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Ms. Suzanne McClure,
Brock McClure Planning & Development Consultants,
63 York Road,
Dun Laoghaire,
Co. Dublin

19 August 2022

Ref: P210203/so'r

Dear Suzanne,

RE: EQUINIX (IRELAND) LTD.,
PLOT 100, PROFILE PARK, NANGOR ROAD, CLONDALKIN, DUBLIN 22,

Please find our response to Item No. 7, addressing the Request For Additional Information pertaining to the above project, as dated 22nd July 2022, together with 6 No. copies of all documentation, as mentioned below:-

Item 7: The applicant is requested to:

a) *Submit a report and drawing showing where each catchment is draining to. The drawing shall show how water flow is controlled in each catchment. The maximum discharge rate shall not exceed Qbar or green field runoff rate for the site. Show on revised drawing and report what the discharge rate is for each catchment in the development. Prior to submission of this report, the applicant is requested to contact water services in South Dublin County Council to discuss the revised submission.*

b) *Submit a report and drawing to show what flood risk there is for the site. If there is a flood risk, the applicant is requested to show what mitigation measures are proposed in respect to such a flood risk.*

Response:

a) The catchments are clearly indicated on Dwg. DB080-PIN-00-ZZ-DR-C-PLAN-1295 Rev. P04. This current OSPG application falls under 2 catchments, i.e. Catchments 08 & 09, which form part of the overall drainage network for the entire development, which was previously granted permission under Planning Reg. Ref. SD21A/0186, dated 24th March 2022.

   The table below, derived from the aforementioned drawing, details the outflow control measures for each catchment, via hydrobrake mechanisms.

Surface Water Manhole	Run-off Rates and Levels		Surface Water Manhole	Run-off Rates and Levels
SWMH3.1	HYDROBREAKSET AT MAX 0.6 l/s CL 74.530 IL 73.010		**SWMH13.2**	HYDROBREAK SET AT MAX 1.9 l/s CL 74.530 IL 73.010
SWMH 5.1	HYDROBREAKSET AT MAX 0.2 l/s CL 75.050 IL 72.900		**SWMH14.1**	HYDROBREAKSET AT MAX 1.0 l/s CL 73.400 IL in 72.800 IL out 72.000
SWMH 6.2	HYDROBREAKSET AT MAX 0.2 l/s CL 74.40 IL 72.670			

Table 1 –Run-Off Rates for each Flow Control Device

The overall Qbar calculation, including for the Qbar calculations of each individual catchment, have been included within Appendix A of this report.

The overall discharge rate off site has been calculated as 3.9l/s, which is in accordance with Greenfield run-off rates and equates to 2l/s/Ha.

Further to the above, please find our hydraulic information below, in support of the On-Site Power Generation (OSPG) Planning Application at above mentioned site.

The OSPG covers a site area of 2 604m^2. The runoff generated from this area and surface water storage requirements have already been included in the site attenuation pond and overall drainage scheme of the site, as granted under Planning Reg. Ref.SD21A/0186. Thus, no additional attenuation storage elements are required for the proposed OSPG development, in order to meet the GDSDS requirements.

The OSPG will drain by pipes, gulley's and channels towards the central pond where storage capacity for a 1:100yr storm event + 20% climate change has already been catered for. The central pond provides a storage volume of circa 756m^3 and is adequately sized to cater for this development, particularly as this application area was considered as being 100% hardstanding under the aforementioned granted application and now, as can be seen, this area consists largely of concrete plinths and gravel type surfaces - refer to Dwg. No.'s DB080-PIN-00-ZZ-DR-C-PLAN-1207 Rev. P04 & DB080-PIN-00-ZZ-DR-C-PLAN-1295 Rev. P04.

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The overall site QBar is 3.9l/s and the total site surface water drainage will be restricted to this discharge rate. Please also refer to the CFI Response letter dated 24 February 2022, as contained within Appendix A, which describes the overall sites hydraulic, drainage, SUDS features and storage requirements.

b) A Flood Risk Assessment was submitted as part of the planning pack for the overall development of the site, dated June 2021 - refer Appendix B. This overall development was subsequently granted permission under Planning Reg. Ref. SD21A/0186, dated 24th March 2022.

It should be noted that this application is located within the confines of the overall development, which has obtained a grant of permission, as noted above.

The following engineering drawings have been prepared in support of the proposed application:

- Dwg. No. DB080-PIN-00-ZZ-DR-C-PLAN-1207 Rev. P04 titled "Surface Water - Site Drainage"
- Dwg. No. DB080-PIN-00-ZZ-DR-C-PLAN-1208 Rev. P01 titled "On Site Power Generation Compound Drainage And Levels Layout
- Dwg. No. DB080-PIN-00-ZZ-DR-C-PLAN-1211 Rev. P04 titled "External Works Layout"
- Dwg. No. DB080-PIN-00-ZZ-DR-C-PLAN-1295 Rev. P04 titled "Surface Water Catchment & SUDS Features"
- Dwg. No. DB080-PIN-00-ZZ-DR-C-PLAN-1296 Rev. P03 titled "SUDS Details"

Should you have any queries, or require any further clarification on the above, please do not hesitate to contact me.

Shaun O'Reilly
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Encl. (30)

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APPENDIX A

CFI Response Letter Dated 24th February 2022

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Ms. Suzanne McClure,
Brock McClure Planning & Development Consultants,
63 York Road,
Dun Laoghaire,
Co. Dublin

24 February 2022

Ref: P210203/so'r

Dear Suzanne,

RE: EQUINIX (IRELAND) LTD.,
PLOT 100, PROFILE PARK, NANGOR ROAD, CLONDALKIN, DUBLIN 22,
PLANNING REG. REF. SD21A/0186

Please find our response to Item No. 1(a) & (b-part), addressing the Request for Clarification of Additional Information pertaining to the above project, as dated 17th January 2022, together with 6 No. copies of all documentation, as listed below. Note that Items 1(c) & (d) are to be responded to by others:-

Item 1(a):-

The applicant was requested to submit a report showing greenfield run off rates and attenuation calculations for each surface water drainage catchment and to submit proposals to minimise the use of underground attenuation systems on site (concrete tanks are not acceptable), requested to clarify what attenuation volumes are proposed for the development as the volumes referred to in the engineering report do not correlate with the submit surface war drainage plans and to submit a drawing showing the inclusion of more Sustainable Drainage Systems (SuDS) for the development such as swales, filter drains, tree pits, rain gardens and Rainwater harvesting systems (amongst other items). The response to Item 6 was not to the satisfaction of the Planning Authority, the Water Services Department and the Parks and Public Realm Department. The following clarification of further information is therefore requested:
(a) The detail submitted by the applicant has not sufficiently clarified previous request for additional information. Prior to submitting the below requested information, the applicant should consult with South Dublin County Council's Water & Drainage Section. The following should be addressed in revised proposals:
(i) Concrete attenuation tanks are not permitted. The applicant is required to submit a drawing showing the use of alternative means of attenuation through the use of Sustainable Drainage Systems (SuDS). The concrete tank should be omitted from the proposed development.

(ii) The Greenfield run off calculations provided by the applicant are not clear. The applicant is required to submit the following which summarises greenfield run off rate proposals for each catchment.
(iii) A report which clarifies greenfield run off rate calculations for each surface water catchment. The report must clearly show standard average annual rainfall (SAAR), SOIL and Catchment Area). Greenfield run off rates must be calculated in accordance with the Institute of Hydrology 124 method (IH 124).
(iv) A drawing which shows the maximum run off rates for each individual flow control device.

Response:-

(a)_(i): The concrete attenuation tank, as previously located beneath the service yard, which had been proposed during the submission for Additional Information, has since been removed in its entireity from the surface water network, as requested. The run-off previously catered for by the concrete tank has now been accommodated within the attenuation pond, which provides for a total volume of circa 756m^3 - refer Dwg. No. DB080-PIN-00-ZZ-DR-C-PLAN-1207 Rev. P03.

(a)_(ii): Refer Appendix A and Dwg. No. DB080-PIN-00-ZZ-DR-C-PLAN-1295 Rev. P03, for individual greenfield run-off calculations for each individual catchment - there are 11No. catchments in total pertaining to this scheme which have been catered for (extract below).

SITE CATCHMENT AREAS						
CATCHMENT	HATCH	AREA (M²)	% AREA	C VALUE	GREENFIELD RUN OFF RATES L/S (QBAR 2L/S/HA. SAAR 754)	DRAINS TO
CAT 1		1381	5.20%	0.5	0.28	SUDS PERMEABLE GRAVEL 1
CAT 2		553	2.1%	0.8	0.11	SUDS SWALE 1
CAT 3		1126	4.2%	1.0	0.23	SUDS POND
CAT 4		2040	7.6%	0.5	0.41	SUDS PERMEABLE GRAVEL 2
CAT 5		2153	8.0%	0.8	0.43	SUDS POND
CAT 6		1946	7.3%	1.0	0.39	SUDS POND
CAT 7		4363	16.3%	0.6	0.87	SUDS PERMEABLE PAVING
CAT 8		2704	10.1%	1.0	0.54	SUDS POND
CAT 9		1773	6.6%	0.5	0.35	SUDS POND
CAT 10		825	3.1%	0.8	0.17	SUDS SWALE 2
CAT 11		708	2.6%	0.8	0.14	SUDS SWALE 2
LANDSCAPING		7193	26.9%	0.8		LANDSCAPING
TOTAL		26 765	100%		3.9 L/s (QBAR)	

(a)_(iii): All individual catchment areas are in accordance with IH 124, as is verified on the individual excel spreadsheets for each catchment. The respective run off rates are replicated in (ii) above and can be found in Appendix A, together with the hydraulic model calculations. The SAAR value is extracted from Met Eirann data and equates to 754mm, for this location. The Met Eireann rainfall data sheet is contained within Appendix B.

(a)_(iv): Refer Dwg. No. DB080-PIN-00-ZZ-DR-C-PLAN-1207 Rev. P03, for information pertaining to the respective flow control devices, detailing the respective run off rates from each device. In total, there are 5 No. flow control devices and for clariy, these are located at Manhole Ref. No.'s SWMH 3.1, 5.1, 6.2, 13.2, & 14.1. Table 1 below is provided for ease of reference.

Surface Water Manhole	Run-off Rates and Levels		Surface Water Manhole	Run-off Rates and Levels
SWMH3.1	HYDROBREAKSET AT MAX 0.6 l/s CL 74.530 IL 73.010		**SWMH13.2**	HYDROBREAK SET AT MAX 1.9 l/s CL 74.530 IL 73.010
SWMH 5.1	HYDROBREAKSET AT MAX 0.2 l/s CL 75.050 IL 72.900		**SWMH14.1**	HYDROBREAKSET AT MAX 1.0 l/s CL 73.400 IL in 72.800 IL out 72.000
SWMH 6.2	HYDROBREAKSET AT MAX 0.2 l/s CL 74.40 IL 72.670			

Table 1 –Run-Off Rates for each Flow Control Device

Item 1(b):-

(b) There is a significant lack of SuDS features proposed for the development. The Planning Authority, the Water Services Department and the Parks and Public Realm Department have all raised concerns regarding this element. The following is required:
(i) The applicant, in their response was requested to provide SUDS throughout the development. The response to the AI request did not significantly address this important issue. The applicant is therefore requested to submit revised proposals showing significantly increased proposals for SuDS features for the development such as green roofs, living walls, swales, channel rills, integrated SuDS bioretention tree pits, bioretention features, rain gardens, rainwater harvesting, above ground attenuation, detention basins, reed bed/wetland etc. and other such SuDS and show what attenuation capacity is provided by such SuDS

(ii) The applicant is required to submit Engineering drawings showing the inclusion of more SuDS for the development as outlined in Item b) i. The drawing should show how the SuDS features are incorporated with the surface water drainage network on the site. A cross sectional detail is required of all proposed SuDS features.
(iii) Underground tanks remain beneath landscaped areas; these are generally not acceptable. These areas could be used for above ground attenuation and/or conveyance - the tanks render these areas sterile for tree planting. SDCC do not approve of using underground tanks as part of SuDS schemes where the full potential for the natural drainage features has not been explored. The applicant is requested to seek alternative solutions to minimise underground tanks and provide for significant SUDS across the entire site and is requested to clearly demonstrate, in revised proposals, the full potential for the natural drainage features explored across the site.
**Note: The applicant should note that SuDS is an interdisciplinary issue their drainage engineers need to address and is not simply a landscaping requirement as indicated by the report by Pinnacle Engineers in the response to the AI request. SUDS should be an integrated multi-*

disciplinary approach which locally addresses water quality, water quantity, and provides for amenity and biodiversity enhancement which meets the objectives of South Dublin County Council Development Plan 2016-2022.
(iv) The applicant is requested to demonstrate, in revised proposals, how the design has made use of the soft landscape to manage surface water and demonstrate how SuDS features have been integrated into the landscape proposal and provide details on how they work.

Response:-

(b) _(i): In respect of SuDS, the scheme has been totally revised and currently comprises of 100% coverage of SuDS elements, pertaining to the surface water attenuation storage volume required of this development, which is based on a 1:100yr storm event + 20% climate change. These storage & SuDS features contain the following:-

- Attenuation Pond / Wetland (1No.)
- **Roadside Swales** (2No.)
- Permeable Paving
- Gravel
- **Green Roofs** (Bin Storage / Loading Dock Roof Area)
- **Rain Water Harvesting** (Office Building Area)
- Bioretention Tree Pits
- Flow Control Devices
- Interceptors

Features in **bold** above denote additional SuDS features proposed in response to this CFI request.

The attenuation storage volumes for each of the pond, swales, permeable paving, gravel areas, bioretention tree pits, green roofs & rain water harvesting are clearly indicated on Dwg. No. DB080-PIN-00-ZZ-DR-C-PLAN-1295 Rev. P03 and summarised in Table 2 below.

Further details pertaining to the green roofs, rain water harvesting and bioretention tree pits are to be provided by the Architect (RKD), Landscape Architect (Murray Ass.) & Red Engineering (M&E Consultants).

No.	SuDS Feature	Attenuation Storage Volume (m3)
1.	Bioretention Tree Pits	Circa 4
2.	Permeable Paving	237
3.	Permeable Gravel Areas 1 & 2	93 (30 and 63)
4.	Green Roofs	Circa 4
5.	Rain Water Harvesting (Office Building Area)	4
6.	Swale 1	30
7.	Swale 2	70
8.	Attenuation Pond	756
Total		**1,198**

Table 2 –Total Attenuation Storage Volumes

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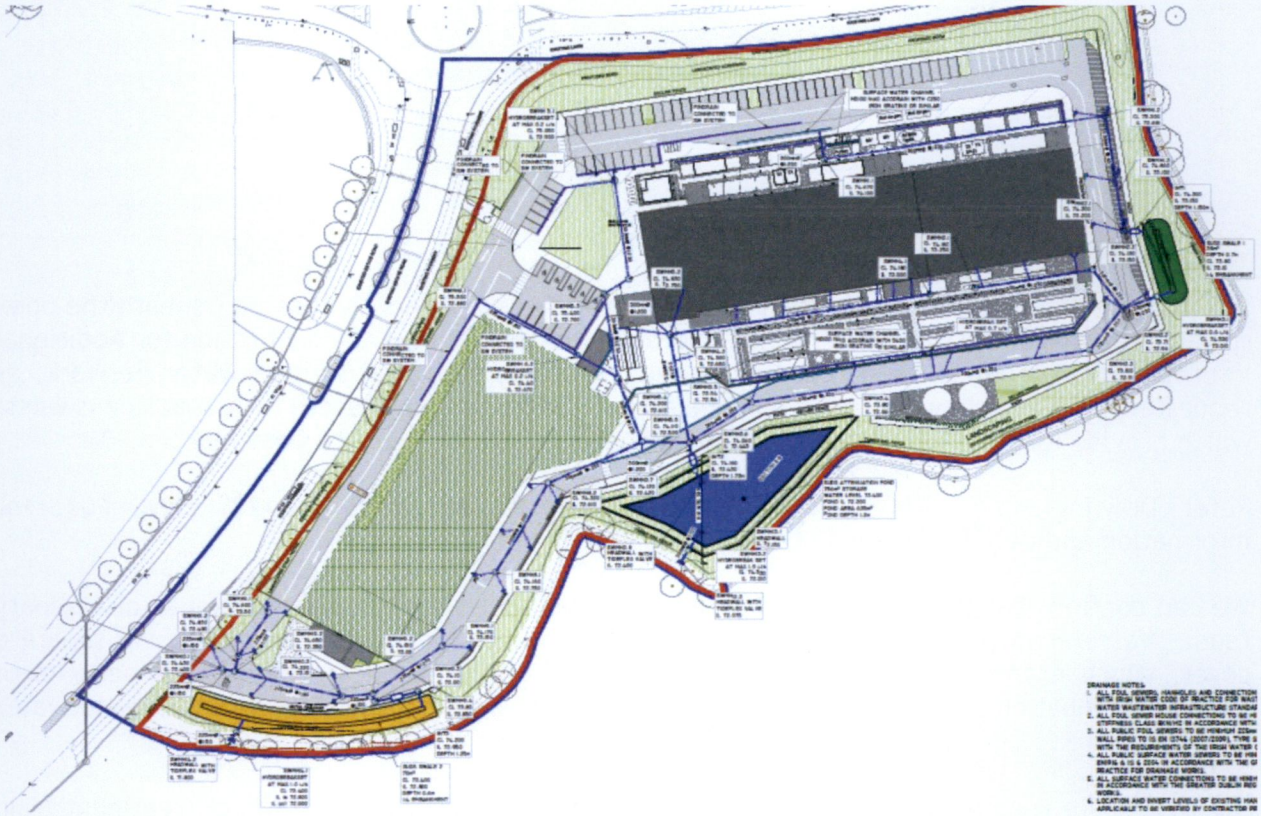
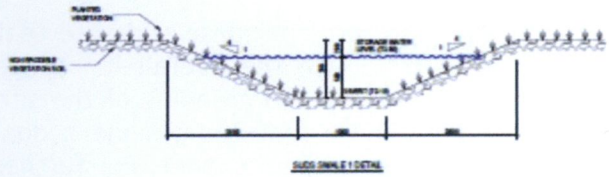
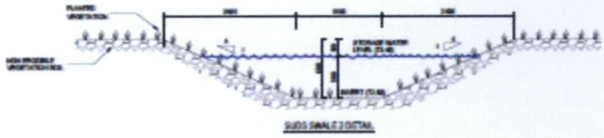
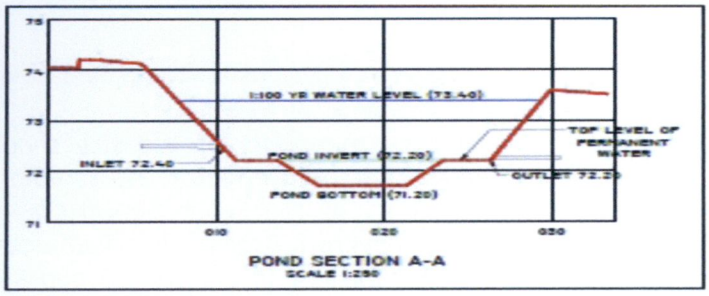
(b)_(ii): Refer Drawing No: DB080-PIN-00-ZZ-DR-C-PLAN-1207 Rev. P03 (extract below), which indicates the overall site reticulation network and the connections of the pipe network draining into the respective attenuation storage features.

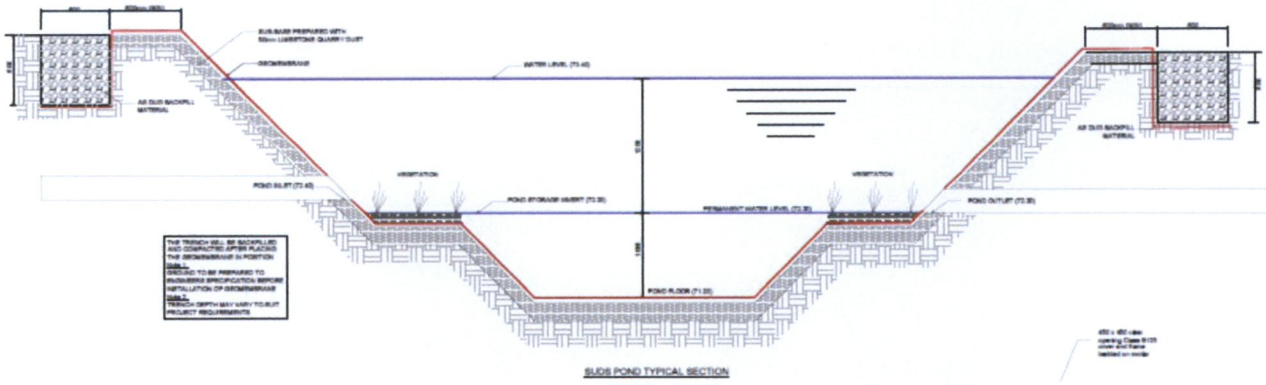


Cross sections of the attenuation pond and swales (extracts below), have been incoporated on Drawing No's: DB080-PIN-00-ZZ-DR-C-PLAN-1295 Rev. P03 & 1296 Rev. P03.









(b)_(iii): The below ground Stormtech attenuation tanks, as previously located beneath the open space areas to the west and east, which had been proposed during the submission for Additional Information, have since been removed in their entireity from the surface water network, as requested. These below ground storage elements have been replaced with roadside swales, which provide for the required attenuation volumes of the respective catchments.

Refer Drawing No.'s: DB080-PIN-00-ZZ-DR-C-PLAN-1207 Rev. P03 & 1295 Rev. P03, for information and details pertaining to same.

We can confirm that the revised SuDS proposal has been designed as part of a multi-disciplinary team. We refer in particular to the response prepared by Murray and Associates, via separate cover, which examines the rationale for the chosen design having regard to the benefits of surface attenuation in the form of ponds and swales, thereby enhancing biodiversity and water quality on site.

(b)_(iv): There is no scope within the landscape elements to provide any form of treatment train connecting the various storage elements along the southern boundary. This is due to a combination of space constraints in proximity to the the site boundary, existing trees having to be retained and new landscaping and berming having to be installed.

However, reference should again be made to the Murray and Associates response and note that bioretention tree pits, green roof elements, swales/ponds are part of the overall landscape strategy for the site. These features contribute to the overall amenity and greening of the site that benefit all future users and visitors to the development. These features provide a dual benefit by managing and reducing surface water discharge in a sustainable manner. For further details of soft landscaping integration into the attenuation pond and swale features, refer to information and drawings as provided by Murray and Associates.

Item 1(c):-

The southern landscaped/SUDS area located along the southern boundary of the site should demonstrate that 10m buffer (minimum) from the top of the northern edge of the stream is provided for its entire length in compliance with Objective G3-2 of the South Dublin County Development Plan 2016-2022. Note: All amendments to the overall proposed development should demonstrate compliance with policies and objectives as laid out in Chapters 7 and 8 of

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the County Development Plan. It should be clearly demonstrated that natural SuDS have been explored sufficiently and incorporated within the site (this may require the area stated for future development to be used to provide the required SuDS.)

Response:-

As mentioned, this item is to be responded to by Murray and Associates & Brock McClure (Planning Consultants), via seperate cover.

Item 1(d):-

Having regard to the above, the Planning Authority have concerns in relation to the intensity of the development on the site and the potential for sustainable surface water attenuation of the indicated additional future development on the site. This future area may need to be used to accommodate appropriate SUDS measures.

Response:-

We note that the SuDS requirements for the subject application are comprehensively addressed as part of this application. The area indicated as additional future development will be planted as a meadow. Any future application will address all SuDS requirements under separate consent. This is reiterated in the response as prepared by Brock McClure (Planning Consultants).

Should you have any queries, or require any further information or drawings, please do not hesitate to contact me.

Yours sincerely,

Shaun O'Reilly
Pinnacle Consulting Engineers
shaun.oreilly@iepinnacle.com
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Encl. (24)

- Dwg. No. DB080-PIN-00-ZZ-DR-C-PLAN-1207 Rev. P03 titled "Surface Water - Site Drainage"
- Dwg. No. DB080-PIN-00-ZZ-DR-C-PLAN-1211 Rev. P03 titled "External Works Layout"
- Dwg. No. DB080-PIN-00-ZZ-DR-C-PLAN-1295 Rev. P03 titled "Surface Water Catchment & SUDS Features"
- Dwg. No. DB080-PIN-00-ZZ-DR-C-PLAN-1296 Rev. P03 titled "SUDS Details"

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APPENDIX A

GREENFIELD (Qbar) RUN OFF CALCULATIONS

FOR CATCHMENTS 01 – 11 &

HYDRAULIC NETWORK CALCULATIONS

Qbar Calculation
Using IOH Report 124 for Sites < 25 km²

Catchment Name
DB8 - PLOT 100 PROFILE PARK, DUBLIN

$^{1}Q_{bar} = 0.00108 * (AREA)^{0.89}(SAAR)^{1.17}(SOIL)^{2.17}$

Estimation of QBAR from IOH Report 124 for catchments less than 25 km² using the 3 variable equation

SITE AREA =	2.68	Ha	Overall Redline Area
CATCHMENT AREA =	1.96	Ha (excl. Public Open Space)	Overall Catchment Area (Hectares) For catchments < 50 hectares in area, flow rates are linearly interpolated for smaller areas.
AREA =	0.020	km²	Area of the Catchment (km²)
SAAR =	754	mm	Standard Annual Average Rainfall (mm)
SOIL =	0.30		
$M5_{60}$	16.8	mm	
$M5_{2DAY}$	61.9	mm	
$R=(M5_{60}/M5_{2d})$	0.27		Soil index value (SPR) calculated from Flood Studies Report Vol V Fig I 4.18(1) - The Classification of Soils from Winter Rainfall Acceptance Rate .

Soil Type Expressed as a Percentage	Soil 1	Soil 2	Soil 3	Soil 4	Soil 5
	0	100	0	0	0
SOIL Value	0.15	0.30	0.40	0.45	0.50

Flood Return Event	[5]Growth Factor	Permitted Flow (l/s)
1	0.85	3.3
QBAR	1	3.9
10	1.67	6.5
30	2.1	8.2
50	2.33	9.1
100	2.6	10.1
200	2.85	11.1
1000	3.5	13.6

[4]QBar from Site with Factorial Error Allowance

r^2 =	0.847
n =	71
fse =	1.651

Q'_{bar} = 6.42 l/s

(With Allowance for the standard factorial error)

Pro-rata based on 50 Ha Site area to calculate Qbar

Q_{bar} =	0.00004	cumecs/Ha
Q_{bar} =	2.0	l/s/Ha

$Q_{bar[rural]}$ = 3.9 l/s

Catchment Characteristics

DB8 - PLOT 100 PROFILE PARK, DUBLIN	Area (m²)	Runoff Coeff.	Effective Area (m²)
Roofs & Balconies - Type 1 (Draining to gullies)	-	1.00	0.0
Roofs - Type 2 (Draining to SUDS Soakaway features)	3,072	0.90	2764.8
Green Roofs	-	0.85	0.0
Roads and Footpaths - Type 1 (Draining to gullies)	-	0.80	0.0
Roads and Footpaths - Type 2 (Draining to Suds features)	8,845	0.70	6191.5
Paved Areas	-	0.80	0.0
Permeable Paving	9,790	0.70	6853.0
Grass over Basement		0.70	0.0
Parks (contributing)		0.30	0.0
Public Open Space (non-contributing)		0.00	0.0

Include Public Open Space in Effective Catchment Area? no

Assumed open space area does not drain to surface water network

Effective Catchment Area 15809.3 m²

Effective Catchment Runoff Coefficient 0.81

Qbar Calculation
Using IOH Report 124 for Sites < 25 km²

Catchment Name
DB8 - PLOT 100 PROFILE PARK, DUBLIN - CAT01

$^1Q_{bar} = 0.00108 * (AREA)^{0.89}(SAAR)^{1.17}(SOIL)^{2.17}$ — **Estimation of QBAR from IOH Report 124 for catchments less than 25 km² using the 3 variable equation**

SITE AREA =	2.68	Ha	Overall Redline Area
CATCHMENT AREA =	0.14	Ha (excl. Public Open Space)	Overall Catchment Area (Hectares) For catchments < 50 hectares in area, flow rates are linearly interpolated for smaller areas.
AREA =	0.001	km²	Area of the Catchment (km²)
SAAR =	754	mm	Standard Annual Average Rainfall (mm)
SOIL =	0.30		
$M5_{60}$	16.8	mm	
$M5_{2DAY}$	61.9	mm	Soil index value (SPR) calculated from Flood Studies Report Vol V Fig I 4.18(1) - The Classification of Soils from Winter Rainfall Acceptance Rate .
$R=(M5_{60}/M5_{2d})$	0.27		

Soil Type Expressed as a Percentage	Soil 1	Soil 2	Soil 3	Soil 4	Soil 5
	0	100	0	0	0
SOIL Value	0.15	0.30	0.40	0.45	0.50

Flood Return Event	[5]Growth Factor	Permitted Flow (l/s)
1	0.85	0.2
QBAR	1	0.3
10	1.67	0.5
30	2.1	0.6
50	2.33	0.6
100	2.6	0.7
200	2.85	0.8
1000	3.5	1.0

[4]QBar from Site with Factorial Error Allowance

r^2 =	0.847
n =	71
fse =	1.651

Q'_{bar} = 0.45 l/s
(With Allowance for the standard factorial error)

Pro-rata based on 50 Ha Site area to calculate Qbar

Q_{bar} =	0.00004	cumecs/Ha
Q_{bar} =	2.0	l/s/Ha

$Q_{bar[rural]}$ = 0.27 l/s

Catchment Characteristics

DB8 - PLOT 100 PROFILE PARK, DUBLIN - CAT01	Area (m²)	Runoff Coeff.	Effective Area (m²)
Roofs & Balconies - Type 1 (Draining to gullies)		1.00	0.0
Roofs - Type 2 (Draining to SUDS Soakaway features)		0.90	0.0
Green Roofs		0.85	0.0
Roads and Footpaths - Type 1 (Draining to gullies)		0.80	0.0
Roads and Footpaths - Type 2 (Draining to Suds features)	1,381	0.70	966.7
Paved Areas		0.80	0.0
Permeable Paving		0.70	0.0
Grass over Basement		0.70	0.0
Parks (contributing)		0.30	0.0
Public Open Space (non-contributing)		0.00	0.0

Include Public Open Space in Effective Catchment Area? no — Assumed open space area does not drain to surface water network

Effective Catchment Area 966.7 m²

Effective Catchment Runoff Coefficient 0.70

Qbar Calculation
Using IOH Report 124 for Sites < 25 km²

Catchment Name
DB8 - PLOT 100 PROFILE PARK, DUBLIN - CAT02

$^{1}Q_{bar} = 0.00108 * (AREA)^{0.89}(SAAR)^{1.17}(SOIL)^{2.17}$

Estimation of QBAR from IOH Report 124 for catchments less than 25 km² using the 3 variable equation

SITE AREA =	2.68	Ha	Overall Redline Area
CATCHMENT AREA =	0.06	Ha (excl. Public Open Space)	Overall Catchment Area (Hectares) For catchments < 50 hectares in area, flow rates are linearly interpolated for smaller areas.
AREA =	0.001	km²	Area of the Catchment (km²)
SAAR =	754	mm	Standard Annual Average Rainfall (mm)
SOIL =	0.30		
$M5_{60}$	16.8	mm	
$M5_{2DAY}$	61.9	mm	
$R=(M5_{60}/M5_{2d})$	0.27		Soil index value (SPR) calculated from Flood Studies Report Vol V Fig I 4.18(1) - The Classification of Soils from Winter Rainfall Acceptance Rate .

Soil Type Expressed as a Percentage	Soil 1	Soil 2	Soil 3	Soil 4	Soil 5
	0	100	0	0	0
SOIL Value	0.15	0.30	0.40	0.45	0.50

Flood Return Event	[5]Growth Factor	Permitted Flow (l/s)
1	0.85	0.1
QBAR	1	0.1
10	1.67	0.2
30	2.1	0.2
50	2.33	0.3
100	2.6	0.3
200	2.85	0.3
1000	3.5	0.4

[4]QBar from Site with Factorial Error Allowance

r^2 =	0.847
n =	71
fse =	1.651

Q'_{bar} = 0.18 l/s
(With Allowance for the standard factorial error)

Pro-rata based on 50 Ha Site area to calculate Qbar

Q_{bar} =	0.00004	cumecs/Ha
Q_{bar} =	2.0	l/s/Ha

$Q_{bar[rural]}$ = 0.11 l/s

Catchment Characteristics			
DB8 - PLOT 100 PROFILE PARK, DUBLIN - CAT02	Area (m²)	Runoff Coeff.	Effective Area (m²)
Roofs & Balconies - Type 1 (Draining to gullies)		1.00	0.0
Roofs - Type 2 (Draining to SUDS Soakaway features)		0.90	0.0
Green Roofs		0.85	0.0
Roads and Footpaths - Type 1 (Draining to gullies)		0.80	0.0
Roads and Footpaths - Type 2 (Draining to Suds features)	553	0.70	387.1
Paved Areas		0.80	0.0
Permeable Paving		0.70	0.0
Grass over Basement		0.70	0.0
Parks (contributing)		0.30	0.0
Public Open Space (non-contributing)		0.00	0.0

Include Public Open Space in Effective Catchment Area? no

Assumed open space area does not drain to surface water network

Effective Catchment Area 387.1 m²

Effective Catchment Runoff Coefficient 0.70

Qbar Calculation
Using IOH Report 124 for Sites < 25 km²

Catchment Name
DB8 - PLOT 100 PROFILE PARK, DUBLIN - CAT03

$^{1}Q_{bar} = 0.00108 * (AREA)^{0.89}(SAAR)^{1.17}(SOIL)^{2.17}$ — **Estimation of QBAR from IOH Report 124 for catchments less than 25 km² using the 3 variable equation**

SITE AREA =	2.68	Ha	Overall Redline Area
CATCHMENT AREA =	0.11	Ha (excl. Public Open Space)	Overall Catchment Area (Hectares) For catchments < 50 hectares in area, flow rates are linearly interpolated for smaller areas.
AREA =	0.001	km²	Area of the Catchment (km²)
SAAR =	754	mm	Standard Annual Average Rainfall (mm)
SOIL =	0.30		

Soil Type Expressed as a Percentage	Soil 1	Soil 2	Soil 3	Soil 4	Soil 5
	0	100	0	0	0
SOIL Value	0.15	0.30	0.40	0.45	0.50

$M5_{60}$	16.8	mm
$M5_{2DAY}$	61.9	mm
$R=(M5_{60}/M5_{2d})$	0.27	

Soil index value (SPR) calculated from Flood Studies Report Vol V Fig I 4.18(1) - The Classification of Soils from Winter Rainfall Acceptance Rate .

Flood Return Event	^{5}Growth Factor	Permitted Flow (l/s)
1	0.85	0.2
QBAR	1	0.2
10	1.67	0.4
30	2.1	0.5
50	2.33	0.5
100	2.6	0.6
200	2.85	0.6
1000	3.5	0.8

^{4}QBar from Site with Factorial Error Allowance

r^2 =	0.847
n =	71
fse =	1.651

Q'_{bar} = 0.37 l/s

(With Allowance for the standard factorial error)

Pro-rata based on 50 Ha Site area to calculate Qbar

Q_{bar} =	0.00004	cumecs/Ha
Q_{bar} =	2.0	l/s/Ha

$Q_{bar[rural]}$ = 0.22 l/s

Catchment Characteristics			
DB8 - PLOT 100 PROFILE PARK, DUBLIN - CAT03	Area (m²)	Runoff Coeff.	Effective Area (m²)
Roofs & Balconies - Type 1 (Draining to gullies)		1.00	0.0
Roofs - Type 2 (Draining to SUDS Soakaway features)	1,126	0.90	1013.4
Green Roofs		0.85	0.0
Roads and Footpaths - Type 1 (Draining to gullies)		0.80	0.0
Roads and Footpaths - Type 2 (Draining to Suds features)		0.70	0.0
Paved Areas		0.80	0.0
Permeable Paving		0.70	0.0
Grass over Basement		0.70	0.0
Parks (contributing)		0.30	0.0
Public Open Space (non-contributing)		0.00	0.0

Include Public Open Space in Effective Catchment Area? no

Assumed open space area does not drain to surface water network

Effective Catchment Area 1013.4 m²

Effective Catchment Runoff Coefficient 0.90

Qbar Calculation
Using IOH Report 124 for Sites < 25 km²

Catchment Name
DB8 - PLOT 100 PROFILE PARK, DUBLIN - CAT04

[1] $Q_{bar} = 0.00108 * (AREA)^{0.89}(SAAR)^{1.17}(SOIL)^{2.17}$ — **Estimation of QBAR from IOH Report 124 for catchments less than 25 km² using the 3 variable equation**

SITE AREA =	2.68	Ha	Overall Redline Area
CATCHMENT AREA =	0.20	Ha (excl. Public Open Space)	Overall Catchment Area (Hectares) For catchments < 50 hectares in area, flow rates are linearly interpolated for smaller areas.
AREA =	0.002	km²	Area of the Catchment (km²)
SAAR =	754	mm	Standard Annual Average Rainfall (mm)
SOIL =	0.30		
$M5_{60}$	16.8	mm	
$M5_{2DAY}$	61.9	mm	
$R=(M5_{60}/M5_{2d})$	0.27		Soil index value (SPR) calculated from Flood Studies Report Vol V Fig I 4.18(1) - The Classification of Soils from Winter Rainfall Acceptance Rate .

Soil Type Expressed as a Percentage	Soil 1	Soil 2	Soil 3	Soil 4	Soil 5
	0	100	0	0	0
SOIL Value	0.15	0.30	0.40	0.45	0.50

Flood Return Event	[5]Growth Factor	Permitted Flow (l/s)
1	0.85	0.3
QBAR	1	0.4
10	1.67	0.7
30	2.1	0.9
50	2.33	0.9
100	2.6	1.1
200	2.85	1.2
1000	3.5	1.4

[4]QBar from Site with Factorial Error Allowance

r^2 =	0.847
n =	71
fse =	1.651

Q'_{bar} = 0.67 l/s
(With Allowance for the standard factorial error)

Pro-rata based on 50 Ha Site area to calculate Qbar

Q_{bar} =	0.00004	cumecs/Ha
Q_{bar} =	2.0	l/s/Ha

$Q_{bar[rural]}$ = 0.41 l/s

Catchment Characteristics			
DB8 - PLOT 100 PROFILE PARK, DUBLIN - CAT04	Area (m²)	Runoff Coeff.	Effective Area (m²)
Roofs & Balconies - Type 1 (Draining to gullies)		1.00	0.0
Roofs - Type 2 (Draining to SUDS Soakaway features)		0.90	0.0
Green Roofs		0.85	0.0
Roads and Footpaths - Type 1 (Draining to gullies)		0.80	0.0
Roads and Footpaths - Type 2 (Draining to Suds features)	2,040	0.70	1428.0
Paved Areas		0.80	0.0
Permeable Paving		0.70	0.0
Grass over Basement		0.70	0.0
Parks (contributing)		0.30	0.0
Public Open Space (non-contributing)		0.00	0.0

Include Public Open Space in Effective Catchment Area? no — Assumed open space area does not drain to surface water network

Effective Catchment Area 1428.0 m²

Effective Catchment Runoff Coefficient 0.70

Qbar Calculation
Using IOH Report 124 for Sites < 25 km²

Catchment Name
DB8 - PLOT 100 PROFILE PARK, DUBLIN - CAT05

[1] $Q_{bar} = 0.00108 * (AREA)^{0.89}(SAAR)^{1.17}(SOIL)^{2.17}$

Estimation of QBAR from IOH Report 124 for catchments less than 25 km² using the 3 variable equation

SITE AREA =	2.68	Ha	Overall Redline Area
CATCHMENT AREA =	0.22	Ha (excl. Public Open Space)	Overall Catchment Area (Hectares) For catchments < 50 hectares in area, flow rates are linearly interpolated for smaller areas.
AREA =	0.002	km²	Area of the Catchment (km²)
SAAR =	754	mm	Standard Annual Average Rainfall (mm)
SOIL =	0.30		
$M5_{60}$	16.8	mm	
$M5_{2DAY}$	61.9	mm	
$R=(M5_{60}/M5_{2d})$	0.27		Soil index value (SPR) calculated from Flood Studies Report Vol V Fig I 4.18(1) - The Classification of Soils from Winter Rainfall Acceptance Rate .

Soil Type Expressed as a Percentage	Soil 1	Soil 2	Soil 3	Soil 4	Soil 5
	0	100	0	0	0
SOIL Value	0.15	0.30	0.40	0.45	0.50

Flood Return Event	[5]Growth Factor	Permitted Flow (l/s)
1	0.85	0.4
QBAR	1	0.4
10	1.67	0.7
30	2.1	0.9
50	2.33	1.0
100	2.6	1.1
200	2.85	1.2
1000	3.5	1.5

[4]QBar from Site with Factorial Error Allowance

r^2 =	0.847
n =	71
fse =	1.651

Q'_{bar} = 0.71 l/s

(With Allowance for the standard factorial error)

Pro-rata based on 50 Ha Site area to calculate Qbar

Q_{bar} =	0.00004	cumecs/Ha
Q_{bar} =	2.0	l/s/Ha

$Q_{bar[rural]}$ = 0.43 l/s

Catchment Characteristics			
DB8 - PLOT 100 PROFILE PARK, DUBLIN - CAT05	Area (m²)	Runoff Coeff.	Effective Area (m²)
Roofs & Balconies - Type 1 (Draining to gullies)		1.00	0.0
Roofs - Type 2 (Draining to SUDS Soakaway features)		0.90	0.0
Green Roofs		0.85	0.0
Roads and Footpaths - Type 1 (Draining to gullies)		0.80	0.0
Roads and Footpaths - Type 2 (Draining to Suds features)	2,153	0.70	1507.1
Paved Areas		0.80	0.0
Permeable Paving		0.70	0.0
Grass over Basement		0.70	0.0
Parks (contributing)		0.30	0.0
Public Open Space (non-contributing)		0.00	0.0

Include Public Open Space in Effective Catchment Area? no

Assumed open space area does not drain to surface water network

Effective Catchment Area 1507.1 m²

Effective Catchment Runoff Coefficient 0.70

Qbar Calculation
Using IOH Report 124 for Sites < 25 km²

Catchment Name
DB8 - PLOT 100 PROFILE PARK, DUBLIN - CAT06

[1] $Q_{bar} = 0.00108 * (AREA)^{0.89}(SAAR)^{1.17}(SOIL)^{2.17}$ — **Estimation of QBAR from IOH Report 124 for catchments less than 25 km² using the 3 variable equation**

SITE AREA =	2.68	Ha	Overall Redline Area
CATCHMENT AREA =	0.19	Ha (excl. Public Open Space)	Overall Catchment Area (Hectares) For catchments < 50 hectares in area, flow rates are linearly interpolated for smaller areas.
AREA =	0.002	km²	Area of the Catchment (km²)
SAAR =	754	mm	Standard Annual Average Rainfall (mm)
SOIL =	0.30		
$M5_{60}$	16.8	mm	
$M5_{2DAY}$	61.9	mm	
$R=(M5_{60}/M5_{2d})$	0.27		Soil index value (SPR) calculated from Flood Studies Report Vol V Fig I 4.18(1) - The Classification of Soils from Winter Rainfall Acceptance Rate .

Soil Type Expressed as a Percentage	Soil 1	Soil 2	Soil 3	Soil 4	Soil 5
	0	100	0	0	0
SOIL Value	0.15	0.30	0.40	0.45	0.50

Flood Return Event	[5]Growth Factor	Permitted Flow (l/s)
1	0.85	0.3
QBAR	1	0.4
10	1.67	0.6
30	2.1	0.8
50	2.33	0.9
100	2.6	1.0
200	2.85	1.1
1000	3.5	1.4

[4]QBar from Site with Factorial Error Allowance

r^2 =	0.847
n =	71
fse =	1.651

Q'_{bar} = 0.64 l/s

(With Allowance for the standard factorial error)

Pro-rata based on 50 Ha Site area to calculate Qbar

Q_{bar} =	0.00004	cumecs/Ha
Q_{bar} =	2.0	l/s/Ha
$Q_{bar[rural]}$ =	**0.39**	**l/s**

Catchment Characteristics			
DB8 - PLOT 100 PROFILE PARK, DUBLIN - CAT06	Area (m²)	Runoff Coeff.	Effective Area (m²)
Roofs & Balconies - Type 1 (Draining to gullies)		1.00	0.0
Roofs - Type 2 (Draining to SUDS Soakaway features)	1,946	0.90	1751.4
Green Roofs		0.85	0.0
Roads and Footpaths - Type 1 (Draining to gullies)		0.80	0.0
Roads and Footpaths - Type 2 (Draining to Suds features)		0.70	0.0
Paved Areas		0.80	0.0
Permeable Paving		0.70	0.0
Grass over Basement		0.70	0.0
Parks (contributing)		0.30	0.0
Public Open Space (non-contributing)		0.00	0.0

Include Public Open Space in Effective Catchment Area? **no** — Assumed open space area does not drain to surface water network

Effective Catchment Area **1751.4** m²

Effective Catchment Runoff Coefficient **0.90**

Qbar Calculation
Using IOH Report 124 for Sites < 25 km²

Catchment Name
DB8 - PLOT 100 PROFILE PARK, DUBLIN - CAT07

[1] $Q_{bar} = 0.00108 * (AREA)^{0.89}(SAAR)^{1.17}(SOIL)^{2.17}$ — **Estimation of QBAR from IOH Report 124 for catchments less than 25 km² using the 3 variable equation**

SITE AREA =	2.68	Ha	Overall Redline Area
CATCHMENT AREA =	0.44	Ha (excl. Public Open Space)	Overall Catchment Area (Hectares) For catchments < 50 hectares in area, flow rates are linearly interpolated for smaller areas.
AREA =	0.004	km²	Area of the Catchment (km²)
SAAR =	754	mm	Standard Annual Average Rainfall (mm)
SOIL =	0.30		
$M5_{60}$	16.8	mm	
$M5_{2DAY}$	61.9	mm	
$R=(M5_{60}/M5_{2d})$	0.27		Soil index value (SPR) calculated from Flood Studies Report Vol V Fig I 4.18(1) - The Classification of Soils from Winter Rainfall Acceptance Rate .

Soil Type Expressed as a Percentage	Soil 1	Soil 2	Soil 3	Soil 4	Soil 5
	0	100	0	0	0
SOIL Value	0.15	0.30	0.40	0.45	0.50

Flood Return Event	[5]Growth Factor	Permitted Flow (l/s)
1	0.85	0.7
QBAR	1	0.9
10	1.67	1.4
30	2.1	1.8
50	2.33	2.0
100	2.6	2.3
200	2.85	2.5
1000	3.5	3.0

[4]QBar from Site with Factorial Error Allowance

r^2 =	0.847
n =	71
fse =	1.651

Q'_{bar} = 1.43 l/s

(With Allowance for the standard factorial error)

Pro-rata based on 50 Ha Site area to calculate Qbar

Q_{bar} =	0.00004	cumecs/Ha

Q_{bar} =	2.0	l/s/Ha

$Q_{bar[rural]}$ = 0.87 l/s

Catchment Characteristics			
DB8 - PLOT 100 PROFILE PARK, DUBLIN - CAT07	Area (m²)	Runoff Coeff.	Effective Area (m²)
Roofs & Balconies - Type 1 (Draining to gullies)		1.00	0.0
Roofs - Type 2 (Draining to SUDS Soakaway features)		0.90	0.0
Green Roofs		0.85	0.0
Roads and Footpaths - Type 1 (Draining to gullies)		0.80	0.0
Roads and Footpaths - Type 2 (Draining to Suds features)		0.70	0.0
Paved Areas		0.80	0.0
Permeable Paving	4,363	0.70	3054.1
Grass over Basement		0.70	0.0
Parks (contributing)		0.30	0.0
Public Open Space (non-contributing)		0.00	0.0

Include Public Open Space in Effective Catchment Area? no

Assumed open space area does not drain to surface water network

Effective Catchment Area 3054.1 m²

Effective Catchment Runoff Coefficient 0.70

Qbar Calculation
Using IOH Report 124 for Sites < 25 km²

Catchment Name
DB8 - PLOT 100 PROFILE PARK, DUBLIN - CAT08

[1] $Q_{bar} = 0.00108 * (AREA)^{0.89}(SAAR)^{1.17}(SOIL)^{2.17}$ — **Estimation of QBAR from IOH Report 124 for catchments less than 25 km² using the 3 variable equation**

SITE AREA =	2.68	Ha	Overall Redline Area
CATCHMENT AREA =	0.27	Ha (excl. Public Open Space)	Overall Catchment Area (Hectares) For catchments < 50 hectares in area, flow rates are linearly interpolated for smaller areas.
AREA =	0.003	km²	Area of the Catchment (km²)
SAAR =	754	mm	Standard Annual Average Rainfall (mm)
SOIL =	0.30		
$M5_{60}$	16.8	mm	
$M5_{2DAY}$	61.9	mm	
$R=(M5_{60}/M5_{2d})$	0.27		

Soil Type Expressed as a Percentage	Soil 1	Soil 2	Soil 3	Soil 4	Soil 5
	0	100	0	0	0
SOIL Value	0.15	0.30	0.40	0.45	0.50

Soil index value (SPR) calculated from Flood Studies Report Vol V Fig I 4.18(1) - The Classification of Soils from Winter Rainfall Acceptance Rate .

Flood Return Event	[5]Growth Factor	Permitted Flow (l/s)
1	0.85	0.5
QBAR	1	0.5
10	1.67	0.9
30	2.1	1.1
50	2.33	1.3
100	2.6	1.4
200	2.85	1.5
1000	3.5	1.9

[4]QBar from Site with Factorial Error Allowance

r^2 =	0.847
n =	71
fse =	1.651

Q'_{bar} = 0.89 l/s

(With Allowance for the standard factorial error)

Pro-rata based on 50 Ha Site area to calculate Qbar

Q_{bar} =	0.00004	cumecs/Ha
Q_{bar} =	2.0	l/s/Ha

$Q_{bar[rural]}$ = 0.54 l/s

Catchment Characteristics			
DB8 - PLOT 100 PROFILE PARK, DUBLIN - CAT08	Area (m²)	Runoff Coeff.	Effective Area (m²)
Roofs & Balconies - Type 1 (Draining to gullies)		1.00	0.0
Roofs - Type 2 (Draining to SUDS Soakaway features)		0.90	0.0
Green Roofs		0.85	0.0
Roads and Footpaths - Type 1 (Draining to gullies)		0.80	0.0
Roads and Footpaths - Type 2 (Draining to Suds features)	2,704	0.70	1892.8
Paved Areas		0.80	0.0
Permeable Paving		0.70	0.0
Grass over Basement		0.70	0.0
Parks (contributing)		0.30	0.0
Public Open Space (non-contributing)		0.00	0.0

Include Public Open Space in Effective Catchment Area? no

Assumed open space area does not drain to surface water network

Effective Catchment Area 1892.8 m²

Effective Catchment Runoff Coefficient 0.70

Qbar Calculation
Using IOH Report 124 for Sites < 25 km²

Catchment Name
DB8 - PLOT 100 PROFILE PARK, DUBLIN - CAT09

$^{1}Q_{bar} = 0.00108 * (AREA)^{0.89}(SAAR)^{1.17}(SOIL)^{2.17}$

Estimation of QBAR from IOH Report 124 for catchments less than 25 km² using the 3 variable equation

SITE AREA =	2.68	Ha	Overall Redline Area
CATCHMENT AREA =	0.18	Ha (excl. Public Open Space)	Overall Catchment Area (Hectares) For catchments < 50 hectares in area, flow rates are linearly interpolated for smaller areas.
AREA =	0.002	km²	Area of the Catchment (km²)
SAAR =	754	mm	Standard Annual Average Rainfall (mm)
SOIL =	0.30		
$M5_{60}$	16.8	mm	
$M5_{2DAY}$	61.9	mm	
$R=(M5_{60}/M5_{2d})$	0.27		Soil index value (SPR) calculated from Flood Studies Report Vol V Fig I 4.18(1) - The Classification of Soils from Winter Rainfall Acceptance Rate .

Soil Type Expressed as a Percentage	Soil 1	Soil 2	Soil 3	Soil 4	Soil 5
	0	100	0	0	0
SOIL Value	0.15	0.30	0.40	0.45	0.50

Flood Return Event	[5]Growth Factor	Permitted Flow (l/s)
1	0.85	0.3
QBAR	1	0.4
10	1.67	0.6
30	2.1	0.7
50	2.33	0.8
100	2.6	0.9
200	2.85	1.0
1000	3.5	1.2

[4]QBar from Site with Factorial Error Allowance

r^2 =	0.847
n =	71
fse =	1.651

Q'_{bar} = 0.58 l/s

(With Allowance for the standard factorial error)

Pro-rata based on 50 Ha Site area to calculate Qbar

Q_{bar} =	0.00004	cumecs/Ha
Q_{bar} =	2.0	l/s/Ha

$Q_{bar[rural]}$ = 0.35 l/s

Catchment Characteristics			
DB8 - PLOT 100 PROFILE PARK, DUBLIN - CAT09	Area (m²)	Runoff Coeff.	Effective Area (m²)
Roofs & Balconies - Type 1 (Draining to gullies)		1.00	0.0
Roofs - Type 2 (Draining to SUDS Soakaway features)		0.90	0.0
Green Roofs		0.85	0.0
Roads and Footpaths - Type 1 (Draining to gullies)		0.80	0.0
Roads and Footpaths - Type 2 (Draining to Suds features)	1,773	0.70	1241.1
Paved Areas		0.80	0.0
Permeable Paving		0.70	0.0
Grass over Basement		0.70	0.0
Parks (contributing)		0.30	0.0
Public Open Space (non-contributing)		0.00	0.0

Include Public Open Space in Effective Catchment Area? no

Assumed open space area does not drain to surface water network

Effective Catchment Area 1241.1 m²

Effective Catchment Runoff Coefficient 0.70

Qbar Calculation
Using IOH Report 124 for Sites < 25 km²

Catchment Name
DB8 - PLOT 100 PROFILE PARK, DUBLIN - CAT10

$^{1}Q_{bar} = 0.00108 * (AREA)^{0.89}(SAAR)^{1.17}(SOIL)^{2.17}$ — **Estimation of QBAR from IOH Report 124 for catchments less than 25 km² using the 3 variable equation**

SITE AREA =	2.68	Ha	Overall Redline Area
CATCHMENT AREA =	0.08	Ha (excl. Public Open Space)	Overall Catchment Area (Hectares) For catchments < 50 hectares in area, flow rates are linearly interpolated for smaller areas.
AREA =	0.001	km²	Area of the Catchment (km²)
SAAR =	754	mm	Standard Annual Average Rainfall (mm)
SOIL =	0.30		
$M5_{60}$	16.8	mm	
$M5_{2DAY}$	61.9	mm	
$R=(M5_{60}/M5_{2d})$	0.27		Soil index value (SPR) calculated from Flood Studies Report Vol V Fig I 4.18(1) - The Classification of Soils from Winter Rainfall Acceptance Rate .

Soil Type Expressed as a Percentage	Soil 1	Soil 2	Soil 3	Soil 4	Soil 5
	0	100	0	0	0
SOIL Value	0.15	0.30	0.40	0.45	0.50

Flood Return Event	[5]Growth Factor	Permitted Flow (l/s)
1	0.85	0.1
QBAR	1	0.2
10	1.67	0.3
30	2.1	0.3
50	2.33	0.4
100	2.6	0.4
200	2.85	0.5
1000	3.5	0.6

[4]QBar from Site with Factorial Error Allowance

r^2 =	0.847
n =	71
fse =	1.651

Q'_{bar} = 0.27 l/s
(With Allowance for the standard factorial error)

Pro-rata based on 50 Ha Site area to calculate Qbar

Q_{bar} =	0.00004	cumecs/Ha
Q_{bar} =	2.0	l/s/Ha
$Q_{bar[rural]}$ =	**0.16**	**l/s**

Catchment Characteristics			
DB8 - PLOT 100 PROFILE PARK, DUBLIN - CAT10	Area (m²)	Runoff Coeff.	Effective Area (m²)
Roofs & Balconies - Type 1 (Draining to gullies)		1.00	0.0
Roofs - Type 2 (Draining to SUDS Soakaway features)		0.90	0.0
Green Roofs		0.85	0.0
Roads and Footpaths - Type 1 (Draining to gullies)		0.80	0.0
Roads and Footpaths - Type 2 (Draining to Suds features)	825	0.70	577.5
Paved Areas		0.80	0.0
Permeable Paving		0.70	0.0
Grass over Basement		0.70	0.0
Parks (contributing)		0.30	0.0
Public Open Space (non-contributing)		0.00	0.0

Include Public Open Space in Effective Catchment Area? **no** — Assumed open space area does not drain to surface water network

Effective Catchment Area **577.5** m²

Effective Catchment Runoff Coefficient **0.70**

Qbar Calculation
Using IOH Report 124 for Sites < 25 km²

Catchment Name
DB8 - PLOT 100 PROFILE PARK, DUBLIN - CAT11

$^1Q_{bar} = 0.00108 * (AREA)^{0.89}(SAAR)^{1.17}(SOIL)^{2.17}$

Estimation of QBAR from IOH Report 124 for catchments less than 25 km² using the 3 variable equation

SITE AREA =	2.68	Ha	Overall Redline Area
CATCHMENT AREA =	0.07	Ha (excl. Public Open Space)	Overall Catchment Area (Hectares) For catchments < 50 hectares in area, flow rates are linearly interpolated for smaller areas.
AREA =	0.001	km²	Area of the Catchment (km²)
SAAR =	754	mm	Standard Annual Average Rainfall (mm)
SOIL =	0.30		
$M5_{60}$	16.8	mm	
$M5_{2DAY}$	61.9	mm	
$R=(M5_{60}/M5_{2d})$	0.27		Soil index value (SPR) calculated from Flood Studies Report Vol V Fig I 4.18(1) - The Classification of Soils from Winter Rainfall Acceptance Rate .

Soil Type Expressed as a Percentage	Soil 1	Soil 2	Soil 3	Soil 4	Soil 5
	0	100	0	0	0
SOIL Value	0.15	0.30	0.40	0.45	0.50

Flood Return Event	[5]Growth Factor	Permitted Flow (l/s)
1	0.85	0.1
QBAR	1	0.1
10	1.67	0.2
30	2.1	0.3
50	2.33	0.3
100	2.6	0.4
200	2.85	0.4
1000	3.5	0.5

[4]QBar from Site with Factorial Error Allowance

r^2 =	0.847
n =	71
fse =	1.651

Q'_{bar} = 0.23 l/s

(With Allowance for the standard factorial error)

Pro-rata based on 50 Ha Site area to calculate Qbar

Q_{bar} =	0.00004	cumecs/Ha
Q_{bar} =	2.0	l/s/Ha

$Q_{bar[rural]}$ = 0.14 l/s

Catchment Characteristics			
DB8 - PLOT 100 PROFILE PARK, DUBLIN - CAT11	Area (m²)	Runoff Coeff.	Effective Area (m²)
Roofs & Balconies - Type 1 (Draining to gullies)		1.00	0.0
Roofs - Type 2 (Draining to SUDS Soakaway features)		0.90	0.0
Green Roofs		0.85	0.0
Roads and Footpaths - Type 1 (Draining to gullies)		0.80	0.0
Roads and Footpaths - Type 2 (Draining to Suds features)	708	0.70	495.6
Paved Areas		0.80	0.0
Permeable Paving		0.70	0.0
Grass over Basement		0.70	0.0
Parks (contributing)		0.30	0.0
Public Open Space (non-contributing)		0.00	0.0

Include Public Open Space in Effective Catchment Area? no

Assumed open space area does not drain to surface water network

Effective Catchment Area 495.6 m²

Effective Catchment Runoff Coefficient 0.70

Design Settings

Rainfall Methodology	FSR	Maximum Time of Concentration (mins)	30.00
Return Period (years)	100	Maximum Rainfall (mm/hr)	40.0
Additional Flow (%)	20	Minimum Velocity (m/s)	0.70
FSR Region	Scotland and Ireland	Connection Type	Level Inverts
M5-60 (mm)	16.000	Minimum Backdrop Height (m)	1.000
Ratio-R	0.300	Preferred Cover Depth (m)	0.800
CV	0.750	Include Intermediate Ground	✓
Time of Entry (mins)	15.00	Enforce best practice design rules	x

Nodes

Name	Area (ha)	T of E (mins)	Cover Level (m)	Diameter (mm)	Easting (m)	Northing (m)	Depth (m)
PP1	0.574	20.00	75.000	1200	703992.846	730815.688	0.700
PP2	0.204	15.00	74.300	1200	704014.687	730777.965	0.700
SWMH1.1	0.055	15.00	74.860	1200	704111.000	730833.000	1.179
SWMH2.1	0.113	15.00	74.280	1200	704117.000	730811.000	1.220
SWMH3.1			74.000	1200	704123.000	730800.000	1.100
SWMH 3.2	0.215	15.00	73.810	1200	704115.460	730797.222	0.910
SWMH3.3			74.060	1200	704003.187	730767.000	1.610
SWMH4.1	0.194	15.00	74.300	1200	703997.745	730794.905	1.700
SWMH8.1	0.448	15.00	74.110	1200	703992.644	730769.038	1.610
SWMH9.1	0.153	15.00	73.800	1200	703895.000	730694.000	1.530
SWMH13.1			74.000	1350	704003.810	730740.194	1.900
SWMH13.2			74.000	1350	704001.064	730736.050	2.000
SWMH14.1			72.800	1200	703870.000	730696.034	0.900
SUDS SWALE 1			74.300	1200	704125.789	730811.304	1.270
SUDS SWALE 2			73.800	1200	703873.000	730701.000	1.800
SUDS POND 1			74.000	1200	704006.519	730746.402	1.850

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)
1.1	SWMH1.1	SUDS SWALE 1	26.257	0.600	73.681	73.030	0.651	40.3	300	15.18	40.0
2.1	SWMH2.1	SWMH3.1	12.530	0.600	73.060	72.900	0.160	78.3	300	15.12	40.0
SWALE 1	SUDS SWALE 1	SWMH3.1	11.643	0.600	73.030	72.950	0.080	145.5	300	15.33	40.0
3.1	SWMH3.1	SWMH 3.2	8.035	0.600	72.950	72.900	0.050	160.7	300	15.43	40.0
3.2	SWMH 3.2	SWMH3.3	116.269	0.600	72.900	72.450	0.450	258.4	300	17.42	40.0
3.3	SWMH3.3	SUDS POND 1	20.866	0.600	72.450	72.150	0.300	69.6	300	20.70	40.0
POND 1	SUDS POND 1	SWMH13.1	6.773	0.600	72.150	72.100	0.050	135.5	300	20.78	40.0
13.1	SWMH13.1	SWMH13.2	4.971	0.600	72.100	72.000	0.100	49.7	375	20.81	40.0

Name	Vel (m/s)	Cap (l/s)	Flow (l/s)	US Depth (m)	DS Depth (m)	Σ Area (ha)	Σ Add Inflow (l/s)	Pro Depth (mm)	Pro Velocity (m/s)
1.1	2.483	175.5	7.2	0.879	0.970	0.055	0.0	41	1.230
2.1	1.778	125.7	14.7	0.920	0.800	0.113	0.0	69	1.202
SWALE 1	1.301	92.0	7.2	0.970	0.750	0.055	0.0	56	0.779
3.1	1.237	87.5	21.9	0.750	0.610	0.168	0.0	102	1.032
3.2	0.973	68.8	49.8	0.610	1.310	0.383	0.0	190	1.057
3.3	1.887	133.4	234.6	1.310	1.550	1.803	0.0	300	1.912
POND 1	1.349	95.3	234.6	1.550	1.600	1.803	0.0	300	1.366
13.1	2.575	284.4	234.6	1.525	1.625	1.803	0.0	261	2.862

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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)
4.1	SWMH4.1	SWMH3.3	28.431	0.600	72.600	72.450	0.150	189.5	300	20.51	40.0
8.1	SWMH8.1	SWMH3.3	10.738	0.600	72.500	72.450	0.050	214.8	300	15.17	40.0
9.1	SWMH9.1	SUDS SWALE 2	23.087	0.600	72.270	72.000	0.270	85.5	300	15.23	40.0
SWALE 2	SUDS SWALE 2	SWMH14.1	5.802	0.600	72.000	71.900	0.100	58.0	300	15.27	40.0
PP1 Pipe	PP1	SWMH4.1	21.353	0.600	74.300	72.600	1.700	12.6	225	20.10	40.0
PP2 Pipe	PP2	SWMH3.3	15.890	0.600	73.600	72.450	1.150	13.8	225	15.07	40.0

Name	Vel (m/s)	Cap (l/s)	Flow (l/s)	US Depth (m)	DS Depth (m)	Σ Area (ha)	Σ Add Inflow (l/s)	Pro Depth (mm)	Pro Velocity (m/s)
4.1	1.138	80.5	99.9	1.400	1.310	0.768	0.0	300	1.153
8.1	1.069	75.5	58.3	1.310	1.310	0.448	0.0	198	1.175
9.1	1.701	120.2	19.9	1.230	1.500	0.153	0.0	82	1.270
SWALE 2	2.068	146.2	19.9	1.500	0.600	0.153	0.0	74	1.458
PP1 Pipe	3.712	147.6	74.7	0.475	1.475	0.574	0.0	113	3.718
PP2 Pipe	3.538	140.7	26.5	0.475	1.385	0.204	0.0	65	2.724

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)
1.1	26.257	40.3	300	Circular	74.860	73.681	0.879	74.300	73.030	0.970
2.1	12.530	78.3	300	Circular	74.280	73.060	0.920	74.000	72.900	0.800
SWALE 1	11.643	145.5	300	Circular	74.300	73.030	0.970	74.000	72.950	0.750
3.1	8.035	160.7	300	Circular	74.000	72.950	0.750	73.810	72.900	0.610
3.2	116.269	258.4	300	Circular	73.810	72.900	0.610	74.060	72.450	1.310
3.3	20.866	69.6	300	Circular	74.060	72.450	1.310	74.000	72.150	1.550
POND 1	6.773	135.5	300	Circular	74.000	72.150	1.550	74.000	72.100	1.600
13.1	4.971	49.7	375	Circular	74.000	72.100	1.525	74.000	72.000	1.625
4.1	28.431	189.5	300	Circular	74.300	72.600	1.400	74.060	72.450	1.310
8.1	10.738	214.8	300	Circular	74.110	72.500	1.310	74.060	72.450	1.310
9.1	23.087	85.5	300	Circular	73.800	72.270	1.230	73.800	72.000	1.500
SWALE 2	5.802	58.0	300	Circular	73.800	72.000	1.500	72.800	71.900	0.600
PP1 Pipe	21.353	12.6	225	Circular	75.000	74.300	0.475	74.300	72.600	1.475
PP2 Pipe	15.890	13.8	225	Circular	74.300	73.600	0.475	74.060	72.450	1.385

Link	US Node	Dia (mm)	Node Type	MH Type	DS Node	Dia (mm)	Node Type	MH Type
1.1	SWMH1.1	1200	Manhole	Adoptable	SUDS SWALE 1	1200	Manhole	Adoptable
2.1	SWMH2.1	1200	Manhole	Adoptable	SWMH3.1	1200	Manhole	Adoptable
SWALE 1	SUDS SWALE 1	1200	Manhole	Adoptable	SWMH3.1	1200	Manhole	Adoptable
3.1	SWMH3.1	1200	Manhole	Adoptable	SWMH 3.2	1200	Manhole	Adoptable
3.2	SWMH 3.2	1200	Manhole	Adoptable	SWMH3.3	1200	Manhole	Adoptable
3.3	SWMH3.3	1200	Manhole	Adoptable	SUDS POND 1	1200	Manhole	Adoptable
POND 1	SUDS POND 1	1200	Manhole	Adoptable	SWMH13.1	1350	Manhole	Adoptable
13.1	SWMH13.1	1350	Manhole	Adoptable	SWMH13.2	1350	Manhole	Adoptable
4.1	SWMH4.1	1200	Manhole	Adoptable	SWMH3.3	1200	Manhole	Adoptable
8.1	SWMH8.1	1200	Manhole	Adoptable	SWMH3.3	1200	Manhole	Adoptable
9.1	SWMH9.1	1200	Manhole	Adoptable	SUDS SWALE 2	1200	Manhole	Adoptable
SWALE 2	SUDS SWALE 2	1200	Manhole	Adoptable	SWMH14.1	1200	Manhole	Adoptable
PP1 Pipe	PP1	1200	Manhole	Adoptable	SWMH4.1	1200	Manhole	Adoptable
PP2 Pipe	PP2	1200	Manhole	Adoptable	SWMH3.3	1200	Manhole	Adoptable

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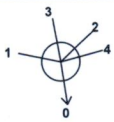
Manhole Schedule

Node	Easting (m)	Northing (m)	CL (m)	Depth (m)	Dia (mm)	Connections	Link	IL (m)	Dia (mm)
PP1	703992.846	730815.688	75.000	0.700	1200	 0	PP1 Pipe	74.300	225
PP2	704014.687	730777.965	74.300	0.700	1200	 0	PP2 Pipe	73.600	225
SWMH1.1	704111.000	730833.000	74.860	1.179	1200	 0	1.1	73.681	300
SWMH2.1	704117.000	730811.000	74.280	1.220	1200	 0	2.1	73.060	300
SWMH3.1	704123.000	730800.000	74.000	1.100	1200	 1 2 0	2.1 SWALE 1 3.1	72.900 72.950 72.950	300 300 300
SWMH 3.2	704115.460	730797.222	73.810	0.910	1200	 1 0	3.1 3.2	72.900 72.900	300 300
SWMH3.3	704003.187	730767.000	74.060	1.610	1200	 1 2 3 4 0	8.1 PP2 Pipe 4.1 3.2 3.3	72.450 72.450 72.450 72.450 72.450	300 225 300 300 300
SWMH4.1	703997.745	730794.905	74.300	1.700	1200	 1 0	PP1 Pipe 4.1	72.600 72.600	225 300
SWMH8.1	703992.644	730769.038	74.110	1.610	1200	 0	8.1	72.500	300
SWMH9.1	703895.000	730694.000	73.800	1.530	1200	 0	9.1	72.270	300
SWMH13.1	704003.810	730740.194	74.000	1.900	1350	 1 0	POND 1 13.1	72.100 72.100	300 375
SWMH13.2	704001.064	730736.050	74.000	2.000	1350	 1	13.1	72.000	375
SWMH14.1	703870.000	730696.034	72.800	0.900	1200	 1	SWALE 2	71.900	300

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Manhole Schedule

Node	Easting (m)	Northing (m)	CL (m)	Depth (m)	Dia (mm)	Connections		Link	IL (m)	Dia (mm)
SUDS SWALE 1	704125.789	730811.304	74.300	1.270	1200		1	1.1	73.030	300
							0	SWALE 1	73.030	300
SUDS SWALE 2	703873.000	730701.000	73.800	1.800	1200		1	9.1	72.000	300
							0	SWALE 2	72.000	300
SUDS POND 1	704006.519	730746.402	74.000	1.850	1200		1	3.3	72.150	300
							0	POND 1	72.150	300

Simulation Settings

Rainfall Methodology	FSR	Drain Down Time (mins)	240
FSR Region	Scotland and Ireland	Additional Storage (m³/ha)	0.0
M5-60 (mm)	16.800	Check Discharge Rate(s)	✓
Ratio-R	0.300	5 year (l/s)	2.8
Summer CV	0.750	30 year (l/s)	4.5
Winter CV	0.840	100 year (l/s)	5.7
Analysis Speed	Normal	Check Discharge Volume	✓
Skip Steady State	x	100 year 1440 minute (m³)	317

Storm Durations

1440

Return Period (years)	Climate Change (CC %)	Additional Area (A %)	Additional Flow (Q %)
100	20	0	0

Pre-development Discharge Rate

Site Makeup	Greenfield	Growth Factor 30 year	1.95
Greenfield Method	IH124	Growth Factor 100 year	2.48
Positively Drained Area (ha)	1.153	Betterment (%)	0
SAAR (mm)	754	QBar	2.3
Soil Index	3	Q 5 year (l/s)	2.8
SPR	0.30	Q 30 year (l/s)	4.5
Region	11	Q 100 year (l/s)	5.7
Growth Factor 5 year	1.20		

Pre-development Discharge Volume

Site Makeup	Greenfield	Return Period (years)	100
Greenfield Method	FSR/FEH	Climate Change (%)	0
Positively Drained Area (ha)	1.153	Storm Duration (mins)	1440
Soil Index	3	Betterment (%)	0
SPR	0.30	PR	0.333
CWI	113.185	Runoff Volume (m³)	317

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Node SUDS SWALE 1 Online Hydro-Brake® Control

Flap Valve	x	Objective	(HE) Minimise upstream storage
Replaces Downstream Link	✓	Sump Available	✓
Invert Level (m)	73.030	Product Number	CTL-SHE-0041-8000-1000-8000
Design Depth (m)	1.000	Min Outlet Diameter (m)	0.075
Design Flow (l/s)	0.8	Min Node Diameter (mm)	1200

Node SUDS POND 1 Online Hydro-Brake® Control

Flap Valve	x	Objective	(HE) Minimise upstream storage
Replaces Downstream Link	✓	Sump Available	✓
Invert Level (m)	72.150	Product Number	CTL-SHE-0064-2000-1200-2000
Design Depth (m)	1.200	Min Outlet Diameter (m)	0.100
Design Flow (l/s)	2.0	Min Node Diameter (mm)	1200

Node SUDS SWALE 2 Online Hydro-Brake® Control

Flap Valve	x	Objective	(HE) Minimise upstream storage
Replaces Downstream Link	x	Sump Available	✓
Invert Level (m)	72.000	Product Number	CTL-SHE-0051-1200-1000-1200
Design Depth (m)	1.000	Min Outlet Diameter (m)	0.075
Design Flow (l/s)	1.2	Min Node Diameter (mm)	1200

Node PP1 Online Hydro-Brake® Control

Flap Valve	x	Objective	(HE) Minimise upstream storage
Replaces Downstream Link	x	Sump Available	✓
Invert Level (m)	74.300	Product Number	CTL-SHE-0034-4000-0500-4000
Design Depth (m)	0.500	Min Outlet Diameter (m)	0.075
Design Flow (l/s)	0.4	Min Node Diameter (mm)	1200

Node PP2 Online Hydro-Brake® Control

Flap Valve	x	Objective	(HE) Minimise upstream storage
Replaces Downstream Link	x	Sump Available	✓
Invert Level (m)	73.600	Product Number	CTL-SHE-0047-7000-0350-7000
Design Depth (m)	0.350	Min Outlet Diameter (m)	0.075
Design Flow (l/s)	0.7	Min Node Diameter (mm)	1200

Node SUDS SWALE 1 Depth/Area Storage Structure

Base Inf Coefficient (m/hr)	0.00000	Safety Factor	1.0	Invert Level (m)	73.030
Side Inf Coefficient (m/hr)	0.00000	Porosity	1.00	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	260.0	0.0	1.000	260.0	0.0	1.001	0.0	0.0

Node SUDS POND 1 Depth/Area Storage Structure

Base Inf Coefficient (m/hr)	0.00000	Safety Factor	1.0	Invert Level (m)	72.150
Side Inf Coefficient (m/hr)	0.00000	Porosity	1.00	Time to half empty (mins)	

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Depth (m)	Area (m²)	Inf Area (m²)	Depth (m)	Area (m²)	Inf Area (m²)	Depth (m)	Area (m²)	Inf Area (m²)
0.000	750.0	0.0	1.400	750.0	0.0	1.401	0.0	0.0

Node SUDS SWALE 2 Depth/Area Storage Structure

Base Inf Coefficient (m/hr)	0.00000	Safety Factor	1.0	Invert Level (m)	72.000
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)	Depth (m)	Area (m²)	Inf Area (m²)
0.000	150.0	0.0	1.500	150.0	0.0	1.501	0.0	0.0

Node PP1 Carpark Storage Structure

Base Inf Coefficient (m/hr)	0.00600	Invert Level (m)	74.300	Slope (1:X)	1000.0
Side Inf Coefficient (m/hr)	0.00600	Time to half empty (mins)	0	Depth (m)	0.350
Safety Factor	2.0	Width (m)	35.000	Inf Depth (m)	0.350
Porosity	0.33	Length (m)	200.000		

Node PP2 Carpark Storage Structure

Base Inf Coefficient (m/hr)	0.00600	Invert Level (m)	73.600	Slope (1:X)	100.0
Side Inf Coefficient (m/hr)	0.00600	Time to half empty (mins)	0	Depth (m)	0.350
Safety Factor	2.0	Width (m)	100.000	Inf Depth (m)	0.350
Porosity	0.33	Length (m)	20.000		

Rainfall

Event	Peak Intensity (mm/hr)	Average Intensity (mm/hr)	Event	Peak Intensity (mm/hr)	Average Intensity (mm/hr)
100 year +20% CC 1440 minute summer	15.421	4.133	100 year +20% CC 1440 minute winter	10.364	4.133

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Results for 100 year +20% CC 1440 minute summer. 1680 minute analysis at 30 minute timestep. Mass balance: 99.75%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
1440 minute summer	PP1	930	74.484	0.184	18.4	195.9524	0.0000	OK
1440 minute summer	PP2	900	73.790	0.190	6.6	59.4964	0.0000	OK
1440 minute summer	SWMH1.1	750	73.703	0.022	1.8	0.0243	0.0000	OK
1440 minute summer	SWMH2.1	750	73.095	0.035	3.6	0.0393	0.0000	OK
1440 minute summer	SWMH3.1	1470	73.058	0.158	4.1	0.1786	0.0000	OK
1440 minute summer	SWMH 3.2	1470	73.058	0.158	11.0	0.1786	0.0000	OK
1440 minute summer	SWMH3.3	1470	73.058	0.608	32.6	0.6876	0.0000	SURCHARGED
1440 minute summer	SWMH4.1	1470	73.058	0.458	6.6	0.5180	0.0000	SURCHARGED
1440 minute summer	SWMH8.1	1470	73.058	0.558	14.4	0.6311	0.0000	SURCHARGED
1440 minute summer	SWMH9.1	990	72.402	0.132	4.9	0.1496	0.0000	OK
1440 minute summer	SWMH13.1	660	72.122	0.022	1.8	0.0315	0.0000	OK
1440 minute summer	SWMH13.2	660	72.021	0.021	1.8	0.0000	0.0000	OK
1440 minute summer	SWMH14.1	1680	71.918	0.018	1.0	0.0000	0.0000	OK
1440 minute summer	SUDS SWALE 1	930	73.114	0.084	1.8	21.9510	0.0000	OK
1440 minute summer	SUDS SWALE 2	990	72.402	0.402	4.9	60.8007	0.0000	SURCHARGED
1440 minute summer	SUDS POND 1	1470	73.058	0.908	31.4	682.0038	0.0000	SURCHARGED

Link Event	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m³)	Discharge Vol (m³)
1440 minute summer	PP1	PP1 Pipe	SWMH4.1	0.4	0.216	0.003	0.4297	
1440 minute summer	PP1	Infiltration		5.4				
1440 minute summer	PP2	PP2 Pipe	SWMH3.3	0.7	0.169	0.005	0.3220	
1440 minute summer	PP2	Infiltration		1.6				
1440 minute summer	SWMH1.1	1.1	SUDS SWALE 1	1.8	0.740	0.010	0.2260	
1440 minute summer	SWMH2.1	2.1	SWMH3.1	3.6	0.327	0.029	0.2375	
1440 minute summer	SWMH3.1	3.1	SWMH 3.2	4.1	0.391	0.047	0.2426	
1440 minute summer	SWMH 3.2	3.2	SWMH3.3	11.0	0.581	0.160	6.2786	
1440 minute summer	SWMH3.3	3.3	SUDS POND 1	31.4	1.274	0.235	1.4694	
1440 minute summer	SWMH4.1	4.1	SWMH3.3	6.6	0.429	0.082	2.0021	
1440 minute summer	SWMH8.1	8.1	SWMH3.3	14.4	0.686	0.190	0.7562	
1440 minute summer	SWMH9.1	9.1	SUDS SWALE 2	4.9	0.612	0.041	1.1584	
1440 minute summer	SWMH13.1	13.1	SWMH13.2	1.8	0.706	0.006	0.0125	144.5
1440 minute summer	SUDS SWALE 1	Hydro-Brake®	SWMH3.1	0.6				
1440 minute summer	SUDS SWALE 2	SWALE 2	SWMH14.1	1.0	0.591	0.007	0.0101	76.2
1440 minute summer	SUDS POND 1	Hydro-Brake®	SWMH13.1	1.8				

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Results for 100 year +20% CC 1440 minute winter. 1680 minute analysis at 30 minute timestep. Mass balance: 99.74%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
1440 minute winter	PP1	990	74.492	0.192	13.9	213.1689	0.0000	OK
1440 minute winter	PP2	990	73.796	0.196	4.9	63.5573	0.0000	OK
1440 minute winter	SWMH1.1	720	73.700	0.019	1.3	0.0209	0.0000	OK
1440 minute winter	SWMH2.1	1440	73.157	0.097	2.7	0.1096	0.0000	OK
1440 minute winter	SWMH3.1	1440	73.157	0.257	3.2	0.2905	0.0000	OK
1440 minute winter	SWMH 3.2	1440	73.157	0.257	8.4	0.2905	0.0000	OK
1440 minute winter	SWMH3.3	1440	73.157	0.707	24.9	0.7995	0.0000	SURCHARGED
1440 minute winter	SWMH4.1	1440	73.157	0.557	5.1	0.6299	0.0000	SURCHARGED
1440 minute winter	SWMH8.1	1440	73.157	0.657	10.8	0.7430	0.0000	SURCHARGED
1440 minute winter	SWMH9.1	1110	72.461	0.191	3.7	0.2159	0.0000	OK
1440 minute winter	SWMH13.1	1440	72.122	0.022	1.9	0.0321	0.0000	OK
1440 minute winter	SWMH13.2	1440	72.022	0.022	1.9	0.0000	0.0000	OK
1440 minute winter	SWMH14.1	720	71.918	0.018	1.0	0.0000	0.0000	OK
1440 minute winter	SUDS SWALE 1	1680	73.137	0.107	1.3	27.9542	0.0000	OK
1440 minute winter	SUDS SWALE 2	1110	72.461	0.461	3.7	69.6603	0.0000	SURCHARGED
1440 minute winter	SUDS POND 1	1440	73.157	1.007	24.0	756.2804	0.0000	SURCHARGED

Link Event	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m³)	Discharge Vol (m³)
1440 minute winter	PP1	PP1 Pipe	SWMH4.1	0.4	0.220	0.003	0.4297	
1440 minute winter	PP1	Infiltration		5.6				
1440 minute winter	PP2	PP2 Pipe	SWMH3.3	0.7	0.173	0.005	0.3220	
1440 minute winter	PP2	Infiltration		1.7				
1440 minute winter	SWMH1.1	1.1	SUDS SWALE 1	1.3	0.736	0.007	0.2960	
1440 minute winter	SWMH2.1	2.1	SWMH3.1	2.7	0.273	0.021	0.5255	
1440 minute winter	SWMH3.1	3.1	SWMH 3.2	3.2	0.368	0.037	0.4662	
1440 minute winter	SWMH 3.2	3.2	SWMH3.3	8.4	0.555	0.122	7.8274	
1440 minute winter	SWMH3.3	3.3	SUDS POND 1	24.0	1.264	0.180	1.4694	
1440 minute winter	SWMH4.1	4.1	SWMH3.3	5.1	0.404	0.063	2.0021	
1440 minute winter	SWMH8.1	8.1	SWMH3.3	10.7	0.648	0.142	0.7562	
1440 minute winter	SWMH9.1	9.1	SUDS SWALE 2	3.7	0.670	0.031	1.3590	
1440 minute winter	SWMH13.1	13.1	SWMH13.2	1.9	0.715	0.007	0.0129	150.7
1440 minute winter	SUDS SWALE 1	Hydro-Brake®	SWMH3.1	0.6				
1440 minute winter	SUDS SWALE 2	SWALE 2	SWMH14.1	1.0	0.591	0.007	0.0101	76.4
1440 minute winter	SUDS POND 1	Hydro-Brake®	SWMH13.1	1.9				

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APPENDIX B

MET EIREANN RAINFALL DATA

Met Eireann
Return Period Rainfall Depths for sliding Durations
Irish Grid: Easting: 304087, Northing: 230773,

	Interval		Years											
DURATION	6months,	1year,	2,	3,	4,	5,	10,	20,	30,	50,	75,	100,	150,	200,	250,	500,
5 mins	2.3,	3.4,	4.1,	5.0,	5.7,	6.2,	8.0,	10.0,	11.4,	13.4,	15.2,	16.6,	18.8,	20.6,	22.1,	N/A ,
10 mins	3.2,	4.8,	5.7,	7.0,	7.9,	8.7,	11.1,	14.0,	15.9,	18.7,	21.2,	23.2,	26.3,	28.7,	30.7,	N/A ,
15 mins	3.8,	5.7,	6.7,	8.3,	9.3,	10.2,	13.1,	16.4,	18.7,	22.0,	24.9,	27.3,	30.9,	33.8,	36.2,	N/A ,
30 mins	5.0,	7.4,	8.7,	10.7,	12.0,	13.1,	16.7,	20.9,	23.7,	27.7,	31.4,	34.2,	38.7,	42.2,	45.1,	N/A ,
1 hours	6.6,	9.6,	11.2,	13.7,	15.5,	16.8,	21.3,	26.5,	30.0,	35.0,	39.4,	42.9,	48.4,	52.6,	56.2,	N/A ,
2 hours	8.6,	12.5,	14.6,	17.7,	19.9,	21.6,	27.2,	33.7,	38.0,	44.1,	49.6,	53.9,	60.5,	65.7,	70.0,	N/A ,
3 hours	10.1,	14.6,	17.0,	20.6,	23.1,	25.0,	31.4,	38.7,	43.6,	50.5,	56.7,	61.5,	69.0,	74.8,	79.7,	N/A ,
4 hours	11.4,	16.2,	18.9,	22.9,	25.6,	27.7,	34.7,	42.7,	48.1,	55.6,	62.3,	67.6,	75.7,	82.0,	87.3,	N/A ,
6 hours	13.3,	18.9,	22.0,	26.6,	29.7,	32.1,	40.1,	49.2,	55.2,	63.7,	71.3,	77.2,	86.3,	93.4,	99.3,	N/A ,
9 hours	15.6,	22.1,	25.6,	30.8,	34.4,	37.2,	46.2,	56.5,	63.3,	72.9,	81.5,	88.1,	98.4,	106.4,	113.0,	N/A ,
12 hours	17.5,	24.7,	28.5,	34.3,	38.2,	41.2,	51.2,	62.4,	69.8,	80.3,	89.6,	96.8,	108.0,	116.6,	123.8,	N/A ,
18 hours	20.5,	28.8,	33.2,	39.8,	44.3,	47.7,	59.0,	71.8,	80.2,	92.0,	102.5,	110.6,	123.1,	132.8,	140.8,	N/A ,
24 hours	23.0,	32.1,	37.0,	44.2,	49.1,	52.9,	65.3,	79.3,	88.4,	101.3,	112.7,	121.5,	135.1,	145.6,	154.3,	184.7,
2 days	28.9,	39.2,	44.6,	52.5,	57.8,	61.9,	75.1,	89.6,	99.1,	112.2,	123.7,	132.5,	146.0,	156.4,	164.9,	194.5,
3 days	33.6,	44.9,	50.7,	59.2,	64.9,	69.2,	83.0,	98.2,	108.0,	121.4,	133.2,	142.2,	155.9,	166.3,	174.9,	204.4,
4 days	37.8,	49.9,	56.1,	65.1,	71.0,	75.6,	90.0,	105.7,	115.8,	129.6,	141.6,	150.8,	164.7,	175.3,	183.9,	213.6,
6 days	45.1,	58.5,	65.4,	75.2,	81.7,	86.6,	102.0,	118.7,	129.3,	143.8,	156.3,	165.8,	180.1,	191.0,	199.9,	230.1,
8 days	51.6,	66.2,	73.5,	84.1,	91.0,	96.2,	112.5,	130.0,	141.1,	156.2,	169.1,	178.9,	193.7,	204.8,	213.9,	244.7,
10 days	57.5,	73.2,	81.0,	92.1,	99.4,	104.9,	122.0,	140.2,	151.7,	167.3,	180.7,	190.8,	205.9,	217.3,	226.6,	257.9,
12 days	63.1,	79.6,	87.9,	99.6,	107.2,	112.9,	130.7,	149.6,	161.5,	177.6,	191.3,	201.7,	217.1,	228.8,	238.3,	270.2,
16 days	73.5,	91.6,	100.6,	113.3,	121.5,	127.7,	146.7,	166.8,	179.4,	196.3,	210.7,	221.5,	237.6,	249.7,	259.5,	292.4,
20 days	83.0,	102.7,	112.3,	125.9,	134.6,	141.1,	161.3,	182.4,	195.5,	213.2,	228.1,	239.3,	256.0,	268.5,	278.6,	312.4,
25 days	94.3,	115.5,	125.9,	140.4,	149.7,	156.6,	178.0,	200.3,	214.1,	232.5,	248.1,	259.8,	277.1,	290.0,	300.4,	335.2,

NOTES:
N/A Data not available
These values are derived from a Depth Duration Frequency (DDF) Model
For details refer to:
'Fitzgerald D. L. (2007), Estimates of Point Rainfall Frequencies, Technical Note No. 61, Met Eireann, Dublin',
Available for download at www.met.ie/climate/dataproducts/Estimation-of-Point-Rainfall-Frequencies_TN61.pdf

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APPENDIX B

Flood Risk Assessment Dated June 2021

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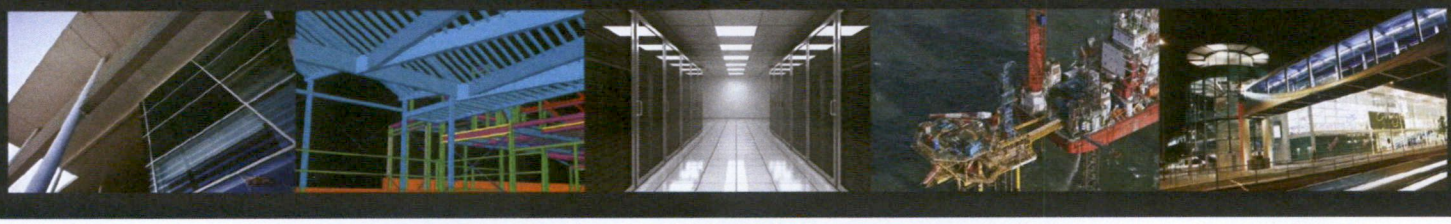

DB8,
Profile Park, Grange Castle,
Lucan, Co. Dublin

FLOOD RISK ASSESSMENT

June 2021

P210203

EQUINIX

STRUCTURAL • CIVIL • DUE DILIGENCE • ENGINEERING MASTERPLANNING
FLOOD MANAGEMENT • INFRASTRUCTURE DESIGN
PRE-DEVELOPMENT ENGINEERING • BIM • TRANSPORTATION

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APPROVALS

	Name	Signature	Position	Date
Prepared by	S. O'Reilly		Associate	08/06/2021
Reviewed by	J. Mayer		Director	10/06/2021
Approved by	J. Mayer		Director	12/06/2021

REVISIONS

Revision By	Date	Context

VERSIONS

Number	By	Date	Context
1	S. O'Reilly	16/06/2021	Planning Submission

SOURCES OF DATA

Office of Public Works (OPW)	Brock McClure
Met Eireann	
Land Survey Services Ltd.	
Google	

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REPORT CONTENTS

Executive Summary

This report was prepared for South Dublin County Council in connection with the planning application for a 3 storey (part 4 storey) data centre and addresses the potential flooding for the proposed development, located in Profile Park, Grange Castle, Dublin, near to the junction of the New Nangor Road.

Equinix (Ireland) Ltd. intend to apply for permission for development at this site of c.2.65ha on lands known as Plot 100, Profile Park, Nangor Road, Clondalkin, Dublin 22 (the site is bounded to the east and south by Grange Castle Golf Club, to the north by Nangor Road (R134) and to the west by an estate road known as Falcon Avenue). The development will consist of the following:

- Construction of a 3 storey (part 4 storey) data centre known as "DB8" to include data halls, electrical/plant rooms, offices, lobbies, ancillary staff areas including break rooms and toilets, stores, stair/lift cores throughout and photovoltaic panels at roof level. The total gross floor area excluding hot air plenums and external staircase is c.9,601sqm. The overall height of the data centre ranges from c.16m to c.20m to roof level and c.20m to c.24m including roof top plant, flues and lift overrun;
- Provision of 5 no. external generators, 8 no. fuel tanks and ancillary plant contained within a plant yard to the north of DB8;
- Provision of a water tank plant room, air cooled chillers and ancillary plant contained within a chiller plant yard to the south of DB8;
- Provision of a sprinkler pump room (c.23sqm), 2 no. sprinkler tanks (c.12m high each), heat recovery plant room (c.17sqm), ESB substation (c.44sqm), waste/bin stores (c.52sqm). Total floor area of ancillary structures and plant (c.303sqm);
- Provision of a delivery yard and loading bays, 64 no. car parking spaces, 5 no. motorcycle spaces, bicycle shelter serving 14 no. spaces, smoke shelter, internal access roads and footpaths, vehicular and pedestrian access to the west from Falcon Avenue and closure of existing vehicular entrances from Falcon Avenue;
- All associated site development works, services provision, drainage works including attenuation, landscape and boundary treatment works including berming, hedgerow protection areas and security fencing;
- No buildings are proposed above the existing ESB wayleave and SDCC watermain wayleave to the west and north of the site;
- The area to the south west of the site is reserved for a future data centre, subject of a separate application to South Dublin County Council;
- This application is accompanied by a Natura Impact Statement.

The Report should be read in conjunction with all associated Planning Drawings, and deals with the potential flood risk and mitigation measures proposed for the subject site.

1 Introduction

The applicant proposes to construct a 3 storey (part 4 storey) data centre, which will be accessed off Falcon Avenue adjacent to and to the west of the site. Profile Park is located in Grange Castle and connects to the New Nangor Road to the north. The purpose of this report is to address any potential flooding elements of the proposed data centre development, on lands as indicated on the site location map below.

The total subject site area extends to circa 6.55 acres (2.65 ha), with the site being greenfield.

The location of the site is indicated indicatively on the map extract below - Figure 1.

FIGURE 1 - Site Location (Source Google Maps)

2 Flood Risk Assessment

The Planning System & Flood Risk Management Guidelines for Planning Authorities, dated November 2009, as published by the OPW, sets out the process to be followed in assessing proposed developments relating to flood risk.

These guidelines introduce comprehensive mechanisms incorporating flood risk identification, assessment and management into the planning process.

Planning authorities, in implementing these guidelines, are to ensure that where relevant, flood risk is a key consideration in the preparation of development and local area plans and also in the assessment of planning applications.

The guidelines will also serve to assist county and local authorities in preparing planning guidelines which should be utilised by developers and the general public in assessing flood risk when submitting development proposals / planning applications. Flood risk is summarised through various levels of the planning system as set out in Figure 1.1 below.

Policy Documents / Instruments	Flood Risk Assessment Technique	Decision-making Tools	Key Chapters
National Spatial Strategy, National Planning Guidelines	Flood Risk Management Guidelines	n/a	1 2
Regional planning guidelines	Regional Flood Risk Appraisal, Catchment Flood Risk Management Plans	Sequential approach, Strategic Environmental Assessment	3 4
City / county development plan	Strategic Flood Risk Assessment, Catchment Flood Risk Management Plans	Sequential approach, dev. plan Justification Test, SEA	3 4
Local area plan	Strategic Flood Risk Assessment	Sequential approach, dev. plan Justification Test, SEA	3 4
Master plan, non-statutory plan, site brief	Site-specific Flood Risk Assessment	Sequential approach, dev. plan Justification Test, SEA / Env. Impact Assessment	3 5
Planning application	Site-specific Flood Risk Assessment	Sequential approach, dev. management Justification Test, EIA	3 5

Fig. 1.1: Flood risk management and the planning system

Using the sequential approach as described in Chapter 3 of the aforementioned guideline document, including confirmation that the site is classified as "Less Vulnerable" and therefore classified as appropriate and in conjunction with assessing available flood data, i.e. OPW, PFRA & CFRAMS mapping etc., it has been determined that the site has been categorised as falling into Zone C, (see Flood Zone definitions below), from a flooding perspective. It is proposed to apply the Source-Pathway-Receptor Model in providing the necessary mitigating measures.

Flood zones

Flood zones are geographical areas within which the likelihood of flooding is in a particular range and they are a key tool in flood risk management within the planning process as well as in flood warning and emergency planning. There are three types or levels of flood zones defined for the purposes of these Guidelines:

Flood Zone A – where the probability of flooding from rivers and the sea is highest (greater than 1% or 1 in 100 for river flooding or 0.5% or 1 in 200 for coastal flooding);

Flood Zone B – where the probability of flooding from rivers and the sea is moderate (between 0.1% or 1 in 1000 and 1% or 1 in 100 for river flooding and between 0.1% or 1 in 1000 year and 0.5% or 1 in 200 for coastal flooding); and

Flood Zone C – where the probability of flooding from rivers and the sea is low (less than 0.1% or 1 in 1000 for both river and coastal flooding). Flood Zone C covers all areas of the plan which are not in zones A or B.

Fig. 2.3: Indicative flood zone map extract

3 Source-Pathway-Receptor Model

In assessing the potential flood risk to the site, the above model, as described in The Planning System & Flood Risk Management Guidelines for Planning Authorities, was used. The following flood sources were considered and necessary mitigating measures proposed, where required:-

- Coastal Flooding
- Fluvial Flooding
- Pluvial Flooding
- Ground Water Flooding

3.1 Coastal Flooding

In considering the risk from coastal flooding, it is necessary to relate the location of the site relative to the coast and the associated height above sea level. The subject site is located circa 15.5km from the nearest point on the Irish coast (Dublin Bay) to the east and the average elevation of the site above sea level is circa 75.00m O.D. Malin Head.

Further to the above, coastal flooding is not considered a risk to the subject site.

3.2 Fluvial Flooding

Fluvial flooding is defined as flooding from a river or other watercourse. Further to site inspections and topographical surveys, there are no rivers flowing through the site. There is a dry ditch forming the southern boundary of the site, which ultimately connects into a tributary of the Camac.

Further to the above, this is considered to be very low risk, given the fact that the records of fluvial flooding on the site or environs, i.e. 0.1% AEP Extreme Event (1:1000yr), indicates a water level of between 0.5m – 1m. Refer the attached CFRAMS mapping as contained in Appendix A.

From a levels perspective, it appears that the peak water level, as taken from the above mapping, is circa 74.50m on the east to 72m in the south. The lowest building finished floor level has been set at 75.50m, which is well in excess of the required 500mm above the highest known 1:1000yr flood level.

Further to the above, any flood extents indicated, in this instance only the 0.1% AEP Extreme Event (1:1000yr) is tabled, which indicates this flood event as displacing water well to the south of the subject site and not impacting on the proposed development.

Additionally, the topographical survey is based on ITM (Irish Transverse Mercator), GPS compatible mapping and is used extensively by Ordnance Survey Ireland, whereas, the CFRAM mapping relies on Lidar (Light Detection & Ranging) survey, which is not nearly as accurate as a topographical survey, as it is conducted by air. The accuracy of Lidar survey varies between 50mm – 200mm vertically and between 400mm – 1500mm horizontally.

3.3 Pluvial Flooding

This type of flooding is applicable to all sites and is caused by summer thunderstorms or high intensity rainfall during longer duration events. This flooding is then generated by overland flows prior to the run-off entering watercourses / sewers (pipe networks).

Further to the above, any future occurrence of this form of flooding taking place, will be mitigated by the fact that the proposed development has been designed in accordance with the relevant guidelines and specifications of the time, with a surface water attenuation pond being provided, together with a hydrobrake flow control mechanism limiting the total outflow to the Q-bar run-off rate of 4.4 l/s. These measures have been utilised in the sites overall network drainage system in order to mitigate pluvial flooding and provide for a wholly sustainable development.

3.4 Ground Water Flooding

This form of flooding is not considered to be of any risk to the site. This is borne out by the fact that trial holes had previously been dug on the site and the results gathered from this excavation work have indicated that minimal groundwater was encountered.

Additionally, the OPW Preliminary Flood Risk Assessments Groundwater Flooding Report concludes that ground water flooding is largely confined to the West Coast of Ireland, due to the hydrogeology of the area.

Refer Appendix B for the Groundwater Flood Hazard map, clearly indicating that ground water flooding is not considered a risk in this area of County Dublin.

4 Impact on Downstream Network

There are no impacts on the downstream network based on the following:-

- The site has been sustainably managed in accordance with the relevant guidelines and specifications of the time
- SuDS measures have been incorporated in the form of a surface water attenuation tank
- Surface water attenuation has been provided and sized based on a Q-bar run-off rate of 4.4 l/s
- A Hydrobrake mechanism has been installed to restrict the outflow into the existing network accordingly, i.e. 4.4 l/s
- Water quality is maintained as the outflow passes through approved Petrol / Oil Interceptors

The above methods will ensure that all surface water on-site will be sustainably managed and discharged off-site, via approved run-off rates into the existing Local Authority sewer network.

5 Conclusion

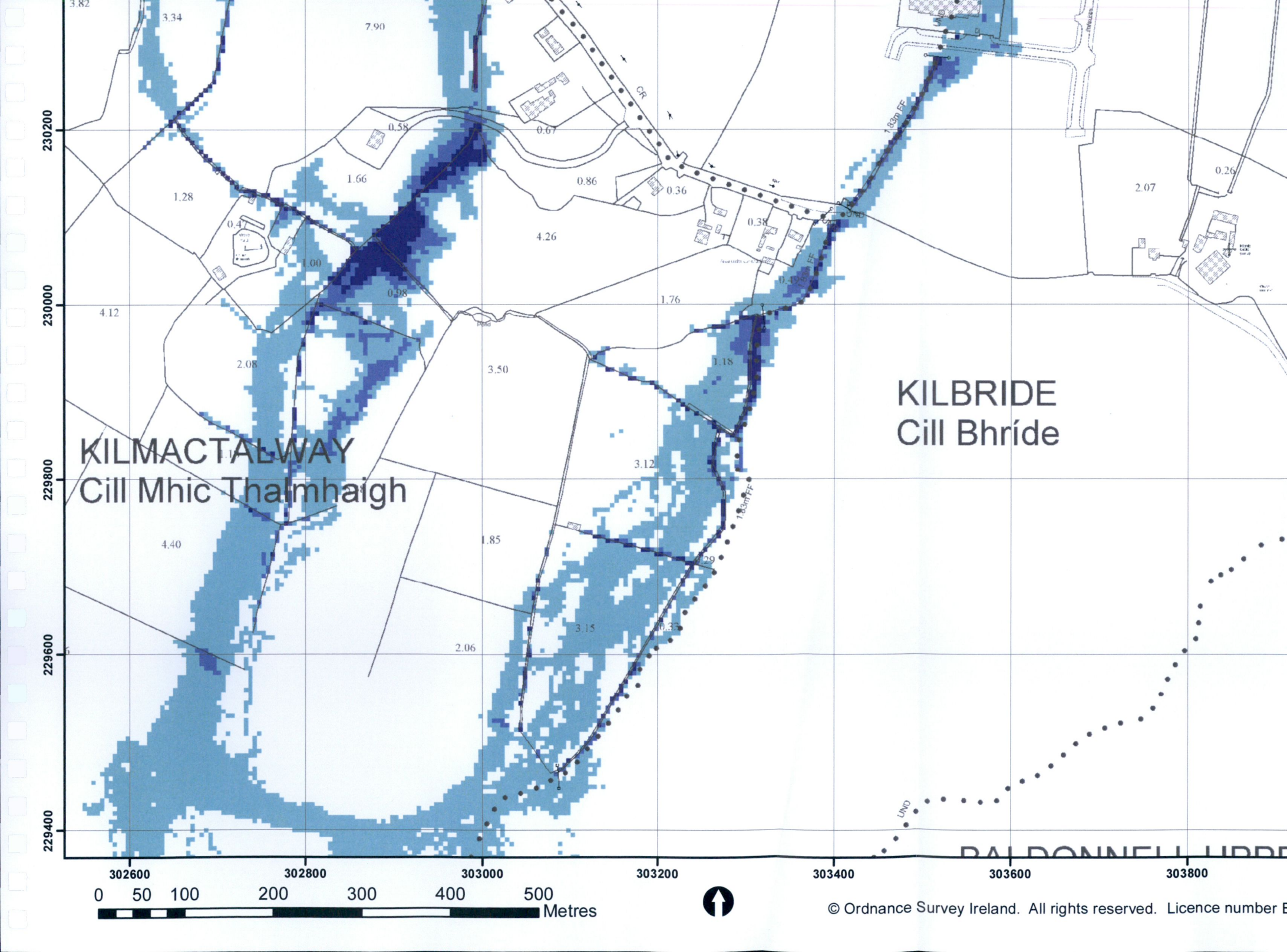
In conclusion, the proposed development of the site will be carried out in a wholly sustainable manner, as described and will not pose any flooding issues. This holds true for the developable site itself or for any lands / properties downstream of the proposed development.

Any fluvial flooding adjacent to the environs of the site is considered to be of an extreme nature, i.e. 1:1000 year storm event and would not jeopardise the proposed development of the site, particularly as the site will be positively drained and surface water will be contained within the overall sites drainage network and managed in a sustainable manner in accordance with all relevant guidelines and specifications.

Further to the above, based on the indicative flood mapping, the development site is located within Flood Zone C "Low Probability". Additionally, as mentioned, the site is classified as "Less Vulnerable" and therefore the development is classified as appropriate.

Appendix A

OPW - CFRAM Mapping


KILMACTALWAY
Cill Mhic Thalmhaigh
KILBRIDE
Cill Bhríde
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230000
229800
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302800
303000
303200
303400
303600
303800
0 50 100 200 300 400 500
Metres
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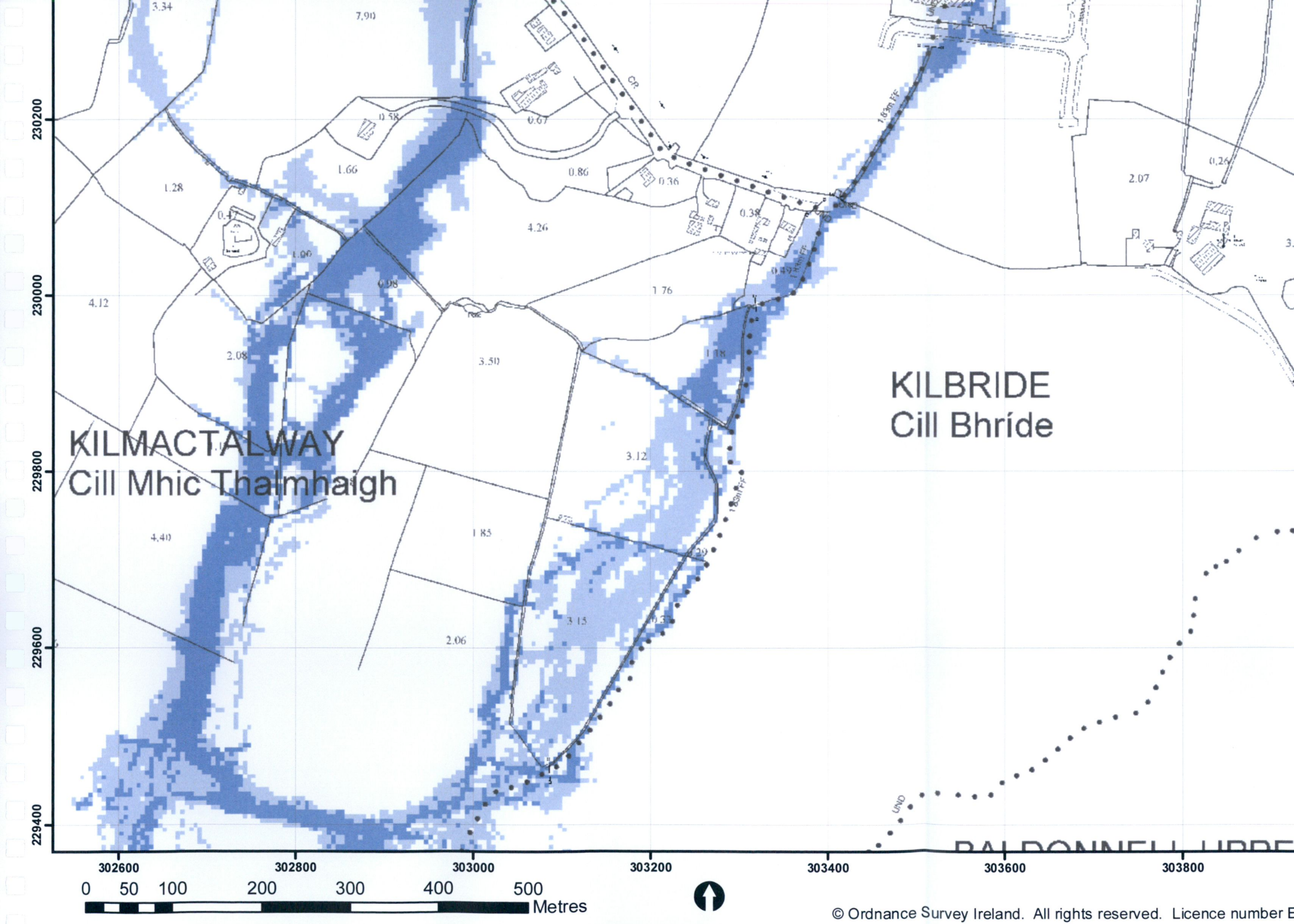

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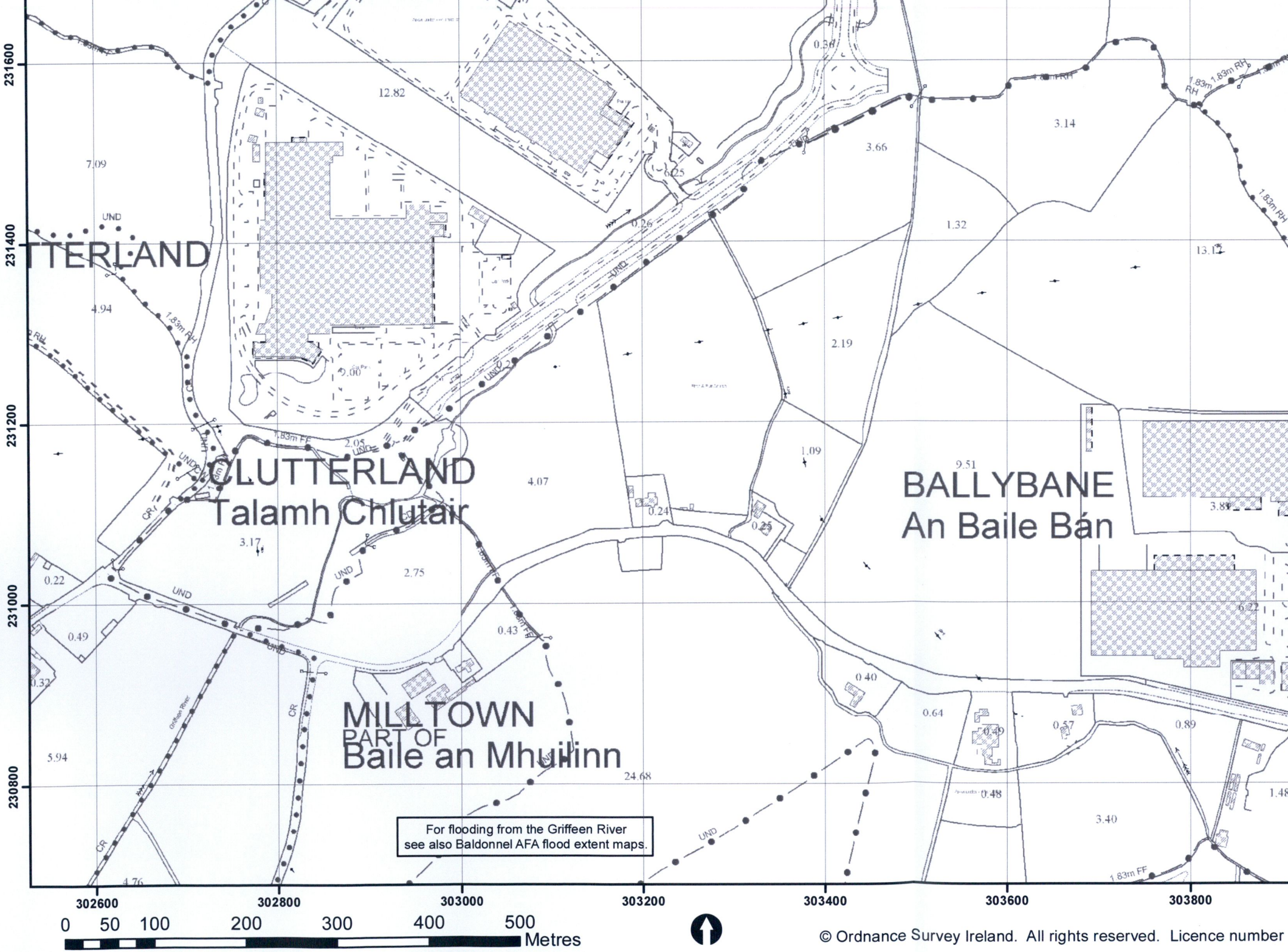

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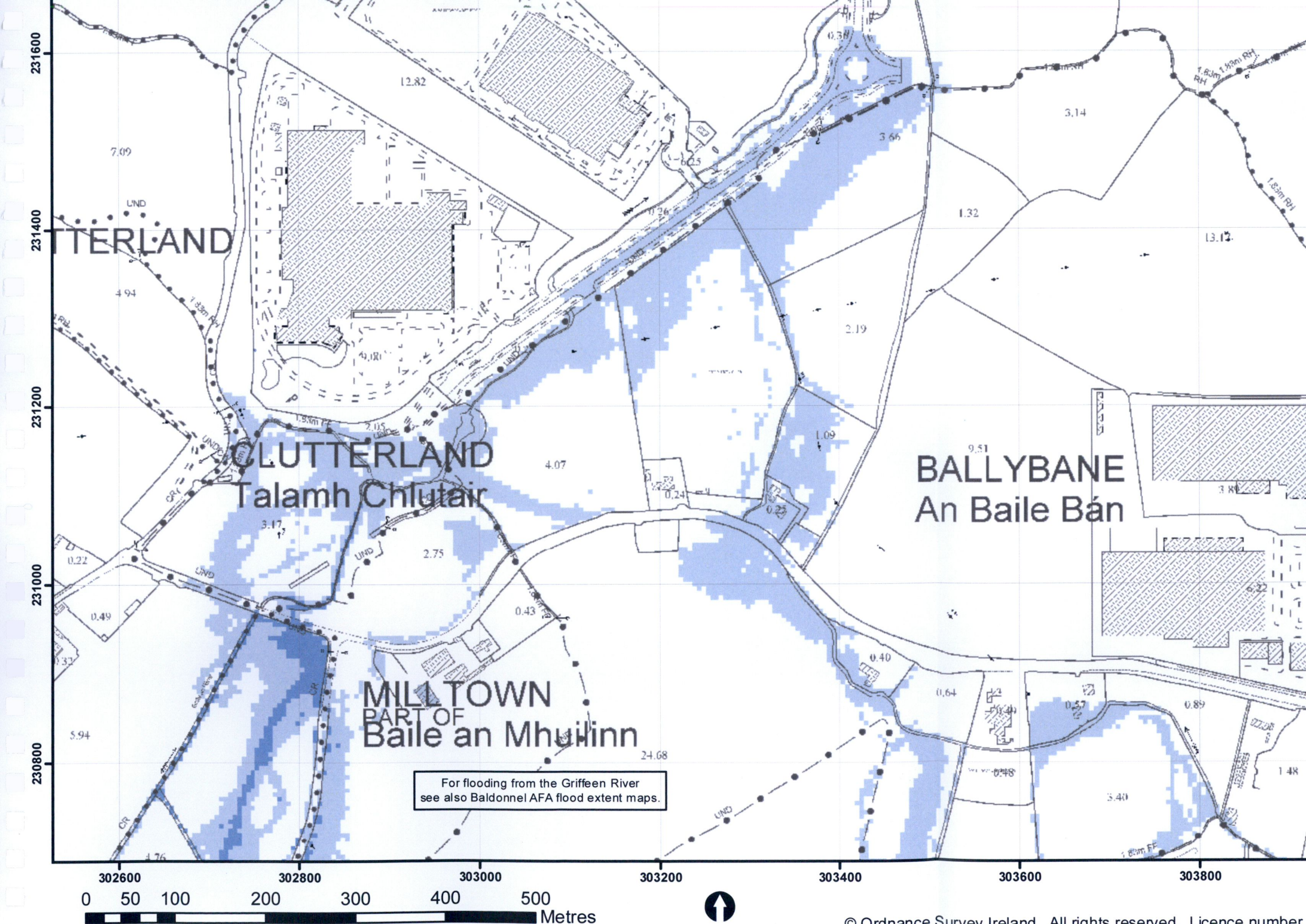

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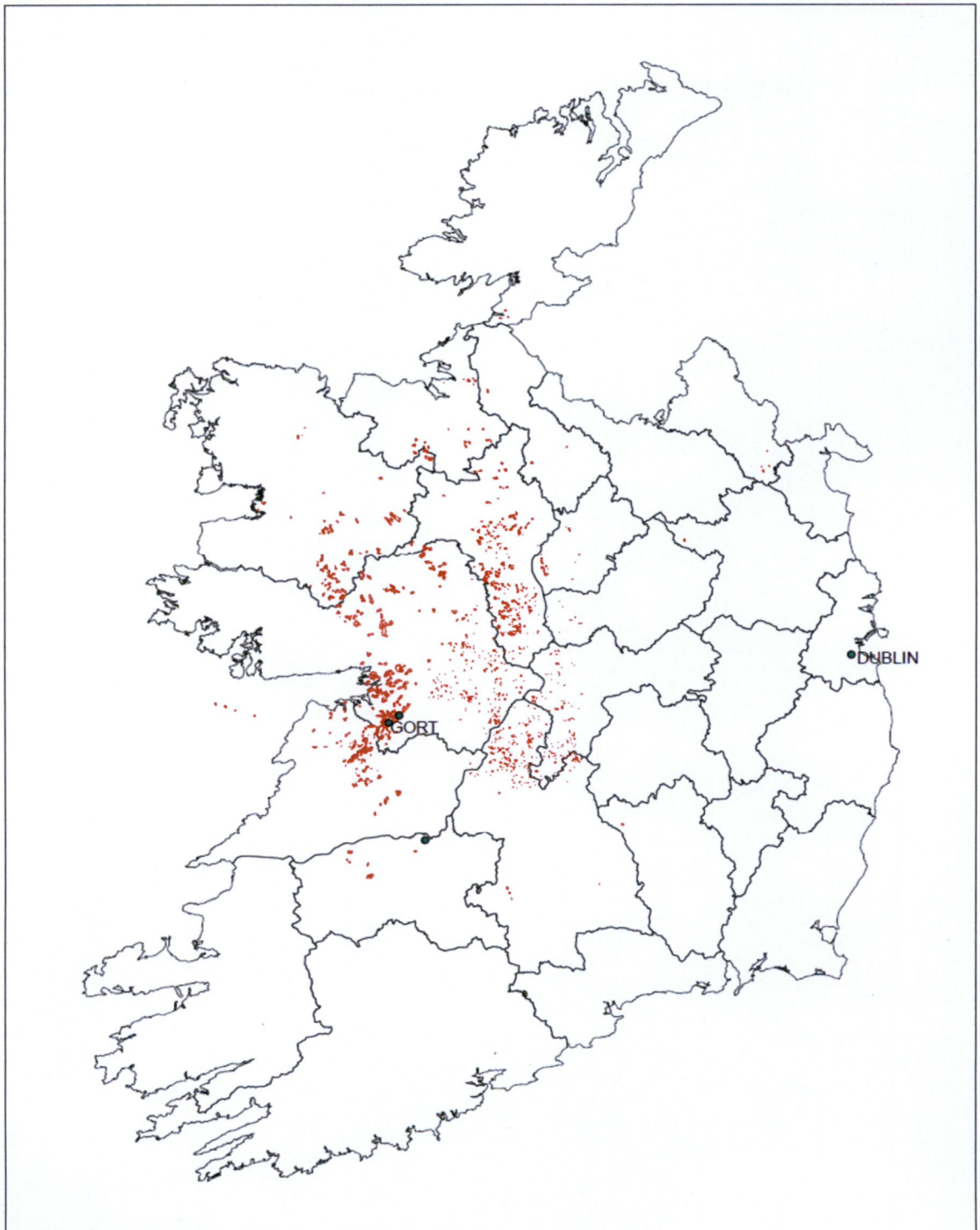
Appendix B

OPW – Preliminary Groundwater Flood Hazard Map



Title	Preliminary Groundwater Flood Hazard Map		
Figure 6.6	Size A4	Drawn	RAH
		Checked	SB
Drawing No: 262128BA/2.1		Approved	SB
Date: 24/06/2010		Rev No	01

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Legend

- County boundary
- Location
- Area at risk of groundwater flooding