


REPORT

Civil Engineering Report for Whitebox Student Campus at Groody Road, Newcastle, Castletroy, Limerick

January 2025

GARLAND
Concepts Realised

CONTENTS

APPENDICES

Description of Change	Originator	Rev	Approval	Date
Initial Release	PC	1st	BL	09/10/24
Updated introduction	PC	A	BL	16/10/24
Updated Project Details	PC	B	BL	23/01/25

1. INTRODUCTION

This report has been prepared by GARLAND to describe the proposed water and drainage services for a development at Groody Road consisting of 196 no. bed clusters, distributed across 5 no. separate blocks, ranging in height from 5 - 8 storeys, with a total of 1,400 no. student bedspaces and all other associated site development works.

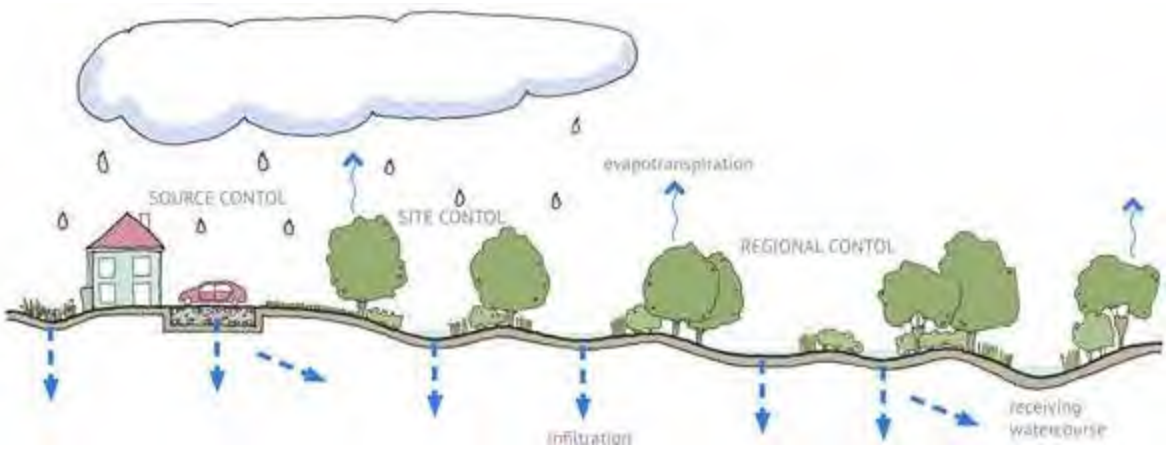
2. SURFACE WATER DRAINAGE

2.1 Sustainable Urban Drainage System

SUDS addresses the water quality, water quantity, amenity and biodiversity by the management of surface water run off in a sequence of treatment processes along the drainage infrastructure network. Using the www.uksuds.com website, an assessment of the appropriate applicable SUDS features were evaluated. The appropriate SUDS features included in this proposal include the following:

- Bioretention systems
- Green roofs
- Permeable paving
- Wetland
- Catchpit manhole
- Bypass interceptor
- Hydrobrake limiting flow to Qbar greenfield rates

The SUDS management train approach to designing the storm water network has been applied in this proposed development similar in principle to the figure below



2.1.1 Source Control

Source control aims to detain or infiltrate runoff as close as possible to the point origin.

Bioretention systems are proposed to be installed in the courtyard areas throughout the development at locations highlighted on the landscape

engineering drawings. Bioretention systems are shallow landscaped depressions that can reduce runoff rates and volumes, treat pollution through the use of engineered soils and vegetation and facilitate infiltration. They are particularly effective in delivering interception and can also provide attractive landscape features that are self-irrigating and fertilising, habitat, biodiversity and cooling of the local microclimate due to evapotranspiration. Details of the biodiversity systems to be installed are shown on the landscape engineering plan and W0657-024.

Parking areas will feature permeable paving allowing infiltration of storm water to ground. These provide a pavement suitable for lighter traffic movement while allowing rainwater to infiltrate through the surface into the structural layers beneath. The water is temporarily stored beneath the overlying surface before infiltration to the sub-surface. Treatment process that occur within the surface structure, the subsurface matrix (including soil layers) and the geotextile layers include filtration, adsorption, biodegradation and sedimentation. Refer to drawing W0657-020 for the private permeable paving locations.

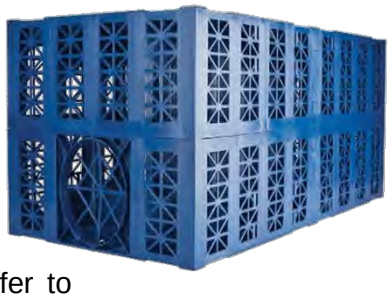
The type of permeable paving proposed for the parking areas on this site is an Aquaflow ® paving system by Roadstone, or similar NSAI certified or equivalent (IAB or BBA cert) approved. To account for the variable infiltration rate of the soils and potential localised clogging of permeable paving areas if not adequately maintained, the overall area of the permeable paving has also been accounted for in the storm network and attenuation tank design, as per CIRIA SUDS manual guidance.

The opportunity to infiltrate to ground within this restricted site are limited however there is still scope to provide a level of interception storage, time delay and treatment as the surface water flows through proposed green roofs on the development. In accordance with the CIRIA SUDS Manual 2015, green roofs can be used to treat and attenuate runoff in their substrate and support root uptake of water with appropriate planting and are an integral part of source control on a site. Green roofs can increase the indigenous biodiversity and is an encouraging environmentally design strategy in accordance with the Limerick City and County Council Development Plan. Green roofs are proposed for a proportion of flat roof area of the apartment blocks. The exact area of the green roof is to be coordinated with the location of the required mechanical lant and solar panels on the roof. A fall restraint system is to be included in the design of the roof. For structural reasons,

a green roof suitable for use on lightweight roofs will be utilised. Refer to Appendix C for details of the proposed green roof.

2.1.2 Site Control

Site control involves the reduction in volume and rate of surface runoff while also providing some treatment of the runoff. As part of the overall control for the site it is proposed to use an attenuation tank, a wetland and hydrobrake manholes to control the surface water runoff rate to the greenfield runoff rate. The greenfield runoff rate was determined as the greater of 2 l/s/ha and Qbar of the net drained area as specified in the Limerick City and County Council Development Plan. The net drained area of the overall site is 1.319 hectares resulting in a rate of 3.75 l/s, refer to greenfield runoff rate estimation calculations in Appendix A.



The attenuation tank proposed is an underground geocellular type system, such as Wavin “Aqua Cell” type system, or similar approved, with 95% porosity. This type of system is proposed along with a wetland to attenuate the surface water discharging from the development to the greenfield runoff rate.

The attenuation volume required was calculated based on the critical storm duration for the 100 year return period storm event inclusive of a 30% climate change allowance and 10% urban creep. The design was undertaken using hydraulic modelling software WinDes which allows for critical design storm duration analysis. The results of this analysis are provided in Appendix A.

A catchpit manhole will be located upstream of the attenuation tank and wetland area to act as a pre-treatment system. This will allow sediment and silt which was passed through the drainage system to settle out, thus reducing the risk of clogging. Outflow from the attenuation tank and wetland within the site will be restricted using a vortex flow control device on the downstream manhole, namely a Hydrobrake® system, or similar approved.

2.1.3 Regional Control

Regional control comprises of treatment facilities to reduce pollutants from runoff and control the surface water runoff rate to the greenfield runoff rate. As noted above the bioretention systems, bio retention

swales, catchpit manhole and the wetland area will be utilised on this project to limit regional impact. In addition, a bypass interceptor is proposed to be installed on the outfall network for removal of any petrol/ oil contaminants that may still remain in the drainage network.

The bypass interceptor proposed is Klargester Class 1 bypass interceptor, or similar approved, sized based on the outflow form the development. A typical example of the proposed interceptor is shown in Figure 2, with the location and size indicated on Garland's Drainage Drawing W0657-020.

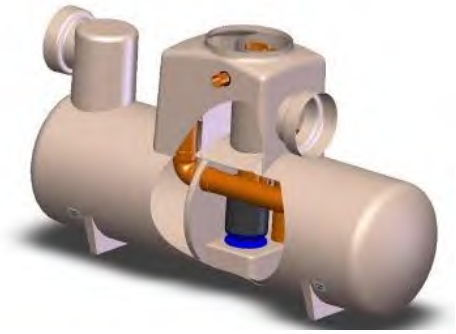


Figure 2 – Proposed Interceptor

2.1.4 SUDS Summary / Considerations:

SUDS Item	Description		Use	Reason
Rainwater Harvesting	Rainwater harvesting systems can be used to effectively drain roofs and provide both water supply and stormwater management benefits.		N	Not proposed for apartment blocks
Permeable Paving	Permeable paving can provide interception, attenuation and storage of surface waters. Permeable paving can be used to infiltrate surface water to ground.		N	No installed because of maintenance requirements of public car parking spaces.
Swale	Swales can be used for road or car park drainage where space allows. Underdrained swales (ie with a subsurface gravel filled conveyance and		Y	Bioretention swales are proposed in the courtyards of the development.

SUDS Item	Description		Use	Reason
	treatment trench) can provide a more efficient solution for hydraulic control and water quality treatment. Swales can be used to convey roof water to other parts of the site.			
Trenches	Trenches can provide treatment and runoff control for road or car park drainage. Trenches can be used to convey roof water to other parts of the site.		N	Bioretention systems and swales are preferred.
Detention Basins	Detention basins can be used in high density developments when effectively integrated within public open space areas. Detention basins can be used to attenuate and treat runoff.		N	A wetland area is preferred. The surface water is to be attenuated in the wetland.
Ponds	Ponds can be used to attenuate and treat roof runoff. It is unlikely that a pond would be suitable for high density development, unless it is an integral amenity feature within the public open space area.		N	A wetland area is preferred. The surface water is to be attenuated in the wetland.
Wetlands	Wetlands can be used to attenuate and treat roof runoff. It is unlikely that a wetland would be suitable for high density development, unless it is an integral amenity feature within the public open space area.		Y	A wetland is to be installed in the open space to the west of the development.

SUDS Item	Description		Use	Reason
Green Roofs	Green roofs can be designed to provide interception, management and treatment of rainfall up to specified rainfall depths. Green roofs can be implemented most cost-effectively on larger roofs. They provide a range of benefits in addition to stormwater management, including combatting the heat island effect, biodiversity and amenity functions.		Y	Green roofs are proposed for this project.
Bioretention Systems	Bioretention systems can be used to attenuate and treat roof runoff. Bioretention systems (either cells or linear systems) can be used for road or car park drainage where space allows.		Y	Bioretention systems to be installed in the courtyard areas throughout the development.
Proprietary Treatment Systems	Proprietary treatment systems may be appropriate to use particularly where there is no space for surface, vegetated treatment systems. However, regular monitoring needs to be ensured so that they are maintained so that they continue to function effectively.		Y	A bypass separator is to be installed upstream of the attenuation tank and wetland
Subsurface Storage	Subsurface storage can be used to attenuate roof runoff. Subsurface storage of runoff is likely to be needed for high density developments.		Y	Surface water to discharge to an attenuation tank.

SUDS Item	Description		Use	Reason
	This can be implemented via a range of proprietary high void systems, or within gravels beneath permeable pavements which provide treatment as well. Sub-surface storage allows the land above the storage system to be used for car parking or public open space areas.			
Subsurface Conveyance Pipes	Subsurface conveyance systems may be an important means of connecting drainage components together and routing flows downstream. Space constraints in high density developments are likely to constrain the use of surface conveyance options		Y	

Table 1 – SUDS Summary / Considerations

Interception storage will be within the green roofs, bioretention systems and permeable paving. In accordance with GDSDS, the volume of interception storage provided is greater than that generated by 5mm of rainfall on the site and up to 10mm if possible.

The surface water runoff rate has been restricted to the greenfield runoff rate and an allowance of 30% climate change and 10% urban creep has been included in the design.

Refer to Appendix C and GARLAND drawing W0657-020, 024, 025 & 026 & 027 for the drainage layout and SUDS details.

In providing the above green roofs, bioretention systems, bioretention swales, wetland, catchpit manholes, bypass separator, attenuation storage and greenfield run off vortex control it is proposed that the SUDS treatment of the surface runoff has been adequately provided.

2.2 Water Quality Protection

The water quality protection measures proposed for the drainage system are as follows;

- Bioretention systems and swales will treat road runoff prior to discharging to the drainage network.
- Road gullies on the road network will remove of initial heavy solids that can be washed into the drainage network – e.g. leaves, stones, heavy grit, etc;
- Catchpit manholes proposed upstream of the porous asphalt will allow settlement of suspended solids washed into the pipe system.
- The wetland will treat road runoff by filtering pollutants from the surface water.
- A Bypass interceptor is proposed upstream of the attenuation systems for removal of any petrol/ oil contaminants that may remain in the drainage network.

2.2.1 Pollution Hazard Indices Assessment:

A Pollution Hazard Indices Assessment was undertaken for the development based on the Simple Index Approach. The method used was guided by the land use and SuDS performance evidence. The design criteria for the Simple Index approach are for the Total SuDS mitigation index (for each contaminant type) ≥ pollution hazard index (for each contaminant type).

Pollution hazard indices are presented in Table 26.2 of the CIRIA SuDS manual as provided below for ease of reference.

Use	Pollution hazard level	Total Suspended Solids (TSS)	Metals	Hydro-carbons
Residential roofs	Very low	0.2	0.2	0.05
Other roofs (typically commercial/industrial roofs)	Low	0.3	0.2 (up to 0.8 where there is potential for metals to leach from the roof)	0.05
Individual property driveways, residential car parks, low traffic roads (e.g. cul de sacs, home zones and general access roads) and non-residential	Low	0.5	0.4	0.4

Use	Pollution hazard level	Total Suspended Solids (TSS)	Metals	Hydro-carbons
car parking with infrequent change (e.g. schools, offices) i.e. <300 traffic movements/day				
Commercial yard and delivery areas, non-residential car parking with frequent change (e.g. hospitals, retail) all roads except low traffic roads and trunk roads/motorways, and roads that have more than 300 traffic movements daily	Medium	0.7	0.6	0.7
Sites with heavy pollution (e.g. haulage yards, lorry parks, highly frequented lorry approaches to industrial estates, waste sites), sites where chemicals and fuels (other than domestic fuel oil) are to be delivered, handled, stored, used or manufactured; industrial sites; trunk roads and motorways	High	0.8	0.8	0.9

Table 2 - Pollution Hazard Indices for Different Land use Classifications

The proposed site consists of the following land uses:

- Residential roofs
- Car parks, low traffic roads

Indicative SuDS mitigation indices are presented in Table 26.3 of the CIRIA SuDS manual and also provided below for ease of reference. These specify the mitigation index for each contaminant type for different types of SuDS measures.

	Mitigation Indices		
Type of SuDS Component	TSS	Metals	Hydrocarbons
Filter Strip	0.4	0.4	0.5

	Mitigation Indices		
Type of SuDS Component	**TSS**	**Metals**	**Hydrocarbons**
Filter Drain	0.4	0.4	0.4
Swale	0.5	0.6	0.6
Biotretention System	0.8	0.8	0.8
Permeable paving	0.7	0.6	0.7
Detention Basin	0.5	0.5	0.6
Pond	0.7	0.7	0.5
Wetland	0.8	0.8	0.8
Propriety treatment system	Designed to address each of the contaminant types to acceptable levels for frequent events up to approximately the 1 In 1 year return period event, for inflow concentrations relevant to the contributing drainage area		

Table 3 - Indicative SuDS mitigation indices for discharges to surface waters

The proposed SuDS measures for the development consist of bio retention systems and a wetland which has been designed to cater for 1:100 storm event plus 30% climate change and 10% urban creep.

Each different SUDS train and associated mitigation measure has been assessed individually:

Run off from the Courtyard Areas

The roof run-off from the courtyard areas will discharge into a bioretnetion system Area (1) prior to the Wetland area (2) and the interceptor (3).

Index	Type	TSS	Metals	Hydrocarbons
Hazard Index	**Courtyard Areas**	**0.5**	**0.4**	**0.4**
Mitigation 1 Index	Bioretention System	0.8	0.8	0.8
Mitigation 2 Index	Wetland Area (50% effective as placed in series)	0.4	0.4	0.4
Mitigation 3 Index	Propriety treatment system (50% effective as placed in series)	Not required as Mitigation 1 index alone is greater than of the Hazard Index		

Index	Type	TSS	Metals	Hydrocarbons
Total Mitigation Provided		**1.2**	**1.2**	**1.2**
Mitigation > Hazard		Yes	Yes	Yes

Table 4 - Comparison of Hazard and Mitigation indices for Courtyard Areas

Residential Roofs and Roads Direct to Gully and Pipe Network

The roof run-off and roads from the residential apartment blocks discharges to a pipe network to a wetland area (1) and an interceptor (2).

Index	Type	TSS	Metals	Hydrocarbons
Hazard Index	**Residential Roofs**	**0.2**	**0.2**	**0.05**
Hazard Index	**Individual property driveways, residential car parks, low traffic roads**	**0.5**	**0.4**	**0.4**
Mitigation 1 Index	Wetland Area	0.8	0.8	0.8
Mitigation 2 Index	Propriety treatment system (50% effective as placed in series)	Not required as Mitigation 1 index is greater than of the Hazard Index		
Total Mitigation Provided		**0.8**	**0.8**	**0.8**
Mitigation > Hazard		Yes	Yes	Yes

Table 5 - Comparison of Hazard and Mitigation indices for Residential Roofs and Roads

The design criteria for the Simple Index approach are for the Total SuDS mitigation index (for each contaminant type) ≥ pollution hazard index (for each contaminant type). As shown above in all cases the mitigation index is greater than the pollution index for each contaminant type. As such the range of SuDS measures proposed satisfies the Simple index Approach and provides adequate mitigation for the site.

2.3 Design of Road Drainage Collection Network

The stormwater network and attenuation systems have been designed to cater for flows which would be generated by the proposed development.

The storm drainage from the car parking spaces roads and footpaths will be collected in gullies and discharged via a traditional storm pipe network to attenuation systems. Given the topography of the site and available green spaces, an attenuation tank

cascading to a wetland is proposed. The attenuation tank attenuates the southern section of the development prior to discharging to the wetland. The wetland attenuates surface water flow from the northern section of the development. The attenuated flows from the wetland will discharge to the Groody River via a headwall at the western site boundary a rate of 3.75l/s. The wetland is to be fenced off to deter people from entering the area for health and safety reasons.

The design of the storm water network and SUDS were based on the following permeability factors from the CIRIA SUDS Manual for the developed site;

- Roofs; 100% runoff.
- Roads and footpaths; 100% runoff.
- Green areas; 0% runoff.

The design of the storm water network and SUDS allow for 30% climate change and 10% urban creep.

This storm pipe network has been designed in accordance with IS EN 12056, IS EN 752 and the Greater Dublin Strategic Drainage Study. The design was completed using hydraulic modelling software WinDes which uses the UK Modified Rational Method, in which the peak flow Q is determined for a storm of critical duration using the following equation:

Q = 3.61 x Cv x i x Ai

Cv = run-off coefficient (0.75), i = rainfall intensity, Ai = impermeable area

The following assumptions were made in the design:

- The maximum discharge of surface water (SW) from an area occurs when the duration of the storm is equal to the time of concentration (tc) of the area. tc = time of entry + (length of drain ÷ full bore velocity of flow).
- Time of entry (te) = 4 minutes.
- Colebrook-White effective roughness (Ks) = 0.6mm for Surface Water Sewers

The layout of the proposed drainage network is shown on Garland Drawing W0657-020. The design calculations are provided in Appendix A. The water quality protection measures that are proposed are described above.

2.4 Finished Floor Level Freeboard Compliance

Section 6.3.2.1 of the Greater Dublin Strategic Drainage Study states that storage pond flooding freeboard of 500mm should be provided to property flood levels. The lowest finished floor level in the development is 7.80m. The following top water levels are designed within the attenuation systems for the 1% AEP event allowing for 30% climate change and 10% urban creep:

- Attenuation Tank = 6.90m
- Wetland = 5.802m

Therefore, a minimum freeboard of 900mm is achieved from the storage system flood level to the lowest finished floor level.

Section 6.3.2.1 of the Greater Dublin Strategic Drainage Study also states that flooding from overland flow in short very high thunderstorm type events, often lasting for only 20 or 30 minutes, involve so much rainfall in this short period that the drainage system cannot cope with the runoff. In this situation water runs off down roads and overland through properties unless it is specifically taken into account.

Manholes MHS-10 to MHS-14 have a freeboard less than 500mm to the lowest finished floor levels in a 15 minute 1% AEP storm event.. However, in accordance with the aforementioned Greater Dublin Strategic Drainage Study, an overland flow path has been created through the fire tender access route between blocks D and E, to allow short events flooded waters from the public storm network to escape overland to the park area and to the Groody River and as a result will not allow water to build up on the surface and will therefore, not affect the finished floor level of the adjacent buildings.

In all other 1% AEP events from 30 minutes in duration and 3.33% AEP storm events a freeboard in excess of 500mm is achieved to the lowest finished floor level.

2.5 Surface Water Outfall and OPW Section 9

It is proposed that attenuated flows from the site will discharge to the Groody River via a headwall at the western site boundary a reduced rate of 3.75l/s. The Groody River is an Arterial Drainage Channel reference C1. As a result, the OPW have been consulted and confirmed that a Section 9 application is required for the works. A Section 9 application to the OPW has been submitted, refer to Appendix D for record of submission.

3. FOUL DRAINAGE

A pre-connection enquiry was lodged with Irish Water for the development outlining the proposed flows and loads which would be generated by the development. This application was undertaken to determine if there is adequate capacity in the existing public foul sewer network to cater for this development. The Uisce Éireann reference number for the application is CDS24007270. A confirmation of feasibility has been received from Uisce Éireann which notes that there is capacity within their system to cater for this development. The Uisce Éireann Confirmation of Feasibility is available within Appendix E. Further details will be agreed with Uisce Éireann during the

connection application process which would commence upon receipt of planning permission.

It is proposed to provide a single gravity foul sewer system for the development, discharging to an existing combined sewer east of the development below the Groody Road refer to drawing W0657-020 attached.

The foul sewer network was designed in accordance with Irish Water Code of Practice July 2020 and to IS EN 12056/ IS EN 752, using hydraulic modelling software WinDes, which uses the Colebrook White equation. These design calculations are included in Appendix B.

The following assumptions were made in the design:

- Colebrook-White effective roughness (Ks) = 1.5mm for Foul Sewers
- Minimum cover to pipes in non-trafficked areas = 900mm
- Minimum cover to pipes in trafficked areas = 1,200mm
- *Pipes with less cover than stated above shall be surrounded in concrete*
- Minimum pipe size to be 150mm diameter as per Irish Water Code of Practice (up to 20 no. houses).

3.1 Wastewater Output Calcualtion

Average Daily Demand	=	Residents No. 1404 x 150 L/Day x 1.1 (For 10% infiltration (I)) = 231,600 L / Day
	=	2.68 L/s

Design Flow = (Pf x P x G) + I + E, where:

Pf = Peaking factor Domestic = 3 (for a population of 1,001 to 5,000)
P = Population = 1404 residents
G = Water Consumption / Capita = 150 l/person/day x 1.1 for unit consumption
I = Infiltration – Negligible for new wastewater system
E = Trade Flow – Not Applicable

Therefore, Design Flow	=	3 x 1404 x 150 l/day x 1.1
	=	694,980 l/day
	=	8.04 l/s

4. WATER SUPPLY

A pre-connection enquiry was lodged with Uisce Éireann for the development outlining the proposed water demand that would be generated by the development. This

application was undertaken to determine if there is adequate capacity in the existing public watermain network to cater for this development. The Irish Water reference number for the application is CDS24007270. The Uisce Éireann reference number for the application is CDS24007270. A confirmation of feasibility has been received from Uisce Éireann which notes that there is capacity within their system to cater for this development. The Uisce Éireann Confirmation of Feasibility is available within Appendix E. Further details will be agreed with Uisce Éireann during the connection application process which would commence upon receipt of planning permission.

It is proposed to provide a 160mm OD watermain with hydrants provided in accordance with Building Regulations. The proposed water supply network layout for the development is shown on GARLAND Drawing W0657-030. It is proposed to connect the development to the existing 300mm diameter east of the development below Groody Road. A new bulk water meter will be installed within the development boundary subject to Irish water consultations.

4.1 Water Supply Demand Calculations

The peak demand for sizing of the pipe network will normally be 5.0 times the average day/ peak week demand from Section 3.7.2 of the Uisce Eireann Water Code of Practice. The average day/peak week demand should be taken as 1.25 times the average daily domestic demand.

Average Daily Domestic Demand = 1404 x 150 l/person/day
= 210,600 l/day
= 2.44 l/s

Average Day / Peak Week Demand = 2.44l/s x 1.25
= 3.05 l/s

5. ROAD DESIGN

This section provides an overview of the key design principles adopted in the road design for the development. The entrance to the development is from Groody Road to the east of the development as shown on GARLAND drawing W0657-010.

Road markings and road signs are to in accordance with IS EN 1436 European Standard for Road Markings and in accordance with the Traffic Signs Manual, refer to GARLAND drawing W0657-050. Footpaths have been widened locally by 300mm at perpendicular parking to allow for overhanging vehicles. Internal pedestrian crossings, including dropped kerbs and tactile paving, are provided at pedestrian desire lines, refer to GARLAND drawing W0657-050. A controlled crossing has been included to provide the safe movement of pedestrians between the proposed development and developments on

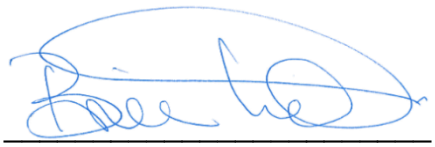
the eastern side of Groody Road. The existing cycle lane at the proposed development junction at the Groody Road roundabout has been designed in line with the current National Cycle Manual.

Adequate sightlines have been provided for the entrance and at horizontal curves to ensure adequate forward visibility for drivers as indicated on GARLAND drawing W0657-040. All road, footpath and car parking dimensions are indicated on GARLAND drawing W0657-040 also. A vehicle tracking analysis has been carried out to confirm that the road network can be safely used by a fire tender vehicle and refuse vehicle. The results are detailed on drawing W0657-060. The internal road layout has been designed to ensure a simple and safe design in accordance with DMURS. The key aim of the design is to provide a self-regulating traffic environment in the estate through the use of suitable road widths and road curvature, with minimum signage and road markings within the development, other than at junctions. This is in line with the key principles of DMURS, which states that;

"*The implementation of a self-regulating street environment means that the reliance on signage or line marking to direct or instruct people is significantly reduced….there may also be traffic calming benefits of a 'less is more' approach to reinforce lower design speeds. For example, the removal of centre line markings has been found to reduce vehicle speeds and the number of accidents. With reduced signage drivers must navigate the street environment with full regard to their own behaviour and the behaviour of others around them. An emphasis on the values of place also requires the visual impact of signage to be considered in order to reduce visual clutter*."

6. FLOOD RISK

A site specific flood risk assessment has been prepared for the development, refer to GARLAND report W0657-Report-001 attached with the planning application.

Signed: 

BRIAN LAHIFF
CHARTERED ENGINEER

Date: 23 January 2025

GARLAND
Concepts Realised

APPENDIX A
Storm Network Calculations

Greenfield runoff rate estimation for sites

www.uksuds.com | Greenfield runoff tool

Calculated by:	Paul Clune
Site name:	Groody Road Student Development
Site location:	Groody Road, Newcastle, Limerick

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

Site Details

Latitude:	52.66402° N
Longitude:	8.58044° W
Reference:	3846678130
Date:	Aug 29 2024 11:05

Runoff estimation approach

IH124

Site characteristics

Total site area (ha): 1.319

Methodology

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

Soil characteristics

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

Hydrological characteristics

	Default	Edited
SAAR (mm):	1023	1023
Hydrological region:	13	13
Growth curve factor 1 year:	0.85	0.85
Growth curve factor 30 years:	1.65	1.65
Growth curve factor 100 years:	1.95	1.95
Growth curve factor 200 years:	2.15	2.15

Notes

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

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

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

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

(3) Is SPR/SPRHOST ≤ 0.3?

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

Greenfield runoff rates

	Default	Edited

Q_{BAR} (l/s):	3.75	3.75
1 in 1 year (l/s):	3.18	3.18
1 in 30 years (l/s):	6.18	6.18
1 in 100 year (l/s):	7.31	7.31
1 in 200 years (l/s):	8.06	8.06

Design Settings

Rainfall Methodology	FSR	Maximum Time of Concentration (mins)	30.00
Return Period (years)	5	Maximum Rainfall (mm/hr)	250.0
Additional Flow (%)	40	Minimum Velocity (m/s)	1.00
FSR Region	Scotland and Ireland	Connection Type	Level Soffits
M5-60 (mm)	15.000	Minimum Backdrop Height (m)	0.200
Ratio-R	0.300	Preferred Cover Depth (m)	1.200
CV	0.750	Include Intermediate Ground	✓
Time of Entry (mins)	4.00	Enforce best practice design rules	✓

Nodes

Name	Area (ha)	T of E (mins)	Cover Level (m)	Diameter (mm)	Easting (m)	Northing (m)	Depth (m)
MHS-14	0.027	4.00	7.980	1200	560820.701	657031.156	1.425
MHS-13	0.093	4.00	7.760	1200	560812.582	657029.588	1.370
MHS-12	0.074	4.00	7.770	1200	560805.135	657032.049	1.501
MHS-11	0.007	4.00	7.810	1200	560799.919	657037.473	1.579
MHS-10	0.222	4.00	7.850	1350	560797.828	657044.772	1.732
MHS-9	0.098	4.00	8.160	1350	560797.448	657099.999	2.263
MHS-8	0.008	4.00	8.060	1350	560777.743	657147.211	2.443
MHS-7	0.349	4.00	8.020	1350	560768.906	657148.957	2.433
MHS-6			7.550	1350	560719.751	657128.656	2.140
MHS-5.1			7.700	1350	560709.917	657123.898	2.326
MHS-5			7.800	1350	560704.105	657121.015	2.500
MHS-4.3	0.208	4.00	7.700	1200	560719.376	657212.964	1.500
MHS-4.2	0.174	4.00	7.500	1350	560680.605	657192.821	1.593
MHS-4.1			7.500	1350	560710.434	657135.440	1.917
MHS-4			7.700	1350	560699.256	657129.914	2.460
MHS-3			7.300	1350	560666.394	657124.936	2.350
MHS-2			6.500	1350	560620.927	657109.334	1.790
MHS-1			7.000	1200	560605.654	657102.756	2.198

Links

Name	US Node	DS Node	Length (m)	ks (mm) / n	US IL (m)	DS IL (m)	Fall (m)	Slope (1:X)	Dia (mm)	T of C (mins)	Rain (mm/hr)
1.000	MHS-14	MHS-13	8.268	0.600	6.555	6.390	0.165	50.1	225	4.07	63.2
1.001	MHS-13	MHS-12	7.843	0.600	6.390	6.344	0.046	170.5	225	4.21	62.5
1.002	MHS-12	MHS-11	7.525	0.600	6.269	6.231	0.038	198.0	300	4.32	61.9
1.003	MHS-11	MHS-10	7.592	0.600	6.231	6.193	0.038	199.8	300	4.43	61.3
1.004	MHS-10	MHS-9	55.228	0.600	6.118	5.897	0.221	249.9	375	5.24	57.6
1.005	MHS-9	MHS-8	51.160	0.600	5.897	5.692	0.205	249.6	375	5.99	54.7
1.006	MHS-8	MHS-7	9.008	0.600	5.617	5.587	0.030	300.3	450	6.11	54.2

Name	Vel (m/s)	Cap (l/s)	Flow (l/s)	US Depth (m)	DS Depth (m)	Σ Area (ha)	Σ Add Inflow (l/s)
1.000	1.852	73.6	6.5	1.200	1.145	0.027	0.0
1.001	0.998	39.7	28.5	1.145	1.201	0.120	0.0
1.002	1.113	78.7	45.6	1.201	1.279	0.194	0.0
1.003	1.108	78.4	46.8	1.279	1.357	0.201	0.0
1.004	1.141	126.1	92.5	1.357	1.888	0.423	0.0
1.005	1.142	126.1	108.1	1.888	1.993	0.521	0.0
1.006	1.168	185.7	108.8	1.993	1.983	0.529	0.0

Links

Name	US Node	DS Node	Length (m)	ks (mm) / n	US IL (m)	DS IL (m)	Fall (m)	Slope (1:X)	Dia (mm)	T of C (mins)	Rain (mm/hr)
1.007	MHS-7	MHS-6	53.182	0.600	5.587	5.410	0.177	300.5	450	6.87	51.6
1.008	MHS-6	MHS-5.1	10.924	0.600	5.410	5.374	0.036	303.4	450	7.03	51.1
1.009	MHS-5.1	MHS-5	6.488	0.600	5.374	5.352	0.022	294.9	450	7.12	50.8
1.010	MHS-5	MHS-4	10.134	0.600	5.300	5.240	0.060	168.9	225	7.29	50.3
2.000	MHS-4.3	MHS-4.2	43.691	0.600	6.200	5.982	0.218	200.4	300	4.66	60.2
2.001	MHS-4.2	MHS-4.1	64.672	0.600	5.907	5.584	0.323	200.2	375	5.50	56.5
2.002	MHS-4.1	MHS-4	12.469	0.600	5.583	5.521	0.062	201.1	375	5.67	55.9
1.011	MHS-4	MHS-3	33.237	0.600	5.240	5.074	0.166	200.2	375	7.72	49.1
1.012	MHS-3	MHS-2	48.069	0.600	4.950	4.710	0.240	200.3	375	8.35	47.4
1.013	MHS-2	MHS-1	16.630	0.600	4.900	4.802	0.098	169.7	225	8.63	46.7

Name	Vel (m/s)	Cap (l/s)	Flow (l/s)	US Depth (m)	DS Depth (m)	Σ Area (ha)	Σ Add Inflow (l/s)
1.007	1.167	185.7	172.0	1.983	1.690	0.878	0.0
1.008	1.162	184.7	170.3	1.690	1.876	0.878	0.0
1.009	1.178	187.4	169.4	1.876	1.998	0.878	0.0
1.010	1.003	39.9	167.7	2.275	2.235	0.878	0.0
2.000	1.107	78.2	47.5	1.200	1.218	0.208	0.0
2.001	1.277	141.0	81.9	1.218	1.541	0.382	0.0
2.002	1.274	140.7	81.0	1.542	1.804	0.382	0.0
1.011	1.277	141.0	234.6	2.085	1.851	1.260	0.0
1.012	1.276	141.0	226.4	1.975	1.415	1.260	0.0
1.013	1.001	39.8	223.1	1.375	1.973	1.260	0.0

Pipeline Schedule

Link	Length (m)	Slope (1:X)	Dia (mm)	Link Type	US CL (m)	US IL (m)	US Depth (m)	DS CL (m)	DS IL (m)	DS Depth (m)
1.000	8.268	50.1	225	1 STANDARD	7.980	6.555	1.200	7.760	6.390	1.145
1.001	7.843	170.5	225	1 STANDARD	7.760	6.390	1.145	7.770	6.344	1.201
1.002	7.525	198.0	300	1 STANDARD	7.770	6.269	1.201	7.810	6.231	1.279
1.003	7.592	199.8	300	1 STANDARD	7.810	6.231	1.279	7.850	6.193	1.357
1.004	55.228	249.9	375	1 STANDARD	7.850	6.118	1.357	8.160	5.897	1.888
1.005	51.160	249.6	375	1 STANDARD	8.160	5.897	1.888	8.060	5.692	1.993
1.006	9.008	300.3	450	1 STANDARD	8.060	5.617	1.993	8.020	5.587	1.983
1.007	53.182	300.5	450	1 STANDARD	8.020	5.587	1.983	7.550	5.410	1.690
1.008	10.924	303.4	450	1 STANDARD	7.550	5.410	1.690	7.700	5.374	1.876
1.009	6.488	294.9	450	1 STANDARD	7.700	5.374	1.876	7.800	5.352	1.998

Link	US Node	Dia (mm)	Node Type	MH Type	DS Node	Dia (mm)	Node Type	MH Type
1.000	MHS-14	1200	Manhole	1 STANDARD	MHS-13	1200	Manhole	1 STANDARD
1.001	MHS-13	1200	Manhole	1 STANDARD	MHS-12	1200	Manhole	1 STANDARD
1.002	MHS-12	1200	Manhole	1 STANDARD	MHS-11	1200	Manhole	1 STANDARD
1.003	MHS-11	1200	Manhole	1 STANDARD	MHS-10	1350	Manhole	1 STANDARD
1.004	MHS-10	1350	Manhole	1 STANDARD	MHS-9	1350	Manhole	1 STANDARD
1.005	MHS-9	1350	Manhole	1 STANDARD	MHS-8	1350	Manhole	1 STANDARD
1.006	MHS-8	1350	Manhole	1 STANDARD	MHS-7	1350	Manhole	1 STANDARD
1.007	MHS-7	1350	Manhole	1 STANDARD	MHS-6	1350	Manhole	1 STANDARD
1.008	MHS-6	1350	Manhole	1 STANDARD	MHS-5.1	1350	Manhole	1 STANDARD
1.009	MHS-5.1	1350	Manhole	1 STANDARD	MHS-5	1350	Manhole	1 STANDARD

Pipeline Schedule

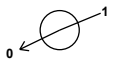
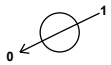
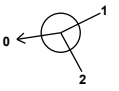
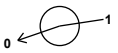
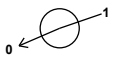
Link	Length (m)	Slope (1:X)	Dia (mm)	Link Type	US CL (m)	US IL (m)	US Depth (m)	DS CL (m)	DS IL (m)	DS Depth (m)
1.010	10.134	168.9	225	1 STANDARD	7.800	5.300	2.275	7.700	5.240	2.235
2.000	43.691	200.4	300	1 STANDARD	7.700	6.200	1.200	7.500	5.982	1.218
2.001	64.672	200.2	375	1 STANDARD	7.500	5.907	1.218	7.500	5.584	1.541
2.002	12.469	201.1	375	1 STANDARD	7.500	5.583	1.542	7.700	5.521	1.804
1.011	33.237	200.2	375	1 STANDARD	7.700	5.240	2.085	7.300	5.074	1.851
1.012	48.069	200.3	375	1 STANDARD	7.300	4.950	1.975	6.500	4.710	1.415
1.013	16.630	169.7	225	1 STANDARD	6.500	4.900	1.375	7.000	4.802	1.973

Link	US Node	Dia (mm)	Node Type	MH Type	DS Node	Dia (mm)	Node Type	MH Type
1.010	MHS-5	1350	Manhole	1 STANDARD	MHS-4	1350	Manhole	1 STANDARD
2.000	MHS-4.3	1200	Manhole	1 STANDARD	MHS-4.2	1350	Manhole	1 STANDARD
2.001	MHS-4.2	1350	Manhole	1 STANDARD	MHS-4.1	1350	Manhole	1 STANDARD
2.002	MHS-4.1	1350	Manhole	1 STANDARD	MHS-4	1350	Manhole	1 STANDARD
1.011	MHS-4	1350	Manhole	1 STANDARD	MHS-3	1350	Manhole	1 STANDARD
1.012	MHS-3	1350	Manhole	1 STANDARD	MHS-2	1350	Manhole	1 STANDARD
1.013	MHS-2	1350	Manhole	1 STANDARD	MHS-1	1200	Manhole	1 STANDARD

Manhole Schedule

Node	Easting (m)	Northing (m)	CL (m)	Depth (m)	Dia (mm)	Connections	Link	IL (m)	Dia (mm)
MHS-14	560820.701	657031.156	7.980	1.425	1200				
						0	1.000	6.555	225
MHS-13	560812.582	657029.588	7.760	1.370	1200		1	1.000	6.390	225
						0	1.001	6.390	225
MHS-12	560805.135	657032.049	7.770	1.501	1200		1	1.001	6.344	225
						0	1.002	6.269	300
MHS-11	560799.919	657037.473	7.810	1.579	1200		1	1.002	6.231	300
						0	1.003	6.231	300
MHS-10	560797.828	657044.772	7.850	1.732	1350		1	1.003	6.193	300
						0	1.004	6.118	375
MHS-9	560797.448	657099.999	8.160	2.263	1350		1	1.004	5.897	375
						0	1.005	5.897	375
MHS-8	560777.743	657147.211	8.060	2.443	1350		1	1.005	5.692	375
						0	1.006	5.617	450

Manhole Schedule

Node	Easting (m)	Northing (m)	CL (m)	Depth (m)	Dia (mm)	Connections	Link	IL (m)	Dia (mm)
MHS-7	560768.906	657148.957	8.020	2.433	1350	1	1.006	5.587	450
									
						0	1.007	5.587	450
MHS-6	560719.751	657128.656	7.550	2.140	1350	1	1.007	5.410	450
									
						0	1.008	5.410	450
MHS-5.1	560709.917	657123.898	7.700	2.326	1350	1	1.008	5.374	450
									
						0	1.009	5.374	450
MHS-5	560704.105	657121.015	7.800	2.500	1350	1	1.009	5.352	450
									
						0	1.010	5.300	225
MHS-4.3	560719.376	657212.964	7.700	1.500	1200				
						0	2.000	6.200	300
MHS-4.2	560680.605	657192.821	7.500	1.593	1350	1	2.000	5.982	300
									
						0	2.001	5.907	375
MHS-4.1	560710.434	657135.440	7.500	1.917	1350	1	2.001	5.584	375
									
						0	2.002	5.583	375
MHS-4	560699.256	657129.914	7.700	2.460	1350	1	2.002	5.521	375
						2	1.010	5.240	225
									
						0	1.011	5.240	375
MHS-3	560666.394	657124.936	7.300	2.350	1350	1	1.011	5.074	375
									
						0	1.012	4.950	375
MHS-2	560620.927	657109.334	6.500	1.790	1350	1	1.012	4.710	375
									
						0	1.013	4.900	225
MHS-1	560605.654	657102.756	7.000	2.198	1200	1	1.013	4.802	225
									

Simulation Settings

Rainfall Methodology	FSR	Winter CV	0.840
Rainfall Events	Singular	Analysis Speed	Normal
FSR Region	England and Wales	Skip Steady State	x
M5-60 (mm)	15.000	Drain Down Time (mins)	240
Ratio-R	0.300	Additional Storage (m³/ha)	20.0
Summer CV	0.750	Starting Level (m)	

Simulation Settings

Check Discharge Rate(s) x | Check Discharge Volume x

Storm Durations

15	60	180	360	600	960	2160	4320	7200	10080
30	120	240	480	720	1440	2880	5760	8640	

Return Period (years)	Climate Change (CC %)	Additional Area (A %)	Additional Flow (Q %)
30	30	10	0
100	30	10	0

Node MHS-2 Online Hydro-Brake® Control

Flap Valve	x	Objective	(HE) Minimise upstream storage
Replaces Downstream Link	✓	Sump Available	✓
Invert Level (m)	4.900	Product Number	CTL-SHE-0085-3800-1500-3800
Design Depth (m)	1.500	Min Outlet Diameter (m)	0.100
Design Flow (l/s)	3.8	Min Node Diameter (mm)	1200

Node MHS-5 Online Hydro-Brake® Control

Flap Valve	x	Objective	(HE) Minimise upstream storage
Replaces Downstream Link	✓	Sump Available	✓
Invert Level (m)	5.300	Product Number	CTL-SHE-0067-2500-1600-2500
Design Depth (m)	1.600	Min Outlet Diameter (m)	0.100
Design Flow (l/s)	2.5	Min Node Diameter (mm)	1200

Node MHS-2 Depth/Area Storage Structure

Base Inf Coefficient (m/hr)	0.00000	Safety Factor	2.0	Invert Level (m)	4.710
Side Inf Coefficient (m/hr)	0.00000	Porosity	1.00	Time to half empty (mins)	0

Depth (m)	Area (m²)	Inf Area (m²)	Depth (m)	Area (m²)	Inf Area (m²)
0.000	200.0	0.0	1.500	500.0	0.0

Node MHS-5 Depth/Area Storage Structure

Base Inf Coefficient (m/hr)	0.00000	Safety Factor	2.0	Invert Level (m)	5.300
Side Inf Coefficient (m/hr)	0.00000	Porosity	0.95	Time to half empty (mins)	

Depth (m)	Area (m²)	Inf Area (m²)	Depth (m)	Area (m²)	Inf Area (m²)	Depth (m)	Area (m²)	Inf Area (m²)
0.000	500.0	0.0	1.600	500.0	0.0	1.601	0.0	0.0

Results for 30 year +30% CC +10% A Critical Storm Duration. Lowest mass balance: 99.64%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
15 minute winter	MHS-14	11	6.992	0.437	9.4	0.6772	0.0000	SURCHARGED
15 minute winter	MHS-13	11	6.991	0.601	41.6	1.5777	0.0000	SURCHARGED
15 minute winter	MHS-12	11	6.947	0.678	64.3	1.5014	0.0000	SURCHARGED
15 minute winter	MHS-11	11	6.919	0.688	63.5	0.8453	0.0000	SURCHARGED
15 minute winter	MHS-10	11	6.890	0.772	138.0	3.2811	0.0000	SURCHARGED
15 minute winter	MHS-9	11	6.677	0.780	149.9	1.8597	0.0000	SURCHARGED
15 minute winter	MHS-8	11	6.374	0.757	146.1	1.1375	0.0000	SURCHARGED
2160 minute winter	MHS-7	2100	6.348	0.761	13.8	3.4892	0.0000	SURCHARGED
2160 minute winter	MHS-6	2100	6.348	0.938	13.4	1.3423	0.0000	SURCHARGED
2160 minute winter	MHS-5.1	2100	6.347	0.973	13.1	1.3921	0.0000	SURCHARGED
2160 minute winter	MHS-5	2100	6.348	1.048	13.3	499.1050	0.0000	SURCHARGED
15 minute winter	MHS-4.3	10	6.441	0.241	72.5	1.0085	0.0000	OK
15 minute winter	MHS-4.2	10	6.206	0.299	132.8	1.1472	0.0000	OK
15 minute winter	MHS-4.1	11	5.899	0.316	129.9	0.4518	0.0000	OK
15 minute winter	MHS-4	11	5.541	0.301	129.8	0.4301	0.0000	OK
2160 minute winter	MHS-3	1680	5.484	0.534	8.0	0.7638	0.0000	SURCHARGED
2160 minute winter	MHS-2	1680	5.484	0.774	7.8	215.6725	0.0000	SURCHARGED
15 minute summer	MHS-1	1	4.802	0.000	1.7	0.0000	0.0000	OK

Link Event (Upstream Depth)	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m³)	Discharge Vol (m³)
15 minute winter	MHS-14	1.000	MHS-13	10.8	0.393	0.147	0.3288	
15 minute winter	MHS-13	1.001	MHS-12	38.5	1.046	0.970	0.3119	
15 minute winter	MHS-12	1.002	MHS-11	61.1	0.942	0.776	0.5299	
15 minute winter	MHS-11	1.003	MHS-10	63.2	0.996	0.807	0.5346	
15 minute winter	MHS-10	1.004	MHS-9	117.6	1.146	0.933	6.0915	
15 minute winter	MHS-9	1.005	MHS-8	144.4	1.310	1.145	5.6428	
15 minute winter	MHS-8	1.006	MHS-7	149.4	0.943	0.804	1.4273	
2160 minute winter	MHS-7	1.007	MHS-6	13.4	0.533	0.072	8.4263	
2160 minute winter	MHS-6	1.008	MHS-5.1	13.1	0.447	0.071	1.7308	
2160 minute winter	MHS-5.1	1.009	MHS-5	13.3	0.453	0.071	1.0280	
2160 minute winter	MHS-5	Hydro-Brake®	MHS-4	2.0				
15 minute winter	MHS-4.3	2.000	MHS-4.2	72.2	1.231	0.922	2.5599	
15 minute winter	MHS-4.2	2.001	MHS-4.1	129.9	1.362	0.921	6.1659	
15 minute winter	MHS-4.1	2.002	MHS-4	129.8	1.415	0.922	1.1385	
15 minute winter	MHS-4	1.011	MHS-3	127.3	1.434	0.903	2.9480	
2160 minute winter	MHS-3	1.012	MHS-2	7.8	0.521	0.056	5.3019	
2160 minute winter	MHS-2	Hydro-Brake®	MHS-1	3.5				355.7

Results for 100 year +30% CC +10% A Critical Storm Duration. Lowest mass balance: 99.64%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
15 minute winter	MHS-14	12	7.648	1.093	12.2	1.6924	0.0000	SURCHARGED
15 minute winter	MHS-13	12	7.642	1.252	45.3	3.2851	0.0000	SURCHARGED
15 minute winter	MHS-12	12	7.563	1.294	68.0	2.8685	0.0000	SURCHARGED
15 minute winter	MHS-11	11	7.519	1.288	70.9	1.5831	0.0000	SURCHARGED
15 minute winter	MHS-10	11	7.479	1.361	145.6	5.7850	0.0000	SURCHARGED
15 minute winter	MHS-9	11	7.178	1.281	170.9	3.0530	0.0000	SURCHARGED
15 minute winter	MHS-8	11	6.737	1.120	178.4	1.6832	0.0000	SURCHARGED
2880 minute winter	MHS-7	2760	6.708	1.121	13.7	5.1417	0.0000	SURCHARGED
2880 minute winter	MHS-6	2760	6.707	1.297	13.6	1.8565	0.0000	SURCHARGED
2880 minute winter	MHS-5.1	2760	6.709	1.335	13.6	1.9097	0.0000	SURCHARGED
2880 minute winter	MHS-5	2760	6.708	1.408	15.6	670.6495	0.0000	SURCHARGED
15 minute winter	MHS-4.3	11	6.679	0.479	92.5	2.0021	0.0000	SURCHARGED
15 minute winter	MHS-4.2	11	6.379	0.472	160.9	1.8108	0.0000	SURCHARGED
15 minute winter	MHS-4.1	11	5.957	0.374	154.5	0.5351	0.0000	OK
2160 minute winter	MHS-4	2100	5.720	0.480	9.4	0.6864	0.0000	SURCHARGED
2160 minute winter	MHS-3	2100	5.720	0.770	9.3	1.1012	0.0000	SURCHARGED
2160 minute winter	MHS-2	2100	5.719	1.009	9.2	305.2272	0.0000	SURCHARGED
15 minute summer	MHS-1	1	4.802	0.000	2.3	0.0000	0.0000	OK

Link Event (Upstream Depth)	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m³)	Discharge Vol (m³)
15 minute winter	MHS-14	1.000	MHS-13	16.3	0.460	0.221	0.3288	
15 minute winter	MHS-13	1.001	MHS-12	44.0	1.107	1.109	0.3119	
15 minute winter	MHS-12	1.002	MHS-11	69.6	0.988	0.884	0.5299	
15 minute winter	MHS-11	1.003	MHS-10	77.4	1.100	0.988	0.5346	
15 minute winter	MHS-10	1.004	MHS-9	142.6	1.293	1.131	6.0915	
15 minute winter	MHS-9	1.005	MHS-8	176.2	1.597	1.396	5.6428	
15 minute winter	MHS-8	1.006	MHS-7	182.4	1.151	0.982	1.4273	
2880 minute winter	MHS-7	1.007	MHS-6	13.6	0.498	0.073	8.4263	
2880 minute winter	MHS-6	1.008	MHS-5.1	13.6	0.419	0.074	1.7308	
2880 minute winter	MHS-5.1	1.009	MHS-5	15.6	0.450	0.083	1.0280	
2880 minute winter	MHS-5	Hydro-Brake®	MHS-4	2.0				
15 minute winter	MHS-4.3	2.000	MHS-4.2	84.7	1.207	1.083	3.0767	
15 minute winter	MHS-4.2	2.001	MHS-4.1	154.5	1.401	1.096	7.1290	
15 minute winter	MHS-4.1	2.002	MHS-4	155.2	1.504	1.104	1.2577	
2160 minute winter	MHS-4	1.011	MHS-3	9.3	0.666	0.066	3.6659	
2160 minute winter	MHS-3	1.012	MHS-2	9.2	0.538	0.065	5.3019	
2160 minute winter	MHS-2	Hydro-Brake®	MHS-1	3.5				337.4

APPENDIX B
Foul Sewer Network Calculations

FOUL SEWERAGE DESIGN

Design Criteria for Foul Network

Pipe Sizes STANDARD Manhole Sizes STANDARD

Industrial Flow (l/s/ha)	0.00	Add Flow / Climate Change (%)	10
Industrial Peak Flow Factor	0.00	Minimum Backdrop Height (m)	0.000
Flow Per Person (l/per/day)	150.00	Maximum Backdrop Height (m)	0.000
Persons per House	2.70	Min Design Depth for Optimisation (m)	1.200
Domestic (l/s/ha)	0.00	Min Vel for Auto Design only (m/s)	0.75
Domestic Peak Flow Factor	6.00	Min Slope for Optimisation (1:X)	500

Designed with Level Soffits

Network Design Table for Foul Network

PN	Length (m)	Fall (m)	Slope (1:X)	Area (ha)	Houses	Base Flow (l/s)	k (mm)	HYD SECT	DIA (mm)	Section Type
F-1.000	46.226	0.231	200.0	0.000	104	0.0	1.500	o	225	Pipe/Conduit
F-1.001	74.655	0.373	200.0	0.000	52	0.0	1.500	o	225	Pipe/Conduit
F-1.002	4.471	0.022	200.0	0.000	0	0.0	1.500	o	225	Pipe/Conduit
F-1.003	56.526	0.565	100.0	0.000	104	0.0	1.500	o	225	Pipe/Conduit
F-1.004	6.964	0.070	100.0	0.000	0	0.0	1.500	o	225	Pipe/Conduit
F-1.005	50.422	0.504	100.0	0.000	52	0.0	1.500	o	225	Pipe/Conduit
F-1.006	55.944	0.186	300.0	0.000	104	0.0	1.500	o	300	Pipe/Conduit
F-1.007	8.181	0.027	300.0	0.000	0	0.0	1.500	o	300	Pipe/Conduit
F-1.008	8.706	0.029	300.0	0.000	0	0.0	1.500	o	300	Pipe/Conduit
F-1.009	8.275	0.028	300.0	0.000	0	0.0	1.500	o	300	Pipe/Conduit
F-1.010	9.585	0.048	200.0	0.000	104	0.0	1.500	o	300	Pipe/Conduit
F-1.011	9.793	0.049	200.0	0.000	0	0.0	1.500	o	300	Pipe/Conduit
F-1.012	24.504	0.123	200.0	0.000	0	0.0	1.500	o	300	Pipe/Conduit
F-1.013	13.183	0.066	200.0	0.000	0	0.0	1.500	o	300	Pipe/Conduit

Network Results Table

PN	US/IL (m)	Σ Area (ha)	Σ Base Flow (l/s)	Σ Hse	Add Flow (l/s)	P.Dep (mm)	P.Vel (m/s)	Vel (m/s)	Cap (l/s)	Flow (l/s)
F-1.000	6.255	0.000	0.0	104	0.3	48	0.52	0.81	32.2	3.2
F-1.001	6.024	0.000	0.0	156	0.4	59	0.58	0.81	32.2	4.8
F-1.002	5.651	0.000	0.0	156	0.4	59	0.58	0.81	32.2	4.8
F-1.003	5.628	0.000	0.0	260	0.7	64	0.86	1.15	45.6	8.0
F-1.004	5.063	0.000	0.0	260	0.7	64	0.86	1.15	45.6	8.0
F-1.005	4.993	0.000	0.0	312	0.9	70	0.91	1.15	45.6	9.7
F-1.006	4.414	0.000	0.0	416	1.2	97	0.65	0.80	56.4	12.9
F-1.007	4.228	0.000	0.0	416	1.2	97	0.65	0.80	56.4	12.9
F-1.008	4.200	0.000	0.0	416	1.2	97	0.65	0.80	56.4	12.9
F-1.009	4.171	0.000	0.0	416	1.2	97	0.65	0.80	56.4	12.9
F-1.010	4.144	0.000	0.0	520	1.5	98	0.80	0.98	69.2	16.1
F-1.011	4.096	0.000	0.0	520	1.5	98	0.80	0.98	69.2	16.1
F-1.012	4.047	0.000	0.0	520	1.5	98	0.80	0.98	69.2	16.1
F-1.013	3.924	0.000	0.0	520	1.5	98	0.80	0.98	69.2	16.1

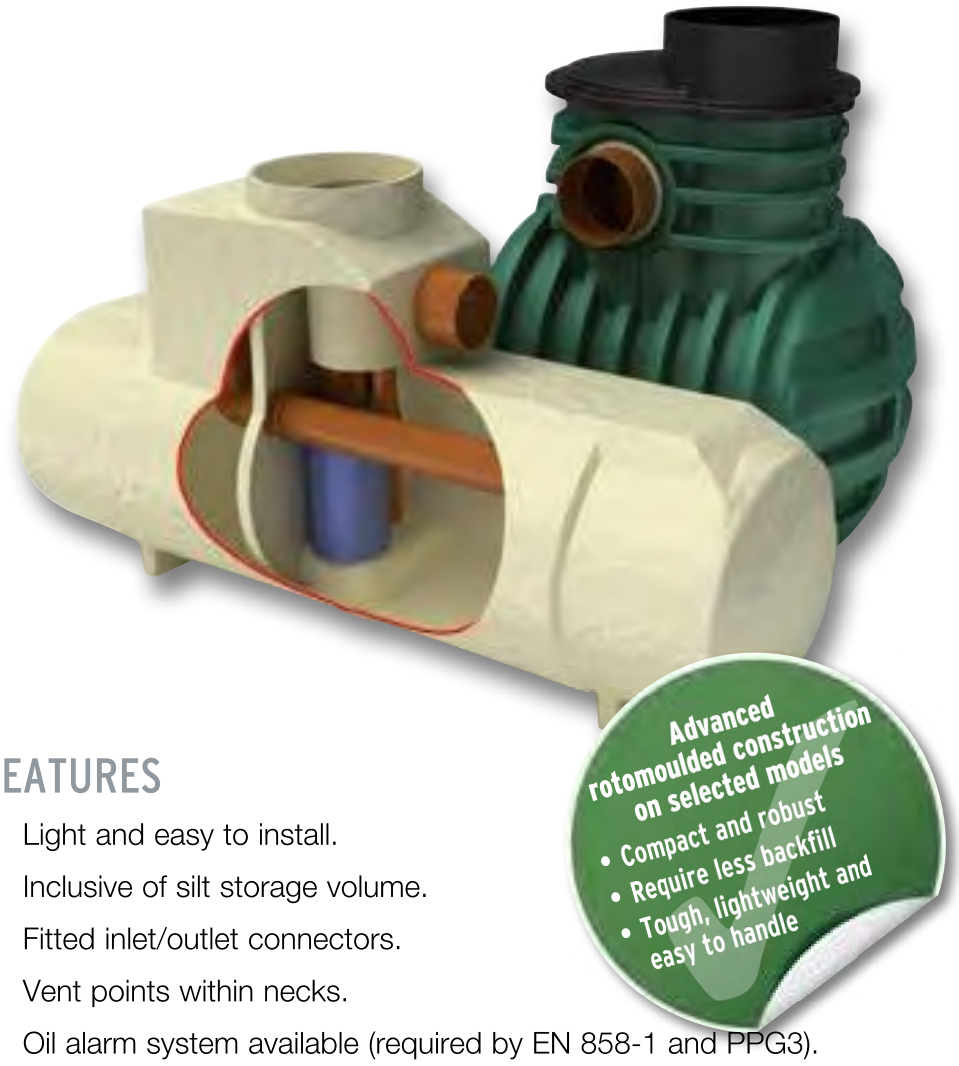
Free Flowing Outfall Details for Foul Network

Outfall Pipe Number	Outfall Name	C. Level (m)	I. Level (m)	Min I. Level (m)	D,L (mm)	W (mm)
F-1.013	MHF-1	8.000	3.858	0.000	0	0

GARLAND
Concepts Realised

APPENDIX C
Product Information

Bypass NSB RANGE



APPLICATION

Bypass separators are used when it is considered an acceptable risk not to provide full treatment, for very high flows, and are used, for example, where the risk of a large spillage and heavy rainfall occurring at the same time is small, e.g.

- Surface car parks.
- Roadways.
- Lightly contaminated commercial areas.

PERFORMANCE

Klargester were one of the first UK manufacturers to have separators tested to EN 858-1. Klargester have now added the NSB bypass range to their portfolio of certified and tested models. The NSB number denotes the maximum flow at which the separator treats liquids.
The British Standards Institute (BSI) tested the required range of Kingspan Klargester Bypass separators and certified their performance in relation to their flow and process performance assessing the effluent qualities to the requirements of EN 858-1. Klargester bypass separator designs follow the parameters determined during the testing of the required range of bypass separators.

Each bypass separator design includes the necessary volume requirements for:

- Oil separation capacity.
- Silt storage capacity.
- Oil storage volume.
- Coalescer.

The unit is designed to treat 10% of peak flow. The calculated drainage areas served by each separator are indicated according to the formula given by PPG3 NSB = 0.0018A(m2). Flows generated by higher rainfall rates will pass through part of the separator and bypass the main separation chamber.

Class I separators are designed to achieve a concentration of 5mg/litre of oil under standard test conditions.

FEATURES

- Light and easy to install.
- Inclusive of silt storage volume.
- Fitted inlet/outlet connectors.
- Vent points within necks.
- Oil alarm system available (required by EN 858-1 and PPG3).
- Extension access shafts for deep inverts.
- Maintenance from ground level.
- GRP or rotomoulded construction (subject to model).

To specify a nominal size bypass separator, the following information is needed:-

- The calculated flow rate for the drainage area served. Our designs are based on the assumption that any interconnecting pipework fitted elsewhere on site does not impede flow into or out of the separator and that the flow is not pumped.
- The drain invert inlet depth.
- Pipework type, size and orientation.

SIZES AND SPECIFICATIONS

UNIT NOMINAL SIZE	FLOW (l/s)	PEAK FLOW RATE (l/s)	DRAINAGE AREA (m²)	STORAGE CAPACITY (litres) SILT	OIL	UNIT LENGTH (mm)	UNIT DIA. (mm)	ACCESS SHAFT DIA. (mm)	BASE TO INLET INVERT (mm)	BASE TO OUTLET INVERT	STANDARD FALL ACROSS (mm)	MIN. INLET INVERT (mm)	STANDARD PIPEWORK DIA.
NSBP003	3	30	1670	300	45	1700	1350	600	1420	1320	100	500	160
NSBP004	4.5	45	2500	450	60	1700	1350	600	1420	1320	100	500	160
NSBP006	6	60	3335	600	90	1700	1350	600	1420	1320	100	500	160
NSBE010	10	100	5560	1000	150	2069	1220	750	1450	1350	100	700	315
NSBE015	15	150	8335	1500	225	2947	1220	750	1450	1350	100	700	315
NSBE020	20	200	11111	2000	300	3893	1220	750	1450	1350	100	700	375
NSBE025	25	250	13890	2500	375	3575	1420	750	1680	1580	100	700	375
NSBE030	30	300	16670	3000	450	4265	1420	750	1680	1580	100	700	450
NSBE040	40	400	22222	4000	600	3230	1920	600	2185	2035	150	1000	500
NSBE050	50	500	27778	5000	750	3960	1920	600	2185	2035	150	1000	600
NSBE075	75	750	41667	7500	1125	5841	1920	600	2235	2035	200	950	675
NSBE100	100	1000	55556	10000	1500	7661	1920	600	2235	2035	200	950	750
NSBE125	125	1250	69444	12500	1875	9548	1920	600	2235	2035	200	950	750

Rotomoulded chamber construction GRP chamber construction * Some units have more than one access shaft – diameter of largest shown.

IRISH AGRÉMENT BOARD
CERTIFICATE NO. 23/0440
IKO Ltd, Unit 502, Northwest Business Park,
Dublin, Ireland, D15 CP3V
Tel: (01) 8855090
Email: waterproofing@iko.ie
Website: www.iko.ie

PERMATEC ECOWRAP HOT MELT ROOF WATERPROOFING SYSTEM

NSAI Agrément (Irish Agrément Board) is designated by Government to carry out European Technical Assessments.

NSAI Agrément Certificates establish proof that the certified products are 'proper materials' suitable for their intended use under Irish site conditions, in accordance with TGD Part D of the second schedule of the Building Regulations 1997 to 2023.

PRODUCT DESCRIPTION

This Agrément Certificate relates to the Permatec EcoWrap Hot Melt Waterproofing System. The system is based on a formulated waterproofing membrane made from a combination of refined bitumen, synthetic rubbers and other additives. The membrane is applied in two layers to provide a waterproofing layer with a nominal coating thickness of 6 mm. The system is used in conjunction with a reinforcement layer and a protection layer.

In the opinion of NSAI, the IKO Permatec Ecowrap hot melt waterproofing system as described in this Certificate, complies with the requirements of the Building Regulations 1997 to 2023.

USE

The Permatec EcoWrap Hot Melt Waterproofing System is suitable for use as a waterproofing layer in protected flat roofs, zero fall roofs, inverted roofs and blue roof specifications in combination with a storm water attenuation system(1).

The System can also be used with an anti-root additive for use as a waterproofing layer in green roof specifications in combination with a storm water attenuation system(1). See detail sheet 1 appended to this Certificate for details specific to green roof specifications.

(1)The storm water attenuation system is outside the scope of this certificate.

The product is manufactured by:

IKO PLC
Prospect Quarry,
Grangemill,
Matlock,
DE4 4BW,
United Kingdom

In Ireland, the product distribution, technical support and sales are performed by:

IKO Ltd.
Unit 502,
Northwest Business Park
Dublin
Ireland
D15 CP3V
Tel: 01 885 5090
Email: waterproofing@iko.ie
Website: www.iko.ie

MANUFACTURE AND MARKETING

1.1 ASSESSMENT

In the opinion of NSAI Agrément, the Permatec EcoWrap Hot Melt Waterproofing System, if installed, used and maintained in accordance with this Certificate, can meet or contribute to meeting the requirements of the Irish Building Regulations as indicated in Clause 1.2 of this Agrément Certificate.

1.2 BUILDING REGULATIONS

REQUIREMENT:

Part B Volume 1 – Fire Safety
B4 – External Fire Spread
When used in accordance with this certificate, the Permatec Hot Melt Waterproofing System can meet the relevant requirements of TGD Part B4 using suitable finishing layers. See section 4.1 for further information.

Part B Volume 2 – Fire Safety
B9 – External Fire Spread
When used in accordance with this certificate, the Permatec Hot Melt Waterproofing System can meet the relevant requirements of TGD Part B4 using suitable finishing layers. See section 4.1 for further information.

Part C – Site Preparation and Resistance to Moisture
C4 – Resistance to Weather and Ground Moisture
The Permatec Hot Melt Waterproofing System can meet the relevant requirements of TGD Part C4, when installed in accordance with this Certificate.

Part D - Materials and Workmanship
D1 - Materials and workmanship
The Permatec Hot Melt Waterproofing System used in accordance with this NSAI Agrément Certificate can meet the requirements of TGD Part D1.

D3 – The Permatec Hot Melt Waterproofing System, as certified in this NSAI Agrément Certificate, is manufactured from materials which are 'proper materials' fit for their intended use.

2.1 PRODUCT DESCRIPTION

The Permatec EcoWrap Hot Melt Waterproofing System consists of a hot applied membrane made from a combination of refined bitumen, synthetic rubbers, fillers and other additives. The material is melted at the installation location in a purpose-built machine and is applied to a prepared structural deck in two nominal 3mm coats. The membrane is reinforced with a polyester reinforcing scrim, providing a monolithic waterproofing system with a nominal coating thickness of 6mm. The system is protected using a suitable protection layer to achieve the necessary resistance to mechanical damage, resistance to solar UV rays, solar heat gain and combustibility rating required for a project.

2.2 ANCILLARY ITEMS

The membrane is used in conjunction with a range of reinforcement membranes, protection membranes and boards depending on a project specific design. The following products have been assessed for use with the system:

- PermaFLASH-R — a 55 g/m^2 polyester reinforcing scrim
- PermaFLASH-D150 — a 1.25mm thick and 150mm wide flexible detailing sheet, used as a reinforcement layer over cracks, construction joints and changes in materials, and where minor movement may occur
- PermaFLASH-D500 — a 1.25mm thick and 500mm wide flexible detailing sheet, used as a reinforcement at rainwater outlets
- PermaGUARD-F — a 180g/m^2 sand-surfaced, polyester-based bitumen membrane protection layer
- PermaGUARD-M — a 180g/m^2 slate-surfaced, high-performance torch-applied bitumen membrane protection layer for use on details which will not be covered by the surface finishes
- PermaGUARD-HDPB — a 3mm thick high-density polymeric protection board
- PermaGUARD-PB — a 3.2mm thick protection board fabricated with a bituminous core sandwiched between two layers of non-woven glass fibre reinforcement
- IKO Permatec High Penetration Primer — a brush or roller-applied bituminous priming solution used in the preparation of cementitious surfaces prior to the application of the membrane.
- IKO Permatec Polymer Primer — a brush- or roller-applied synthetic rubber-based priming solution used in the preparation of cementitious surfaces prior to the application of the membrane.

Other products which may be used with the system but are outside the scope of this certificate include:

- Foamglass insulation - cellular glass insulation slabs with a minimum compressive strength of 400kpa
- IKO Plasdrain — a range of drainage boards
- Inverted Roof Insulation Board — insulation used in inverted/protected roof specifications
- Upstand Insulation Board — insulation with a weather-resistant facing board, used for upstand detailing
- Proprietary expansion joint systems
- PermaFLASH-UN — a 1.5 mm thick and 300 mm wide un-cured neoprene rubber reinforcement sheet used at construction joints and where minor structural movement is anticipated.

2.3 MANUFACTURE

The Permatec EcoWrap compound is manufactured by heating and blending bitumen, process oils, fillers and other additives in a temperature-controlled cycle. Protection membranes are manufactured by traditional continuous coating processes, and other components of the system are purchased to agreed specifications.

2.4 QUALITY CONTROL

The NSAI has assessed and agreed the following with respect to the quality control of the waterproofing membrane:

- The quality control procedures and product testing to be undertaken have been agreed, documented, and implemented within the company quality management system. The management system of IKO PLC has been assessed and registered as meeting the requirements of EN ISO 9001 : 2015 by BSI, EN ISO 14001 : 2015 by Lucideon and BES 6001 : Issue 3.1 by Lucideon.
- The quality control procedures implemented for batches of incoming materials have been assessed and agreed.
- The production process has been audited and verified that it is in accordance with the documented process.

- The investigative procedures and management of non-conformities has been evaluated for effectiveness.
- Agreed to verify the above measures on a regular basis through a surveillance process.

2.5 DELIVERY, STORAGE AND MARKING

The Permatec EcoWrap compound is moulded into 12kg blocks and encased in an EcoWrap heat-dispersible film. The encased blocks are stacked on a pallet and shrink wrapped for transport. Each pallet receives a pallet label which contains the following information:

- Product Name
- Product Code
- Pallet weight and Quantity of Blocks
- Manufacturing Order Number
- Recommended Laying Temperature
- Maximum Temperature
- Storage Information
- NSAI Agrément identification mark incorporating the number of this Certificate

Reinforcing and protection layers are packaged with labels bearing the product trade name and should be stored under cover and kept dry.

IKO Permatec High Penetration Primer and IKO Permatec Polymer Primer are delivered to site in 25 litre cans. The Certificate Holder has taken the responsibility of classifying and labelling the system components under the CLP Regulation (EC) No 1272/2008 on the classification, labelling and packaging of substances and mixtures. Users must refer to the relevant Safety Data Sheet(s).

2.6 INSTALLATION

2.6.1 APPROVED INSTALLERS

All installation work must be carried out in accordance with the manufacturer's installation instructions by trained and licensed IKO roofing contractors, records of whom are kept on the Certificate Holder's database. Installation details are available in the IKO PermaTec System Installation Guide.

2.6.2 ASSESSMENT OF SUBSTRATE SUITABILITY

It must be ensured that the structure is sound and designed to accept the dead and imposed loading of the waterproofing system and associated installation procedures. The substrates must comply with the relevant requirements of BS 6229. The substrate must be dry and clean of all surface contaminants, such as curing compounds, formwork release agents, oils, dirt etc. Any surface irregularities likely to inhibit IKO Permatec from being applied as a continuous monolithic membrane should be removed, replaced or properly repaired. To assess the suitability of a substrate to receive the membrane, bond tests must be carried out by approved installers to ensure that adequate adhesion can be achieved between the substrate and the membrane. If bonding problems occur, advice must be sought from the Certificate Holder.

The moisture content of cementitious substrates is critical to achieving adequate bond strength.

Substrates must be free of defects before any work commences such as cracks, surface level irregularities, raised float marks or protruding aggregate and any other areas of potential weakness. These areas must be repaired, and the substrate cleaned in accordance with the Certificate Holder's instructions. Laitance, dusting and curing materials will need to be removed in order for the IKO Permatec to achieve a suitable bond.

Sand and cement screeds are not suitable to receive IKO Permatec and should be avoided. Bond tests have shown satisfactory adhesion to the following substrates:

- In-situ structural concrete deck
- Pre-cast concrete deck
- Plywood
- Metal deck with cement particle board
- Metal deck with plywood board
- IKO Approved Modified Screeds

2.6.3 CEMENTITIOUS SUBSTRATE PREPARATION

Cementitious substrates must be conditioned with IKO Permatec High Penetration Primer or IKO Permatec Polymer Primer in accordance with the Certificate Holder's instructions and allowed to dry before application of the membrane.

2.6.4 INSTALLATION PROCEDURE

The Permatec EcoWrap Hot Melt Roofing System must be installed in accordance with the Certificate Holder's instructions and this Certificate.

Blocks of the membrane compound are heated at the installation location in a purpose-built machine with a mechanically agitated melter. The machine must have a double jacket containing either air or a heat-transfer mineral oil and be fitted with thermometers to measure the melt and air/oil temperatures. The nominal temperature range for the molten membrane is 160°C to 180°C. The temperature of the melt must not exceed 190°C.

The molten membrane is discharged from the melter into a suitable container and applied to the roof, using a long-handled squeegee for horizontal surfaces and a suitable spreader for vertical upstands. The substrate must be dry and frost free.

At all non-monolithic changes in substrate materials, at structural/shrinkage cracks between 3 and 6 mm wide, at structural joints between 6 and 12 mm wide and where minor movement may occur, a reinforcement layer of PermaFLASH-D150 should be applied prior to applying the Permatec EcoWrap membrane.

At structural movement joints between 12mm and 50 mm, a proprietary joint system must be installed. The Certificate Holder should be consulted for suitable products.

At all board joints in plywood, calcium silicate and composite metal decks, a reinforcement layer of PermaFLASH-D150 or a minimum 150 mm wide strip of PermaFLASH-R must be applied prior to applying the Permatec EcoWrap membrane. The advice of the certificate Holder should be sought. Detailing must be formed in accordance with the Certificate Holder's instructions.

The first layer of the molten Permatec EcoWrap membrane should have a nominal thickness of 3 mm. PermaFLASH-R polyester reinforcing scrim is embedded by lightly brushing it into the first layer of the membrane whilst it is still hot and tacky. The reinforcement overlaps must be at least 75 mm and fully sealed by Permatec EcoWrap membrane. The second layer of Permatec EcoWrap membrane, applied over the top of the reinforcement, should have a nominal thickness of 3 mm.

The membrane is covered by a protective layer immediately after installation, in accordance with the Certificate Holder's instructions. The system will accept the limited foot traffic and loads associated with installation, but adequate protection should be afforded to the newly installed Permatec against damage caused by following trades.

2.6.5 MAINTENANCE

Adequate provision should be made in the initial design phase for access and maintenance over the life of the system. The system must be inspected at six monthly intervals in accordance with BS 6229, Chapter 7. Maintenance should include checks and operations to ensure that the system and drainage outlets are free from the build-up of silt and other debris, and that protection layers, e.g., walkways, are in good condition. In the event of the system being contaminated by oil, grease or other chemicals, the advice of the Certificate Holder must be sought. Damage to the system must be repaired as soon as possible.

2.6.6 REPAIR

Any damage to the system must be repaired as soon as possible to ensure that the integrity of the waterproofing is maintained. The advice of the Certificate Holder should be sought in all cases. Should a leak occur in the roof waterproofing, it must be repaired following removal of the upper layers of the system. Correct reinstatement of these layers must be carried out with particular care and the advice of the Certificate Holder should be sought. Where maintenance or repair of any of the roof components above the waterproofing system is necessary, care must be taken to avoid damage to the membrane. In the event that the system is contaminated by chemicals, oils and greases, the advice of the Certificate Holder should be sought.

2.6.7 ENVIRONMENTAL INFORMATION

The Permatec waterproofing membrane compound has a recycled content of 45% by mass of the total product. The recycled materials are described as limestone filler and ground rubber crumb, the latter manufactured from post-consumer vehicular tyres. Post-consumer material is defined in I.S. EN ISO 14021: 2016, and the Waste & Resources Action Programme (WRAP) 'Rules of Thumb' Guide to Recycled Content in Construction Products. The recycled content has been calculated in accordance with I.S. EN ISO 14021 : 2016 by expressing the input mass of recycled material as a percentage of the total input mass for the product.

2.6.8 GREEN ROOF SPECIFICATIONS

See Detail Sheet 1 appended to this Certificate.

3.0 GENERAL

3.1 The Permatec EcoWrap Hot Melt Waterproofing System is satisfactory for use as a waterproofing layer on flat roofs (including zero fall) with limited access in:

- inverted roof specifications
- protected roof specifications
- podium decks and walkways for pedestrian access
- blue roofs in combination with a storm water attenuation system.

3.2 The system is suitable for use on in-situ concrete, precast concrete, concrete block, timber substrates, Foamglass insulation (with a minimum compressive strength of 400kpa), modified screeds and levelling compounds. The substrates must comply with the relevant requirements of BS 6229.

3.3 Blue roofs are defined for the purpose of this Certificate as zero fall roofs designed to allow controlled attenuation of rainfall during heavy storm events, as part of Sustainable Urban Drainage Systems (SuDS). Reference should be made to the appropriate clauses of the NFRC Technical Guidance Note for the construction and design of Blue Roofs.

3.4 Pedestrian access roofs are defined for the purpose of this Certificate as those not subject to vehicular traffic.

3.5 Limited access roofs are defined for the purpose of this Certificate as those subjected to pedestrian traffic only for maintenance of the roof covering, cleaning of gutters, etc. Where traffic in excess of this is envisaged, additional protection to the membrane must be provided.

3.6 Flat roofs are defined for the purpose of this Certificate as those having a weathered surface at no more than ten degrees (10°) to the horizontal.

3.7 Zero fall roofs are defined for the purpose of this Certificate as those having a finished fall which can vary between 0 and 1:80. Reference should also be made to appropriate Mastic Asphalt Council Association guidance documents.

3.8 Structural decks to which the system is to be applied must comply with the relevant requirements of BS 6229 and must be suitable to transmit the dead and imposed loads experienced in service.

3.9 Imposed loads, dead loading and wind loads are calculated in accordance with IS EN 1991-1-1, IS EN 1991-1-3 and IS EN 1991-1-4, and their Irish National Annexes.

3.10 The drainage systems for inverted, protected zero fall and blue roofs must be correctly designed, and the following points should be addressed:

- provision made for access for maintenance purposes
- for zero fall roofs, it is particularly important to identify the correct drainage points, to ensure that drainage is sufficient and effective
- the attenuation system and drainage for blue roofs should be designed by a suitably competent and experienced individual to allow the short-term storage and discharge at a set flow rate of storm water to alleviate the risk of localised flooding.

3.11 Insulation materials used in conjunction with the system must be suitable for use within inverted roofs in accordance with the Certificate Holder's instructions.

3.12 The system can accept the limited foot traffic and light concentrated loads associated with installation and maintenance. Reasonable care should be taken to avoid puncture by sharp objects or concentrated loads. Where traffic in excess of this is envisaged, such as for maintenance of lift equipment, a walkway should be provided.

3.13 Contact with oil-based products must be avoided as the system may not be compatible with these types of products. If contact with such products the advice of the Certificate holder must be sought.

3.14 Wind loads should be assessed in accordance with I.S. EN 1991-1-4:2005 + A1:2010 and the Irish National Annex on a project specific basis, taking due consideration of the roof build-up for the project such as; any added surfacing such as green roofs, paving slabs, gravel, blue roof water retention, etc. The resistance to wind uplift of the waterproof covering and finishes on a flat roof should be assessed having regard to the dead weight of those materials and to the nature, type, and disposition of their attachment to the slab or deck, in accordance with BS 8217 and IS EN 16002.

3.15 On blue roof specifications, it may be necessary to increase the normal level of protection to avoid flotation and care should be taken to ensure that the roof structure can withstand this extra loading in addition to the

retained rainwater. Where the insulation is secured by ballast, the minimum aggregate size should be sufficient to prevent wind scour.

3.16 The system can accept, without damage, the thermal movement likely to occur in practice and the limited foot traffic and light concentrated loads associated with installation and maintenance operations. Where access exceeding this is envisaged, this should be taken into account when determining the surface protection. Reasonable care is required to avoid prolonged point loading by heavy and/or sharp objects.

3.17 Calculations of the thermal transmittance (U-value) of specific roof build-ups should be carried out in accordance with IS EN ISO 6946 using thermal conductivity (λ) values of the products used as defined by the certificate holder. The U-value of a construction will depend on the materials used and the design. For retrofit installations on existing dwellings guidance should be sought from the certificate holder on achievable U-values as the actual U-value of installation will depend on the construction of the existing building elements. Guidance in this respect, and on limiting heat loss by air infiltration, shall be sought from the certificate holder and by reference to the DoEHLG publication Limiting Thermal Bridging & Air Infiltration – Acceptable Construction Details.

3.18 The internal condensation risk of the roof must be assessed in accordance with BS 6229 and BS 5250. An approved vapour barrier (AVCL) is required on the warm side of the insulation in all instances.

3.19 The risk of interstitial condensation in the roof build-up is dependent on several factors including roof design. Reference should be made to BS 6229 and BS 5250. To avoid the risk of interstitial condensation in cold flat roofs, an AVCL should be provided on the warm side of the insulation and there should be a cross ventilated void, not less than 50mm deep, between the slab or deck and the insulation. Ventilation openings shall be provided to every roof void along two opposite sides of the roof. The risk of interstitial condensation in warm flat roofs is dependent on the nature of the supporting structure. As there is a risk of interstitial condensation forming between the thermal insulation and the waterproofing covering , an AVCL with a vapour resistance at least equal to that of the waterproofing covering should be installed immediately above the supporting structure , wrapped and sealed at the perimeter and at all penetrations through the roof covering. For inverted flat roofs, it is essential that the thermal insulation used resists water absorption and is sufficiently loadbearing to support the protective covering or ballast where used. When building elements do not follow the principles of BS 5250, a robust hygrothermal assessment to either I.S. EN 15026 or I.S. EN ISO 13788 must be considered. Care should be taken to provide adequate ventilation, particularly in rooms expected to experience high humidity, and to ensure the integrity of vapour control layers and linings against vapour ingress.

3.20 For retrofit installation, when improving the thermal performance of the external envelope of an existing building, through to upgrading of roof insulation as part of a roof build-up, designers need to consider the impact of these improvements on other untouched elements of the building. When bridged junctions meet the requirements of TGD Part L, Appendix D - table D1, the coldest internal surface temperature will satisfy the requirements of section D2, namely that the temperature factor (fRsi) shall be equal to or greater than 0.75. As a result, best practice will have been adopted in order to limit the risk of internal surface condensation which can result in dampness and mould growth. When site limiting factors give rise to substandard level of insulation at bridged junctions, guidance should be sought from the certificate holder as to acceptable minimum requirements. When insulating buildings, the recommendations of BS 5250 should be followed to minimise the risk of condensation within the building elements and structures. Roofs will adequately limit the risk of surface condensation where the thermal transmittance (U-value) does not exceed 0.35 W/m^2 K at any point, and openings and junctions with other elements are designed in accordance with the DoEHLG publication Limiting Thermal Bridging & Air Infiltration – Acceptable Construction Details (ACD).

3.21 The linear thermal transmittance ψ (Psi) describes the heat loss associated with junctions and around openings. When all building junctions are shown to be equivalent or better than those detailed in the DoEHLG Acceptable Construction Details, then it is acceptable to use the linear thermal transmittance values outline in Table D1 of Appendix D of TGD to Part L of the Building Regulations. When all bridged junctions within a building comply with the requirements of Table D1 of appendix D of TGD to Part L, the improved 'y' factor of 0.08 can be entered into the Dwelling Energy Assessment Procedure (DEAP) Building Energy Rating (BER) calculation. Where either of the above options are shown to be valid, or when the required values cannot be achieved, all relevant details should be recorded for that project for use in future BER calculations. Ψ-values for other junctions outside the scope of this certificate should be assessed in accordance with the BRE IP1/06 "Assessing the effects of thermal bridging at junctions and around openings" and BRE Report BR 497 in accordance with appendix D of TGD to Part L of the Building Regulations.

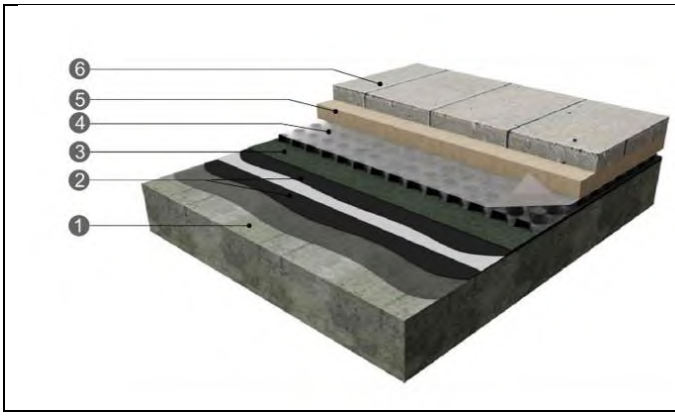
3.22 Adequate room and roof ventilation must be provided in accordance with TGD Part F of the

Building Regulations for all installations. This will also limit the potential for Interstitial Condensation and Internal Surface condensation as detailed in Cl. 3.18 of this certificate. In addition, a cross-ventilation shall be provided in cold flat roof designs as detailed in Cl. 3.19 of this certificate.

3.23 Typical Design Specifications

Table 3: Typical Roof Build-ups 1/			
	- New Build - Concrete	**-New build -Metal deck with Cement Particle Board or Plywood Deck**	**- New Build - Concrete - Green Roof**
Build-up			
Substrate Preparation	Permatec Polymer Primer	PermaFlash D150 to joints + Permatec Polymer Primer	Permatec Polymer Primer
Change of Substrate	PermaFlash D150 bonded in Permatec Ecowrap	PermaFlash D150 bonded in Permatec Ecowrap	PermaFlash D150 bonded in Permatec Ecowrap
Outlet Detailing	PermaFlash D500 bonded in Permatec Ecowrap	PermaFlash D500 bonded in Permatec Ecowrap	PermaFlash D500 bonded in Permatec Ecowrap
Expansion Joints	PermaFlash UN	PermaFlash UN	PermaFlash UN
Waterproofing Options	Permatec Ecowrap	Permatec Ecowrap	Permatec Ecowrap Anti-Root or Permatec Ecowrap with Roofgarden 4APP AD/F
Reinforcement	PermaFlash R	PermaFlash R	PermaFlash R
Protection Layer – Field Area	PermaGuard F	PermaGuard F	PermaGuard F
Other Optional Protection Boards	PermaGuard PB or PermaGuard HDPB	PermaGuard PB or PermaGuard HDPB	PermaGuard PB or PermaGuard HDPB
Protection Layer – Vertical Upstands	PermaGuard M	PermaGuard M	PermaGuard M
Insulation Type	XPS Insulation	XPS Insulation	XPS Insulation
Fastening	Loose Laid – Ship Lapped	Loose Laid – Ship Lapped	Loose Laid – Ship Lapped
Types of Roof Finishes	Stone Ballast Paving Flags Blue Roof	Stone Ballast Paving Flags Blue Roof	Stone Ballast Paving Flags Green Roof Brown Roof Blue Roof

3.23 Typical Design Specifications (continued)



Layer No.	Build-up Description
1	Concrete Deck primed with PermaTec Primer
2	2 Coats of Permatec Anti-Root Incorporating Permaflash-R Reinforcement
3	Permaguard-F Protection Layer
4	Drainage/Moisture Retention Layer
5	Sand/Cement Screed
6	Brick paviours/Concrete Paving Slabs

4.1 BEHAVIOUR IN FIRE
The system requires a suitable protection layer to achieve the necessary combustibility rating applicable to each project. Tests were conducted to EN 13501-5:2016 using an accredited laboratory on samples to determine the combustibility of the system incorporating various protection layers. Fire test reports for various design specifications are available from the Certificate Holder. Fire tests assessed demonstrate that the system can achieve a $B_{roof}(t4)$ rating.

4.2 LIQUID WATER PENETRATION
Test data obtained by NSAI Agrément confirms that the system is watertight when installed in accordance this certificate and the Certificate Holders instructions.

4.3 RESISTANCE TO MECHANICAL DAMAGE
The systems can accept the limited foot traffic and light concentrated loads associated with installation and maintenance. Reasonable care should be taken to avoid puncture by sharp objects or concentrated loads. Where traffic in excess of this is envisaged, such as for maintenance of lift equipment, a walkway should be provided. The system is capable of accepting minor structural movement while remaining weathertight.

4.4 PERMATEC ECOWRAP CHARACTERISATION
Characterisation test data obtained by NSAI Agrément was reviewed to establish fines, penetration, flow and resilience of the Permatec EcoWrap compound.

4.5 PERMAFLASH-R AND PERMAFLASH-D CHARACTERISATION
Characterisation test data obtained by NSAI Agrément was reviewed to establish thickness, mass per unit area and tensile properties of the PermaFlash-R and Permaflash-D membranes.

4.6 WATER VAPOUR PERMEBAILITY
Test data was obtained by NSAI Agrément on samples of the system and/or system components, and the results assessed to determine water vapour permeability.

4.7 LOW TEMPERATURE FLEXIBILITY
Test data was obtained by NSAI Agrément on samples of the system and/or system components, and the results assessed to determine Low Temperature Flexibility.

4.8 RESISTANCE TO FATIGUE
Test data obtained by NSAI Agrément on samples of the system and/or system components, and the results assessed to determine resistance to fatigue.

4.9 RESISTANCE TO DYNAMIC INDENTATION
Test data was obtained by NSAI Agrément on samples of the system incorporating Permaguard-PB protection, and the results assessed to determine resistance to dynamic indentation.

4.10 RESISTANCE TO STATIC INDENTATION
Test data was obtained by NSAI Agrément on samples of the system incorporating Permaguard-PB protection, and the results assessed to determine resistance to static indentation.

4.11 EFFECT OF HEAT AGING
Test data was obtained by NSAI Agrément on samples of the system and/or system components, and the results assessed to determine the effect of heat aging.

4.12 EFFECT OF EXPOSURE TO SURFACE WATER
Test data was obtained by NSAI Agrément on samples of the system and/or system components, and the results assessed to determine the effect of exposure to surface water.

4.13 DURABILITY
The assessment indicates that the system is capable of lasting 35 years providing it is designed, installed and maintained in accordance with this Certificate. Any damage to the surface finish must be repaired immediately and regular inspections and maintenance shall be undertaken as outlined in Section 2.6.5 of this Certificate.

4.14 MANUFACTURING PROCESS
The manufacturing process was evaluated, including the methods adopted for quality control, and details were obtained of the quality and composition of the materials used to formulate the Permatec EcoWrap Hot Melt compound.

4.15 INSTALLATION
Site visits were conducted to assess the practicability of installation in accordance with the installation manuals and training provided by the certificate holder.

5.0 CONDITIONS OF CERTIFICATION

5.1 National Standards Authority of Ireland ("NSAI") following consultation with NSAI Agrément has assessed the performance and method of installation of the product/process and the quality of the materials used in its manufacture and certifies the product/process to be fit for the use for which it is certified provided that it is manufactured, installed, used and maintained in accordance with the descriptions and specifications set out in this Certificate and in accordance with the manufacturer's instructions and usual trade practice. This Certificate shall remain valid for five years from date of last revision date so long as:

(a) the specification of the product is unchanged.

(b) the Building Regulations and any other regulation or standard applicable to the product/process, its use or installation remains unchanged.

(c) the product continues to be assessed for the quality of its manufacture and marking by NSAI.

(d) no new information becomes available which in the opinion of the NSAI, would preclude the granting of the Certificate.

(e) the product or process continues to be manufactured, installed, used and maintained in accordance with the description, specifications and safety recommendations set out in this certificate.

(f) the registration and/or surveillance fees due to NSAI Agrément are paid.

5.2 The NSAI Agrément mark and certification number may only be used on or in relation to product/processes in respect of which a valid Certificate exists. If the Certificate becomes invalid the Certificate Holder must not use the NSAI Agrément mark and certification number and must remove them from the products already marked.

5.3 In granting Certification, the NSAI makes no representation as to;

(a) the absence or presence of patent rights subsisting in the product/process; or

(b) the legal right of the Certificate Holder to market, install or maintain the product/process; or

(c) whether individual products have been manufactured or installed by the Certificate Holder in accordance with the descriptions and specifications set out in this Certificate.

5.4 This Certificate does not comprise installation instructions and does not replace the manufacturer's directions or any professional or trade advice relating to use and installation which may be appropriate.

5.5 Any recommendations contained in this Certificate relating to the safe use of the certified product/process are preconditions to the validity of the Certificate. However, the NSAI does not certify that the manufacture or installation of the certified product or process in accordance with the descriptions and specifications set out in this Certificate will satisfy the requirements of the Safety, Health and Welfare at Work Act 2005**Error! Reference source not found.**, or of any other current or future common law duty of care owed by the manufacturer or by the Certificate Holder.

5.6 The NSAI is not responsible to any person or body for loss or damage including personal injury arising as a direct or indirect result of the use of this product or process.

5.7 Where reference is made in this Certificate to any Act of the Oireachtas, Regulation made thereunder, Statutory Instrument, Code of Practice, National Standards, manufacturer's instructions, or similar publication, it shall be construed as reference to such publication in the form in which it is in force at the date of this Certification.

Bibliography

[1] I.S. EN ISO 9001 : 2015 Quality management systems — Requirements

[2] I.S. EN ISO 14001 : 2015 Environmental management systems — Requirements with guidance for use

[3] BES 6001 : Issue 3.1 Framework Standard for Responsible Sourcing

[4] CLP Regulation (EC) No 1272/2008 - Regulation (EC) No 1272/2008 - classification, labelling and packaging of substances and mixtures (CLP)

[5] BS 6229 : 2018 Flat roofs with continuously supported coverings — Code of practice

[6] I.S. EN ISO 14021 : 2016 Environmental labels and declarations — Self-declared environmental claims (Type II environmental labelling)

[7] I.S. EN 1991-1-1 : 2002 Eurocode 1 : Actions on structures — General actions— Densities, self-weight, imposed loads for buildings.

[8] NA to I.S. EN 1991-1-1 : National Annex to Eurocode 1 : Actions on structures — General actions— Densities, self-weight, imposed loads for buildings.

[9] I.S. EN 1991-1-3 : 2003 + A1 : 2015 Eurocode 1 — Actions on structures — General actions — Snow loads

[10] NA to I.S. EN 1991-1-3 : 2003 + A1 : 2015 National Annex to Eurocode 1 : Actions on structures — General actions — Snow loads

[11] I.S. EN 1991-1-4 : 2005 + A1 : 2010 Eurocode 1 : Actions on structures — General actions — Wind actions

[12] NA to I.S. EN 1991-1-4 : 2005 National Annex to Eurocode 1 : Actions on structures — General actions — Wind actions

[13] BS 8217:2005 Reinforced bitumen membranes for roofing - Code of practice

[14] EN 16002:2018 - Flexible sheets for waterproofing - Determination of the resistance to wind load of mechanically fastened flexible sheets for roof waterproofing.

[15] BS 5250: 2021 Management of moisture in buildings – Code of practice

[16] IS EN 15026:2023 - Hygrothermal performance of building components and building elements. Assessment of moisture transfer by numerical simulation

[17] I.S. EN 13501-5:2016 - Fire Classification Of Construction Products And Building Elements - Part 5: Classification Using Data From External Fire Exposure To Roofs Tests

NSAI Agrément

This Certificate No. **23/0440** is accordingly granted by the NSAI to **IKO Ltd** on behalf of NSAI Agrément.

Date of Issue: 13th December 2023

Signed

Kevin D. Mullaney
Director of Certification, NSAI

Readers may check that the status of this Certificate has not changed by contacting NSAI Agrément , NSAI, 1 Swift Square, Northwood, Santry, Dublin 9, Ireland. Telephone: (01) 807 3800. Fax: (01) 807 3842. www.nsai.ie

D.1.1 PRODUCT DESCRIPTION
This Product Detail Sheet relates to the use of the Permatec Green Roof Waterproofing System, for use as a waterproofing layer in flat roofs (including zero fall), green roofs, biodiverse roofs and roof gardens. The formulation for the Permatec Anti-Root Hot Melt Waterproofing System includes an additional anti-root inhibitor additive. Alternatively, an anti-root membrane can be incorporated into the build-up to inhibit root penetration.

D.1.2 USE
The membranes and ancillary items in this detail sheet are for use with green roof specifications. These consist of:

- Permatec EcoWrap membrane incorporating PermaFLASH-R reinforcement finished with a layer of IKO Roofgarden 4APP AD/F 7.5 m
- Permatec Anti-Root membrane incorporating PermaFLASH-R reinforcement finished with a layer of PermaGUARD F.

D.1.3 MANUFACTURE AND MARKETING
See section 1 of this Agrément Certificate for information regarding the manufacture and marketing of these compounds.

D.1.4 ANCILLARY ITEMS
The membranes are used in conjunction with a range of reinforcement membranes, protection membranes and boards depending on a project specific design. A list of system components compatible with the system is given in section 2.2 of this certificate.

Products which may be used with the system, but which are outside the scope of this Certificate are listed in section 2.2 of this certificate. Additionally, for green roof specifications, the following products may be used with the system, but are outside the scope of this Certificate:

- IKOgreen Vegetation — for use in roof garden applications
- IKOgreen Growing Medium — for use in roof garden applications
- IKOgreen Plasfeed — a range of drainage/moisture retention layers for use in roof gardens applications

D.1.5 MANUFACTURE & QUALITY CONTROL
The manufacturing processes and quality control applied to the system are described in sections 2.3 and 2.4 of this certificate.

D.1.6 DELIVERY, SITE HANDLING AND MARKING
The delivery, site handling and marking applicable to this system is detailed in section 2.4 of this certificate.

D.1.7 ENVIRONMENTAL INFORMATION
The environmental information provided in section 2.6.8 of this certificate is applicable to the green roof waterproofing system.

D.1.8 MAINTENANCE
Green roofs and roof gardens must be the subject of regular inspections, particularly in autumn after leaf fall and in spring, to ensure unwanted vegetation and other debris are cleared from the roof and drainage outlets. Guidance is available within the latest edition of The GRO Green Roof Code – Green Roof Code of Best Practice for the UK. Should a leak occur in the roof waterproofing, it must be repaired following removal of the upper layers of the system. Correct reinstatement of these layers must be carried out with particular care and the advice of the Certificate Holder should be sought.

D.1.9 DURABILITY
See section 4.13 of this certificate for durability information.

D.1.10 REPAIR
See section 2.6.6 of this certificate for repair information.

D.1.11 DESIGN DATA
See section 3 of this certificate for design data relevant to the use of the Permatec waterproofing systems.
In addition, for green roof specifications, recommendations for the design of green roof and roof garden specifications are available within the latest edition of The GRO Green Roof Code – Green Roof Code of Best Practice.

Dead loads for green roofs and roof gardens can increase if the drains become partially or completely blocked causing waterlogging of the drainage layer. The system requires a suitable protection layer to achieve the necessary combustibility rating applicable to each project. Fire test reports for various design specifications are available from the Certificate Holder. For green roof specifications, plants used may allow flame spread across the roof. This should be taken into consideration when selecting suitable plants for the roof. Appropriate planting irrigation and/or protection should be applied to ensure the overall fire-rating of the roof is not compromised.

D.1.12 TYPICAL GREEN ROOF DESIGN SPECIFICATION

Layer No.	Build-up Description	Alternative Build-up
1	Concrete Deck primed with PermaTec Primer	Concrete Deck primed with PermaTec Primer
2	2 Coats of Permatec Anti-Root Incorporating Permaflash-R Reinforcement	Permatec EcoWrap membrane incorporating PermaFLASH-R reinforcement
3	Permaguard-F Protection Layer	IKO Roofgarden 4APP AD/F 7.5 m
4	Inverted Roof Insulation	Inverted Roof Insulation
5	Water Control Layer	Water Control Layer
6	Drainage/Moisture Retention Layer	Drainage/Moisture Retention Layer
7	Broken Rubble/Brick	Broken Rubble/Brick
8	Biodiverse Growing Medium	Biodiverse Growing Medium
9	Wildflower Seed Mix	Wildflower Seed Mix

D.1.13 INSTALLATION

The installation procedures applicable are detailed in section 2.6 of this certificate. Soil or other bulk material should not be stored on one area of the roof prior to installation, to ensure that localised overloading does not occur. The membrane must be protected immediately with the specified PermaGUARD or IKO Roofgarden 4APP/F 7.5 m protection layer. This is carried out prior to applying the insulation, water control layer and the protective layer or other specified surface finish.

D.1.14 TECHNICAL INVESTIGATIONS

Section 4 of this Agrément Certificate details the tests, investigations and assessments conducted on the system. In addition, root resistance testing was evaluated as part of the green roof waterproofing system assessment. Tests on IKO Roofgarden 4APP AD/F 7.5m indicate that it is suitable for use as a root-resistant membrane and, when used with the systems in roof garden applications, will provide adequate protection from penetration by roots. The Permatec Anti-Root system will provide adequate protection from penetration by roots.

Design Data

Hydro-Brake® Optimum

Vortex Flow Control Valve

Inspired by nature and engineered to deliver the perfect curve, the Hydro-Brake® Optimum is the most advanced vortex flow control valve available. There is no equivalent to the Hydro-Brake® Optimum when it comes to delivering the best possible hydraulic performance with a passive flow control.

With a wide range of configurations and options available, the Hydro-Brake® Optimum is able to provide precision flow control to suit the vast majority of applications.

Figure 1 - The Hydro-Brake® Optimum is designed and manufactured to deliver precise, repeatable flow control.

Precision Engineered Vortex Flow Controls

Each Hydro-Brake® Optimum is custom configured to suit the application and is manufactured under strict quality assurance procedures to deliver precise flow control to exacting requirements.

Every unit is backed by significant R&D investment to fine-tune the performance, meaning that the Hydro-Brake® Optimum is the only vortex flow control to have been independently certified by the BBA and WRc.

BBA APPROVAL INSPECTION TESTING CERTIFICATION CERTIFICATE 08/4596

WRc Approved PT/329/0412

Benefits

- Manufactured from high grade stainless steel.
- Future proof – adjustable or replaceable inlet plates available to alter flow rates post-installation.
- Configurations available to suit a wide variety of installations.
- Large cross sectional area at all heads.
- Simple installation.
- Self-activating.
- No moving parts or external power requirement.

Versatile and Flexible

At Hydro International, we pride ourselves on providing solutions that meet your requirements, rather than providing a standard solution and asking you to compromize on your project needs.

The Hydro-Brake® Optimum offers designers options to precision-engineer a vortex flow control to:

- Minimize upstream storage volumes.
- Maximize internal (inlet & outlet) cross sectional areas to prevent blockages.
- Build-in a climate change factor to allow for future changes in flow rate.

Further, if you need to retrofit a flow control, our dedicated team of engineers can assist with providing a customized Hydro-Brake® Optimum suitable for installation into existing infrastructure.

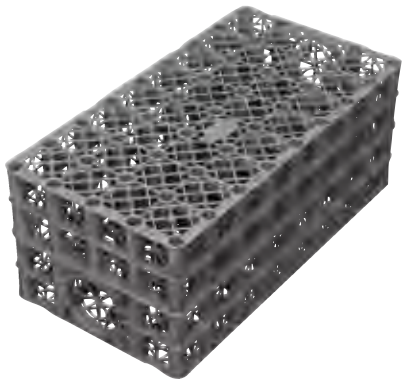
Polystorm Modular Cell

Data Sheet

PRODUCT INFORMATION | **ISSUE 3 - JAN 2016**

Product code: PSM1

The Polystorm cell made of virgin material, has a 44 tonnes/m² compressive strength. It is ideally suited for retention, attenuation or infiltration under trafficked or loaded areas at greater depths, such as car parks, housing and commercial developments.
An efficient and versatile solution for SuDS compliance, it is hard-wearing, lightweight and provides a 95% void ratio for maximum water capture.



Key Benefits

- Compressive strength of 44 tonnes/m²
- Ideal for retention, attenuation or infiltration applications with a suitable geomembrane or geotextile
- Designed for trafficked and loaded conditions
- BBA approved
- Visual and maintenance access can be achieved when used in conjunction with Polystorm Access & Inspect
- Can be used as part of a value engineered hybrid system with Polystorm Xtra & Polystorm Lite
- Integrated inlet and outlet
- 3D flow throughout the structure
- 95% void ratio
- 100% recyclable
- 50 years creep limited life expectancy

Technical Support

Detailed guidance and assistance is available.
For further information, please contact our Technical Team on **+44 (0) 1509 615100** or email **civils@polypipe.com**

BBA BRITISH BOARD OF AGREMENT
CERTIFICATE No. 06/4297

ELEMENT	VALUE
PHYSICAL PROPERTIES	
Length	1m
Width	0.5m
Depth	0.4m
Total volume	0.2m³
Unit weight	9kg
Unit storage volume	0.19m³ (190 litres)
Void ratio	95%
SHORT TERM COMPRESSIVE STRENGTH	
Vertical	Maximum 440kN/m² **
Lateral	Maximum 63kN/m² **
SHORT TERM DEFLECTION	
Vertical	83kN/m² per mm
Lateral	4.2kN/m² per mm
OTHER PROPERTIES	
Maximum burial depths:	
Light trafficked	3.7m***
Non-trafficked	3.8m***

* Each unit includes 4 Clips and 2 Shear Connectors.

** Compressive strength at yield, maximum recommended value for design purposes.

*** Based on ground conditions being dense sand and gravel with no groundwater present using the calculation methodology detailed within CIRIA C680 (2008). Where ground conditions differ please consult our water management solutions technical department on +44 (0) 1509 615100.

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Polypipe

APPENDIX D
Section 9 Application Submission to OPW

Paul Clune

From: Paul Clune
Sent: 16 October 2024 16:41
To: David Cleary
Cc: Marion Coughlan; Siobhán Morrissey; Dennis O'Keeffe; Brian Lahiff
Subject: RE: Residential Development at Groody Road - Surface Water Discharge to the Groody River
Attachments: W0657-Misc-002-Section 9 Application.pdf; Proposed Site Layout.pdf; W0657-020B-Foul and Stormwater Layout.pdf; W0657-024-Typical Surface Water Details.pdf; W0657-Report-002-Civil Engineering Report.pdf; W0657-Report-001B-Flood Risk Assessment.pdf

Categories: Filed by Newforma

Hi David

Please find attached the documentation for the section 9 application for the proposed student accommodation development at Groody Road, Newcastle, Limerick.

Please contact me should you have any queries or require more information.

Regards,

Paul Clune

GARLAND
Concepts Realised

Riverfront,
Howleys Quay,
Limerick, Ireland

T +353 61 319708

E paul.clune@garlandconsultancy.com

CONSULTING ENGINEERS | PROJECT MANAGEMENT
SAFETY MANAGEMENT | INTERNATIONAL
WWW.GARLANDCONSULTANCY.COM

DUBLIN
WATERFORD
INTERNATIONAL

VISIT US ON

From: David Cleary <David.Cleary@opw.ie>
Sent: 11 September 2024 10:09
To: Paul Clune <paul.clune@garlandconsultancy.com>
Cc: Marion Coughlan <marion.coughlan@opw.ie>; Siobhán Morrissey <siobhan.morrissey@opw.ie>; Dennis O'Keeffe <dennis.okeeffe@opw.ie>
Subject: RE: Residential Development at Groody Road - Surface Water Discharge to the Groody River

Hi Paul,

There is no form to fill out, but your letter of submission for section 9 should be accompanied by a report. The report should be similar to the Section 50 application report and have as many details as possible.

Some must-haves :
Headwall design detail.
Flow calculations and a full flood risk assessment including flood history for the location.

Best regards,

David Cleary

APPENDIX E
Uisce Éireann Confirmation of Feasibility

CONFIRMATION OF FEASIBILITY

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

Uisce Éireann
PO Box 448
South City
Delivery Office
Cork City

www.water.ie

Paul Clune

Riverfront
Howleys Quay
Limerick
Co. Limerick
V94 WTK7

5 December 2024

Our Ref: CDS24007270 Pre-Connection Enquiry
Groody Road, Newcastle, Co. Limerick

Dear Applicant/Agent,

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

Uisce Éireann has reviewed the pre-connection enquiry in relation to a Water & Wastewater connection for a Housing Development of 198 unit(s) at Groody Road, Newcastle, Co. Limerick **(the Development)**.

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

- **Water Connection** - Feasible without infrastructure upgrade by Uisce Éireann
- **Wastewater Connection** - Feasible without infrastructure upgrade by Uisce Éireann

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

As the network capacity changes constantly, this review is only valid at the time of its completion. As soon as planning permission has been granted for the Development, a completed connection application should be submitted. The connection application is available at www.water.ie/connections/get-connected/

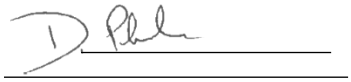
Where can you find more information?

- **Section A -** What is important to know?

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

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

Yours sincerely,



Dermot Phelan
Connections Delivery Manager

Section A - What is important to know?

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

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

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