each housing unit. This employment of these source controls along with the usage of localised tree pits and infiltration/ filter drains will aid to reduce the peak runoff rate, placing less stress on the facilities downstream.

The second stage of the management train, site control, is provided by the introduction of the hydrocarbon interceptors in open areas which provide a degree of treatment before discharging to the attenuation system.

The attenuation tanks offer a third stage of treatment, regional control, by slowing the storm water discharge down and removing additional silts which may remain in the storm water.

2.8 Surface Water Drainage Network

The surface water drainage network for the proposed development will be modelled using the Microdrainage software application. The surface water pipe lengths, slopes, contributing impermeable areas, upstream invert levels, upstream cover levels and pipe diameters will be entered into the model using the drawings supplied.

In order to reduce the effects of the surface runoff on potential flooding, a Stormwater Management Plan will be applied to surface water discharging into sewers and adjacent watercourses. The Stormwater Management Plan can be applied to control the rate of runoff from new development and takes into consideration of the various SUDS elements and techniques available. The maximum permitted surface water outflow from the new development is to be restricted to that of the existing Greenfield site.

Control of runoff by attenuation methods requires a hydraulic control to restrict the magnitude of flows passing downstream, together with an upstream storage capacity to contain the volume of runoff held back by the hydraulic control. The flows are proposed to be attenuated in the surface water system by adopting a flood storage detention tank along with a restricted outlet as the control devise. The storage volume required has been designed using the computer aided design package Windes 10.

The global variables required for the model were the M5-60 and Rainfall Ratio. These two factors may be read from maps contained in the Wallingford procedure. They enable the program to calculate the intensity, duration and frequency characteristics of storms.

M5-60 is the rainfall depth based on a 60-minute storm of 5 years return period. Ratio R is the ratio of the 60-minute storm to the 2-day storm for the 5-year return period events. These values are as follows:

- M5-60 = 18.80mm
- Ratio R = 0.250

Microdrainage generates design storms using the principles set out in the Flood Studies Report (NERC 1975).

A summer rainfall profile was used for the design of the pipework and a winter rainfall profile was used for the design of the storm water attenuation tank to give the critical design. A summer profile gives higher rainfall intensities and results in higher runoff rates and is used to determine the required capacity of the pipework. A winter rainfall profile gives a flatter more sustained profile and results in higher runoff volumes and is used to determine the attenuation/storage requirements.

The surface water drainage network will be assessed for compliance with maximum and minimum velocities, pipe length etc. The network will be designed to ensure velocities in the network and pipe gradients will not exceed the maximum velocity of 4.0m/s. The minimum velocity allowed will be 0.75m/s.

The design of the drainage network was assessed using events with a range of different durations to determine the critical event for each return period analysed as follows:

- 1 in 5-year return period events were used to ensure that the system did not surcharge;

- 1 in 100 year return period events were used to ensure that flooding did not occur. An allowance of 20% for climate change was also include in the design.

2.9 Design Criteria

The proposed surface water drains have been designed in accordance with the Greater Dublin Strategic Drainage Study (GDSDS), the Department of the Environment's Recommendations for Site Development Works for Housing Areas, the Department of the Environment's Building Regulations "Technical Guidance Document Part H Drainage and Waste Water Disposal" and BS EN 752: 2008 Drain and Sewer Systems Outside Buildings.

• Return period for pipe work design	2 and 5 years
• Return period for attenuation design	100 years
• Soil Type	2
• Allowable Outflow	2.8 l/sec
• Time of entry	5 minutes
• M5 – 60	18.80 mm
• Ratio "r"	0.25
• Pipe Friction (Ks)	0.6 mm
• Minimum Velocity (based on pipe flowing full)	1.0 m/s
• Rainfall Runoff from Roads and Footpaths	100%
• Rainfall Runoff from Roofs	80%
• Rainfall Runoff from Driveways	80%
• Rainfall Runoff from Green Areas	20%
• Rainfall Depth Factored for Climate Change (as per GDSDS)	20%

(in accordance with GDSDS Volume 2, Chapter 6, Table 6.2 – see below)

Climate Change Category	Characteristics
River flows	20% increase in flows for all return periods up to 100 years
Sea level	400+mm rise (see Climate Change policy document for sea levels as a function of return period)
Rainfall	10% increase in depth (factor all intensities by 1.1)
	Modify time series rainfall in accordance with the GDSDS climate change policy document

Table 6.2 Climate Change Factors to be Applied to Drainage Design

The global variables required for the model were the M5-60 and Rainfall Ratio. These two factors may be read from maps contained in the Wallingford procedure. They enable the program to calculate the intensity, duration and frequency characteristics of storms.

M5-60 is the rainfall depth based on a 60-minute storm of 5 years return period. Ratio R is the ratio of the 60-minute storm to the 2-day storm for the 5-year return period events. These values are as follows:

2.10 Storm Water Outfall

Storm water from the proposed development shall discharge into the existing storm sewer located to the north eastern boundary of the site via a hydro brake manhole, which will limit the amount of water discharging to the network. The amount of water discharged from the hydro brake manhole will be determined by using the allowable Greenfield Runoff rate for the developable area of the site. It is to be noted that all on site storm water storage facilities have been sized to cater for all storm water generated within the site boundary of the development.

2.11 SuDS Calculations

Calculations of the various SuDS elements proposed are contained in Appendix B of this report. This report should also be read in conjunction with the Infrastructure Report submitted as part of the application. Attenuation Tank Sizes and Petrol Interceptor Sizing/Specifications have been included as part of the Stormwater Network Design in this report. The nature-based SuDS principles proposed will have a positive impact from a sustainable impact. As noted the volumetric attenuation capacity was calculated ignoring the benefits of all SuDS elements.

2.12 Stormwater Attenuation Strategy

The area of this proposed development is approximately 1.0 (ha). The stormwater management plan will involve using an attenuation tank

All surface water runoff arising from the paved development will be drained away from the site. The attenuation tank is designed for a 100-year storm event. The maximum discharge from the attenuation tank will be limited to calculated permissible runoff (QBAR) for the site.

Based on the proposed development design there will be a change in the land surface. Therefore, due to this proposed change a corresponding increase in the peak rate of surface runoff from the site will arise during times of high rainfall.

The flood peak runoff rates from the post-development grassy permeable area (Q_p grass) and the post-development impervious area (Q_p imp.) using the Rational Method (100% impermeability of hard surfaces) are calculated using Windes 10.4. The Sources Control Module of the MicroDrainage Software was used to design the attenuation tank capacities. This module also provides the critical storm duration for the attenuation tank during the design process.

It should be noted that climate change has been accounted for in the design. As per volume 5 of the GDSDS a factor of 20% has been incorporated into the design.

2.13 Attenuation Tank

2.13.1 Volume of Attenuation Tank

The capacity of the attenuation tank will be designed to cater for the capacity required for a 1 in 100 year ARI event.

Tank No.	Capacity (m^3)	Restricted Outlet (l/sec)
1	100	2.8 l/sec

2.14 Hydrocarbon Treatment

A petrol interceptor is a trap used to filter out hydrocarbon pollutants from rainwater runoff. It is used in construction to prevent fuel contamination of streams carrying away the runoff.

Petrol interceptors work on the premise that some hydrocarbons such as petroleum and diesel float on the top of water. The contaminated water enters the interceptor typically after flowing off roads or hardstanding areas before being deposited into the first tank inside the interceptor.

The first tank builds up a layer of the hydrocarbon as well as other scum. Typically, petrol interceptors have 3 separate tanks each connected with a dip pipe, as more liquid enters the interceptor the water enters into the second tank leaving the majority of the hydrocarbon behind as it cannot enter the dip pipe, whose opening into the second tank is below the surface.

However, some of the contaminants may by chance enter the second tank. This second tank will not build up as much of the hydrocarbon on its surface. As before, the water is pushed into the third tank and more water enters the second.

The third tank should be practically clear of any hydrocarbon floating on its surface. As a precaution, the outlet pipe is also a dip pipe. When the water leaves the third tank via the outlet pipe it should

2.14.1 Silt Control

The proposed petrol interceptors from Conder Environmental also include a silt storage capacity in addition to the oil storage capacity that allow silt to be collected in the interceptor prior to discharge to the proposed attenuation tanks. This silt build-up can then be removed from the tanks..

3 *Maintenance Regime for SuDS Devices*

The SuDS features proposed above for the site will require the following maintenance: It should be noted that as part of the as-builts and taking in charge process, documentation in relation to Operation and maintenance etc will be provided. The proposed SuDS strategy has been developed to try and strike a balance between efficient and robust operation and the minimising of frequent and on-going maintenance requirements. The maintenance of all SuDS features shall remain the responsibility of the developer until such time as any proposed taking in charge has been completed.

3.1.1 Underground attenuation systems

Inspection of the system should be conducted monthly for the first 3 months and then annually to ensure the system is working correctly. Debris should be removed monthly from the catchment surface where it may cause risk to the performance of the underground attenuation system. As required sediment from pre-treatment (catch pit) manholes prior to the attenuation system should be removed to ensure on going performance of the system. The inside of the tank should be surveyed every 5 years or as required if performance is reduced with any sediment build up removed if necessary.

In terms Of Operation and Maintenance the use of Reinforced concrete tanks is robust and maintenance free. The typical arrangement is the following train

- A Petrol interceptor which is accessible only via an on-grade heavy duty manhole cover.
- An inlet manhole to the tank will have a sump incorporated to trap silt so as to reduce the need to access the tank.
- The SuDS train is followed by a reinforced concrete attenuation tank. This is accessed via a number of heavy-duty manholes covers and fall arrest gates. (anticipated requirement to enter is extremely low). In the unlikely event of entry being necessary only trained personnel in confirmed spaces will be permitted in any tank and this will be detailed and highlighted in any handover/maintenance files at taking in charge stage. There are no moving parts or plant associated with these tanks.
- The outflow will be controlled by a hydro brake located in an outlet manhole abutting the tank. This will be a vortex arrangement and separate access to that of the tank itself.
- The attenuation tank is located adjacent to the proposed access road which will allow ease of access and maintenance of the tank

3.1.2 Tree Pits

Maintenance of trees will be greatest in the first few years, which will include regular inspection of tree condition including inlets and outlets, removal of invasive vegetation and possibly irrigation during long dry periods. As any handover process (taking in charge) is medium to long term it is anticipated that the Tree Pit regime will be well established and operational with little maintenance required.

3.1.3 Filter Drains

Inspection of the system should be conducted monthly on the inlet / outlet pipework and any control systems for blockages. Inspection of pre-treatment systems including should be conducted every 6 months for catch pits manholes prior to the filter drain with removal of silt or other build-ups. Removal of silt build-up may be required more frequent. Annual cleaning of roof runoff gutters etc should be part of the maintenance of the drainage system to ensure debris is removed prior to entering the network. Perforated pipework should be cleared of blockage if required.

3.1.4 Hydro brake Manhole:

Normally little maintenance is required as there are no moving parts within a hydro brake, however, after installation, hydro brakes should be inspected to ensure the hydro brake orifice is not blocked monthly for three months and thereafter at six monthly intervals and hosed down if required. Remove rubbish or debris from hydro brake if present. Hydro-Brake Flow Controls are fitted with a pivoting by-pass door, which allows the manhole chamber to be drained down should blockages occur. The hydro brake will be located in a manhole separate to the tanks. As a result, any access will be similar to entering a standard manhole.

3.1.5 Petrol Interceptor:

Systems should be visually inspected for every rainfall event for 30 days after installation and the amount of sediment measured to give the operator an idea of the expected rate of deposition. Systems should then be inspected every 6 months to verify the appropriate level of maintenance. Floating debris and solids should be removed, and the sump cleaned with a conventional sump vacuum cleaner. Filter media should be replaced, and sediments, oils and grease should be removed where required.

4 Foul Sewer System

4.1 Foul Sewer Design

A Pre-Connection Enquiry was submitted to Irish Water. The Irish Water Reference Number for this enquiry is CDS24006625. The response to this Enquiry issued on the 13th December 2024 confirmed that connection to the network was feasible but upgrades to the infrastructure is required.

The foul sewer has been designed using the System 1 and Simulation Modules of the Micro-drainage package. The foul network design addresses present day design issues and can view velocities at Full Bore, Proportional Depth and 1/3 flow.

A model of the proposed foul drainage network was built using the micro-drainage software applications. The model was analysed and amended until the results met with the design criteria specified.

The layout of the proposed Foul network is shown on the Proposed draiange Layout Plan 6766-0020

The network has been designed to achieve self-cleansing velocities at 1/3 flow whilst maintaining minimum gradients.

5 Water Supply

As with the drainage network, a Pre-Connection Enquiry was submitted to Irish Water under Reference No. CDS24006625. This confirmed that connection to the network was feasible subject to internal diversion and upgrades.

It is proposed to provide a new 100mm internal diameter HDPE connection within the development with associated hydrants, valves and metering requirements.

Water distribution supply to each building will be sized to cater for the requirements of those particular uses. Metered connections will be made to the main in accordance with Irish Water specifications and details.

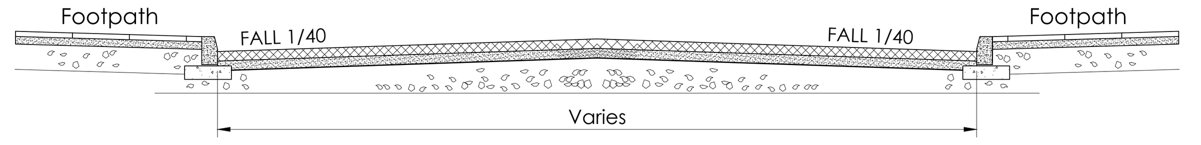
The layout of the proposed watermain network is shown on the Proposed Watermain Layout Plan 6767-0030.

All works will be in accordance with Irish Water Code of Practice for Water Supply & the Water Infrastructure Standard Details Document Number: IW-CDS-5020-01.

6 Conclusion

The Drainage Impact Assessment and SuDS Treatment Train Design has been developed in accordance document reference in section 1.6. Whilst it deviates from some of the recommendations (due to site specific investigations) made we believe that the overall strategy achieves the objectives set out and SUDS measures will be implemented within the development . SUDS measures will consist of Tree pits, Filtration Basin and trenches, rainwater harvesting and aconcrete attenuation tanks.

Appendix A –SuDS Drawings



100mm Concrete paths on blinding on 200mm granular subbase material (clause 801)

45mm macadam wearing course on 55mm base course on blinding on 300mm granular sub-base material (clause 804) on crushed stone fill as required finish in accordance with county council specification

100mm Concrete paths on blinding on 200mm granular subbase material (clause 801)

Typical Road Detail for Internal Estate Roads

Scale 1:50

Legend:

125.00	Main Road Level
F.F.L. 125.00	Proposed Finished Floor Level
	Road Centerline
1/100	Road Slope
000.00m	Road Chainage
	Shared Surface

Proposed Internal Road Layout & Levels

Scale : 1:250

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REV.	DRAWN	CHKD	APPRVD	DATE	DETAILS
H	A.G.	S.O'D.	C.O'S.	02.04.'25	Issued for RFI Planning
G	A.G.	S.O'D.	C.O'S.	28.03.'25	Issued for RFI Planning
F	AG.	S.O'D.	C.O'S.	07.03.'25	Issued for RFI Planning
E	A.B.	S.O'D.	C.O'S.	05.11.24	Revised & Reissued for 20241029 HP-OBR ITCD CLARIFICATIONS
D	A.B.	S.O'D.	C.O'S.	04.09.'24	Issued for Planning Application

CLIENT: OBR Construction

PROJECT: Innishmore, Ballincolig, Co. Cork

DRAWING TITLE: Proposed Internal Road Layout & Levels

SHEET	SCALE	PROJECT NO.	DRAWING NO.	STATUS/ISSUE
A1	1:250	6767	0010	H

Legend:

Wasteater Details:	Document No. IW-CDS-5030-01	
Denotes Foul Pipe	Waste Water Service Connection Responsibility :	STD-WW-01
F01 Denotes Foul Manhole	Drain & Service Connection Pipework :	STD-WW-03
Denotes Foul Sewer (Concrete encased)	Typical Sewer / Service pipe Connection :	STD-WW-04
IC Denotes Inspection Chamber	Trench Backfill & Bearing :	STD-WW-07
Denotes Existing Foul Pipe	Concrete Bed, Haunch & Surround to Waste Water :	STD-WW-08
Denotes Diverted Existing Foul Pipe	Pre-cast Concrete Manhole :	STD-WW-10
	Backdrop manholes:	STD-WW-12
	Private Side Inspection Chamber :	STD-WW-13
Storm Water Details:	Thrust blocks for rising main:	STD-WW-14
Denotes Storm Pipe	Scour valve chamber (Foul rising main <200mmØ):	STD-WW-15
S01 Denotes Storm Manhole	Sluice valve details for rising mains Polyethylene (P.E.) (<200mmØ) :	STD-WW-17
Denotes Storm Sewer (Concrete encased)	Air valve chamber (Foul rising main <200mmØ) :	STD-WW-18
Denotes Ex. Storm Sewer		

Note:
- Refer to Irish Water Standard Details Drawings Document No. IW-CDS-5030-01
- Pipe materials shall comply with Section 3.9 of Irish Water's Code of Practice.
- All works to be constructed to conform with Irish Water's Code of Practice for Wastewater Infrastructure: Document No. IW-CDS-5030-03.
- For Drainage Layout to Perimeter of Dwellings, refer to Dwelling Drawings.

Proposed Drainage Layout
Scale : 1:250

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D	A.G.	S.O'D.	C.O'S.	10.03.'25	Issued for IW
C	A.G.	S.O'D.	C.O'S.	07.03.'25	Issued for RFI Planning
B	A.B.	S.O'D.	C.O'S.	05.11.24	Revised & Reissued for 20241029 HP-OBR ITCD CLARIFICATIONS

CLIENT	DRAWING TITLE				
OBR Construction	Proposed Drainage Layout				
PROJECT	**SHEET**	**SCALE**	**PROJECT NO.**	**DRAWING NO.**	**STATUS/ISSUE**
Innishmore, Ballincolig, Co. Cork	A1	1:250	6767	0020	F

Legend:

Wasteater Details:	Document No. IW-CDS-5030-01	
Denotes Foul Pipe	Waste Water Service Connection Responsibility :	STD-WW-01
F01 Denotes Foul Manhole	Drain & Service Connection Pipework :	STD-WW-03
Denotes Foul Sewer (Concrete encased)	Typical Sewer / Service pipe Connection :	STD-WW-04
IC Denotes Inspection Chamber	Trench Backfill & Bearing :	STD-WW-07
Denotes Existing Foul Pipe	Concrete Bed, Haunch & Surround to Waste Water :	STD-WW-08
Denotes Diverted Existing Foul Pipe	Pre-cast Concrete Manhole :	STD-WW-10
	Backdrop manholes:	STD-WW-12
	Private Side Inspection Chamber :	STD-WW-13
Storm Water Details:	Thrust blocks for rising main:	STD-WW-14
Denotes Storm Pipe	Scour valve chamber (Foul rising main <200mmØ):	STD-WW-15
S01 Denotes Storm Manhole	Sluice valve details for rising mains Polyethylene (P.E.) (<200mmØ) :	STD-WW-17
Denotes Storm Sewer (Concrete encased)	Air valve chamber (Foul rising main <200mmØ) :	STD-WW-18
Denotes Ex. Storm Sewer		

Note:

- Refer to Irish Water Standard Details Drawings Document No. IW-CDS-5030-01
- Pipe materials shall comply with Section 3.9 of Irish Water's Code of Practice.
- All works to be constructed to conform with Irish Water's Code of Practice for Wastewater Infrastructure: Document No. IW-CDS-5030-03.
- For Drainage Layout to Perimeter of Dwellings, refer to Dwelling Drawings.

Legend:

- Tree Pit
- Bio Retention
- Filter Drain
- Stormwater Attenuation
- Rain Garden

Proposed Drainage Layout
Scale : 1:250

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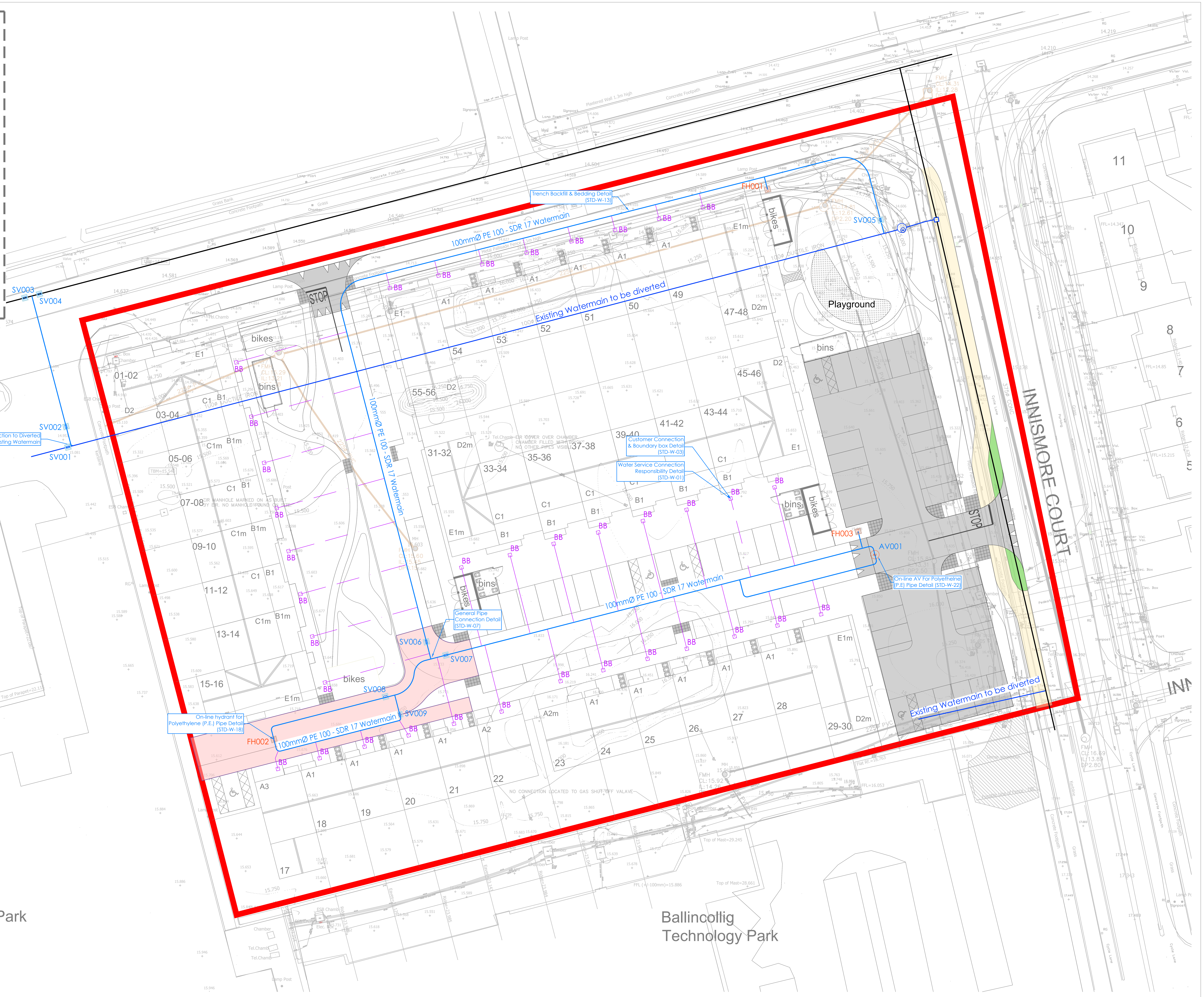
B	A.B.	S.O'D.	C.O'S.	04.09.'24	Issued for Planning Application

CLIENT	DRAWING TITLE
OBR Construction	Proposed SuDS Measures Layout

PROJECT	SHEET	SCALE	PROJECT NO.	DRAWING NO.	STATUS/ISSUE
Innishmore, Ballincolig, Co. Cork	A1	1:250	6767	0021	F



Legend:

Watermain Details:	Document No. IW-CDS-5020-01	
BB050 Denotes Connection Pipe (25mm O.D. PE Pipe)	Water Service Connection Responsibility :	STD-W-01
BB051 Denotes Connection Pipe (32mm O.D. PE Pipe)	Customer Connection & Boundary Box :	STD-W-03
	Marker Posts & Plates :	STD-W-27
Denotes 110/125mm O.D. HDPE Watermain	General Pipe Connections :	STD-W-04
Denotes 80mm O.D. HDPE Watermain loop	General Pipe Connections :	STD-W-05
Denotes 150mm Ø (I.D.) - HDPE Watermain	General Pipe Connections :	STD-W-07
	Trench Backfill and Bedding :	STD-W-13
	Watermain Thrust & Support Blocks :	STD-W-28
SV001 Denotes Sluice Valve	Sluice Valve :	STD-W-15
	Marker Posts & Plates :	STD-W-27
WO Denotes Washout Hydrant	Washout Hydrant :	STD-W-30A
NRV Denotes Non-Return Valve	On Line Hydrant :	STD-W-18
FH003 Denotes Fire Hydrant	Off Line Hydrant :	STD-W-19
	Marker Posts & Plates :	STD-W-27
AV001 Denotes Air Valve	Air Valve :	STD-W-22
Meter Chamber Denotes Water Meter	Meter Chamber :	STD-W-26/26A
	Marker Posts & Plates :	STD-W-27
Denotes Existing Public Watermain		

Note: Refer to Irish Water Standard Details Drawings Document No. IW-CDS-5020-01

1. Mains should extend no more than 1.2m beyond the final Service Connection to mitigate dead-end Mains (Code of Practice for Water Infrastructure - Section 3.5)
2. Service connection pipes should be a minimum of 25mm ouside diameter, 20mm inside diameter, and should be provided with appropriately sized fittings. (Code of Practice for Water Infrastructure - Section 3.8)
3. Separation distances must be in compliance with Standard details & Code of Practice for Water Infrastructure
4. All meters in the manifold shall be tagged to indicate which property is supplied and any unused outlets are to be blanked off.

Proposed Watermain Layout
Scale : 1:250

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CLIENT: OBR Construction

PROJECT: Innishmore, Ballincolig, Co. Cork

DRAWING TITLE: Proposed Watermain Layout

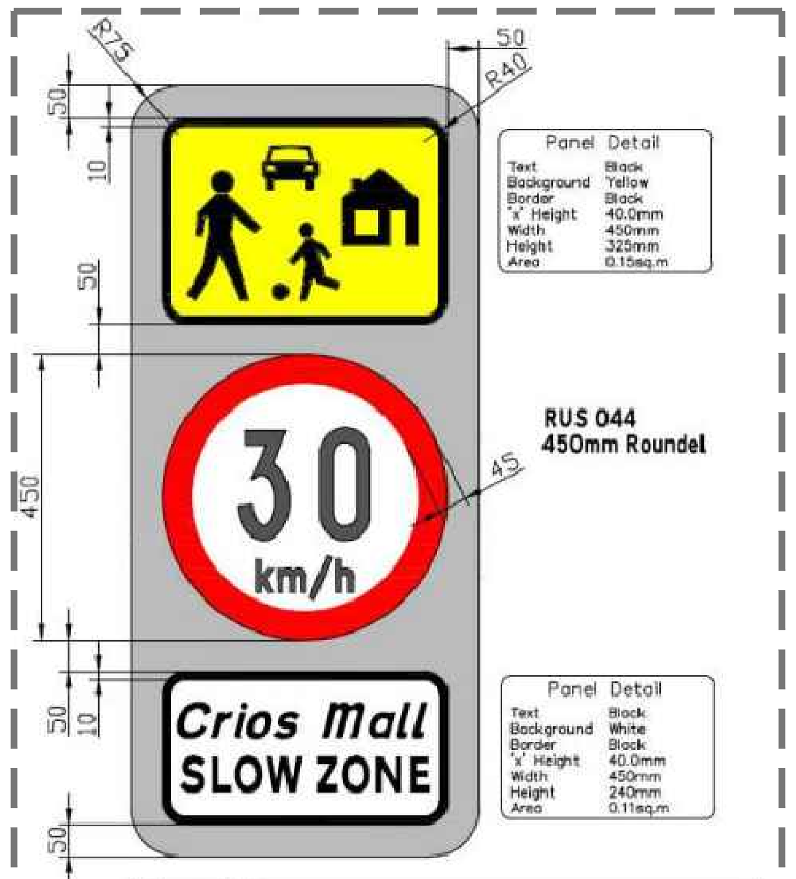
SHEET: A1

SCALE: 1:250

PROJECT NO.	DRAWING NO.	STATUS/ISSUE
6767	0030	F

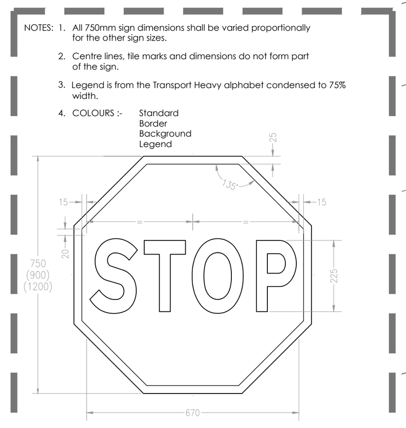
Legend:

- Tactile Surfacing
- Shared Surface Carriageway
- Cycle Pathway
- Raised Table



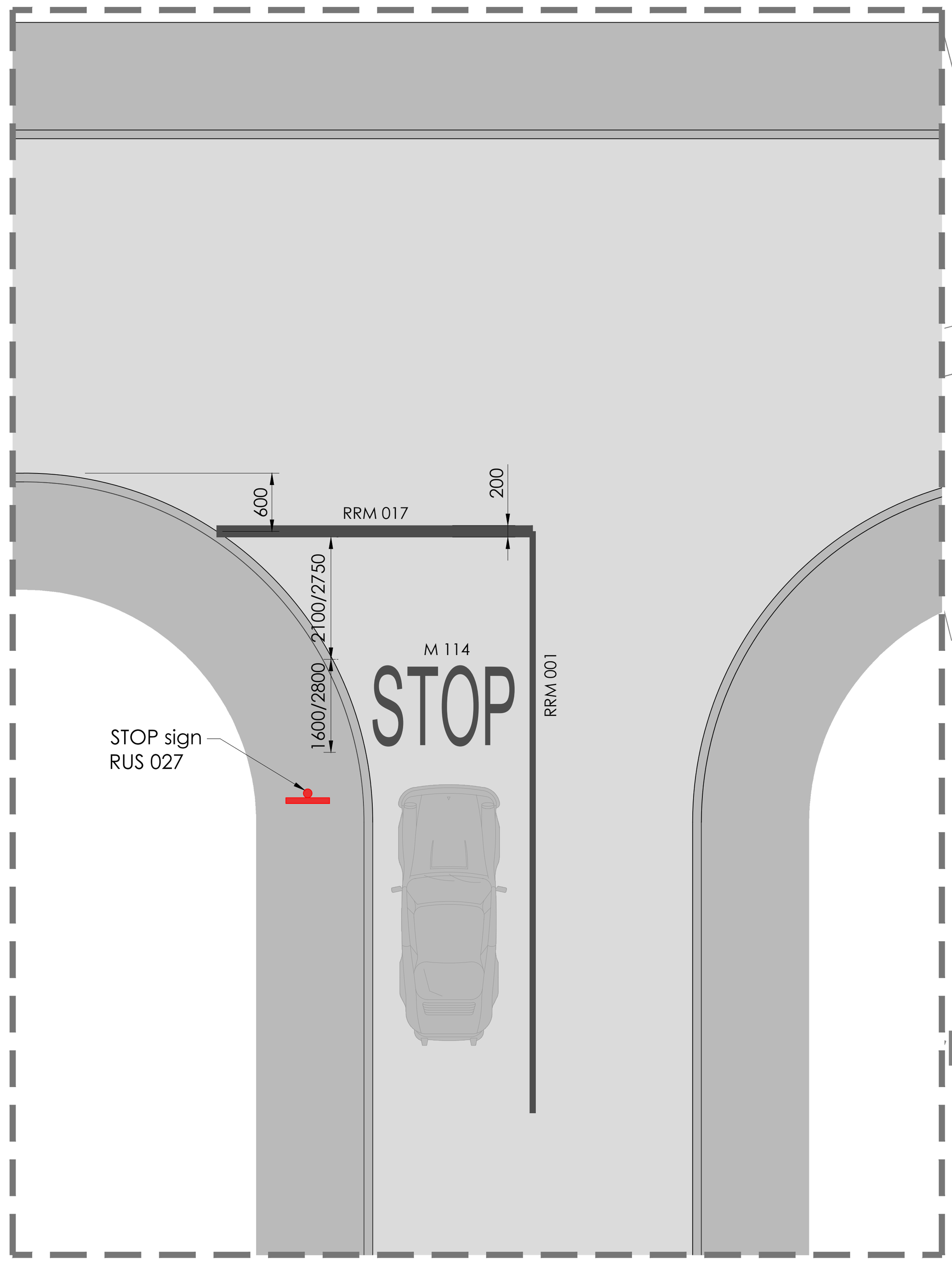
Scheme Ref.			
Sign Ref.	slow zone 001	X-height	40mm
Letter colour	N\A	SIGN FACE	
Background	GREY	Width	550mm
Border	N\A	Height	1210mm
Material	Class RA2 (12899-1:2007)	Area	0.67sq.m
Drawing file	housing estate speed limit-home zone		
NOTE Edge of sign must be at least 750 mm from edge of carriageway			

Detail 'A' - Slow Zone Sign

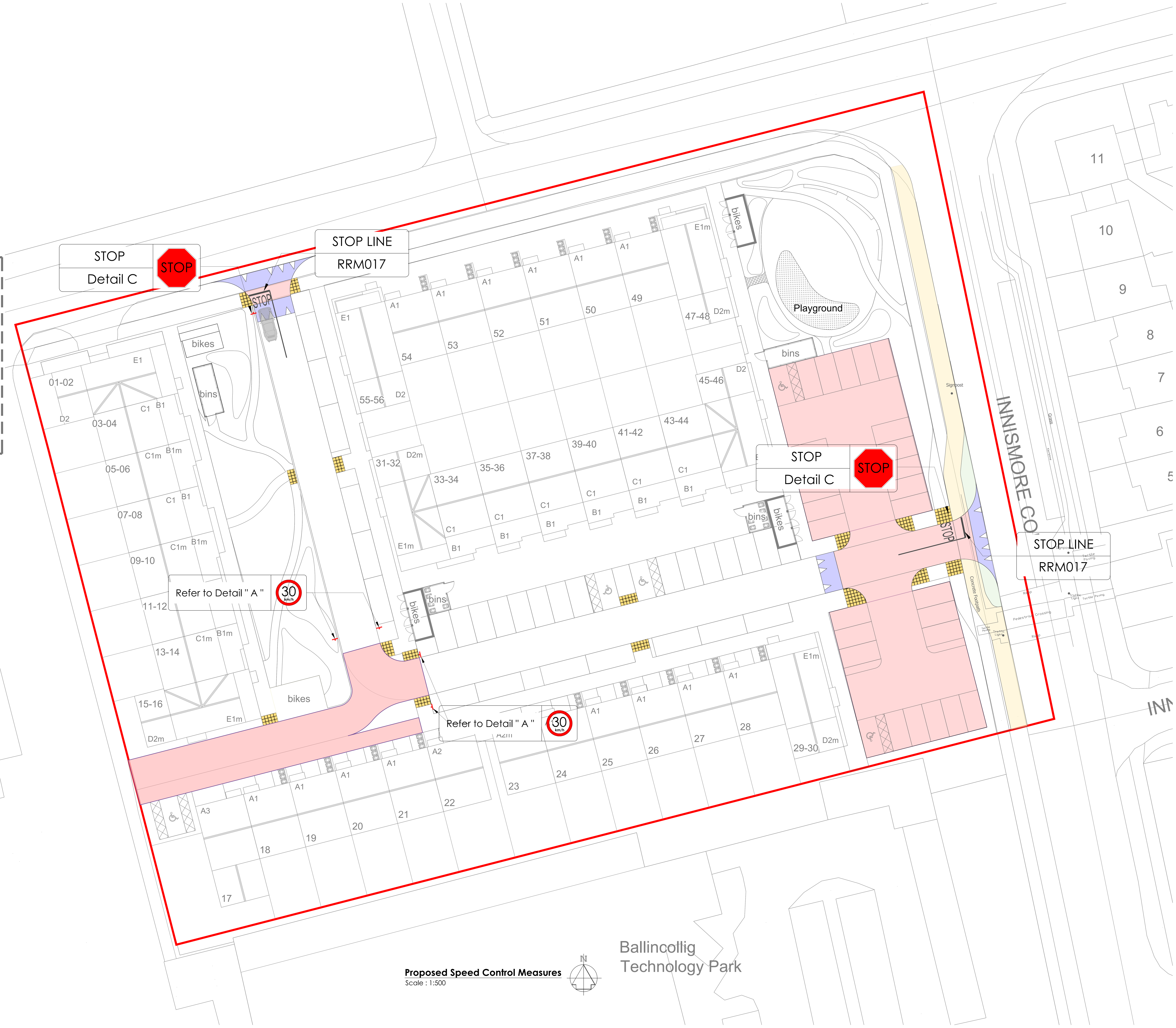


Speed Km/h	Sign Size
< 50	750mm
50-60	750-900mm
60<	900-1200mm

Detail B:
750mm STOP SIGN (RUS 027) TO COMPLY WITH TSM 5.2



Detail 'C' - Typical Stop Junction Marking



Proposed Speed Control Measures
Scale : 1:500

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B	A.G.	S.O'D.	C.O'S.	02.04.'25	Issued for Information
A	A.G.	S.O'D.	C.O'S.	26.03.'25	Issued for Information

CLIENT: OBR Construction

PROJECT: Innishmore, Ballincollig, Co. Cork

DRAWING TITLE: Proposed Speed Control Measures Layout

SHEET	SCALE	PROJECT NO.	DRAWING NO.	STATUS/ISSUE
A1	1:250	6767	0015	B

Appendix B –QBAR and storm sewer design

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)	100	Add Flow / Climate Change (%)	20
M5-60 (mm)	18.000	Minimum Backdrop Height (m)	0.200
Ratio R	0.250	Maximum Backdrop Height (m)	1.500
Maximum Rainfall (mm/hr)	50	Min Design Depth for Optimisation (m)	1.200
Foul Sewage (l/s/ha)	0.00	Min Vel for Auto Design only (m/s)	1.00
Volumetric Runoff Coeff.	0.750	Min Slope for Optimisation (1:X)	500

Designed with Level Inverts

Time Area Diagram for Storm

Time (mins)	Area (ha)	Time (mins)	Area (ha)	Time (mins)	Area (ha)
0-4	0.117	4-8	0.310	8-12	0.009

Total Area Contributing (ha) = 0.437

Total Pipe Volume (m³) = 13.421

Network Design Table for Storm

PN	Length (m)	Fall (m)	Slope (1:X)	Area (ha)	T.E. (mins)	DWF (l/s)	k (mm)	HYD SECT	DIA (mm)
S1.000	21.700	0.109	199.1	0.020	5.00	0.0	0.600	o	225
S2.000	20.000	0.259	77.2	0.020	5.00	0.0	0.600	o	225
S1.001	65.000	0.433	150.1	0.000	0.00	0.0	0.600	o	225
S1.002	6.500	0.626	10.4	0.200	0.00	0.0	0.600	o	225

Network Results Table

PN	Rain (mm/hr)	T.C. (mins)	US/IL (m)	Σ Area (ha)	Σ DWF (l/s)	Foul (l/s)	Add Flow (l/s)	Vel (m/s)	Cap (l/s)	Flow (l/s)
S1.000	50.00	5.39	13.850	0.020	0.0	0.0	0.5	0.92	36.7	3.2
S2.000	50.00	5.22	14.000	0.020	0.0	0.0	0.5	1.49	59.2	3.2
S1.001	50.00	6.41	13.741	0.040	0.0	0.0	1.1	1.06	42.3	6.5
S1.002	50.00	6.44	13.308	0.240	0.0	0.0	6.5	4.08	162.4	39.0

Network Design Table for Storm

PN	Length (m)	Fall (m)	Slope (1:X)	Area (ha)	T.E. (mins)	DWF (l/s)	k (mm)	HYD SECT	DIA (mm)
S3.000	26.000	1.040	25.0	0.067	5.00	0.0	0.600	o	225
S3.001	6.000	0.408	14.7	0.000	0.00	0.0	0.600	o	225
S1.003	19.000	0.095	200.0	0.030	0.00	0.0	0.600	o	300
S1.004	5.000	0.025	200.0	0.100	0.00	0.0	0.600	o	300
S1.005	15.000	0.075	200.0	0.000	0.00	0.0	0.600	o	300
S1.006	5.000	0.025	200.0	0.000	0.00	0.0	0.600	o	225
S1.007	21.000	0.105	200.0	0.000	0.00	0.0	0.600	o	225
S1.008	33.200	0.166	200.0	0.000	0.00	0.0	0.600	o	225
S1.009	54.000	0.270	200.0	0.000	0.00	0.0	0.600	o	225
S1.010	8.800	0.044	200.0	0.000	0.00	0.0	0.600	o	225
S1.011	1.000	0.006	166.0	0.000	0.00	0.0	0.600	o	225

Network Results Table

PN	Rain (mm/hr)	T.C. (mins)	US/IL (m)	Σ Area (ha)	Σ DWF (l/s)	Foul (l/s)	Add Flow (l/s)	Vel (m/s)	Cap (l/s)	Flow (l/s)
S3.000	50.00	5.16	14.130	0.067	0.0	0.0	1.8	2.63	104.5	10.9
S3.001	50.00	5.19	13.090	0.067	0.0	0.0	1.8	3.43	136.4	10.9
S1.003	50.00	6.72	12.682	0.337	0.0	0.0	9.1	1.11	78.3	54.8
S1.004	50.00	6.80	12.587	0.437	0.0	0.0	11.8	1.11	78.3	71.0
S1.005	50.00	7.02	12.562	0.437	0.0	0.0	11.8	1.11	78.3	71.0
S1.006	50.00	5.09	11.560	0.000	2.8	0.0	0.5	0.92	36.6	2.8
S1.007	50.00	5.47	11.535	0.000	2.8	0.0	0.6	0.92	36.6	3.4
S1.008	50.00	6.07	11.430	0.000	2.8	0.0	0.6	0.92	36.6	3.4
S1.009	50.00	7.05	11.264	0.000	2.8	0.0	0.6	0.92	36.6	3.4
S1.010	50.00	7.21	10.994	0.000	2.8	0.0	0.6	0.92	36.6	3.4
S1.011	50.00	7.22	10.950	0.000	2.8	0.0	0.6	1.01	40.2	3.4

Manhole Schedules for Storm

MH Name	MH CL (m)	MH Depth (m)	MH Diam.,L*W (mm)	PN	Pipe Out Invert Level (m)	Diameter (mm)	PN	Pipes In Invert Level (m)	Diameter (mm)	Backdrop (mm)
SSW014	15.350	1.500	1200	S1.000	13.850	225				
SSw013	15.585	1.585	1200	S2.000	14.000	225				
SSw012	15.830	2.089	1200	S1.001	13.741	225	S1.000	13.741	225	
							S2.000	13.741	225	
SSw011	15.480	2.172	1200	S1.002	13.308	225	S1.001	13.308	225	
SSw010	15.630	1.500	1200	S3.000	14.130	225				
SSw009	15.530	2.440	1200	S3.001	13.090	225	S3.000	13.090	225	
SSw008	15.380	2.698	1200	S1.003	12.682	300	S1.002	12.682	225	
							S3.001	12.682	225	
SSw007	15.330	2.743	1200	S1.004	12.587	300	S1.003	12.587	300	
SSw006	14.730	2.168	1200	S1.005	12.562	300	S1.004	12.562	300	
SSw005	14.860	3.300	1200	S1.006	11.560	225	S1.005	12.487	300	1002
SSW004	14.850	3.315	1200	S1.007	11.535	225	S1.006	11.535	225	
SSW003	14.600	3.170	1200	S1.008	11.430	225	S1.007	11.430	225	
SSW002	14.520	3.256	1200	S1.009	11.264	225	S1.008	11.264	225	
SSw001	14.300	3.306	1200	S1.010	10.994	225	S1.009	10.994	225	
SExisting	14.200	3.250	1200	S1.011	10.950	225	S1.010	10.950	225	
S	14.200	3.256	225		OUTFALL		S1.011	10.944	225	

PIPELINE SCHEDULES for Storm

Upstream Manhole

PN	Hyd Sect	Diam (mm)	MH Name	C.Level (m)	I.Level (m)	D.Depth (m)	MH DIAM., L*W (mm)
S1.000	o	225	SSW014	15.350	13.850	1.275	1200
S2.000	o	225	SSw013	15.585	14.000	1.360	1200
S1.001	o	225	SSw012	15.830	13.741	1.864	1200
S1.002	o	225	SSw011	15.480	13.308	1.947	1200
S3.000	o	225	SSw010	15.630	14.130	1.275	1200
S3.001	o	225	SSw009	15.530	13.090	2.215	1200
S1.003	o	300	SSw008	15.380	12.682	2.398	1200
S1.004	o	300	SSw007	15.330	12.587	2.443	1200
S1.005	o	300	SSw006	14.730	12.562	1.868	1200
S1.006	o	225	SSw005	14.860	11.560	3.075	1200
S1.007	o	225	SSW004	14.850	11.535	3.090	1200
S1.008	o	225	SSW003	14.600	11.430	2.945	1200
S1.009	o	225	SSW002	14.520	11.264	3.031	1200
S1.010	o	225	SSw001	14.300	10.994	3.081	1200
S1.011	o	225	SExisting	14.200	10.950	3.025	1200

Downstream Manhole

PN	Length (m)	Slope (1:X)	MH Name	C.Level (m)	I.Level (m)	D.Depth (m)	MH DIAM., L*W (mm)
S1.000	21.700	199.1	SSw012	15.830	13.741	1.864	1200
S2.000	20.000	77.2	SSw012	15.830	13.741	1.864	1200
S1.001	65.000	150.1	SSw011	15.480	13.308	1.947	1200
S1.002	6.500	10.4	SSw008	15.380	12.682	2.473	1200
S3.000	26.000	25.0	SSw009	15.530	13.090	2.215	1200
S3.001	6.000	14.7	SSw008	15.380	12.682	2.473	1200
S1.003	19.000	200.0	SSw007	15.330	12.587	2.443	1200
S1.004	5.000	200.0	SSw006	14.730	12.562	1.868	1200
S1.005	15.000	200.0	SSw005	14.860	12.487	2.073	1200
S1.006	5.000	200.0	SSW004	14.850	11.535	3.090	1200
S1.007	21.000	200.0	SSW003	14.600	11.430	2.945	1200
S1.008	33.200	200.0	SSW002	14.520	11.264	3.031	1200
S1.009	54.000	200.0	SSw001	14.300	10.994	3.081	1200
S1.010	8.800	200.0	SExisting	14.200	10.950	3.025	1200
S1.011	1.000	166.0	S	14.200	10.944	3.031	225

Free Flowing Outfall Details for Storm

Outfall Pipe Number	Outfall Name	C. Level (m)	I. Level (m)	Min I. Level (m)	D,L (mm)	W (mm)
S1.011	S	14.200	10.944	18.850	225	0

Simulation Criteria for Storm

Volumetric Runoff Coeff	0.750	Foul Sewage per hectare (l/s)	0.000
PIMP (% impervious)	100	Additional Flow - % of Total Flow	20.000
Areal Reduction Factor	1.000	MADD Factor * 10m³/ha Storage	2.000
Hot Start (mins)	0	Inlet Coeffiecient	0.800
Hot Start Level (mm)	0	Run Time (mins)	60
Manhole Headloss Coeff (Global)	0.500	Output Interval (mins)	1

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

Synthetic Rainfall Details

Rainfall Model	FSR	Profile Type	Summer
Return Period (years)	100	Cv (Summer)	0.750
Region	Scotland and Ireland	Cv (Winter)	0.840
M5-60 (mm)	18.000	Storm Duration (mins)	30
Ratio R	0.250		

Online Controls for Storm

Hydro-Brake® Manhole: SSw005, DS/PN: S1.006, Volume (m^3): 4.7

Design Head (m) 1.000 Hydro-Brake® Type Md4 Invert Level (m) 11.560
Design Flow (l/s) 2.8 Diameter (mm) 60

Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)
0.100	1.6	1.200	3.1	3.000	4.9	7.000	7.4
0.200	1.5	1.400	3.3	3.500	5.2	7.500	7.7
0.300	1.6	1.600	3.5	4.000	5.6	8.000	7.9
0.400	1.8	1.800	3.8	4.500	6.0	8.500	8.2
0.500	2.0	2.000	4.0	5.000	6.3	9.000	8.4
0.600	2.2	2.200	4.2	5.500	6.6	9.500	8.6
0.800	2.5	2.400	4.3	6.000	6.9		
1.000	2.8	2.600	4.5	6.500	7.2		

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

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

Profile(s) Summer and Winter
Duration(s) (mins) 15, 30, 60, 120, 180, 240, 360, 480, 600, 720, 960, 1440, 2160, 2880, 4320, 5760, 7200, 8640, 10080
Return Period(s) (years) 5
Climate Change (%) 0

PN	Storm	Return Period	Climate Change	First X Surcharge	First Y Flood	First Z Overflow	O/F Act.	Lvl Exc.
S1.000	15 Winter	5	0%					
S2.000	15 Winter	5	0%					
S1.001	15 Winter	5	0%					
S1.002	15 Winter	5	0%					
S3.000	15 Winter	5	0%					
S3.001	15 Winter	5	0%					
S1.003	600 Winter	5	0%	5/15 Summer				
S1.004	600 Winter	5	0%	5/15 Summer				
S1.005	600 Winter	5	0%	5/15 Summer				
S1.006	600 Winter	5	0%	5/15 Summer				
S1.007	600 Winter	5	0%					
S1.008	600 Winter	5	0%					
S1.009	600 Winter	5	0%					
S1.010	600 Winter	5	0%					
S1.011	600 Winter	5	0%					

PN	US/MH Name	Water Level (m)	Surch'ed Depth (m)	Flooded Volume (m³)	Flow / Cap.	O'flow (l/s)	Pipe Flow (l/s)	Status
S1.000	SSW014	13.904	-0.171	0.000	0.13	0.0	4.2	OK
S2.000	SSw013	14.043	-0.182	0.000	0.08	0.0	4.3	OK
S1.001	SSw012	13.811	-0.155	0.000	0.20	0.0	8.1	OK
S1.002	SSw011	13.407	-0.126	0.000	0.39	0.0	43.9	OK
S3.000	SSw010	14.188	-0.167	0.000	0.15	0.0	14.4	OK
S3.001	SSw009	13.150	-0.165	0.000	0.16	0.0	14.3	OK
S1.003	SSw008	13.111	0.129	0.000	0.15	0.0	10.4	SURCHARGED
S1.004	SSw007	13.108	0.221	0.000	0.26	0.0	13.4	SURCHARGED
S1.005	SSw006	13.107	0.245	0.000	0.20	0.0	13.3	SURCHARGED
S1.006	SSw005	13.103	1.318	0.000	0.13	0.0	3.5	SURCHARGED
S1.007	SSW004	11.583	-0.177	0.000	0.10	0.0	3.5	OK
S1.008	SSW003	11.477	-0.178	0.000	0.10	0.0	3.5	OK
S1.009	SSW002	11.311	-0.178	0.000	0.10	0.0	3.5	OK
S1.010	SSw001	11.045	-0.174	0.000	0.12	0.0	3.5	OK
S1.011	SExisting	11.001	-0.174	0.000	0.12	0.0	3.5	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)	100	Add Flow / Climate Change (%)	20
M5-60 (mm)	18.000	Minimum Backdrop Height (m)	0.200
Ratio R	0.250	Maximum Backdrop Height (m)	1.500
Maximum Rainfall (mm/hr)	50	Min Design Depth for Optimisation (m)	1.200
Foul Sewage (l/s/ha)	0.00	Min Vel for Auto Design only (m/s)	1.00
Volumetric Runoff Coeff.	0.750	Min Slope for Optimisation (1:X)	500

Designed with Level Inverts

Network Design Table for Storm

PN	Length (m)	Fall (m)	Slope (1:X)	Area (ha)	T.E. (mins)	DWF (l/s)	k (mm)	HYD SECT	DIA (mm)
S1.000	21.700	0.109	199.1	0.020	5.00	0.0	0.600	o	225
S2.000	20.000	0.259	77.2	0.020	5.00	0.0	0.600	o	225
S1.001	65.000	0.433	150.1	0.000	0.00	0.0	0.600	o	225
S1.002	6.500	0.626	10.4	0.200	0.00	0.0	0.600	o	225
S3.000	26.000	1.040	25.0	0.067	5.00	0.0	0.600	o	225
S3.001	6.000	0.408	14.7	0.000	0.00	0.0	0.600	o	225
S1.003	19.000	0.095	200.0	0.030	0.00	0.0	0.600	o	300
S1.004	5.000	0.025	200.0	0.100	0.00	0.0	0.600	o	300

Network Results Table

PN	Rain (mm/hr)	T.C. (mins)	US/IL (m)	Σ Area (ha)	Σ DWF (l/s)	Foul (l/s)	Add Flow (l/s)	Vel (m/s)	Cap (l/s)	Flow (l/s)
S1.000	50.00	5.39	13.850	0.020	0.0	0.0	0.5	0.92	36.7	3.2
S2.000	50.00	5.22	14.000	0.020	0.0	0.0	0.5	1.49	59.2	3.2
S1.001	50.00	6.41	13.741	0.040	0.0	0.0	1.1	1.06	42.3	6.5
S1.002	50.00	6.44	13.308	0.240	0.0	0.0	6.5	4.08	162.4	39.0
S3.000	50.00	5.16	14.130	0.067	0.0	0.0	1.8	2.63	104.5	10.9
S3.001	50.00	5.19	13.090	0.067	0.0	0.0	1.8	3.43	136.4	10.9
S1.003	50.00	6.72	12.682	0.337	0.0	0.0	9.1	1.11	78.3	54.8
S1.004	50.00	6.80	12.587	0.437	0.0	0.0	11.8	1.11	78.3	71.0

Network Design Table for Storm

PN	Length (m)	Fall (m)	Slope (1:X)	Area (ha)	T.E. (mins)	DWF (l/s)	k (mm)	HYD SECT	DIA (mm)
S1.005	15.000	0.075	200.0	0.000	0.00	0.0	0.600	o	300
S1.006	5.000	0.025	200.0	0.000	0.00	0.0	0.600	o	225
S1.007	21.000	0.105	200.0	0.000	0.00	0.0	0.600	o	225
S1.008	33.200	0.166	200.0	0.000	0.00	0.0	0.600	o	225
S1.009	54.000	0.270	200.0	0.000	0.00	0.0	0.600	o	225
S1.010	8.800	0.044	200.0	0.000	0.00	0.0	0.600	o	225
S1.011	1.000	0.006	166.0	0.000	0.00	0.0	0.600	o	225

Network Results Table

PN	Rain (mm/hr)	T.C. (mins)	US/IL (m)	Σ Area (ha)	Σ DWF (l/s)	Foul (l/s)	Add Flow (l/s)	Vel (m/s)	Cap (l/s)	Flow (l/s)
S1.005	50.00	7.02	12.562	0.437	0.0	0.0	11.8	1.11	78.3	71.0
S1.006	50.00	5.09	11.560	0.000	2.8	0.0	0.5	0.92	36.6	2.8
S1.007	50.00	5.47	11.535	0.000	2.8	0.0	0.6	0.92	36.6	3.4
S1.008	50.00	6.07	11.430	0.000	2.8	0.0	0.6	0.92	36.6	3.4
S1.009	50.00	7.05	11.264	0.000	2.8	0.0	0.6	0.92	36.6	3.4
S1.010	50.00	7.21	10.994	0.000	2.8	0.0	0.6	0.92	36.6	3.4
S1.011	50.00	7.22	10.950	0.000	2.8	0.0	0.6	1.01	40.2	3.4

Manhole Schedules for Storm

MH Name	MH CL (m)	MH Depth (m)	MH Diam.,L*W (mm)	PN	Pipe Out Invert Level (m)	Diameter (mm)	PN	Pipes In Invert Level (m)	Diameter (mm)	Backdrop (mm)
SSW014	15.350	1.500	1200	S1.000	13.850	225				
SSw013	15.585	1.585	1200	S2.000	14.000	225				
SSw012	15.830	2.089	1200	S1.001	13.741	225	S1.000	13.741	225	
							S2.000	13.741	225	
SSw011	15.480	2.172	1200	S1.002	13.308	225	S1.001	13.308	225	
SSw010	15.630	1.500	1200	S3.000	14.130	225				
SSw009	15.530	2.440	1200	S3.001	13.090	225	S3.000	13.090	225	
SSw008	15.380	2.698	1200	S1.003	12.682	300	S1.002	12.682	225	
							S3.001	12.682	225	
SSw007	15.330	2.743	1200	S1.004	12.587	300	S1.003	12.587	300	
SSw006	14.730	2.168	1200	S1.005	12.562	300	S1.004	12.562	300	
SSw005	14.860	3.300	1200	S1.006	11.560	225	S1.005	12.487	300	1002
SSW004	14.850	3.315	1200	S1.007	11.535	225	S1.006	11.535	225	
SSW003	14.600	3.170	1200	S1.008	11.430	225	S1.007	11.430	225	
SSW002	14.520	3.256	1200	S1.009	11.264	225	S1.008	11.264	225	
SSw001	14.300	3.306	1200	S1.010	10.994	225	S1.009	10.994	225	
SExisting	14.200	3.250	1200	S1.011	10.950	225	S1.010	10.950	225	
S	14.200	3.256	225		OUTFALL		S1.011	10.944	225	

PIPELINE SCHEDULES for Storm

Upstream Manhole

PN	Hyd Sect	Diam (mm)	MH Name	C.Level (m)	I.Level (m)	D.Depth (m)	MH DIAM., L*W (mm)
S1.000	o	225	SSW014	15.350	13.850	1.275	1200
S2.000	o	225	SSw013	15.585	14.000	1.360	1200
S1.001	o	225	SSw012	15.830	13.741	1.864	1200
S1.002	o	225	SSw011	15.480	13.308	1.947	1200
S3.000	o	225	SSw010	15.630	14.130	1.275	1200
S3.001	o	225	SSw009	15.530	13.090	2.215	1200
S1.003	o	300	SSw008	15.380	12.682	2.398	1200
S1.004	o	300	SSw007	15.330	12.587	2.443	1200
S1.005	o	300	SSw006	14.730	12.562	1.868	1200
S1.006	o	225	SSw005	14.860	11.560	3.075	1200
S1.007	o	225	SSW004	14.850	11.535	3.090	1200
S1.008	o	225	SSW003	14.600	11.430	2.945	1200
S1.009	o	225	SSW002	14.520	11.264	3.031	1200
S1.010	o	225	SSw001	14.300	10.994	3.081	1200
S1.011	o	225	SExisting	14.200	10.950	3.025	1200

Downstream Manhole

PN	Length (m)	Slope (1:X)	MH Name	C.Level (m)	I.Level (m)	D.Depth (m)	MH DIAM., L*W (mm)
S1.000	21.700	199.1	SSw012	15.830	13.741	1.864	1200
S2.000	20.000	77.2	SSw012	15.830	13.741	1.864	1200
S1.001	65.000	150.1	SSw011	15.480	13.308	1.947	1200
S1.002	6.500	10.4	SSw008	15.380	12.682	2.473	1200
S3.000	26.000	25.0	SSw009	15.530	13.090	2.215	1200
S3.001	6.000	14.7	SSw008	15.380	12.682	2.473	1200
S1.003	19.000	200.0	SSw007	15.330	12.587	2.443	1200
S1.004	5.000	200.0	SSw006	14.730	12.562	1.868	1200
S1.005	15.000	200.0	SSw005	14.860	12.487	2.073	1200
S1.006	5.000	200.0	SSW004	14.850	11.535	3.090	1200
S1.007	21.000	200.0	SSW003	14.600	11.430	2.945	1200
S1.008	33.200	200.0	SSW002	14.520	11.264	3.031	1200
S1.009	54.000	200.0	SSw001	14.300	10.994	3.081	1200
S1.010	8.800	200.0	SExisting	14.200	10.950	3.025	1200
S1.011	1.000	166.0	S	14.200	10.944	3.031	225

Free Flowing Outfall Details for Storm

Outfall Pipe Number	Outfall Name	C. Level (m)	I. Level (m)	Min I. Level (m)	D,L (mm)	W (mm)
S1.011	S	14.200	10.944	18.850	225	0

Simulation Criteria for Storm

Volumetric Runoff Coeff	0.750	Foul Sewage per hectare (l/s)	0.000
PIMP (% impervious)	100	Additional Flow - % of Total Flow	20.000
Areal Reduction Factor	1.000	MADD Factor * 10m³/ha Storage	2.000
Hot Start (mins)	0	Inlet Coeffiecient	0.800
Hot Start Level (mm)	0	Run Time (mins)	60
Manhole Headloss Coeff (Global)	0.500	Output Interval (mins)	1

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

Synthetic Rainfall Details

Rainfall Model	FSR	Profile Type	Summer
Return Period (years)	100	Cv (Summer)	0.750
Region	Scotland and Ireland	Cv (Winter)	0.840
M5-60 (mm)	18.000	Storm Duration (mins)	30
Ratio R	0.250		

Online Controls for Storm

Hydro-Brake® Manhole: SSw005, DS/PN: S1.006, Volume (m³): 4.7

Design Head (m) 1.000 Hydro-Brake® Type Md4 Invert Level (m) 11.560
Design Flow (l/s) 2.8 Diameter (mm) 60

Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)
0.100	1.6	1.200	3.1	3.000	4.9	7.000	7.4
0.200	1.5	1.400	3.3	3.500	5.2	7.500	7.7
0.300	1.6	1.600	3.5	4.000	5.6	8.000	7.9
0.400	1.8	1.800	3.8	4.500	6.0	8.500	8.2
0.500	2.0	2.000	4.0	5.000	6.3	9.000	8.4
0.600	2.2	2.200	4.2	5.500	6.6	9.500	8.6
0.800	2.5	2.400	4.3	6.000	6.9		
1.000	2.8	2.600	4.5	6.500	7.2		

Storage Structures for Storm

Tank or Pond Manhole: SSw005, DS/PN: S1.006

Invert Level (m) 11.560

Depth (m)	Area (m²)	Depth (m)	Area (m²)
0.000	0.0	1.000	100.0

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

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

Profile(s)	Summer and Winter
Duration(s) (mins)	15, 30, 60, 120, 180, 240, 360, 480, 600, 720, 960, 1440, 2160, 2880, 4320, 5760, 7200, 8640, 10080
Return Period(s) (years)	100
Climate Change (%)	20

PN	Storm	Return Period	Climate Change	First X Surcharge	First Y Flood	First Z Overflow	O/F Act.	Lvl Exc.
S1.000	960 Winter	100	+20%	100/15 Summer				
S2.000	960 Winter	100	+20%	100/15 Summer				
S1.001	960 Winter	100	+20%	100/15 Summer				
S1.002	960 Winter	100	+20%	100/15 Summer				
S3.000	960 Winter	100	+20%	100/360 Winter				
S3.001	960 Winter	100	+20%	100/15 Summer				
S1.003	960 Winter	100	+20%	100/15 Summer				
S1.004	960 Winter	100	+20%	100/15 Summer				
S1.005	960 Winter	100	+20%	100/15 Summer				
S1.006	960 Winter	100	+20%	100/15 Summer				
S1.007	960 Winter	100	+20%					
S1.008	960 Winter	100	+20%					
S1.009	960 Winter	100	+20%					
S1.010	960 Winter	100	+20%					
S1.011	960 Winter	100	+20%					

PN	US/MH Name	Water Level (m)	Surch'ed Depth (m)	Flooded Volume (m^3)	Flow / Cap.	O'flow (l/s)	Pipe Flow (l/s)	Status
S1.000	SSW014	14.602	0.527	0.000	0.03	0.0	0.9	SURCHARGED
S2.000	SSw013	14.602	0.377	0.000	0.02	0.0	0.9	SURCHARGED
S1.001	SSw012	14.602	0.636	0.000	0.05	0.0	1.8	SURCHARGED
S1.002	SSw011	14.600	1.067	0.000	0.09	0.0	10.4	SURCHARGED
S3.000	SSw010	14.600	0.245	0.000	0.03	0.0	3.1	SURCHARGED
S3.001	SSw009	14.598	1.283	0.000	0.03	0.0	2.8	SURCHARGED
S1.003	SSw008	14.597	1.615	0.000	0.21	0.0	14.0	SURCHARGED
S1.004	SSw007	14.593	1.706	0.000	0.35	0.0	18.2	SURCHARGED
S1.005	SSw006	14.591	1.729	0.000	0.28	0.0	18.1	FLOOD RISK
S1.006	SSw005	14.586	2.801	0.000	0.18	0.0	4.9	FLOOD RISK
S1.007	SSW004	11.592	-0.168	0.000	0.15	0.0	4.9	OK
S1.008	SSW003	11.486	-0.169	0.000	0.14	0.0	4.9	OK
S1.009	SSW002	11.319	-0.170	0.000	0.14	0.0	4.9	OK
S1.010	SSw001	11.054	-0.165	0.000	0.16	0.0	4.9	OK
S1.011	SExisting	11.010	-0.165	0.000	0.16	0.0	4.9	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)	100	Add Flow / Climate Change (%)	20
M5-60 (mm)	18.000	Minimum Backdrop Height (m)	0.200
Ratio R	0.250	Maximum Backdrop Height (m)	1.500
Maximum Rainfall (mm/hr)	50	Min Design Depth for Optimisation (m)	1.200
Foul Sewage (l/s/ha)	0.00	Min Vel for Auto Design only (m/s)	1.00
Volumetric Runoff Coeff.	0.750	Min Slope for Optimisation (1:X)	500

Designed with Level Inverts

Time Area Diagram for Storm

Time (mins)	Area (ha)	Time (mins)	Area (ha)	Time (mins)	Area (ha)
0-4	0.117	4-8	0.310	8-12	0.009

Total Area Contributing (ha) = 0.437

Total Pipe Volume (m³) = 13.421

Network Design Table for Storm

PN	Length (m)	Fall (m)	Slope (1:X)	Area (ha)	T.E. (mins)	DWF (l/s)	k (mm)	HYD SECT	DIA (mm)
S1.000	21.700	0.109	199.1	0.020	5.00	0.0	0.600	o	225
S2.000	20.000	0.259	77.2	0.020	5.00	0.0	0.600	o	225
S1.001	65.000	0.433	150.1	0.000	0.00	0.0	0.600	o	225
S1.002	6.500	0.626	10.4	0.200	0.00	0.0	0.600	o	225

Network Results Table

PN	Rain (mm/hr)	T.C. (mins)	US/IL (m)	Σ Area (ha)	Σ DWF (l/s)	Foul (l/s)	Add Flow (l/s)	Vel (m/s)	Cap (l/s)	Flow (l/s)
S1.000	50.00	5.39	13.850	0.020	0.0	0.0	0.5	0.92	36.7	3.2
S2.000	50.00	5.22	14.000	0.020	0.0	0.0	0.5	1.49	59.2	3.2
S1.001	50.00	6.41	13.741	0.040	0.0	0.0	1.1	1.06	42.3	6.5
S1.002	50.00	6.44	13.308	0.240	0.0	0.0	6.5	4.08	162.4	39.0

Network Design Table for Storm

PN	Length (m)	Fall (m)	Slope (1:X)	Area (ha)	T.E. (mins)	DWF (l/s)	k (mm)	HYD SECT	DIA (mm)
S3.000	26.000	1.040	25.0	0.067	5.00	0.0	0.600	o	225
S3.001	6.000	0.408	14.7	0.000	0.00	0.0	0.600	o	225
S1.003	19.000	0.095	200.0	0.030	0.00	0.0	0.600	o	300
S1.004	5.000	0.025	200.0	0.100	0.00	0.0	0.600	o	300
S1.005	15.000	0.075	200.0	0.000	0.00	0.0	0.600	o	300
S1.006	5.000	0.025	200.0	0.000	0.00	0.0	0.600	o	225
S1.007	21.000	0.105	200.0	0.000	0.00	0.0	0.600	o	225
S1.008	33.200	0.166	200.0	0.000	0.00	0.0	0.600	o	225
S1.009	54.000	0.270	200.0	0.000	0.00	0.0	0.600	o	225
S1.010	8.800	0.044	200.0	0.000	0.00	0.0	0.600	o	225
S1.011	1.000	0.006	166.0	0.000	0.00	0.0	0.600	o	225

Network Results Table

PN	Rain (mm/hr)	T.C. (mins)	US/IL (m)	Σ Area (ha)	Σ DWF (l/s)	Foul (l/s)	Add Flow (l/s)	Vel (m/s)	Cap (l/s)	Flow (l/s)
S3.000	50.00	5.16	14.130	0.067	0.0	0.0	1.8	2.63	104.5	10.9
S3.001	50.00	5.19	13.090	0.067	0.0	0.0	1.8	3.43	136.4	10.9
S1.003	50.00	6.72	12.682	0.337	0.0	0.0	9.1	1.11	78.3	54.8
S1.004	50.00	6.80	12.587	0.437	0.0	0.0	11.8	1.11	78.3	71.0
S1.005	50.00	7.02	12.562	0.437	0.0	0.0	11.8	1.11	78.3	71.0
S1.006	50.00	5.09	11.560	0.000	2.8	0.0	0.5	0.92	36.6	2.8
S1.007	50.00	5.47	11.535	0.000	2.8	0.0	0.6	0.92	36.6	3.4
S1.008	50.00	6.07	11.430	0.000	2.8	0.0	0.6	0.92	36.6	3.4
S1.009	50.00	7.05	11.264	0.000	2.8	0.0	0.6	0.92	36.6	3.4
S1.010	50.00	7.21	10.994	0.000	2.8	0.0	0.6	0.92	36.6	3.4
S1.011	50.00	7.22	10.950	0.000	2.8	0.0	0.6	1.01	40.2	3.4

Manhole Schedules for Storm

MH Name	MH CL (m)	MH Depth (m)	MH Diam.,L*W (mm)	PN	Pipe Out Invert Level (m)	Diameter (mm)	PN	Pipes In Invert Level (m)	Diameter (mm)	Backdrop (mm)
SSW014	15.350	1.500	1200	S1.000	13.850	225				
SSw013	15.585	1.585	1200	S2.000	14.000	225				
SSw012	15.830	2.089	1200	S1.001	13.741	225	S1.000	13.741	225	
							S2.000	13.741	225	
SSw011	15.480	2.172	1200	S1.002	13.308	225	S1.001	13.308	225	
SSw010	15.630	1.500	1200	S3.000	14.130	225				
SSw009	15.530	2.440	1200	S3.001	13.090	225	S3.000	13.090	225	
SSw008	15.380	2.698	1200	S1.003	12.682	300	S1.002	12.682	225	
							S3.001	12.682	225	
SSw007	15.330	2.743	1200	S1.004	12.587	300	S1.003	12.587	300	
SSw006	14.730	2.168	1200	S1.005	12.562	300	S1.004	12.562	300	
SSw005	14.860	3.300	1200	S1.006	11.560	225	S1.005	12.487	300	1002
SSW004	14.850	3.315	1200	S1.007	11.535	225	S1.006	11.535	225	
SSW003	14.600	3.170	1200	S1.008	11.430	225	S1.007	11.430	225	
SSW002	14.520	3.256	1200	S1.009	11.264	225	S1.008	11.264	225	
SSw001	14.300	3.306	1200	S1.010	10.994	225	S1.009	10.994	225	
SExisting	14.200	3.250	1200	S1.011	10.950	225	S1.010	10.950	225	
S	14.200	3.256	225		OUTFALL		S1.011	10.944	225	

PIPELINE SCHEDULES for Storm

Upstream Manhole

PN	Hyd Sect	Diam (mm)	MH Name	C.Level (m)	I.Level (m)	D.Depth (m)	MH DIAM., L*W (mm)
S1.000	o	225	SSW014	15.350	13.850	1.275	1200
S2.000	o	225	SSw013	15.585	14.000	1.360	1200
S1.001	o	225	SSw012	15.830	13.741	1.864	1200
S1.002	o	225	SSw011	15.480	13.308	1.947	1200
S3.000	o	225	SSw010	15.630	14.130	1.275	1200
S3.001	o	225	SSw009	15.530	13.090	2.215	1200
S1.003	o	300	SSw008	15.380	12.682	2.398	1200
S1.004	o	300	SSw007	15.330	12.587	2.443	1200
S1.005	o	300	SSw006	14.730	12.562	1.868	1200
S1.006	o	225	SSw005	14.860	11.560	3.075	1200
S1.007	o	225	SSW004	14.850	11.535	3.090	1200
S1.008	o	225	SSW003	14.600	11.430	2.945	1200
S1.009	o	225	SSW002	14.520	11.264	3.031	1200
S1.010	o	225	SSw001	14.300	10.994	3.081	1200
S1.011	o	225	SExisting	14.200	10.950	3.025	1200

Downstream Manhole

PN	Length (m)	Slope (1:X)	MH Name	C.Level (m)	I.Level (m)	D.Depth (m)	MH DIAM., L*W (mm)
S1.000	21.700	199.1	SSw012	15.830	13.741	1.864	1200
S2.000	20.000	77.2	SSw012	15.830	13.741	1.864	1200
S1.001	65.000	150.1	SSw011	15.480	13.308	1.947	1200
S1.002	6.500	10.4	SSw008	15.380	12.682	2.473	1200
S3.000	26.000	25.0	SSw009	15.530	13.090	2.215	1200
S3.001	6.000	14.7	SSw008	15.380	12.682	2.473	1200
S1.003	19.000	200.0	SSw007	15.330	12.587	2.443	1200
S1.004	5.000	200.0	SSw006	14.730	12.562	1.868	1200
S1.005	15.000	200.0	SSw005	14.860	12.487	2.073	1200
S1.006	5.000	200.0	SSW004	14.850	11.535	3.090	1200
S1.007	21.000	200.0	SSW003	14.600	11.430	2.945	1200
S1.008	33.200	200.0	SSW002	14.520	11.264	3.031	1200
S1.009	54.000	200.0	SSw001	14.300	10.994	3.081	1200
S1.010	8.800	200.0	SExisting	14.200	10.950	3.025	1200
S1.011	1.000	166.0	S	14.200	10.944	3.031	225

Free Flowing Outfall Details for Storm

Outfall Pipe Number	Outfall Name	C. Level (m)	I. Level (m)	Min I. Level (m)	D,L (mm)	W (mm)
S1.011	S	14.200	10.944	18.850	225	0

Simulation Criteria for Storm

Volumetric Runoff Coeff	0.750	Foul Sewage per hectare (l/s)	0.000
PIMP (% impervious)	100	Additional Flow - % of Total Flow	20.000
Areal Reduction Factor	1.000	MADD Factor * 10m³/ha Storage	2.000
Hot Start (mins)	0	Inlet Coeffiecient	0.800
Hot Start Level (mm)	0	Run Time (mins)	60
Manhole Headloss Coeff (Global)	0.500	Output Interval (mins)	1

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

Synthetic Rainfall Details

Rainfall Model	FSR	Profile Type	Summer
Return Period (years)	100	Cv (Summer)	0.750
Region	Scotland and Ireland	Cv (Winter)	0.840
M5-60 (mm)	18.000	Storm Duration (mins)	30
Ratio R	0.250		

Online Controls for Storm

Hydro-Brake® Manhole: SSw005, DS/PN: S1.006, Volume (m³): 4.7

Design Head (m) 1.000 Hydro-Brake® Type Md4 Invert Level (m) 11.560
Design Flow (l/s) 2.8 Diameter (mm) 60

Depth (m)	**Flow (l/s)**	**Depth (m)**	**Flow (l/s)**	**Depth (m)**	**Flow (l/s)**	**Depth (m)**	**Flow (l/s)**
0.100	1.6	1.200	3.1	3.000	4.9	7.000	7.4
0.200	1.5	1.400	3.3	3.500	5.2	7.500	7.7
0.300	1.6	1.600	3.5	4.000	5.6	8.000	7.9
0.400	1.8	1.800	3.8	4.500	6.0	8.500	8.2
0.500	2.0	2.000	4.0	5.000	6.3	9.000	8.4
0.600	2.2	2.200	4.2	5.500	6.6	9.500	8.6
0.800	2.5	2.400	4.3	6.000	6.9		
1.000	2.8	2.600	4.5	6.500	7.2		

Storage Structures for Storm

Tank or Pond Manhole: SSw005, DS/PN: S1.006

Invert Level (m) 11.560

Depth (m)	Area (m²)	Depth (m)	Area (m²)
0.000	0.0	1.000	100.0

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

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

Profile(s) Summer and Winter
Duration(s) (mins) 15, 30, 60, 120, 180, 240, 360, 480, 600, 720, 960, 1440, 2160, 2880, 4320, 5760, 7200, 8640, 10080
Return Period(s) (years) 2
Climate Change (%) 0

PN	Storm	Return Period	Climate Change	First X Surcharge	First Y Flood	First Z Overflow	O/F Act.	Lvl Exc.
S1.000	15 Winter	2	0%					
S2.000	15 Winter	2	0%					
S1.001	15 Winter	2	0%					
S1.002	15 Winter	2	0%					
S3.000	15 Winter	2	0%					
S3.001	15 Winter	2	0%					
S1.003	15 Winter	2	0%					
S1.004	15 Winter	2	0%	2/15 Summer				
S1.005	600 Winter	2	0%	2/360 Winter				
S1.006	600 Winter	2	0%	2/15 Summer				
S1.007	600 Winter	2	0%					
S1.008	600 Winter	2	0%					
S1.009	600 Winter	2	0%					
S1.010	600 Winter	2	0%					
S1.011	600 Winter	2	0%					

PN	US/MH Name	Water Level (m)	Surch'ed Depth (m)	Flooded Volume (m³)	Flow / Cap.	O'flow (l/s)	Pipe Flow (l/s)	Status
S1.000	SSW014	13.898	-0.177	0.000	0.10	0.0	3.4	OK
S2.000	SSw013	14.037	-0.188	0.000	0.06	0.0	3.4	OK
S1.001	SSw012	13.803	-0.163	0.000	0.16	0.0	6.5	OK
S1.002	SSw011	13.395	-0.138	0.000	0.32	0.0	35.1	OK
S3.000	SSw010	14.182	-0.173	0.000	0.12	0.0	11.6	OK
S3.001	SSw009	13.144	-0.171	0.000	0.13	0.0	11.4	OK
S1.003	SSw008	12.967	-0.015	0.000	0.74	0.0	50.4	OK
S1.004	SSw007	12.914	0.027	0.000	1.24	0.0	64.1	SURCHARGED
S1.005	SSw006	12.895	0.033	0.000	0.17	0.0	11.4	SURCHARGED
S1.006	SSw005	12.891	1.106	0.000	0.12	0.0	3.2	SURCHARGED
S1.007	SSW004	11.582	-0.178	0.000	0.10	0.0	3.2	OK
S1.008	SSW003	11.476	-0.179	0.000	0.09	0.0	3.2	OK
S1.009	SSW002	11.310	-0.179	0.000	0.09	0.0	3.2	OK
S1.010	SSw001	11.043	-0.176	0.000	0.11	0.0	3.2	OK
S1.011	SExisting	10.999	-0.176	0.000	0.11	0.0	3.2	OK

ICP SUDS Mean Annual Flood

Input

Return Period (years)	1	Soil	0.300
Area (ha)	1.000	Urban	0.000
SAAR (mm)	1171	Region Number	Ireland South

Results	**l/s**
QBAR Rural	3.3
QBAR Urban	3.3
Q1 year	2.8
Q1 year	2.8
Q30 years	5.3
Q100 years	6.1