Sea Gardens Phase 1 Block A

Stormwater Impact Assessment Report

Shankill Property Investments Ltd.

May 2025

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This document has 35 pages including the cover.

Document history

Revision	Purpose description	Originated	Checked	Reviewed	Authorised	Date
Rev 0	SuDS Audit Review	G. Hanratty	A. Corrigan	G. Hanratty	G. Hanratty	20/05/25
Rev 1	SuDS Audit Response	G. Hanratty	A. Corrigan	G. Hanratty	G. Hanratty	18/06/25
Rev 2	Planning submission	G. Hanratty	A. Corrigan	G. Hanratty	G. Hanratty	26/06/25

Client signoff

Client	Shankill Property Investments Ltd.
Project	Sea Gardens Phase 1 Block A
Job number	5193890
Client signature / date	

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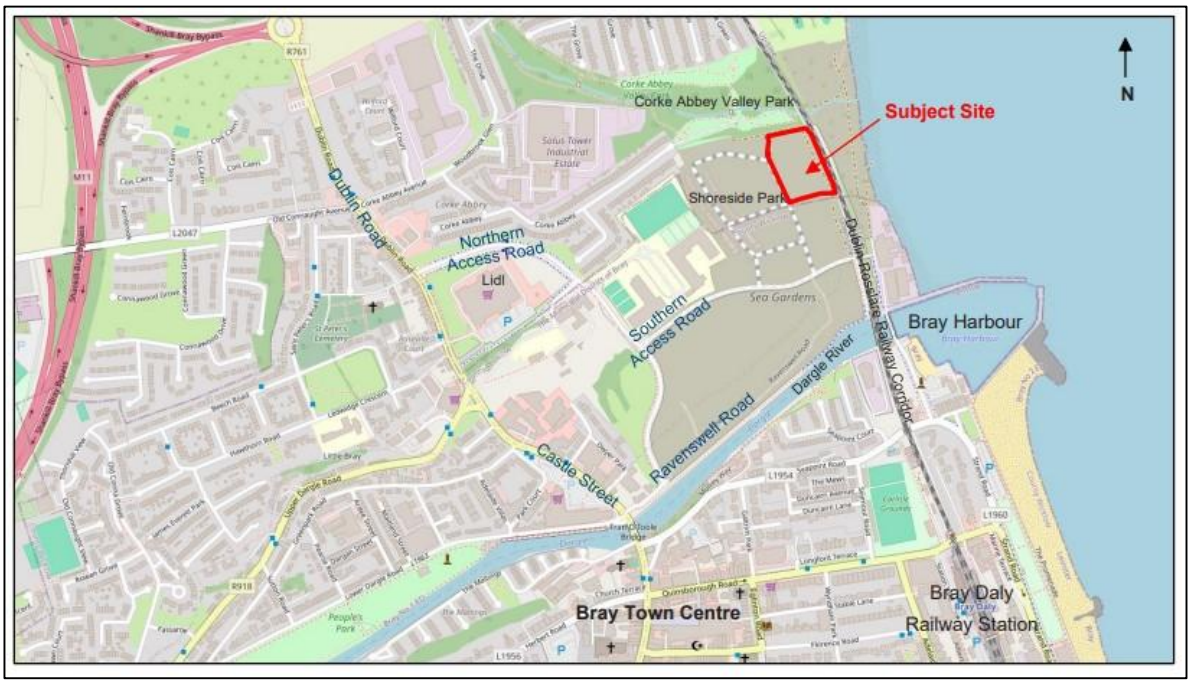
1. Introduction

The proposed development comprises of a residential development on a site at the former Bray Golf Club Lands off the Dublin Road, Bray, Co. Dublin. The development will complete Phase 1 of the wider Sea Gardens development – the first part of which (Shoreside Park as permitted under ABP-311181-21) is nearing completion and occupation.

The c. 1.38 hectare site is generally bounded to the north by existing public open space at Corke Abbey Valley Park, to the east by the Irish Rail Dublin-Wexford/Rosslare main rail line, to the south by undeveloped lands and to the west by Shoreside Park.

The proposed development will consist of the provision of 159 no. residential units over/around a shared 2-level podium comprising of: 9 no. 4-bedroom, 3 and 4-storey terraced houses with associated private gardens / terraces; and 150 no. apartments in 2 no. blocks ranging in height from 5 to 10-storeys (Block A1) and 6 to 11-storeys (Block A2) and consisting of a total of 48 no. 1-bedroom units, 58 no. 2-bedroom units, 44 no. 3-bedroom units, all with private balconies or terraces. The blocks will also include communal lounge areas; a communal gym in Block A1; refuse storage areas; and associated plant. The shared 2-level podium will include car, motorcycle and bicycle parking, with additional car parking provided within the curtilage of 5 no. of the proposed townhouses. The proposed development will also include: public open space including play areas; communal open space within the central podium courtyard; pedestrian / cycle linkages with adjoining existing and permitted developments; associated connections to the surrounding road network; all associated landscaping and public lighting; an ESB substation; drainage arrangements; utility connections; and all site development works.

Figure 1-1 – Site Location



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

1.1. Site Location

The proposed development site is located on the former Bray Golf Course lands to the North East of the permitted Coastal Quarter Development. The total planning application area circa 1.38 hectare.

1.2. Existing Site Description

The proposed residential site and surrounding lands are moderate sloping from the highest point located to the North West of the site and falls gradually to the South East. The existing site elevations range from 11.50mOD to 1.50mOD. The site is currently accessed via the Ravenwell Primary school access road.

1.3. 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;

- Dún Laoghaire Rathdown County Development Plan, 2022 - 2028
- Dún Laoghaire Rathdown Stormwater Management Policy
- Greater Dublin Strategic Drainage Study (GDSDS)
- CIRIA report C753 The SuDS Manual-v6
- *Bray Municipal District Local Area Plan (LAP) 2018 - 2024
- Wicklow County Development Plan, 2016 – 2022

** Bray LAP 2018 – 2024 was used for reference only and the new Bray LAP is currently at Draft Stages prior to being published by WCC.*

The stormwater drainage for this proposed development was original designed as part of the wider masterplan area for the Coastal Quarter SHD planning applications (ABP ref 311181 & 314686) in consultation with the relevant authorities including both Dún Laoghaire Rathdown County Council (DLRCC) & Wicklow County Council (WCC) Municipal services departments.

2. Surface Water Design

The storm drainage system has been designed in accordance with the key documents and standards listed in Section 1.3 above.

Surface water generated from the proposed residential development will be conveyed through a proposed surface water network including SuDS with a focus on green roofs as the proposed hard standing areas are previously permitted. The proposed storm drainage network for the development is as indicated on the planning drawing 5214419-ATK-01-ZZ-DR-CE-0501

In accordance with the DLRCC Development Plan, a Stage 1 Stormwater Audit has been carried out by Punch Consulting Engineers in June 2025. In advance of this application a full copy of the Audit has been issued by Punch Consulting Engineering to DLRCC Municipal services department.

Refer to Appendix A for a copy of the Stage 1 Stormwater Audit report received from Punch Consulting Engineers including comments and feedback. Note Appendix A of the Punch report has been omitted and will be issued directly to DLRCC by Punch in accordance with the Storm Water Audit requirements.

The proposed measures included within the design are as follows:

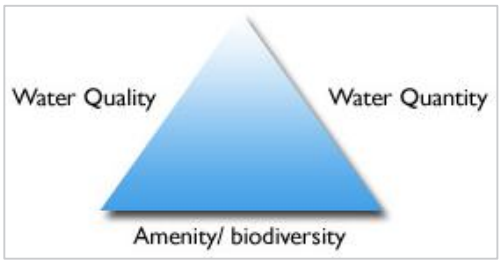
- Swales within Open Space / Park areas adjacent to roads
- Permeable paving in light traffic areas (parking bays)
- Green roofs to suitable apartment blocks
- Green courtyards to suitable apartment blocks
- Tree pits

The basis for this report and overall design is as per those set out in the Stage 2 Stormwater Audit in January 2023 and subsequent planning compliance submission for the Coastal Quarter SHD LRD planning applications (ABP ref 311181)

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

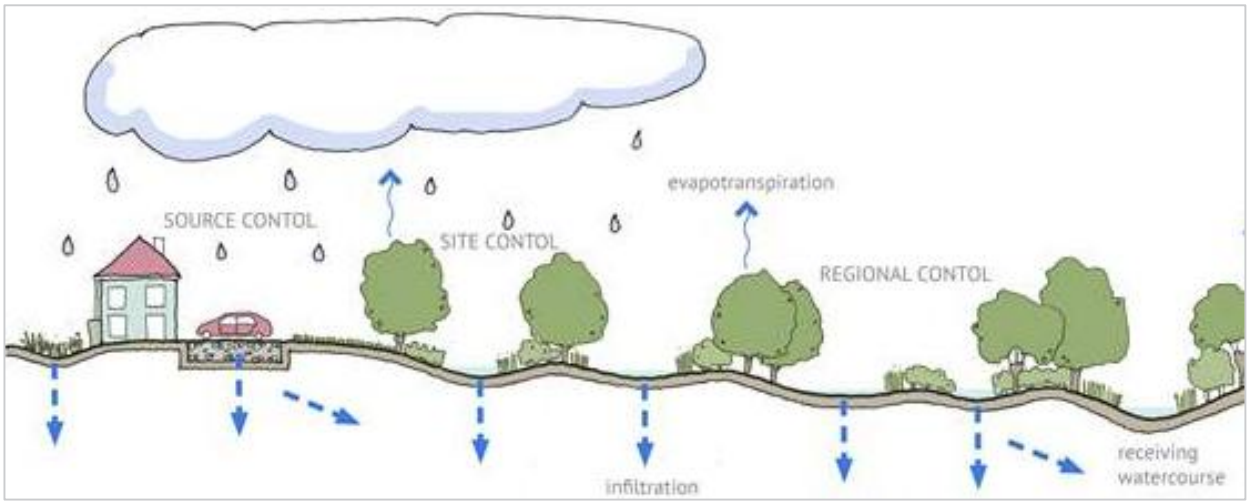


By considering the three functions of the triangle, a SuDS system will allow for water quality treatment through natural processes by;

- 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)

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.

Figure 2-2 - SuDS Treatment Train



The treatment train principles include;

- Prevention of surface water run-off from the proposed site by use of filter drains, swales, permeable paving, tree pits, extensive green roofs, intensive green courtyards and modular attenuation systems with a permeable base (where appropriate)
- Minimising impermeable paved areas using permeable paving, extensive green roofs, intensive green courtyards and modular grass road proprietary product.
- Infiltration by use of filter drains, swales, permeable paving and tree pits.
- Storm water runoff from the site will be treated through the use of a Bypass Interceptor prior to discharge to the receiving watercourse. The Bypass Interceptor has been sized as a Klargester NBBE100

Each of the items outlined above will help to improve water quality, reduce storm water runoff quantity from the proposed site and ensure that there is no increased risk to downstream flooding where discharging to the Dargle River.

Drawings 5214419-ATK-01-ZZ-DR-CE-0501, 0503, 0504 and 0510 outline the proposed details of the storm-water network, longitudinal sections, catchment areas and flow paths.

The SuDS techniques proposed within the development are as outlined below:

- Swales are to be used within the site as conveyance systems for surface water runoff from sections of road, footpaths or shared surfaces. Discharge into the swale will be via drop kerbs / side inlet gully's or over edge flows.
- Permeable paving will be used in light traffic areas to the front of residential units. The permeable paving will allow for attenuation, infiltration to ground, reduction of peak flow rates and improved water quality. Roof run-off from the front roof area of residential housing units will discharge directly into the subbase below each permeable paving area allowing for reduced runoff from these roof areas.
- Extensive green roof and intensive green courtyards will be provided on suitable buildings as indicated on drawing 5214419-ATK-01-ZZ-DR-CE-0601 in accordance with DLRCC Development Plan, 2022 - 2028. The green roofs / courtyards will provide reduced peak flow rates, attenuation, evaporation and improved water quality.

The storm water drainage network will be assessed for compliance with the key design parameters as set out in Table 2-1 below.

Table 2-1 – Key Design Parameters

Parameter	Value/Requirement
Minimum depth	1.2m cover under highways 0.9m elsewhere*
Maximum depth	5.0m
Minimum sewer size for main drainage	225mm
DLRCC Municipal services agreed co-efficient runoff factors for pipe sizing and storage requirements	100% - Roads / Cycle tracks / Footpaths / Roofs (when discharging directly to storm drainage network) 75% - Roads / Cycle tracks / Footpaths / Roofs when discharging directly swales, tree pits and filter drains 60% - Roads / Cycle tracks / Footpaths / Roofs when discharging directly to permeable paving 85% - Extensive Green Roof (> 150mm thk.) 70% - Intensive Green Courtyard (landscape courtyard areas with soil > 500mm thk.)
Max. velocity at pipe full	3.0 m/s
Min. velocity in	0.75 m/s (1.0 m/s used where achievable)
Roughness	0.6mm
Agreed maximum discharge rate	Uncontrolled as discharging to Tidal Waters. Note that the existing network has been designed to cater for uncontrolled discharge as part of the planning compliance submission for the Coastal Quarter SHD ABP ref 311181.
Level of Service Critical Storm 1 in 2 yr return period	No surcharge within the pipe network, no flooding
Level of Service Critical Storm 1 in 30 yr return period	Surcharge allowed with no flooding
Level of Service Critical Storm 1 in 100 yr return period	No flooding unless planned and contained on site.

**Without recourse to concrete. Absolute minimum cover in roads is 0.9m. Pipes with cover between 0.9m and 1.2m shall be bedded and surrounded in concrete, 150mm thick, Class E, in accordance with Clause 1502 of the Specification for Roadworks.*

“Micro Drainage”, which is an industry standard tool for the design and assessment of gravity sewer drainage networks, has been used to simulate the proposed storm drainage network. Outputs from the model for the proposed storm network completed for the Coastal Quarter SHD ABP ref 311181 planning compliance submission are contained in Appendix B of this report.

3. Site Investigations

Site Investigations were carried out by IGSL in September 2020 with final factual report issued in February 2021. Full details of the ground investigation are presented in the 'Harbour Point Bray Ground Investigation Report – Factual' prepared by IGSL (2021) and presented in Appendix 9.1, Volume 3 of the EIAR (Atkins, 2021).

The purpose of the site investigation was to investigate subsurface conditions utilising a variety of investigative methods. The scope of the site investigation works undertaken for this project included the following:

- 10 No. Trial Pits to a maximum depth of 3.0m BGL
- 23 No. Cable Percussion Boreholes to a maximum depth of 14.5m BGL
- 19 No. Rotary Core Drill holes
- 10 No. Window Sampling / Driven Sampling to a depth of 3.90m BGL
- 3 No. Soakaways to determine a soil infiltration value to BRE digest 365
- 10 No. Dynamic Cone Penetrometer to a depth of 0.60m BGL
- Groundwater monitoring
- Gas monitoring
- Surveying of Exploratory Hole Locations

Ground water levels are indicted in the Trial Pits records in Appendix 1 and Soakaway Test Records in Appendix 5 of the IGSL factual report.

Figure 3-1 - SI Testing Locations

Review of the SI results including Cable Percussion Boreholes (BH) logs and Trial Pits (TP) indicated no ground water was encountered.

The location of trial pits, ground levels and ground water levels are indicated on the storm water layout drawing 5214419-ATK-01-ZZ-DR-CE-0501

Based on the information contained within the IGSL report, there will be no perceptible impacts from groundwater levels on proposed SuDS.

4. Existing Site Hydrology

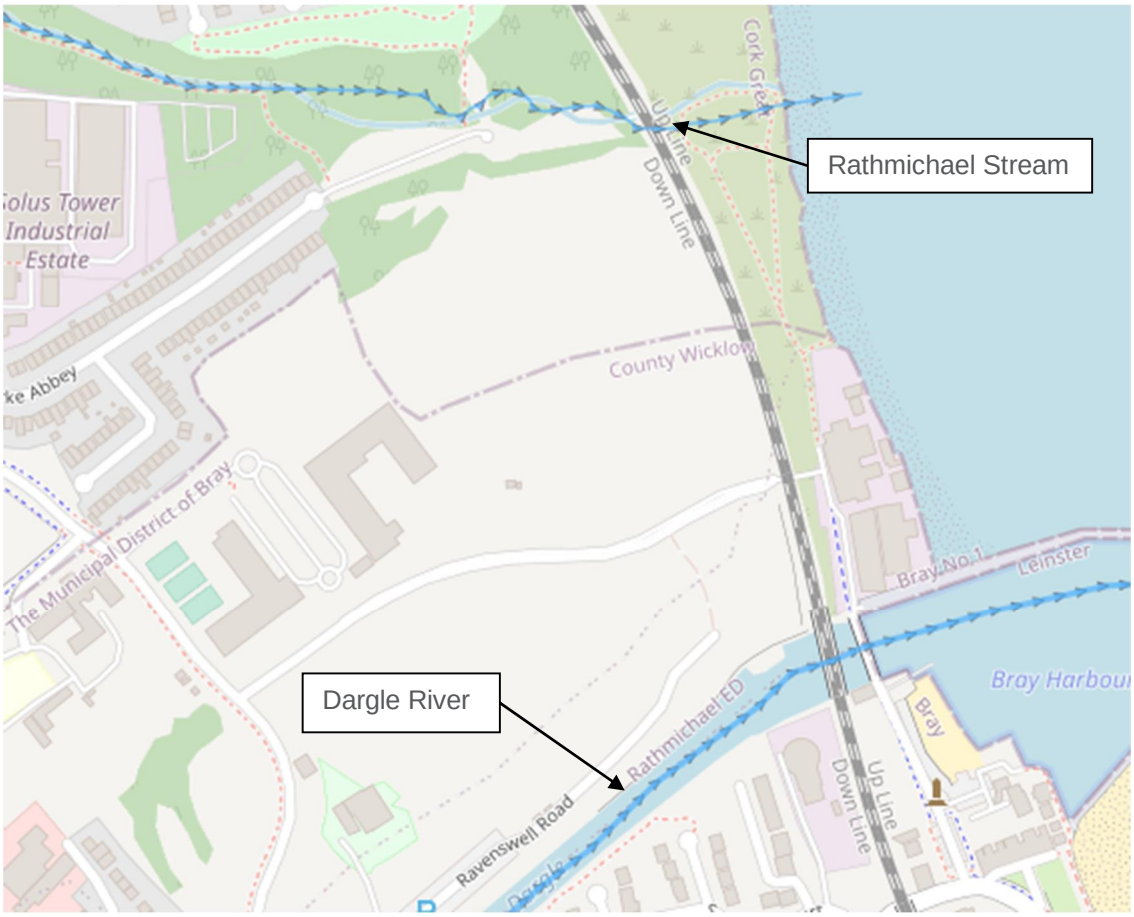
No existing waterbodies traverse the site as indicated in Figure 4-1 below. A review of Historical Ordinance Survey Ireland information (www.osi.ie) was then carried out to determine if the OSI 6-inch Maps indicated historic water courses / surface water features within the site. The maps do not indicate any record of a water course onsite.

The Crinken \ Rathmichael Stream is located to the North of the proposed development. The stream flows under the existing Irish Rail railway line and discharges into the Irish Sea.

The Dargle River is located to the Southern boundary of the proposed development. The River flows into Bray Harbour. The River Dargle Flood Defence scheme is in place along the river and is discussed further in the Atkins Flood Risk Assessment.

Lands within the proposed development have been designed to discharge into the Dargle River at unrestricted rate as discharging to Tidal water as discussed further within this report.

Figure 4-1 - Site Hydrology Overview



5. Soil Type Classification

To determine the allowable Qbar discharge rate from the proposed site, the SOIL value for the existing site was classified using the 'Winter Rain Acceptance Potential classification' Table 2.1 from the Institute of Hydrology Report No. 126, see Figure 5-1 below.

Figure 5-1 - WRAP Table

Water regime class	Depth to impermeable horizon(cm)	Slope Classes								
		<2°			2-8°			>8°		
		Permeability class (above impermeable horizon)								
		Rapid	Medium	Slow	Rapid	Medium	Slow	Rapid	Medium	Slow
1	>80	1			1		2	1	2	3
	80-40			2			3			4
	<40	-			-			-		
2	>80	2			3			-		
	80-40					4				
	<40	3								
3	>80									
	80-40					5				
	<40									

Winter Rain Acceptance Class		Winter Run-off Potential	
1	Very high	1	Very Low
2	High	2	Low
3	Moderate	3	Moderate
4	Low	4	High
5	Very low	5	Very high

The table considers four main soil and site properties which include:

- Soil water regime
- Depth to an impermeable layer
- Slope class
- Permeability of the soil horizons above the impermeable layer

5.1. Soil Water Regime

The water regime class is taken from the Soil Survey Field Handbook (Hodgson 1974). The classes are identified as:

Figure 5-2 - Water Regime Classes

1) soils rarely waterlogged within 40 cm depth, and for less than 90 days within 70 cm in most years,

2) soils commonly waterlogged within 40 cm, but for less than 335 days within 70 cm in most years, and

3) soils waterlogged within 40 cm for more than 180 days, and for more than 335 days within 70 cm in most years.

Follow a review of the site Investigations Bore Hole Logs a ranging depth of topsoil was found to be between 100mm and 300mm with the average depth of 200mm.

Due to the maximum depth of the topsoil (200mm thick.) and the depth to impermeable layer discussed in Section 5.2 below, it was determined that water regime Class 2 “soils commonly waterlogged within 40cm, but for less than 335 days within the 70mm in most years” is the most suitable selection for this site.

5.2. Depth to an Impermeable Layer

Below the topsoil the existing strata was classified as sandy gravelly SILT/CLAY.

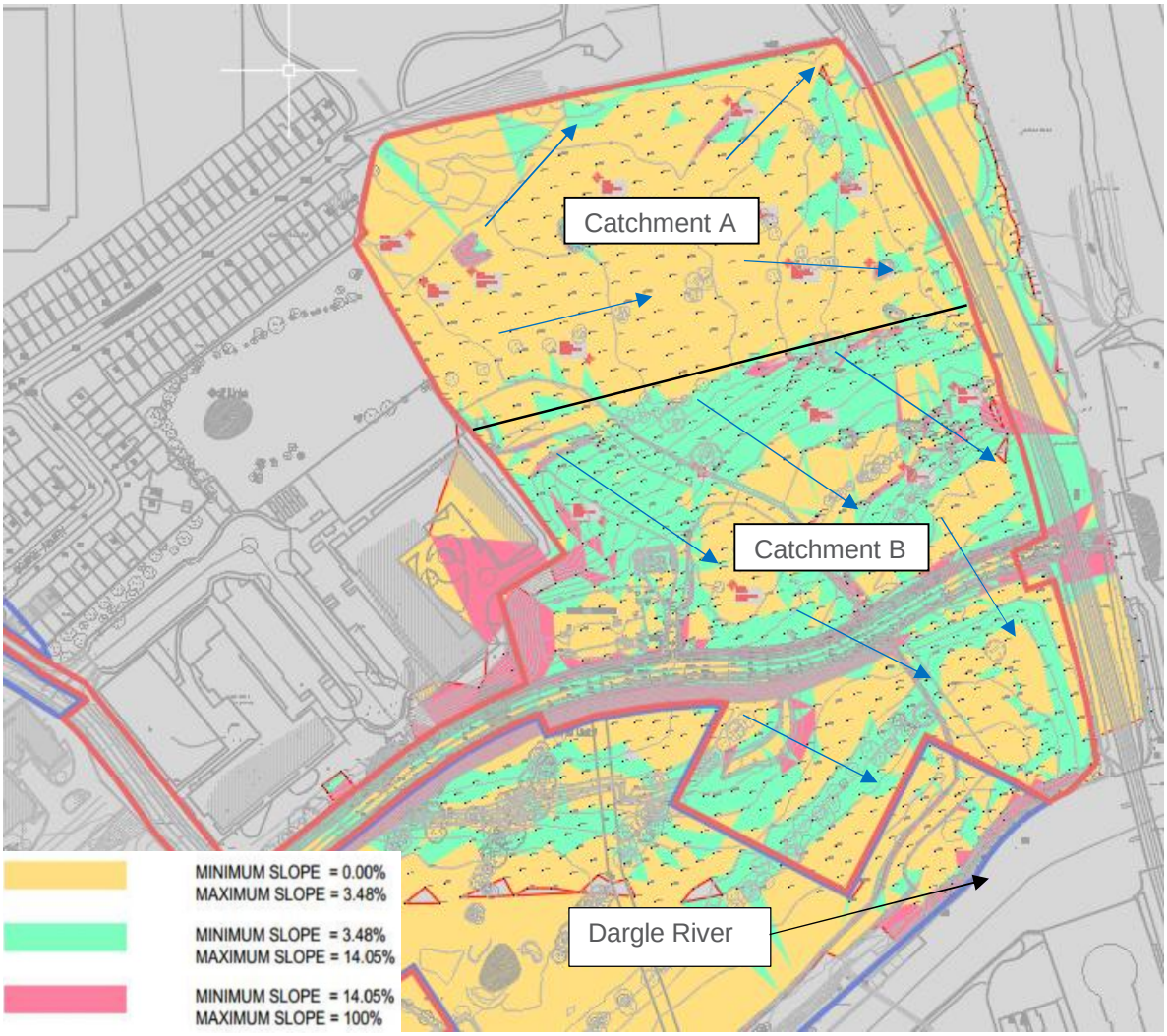
The Institute of Hydrology Report No. 126 outlines that “an impermeable layer is defined as a layer with a hydraulic conductivity of less than 0.1 m/day”.

Based on this information with predominant soil type for each of the soakaway tests being SILT/CLAY, the depth to an impermeable layer is determined to be located circa 200mm below surface level or at the underside of the topsoil or, accordance with the WRAP table a depth to impermeable horizon of <40cm.

5.3. Slope Class

Following a review of the topographical survey a 3D heatmap model of the existing site gradients was generated. The 3D model allowed for identification of the slopes on site between the ranges set out in the 'Winter Rain Acceptance Potential classification', see Figure **5-3** below for slope classifications.

Figure 5-3 **– Site Slope Classification**



As part of the permitted site Coastal Quarter SHD ABP ref 311181 the overall site was split into two catchments, one to the north (A) and a second to the south (B). The majority of the Catchment A has a slope below 2 degrees, as indicated in yellow, with some areas having a slope of between 2 – 8 degrees. For this assessment based on the predominate, a slope of below 2 degrees slope will therefore be used for Catchment A.

Meanwhile, Catchment B has a slope between 2 – 8 degrees as indicated in green. It is noted however that parts of the site have a slope of < 2 degrees indicated in yellow with some minor areas having a slope of > 8 degrees indicated in red. For this assessment based on the predominate, a slope of between 2 - 8 degrees slope will therefore be used for Catchment B.

It is noted that the approximate location of the split between the 2 catchments is similar to that of the county boundary line between DLRCC and WCC.

For this planning application for Sea Gardens Phase 1A, the proposed development will be located within catchment A

5.4. Permeability Class

The Handbook of Soils for Landscape Architects by Robert F. Keeler Table 6.1 provides a soil characterisation for permeability from slow to rapid as outlined in Figure 5-4 below:

Figure 5-4 - Permeability Classifications

Table 6.1 Soil Permeability Class Related to Flow of Water through a Saturated Soil

Permeability Class	Rate of Flow (inches per hour)
Very slow	Less than 0.06
Slow	0.06–0.2
Moderately slow	0.2–0.6
Moderate	0.6–2.0
Moderately rapid	2.0–6.0
Rapid	6.0–20.0
Very rapid	More than 20

From review of the site investigations report, the strata are identified as SILT/CLAY. As indicated below and set out in table 25.1 of the CIRIA SuDS Manual, the expected Infiltration coefficients would be between 1 x 10^{-8} & 1 x 10^{-6} m/s. These rates are equivalent to 0.0014 & 0.141 inch / hour.

Figure 5-5 – Typical Infiltration Coefficients

TABLE 25.1 Typical infiltration coefficients based on soil texture (after Bettess, 1996)

Soil type/texture	ISO 14688-1 description (after Blake, 2010)	Typical infiltration coefficients (m/s)
Good infiltration media		
▪ gravel	Sandy GRAVEL	$3 \times 10^{-4} – 3 \times 10^{-2}$
▪ sand	Slightly silty slightly clayey SAND	$1 \times 10^{-5} – 5 \times 10^{-5}$
▪ loamy sand	Silty slightly clayey SAND	$1 \times 10^{-4} – 3 \times 10^{-5}$
▪ sandy loam	Silty clayey SAND	$1 \times 10^{-7} – 1 \times 10^{-5}$
Poor infiltration media		
▪ loam	Very silty clayey SAND	$1 \times 10^{-7} – 5 \times 10^{-6}$
▪ silt loam	Very sandy clayey SILT	$1 \times 10^{-7} – 1 \times 10^{-5}$
▪ chalk (structureless)	N/A	$3 \times 10^{-8} – 3 \times 10^{-6}$
▪ sandy clay loam	Very clayey silty SAND	$3 \times 10^{-10} – 3 \times 10^{-7}$
Very poor infiltration media	–	
▪ silty clay loam	–	$1 \times 10^{-8} – 1 \times 10^{-6}$
▪ clay	Can be any texture of soil described above	$< 3 \times 10^{-8}$
▪ till		$3 \times 10^{-9} – 3 \times 10^{-6}$
Other		
▪ rock* (note mass infiltration capacity will depend on the type of rock and the extent and nature of discontinuities and any infill)	N/A	$3 \times 10^{-9} – 3 \times 10^{-5}$

Based on the more onerous values above it is determined that permeability class is ‘Slow’.

5.5. Soil Type Classification

Figure 5-6 - Catchment A Soil Type Classification

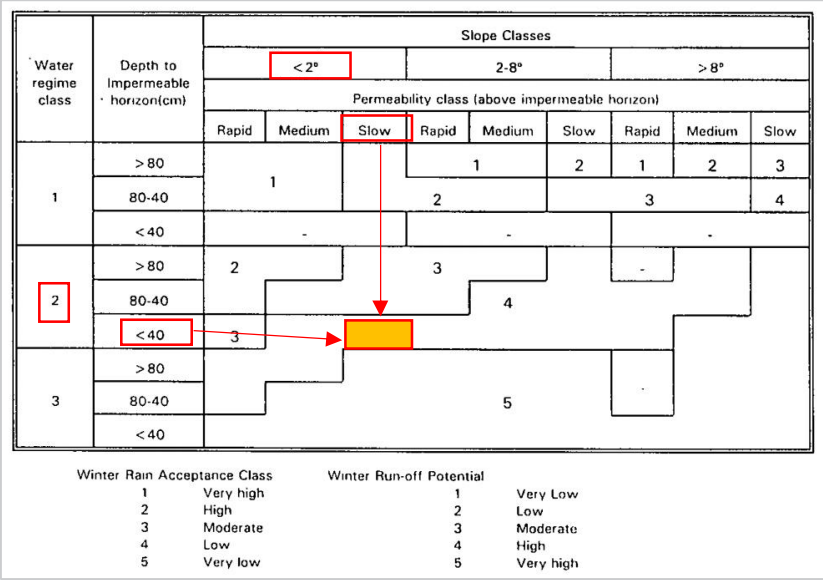
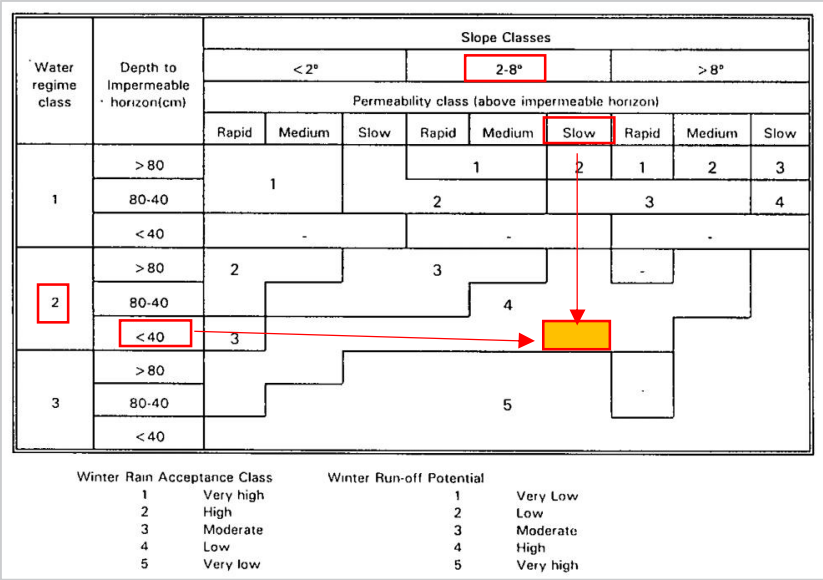


Figure 5-7 - Catchment B Soil Type Classification



Based on the above Figure 2.5 & Figure 2.6, catchments A & B would have been previously classified as Soil Type 4 for the purpose of Qbar discharge rate calculations. However, the planning compliance submission proposed to remove flow control and attenuation to allow for free discharge into the Dargle River. The above exercise also indicated poor infiltration to ground and any proposed SuDS systems such as swales will require an outfall to the storm drainage system rather than relying on infiltration to ground.

6. Surface Water Storage Requirements

Prior to the permitted Coastal Quarter SHD ABP ref 311181, WCC had indicated at preplanning stage that an option free discharge to the Dargle River (which is located within the Wicklow County Boundary) may be acceptable, following the grant of planning the planning compliance submission proposed to remove the tanks and flow controls and this was deemed acceptable.

Based on the above there is no proposed Surface Water Storage requirements as part of this Sea Gardens Phase 1A planning application.

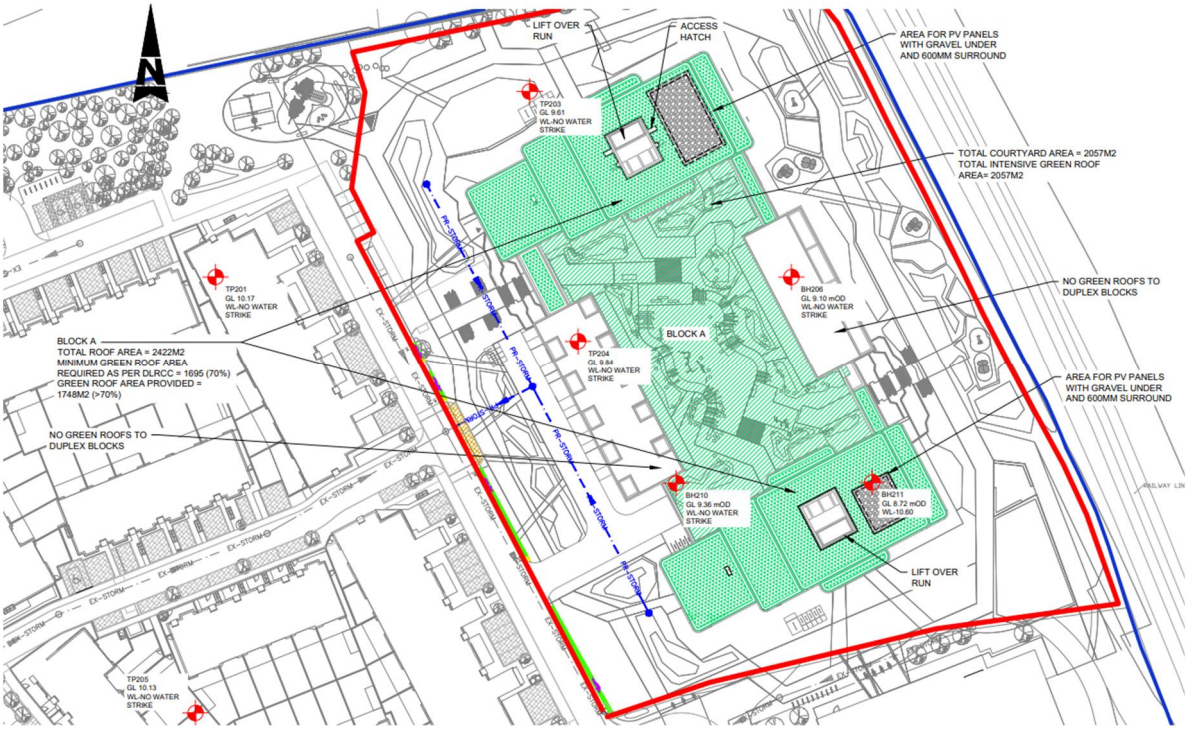
7. Proposed Site Characteristics

7.1. Catchment Design Details

The proposed overall catchment area of 7.7ha for the permitted development was split into 2No. catchment areas (catchment A & B) as indicated on drawing 5214419-ATK-01-ZZ-DR-CE-0503. The permitted development catchments have incorporated multiple SuDS features as outlined in Section 2 above.

For this proposed development the overall catchment area is circa 1.38 ha as indicated within the green roof / drainage layout indicated below in Figure 7-1.

Figure 7-1 – Drainage Catchment Areas



The total Site Impermeable Areas and reduced Impermeable Areas based on coefficient runoff factors are indicated below in **Table 7-1**.

Table 7-1 – Site Impermeable Areas

	Total Impermeable Area	Impermeable Area based on co-efficient runoff factors (Table 2-1)
Roads / Cycle tracks / Footpaths / Roofs (when discharging directly to storm drainage network) Access Road	0.038ha	0.038ha
Roads / Cycle tracks / Footpaths / Roofs when discharging directly swales, tree pits and filter drains (Landscape areas)	0.105ha	0.079ha

	Total Impermeable Area	Impermeable Area based on co-efficient runoff factors (Table 2-1)
Roads / Cycle tracks / Footpaths / Roofs when discharging directly to permeable paving	0.000ha	0.000ha
Extensive Green Roof (> 150mm thk.)	0.175ha	0.149ha
Intensive Green Courtyard (landscape courtyard areas with soil > 500mm thk.)	0.205ha	0.144ha
Total	**0.523ha**	**0.410ha**

It is noted to allow for use of reduced co-efficient runoff factors, Summer and Winter Cv values within the Micro drainage storm network modelling has been increased to 1 in accordance with DLRCC requirements.

Where swales are provided, they are used for the conveyance of surface water runoff from the adjoining roads / footpaths. Discharge into the swale will be via drop kerbs / side inlet gullies. Discharge from the swales to the storm water network will be via a perforated manhole cover. The manhole cover has been designed to be 50mm above the base on the swale to provide for interception volumes. Refer to **Error! Reference source not found.** for further details on the swale d esign.

Porous paving provided will cater for runoff from the porous paving surface, adjacent roads / footpaths and roof runoff from the front of residential units. The subbase below the porous paving will allow for infiltration, reduced peak flows and 30% storage capacity within the subbase voids. An orifice plate / flow control will be used in the outfall chamber from each porous paving area to reduce the flow and increase the overall storage capacity of the subbase.

Filter Drains with a perforated pipe will be provided in private rear gardens to drain storm water from roof runoff from the rear of the proposed associated dwellings.

A suitably sized Bypass Interceptor (Klargester NSBE100 or similar) permitted under the Coastal Quarter Phase 1 project has been installed downstream of Catchment B's to provide a final treatment for the storm runoff before being discharged to the receiving Dargle River.

Tree pits will be used at locations as indicated. Runoff from adjacent roads / footpaths and excess runoff from adjoining impermeable surface will discharge into the pit via a dropped kerb. The tree pit will allow for interception and percolation to ground. An overflow pipe with a raised level of 50mm above the finished surface level will allow for overflow into the storm drainage network during high intensity rainfall events. It is noted that tree pit interception volumes have not been included within the interception calculations below however, a minimum interception volume of $0.1m^3$ will be provided with each tree pit.

Extensive green roofs and Intensive green courtyards will be provided to suitable apartment blocks and retail units as indicated on drawing 5214419-ATK-01-ZZ-DR-CE-0601. A run-off factor of 80% has been used within the calculations.

7.2. Compliance with GDSDS Design Criteria

Outfall Section 6.3.4 of the GDSDS Volume 2 New Development sets out four design criterion which are required to be met by the proposed drainage system. Compliance with these criteria are outlined below:

7.2.1. Interception Volume – Criterion 1.1

Interception storage volume is based on 80% runoff from paved areas and 0% runoff from pervious surfaces for the first 5mm of rainfall.

As set out in Table 24.6 - Interception Mechanisms of the CIRIA report C753 The SuDS Manual-v6, hard standing areas discharging into SuDS area deemed to be compliant for interception. As a result, the impermeable areas draining to these SuDS features can be subtracted from the total hardstanding area when calculating the interception volume requirement. The new hardstanding areas requiring interception storage for both catchments is as described in Table 7-2 & **Error! Reference source not found.** below.

7.2.1.1. Catchment A

Table 7-2 – Total Hardstanding Area Requiring Interception Storage– Catchment A

		Total Paved Site
Total Hardstanding Area		**0.523ha**
Impermeable Areas deemed to be compliant as per Table 24.6 of the SuDS Manual	Extensive Green Roof (> 150mm thk.)	0.175ha
	Intensive Green Courtyard (landscape courtyard areas with soil > 500mm thk.)	0.205ha
	Total Permeable Paving Area (plus additional hardstanding area draining to permeable paving that is not greater than total area of permeable paving)	0.038ha
	Swales	0.000ha
	Tree Pits	0.000ha
Total Area deemed to be compliant		0.418ha
Total Remaining Hardstanding Area requiring interception storage		0.523 – 0.418 = 0.105ha

Table 7-3 – Interception Storage Volume Requirement

	Total
Total Hardstanding Area Not Discharging to SuDS Features	0.105ha
Volume of Interception Required	1050m^2 x 0.005m x 0.8 = 4.2m^3

Table 7-4 – Interception Volume Provided

SuDS	Volume
Storage within Permeable Paving (Access roads to front of Duplex Units)	0.0225ha = 225m^2 0.350(D min) x 225m^2 = 78.75m^3 78.75 x 30% Voids = **23.6m^3**
Total	23.6m^3 provided > 4.2m^3 required (OK)

Interception Volume for the proposed developed has been provided using SuDS permeable paving. The overall volume being provide is a minimum of 23.6m^3 which is greater than the 4.2m^3 required. Interception volume has been provided on the proposed site using the SuDS features noted below.

- Permeable pavement to parking bays
- Green roofs (to apartment buildings only)
- Green courtyards (to apartment buildings only)

7.2.2. Treatment Volume – Criterion 1.2

Treatment volume is based on 80% runoff from paved areas and 0% runoff from pervious surfaces for the first 15mm of rainfall.

Table 7-5 – Treatment Volume

	Total Paved Site
Paved surfaces (roads, footpaths, permeable paving & roof areas)	0.523ha
Volume of Treatment Storage Required	5230 x 0.015 x 0.8 = 62.76m^3

Due to site constraints including open space requirements, existing flood extents and density requirements there is insufficient area on site to provide the Treatment Volume (retention pond or wetland) and therefore Criterion 1.2 cannot be successfully met for this site.

In accordance with Table 6.3 of the Regional Drainage Policies – Volume 2 New Development, as Criterion 1.1 is being achieved, Criterion 1.2 is therefore not required for Catchment A

It is proposed that no attenuation tank will be provided as previously noted for this proposed development as part of the original permitted Sea Gardens Development prior to discharging to the receiving water as the discharge location to the Dargle River is Tidal. Acceptance of this approach is as set out in the Dún Laoghaire Rathdown County Development Plan, 2022 - 2028 and previous discussed with Wicklow County Council.

7.2.3. Levels of Service – Criterion 3

The four criteria for levels of service are as follows:

- Criterion 3.1: No external flooding (30 year high intensity rainfall event)
- Criterion 3.2: No internal flooding (100 year high intensity rainfall event)
- Criterion 3.3: No internal flooding (100 year river event and critical duration for site storage)
- Criterion 3.4: No flood routing off site except where specifically planned (100 year high intensity rainfall event)

Criteria 3.1, 3.2, 3.3 & 3.4: All potential flooding has been reviewed and modelled using micro drainage for up to the required 1 in 100 year storm event including 30% for climate change. Outputs from the model for the proposed storm network are contained in Appendix B of this report.

7.2.4. River Flood Protection – Criterion 4

A review of the three methods referred to in the GDSDS for establishing River Flood Protection, by comparison of the pre and post development runoff volumes, Criteria 4.1, 4.2 and 4.3 respectively, none were deemed suitable for this site and the approach set out in the Dún Laoghaire Rathdown County Development Plan, 2022 – 2028 for free discharge to tidal water was deemed acceptable for the previously permitted scheme.

8. Flooding & Exceedance Flows

8.1. Flood Risk Assessment

A Flood Risk Assessment (FRA) Atkins Document No. 51193890DG0003 has been undertaken for the site to satisfy the requirements of the Planning System and Flood Risk Management Guidelines. The report aimed at scoping sources of flooding, assessing whether any significant flood risk issues exist and proposing appropriate flood risk management measures as required.

The FRA conclusion identifies that there is potential flood risk identified in the vicinity of the proposed residential development site. All 'highly vulnerable' infrastructure within the development are located outside of the existing flood zone.

The outfall from the storm drainage network to the Dargle River will be fitting with a non-return flap valve and high-level overflow to ensure that in the event of high water levels in the Dargle river, the storm water outfall from the proposed development will not be impacted by external water from the river.

8.2. Exceedance Flows

Surface Water exceedance flows from the site have been considered as part of the Coastal Quarter Phase 1 permitted Development. While the risk of blockages has been reduced by removal of the attenuation systems, flow controls and increased pipe sizes, there is a required for Flood storage during a 1 in 100-year 15min summer event as indicated in the modelling outputs in Appendix B of this report

The total max flood volume occurs during 1 in 200 year max Tidal level. The area of flood storage was indicated and agreed as part of the permitted development and there is no proposed change to this.

9. SuDS Maintenance

Regular checks and maintenance of the SuDS systems is required and have been considered as part of the overall drainage design for the proposed development. This will ensure both the design life of the SuDS systems, ongoing improved water quality, reduced water runoff and reduce the risk of onsite flooding and exceedance flows.

9.1. Permeable Paving

Paving should be inspected regularly, preferable during and after heavy rainfall to ensure effective operation.

Vacuum brushing or jetting of the permeable paving should be carried out once a year. Cleaning is generally carried out after Autumn leaf fall to remove silts and sediments.

9.2. Green Roofs / Green Courtyards

All components (soil substrate, vegetation, drains, membranes and rood structure) should be inspected annually and after severe storms.

Underside of roof should also be inspected annually and after severe storms for evidence of leakage.

Debris, fallen leaves and litter should be regularly removed to prevent clogging of inlet drains.

9.3. 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.

9.4. Swales

Mowing in the first year is critical to eliminate competition from weeds. Lawn-mowing to an ideal height of 100mm should be maintained as grasses tend to flatten down when water is flowing over them, reducing sedimentation. Maintenance of the swale should include:

- Periodic litter removal with the swale and self-clearing inlet grid.
- Occasional stabilisation of eroded side slopes and base.
- Check and Removal of Sediment build up.
- Ongoing maintenance should form part of the site landscaping proposals.

9.5. Filter Drains

Inspection of the system should be carried out monthly on the inlet / outlet pipework and any control systems for blockages.

Inspection of pre-treatment systems including should be carried out 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 generally maintenance of the drainage system to ensure debris is removed prior to entering the network.

Perforated pipework should be cleared of blockage if required.

9.6. Flap Valve

Flap Valve installed as part of the permitted development should have an annual visual check and after large storm events.

The following parts require attention in particular and need to be cleaned if necessary:

Seal surrounding the valve should be inspected for dirt and wear

10. SuDS Audit Overview

As required by DLRCC Development Plan a Stage 1 Surface Water Audit was carried out as part of this planning application. The Audit was carried out by Punch Consulting Engineers in May 2025.

The Audit noted 6 recommendations / measures to be reviewed. It is noted that each item highlighted has been fully considered and addressed with measures accepted by the Auditors.

The Audit was completed and signed off by AtkinsRealis and Punches on the 26/062025

Refer to Appendix A for a copy of the final report including comments and feedback.

Appendices

Appendix A. Stage 1 - Stormwater Audit Report

PUNCH
consulting engineers

Sea Gardens Phase 1 Block A

Stage 1 Stormwater Audit
252175-PUNCH-XX-XX-RP-C-0001

June 2025

Document Control

Document Number: **252175-PUNCH-XX-XX-RP-C-0001**

Status	Rev	Description	Date	Prepared	Checked	Approved
S3	P01	Draft Issue	17/06/2025	P. McDowell	JP. Murray	L. Brennan
A0	C01	Final Issue	26/06/2025	P. McDowell	JP. Murray	L. Brennan

Report by: _____ Date: 26th June 2025

Philip McDowell

Graduate Engineer, BAI MAI

PUNCH Consulting Engineers

Checked by: _____ Date: 26th June 2025

John Paul Murray

Project Engineer, MEng BSc MIEI

PUNCH Consulting Engineers

Checked by: _____ Date: 26th June 2025

Leonard Brennan

Technical Director, BE Dip Hy&Geo Eng PGDipHSC CEng MIEI MIOSH

PUNCH Consulting Engineers

Table of Contents

1 Introduction

1.1 Purpose of Report

This report presents a Stage 1 Stormwater Audit carried out for the proposed 159 no. residential unit development located at the former Bray Golf Club Lands off the Dublin Road, Bray, Co. Dublin. The subject development is Phase 1 Block A of the wider Sea Garden Development.

Atkins Réalis were appointed by Shankill Property Investment Ltd. to provide Engineering Services, which includes design of the surface water network and associated sustainable drainage systems (SuDS) proposed.

PUNCH Consulting Engineers have been appointed by Atkins Réalis to carry out an independent Stage 1 Stormwater Audit in line with Dún Laoghaire Rathdown City Council requirements.

1.2 Site Details

The c. 1.38 hectare site is generally bounded to the north by existing public open space at Corke Abbey Valley Park, to the east by the Irish Rail Dublin-Wexford/Rosslare main rail line, to the south by undeveloped lands and to the west by Shoreside Park.

The proposed residential site and surrounding lands are moderate sloping from the highest point located to the North West of the site and falls gradually to the South East. The existing site elevations range from 11.50mOD to 1.50mOD. The site is currently accessed via the Ravenwell Primary school access road.

1.3 Report Details

The audit was carried out by Philip McDowell, checked by John Paul Murray, and approved by Leonard Brennan between the dates of June 10th and June 17th, 2025.

The Stage 1 Audit has been carried out in accordance with the Dún Laoghaire-Rathdown County Council (DLRCC) procedures outlined in the Dun Laoghaire Rathdown Development Plan 2022-2028, Appendix 7 “Stormwater Management Policy - Including Stormwater Audit Procedure”. The auditor has examined only those issues within the design relating to surface water drainage and Sustainable Drainage Systems (SuDS) implications of the scheme and has therefore not examined or verified the compliance of the design to any other criteria. Design responsibility for the stormwater drainage and SuDS remains solely with the Design Engineer.

Appendix A contains the copies of drawings and documents examined by the auditor. Appendix B contains the Stage 1 Surface Water Audit Feedback form.

All findings outlined in Section 2 of this report are considered by the auditor to require action to improve the stormwater credentials of the scheme.

1.4 Drawings & Documents Reviewed

Planning Stage

Drawings:

1. 5214419-ATK-01-ZZ-DR-CE-0501
2. 5214419-ATK-01-ZZ-DR-CE-0503
3. 5214419-ATK-01-ZZ-DR-CE-0504
4. 5214419-ATK-01-ZZ-DR-CE-0510
5. 5214419-ATK-01-ZZ-DR-CE-0601
6. 5214419-ATK-01-ZZ-DR-SD-0001
7. 5214419-ATK-01-ZZ-DR-SD-0002
8. 5214419-ATK-01-ZZ-DR-SD-0003

Reports and other Documents:

1. 0118265DG0010 rev 1
2. 0118265DG0014 rev 0

2 Stage 1 Audit Findings

2.1 General Requirements as per DLRCC County Development Plan 2022-2028

Table 2-1 below outlines the result of a review of the scheme designer's proposals against the general requirements outlined in the DLRCC County Development Plan 2022-2028, Appendix 7, section 7.1.1.

Table 2-1 General Requirements for all developments greater than a single house

	Requirements as per DLRCC 2022-2028 Development Plan	Addressed by Scheme Designer?
2.1.1	**Climate Change:** All developments must apply a minimum factor of 1.2 to their drainage design and attenuation volumes to accommodate climate change.	STATUS Y
2.1.2	**Urban Creep:** All developments must apply a factor of 1.1 to their drainage design and attenuation volumes to accommodate urban creep.	STATUS N
2.1.3	**Blockage Analysis:** Scheme Designers must submit details of the proposed surface water drainage system in the event of blockage or partial blockage of the system, commenting on any surcharging or flood risk that may be identified, particularly in relation to freeboard used in the simulation analysis. The proposal must include a drawing confirming that safe overland flow routes do not negatively impact properties both within and without the site. The overland flow route plan should identify drop kerbs or ramps required for channelling the flow and address low point areas in the site and detail how properties, both within the development and on adjacent lands, will be protected in the event of excessive overland flows.	STATUS N
2.1.4	**Utility Clash Check:** The Scheme Designer must undertake a utilities clash check to ensure all utilities' vertical and horizontal separation distances can be provided throughout the scheme. The Scheme Designer should demonstrate this with cross-sections at critical locations such as junctions, site thresholds and connection points to public utilities. Minimum separation distances must be in accordance with applicable Codes of Practice.	STATUS N
2.1.5	**Private Drains:** Where an applicant's land is crossed by a private drain, the applicant is responsible for acquiring any rights or permissions necessary to connect to, or to increase the discharge into, or to build over, or divert, or to ensure the adequate capacity is not exceeded, or otherwise alter any private drains not in their exclusive ownership or control, and for ensuring their adequacy.	STATUS N
2.1.6	**Pumping of Surface Water**	STATUS N/A

	Requirements as per DLRCC 2022-2028 Development Plan	Addressed by Scheme Designer?
2.1.7	**Sustainable Drainage Systems (SuDS):** The proposal must demonstrate that they meet the requirements of the Greater Dublin Strategic Drainage Study (GDSDS) policies in relation to Sustainable Drainage Systems (SuDS). The design must incorporate SuDS measures appropriate to the scale of the proposed development such as green roofs, bioretention areas, permeable paving, rainwater harvesting, swales, etc. that minimise flows to the public drainage system and maximises local infiltration potential. The Scheme Designer should provide cross-sections and long-sections, and commentary that demonstrates all proposed SuDS measures have been designed in accordance with the relevant industry standards and the recommendations of The SuDS Manual (CIRIA C753)	STATUS Y
2.1.8	**Infiltration:** The Scheme Designer should submit Site Investigation Report and results, including infiltration tests, and a plan showing the trial pits/soakaway test locations across the site. The report should address instances where groundwater, if any, was encountered during testing and its impact.	STATUS Y
2.1.9	**Hardstanding/Parking Areas:** All proposed parking and hardstanding areas should maximise local infiltration before discharge to the surface water drainage system, via a specifically designed permeable paving/porous asphalt system, in accordance with the requirements of Section 12.4.8 of the County Development Plan 2022-2028.	STATUS N
2.1.10	**Basement:** If basement carparking is provided, then all incidental run-off from the basement should be shown to drain to the foul system and not the surface water system	STATUS N/A
2.1.11	**Run-off Factors:** Where Scheme Designers propose to use reduced run-off factors (or reduced impermeable contributing areas) for areas of their site that drain to SuDS measures these factors must be agreed with Municipal Services, preferable during the pre-planning process. It should be noted that standard surface water simulation software uses default Cv values of 0.84 for Winter and 0.75 for Summer. If the Scheme Designer proposes to use their own reduced run-off rates, then the default Cv values should be amended to a value of 1.0. Maintaining the default Cv values in conjunction with the Scheme Designers proposed rates reduces the run-off in simulations of rainfall events, giving inaccurate simulation results which may lead to under sizing of the drainage system and attenuation storage required.	STATUS Y
2.1.12	**Hydrological Parameters:** Scheme Designers must use site specific or local data in their Qbar, attenuation volume and surface water system design such as: • SAAR • Soil Type • Rainfall Return Period Table (available from MET Eireann) • Rainfall intensity • Other hydrological parameters	STATUS Y

	Requirements as per DLRCC 2022-2028 Development Plan	Addressed by Scheme Designer?
2.1.13	**Discharge Rate:** Surface Water discharge from a development must be restricted to 2 l/s/ha or the calculated Qbar, whichever is greater. The Qbar should be calculated using the net area drained and not the gross area of the site (i.e. red line boundary). This discharge rate should be marked on the drainage drawing on the manhole in which the flow restricting device if located. The manhole in which the flow restricting device is located should not have a bypass pipe and, a penstock and silt trap should be provided. Flow restricting devices with an orifice of less than 50mm in diameter should be avoided. Where this is not possible then the Scheme Designer must submit a robust maintenance regime to ensure blockages are avoided, to the satisfaction of dlr. Scheme Designers are recommended to use the HR Wallingford UK SuDS Greenfield runoff rate estimation tool to estimate Qbar for their site: https://www.uksuds.com/drainage-calculation-tools/greenfield-runoff-rate-estimation	STATUS N
2.1.14	**Attenuation:** If an attenuation system is proposed it should, where possible, not be located under the internal roads but in/under open space or parking areas. Attenuation systems must be inline. The preference is for attenuation systems that allow for infiltration and/or treatment within the site. The Scheme Designer should note that certain landscaping items, such as trees, may not be compatible with attenuation systems. The Scheme Designer must provide fully dimensioned plans and sections of the attenuation storage system. All relevant inlet and outlet levels, dimensioned clearances between other utilities, and actual depths of cover to the system should be provided. Details of the proposed inlet and outlet manholes and arrangements to facilitate draw down and maintenance should also be provided. Scheme Designers are recommended to use the HR Wallingford UK SuDS Surface water storage volume estimation tool to estimate the attenuation storage required for their site: https://www.uksuds.com/drainage-calculation-tools/surface-water-storage.	STATUS N/A
2.1.15	**Green Roof:** The proposal must meet the requirements of Appendix 7.2: Green Roof Policy of the County Development Plan 2022-2028.	STATUS Y
2.1.16	**Interception and Treatment:** The Scheme Designer must demonstrate that required interception and/or treatment of surface water run-off is achieved in accordance with GDSDS policy. To be in compliance with GDSDS Volume 2 Section 6.3.3 Table 6.3 Criterion 1, interception of the first 5-10mm is required. If interception of first 5-10mm can't be achieved, then treatment of first 15mm is required.	STATUS Y
2.1.17	**Maintenance:** Scheme Designers must submit a post-construction maintenance specification and schedule for the drainage system, including SuDS measures and attenuation system to dlrcc for approval. This maintenance specification and schedule must be included in the Safety File.	To be addressed by the Scheme Designer at Construction Stage
2.1.18	**New Connections:** Prior to submission of the planning application, the Scheme Designer must obtain the sewer network records from DLRCC and assess if a new connection to the public sewer is technically feasible.	STATUS Y

2.2 DLRCC 2022 Development Plan - Stormwater Audit Procedure Table

Table 2-2 Stormwater Audit Procedure Table - Completed by Scheme Designer

Surface Cover Type	Area (m^2)
Wetland or open water (semi-natural; not chlorinated) maintained or established on site.	N/A
Semi-natural vegetation (e.g. hedgerows, trees, woodland, species-rich grassland) maintained or established on site.	100lm Hedgerow 90lm mature tree line
Reuse of existing soils and seed source to develop vegetation cover	N/A
Standard trees planted in connected tree pits with a minimum soil volume equivalent to at least two thirds of the projected canopy area of the mature tree.	4 no.
Standard trees planted in pits with soil volumes less than two thirds of the projected canopy area of the mature tree.	N/A
Intensive green roof or vegetation over structure. Substrate minimum settled depth of 150mm.	2057m2
Non intensive Brown Roof (Biodiversity Roof). Substrate minimum settled depth of 150mm. Design will be site specific and developed by a suitably qualified ecologist.	N/A
Extensive green roof with substrate of minimum settled depth of 80mm (or 60mm beneath vegetation blanket)	1748m2
Extensive green roof of sedum mat or other lightweight systems	N/A
Green wall -modular system or climbers rooted in soil.	N/A
Rain gardens and other vegetated sustainable drainage elements.	175m2
Flower-rich perennial planting.	2,016m2
Hedges (line of mature shrubs one or two shrubs wide).	N/A
Hedgerows or double hedgerow of native species (may have an associated ditch and bank)	N/A
Groundcover planting.	N/A
Amenity grassland entire area or sections managed for lesser mowing frequencies for pollinators (e.g. six week meadow)	14450m2
Amenity grassland (species-poor, regularly mown lawn).	510m2
Water features (chlorinated) or unplanted detention basins.	N/A
Permeable paving.	380m2
Sealed surfaces (e.g. concrete, asphalt, waterproofing, stone)	1050m2
Blue roof	N/A

2.3 Climate Change / Urban Creep

Problem:

An allowance for urban creep is not stated in the stormwater calculations provided, while an allowance of 30% is stated for climate change.

Recommendation:

Consider providing clarity regarding the allowance for both climate change and urban creep.

2.4 Blockage Analysis (Flow Exceedance)

Problem:

An Overland Flow Routes Drawing that includes the features outlined in 2.1.3 was not provided. Drawing 5214419-ATK-01-ZZ-DR-CE-0504 includes routes of surface water flow for the lands around the site, but not for the site itself.

Additionally, the supplied drawing appears to show significant flow from the surrounding area into the subject site.

Recommendation:

The designer could consider providing an Overland Flow Routes Drawing with the features outlined in section 2.1.3 above.

2.5 Utility Clash Checks

Problem:

It is noted that stormwater drainage long sections are provided in drawing 5214419-ATK-01-ZZ-DR-CE-0510. These long sections do not show the position of any other utilities in relation to stormwater drainage. Without sections drawings it is not possible to verify that minimum separation details are maintained for the stormwater drainage.

Recommendation:

The designer could provide amended long section drawings to show the separation between stormwater drainage and other services.

2.6 Private Drains

Problem:

There is no commentary provided with regard to private drains.

Recommendation:

The designer provide comment on whether there are pre-existing private drains present on site.

Should there be pre-exiting private drains on site the designer could provide evidence that the design has been implemented in accordance with the method set out above in 2.1.5.

2.7 Hardstanding/Parking Areas

Problem:

Information should be provided to describe how local infiltration will be maximized for runoff from proposed parking and hardstanding areas, in accordance with the requirements of Section 12.4.8 of the County Development Plan 2022-2028.

Recommendation:

The designer could provide a SuDs Layout Drawing highlighting the infiltration features that have been incorporated into the design.

2.8 Discharge Rates (Qbar)

Problem:

Table 2-1 of the Sea Garden Phase 1 Block A Stormwater Impact Assessment Report (0118265DG0014 rev 0) states that discharge will be uncontrolled as the discharge would be into tidal waters. The table states that this discharge approach was as per the planning compliance submission for Coastal Quarter SHD ABP ref 311181.

Section 4 “Existing Site Hydrology” of same report states that the proposed development will “discharge into the Dargle River at a restricted rate”.

Recommendation:

The designer could amend the report to clarify the approach.

Appendix A Drawings and Documents Examined by the Author

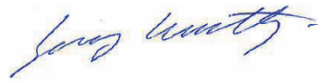
Appendix B Stage 1 Stormwater Audit Feedback Form

Scheme Title: Sea Gardens Phase 1 Block A

Audit Stage: 1 **Audit Completed:** 17-06-2025 **Project Ref:** 252175

Paragraph No. in Audit Report	Issue Accepted (Yes/No)	Recommended Measure Accepted (Yes/No)	Alternative Measures (described) [or reason problem not accepted]	Alternative Measures Accepted by Auditors (Yes/No)
2.3	Y	Y	An allowance of 30% for climate change has been allowed for within the hydraulic model. This allows for 20% c/c and an additional 10% which has been previously deemed an acceptable approach by DLRCC. It is noted that has this is a large apartment block located at the highest point of the site, there is no scope for Urban Creep to create additional runoff at this location.	Yes
2.4	Y	Y	Flood flow route drawing updated to expand on area within the subject site. Please refer to drawing 0504	Yes
2.5	Y	N	We can confirm there are no existing services in this area due to the previous use as a golf course. Existing foul services as previously noted are indicated to the North and East of the proposed site, however, the proposed development has been specifically designed not to impact on these and their associated UE wayleave requirements.	Yes

Paragraph No. in Audit Report	Issue Accepted (Yes/No)	Recommended Measure Accepted (Yes/No)	Alternative Measures (described) [or reason problem not accepted]	Alternative Measures Accepted by Auditors (Yes/No)
2.6	Y	N	The existing site has no private storm drainage. The storm drainage that proposed development is currently under the control of the applicant and therefore no permission is required to discharge into it. The planning report discusses that the proposed storm drainage for the site will discharge into the existing storm drainage network constructed as part of the Sea Gardens Phase 1. If at the time of construction, the existing network is taken in charge by DLRCC / WCC a successful grant of planning along with planning compliance and agreements with DLRCC / WCC will allow for connection into the existing network. It is noted within the report that there is existing trunk foul drainage located to the North and East of the proposed development. No diversions are required to existing infrastructure and the planning application will be submitted with support of a Confirmation of Feasibility from Uisce Eireann.	Yes
2.7	Y	Y	Drawing 501 has been indicated to show extents of Permeable paving to lightly trafficked areas located to the west of the proposed building along with rain gardens to the east of the building in coordination with the landscape architects design. Minor / local footways surrounding the building will have runoff into the landscape areas.	Yes
2.8	Y	Y	It is noted that discharge to the will be uncontrolled as the discharge is to tidal water. Report has been updated to indicate uncontrolled discharge.	Yes

Signed:  *Design Team Project Manager* **Date:** 26/06/25.....

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Please complete and return to the auditor

Auditor Signed Off:  *Auditor* **Date:** 26/06/25.....

.....

Appendix B. Storm Drainage Model

B.1. Simulation Criteria

Simulation Criteria for Storm

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

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

Synthetic Rainfall Details

Rainfall Model		FSR	Profile Type		Winter
Return Period (years)		30	Cv (Summer)		1.000
Region	Scotland and Ireland		Cv (Winter)		1.000
M5-60 (mm)		16.900	Storm Duration (mins)		30
Ratio R		0.269			

as per DLRCC requirements

M5-60 and Ratio 'R' as per Met Eireann Return Period Rainfall Depths for sliding Duration Data

B.2. Outfall Details

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)
S1.010	S	4.290	2.903	2.903	0	0

Overflow Level from permitted development

B.3. Pipeline Schedule

PIPELINE SCHEDULES for Storm

Upstream Manhole

PN	Hyd Sect	Diam (mm)	MH Name	C.Level (m)	I.Level (m)	D.Depth (m)	MH Connection	MH DIAM., L*W (mm)
S1.000	o	225	S1	9.920	8.395	1.300	Open Manhole	1200
S1.001	o	300	S2	9.370	7.770	1.300	Open Manhole	1200
S2.000	o	300	S4	10.060	8.560	1.200	Open Manhole	1200
S2.001	o	375	S5	10.100	8.172	1.553	Open Manhole	1350
S3.000	o	300	S6	9.930	8.330	1.300	Open Manhole	1200
S3.001	o	375	S7	10.150	8.014	1.761	Open Manhole	1350
S3.002	o	375	S8	10.170	7.984	1.811	Open Manhole	1350
S3.003	o	375	S9	10.030	7.852	1.803	Open Manhole	1350
S3.004	o	450	S10	9.930	7.681	1.799	Open Manhole	1350
S2.002	o	450	S11	10.050	7.654	1.946	Open Manhole	1350
S2.003	o	450	S12	9.910	7.591	1.869	Open Manhole	1350
S2.004	o	450	S13	9.700	7.342	1.908	Open Manhole	1350
S4.000	o	225	S14	9.760	8.235	1.300	Open Manhole	1200
S5.000	o	375	S17	9.272	7.461	1.436	Open Manhole	1350
S6.000	o	375	S18	9.075	7.355	1.345	Open Manhole	1350
S5.001	o	450	S19	9.695	7.102	2.143	Open Manhole	1350
S2.005	o	600	S20	9.600	6.904	2.096	Open Manhole	1500

Downstream Manhole

PN	Length (m)	Slope (1:X)	MH Name	C.Level (m)	I.Level (m)	D.Depth (m)	MH Connection	MH DIAM., L*W (mm)
S1.000	47.125	85.7	S2	9.370	7.845	1.300	Open Manhole	1200
S1.001	30.936	70.0	S3	8.930	7.328	1.302	Open Manhole	1500
S2.000	52.580	168.0	S5	10.100	8.247	1.553	Open Manhole	1350
S2.001	4.530	119.2	S11	10.050	8.134	1.541	Open Manhole	1350
S3.000	55.360	229.7	S7	10.150	8.089	1.761	Open Manhole	1350
S3.001	7.569	250.0	S8	10.170	7.984	1.811	Open Manhole	1350
S3.002	33.051	250.0	S9	10.030	7.852	1.803	Open Manhole	1350
S3.003	23.816	250.0	S10	9.930	7.756	1.799	Open Manhole	1350
S3.004	6.814	250.0	S11	10.050	7.654	1.946	Open Manhole	1350
S2.002	19.018	300.0	S12	9.910	7.591	1.869	Open Manhole	1350
S2.003	43.463	175.0	S13	9.700	7.342	1.908	Open Manhole	1350
S2.004	40.013	139.1	S20	9.600	7.055	2.095	Open Manhole	1500
S4.000	38.761	164.9	S20	9.600	8.000	1.375	Open Manhole	1500
S5.000	49.559	174.5	S19	9.695	7.177	2.143	Open Manhole	1350
S6.000	44.478	250.0	S19	9.695	7.177	2.143	Open Manhole	1350
S5.001	19.019	400.0	S20	9.600	7.054	2.096	Open Manhole	1500
S2.005	69.700	500.0	S3	8.930	6.765	1.565	Open Manhole	1500

Proposed within this application

PIPELINE SCHEDULES for Storm

Upstream Manhole

PN	Hyd Sect	Diam (mm)	MH Name	C.Level (m)	I.Level (m)	D.Depth (m)	MH Connection	MH DIAM., L*W (mm)
S1.002	o	600	S3	8.930	5.946	2.384	Open Manhole	1500
S1.003	o	600	S23	8.710	5.426	2.684	Open Manhole	1500
S7.000	o	225	S24	8.584	7.159	1.200	Open Manhole	1200
S7.001	o	225	S25	8.986	6.938	1.823	Open Manhole	1200
S1.004	o	600	S26	8.490	4.994	2.896	Open Manhole	1500
S8.000	o	225	S27	10.040	8.615	1.200	Open Manhole	1200
S8.001	o	225	S28	9.250	6.983	2.042	Open Manhole	1200
S8.002	o	225	S29	8.240	6.462	1.553	Open Manhole	1200
S8.003	o	225	S30	7.810	6.385	1.200	Open Manhole	1200
S9.000	o	300	S31	7.030	5.530	1.200	Open Manhole	1200
S10.000	o	225	S32	7.160	5.725	1.210	Open Manhole	1200
S9.001	o	375	S33	7.130	5.290	1.465	Open Manhole	1350
S8.004	o	450	S34	7.310	5.131	1.729	Open Manhole	1350
S8.005	o	525	S35	7.005	4.873	1.607	Open Manhole	1500
S1.005	o	675	S36	6.930	2.886	3.369	Open Manhole	1500
S1.006	o	750	S37	4.930	2.352	1.828	Open Manhole	1800

Downstream Manhole

PN	Length (m)	Slope (1:X)	MH Name	C.Level (m)	I.Level (m)	D.Depth (m)	MH Connection	MH DIAM., L*W (mm)
S1.002	9.316	75.0	S23	8.710	5.822	2.288	Open Manhole	1500
S1.003	8.522	75.0	S26	8.490	5.312	2.578	Open Manhole	1500
S7.000	44.165	200.0	S25	8.986	6.938	1.823	Open Manhole	1200
S7.001	16.107	200.0	S26	8.490	6.858	1.407	Open Manhole	1500
S1.004	60.255	107.8	S36	6.930	4.435	1.895	Open Manhole	1500
S8.000	33.448	42.0	S28	9.250	7.819	1.206	Open Manhole	1200
S8.001	20.208	120.3	S29	8.240	6.815	1.200	Open Manhole	1200
S8.002	9.199	119.5	S30	7.810	6.385	1.200	Open Manhole	1200
S8.003	10.390	20.0	S34	7.310	5.866	1.220	Open Manhole	1350
S9.000	14.767	95.9	S33	7.130	5.376	1.454	Open Manhole	1350
S10.000	8.154	25.8	S33	7.130	5.409	1.496	Open Manhole	1350
S9.001	15.358	182.8	S34	7.310	5.206	1.729	Open Manhole	1350
S8.004	47.418	300.0	S35	7.005	4.973	1.582	Open Manhole	1500
S8.005	40.106	250.0	S36	6.930	4.713	1.692	Open Manhole	1500
S1.005	55.136	120.1	S37	4.930	2.427	1.828	Open Manhole	1800
S1.006	11.245	200.8	S38	5.090	2.296	2.044	Open Manhole	1800

PIPELINE SCHEDULES for Storm

Upstream Manhole

PN	Hyd Sect	Diam (mm)	MH Name	C.Level (m)	I.Level (m)	D.Depth (m)	MH Connection	MH DIAM., L*W (mm)
S11.000	o	300	S40	7.056	4.600	2.156	Open Manhole	1200
S11.001	o	375	S41	6.848	4.040	2.433	Open Manhole	1350
S11.002	o	375	S41A	5.160	3.546	1.239	Open Manhole	1350
S1.007	o	750	S38	5.090	2.296	2.044	Open Manhole	1800
S12.000	o	225	S42	6.606	5.048	1.333	Open Manhole	1200
S12.001	o	225	S43	6.300	4.726	1.349	Open Manhole	1200
S1.008	o	750	S44	6.180	2.154	3.276	Open Manhole	1800
S1.009	o	750	S45	3.500	2.100	0.650	Open Manhole	1800
S1.010	o	750	S46	4.290	3.000	0.540	Open Manhole	1500

Downstream Manhole

PN	Length (m)	Slope (1:X)	MH Name	C.Level (m)	I.Level (m)	D.Depth (m)	MH Connection	MH DIAM., L*W (mm)
S11.000	66.488	210.4	S41	6.848	4.284	2.264	Open Manhole	1350
S11.001	49.387	100.0	S41A	5.160	3.546	1.239	Open Manhole	1350
S11.002	17.854	99.7	S38	5.090	3.367	1.348	Open Manhole	1800
S1.007	39.314	276.9	S44	6.180	2.154	3.276	Open Manhole	1800
S12.000	38.698	120.0	S43	6.300	4.726	1.349	Open Manhole	1200
S12.001	12.353	120.0	S44	6.180	4.623	1.332	Open Manhole	1800
S1.008	72.883	1349.7	S45	3.500	2.100	0.650	Open Manhole	1800
S1.009	27.811	600.0	S46	4.290	2.054	1.486	Open Manhole	1500
S1.010	2.500	25.8	S	4.290	2.903	0.637	Open Manhole	0

B.4. Critical Storm Simulation Results

OK when the maximum water level is lower than the pipe's soffit.

SURCHARGED when the maximum water level is above the pipe's soffit and to within 300mm of the manhole cover level. (Allowable for 1 in 30 year storm events and greater in accordance with the GDSDS, refer to table 2-1)

FLOOD RISK when the maximum water level is above the pipe’s soffit but below the manhole cover by the depth specified in the Preferences.

FLOOD when the maximum water level is above the manhole cover (No Flooding has been indicated within Summary of Results for up to the 1 in 100 year storm event)

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

Synthetic Rainfall Details

Rainfall Model	FSR	M5-60 (mm) 16.900	Cv (Summer) 1.000
Region	Scotland and Ireland	Ratio R 0.269	Cv (Winter) 1.000

Margin for Flood Risk Warning (mm)	200.0
Analysis Timestep	2.5 Second Increment (Extended)
DTS Status	OFF
DVD Status	ON
Inertia Status	ON

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

PN	US/MH Name	Storm	Return Period	Climate Change	First (X) Surcharge	First (Y) Flood	First (Z) Overflow	Overflow Act.	Water Level (m)	Surcharged Depth (m)	Flooded Volume (m³)
S1.000	S1	15 Summer	30	+30%	30/15 Summer				9.080	0.460	0.000
S1.001	S2	15 Summer	30	+30%					7.935	-0.135	0.000
S2.000	S4	15 Summer	30	+30%	30/15 Summer				8.889	0.029	0.000
S2.001	S5	15 Summer	30	+30%					8.474	-0.073	0.000
S3.000	S6	15 Summer	30	+30%	30/15 Summer				8.885	0.255	0.000
S3.001	S7	15 Summer	30	+30%	30/15 Summer				8.754	0.365	0.000
S3.002	S8	15 Summer	30	+30%	30/15 Summer				8.734	0.375	0.000
S3.003	S9	15 Summer	30	+30%	30/15 Summer				8.627	0.401	0.000
S3.004	S10	15 Summer	30	+30%	30/15 Summer				8.495	0.364	0.000
S2.002	S11	15 Summer	30	+30%	30/15 Summer				8.464	0.360	0.000
S2.003	S12	15 Summer	30	+30%	30/15 Summer				8.352	0.311	0.000
S2.004	S13	15 Summer	30	+30%	30/15 Summer				8.048	0.256	0.000
S4.000	S14	15 Summer	30	+30%	30/15 Summer				8.570	0.110	0.000
S5.000	S17	15 Summer	30	+30%	30/15 Summer				8.111	0.275	0.000
S6.000	S18	15 Summer	30	+30%	30/15 Summer				8.025	0.295	0.000
S5.001	S19	15 Summer	30	+30%	30/15 Summer				7.922	0.370	0.000
S2.005	S20	15 Summer	30	+30%	30/15 Summer				7.790	0.285	0.000
S1.002	S3	15 Summer	30	+30%	30/15 Summer				6.713	0.168	0.000
S1.003	S23	30 Summer	30	+30%	30/15 Summer				6.195	0.169	0.000
S7.000	S24	15 Summer	30	+30%	30/15 Summer				7.954	0.570	0.000
S7.001	S25	15 Summer	30	+30%	30/15 Summer				7.323	0.160	0.000
S1.004	S26	30 Summer	30	+30%	30/15 Summer				5.815	0.221	0.000
S8.000	S27	15 Summer	30	+30%					8.779	-0.061	0.000
S8.001	S28	15 Summer	30	+30%	30/15 Summer				7.433	0.225	0.000
S8.002	S29	15 Summer	30	+30%	30/15 Summer				6.925	0.238	0.000
S8.003	S30	15 Summer	30	+30%					6.539	-0.071	0.000
S9.000	S31	15 Summer	30	+30%	30/15 Summer				6.177	0.347	0.000
S10.000	S32	15 Summer	30	+30%	30/15 Summer				6.287	0.337	0.000
S9.001	S33	15 Summer	30	+30%	30/15 Summer				6.057	0.392	0.000
S8.004	S34	15 Summer	30	+30%	30/15 Summer				5.953	0.372	0.000

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

PN	US/MH Name	Flow / Cap.	Overflow (l/s)	Pipe Flow (l/s)	Status	Level Exceeded
S1.000	S1	1.33		71.3	SURCHARGED	
S1.001	S2	0.58		70.7	OK	
S2.000	S4	1.02		82.5	SURCHARGED	
S2.001	S5	0.88		94.7	OK	
S3.000	S6	0.98		67.8	SURCHARGED	
S3.001	S7	0.84		72.7	SURCHARGED	
S3.002	S8	0.89		100.5	SURCHARGED	
S3.003	S9	1.15		124.7	SURCHARGED	
S3.004	S10	0.98		124.8	SURCHARGED	
S2.002	S11	1.37		203.9	SURCHARGED	
S2.003	S12	1.06		231.6	SURCHARGED	
S2.004	S13	0.96		234.4	SURCHARGED	
S4.000	S14	1.21		46.4	SURCHARGED	
S5.000	S17	0.92		128.1	SURCHARGED	
S6.000	S18	0.84		96.7	SURCHARGED	
S5.001	S19	1.70		213.5	SURCHARGED	
S2.005	S20	1.78		494.4	SURCHARGED	
S1.002	S3	1.58		556.9	SURCHARGED	
S1.003	S23	1.59		553.0	SURCHARGED	
S7.000	S24	1.67		58.3	SURCHARGED	
S7.001	S25	1.77		57.3	SURCHARGED	
S1.004	S26	1.10		649.3	SURCHARGED	
S8.000	S27	0.88		66.6	OK	
S8.001	S28	1.53		65.6	SURCHARGED	
S8.002	S29	2.02		79.0	SURCHARGED	
S8.003	S30	0.81		79.2	OK	
S9.000	S31	0.49		46.1	SURCHARGED	
S10.000	S32	0.83		65.4	SURCHARGED	
S9.001	S33	0.99		112.2	SURCHARGED	
S8.004	S34	1.77		297.4	SURCHARGED	

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

PN	US/MH Name	Storm	Return Period	Climate Change	First (X) Surcharge	First (Y) Flood	First (Z) Overflow	Overflow Act.	Water Level (m)	Surcharged Depth (m)	Flooded Volume (m³)
S8.005	S35	15 Summer	30	+30%					5.397	-0.001	0.000
S1.005	S36	30 Summer	30	+30%	30/15 Summer				5.168	1.607	0.000
S1.006	S37	30 Summer	30	+30%	30/15 Summer				4.529	1.427	0.000
S11.000	S40	15 Summer	30	+30%					4.738	-0.162	0.000
S11.001	S41	30 Summer	30	+30%					4.228	-0.187	0.000
S11.002	S41A	30 Summer	30	+30%	30/15 Summer				4.214	0.293	0.000
S1.007	S38	30 Summer	30	+30%	30/15 Summer				4.205	1.159	0.000
S12.000	S42	15 Summer	30	+30%					5.160	-0.113	0.000
S12.001	S43	15 Summer	30	+30%					4.893	-0.058	0.000
S1.008	S44	30 Summer	30	+30%	30/15 Summer				3.869	0.965	0.000
S1.009	S45	30 Summer	30	+30%	30/15 Summer				3.359	0.509	0.000
S1.010	S46	30 Summer	30	+30%	30/15 Summer				3.026	0.271	0.000

PN	US/MH Name	Flow / Cap.	Overflow (l/s)	Pipe Flow (l/s)	Status	Level Exceeded
S8.005	S35	1.03		274.5	OK	
S1.005	S36	1.20		894.8	SURCHARGED	
S1.006	S37	1.73		901.9	SURCHARGED	
S11.000	S40	0.43		31.6	OK	
S11.001	S41	0.25		46.1	OK	
S11.002	S41A	0.31		51.2	SURCHARGED	
S1.007	S38	1.51		910.4	SURCHARGED	
S12.000	S42	0.49		21.9	OK	
S12.001	S43	0.88		35.9	OK	
S1.008	S44	2.64		904.5	SURCHARGED	
S1.009	S45	2.45		903.3	FLOOD RISK	
S1.010	S46	2.21		902.5	SURCHARGED	

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

Synthetic Rainfall Details

Rainfall Model	FSR	M5-60 (mm) 16.900	Cv (Summer) 1.000
Region	Scotland and Ireland	Ratio R 0.269	Cv (Winter) 1.000

Margin for Flood Risk Warning (mm)	200.0
Analysis Timestep	2.5 Second Increment (Extended)
DTS Status	OFF
DVD Status	ON
Inertia Status	ON

Profile(s)	Summer and Winter
Duration(s) (mins)	15, 30, 60, 120, 180, 240, 360
Return Period(s) (years)	100
Climate Change (%)	30

PN	US/MH Name	Storm	Return Period	Climate Change	First (X) Surcharge	First (Y) Flood	First (Z) Overflow	Overflow Act.	Water Level (m)	Surcharged Depth (m)
S1.000	S1	15 Summer	100	+30%	100/15 Summer				9.611	0.991
S1.001	S2	15 Summer	100	+30%					7.961	-0.109
S2.000	S4	15 Summer	100	+30%	100/15 Summer				9.331	0.471
S2.001	S5	30 Summer	100	+30%	100/15 Summer				9.074	0.527
S3.000	S6	15 Summer	100	+30%	100/15 Summer				9.629	0.999
S3.001	S7	15 Summer	100	+30%	100/15 Summer				9.420	1.031
S3.002	S8	15 Summer	100	+30%	100/15 Summer				9.394	1.035
S3.003	S9	15 Summer	100	+30%	100/15 Summer				9.236	1.010
S3.004	S10	15 Summer	100	+30%	100/15 Summer				9.029	0.898
S2.002	S11	15 Summer	100	+30%	100/15 Summer				8.989	0.885
S2.003	S12	30 Summer	100	+30%	100/15 Summer				8.811	0.770
S2.004	S13	30 Summer	100	+30%	100/15 Summer				8.398	0.606
S4.000	S14	15 Summer	100	+30%	100/15 Summer				8.802	0.342
S5.000	S17	15 Summer	100	+30%	100/15 Summer				8.628	0.792
S6.000	S18	15 Summer	100	+30%	100/15 Summer				8.475	0.745
S5.001	S19	15 Summer	100	+30%	100/15 Summer				8.288	0.736
S2.005	S20	15 Summer	100	+30%	100/15 Summer				8.061	0.557
S1.002	S3	30 Summer	100	+30%	100/15 Summer				7.543	0.997
S1.003	S23	30 Summer	100	+30%	100/15 Summer				7.159	1.133
S7.000	S24	15 Summer	100	+30%	100/15 Summer				8.440	1.056
S7.001	S25	15 Summer	100	+30%	100/15 Summer				7.472	0.309
S1.004	S26	30 Summer	100	+30%	100/15 Summer				6.772	1.179
S8.000	S27	15 Summer	100	+30%	100/15 Summer				9.005	0.165
S8.001	S28	15 Summer	100	+30%	100/15 Summer				7.722	0.514
S8.002	S29	15 Summer	100	+30%	100/15 Summer				7.153	0.466
S8.003	S30	30 Summer	100	+30%	100/15 Summer				6.770	0.160
S9.000	S31	30 Summer	100	+30%	100/15 Summer				6.654	0.824
S10.000	S32	15 Summer	100	+30%	100/15 Summer				6.742	0.792
S9.001	S33	30 Summer	100	+30%	100/15 Summer				6.532	0.867
S8.004	S34	30 Summer	100	+30%	100/15 Summer				6.517	0.936
S8.005	S35	30 Summer	100	+30%	100/15 Summer				6.160	0.762

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

PN	US/MH Name	Flooded Volume (m^3)	Flow / Cap.	Overflow (l/s)	Pipe Flow (l/s)	Status	Level Exceeded
S1.000	S1	0.000	1.64		87.9	SURCHARGED	
S1.001	S2	0.000	0.72		87.7	OK	
S2.000	S4	0.000	1.26		101.4	SURCHARGED	
S2.001	S5	0.000	0.86		91.9	SURCHARGED	
S3.000	S6	0.000	1.10		76.1	SURCHARGED	
S3.001	S7	0.000	0.98		84.8	SURCHARGED	
S3.002	S8	0.000	1.12		126.5	SURCHARGED	
S3.003	S9	0.000	1.44		155.7	SURCHARGED	
S3.004	S10	0.000	1.21		154.6	SURCHARGED	
S2.002	S11	0.000	1.63		243.0	SURCHARGED	
S2.003	S12	0.000	1.26		275.7	SURCHARGED	
S2.004	S13	0.000	1.13		274.3	SURCHARGED	
S4.000	S14	0.000	1.54		58.8	SURCHARGED	
S5.000	S17	0.000	1.12		156.1	SURCHARGED	
S6.000	S18	0.000	1.02		118.0	SURCHARGED	
S5.001	S19	0.000	2.15		270.4	SURCHARGED	
S2.005	S20	0.000	2.21		614.3	SURCHARGED	
S1.002	S3	0.000	1.77		623.8	SURCHARGED	
S1.003	S23	0.000	1.81		628.6	SURCHARGED	
S7.000	S24	0.000	2.05		71.7	FLOOD RISK	
S7.001	S25	0.000	2.22		72.2	SURCHARGED	
S1.004	S26	0.000	1.24		736.7	SURCHARGED	
S8.000	S27	0.000	1.08		81.7	SURCHARGED	
S8.001	S28	0.000	1.88		80.7	SURCHARGED	
S8.002	S29	0.000	2.39		93.5	SURCHARGED	
S8.003	S30	0.000	0.89		87.1	SURCHARGED	
S9.000	S31	0.000	0.57		54.1	SURCHARGED	
S10.000	S32	0.000	1.03		81.7	SURCHARGED	
S9.001	S33	0.000	1.14		129.2	SURCHARGED	
S8.004	S34	0.000	2.05		344.4	SURCHARGED	
S8.005	S35	0.000	1.20		320.5	SURCHARGED	

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

PN	US/MH Name	Storm	Return Period	Climate Change	First (X) Surcharge	First (Y) Flood	First (Z) Overflow	Overflow Act.	Water Level (m)	Surcharged Depth (m)
S1.005	S36	30 Summer	100	+30%	100/15 Summer				5.974	2.413
S1.006	S37	30 Summer	100	+30%	100/15 Summer	100/15 Summer			4.950	1.848
S11.000	S40	15 Summer	100	+30%					4.761	-0.139
S11.001	S41	30 Summer	100	+30%	100/15 Summer				4.599	0.184
S11.002	S41A	30 Summer	100	+30%	100/15 Summer				4.576	0.655
S1.007	S38	30 Summer	100	+30%	100/15 Summer				4.557	1.511
S12.000	S42	15 Summer	100	+30%					5.180	-0.093
S12.001	S43	15 Summer	100	+30%	100/15 Summer				4.978	0.027
S1.008	S44	30 Summer	100	+30%	100/15 Summer				4.150	1.246
S1.009	S45	30 Summer	100	+30%	100/15 Summer	100/15 Summer			3.505	0.655
S1.010	S46	30 Summer	100	+30%	100/15 Summer				3.099	0.344

PN	US/MH Name	Flooded Volume (m^3)	Flow / Cap.	Overflow (l/s)	Pipe Flow (l/s)	Status	Level Exceeded
S1.005	S36	0.000	1.48		1101.4	SURCHARGED	
S1.006	S37	19.816	1.99		1034.8	FLOOD	5
S11.000	S40	0.000	0.56		41.0	OK	
S11.001	S41	0.000	0.33		60.2	SURCHARGED	
S11.002	S41A	0.000	0.36		59.5	SURCHARGED	
S1.007	S38	0.000	1.70		1025.9	SURCHARGED	
S12.000	S42	0.000	0.63		28.5	OK	
S12.001	S43	0.000	1.13		45.9	SURCHARGED	
S1.008	S44	0.000	2.96		1014.9	SURCHARGED	
S1.009	S45	5.234	2.71		997.8	FLOOD	5
S1.010	S46	0.000	2.44		997.9	SURCHARGED	

Appendix C. UK SuDS Output

Greenfield runoff rate estimation for sites

www.uksuds.com | Greenfield runoff tool

Calculated by:	Peter Egan
Site name:	North Catchment - Revised Qbar
Site location:	Coastal Quarter SHD

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

Site Details

Latitude:	53.21123° N
Longitude:	6.10625° W
Reference:	1902335231
Date:	Jun 21 2021 10:48

Runoff estimation approach

IH124

Site characteristics

Total site area (ha): 2.228

Methodology

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

Soil characteristics

	Default	Edited
SOIL type:	2	4
HOST class:	N/A	N/A
SPR/SPRHOST:	0.3	0.47

Hydrological characteristics

	Default	Edited
SAAR (mm):	963	825
Hydrological region:	12	12
Growth curve factor 1 year:	0.85	0.85
Growth curve factor 30 years:	2.13	2.13
Growth curve factor 100 years:	2.61	2.61
Growth curve factor 200 years:	2.86	2.86

Notes

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

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

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

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

(3) Is SPR/SPRHOST ≤ 0.3?

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

Greenfield runoff rates

	Default	Edited
Q_{BAR} (l/s):	5.9	13.04
1 in 1 year (l/s):	5.01	11.08
1 in 30 years (l/s):	12.56	27.77
1 in 100 year (l/s):	15.39	34.02
1 in 200 years (l/s):	16.87	37.28

Greenfield runoff rate estimation for sites

www.uksuds.com | Greenfield runoff tool

Calculated by:	Peter Egan
Site name:	South Catchement
Site location:	Ballymore

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

Site Details

Latitude:	53.20959° N
Longitude:	6.10528° W
Reference:	275982064
Date:	Feb 16 2021 10:16

Runoff estimation approach

IH124

Site characteristics

Total site area (ha): 4.338

Methodology

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

Soil characteristics

	Default	Edited
SOIL type:	2	4
HOST class:	N/A	N/A
SPR/SPRHOST:	0.3	0.47

Hydrological characteristics

	Default	Edited
SAAR (mm):	963	1027.99
Hydrological region:	12	12
Growth curve factor 1 year:	0.85	0.85
Growth curve factor 30 years:	2.13	2.13
Growth curve factor 100 years:	2.61	2.61
Growth curve factor 200 years:	2.86	2.86

Notes

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

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

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

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

(3) Is SPR/SPRHOST ≤ 0.3?

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

Greenfield runoff rates

	Default	Edited
Q_{BAR} (l/s):	11.48	32.83
1 in 1 year (l/s):	9.76	27.91
1 in 30 years (l/s):	24.46	69.93
1 in 100 year (l/s):	29.97	85.69
1 in 200 years (l/s):	32.84	93.9