JJ CAMPBELL & ASSOCIATES
CONSULTING CIVIL & STRUCTURAL ENGINEERS
F1 Nutgrove Office Park, Dublin 14
tel: 01 2980538, fax: 01 2963956, e-mail info@jjc.ie, www.jjc.ie

South Dublin County Council
Civic Office
Dublin 24

Attention: Planning Department - Drainage Division
Re: Proposed Single-storey warehouse at Lands to the south side of Lucan Road, Ballydowd and abutting Hermitage Gardens, Lucan, Co Dublin

Our ref: 2211-04
Date: 29.09.22

Dear Sirs,

Please find attached J.J. Campbell and Associates planning / drainage drawings for the above project, together with drainage calculations and SUDs spreadsheet.

Drawings to be read in conjunction with drainage report:

- C1 Proposed Drainage Layout
- C2 Proposed Water Main Layout
- C3 Drainage Details / Sections Sheet 1
- C4 Drainage Details / Sections Sheet 2
- C5 Drainage Details/ Sections Sheet 3

Yours faithfully

Marcus Wallace

Marcus Wallace

JJ CAMPBELL & ASSOCIATES
CONSULTING CIVIL & STRUCTURAL ENGINEERS
F1 Nutgrove Office Park, Dublin 14
tel: 01 2980538, fax: 01 2963956, e-mail info@jjc.ie, www.jjc.ie

Single-Storey Warehouse

Planning Submission
Drainage

Job No. 2211-04
Date: Sept 2022
Prepared by: Marcus Wallace

CONTENTS:

1. Site Description. Existing Buildings and Proposed Development

Jogor Point Ltd intends to apply for Planning Permission at Lands to the south side of Lucan Road, Ballydowd and abutting Hermitage Gardens, Lucan, Co Dublin . The development will consist of: The construction of a) a metal clad single-storey warehouse, of 3072 sqm, 13.58m high to parapet at front and part of the sides, and 10.4m high to eaves and 12.9m high to the ridge at part of sides and rear; b) a single storey 2.9m high ESB substation of 14sqm ; c) the widening of the existing vehicular/cycle entrance to The Foxhunter Public House , and the forming of a new vehicular/cycle exit to the north west corner of the site; d) the formation of pedestrian/cycle gate to Hermitage Gardens and pedestrian gate to Lucan Road, e) internal roads and pathways and all associated hard and soft landscaping, f) foul and surface drainage, including attenuation tanks; g) 18 no. carparking spaces and 16 no. bicycle spaces.

Figure 1 - Site Location

2. Existing Foul Effluent

An existing 150Ø foul sewer crosses the site from the Foxhunter, the existing sewer starts at the north east corner of the site and runs to the existing outfall manhole located to the east of the site at Hermitage Gardens and then discharges to a dedicated 225Ø Irish Water foul sewer.

3. Proposed Foul Effluent

3.1 General

The foul sewer crossing the site from the Foxhunter is to be diverted around the proposed single-storey warehouse to the existing public foul sewer at Hermitage Gardens. The diverted foul sewer is to be on dedicated 225Ø foul sewer and separate to the proposed single-storey warehouse. The adjacent Foxhunter and proposed single-storey warehouse are in the same ownership but on completely separate sites, the existing foul sewers are private.

Foul effluent from the proposed Single-storey warehouse is to discharge via a gravity outfall system to the 225Ø Irish Water foul sewer in Hermitage Gardens.

3.2 Discharge from the proposed Single-Story Warehouse:

All foul from the proposed development will be on a completely separate system to the proposed surface water.

Dry Weather Flow:

Say 50 staff @ 60 l/person/day:	3000 l/day
3000 / 24x60x60:	0.035 l/sec
Add 10% for unit consumption allowance:	0.039 l/sec

Peak Flow (6 DWF):

6 x 0.039 l/sec:	0.23 l/sec

3.3 Self-Cleansing Velocity.

See ISEN *7524 (1998) Part 4. - Drain and sewer systems outside buildings* Hydraulic Design Clause 8 , Self Cleansing Velocity.

For small diameter drains and sewers less than DN 300, self-cleansing can generally be achieved by ensuring that a velocity of at least 0.7 m/s occurs daily or that a gradient of 1:DN is specified.

The internal drainage will have minimum fall of 1:80 and higher flows can be expected at least once daily and the self-cleansing velocity will be achieved.

3.4 Grease Traps.

If grease traps are required, they shall be under-sink in-line Grease Traps by FM Environmental, Grease Shield EPAS Ltd or equivalent, will be installed in the line between all grease producing appliance/hot wash sink and the foul drainage system.

4. Existing Surface Water

The proposed development is situated to the west of the Foxhunter in a disused carpark. The existing carpark gullies discharge by gravity to an existing 300Ø public surface water sewer in Hermitage Gardens. Storm water from the existing carpark is unattenuated.

An existing 300Ø storm sewer crosses the site from the Foxhunter, the existing storm pipe starts at the north east corner of the site and runs to the existing outfall manhole located to the East of the site at Hermitage Gardens.

5. Proposed Surface Water

Storm water from the existing Foxhunter is to be diverted around the proposed Single-storey warehouse to the existing public storm sewer at Hermitage Gardens. The diverted storm sewer is to be on dedicated 300Ø storm sewer and separate to the proposed Single-storey warehouse. The Foxhunter and proposed Single-storey warehouse are in the same ownership but are completely separate sites. The storm sewers private.

Surface water from the proposed Single-storey warehouse will discharge by gravity to the existing 300Ø public sewer in Hermitage Gardens.

Surface water from the proposed Single-storey warehouse will all be attenuated before discharging to the existing public surface water sewer in Hermitage Gardens.

A petrol interceptor will be installed in the East service yard.

5.1 SuDS

5.1.1 Green Roofs.

The proposed Single-storey warehouse is a steel portal frame with pitched roof. Green roofs are suitable for this project.

5.1.2 Permeable Parking.

Permeable parking is located on the South and West of the proposed Single-storey warehouse,

Total permeable parking area: 331m^2

5.1.2 Permeable Paving.

Permeable paving is located on the North, South and West of the proposed Single-storey warehouse

Total permeable paving area: 873m^2

5.1.3 Dry Swales / Infiltration Trench

Dry Swale landscaped areas are located on the South and West of the proposed Single-storey warehouse.

Total Dry Swale area: 631m^2 – Total length: 150m

CIRIA Report C753, Table 24.6 states that areas up to 25 times the base plan of the basin can be assumed to meet interception requirements where infiltration rates are greater than 1x10-6 m/s.

Where the infiltration is poor, some infiltration along with evotranspiration will take place in the infiltration trench which is filled with stone with 30% voids.

In accordance with the GDSDS the criterion requirements as set out in Table 6.3 are to be complied with in the following manner;

Criterion 1 – River Water Quality Protection

Interception Storage of 5mm of rainfall will be achieved through the use of permeable paving, permeable parking and dry swales at ground level:

Permeable Parking:

Area:	331m^2
300 stone sub-base:	30% voids
Total Storage: 331m^2 x 30%:	99.3m^3

Permeable Paving:

Area:	873m^2
200 stone sub-base:	30% voids
Total Storage: 873m^2 x 30%:	262m^3

Dry Swales / Infiltration Trenches

Total Storage: 150m x 1m x 0.6m x 30% voids:	27m^3

Interception volume is required to cater for 5mm rainfall on paved (impervious) surfaces. We have conservatively included the whole site 6462m^2.

Interception volume required = 6462m^2 * 0.005m = 32.1m^3

Interception volume provided is 388.3m^3, interception volume required is 32.1m^3.

Criterion 2 – River Regime Protection

Surface water discharge from the proposed development will be restricted to an equivalent rate of 2.0 l/s. This will be achieved with the provision of a Hydro-Brake device on the west side of the site. For operation purposes the minimum discharge from a Hydro-Brake is set at 2l/s.

Criterion 3 – Level of Service (Flooding) Site

See Appendix 4.

Criterion 4 – River Flood Protection

As outlined above, the runoff from the site will be limited to a maximum of 2.0l/s for the proposed development. This in accordance with guidelines set out in the GDSDS Volume 2.

The site currently discharges to the public storm network unattenuated at a maximum rate of 6462m² x 0.037m/hr = 66l/s. The proposed development will greatly reduce the discharge to the public storm water system.

5.2 Attenuation Storage.

SDCC require that attenuation storage is provided to store the storm water from the GDSDS Design Storm – 30yr, 1-hr flood. In addition, because the whole site is more or less taken up with the development, the 100yr 6-hr flood will also attenuated underground.

Because of the very limited space for attenuation, the only option is to construct an underground concrete tank within the foot print of the building. The volume required for the attenuation tank is 507m³, actual volume of the tank is 578m³ with a free bore of 200mm.

A 225Ø channel will be installed in the bottom of the tank to channel storm water during small storm events. The tank falls at 1:100 longitudinal and transversely. External access manholes are located at both ends of the tank to allow for easy access for inspections / cleaning.

5.3 Landscaping

Dry Swale landscaping is to be provided on the Southern and Western boundaries. See civil drawing C1.

5.4 Hydro-brake

A HDR Hydro-brake Optimum Flow Control limiting outflow to 2.0 l/s will be fitted to the surface water manhole S04, located at the western side of the proposed

development. A penstock valve will also be fitted to the inlet on the manhole to allow maintenance of hydro-brake.

Refer to drawing: C1 – Proposed Drainage Layout

6. Water Supply

6.1 Existing Water Supply

Irish Water maps show a 4" uPVC spur into the site on the western boundary.

6.2 Proposed Water Supply

Irish Water confirmed in their Confirmation of Feasibility (CDS20002939) in a previous planning for an apartment complex on the same site that the new connection has to be made to the existing 200Ø HDPE Watermain to the North of the development in the access road from the N4. The new scheme for the Single-storey warehouse has a much lower water demand. A 100Ø connection is required for the fire ring main.

On site storage for the average day peak week demand rate for the commercial section for 24 hours period will be provided. Separate storage will be provided to supply this demand for whole 24 hours and will have a refill time of 12 hours.

Average Daily Demand

60 ltr/person/day x 50 persons = 3000 ltr/ day

Average day / Peak Week

3000 / (60x60x24) = 0.035 ltr/ sec

0.035 X 1.25 = 0.043 ltr/sec IW Factor for Peak: 1.25

Peak Demand

0.043 X 2.1 = 0.09 ltr/sec

Pressure boosting and storage will be to the requirements of South Dublin Co Co / Irish Water. Design Details for pressure boosting and storage will be agreed with South Dublin Co Co Water Services Division/Irish Water prior to development commencing on site.

Appendix 1 - Attenuation Calculation

Project :	Warehouse Unit	**Architect :**	Cathal O'Neill Architects
Job No :	1911-12A		

ATTENUATION DESIGN RETURN PERIOD 100 Yrs **Rev** A

Total Area: 6462m² / 0.6462Ha

Rainfall Data Issued By Met Eireann for Lucan

Total Allowable Outflow for Warehouse Unit **2.00 l/s**

Duration (minutes)	Rainfall (mm)	Rainfall (m3/ha)	Roof Area (m3)	Permeable Parking (m3)	Landscape (m3)	Road Path (m3)	Total Inflow	Allowable Outflow (m3)	Storage (m3)	Duration (minutes)
10	22.60	226.00	104.57	3.74	9.86	7.13	125.31	1.20	124.11	10
15	26.50	265.00	122.62	4.39	11.57	8.36	146.93	1.80	145.13	15
30	32.80	328.00	151.77	5.43	14.32	10.35	181.86	3.60	178.26	30
60	40.60	406.00	187.86	6.72	17.72	12.81	225.11	7.20	217.91	60
120	50.20	502.00	232.28	8.31	21.91	15.84	278.33	14.40	263.93	120
240	62.00	620.00	286.87	10.26	27.06	19.56	343.76	28.80	314.96	240
360	70.20	702.00	324.82	11.62	30.64	22.15	389.22	43.20	346.02	360
720	86.80	868.00	401.62	14.37	37.89	27.39	481.26	86.40	394.86	720
1440	107.30	1073.00	496.48	17.76	46.84	33.85	594.92	172.80	422.12	1440
2880	118.40	1184.00	547.84	19.60	51.68	37.36	656.47	345.60	310.87	2880
Max Storage Capacity Required									**422.12**	
						Allow 20% for climatic change			506.55	m3

Contribution Areas

Hard Area's incl roof	**0.4627**	**Hectares**	**100**	**% Impervious**	0.4627	Hectares
Permeable Parking	**0.0331**	**Hectares**	**50**	**% Impervious**	0.0166	Hectares
Permeable Paving	**0.0873**	**Hectares**	**50**	**% Impervious**	0.0437	Hectares
Swale / Green Space	**0.0631**	**Hectares**	**50**	**% Impervious**	0.0316	Hectares
Total	**0.6462**	**Hectares**		**Total Impervious**	0.5545	Hectares

Appendix 2 - Rainfall Data

Met Eireann
Return Period Rainfall Depths for sliding Durations
Irish Grid: Easting: 305267, Northing: 235388,

	Interval		Years												
DURATION	6months,	1year,	2,	3,	4,	5,	10,	20,	30,	50,	75,	100,	150,	200,	250,	500,
5 mins	2.3,	3.5,	4.1,	5.0,	5.7,	6.2,	7.9,	9.9,	11.2,	13.1,	14.8,	16.2,	18.3,	20.0,	21.4,	N/A ,
10 mins	3.3,	4.8,	5.7,	7.0,	7.9,	8.6,	11.0,	13.7,	15.6,	18.3,	20.7,	22.6,	25.5,	27.8,	29.8,	N/A ,
15 mins	3.8,	5.7,	6.7,	8.2,	9.3,	10.1,	12.9,	16.2,	18.3,	21.5,	24.3,	26.5,	30.0,	32.7,	35.0,	N/A ,
30 mins	5.1,	7.4,	8.6,	10.6,	11.9,	12.9,	16.4,	20.3,	23.0,	26.8,	30.2,	32.8,	36.9,	40.2,	42.9,	N/A ,
1 hours	6.7,	9.6,	11.2,	13.6,	15.3,	16.5,	20.7,	25.6,	28.8,	33.3,	37.4,	40.6,	45.5,	49.3,	52.5,	N/A ,
2 hours	8.9,	12.6,	14.5,	17.5,	19.6,	21.1,	26.3,	32.1,	36.0,	41.5,	46.4,	50.2,	56.0,	60.5,	64.3,	N/A ,
3 hours	10.5,	14.7,	16.9,	20.3,	22.6,	24.4,	30.2,	36.8,	41.1,	47.2,	52.6,	56.8,	63.2,	68.2,	72.4,	N/A ,
4 hours	11.7,	16.4,	18.9,	22.6,	25.1,	27.0,	33.3,	40.4,	45.1,	51.7,	57.5,	62.0,	68.9,	74.3,	78.7,	N/A ,
6 hours	13.8,	19.1,	22.0,	26.2,	29.0,	31.2,	38.3,	46.2,	51.5,	58.8,	65.2,	70.2,	77.8,	83.8,	88.6,	N/A ,
9 hours	16.3,	22.3,	25.6,	30.3,	33.5,	36.0,	44.0,	52.9,	58.7,	66.8,	74.0,	79.5,	87.9,	94.4,	99.8,	N/A ,
12 hours	18.3,	25.0,	28.5,	33.7,	37.2,	39.9,	48.5,	58.2,	64.4,	73.2,	80.9,	86.8,	95.8,	102.8,	108.5,	N/A ,
18 hours	21.5,	29.1,	33.2,	39.1,	43.0,	46.0,	55.7,	66.5,	73.5,	83.2,	91.7,	98.3,	108.2,	115.9,	122.2,	N/A ,
24 hours	24.1,	32.5,	36.9,	43.4,	47.7,	50.9,	61.5,	73.1,	80.7,	91.1,	100.3,	107.3,	118.0,	126.2,	132.9,	156.2,
2 days	30.1,	39.6,	44.5,	51.6,	56.2,	59.8,	71.1,	83.3,	91.2,	101.9,	111.3,	118.4,	129.1,	137.3,	144.1,	167.0,
3 days	35.0,	45.4,	50.6,	58.2,	63.2,	67.0,	78.8,	91.7,	99.8,	111.0,	120.6,	127.9,	138.9,	147.2,	154.0,	177.2,
4 days	39.2,	50.4,	56.0,	64.0,	69.2,	73.2,	85.6,	99.0,	107.4,	118.9,	128.8,	136.2,	147.5,	156.0,	162.9,	186.4,
6 days	46.7,	59.1,	65.3,	74.0,	79.7,	84.0,	97.4,	111.6,	120.6,	132.7,	143.1,	150.9,	162.5,	171.3,	178.5,	202.6,
8 days	53.3,	66.8,	73.4,	82.8,	88.9,	93.5,	107.7,	122.7,	132.1,	144.7,	155.5,	163.6,	175.7,	184.8,	192.1,	216.9,
10 days	59.4,	73.8,	80.8,	90.8,	97.2,	102.1,	117.0,	132.6,	142.4,	155.5,	166.7,	175.1,	187.5,	196.9,	204.4,	229.8,
12 days	65.1,	80.3,	87.7,	98.2,	105.0,	110.0,	125.6,	141.8,	152.0,	165.5,	177.0,	185.7,	198.5,	208.1,	215.8,	241.7,
16 days	75.6,	92.3,	100.4,	111.8,	119.1,	124.5,	141.2,	158.6,	169.4,	183.7,	195.8,	204.9,	218.3,	228.3,	236.4,	263.3,
20 days	85.3,	103.4,	112.1,	124.3,	132.1,	137.8,	155.5,	173.8,	185.1,	200.2,	212.9,	222.3,	236.2,	246.6,	255.0,	282.8,
25 days	96.8,	116.3,	125.7,	138.8,	147.0,	153.2,	172.0,	191.4,	203.3,	219.1,	232.4,	242.2,	256.8,	267.6,	276.3,	305.1,

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

Appendix 3 - Hydro-Brake Design

Technical Specification

Control Point	Head (m)	Flow (l/s)
Primary Design	1.100	2.000
Flush-Flo™	0.289	1.844
Kick-Flo®	0.584	1.500
Mean Flow		1.672

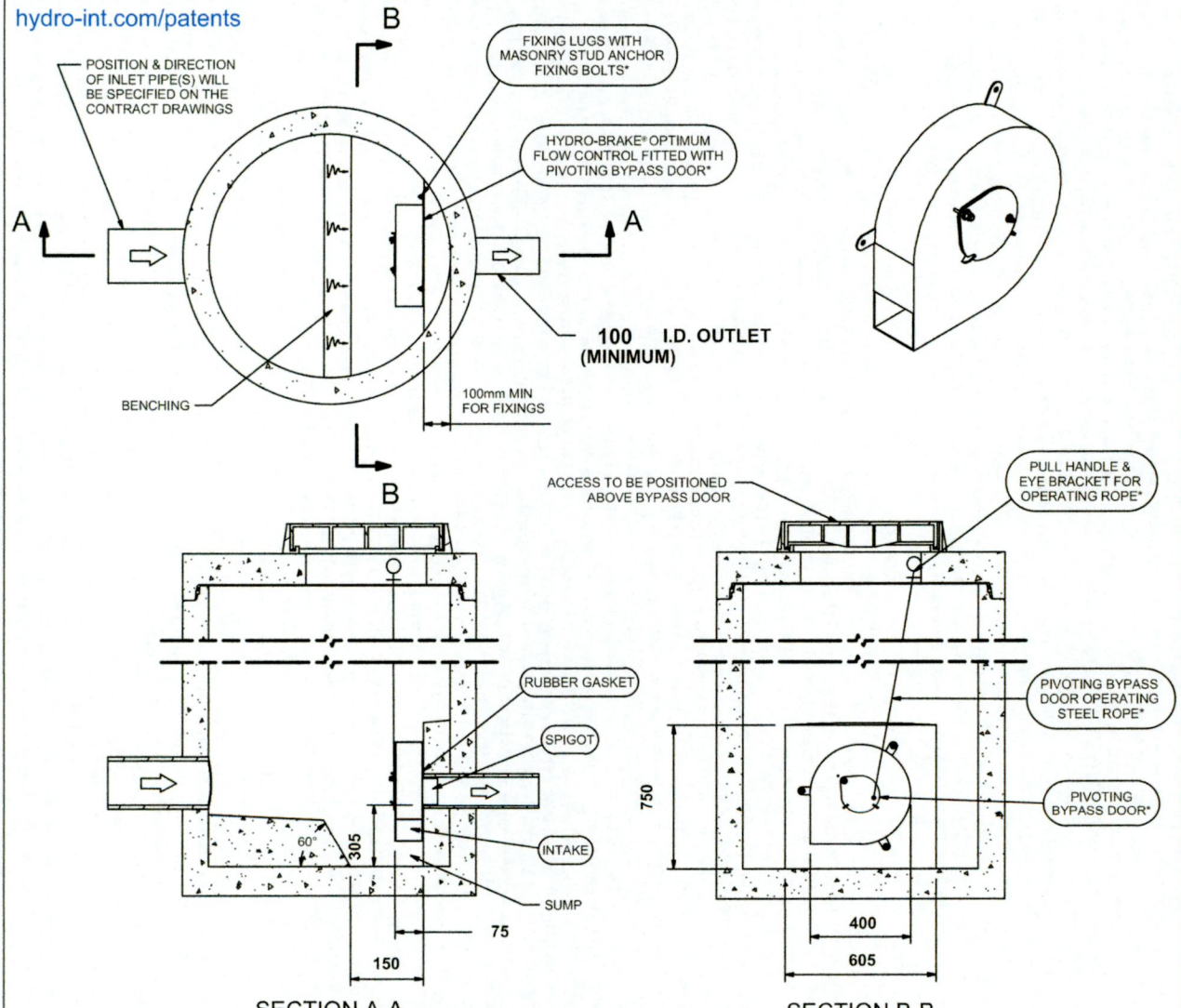
Hydro-Brake® Optimum Flow Control including:

- 3 mm grade 304L stainless steel
- Integral stainless steel pivoting by-pass door allowing clear line of sight through to outlet, c/w stainless steel operating rope
- Beed blasted finish to maximise corrosion resistance
- Stainless steel fixings
- Rubber gasket to seal outlet
- Indicative Weight: 75 kg

BBA APPROVAL INSPECTION TESTING CERTIFICATION
CERTIFICATE 08/4596

WRc Approved
PT/329/0412

hydro-int.com/patents



SECTION A-A

SECTION B-B

IMPORTANT: ⬭ LIMIT OF HYDRO INTERNATIONAL SUPPLY
THE DEVICE WILL BE HANDED TO SUIT SITE CONDITIONS
FOR SITE SPECIFIC DETAILS AND MINIMUM CHAMBER SIZE REFER TO HYDRO INTERNATIONAL
ALL CIVIL AND INSTALLATION WORK BY OTHERS
* WHERE SUPPLIED
HYDRO-BRAKE® FLOW CONTROL & HYDRO-BRAKE® OPTIMUM FLOW CONTROL ARE REGISTERED TRADEMARKS FOR FLOW CONTROLS DESIGNED AND MANUFACTURED EXCLUSIVELY BY HYDRO INTERNATIONAL

THIS DESIGN LAYOUT IS FOR ILLUSTRATIVE PURPOSES ONLY. NOT TO SCALE.

DESIGN ADVICE !

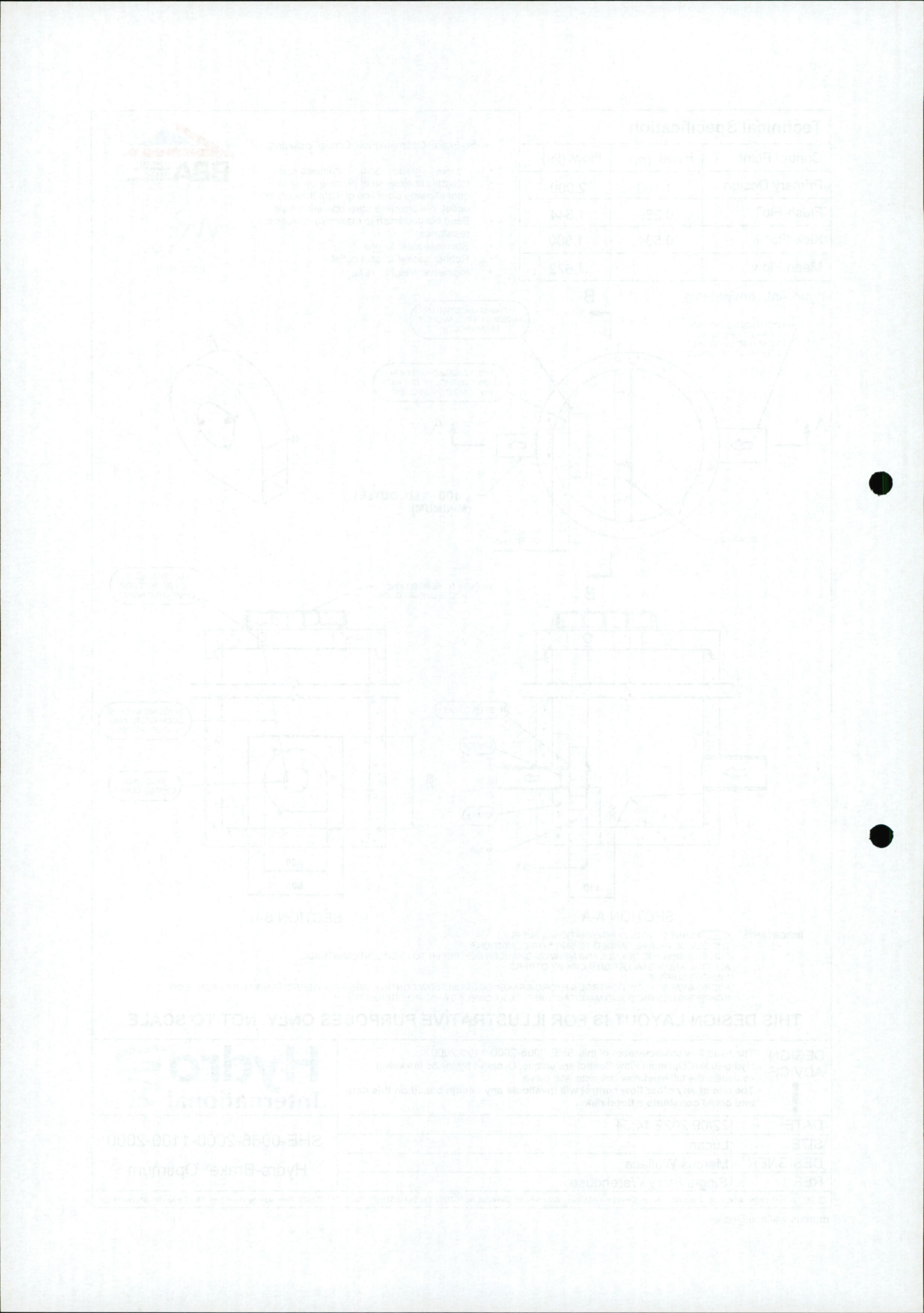
The head/flow characteristics of this SHE-0066-2000-1100-2000 Hydro-Brake® Optimum Flow Control are unique. Dynamic hydraulic modelling evaluates the full head/flow characteristic curve.
The use of any other flow control will invalidate any design based on this data and could constitute a flood risk.

Hydro International®

DATE	22/09/2022 14:54
SITE	Lucan
DESIGNER	Marcus Wallace
REF	Single Story Warehouse

SHE-0066-2000-1100-2000
Hydro-Brake® Optimum

marcus.wallace@jjc.ie



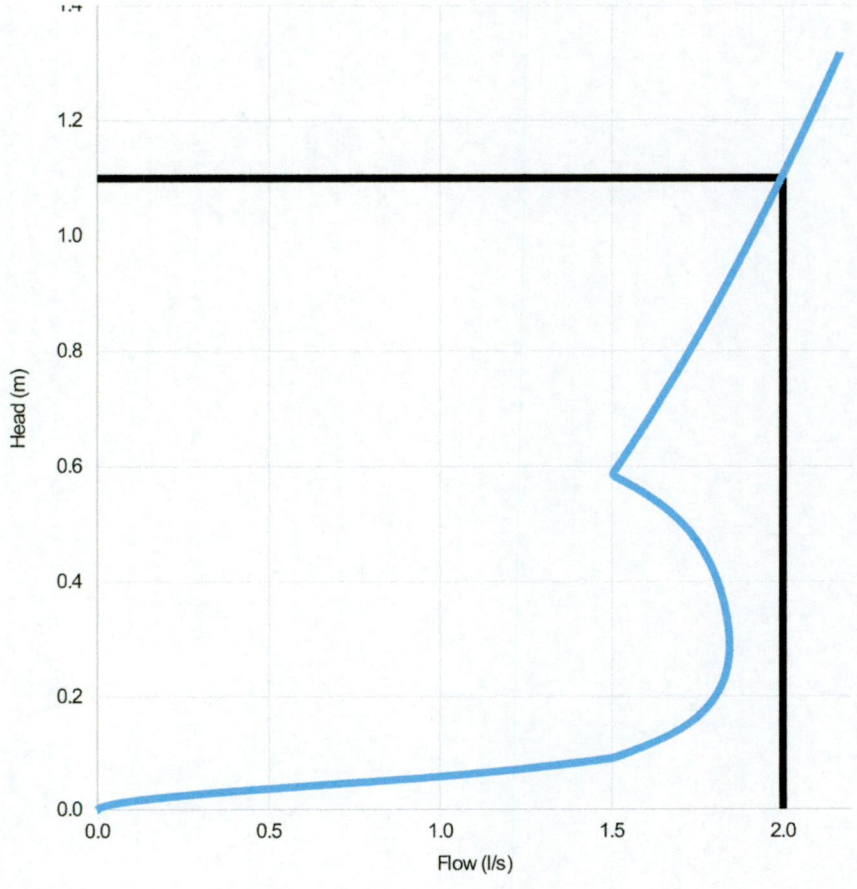
Technical Specification

Control Point	Head (m)	Flow (l/s)
Primary Design	1.100	2.000
Flush-Flo	0.289	1.844
Kick-Flo®	0.584	1.500
Mean Flow		1.672

BBA APPROVAL INSPECTION TESTING CERTIFICATION
CERTIFICATE No 08/4596

WRc APPROVED
PT/329/0412

hydro-int.com/patents



Head (m)	Flow (l/s)
0.000	0.000
0.038	0.533
0.076	1.308
0.114	1.611
0.152	1.724
0.190	1.791
0.228	1.827
0.266	1.842
0.303	1.843
0.341	1.835
0.379	1.820
0.417	1.798
0.455	1.765
0.493	1.718
0.531	1.649
0.569	1.551
0.607	1.526
0.645	1.568
0.683	1.609
0.721	1.648
0.759	1.687
0.797	1.724
0.834	1.761
0.872	1.797
0.910	1.831
0.948	1.866
0.986	1.899
1.024	1.932
1.062	1.964
1.100	1.995

DESIGN ADVICE

The head/flow characteristics of this SHE-0066-2000-1100-2000 Hydro-Brake Optimum® Flow Control are unique. Dynamic hydraulic modelling evaluates the full head/flow characteristic curve.

! **The use of any other flow control will invalidate any design based on this data and could constitute a flood risk.**

Hydro International®

DATE	22/09/2022 14:54
Site	Lucan
DESIGNER	Marcus Wallace
Ref	Single Story Warehouse

SHE-0066-2000-1100-2000

Hydro-Brake Optimum®

Appendix 4 – Flood Risk Assessment

1 Introduction

The developer has requested a flood risk assessment be undertaken to support an application to construct a Single-storey warehouse at Lands to the south side of Lucan Road, Ballydowd and abutting Hermitage Gardens, Lucan, Co Dublin.

JJ Campbell and Associates have undertaken this Flood Risk Assessment (FRA) in accordance with the Planning System and Flood Risk Management Guidelines for Planning Authorities (DoEHLG & OPW, 2009), to ensure sustainability and effective management of flood risk associated with the completion of the development.

1.1 Terms of reference

JJ Campbell and Associates were appointed by Jogor Point Ltd to prepare a Flood Risk Assessment (FRA) for a Single-storey warehouse at Lands to the south side of Lucan Road, Ballydowd and abutting Hermitage Gardens, Lucan, Co Dublin.

1.2 Flood Risk Assessment: Aims and Objectives

This study is being completed to inform the future development of the site as it relates to flood risk. It aims to identify, quantify and communicate to Planning Authority officials and other stakeholders the risk of flooding to land, property and people and the measures that would be recommended to manage the risk.

The objectives are to:

- Identify potential sources of flood risk;
- Confirm the level of flood risk and identify key hydraulic features;
- Assess the impact the proposed development has on flood risk;
- Develop appropriate flood risk mitigation and management measures which will allow for the long-term development of the site.

Recommendations for development have been provided in the context of the OPW / DoEHLG planning guidance, "The Planning System and Flood Risk Management". A review of the likely effects of climate change, and the long-term impacts this may have on existing development has also been undertaken.

1.3 Development Proposal

The client is applying for planning permission for a single-story Single-storey warehouse at Lands to the south side of Lucan Road, Ballydowd and abutting Hermitage Gardens, Lucan, Co Dublin. The proposed site layout and associated stormwater system are shown on drawing C1.

As part of the stormwater design, permeable paving, permeable parking and dry swales will be provided.

2 Site Background

This section describes the proposed development site, including adjacent watercourses and the wider geographical area.

2.1 Location and Topography

Commercial and residential land bounds the site location on the west, south and eastern boundaries. The N4 (Lucan Road) borders the site to the north while the Hermitage golf club is located north of the N4. Figure 2-1 shows the site location and surrounding area.

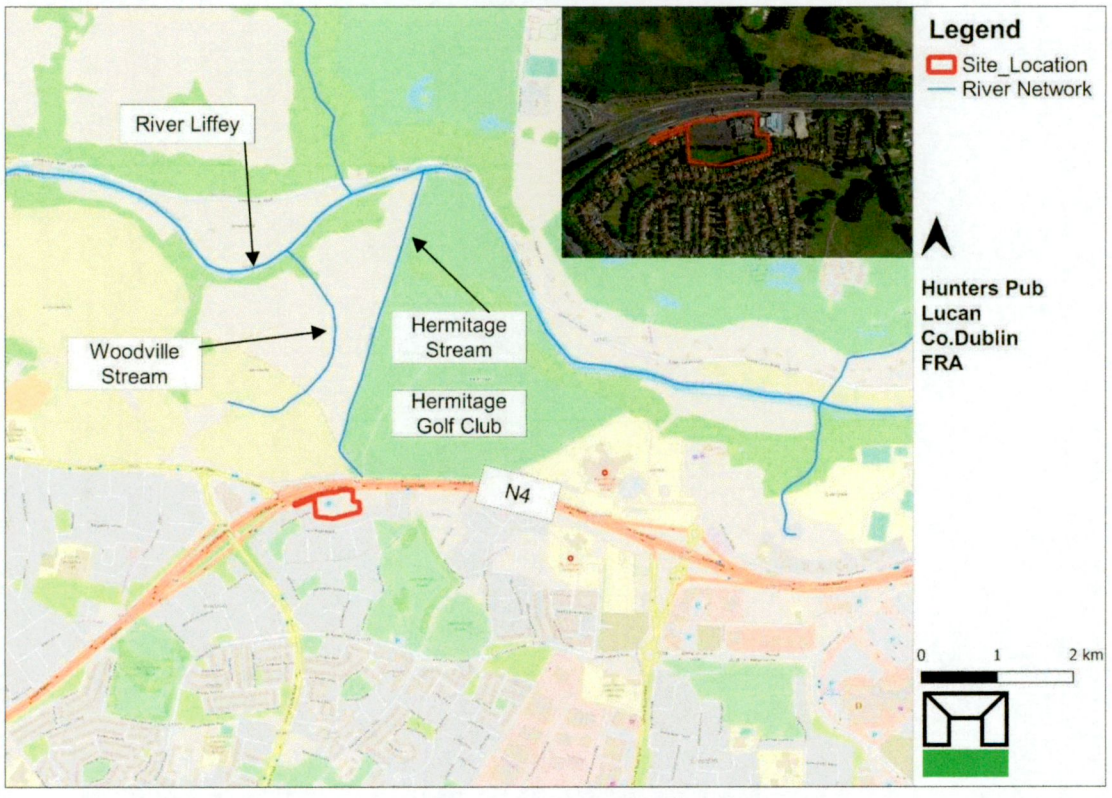


Figure 2-1: Site Location and watercourses (source: OSM and Google Satellite)

2.2 Watercourses

The River Liffey is the main hydrological feature in the area and is located c. 1km north of the site and flows in an easterly direction, refer to Figure 2-1. There are two streams, the Woodville Stream and Hermitage stream north of the site. All surface watercourse rise downgradient of the site.

2.3 Site Geology

The groundwater and geological maps of the site provided by the Geological Survey of Ireland (GSI) have been studied. The underlying subsoil layer is made ground. There is a strain of alluvial soils found c.1km north of the site along the River Liffey watercourse.

The underlying bedrock is identified as Waulsortian Limestones which is classified as massive unbedded lime-mudstone. There are no karst features or historic springs located at the site. The groundwater vulnerability for the site is classified as 'Low' to

'Moderate', which indicates a depth to bedrock of 5 - 10m. This suggests there is no indication of groundwater flooding at the site location.

Figure 2-2: Lucan Soils (Source: GSI Database)

Figure 2-3: Lucan Groundwater Vulnerability (Source: GSI Database)

3 Flood Risk Identification

An assessment of the potential and scale of flood risk at the site is conducted using historical and predictive information. This identifies any sources of potential flood risk to the site and reviews historic flood information. The findings from the flood risk identification stage of the assessment are provided in the following sections.

3.1 Flood History

A number of sources of flood information were reviewed to establish any recorded flood history at, or near the site. This includes the OPW's website, www.floodmaps.ie and general internet searches.

3.1.1 Floodmaps.ie

The OPW host a National Flood Hazard mapping website, www.floodmaps.ie, which highlights areas at risk of flooding through the collection of recorded data and observed flood events, refer to Figure 3-1. The website has returned several results within the Lucan area. Review of the flood record did not show any flood event at or immediately surrounding the site. The nearest floods were reported as follows:

- Flood Event: River Liffey Flood August 25th-26th 1986. Flooding of River Liffey Catchment c. 0.5km north of site.
- Flood Event: Recurring flood event along St Edmonsbury Road, Lucan c. 0.5km west of site.
- Flood Event: Lower Lucan Road/Strawberry Beds c. 1.5km northwest of site. Road and houses flooded. The Strawberry Road location was flooded over the period 13th-15th November 2002. It is noted that the road level is low and impacted when Liffey is in flood.
- Flood Event: Between Sommerton Road & Luttrellstown Golf Course c.1km northeast of site. Road level impacted when Liffey in flood. Usually passable. Impassable in 2004 due to surface water from Porterstown/Luttrelstown Golf Club unable to exit due to blockage of drainage pipe by local landowner.

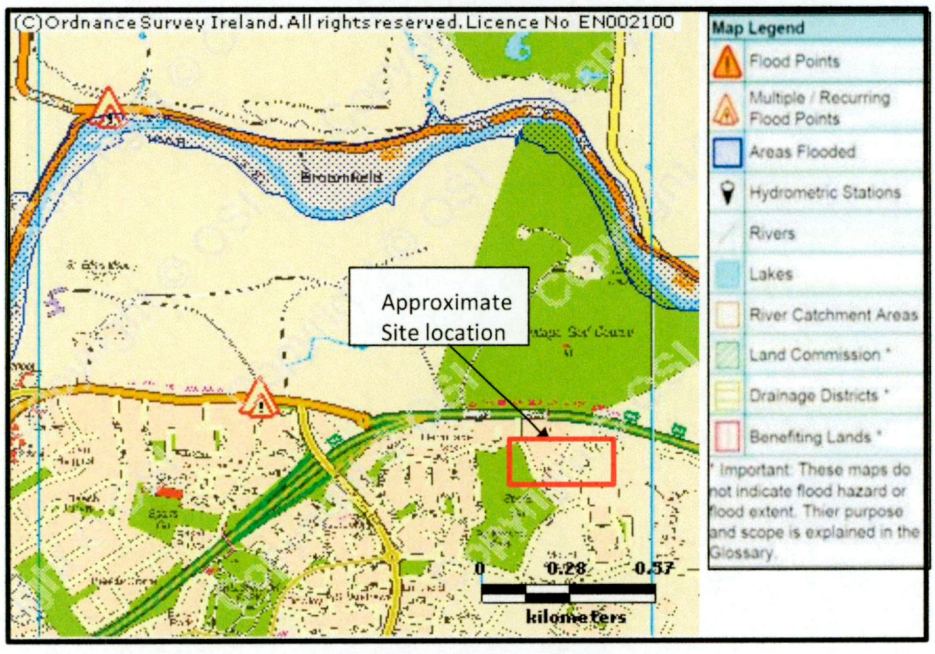


Figure 3-1: Historical Flooding (Source: floodmaps.ie)

3.1.2 Internet Search

An internet search was conducted to gather information about whether or not the site was affected by flooding previously and several results are present for the past flooding of Lucan in 2000, confirming the historic flooding provided in Section 3.1.1. However, the site was not indicated as being affected in the reports.

3.2 Predictive Flooding

A number of predictive flood mapping and/or modelling studies have been carried out on the River Liffey and its tributaries. The main studies to consider are:

1.South Dublin County Council Development Plan 2016-2022

2. OPW Preliminary Flood Risk Assessment (PFRA) (2011)

3. Eastern Catchment Flood Risk Assessment and Management (CFRAM) Study (2016)

The level of detail presented by the studies listed above is variable, however the Eastern CFRAM is the most recent and detailed assessment of flood extent. The Eastern CFRAM supersedes the fluvial and tidal flood outlines presented in the OPW PFRA.

3.2.1 South Dublin County Council Development Plan 2016-2022

The South Dublin County Council Development Plan includes a Strategic Flood Risk Assessment to assess all types of flood risk within the county and to assist South Dublin County Council to make informed strategic land-use planning decisions and formulate flood risk policies. Indicative pluvial flood maps have been produced for South Dublin County and an extract of the flood map is presented in Figure 3-2. The mapping appears to be based on the 1st generation OPW PFRA flood mapping.

Fluvial flood extents are provided within the SFRA but are based on the CFRAM mapping, refer to Section 3.2.3.

Review of Figure 3-2 confirms that the site is not identified at risk of flooding during the 1% or 0.1% AEP pluvial flood events but there is an area to the south of the site.

3.2.2 OPW Preliminary Flood Risk Assessment

The preliminary Flood Risk Assessment (PFRA) is a requirement of the EU Flood Directive (2007/60/EC). One of the PFRA deliverables is flood probability mapping for various sources:

Pluvial (surface water), groundwater, fluvial and tidal. The PFRA is a preliminary or 'indicative' assessment and analysis has been undertaken to identify areas potentially prone to flooding. The PFRA study has gone through an update during 2019, however the updated flood maps have not been made public at the time of writing, and the first generation PFRA maps have been withdrawn by the OPW.

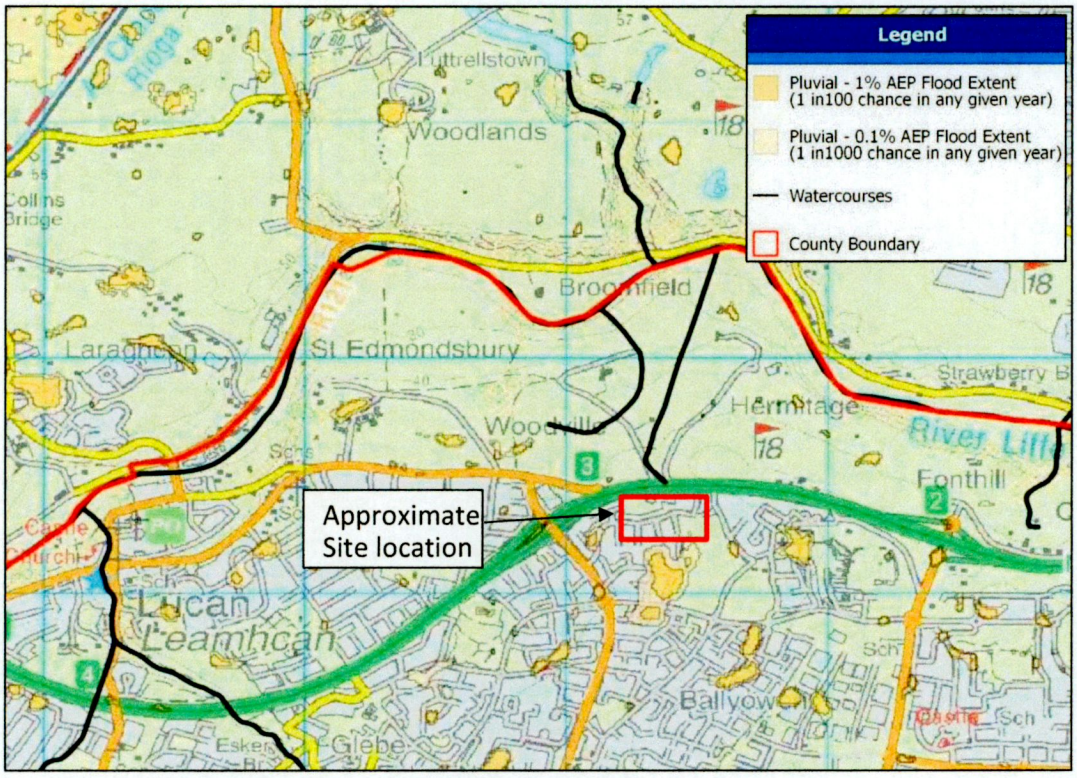


Figure 3-2: Pluvial Flood Map South Dublin County

3.2.3 Eastern CFRAM Flood Risk Assessment Study (Eastern CFRAM)

The primary source of data with which to identify flood risk to the site is the Eastern CFRAM. Flood maps have been finalised for South Dublin County and an extract of the flood map covering the site is presented in Figure 3-3.

Review of Figure 3-3 confirms that the site and the surrounding area are not identified at risk of flooding during the 1% or 0.1% AEP flood events.

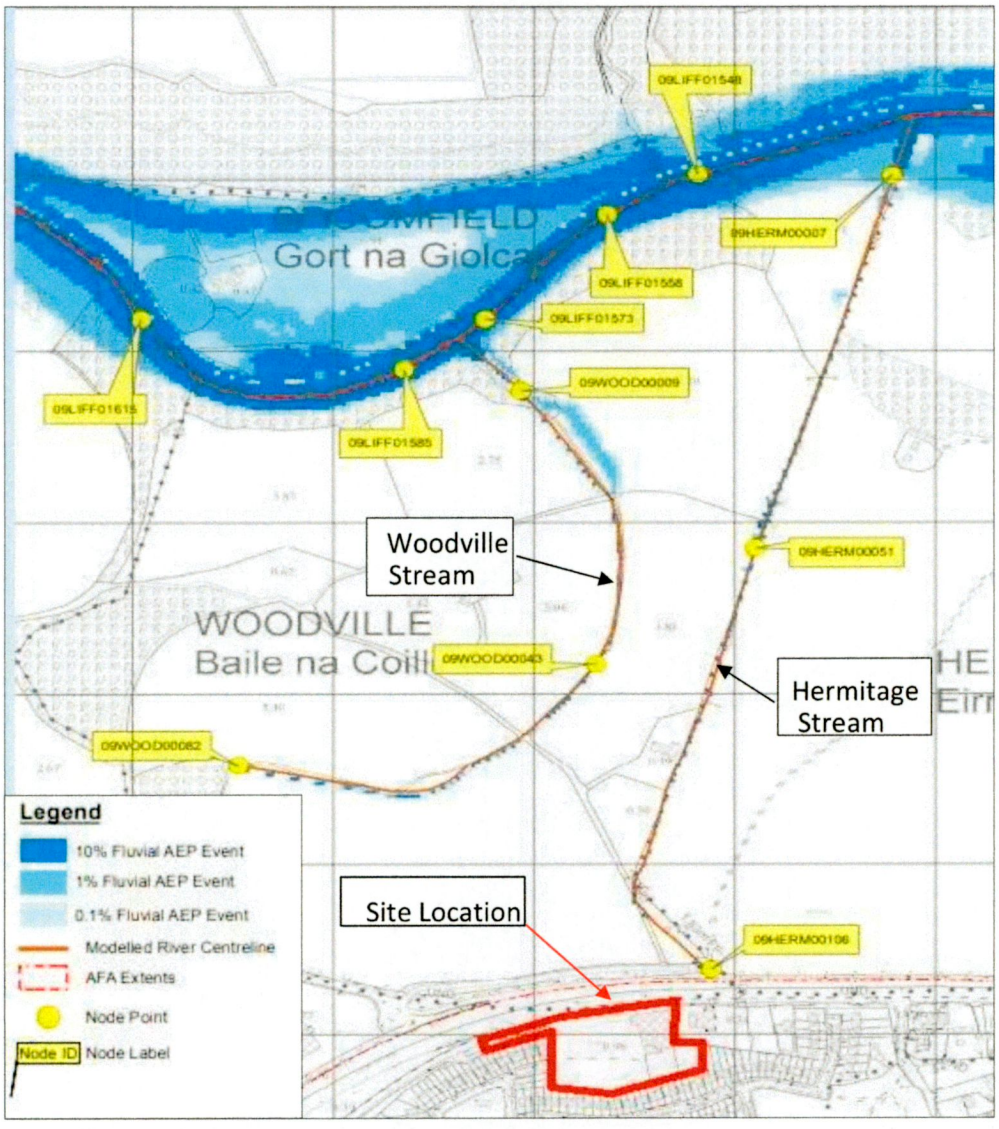


Figure 3-3: Eastern CFRAM Fluvial Flood Extent Map

The modelled fluvial flood levels for the nearest nodes to the site along Hermitage Stream (009HERM00106) & Woodville Steam (09WOOD00082) are presented in Table 3-1.

Table 3-1: CFRAM Modelled Flood Levels

Node Label	**10% AEP**	**1% AEP**	**0.1% AEP**
	Water Level (mOD)	Water Level (mOD)	Water Level (mOD)
009HERM00106	50.72	50.74	50.78
09WOOD00082	43.86	43.93	44.03

3.3 Sources of Flooding

The initial stage of a Flood Risk Assessment requires the identification and consideration of probable sources of flooding. Following the initial phase of this Flood Risk Assessment, it is possible to summarise the level of potential risk posed by each source of flooding. The flood sources are described below.

3.3.1 Fluvial

There is one major watercourse located near the site, the River Liffey. After studying the flooding data from the CFRAM, historic data and local topography, there is a very low probability of flooding from this watercourse to the proposed development site. Flood risk from the Hermitage and Woodville Streams has also been screened out on the basis of the CFRAM outputs and position of the site to the south of the N4.

3.3.2 Tidal/Coastal

The development site is inland and therefore not identified as being at risk of coastal flooding.

3.3.3 Pluvial/Surface Water

Pluvial flooding is the result of rainfall-generated overland flows that arise before run-off can enter a watercourse or sewer. It is particularly sensitive to increases in hard-standing ground/urbanised areas and is usually associated with rainfall events of high intensity. A number of sources have been researched such as floodmaps.ie and the South Dublin County Council Development Plan. Based on review of the available information there is no recorded pluvial flooding at the site.

As the site is already partially developed and covered in hardstanding in the form of buildings and car park. Nonetheless, opportunities for improvements in management of surface water should be incorporated into the drainage design. Specific mitigation measures are proposed in Section 4.2.2.

3.3.4 Groundwater

Groundwater flooding results from high sub-surface water levels that impact upper levels of the soil strata and overland areas that are usually dry. The GSI groundwater vulnerability for the site is classified 'low' to 'moderate' which indicates a groundwater depth of 5 - 10m. Review of the gsi.ie web-portal confirms that no karst features are located in the area surrounding the site.

In summary, there is no known risk of groundwater flooding in this area and has been screened out at this stage.

4 Flood Risk Assessment and Mitigation

4.1 Flood Risk

Review of the available historic and predictive flood risk information contained in Section 3 confirms that the proposed development site is located in Flood Zone C. This means the probability of flooding from rivers is low (less than 0.1% or 1 in 1000 for river floods). There is no identified historic or predicted fluvial flooding within the site boundary or surrounding area.

This FRA therefore confirms the site as being located within Flood Zone C. Although the residential unit is highly vulnerable to the impacts of flooding, it is an appropriate use within Flood Zone C, where the risk is low.

4.2 Mitigation

4.2.1 Finished Floor Levels

Based on review of the available information, the site is shown to be within Flood Zone C, therefore no specific measures are required to manage flood risk from fluvial sources. However, to minimise the flood risk from pluvial events it is recommended that the ground floor Finish Floor Level (FFL) be placed 150mm above the external hardstanding area.

4.2.2 Surface Water Design

A stormwater system will be incorporated within the development design to manage surface water run-off from the site. A stormwater attenuation tank is included as part of the design to ensure that stormwater discharge is limited to 2l/s. The attenuation tank is designed to retain a 100-year 6hr rainfall event including an allowance for climate change (20%).

Refer to the supporting stormwater layout and design calculations for the details.

4.2.3 Access

Vehicular access to the development is via the N4 roadway at the site's north-eastern corner and from Hermitage Road at the site's south-western corner. All site access points are located in Flood Zone C and therefore access is not considered an issue.

4.3 Residual Risk/Additional Assessment

Residual risks are defined as risks that remain after all risk avoidance, substitution and mitigation measures have been taken. The flood risk assessment identifies the following as the main sources of residual risk to the proposed development:

- Climate Change
- Failure of Stormwater system

4.3.1 Climate Change

As per the OPW guidelines, it is necessary to assess the potential impact of climate change on flood risk. Even with a climate change allowance on fluvial flood extents, the site remains in Flood Zone C.

A climate change allowance of has been incorporated within the stormwater system calculations and therefore the development will be protected by the potential impacts of climate change.

4.3.2 Failure of Stormwater System

Failure of the stormwater system could pose a flood risk to the proposed development. However, the proposed threshold of 150mm will ensure that the dwellings are protected from inundation during this scenario.

5 Conclusion

JJ Campbell and Associates has undertaken a detailed Flood Risk Assessment for the proposed Single-storey warehouse.

From reviewing the available sources of flooding the site has been shown to be in Flood Zone C and is at a low risk of inundation from fluvial sources. No historic flooding was identified at the site or but there has been in the surrounding area. Review of the CFRAM flood map confirm that the site is not at risk of inundation from the 1% AEP & 0.1% AEP events (fluvial or pluvial).

The development will include a stormwater system that will manage surface water within the site boundary. This will contain attenuation tanks and discharge surface water from the site at 2l/s. The stormwater will also minimise the risk of pluvial flooding to the development.

To further minimise the risk of pluvial flooding it is recommended that the FFL be set a minimum of 150mm above the external hardstanding area.

Climate change and residual risks have been assessed for the site. A climate change allowance has been incorporated into the stormwater design calculations. Residual risk has been identified as the possible failure of the stormwater system. The proposed FFL threshold of 150mm will protect the development during this scenario.

The Flood Risk Assessment was undertaken in accordance with 'The Planning System and Flood Risk Management' guidelines and confirm that the development resides in Flood Zone C and is in agreement with the core principles contained within.