REPORT ON DISPOSAL OF STORM WATER FROM NEW RESIDENTIAL DEVELOPMENT AT CARLEY'S BRIDGE, ENNISCORTHY, CO. WEXFORD.

Our Clients: TORCA DEVELOPMENTS LTD

Development Description: The proposed Strategic Housing Development will comprise a residential development of 233 no. units (53 no., 3-4 bed houses and 180 no. 1/2/3 bed duplexes/apartments). Provision of a creche. Associated car parking, bicycle parking, and open spaces/landscaping. Vehicular and pedestrian accesses provided via Carley's Bridge Road to the north west, pedestrian/cyclist access via Carley's Bridge Road to the north and Millbrook Residential Estate to the east of the site. All associated site works including boundary treatments, plant, bin stores, site services and connections to facilitate the development.

1.0 Overview

Sweeney Consulting Engineers Limited have been employed by Torca Developments Ltd to carry out calculations, in accordance with SUDS guidelines, to determine the volume of attenuation required for the above mentioned development. Given the constraints of the site, it is proposed to split the stormwater drainage network for the development into 2 no. zones, namely Zone A and Zone B. There will be an attenuation system for each zone and the attenuated stormwater from each zone will discharge to the River Urrin located to the southwest of the site.

It is a normal requirement of Wexford County Council to limit the storm water outflow from such a development to the 'greenfield' runoff. The allowable 'greenfield' runoff, Q_{BAR}, is determined using the equation devised in the Flood Studies Report (1974), and adopted in Section 24.3 of CIRIA SuDS Manual 2015. In addition attenuation must be provided for a 1 in 30 year storm and the site designed to accommodate the additional waters generated in a 1 in 100 year storm without flooding any property within the proposed development or any neighbouring property.

2.1.0 – Zone A - Allowable Run-Off, Q_{BAR}, (Rainfall Outflow):

Q_{BAR} is determined from the following equation:

$$Q_{BAR} = 0.00108 \times A^{0.89} \times SAAR^{1.17} \times S.I.^{2.17}$$

where: A = Site Area in km^2

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SAAR	=	Standard Average Annual Rainfall
	=	1163mm
S.I.	=	Soil Index

The soil index is a value varying between 0.15 and 0.5, depending on the impermeability of the soil (0.5 being most impermeable). The soil index was estimated using the HR Wallingford online calculator as being 0.3 (Soil Type 2).
The SAAR value of 1163mm was obtained from rainfall records recorded by Met Eireann at their Wexford Station, copy attached.
Section 24.3 of CIRIA SuDS Manual 2015 advocates the use of the flood studies equation for a site of 50 Hectares (0.5km^2), with the allowable run-off then being interpolated for sites with areas smaller than 50 Hectares.

Q_{BAR50}	=	$0.00108 \times 0.5^{0.89} \times 1163^{1.17} \times 0.3^{2.17}$
	=	0.16504 m^3/s
	=	165 l/s

The site area has been taken as that shaded cream and labelled Zone A on the drawing SCE-002P submitted with this planning application and is equal to 5.02 Hectares.

Q_{BAR}	=	5.02 x (0.165/50)
	=	16.57 l/s.

As detailed in SUDS manual, this Q_{BAR} figure should be modified for the year 2 Q_{BAR} rate for calculating the attenuation required for the 1 in 30 year storm and the year 30 Q_{BAR} rate for calculating the attenuation required for the 1 in 100 year storm using the formulae

$$Q_T / Q_{BAR} = -3.33 + 4.20\, e^{Y/20} \quad \text{and} \quad Y = -\ln [-\ln (T-1)/T]$$

Thus **Q_2 = 15.7 l/s and Q_{30} = 27.3 l/s**

2.1.1 – Zone A - Storage Volumes Required:

The following data is used to determine the storage required:

- Equivalent Hardstanding area = 100% Roofs + 80% Impermeable Paved Area + 30% Permeable Areas (30% of the remainder of the site not covered by roof or paved).
  = (100% x 6545m^2) + (80% x 12316m^2) + (30% x 31339m^2) = **25799.5m^2**
- Permitted Outfall of **15.7 l/s for 1 in 30 year storm and 27.3 l/s for 1 in 100 year storm**
- Rainfall Data (mm) from Met Eireann data

Section 24.7.1 of CIRIA SuDS Manual 2015 advocates an increase in the rainfall figures be adopted to account for future climate change. An increase of 10% has been allowed for in these calculations.

1 in 30 Year Storm – Based on the Q_2 outflow rate

Duration	30 Year Rainfall (mm)	Rainfall +10% (mm)	Inflow (m^3)	Outflow (m^3)	Storage Required (m^3)
15 min	15.8	17.4	448.4	14.1	434.3
30 min	20.6	22.7	584.6	28.3	556.4
1 Hour	26.0	28.6	737.9	56.5	681.3
2 Hour	32.0	35.2	908.1	113.1	795.1
4 Hour	41.0	45.1	1163.6	226.1	937.4
6 Hour	48.0	52.8	1362.2	339.2	1023.0
12 Hour	60.0	66.0	1702.8	678.4	1024.4
24 hour	72.0	79.2	2043.3	1356.7	686.6
48 hour	87.0	95.7	2469.0	2713.5	0

The maximum volume of storage is required for the 12 hour storm, which is $1024.4m^3$.

1 in 100 Year Storm – Based on the Q_{30} outflow rate

Duration	100 Year Rainfall (mm)	Rainfall +10% (mm)	Inflow (m^3)	Outflow (m^3)	Storage Required (m^3)
15 min	21.0	23.1	596.0	24.5	571.4
30 min	27.0	29.7	766.2	49.0	717.2
1 Hour	34.0	37.4	964.9	98.1	866.8
2 Hour	42.0	46.2	1191.9	196.2	995.8
4 Hour	52.0	57.2	1475.7	392.4	1083.4
6 Hour	60.0	66.0	1702.8	588.5	1114.2
12 Hour	74.0	81.4	2100.1	1177.1	923.0
24 hour	89.0	97.9	2525.8	2354.2	171.6
48 hour	106.0	116.6	3008.2	4708.3	0

The maximum volume of storage is required for the 6 hour storm, which is $1114.2m^3$.

2.1.2 – Zone A - Attenuation Provided

Section 3.3.2 of CIRIA SuDS Manual 2015 states that *"The drainage system should be designed so that peak runoff rates from the site for events are constrained to the greenfield rates of runoff for the same return period".* This implies that a 1 in 1 year storage system with a 1 in 1 year Greenfield runoff outlet should be provided for the 1 in 1 year return event and so on for the 1 in 2 year, 1 in 3 year etc.

This design has adopted the approach outlined in the Carlow County Council SUDS policy document and proposes an attenuation system with 2 no. flow control devices.
It is proposed to attenuate the storm water generated in the 1 in 100 year storm in the same attenuation system as the 1 in 30 year storm. This system shall be fitted with 2 no. flow control devices to limit the outflow from the system.
A low level flow control device shall be installed to restrict the flow to 15.7 l/s (Q_2 flow rate) and a high level flow control device shall be installed to restrict the additional flow of 11.6 l/s (Q_{30} - Q_2 flow rate).
The high level device shall be installed at a level that allows the 1 in 30 year storage volume of 1024.4m^3 be accommodated within the tank therefore allowing the 1 in 100 year storm flows discharge through the higher flow control device at a rate of 11.6 l/s i.e. the $Q_{30} – Q_2$ rate.

Accordingly it is proposed to provide a storm water attenuation system for this development with capacity of 1114.2m^3. The outflow from the development shall be fitted with 2 no. flow control devices as described above.
The precise type /model of attenuation systems to be installed shall be agreed with Wexford County Council prior to construction

3.0 – Zone A - Maintenance

It is proposed to attenuate the stormwaters in an offline system adjacent to manhole S20. S20 shall accommodate the flow control devices on the outlet pipes from the manhole as mentioned above. Furthermore S20 shall be constructed as a silt-trap manhole i.e. the base of the manhole shall be formed 500mm lower than the outlet pipe of the manhole. This manhole should be monitored for silt build-ups at regular intervals and cleaned out accordingly. Depending on the quantity of silt build-ups, the monitoring of the silt-trap can be increased or decreased.

4.1.0 – Zone B - Allowable Run-Off, Q_{BAR}, (Rainfall Outflow):

Q_{BAR} is determined from the following equation:

$$Q_{BAR} = 0.00108 \times A^{0.89} \times SAAR^{1.17} \times S.I.^{2.17}$$

where:
- A = Site Area in km^2
- SAAR = Standard Average Annual Rainfall
  = 1163mm
- S.I. = Soil Index

The soil index is a value varying between 0.15 and 0.5, depending on the impermeability of the soil (0.5 being most impermeable). The soil index was estimated using the HR Wallingford online calculator as being 0.3 (Soil Type 2).
The SAAR value of 1163mm was obtained from rainfall records recorded by Met Eireann at their Wexford Station, copy attached.
Section 24.3 of CIRIA SuDS Manual 2015 advocates the use of the flood studies equation for a site of 50 Hectares ($0.5km^2$), with the allowable run-off then being interpolated for sites with areas smaller than 50 Hectares.

$$Q_{BAR50} = 0.00108 \times 0.5^{0.89} \times 1163^{1.17} \times 0.3^{2.17}$$
$$= 0.16504\ m^3/s$$
$$= 165\ l/s$$

The site area has been taken as that shaded pink and labelled Zone B on the drawing SCE-002P submitted with this planning application and is equal to 1.68 Hectares.

$$Q_{BAR} = 1.68 \times (0.165/50)$$
$$= 5.55\ l/s.$$

As detailed in SUDS manual, this Q_{BAR} figure should be modified for the year 2 Q_{BAR} rate for calculating the attenuation required for the 1 in 30 year storm and the year 30 Q_{BAR} rate for calculating the attenuation required for the 1 in 100 year storm using the formulae

$$Q_T / Q_{BAR} = -3.33 + 4.20\ e^{Y/20} \quad \text{and} \quad Y = -\ln [-\ln (T-1)/T]$$

Thus **Q_2 = 5.2 l/s and Q_{30} = 9.0 l/s**

4.1.1 – Zone B - Storage Volumes Required:

The following data is used to determine the storage required:

- Equivalent Hardstanding area = 100% Roofs + 80% Impermeable Paved Area + 30% Permeable Areas (30% of the remainder of the site not covered by roof or paved).
  = (100% x 3773m^2) + (80% x 5161m^2) + (30% x 7866m^2) = **10261.6m^2**
- Permitted Outfall of **5.2 l/s for 1 in 30 year storm and 9.0 l/s for 1 in 100 year storm**
- Rainfall Data (mm) from Met Eireann data

Section 24.7.1 of CIRIA SuDS Manual 2015 advocates an increase in the rainfall figures be adopted to account for future climate change. An increase of 10% has been allowed for in these calculations.

1 in 30 Year Storm – Based on the Q_2 outflow rate

Duration	30 Year Rainfall (mm)	Rainfall +10% (mm)	Inflow (m^3)	Outflow (m^3)	Storage Required (m^3)
15 min	15.8	17.4	178.3	4.7	173.6
30 min	20.6	22.7	232.5	9.5	223.1
1 Hour	26.0	28.6	293.5	18.9	274.6
2 Hour	32.0	35.2	361.2	37.8	323.4
4 Hour	41.0	45.1	462.8	75.7	387.1
6 Hour	48.0	52.8	541.8	113.5	428.3
12 Hour	60.0	66.0	677.3	227.0	450.2
24 hour	72.0	79.2	812.7	454.0	358.7
48 hour	87.0	95.7	982.0	908.1	73.9

The maximum volume of storage is required for the 12 hour storm, which is 450.2m^3.

1 in 100 Year Storm – Based on the Q_{30} outflow rate

Duration	100 Year Rainfall (mm)	Rainfall +10% (mm)	Inflow (m^3)	Outflow (m^3)	Storage Required (m^3)
15 min	21.0	23.1	237.0	8.2	228.8
30 min	27.0	29.7	304.8	16.4	288.4
1 Hour	34.0	37.4	383.8	32.8	351.0
2 Hour	42.0	46.2	474.1	65.7	408.4
4 Hour	52.0	57.2	587.0	131.3	455.7
6 Hour	60.0	66.0	677.3	197.0	480.3
12 Hour	74.0	81.4	835.3	393.9	441.4
24 hour	89.0	97.9	1004.6	787.8	216.8
48 hour	106.0	116.6	1196.5	1575.7	0

The maximum volume of storage is required for the 6 hour storm, which is 480.3m^3.

4.1.2 – Zone B - Attenuation Provided

Section 3.3.2 of CIRIA SuDS Manual 2015 states that *"The drainage system should be designed so that peak runoff rates from the site for events are constrained to the greenfield rates of runoff for the same return period".* This implies that a 1 in 1 year storage system with a 1 in 1 year Greenfield runoff outlet should be provided for the 1 in 1 year return event and so on for the 1 in 2 year, 1 in 3 year etc.

This design has adopted the approach outlined in the Carlow County Council SUDS policy document and proposes an attenuation system with 2 no. flow control devices.
It is proposed to attenuate the storm water generated in the 1 in 100 year storm in the same attenuation system as the 1 in 30 year storm. This system shall be fitted with 2 no. flow control devices to limit the outflow from the system.
A low level flow control device shall be installed to restrict the flow to 5.2 l/s (Q_2 flow rate) and a high level flow control device shall be installed to restrict the additional flow of 3.8 l/s (Q_{30} - Q_2 flow rate).
The high level device shall be installed at a level that allows the 1 in 30 year storage volume of 450.2m^3 be accommodated within the tank therefore allowing the 1 in 100 year storm flows discharge through the higher flow control device at a rate of 3.8 l/s i.e. the $Q_{30} – Q_2$ rate.

Accordingly it is proposed to provide a storm water attenuation system for this development with capacity of 480.3m^3. The outflow from the development shall be fitted with 2 no. flow control devices as described above.
The precise type /model of attenuation systems to be installed shall be agreed with Wexford County Council prior to construction

5.0 – Zone B - Maintenance

It is proposed to attenuate the stormwaters in an offline system adjacent to manhole S1. S1 shall accommodate the flow control devices on the outlet pipes from the manhole as mentioned above. Furthermore S1 shall be constructed as a silt-trap manhole i.e. the base of the manhole shall be formed 500mm lower than the outlet pipe of the manhole. This manhole should be monitored for silt build-ups at regular intervals and cleaned out accordingly. Depending on the quantity of silt build-ups, the monitoring of the silt-trap can be increased or decreased.

Signed:

Martin Sweeney BA, BAI, C.Eng.
24th March 2022.

Extreme Rainfall Return Periods

Location: WEXFORD
Average Annual Rainfall: 1163

Maximum rainfall (mm) of indicated duration expected in the indicated return period.

Special (log

	Return Period (years)							
Duration	1/2	1	2	5	10	20	50	100	30
1 min				1.9	2.1	2.5	3.0	3.4	2.7
2 min				3.2	3.6	4.2	5.2	6.0	4.7
5 min				5.7	6.5	7.7	9.5	10.9	8.4
10 min				8.1	9.4	11.2	14.0	16.2	12.3
15 min	5.2	6.5	7.3	9.8	11.9	14.2	18.0	21	15.8
30 min	7.1	8.8	9.8	13.1	15.6	18.6	23	27	20.6
60 min	9.4	11.5	12.8	16.9	20.1	24	30	34	26
2 hour	12.5	15.3	16.8	21.7	26	30	36	42	32
4 hour	17.2	20.6	22.3	28	33	38	45	52	41
6 hour	20.8	24.7	27	34	39	44	53	60	48
12 hour	26.7	32	34	43	49	56	65	74	60
24 hour	33	39	42	52	59	67	79	89	72
48 hour	41	48	52	64	72	81	94	106	87

Notes: Larger margins of error for 1, 2 ,5 and 10 minute values and for 100 year return periods

M560: 16.9 M52d: 60 M560/m52d: 0.28

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Greenfield runoff rate estimation for sites

www.uksuds.com | Greenfield runoff tool

Calculated by:	Martin Sweeney
Site name:	Torca Developments Ltd
Site location:	Enniscorthy (Zone A)

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:	52.49910° N
Longitude:	6.58563° W
Reference:	398294681
Date:	Mar 24 2022 11:48

Runoff estimation approach IH124

Site characteristics

Total site area (ha): 5.02

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):	1030	1163
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):	14.38	16.57
1 in 1 year (l/s):	12.22	14.08
1 in 30 years (l/s):	23.72	27.34
1 in 100 year (l/s):	28.03	32.31
1 in 200 years (l/s):	30.91	35.63

HR Wallingford
Working with water

Greenfield runoff rate estimation for sites

www.uksuds.com | Greenfield runoff tool

Calculated by:	Martin Sweeney
Site name:	Torca Developments Ltd
Site location:	Enniscorthy (Zone B)

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:	52.49802° N
Longitude:	6.58308° W
Reference:	633378035
Date:	Mar 24 2022 11:54

Runoff estimation approach IH124

Site characteristics

Total site area (ha): 1.68

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):	1032	1163
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):	4.82	5.55
1 in 1 year (l/s):	4.1	4.71
1 in 30 years (l/s):	7.96	9.15
1 in 100 year (l/s):	9.4	10.81
1 in 200 years (l/s):	10.37	11.92