



Site C, College Lane, Greenogue, Rathcoole, Co. Dublin

Flood Risk Assessment Final Report

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**Jordanstown Properties Limited,
Block 660, Unit 5, The Plaza
Greenogue Business Park
Rathcoole,
Co. Dublin**



JBA Project Manager

Ross Bryant
 Unit 3 Block 660
 Greenogue Business Plaza
 Rathcoole
 Co. Dublin

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Contract

This report describes work commissioned by Con McCarthy of Jordanstown Properties Limited. Seodhna Foley of JBA Consulting carried out this work.

Prepared by Seodhna Foley Msc BA BEng
 Assistant Engineer

Reviewed by Elizabeth Russell BSc MSc CEnv MCIWEM
 C.WEM
 Associate Director

Purpose

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Contents

1	Introduction	1
1.1	Aims and Objectives	1
1.2	Development Proposal	1
2	Site Background	3
2.1	Site Location	3
2.2	Watercourses	3
2.3	Topography	4
2.4	Site Geology	4
3	Flood Risk Identification	6
3.1	Flood History	6
3.1.1	FloodInfo.ie	6
3.1.2	Internet Search	6
3.2	Predictive Flooding	6
3.2.1	OPW Preliminary Flood Risk Assessment (PFRA)	7
3.2.2	Eastern Catchment Flood Risk Assessment and Management Study (ECFRAM)	7
3.2.3	Planning application SD18A/0265	8
3.2.4	SDCC Strategic Flood Risk Assessment (SFRA 2016-2022)	9
3.3	Summary of Flood Sources	10
3.3.1	Fluvial	10
3.3.2	Pluvial	10
3.3.3	Groundwater	10
3.3.4	Coastal	10
4	Flood Risk Assessment	11
4.1	Flood Risk	11
4.2	Mitigation Measures	11
4.2.1	Finished Floor Levels	11
4.2.2	Access and Egress	13
4.2.3	Drainage Design	13
4.2.4	Residual Risk	14
5	Conclusions	15

List of Figures

Figure 1-1: Proposed Design for Site C (Source: Kavanagh Burke D1658-D2-PL3)	2
Figure 2-1: Site location (Source: OSM Standard / Google Satellite)	3
Figure 2-2: Topography of Site	4
Figure 2-3: Subsoils (Source: Geological Surveys Ireland)	5
Figure 3-1: OPW PFRA Pluvial Flood Maps (Source:MyPlan.ie)	7
Figure 3-2: ECFRAM Flood Map (Source: Floodinfo.ie)	8
Figure 3-3: Existing Scenario 1% AEP Event (Planning no. SD18A/0265)	9
Figure 4-1: Post Development Water Levels from Planning SD18A/0265	12
Figure 4-2: Cross Section E-E from Planning SD18A/0265	12
Figure 4-3: Drainage Design (Source: Kavanagh Burke Drawing D165B-D3-PL3)	13

List of Tables

Table 4-1: Summary of Residual Risk	14
Table B-1: Conversion between return periods and annual exceedance probabilities	16

Abbreviations

AEP	Annual Exceedance Probability
CC	Climate Change
CFRAM	Catchment Flood Risk Assessment and Management
DECLG	Department of the Environment, Community and Local Government
FRA	Flood Risk Assessment
GSDSDS	Greater Dublin Strategic Drainage Strategy
GSI	Geological Survey of Ireland
MRFS	Medium Range Flood Scenario
OPW	Office of Public Works
PFRA	Preliminary Flood Risk Assessment
SFRA	Strategic Flood Risk Assessment

1 Introduction

Under the Planning System and Flood Risk Management Guidelines for Planning Authorities (DoEHIG & OPW,2009) proposed development must undergo a Flood Risk Assessment to ensure sustainability and effective management of flood risk.

This FRA is submitted as a response to a request from Jordanstown Properties Limited to assess the flood risk to the proposed Site C, College Lane, Greenogue, Rathcoole Co. Dublin.

The original FRA was submitted under PA ref: SD19A/0407 which was subsequently granted planning on 17 April 2020. This updated FRA is in support of a new application with an amended building footprint.

1.1 Aims and Objectives

This study is being completed to inform the planning application for the proposed site. It aims to identify, quantify and communicate to applicant, 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 in respect to the issue of attenuation and displacement of flooding,
- 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 any development has also been undertaken.

1.2 Development Proposal

Uniphar intend to apply for permission for development of lands (2.7 hectares) at a site known as 'Site C' College Lane, Greenogue, Rathcoole, Co. Dublin. The development will consist of modifications to a permitted warehouse development (as granted under SDCC Reg. Ref SD19A/0407).

The amendments principally comprise: an overall increase in the commercial floor area by 15,479 sq m from the permitted 13,959 sq m to 29,438 sq m. The permitted scheme has 3 No. internal ancillary office floor levels, and the proposed alterations provide 2 No. mezzanine levels in the warehouse area (i.e a total of 5 No. internal floor levels). The permitted maximum height of the development at 23.7 metres will remain unchanged.

The additional 15,479 sq m development proposed will comprise an increase in the warehouse floor area from 12,369 sq m to 13,353 sq. m, staff facilities from 548 sq m to 2,582 sq m and ancillary office area from 1,042 sq m to 2,437 sq m. Provision of a 2 No. storey mezzanine warehouse area (9,703 sq m), integrated plant room (434 sq m) and plant area on 2 No. floors (929 sq m).

The development will also include the construction of a 2 No. storey car-parking area (4,057 sq m and 7.8m height) to accommodate an increase from the previously permitted 119 No. ancillary car parking spaces to 190 No. car parking spaces; 13 No. designated van parking spaces (no dedicated van spaces previously proposed); 72 No. permitted cycle parking spaces; reconfiguration of the HGV yard and an increase in the number of HGV dock levellers from 12 No. to 14 No. and the provision of 16 No. van loading level entry

doors; sprinkler tank and associated underground pumps; repositioned ESB substation (15 sq m and 3 m height); bin storage (42 sq m and 2.9 m height); amended lighting layout; signage; modifications to hard and soft landscaping and boundary treatments; and associated site development works above and below ground.

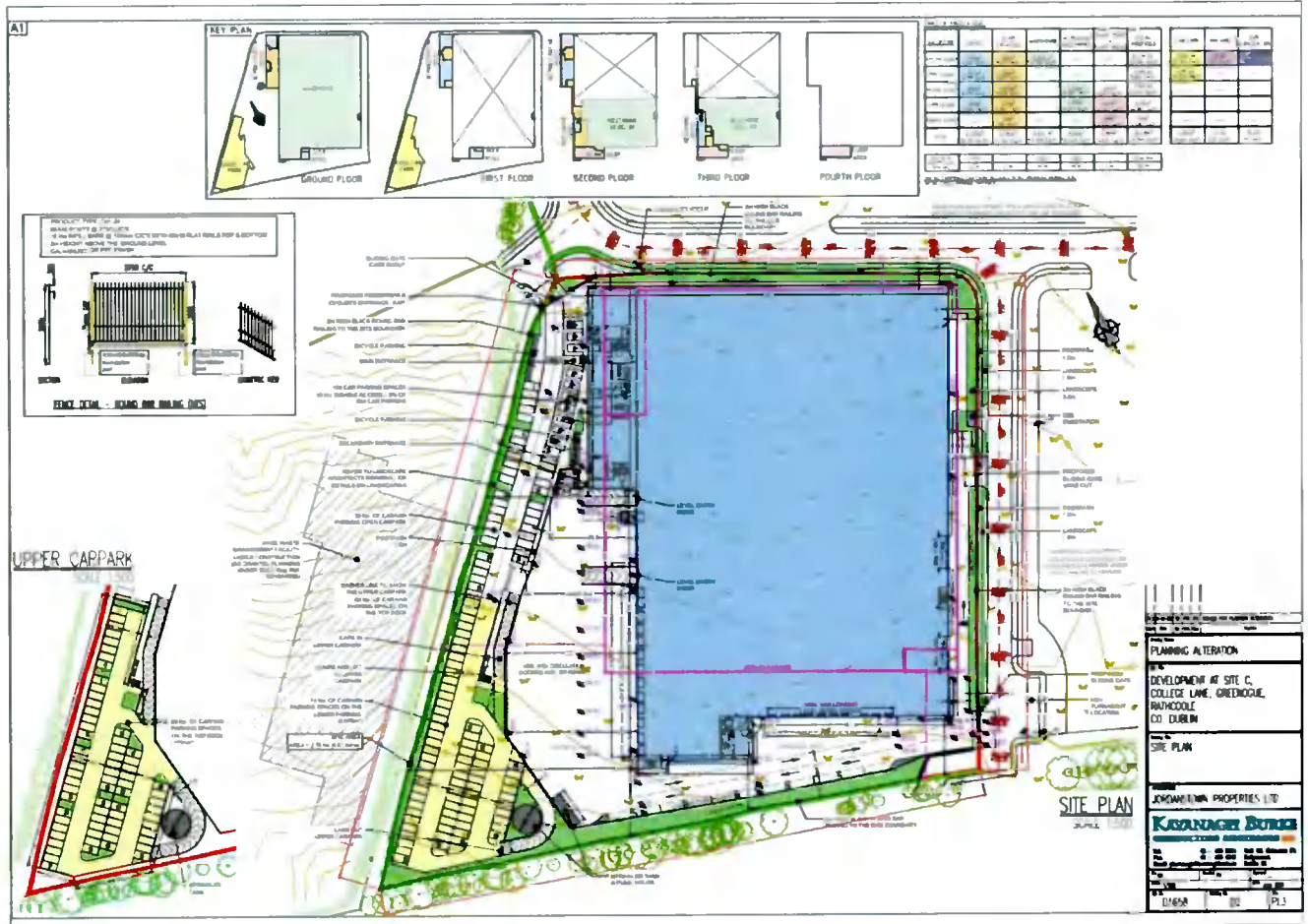


Figure 1-1: Proposed Design for Site C (Source: Kavanagh Burke D1658-D2-PL3)

2 Site Background

2.1 Site Location

The proposed development site is an existing greenfield site of 2.7Ha. It is situated at College Lane off the Newcastle Road (R120) in Rathcoole. Greenfield and agricultural lands surround the site to the east, south and west. Greenogue business park is situated to the north. A proposed development for two warehouses, car parking and access roads has approved planning under reference number SD18A/0265. This development will be built to the north and east of the site. Figure 2-1 shows the site location and surrounding area. Access roads into the site will be provided from Newcastle road.

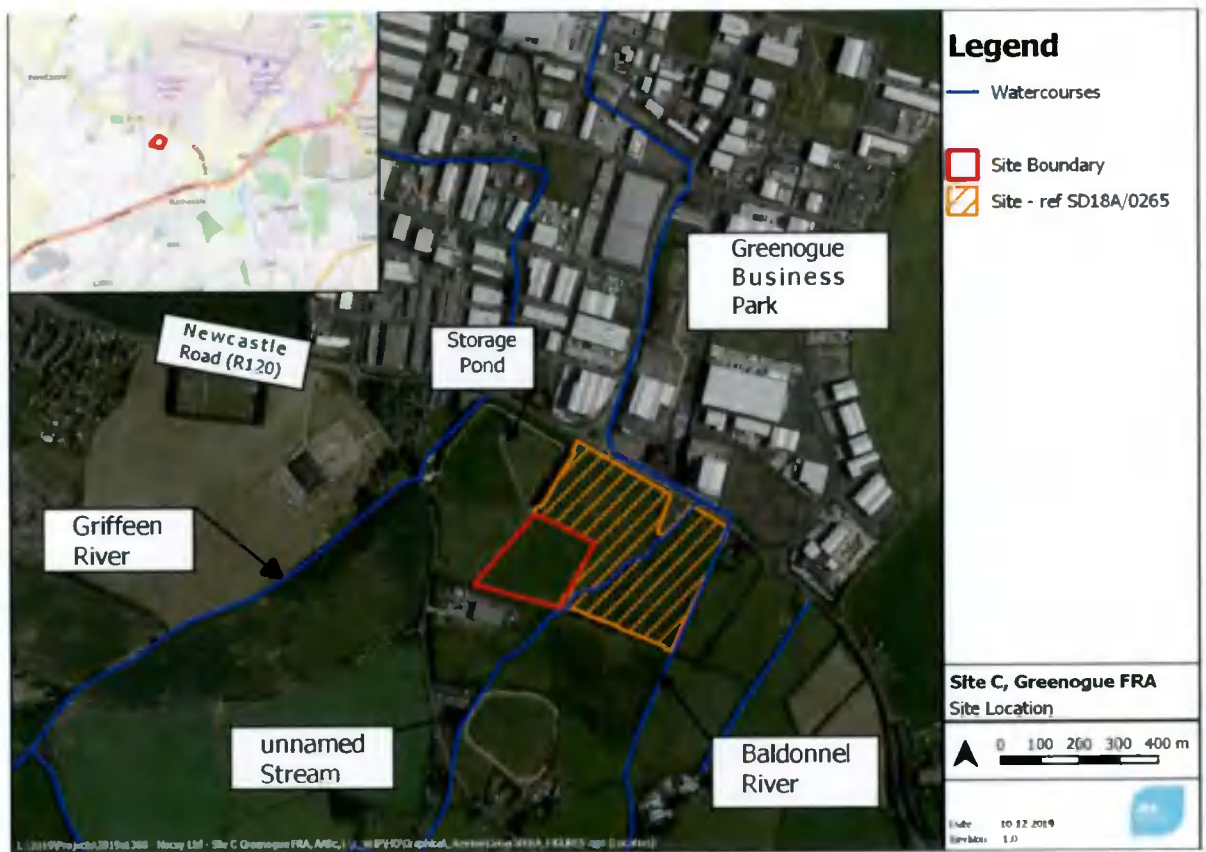


Figure 2-1: Site location (Source: OSM Standard / Google Satellite)

2.2 Watercourses

The Griffeen River, Baldonnel River and an unnamed open channel stream are the main local watercourses in the area. Figure 2-1 outlines these watercourse locations and storage pond close to the site.

The Griffeen River flows in a northerly direction approximately 450m west of the site. A storage pond is located along the Griffeen River just northwest of the site. The purpose of the pond is to contain the 1% AEP flows from the Griffeen River and prevent flooding to the Greenogue Business Park and surrounding area. It is predominantly excavated into the

ground to approximately 96mOD. An earthen berm up to 4m above this height is provided around the pond to retain flood waters.

The Baldonnell River flows north in an open channel approximately 600m east of the site. It flows via culvert along the Newcastle Road and through Greenogue Business Park.

A small, unnamed, open channel stream flows in a north easterly direction along the east boundary of the site. It flows via culvert along an existing residential property north east of the site before meeting the Baldonnell Stream culvert under the Newcastle Road. This stream is considered the greatest source of risk to the site based on its location.

2.3 Topography

The site slopes from the south boundary down to the north. A review of site survey data provided shows the site elevations ranging from 102mOD at the south boundary to 98.5mOD at the north boundary. Figure 2-2, shows the topography for the site and surrounding area.

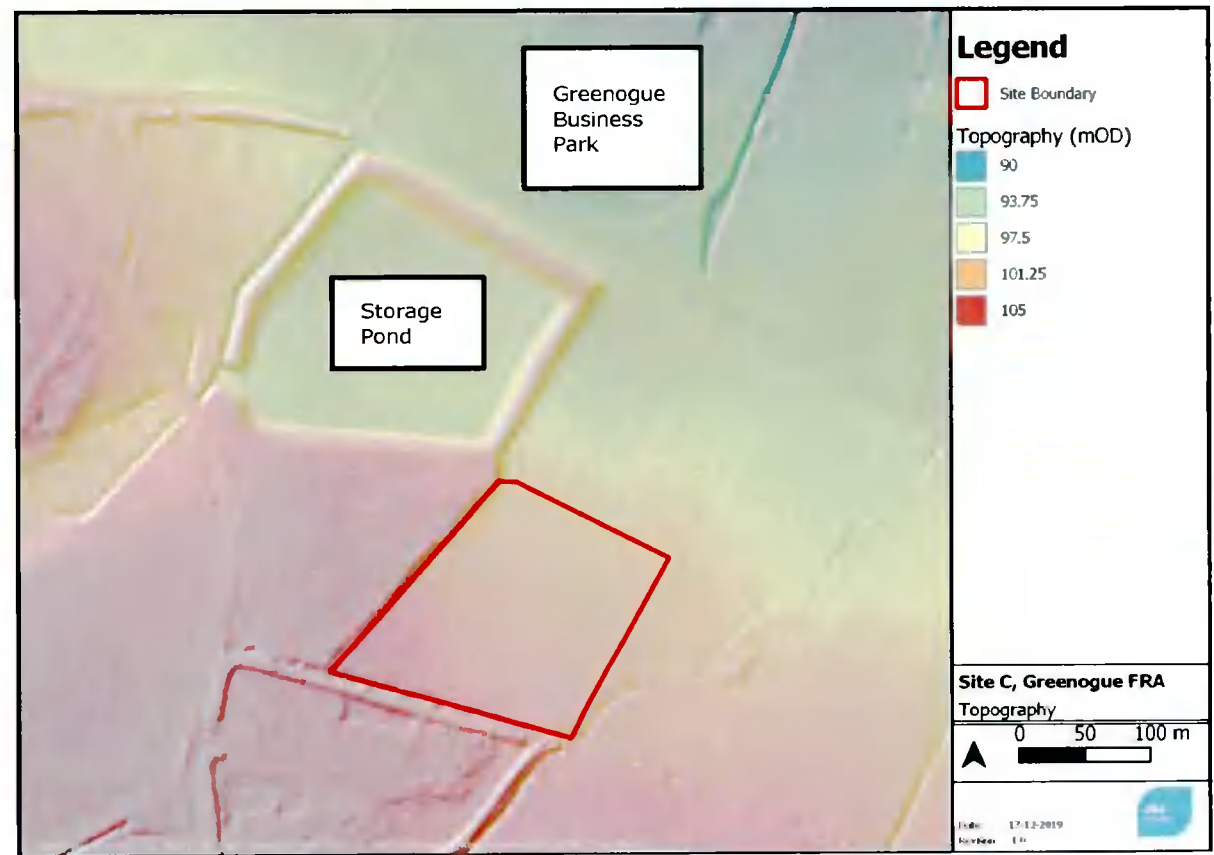


Figure 2-2: Topography of Site

2.4 Site Geology

The Geological Survey of Ireland (GSI) groundwater and geological maps were reviewed. The Subsoil within the site is made of till derived chiefly from Palaeozoic rocks. The underlying bedrock is classified as Lucan Formation (LU).The associated groundwater vulnerability is classified as 'extreme' at this location indicating bedrock close to the surface. However, the bedrock is not exposed, it is covered with subsoil with a permeability classification. There were no karst features, wells or springs identified at the site which could indicate groundwater flooding. Figure 2-3 shows subsoils at the site and surrounding area.

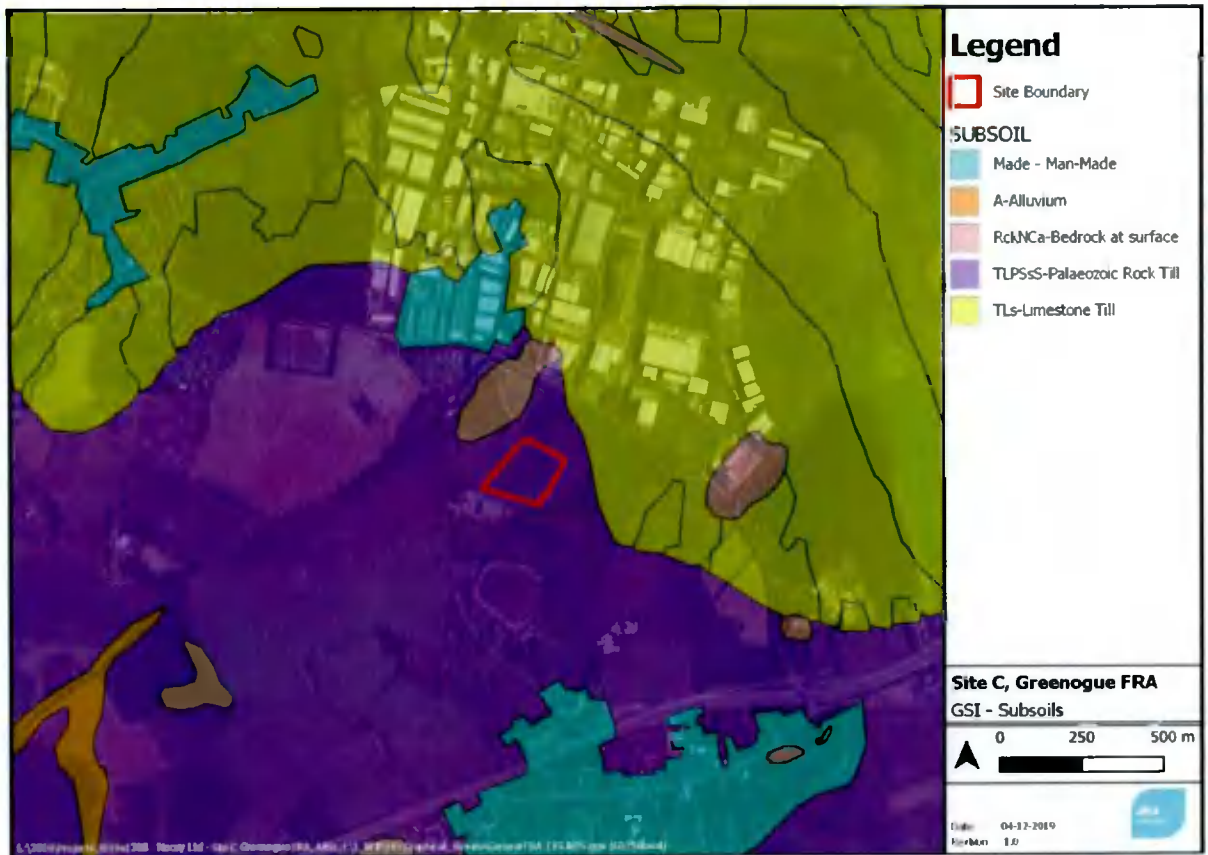


Figure 2-3: Subsoils (Source: Geological Surveys Ireland)

3 Flood Risk Identification

An assessment of the potential and scale of flood risk at the site was conducted using historical and predictive information. This identifies sources of potential flood risk to the site and reviews historical flooding information. The findings from the flood risk identification stage of the assessment are provided in the following sections. Further detail on the Planning Guidelines and technical concepts are provided in Appendix A.

3.1 Flood History

A number of sources of flood information were reviewed to establish whether there was any recorded flood history at or near the site location. This includes the OPW's website; www.floodinfo.ie as well as a general internet search.

3.1.1 FloodInfo.ie

The OPW host a national flood hazard mapping database that is incorporated into the floodinfo website. This highlights areas at risk of flooding through the collection of recorded data and observed flood events.

Review of the mapping shows no instances of historical flooding at the specific site location. There are however several recorded flood events in the wider area.

- 24th October 2011 - Flooding occurred in Greenogue Business Park to commercial unit 525. Heavy rainfall resulted in pluvial flooding at the site, this event also caused significant inundation to adjacent road networks. This site is located approximately 1.2km north of the site.
- November 2000 - Overtopping of the Griffeen River following heavy rainfall causing flooding along Aylmer Road (70-year return event). Flooding was located approximately 2km southwest of the development site.
- Aylmer Road - Re-occurring flooding occurring from the Griffeen River.
- Newcastle, Co Dublin - Re-occurring flooding near Newcastle Village approximately 1km from the proposed development site.

3.1.2 Internet Search

An Internet search was carried out to gather further information on flooding at or close to the site location. There are several news articles and YouTube videos available online for flooding in Rathcoole during the event on 24.10.2011. There were no flood events found in additions to those mentioned in Section 3.1.1.

3.2 Predictive Flooding

The Rathcoole area has been subject to three predictive flood mapping and modelling studies

- OPW Preliminary Flood Risk Assessment (PFRA)
- Eastern Catchment Flood Risk Assessment and Management Study (Eastern CFRAM)
- SDCC Strategic Flood Risk Assessment (SFRA)

The level of detail presented by each method varies according to the quality of the information used and the approaches involved. The Eastern CFRAM is the most detailed assessment of flood extent and supersedes the fluvial flood outlines that were presented in the OPW PFRA mapping.

3.2.1 OPW Preliminary Flood Risk Assessment (PFRA)

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 OPW PFRA study has largely been superseded by the CFRAM programme however, it does provide valuable information regarding pluvial and groundwater flooding. The PFRA flood maps are also the main source of flood risk in areas not covered by the CFRAM programme.

A review of the map in Figure 3-1 shows no pluvial flood risk to the site.

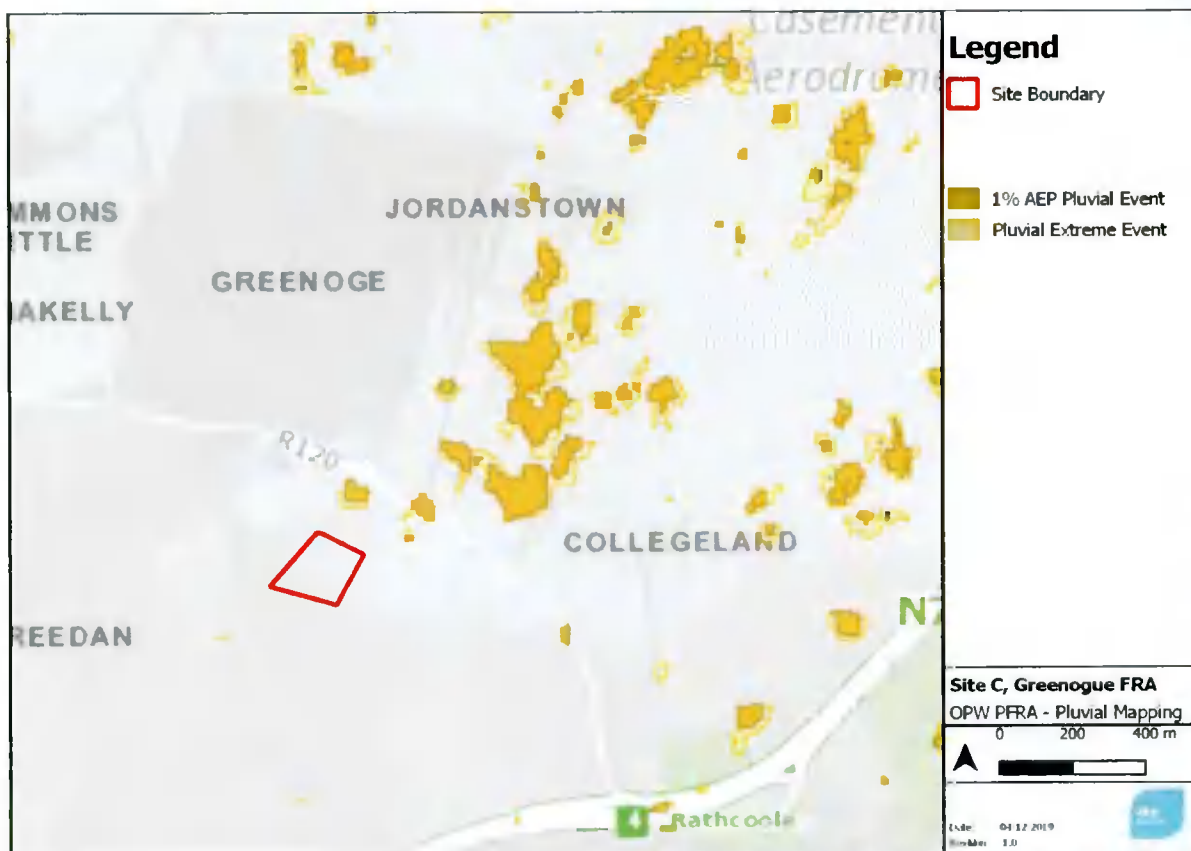


Figure 3-1: OPW PFRA Pluvial Flood Maps (Source:MyPlan.ie)

3.2.2 Eastern Catchment Flood Risk Assessment and Management Study (ECFRAM)

The Eastern CFRAM study is the most detailed mapping undertaken in the Dublin region. It commenced in June 2011 with final flood maps issued during 2016. The study involves detailed hydraulic modelling of rivers and their tributaries. The main watercourses in the study area were modelled in the CFRAM study which resulted in flood mapping for the 10%, 1% and 0.1% AEP fluvial events. The Baldonnel River and Griffeen River were included in the study. Figure 3-2 shows a section of the flood map outputs from the ECFRAM study.

The site is within Flood Zone C according to the study. The Griffeen River to the west of the site shows all out of bank flows occurring during extreme events are captured by the storage pond north west of the site. Minor flooding occurs along the Baldonnel River during the 0.1% AEP event. This does not reach the site boundary.

The unnamed stream east of the site flows in an open channel. This stream has not been incorporated directly as part of the CFRAM study. The mapping only represents a generalised overland flow conveyed from upstream of the site. Potential flooding from this stream has been considered as part of the previous planning application number SD18A/0265 for two additional warehouses north and east of the site. This is discussed in Section 3.2.3.

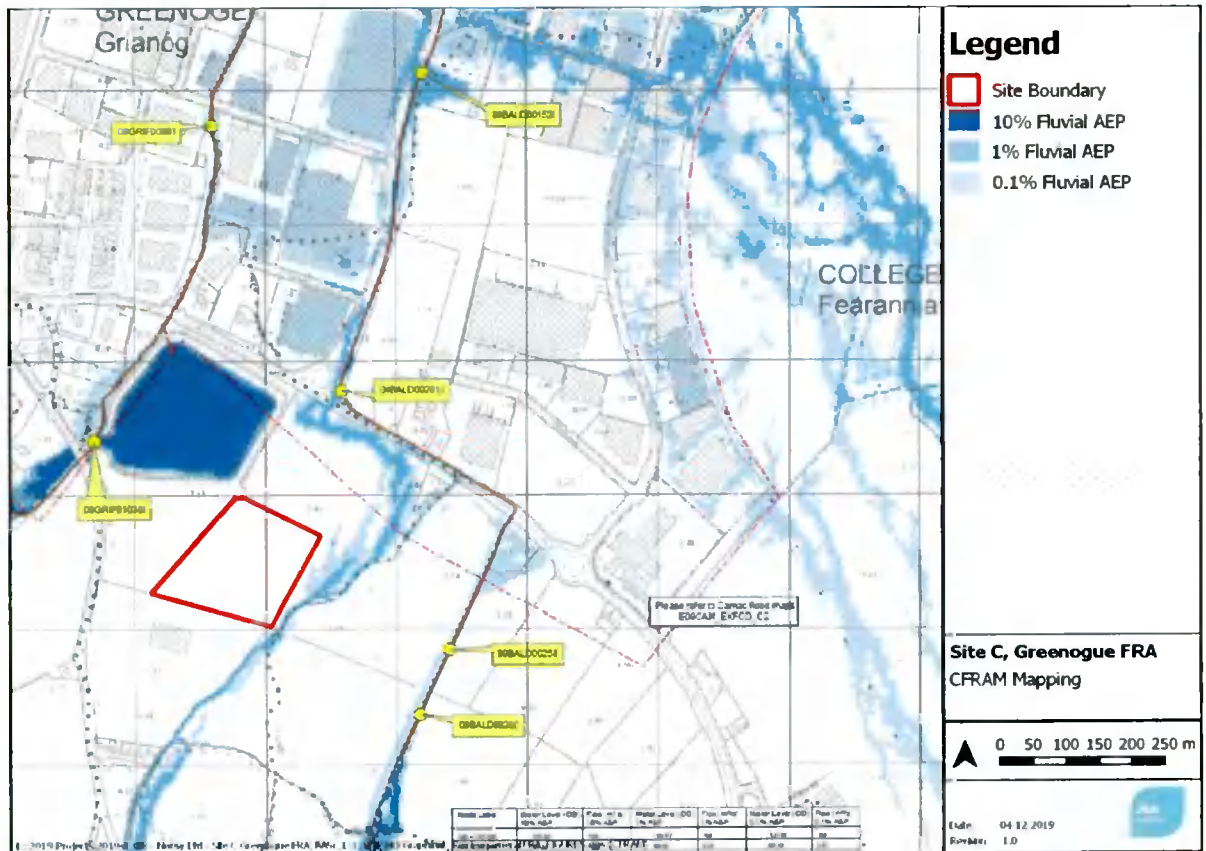


Figure 3-2: ECFRAM Flood Map (Source: Floodinfo.ie)

3.2.3 Planning application SD18A/0265

A development for two warehouses, carparking and access roads has been approved under planning application reference SD18A/0265. This development is to the north and east of Site C (refer to Figure 2-1). JBA carried out detailed hydraulic modelling as part of the planning for the development on the unnamed stream along the east boundary of Site C to build from the CFRAM study.

A pre development 1% AEP scenario shows flooding from the stream at the existing culvert system downstream of Site C. There is no flooding occurring within Site C. Figure 3-3 has been taken from planning SD18A/0265 which shows the overland flow paths during a pre-development 1% AEP event.



Figure 3-3: Existing Scenario 1% AEP Event (Planning no. SD18A/0265)

3.2.4 SDCC Strategic Flood Risk Assessment (SFRA 2016-2022)

The SFRA for the South Dublin County Development Plan (2016-2022) assists SDCC in making strategic land-use planning decisions by providing information about flood risk within the County. The assessment is based on the Eastern CFRAM Study flood mapping discussed above and therefore, presents the same flood outlines. CFRAM flood maps were replicated as part of the SFRA, which includes the Greenogue Business Park.

The SFRA recommends consideration of the likelihood and impact of failure of the storage pond. The integrity and risk of failure has been reviewed in SFRA. In the context of the subject site, the following points are highlighted:

- The storage area operates from a fixed concrete spillway and manual offtake to control flows into the basin.
- Blockage is more likely to occur in the channel, rather than of the spillway. This will result in an increase in flow in the retention basin, rather than an increase in flow down the channel.

3.3 Summary of Flood Sources

The initial stage of Flood Risk Assessment requires the identification and consideration of probable sources of flooding. These sources are described as:

3.3.1 Fluvial

The Griffeen River was assessed as part of the ECFRAM study. The mapping outputs showed out of bank flows captured within the storage pond northwest of the site location and is therefore not considered a source of risk to the site.

The Baldonnel River has minor out of bank flows during extreme events but does not flow close to the site and therefore is not considered to be a risk to the site.

The unnamed stream along the east boundary of the site is the closest watercourse posing a potential flood risk to the site. This stream was not directly included as part of the ECFRAM study, however has been assessed by JBA previously as part of planning number SD18A/0265. The unnamed channel floods at the existing culvert system downstream (to the north east) of Site C. There are no overland flow paths onto the site and so it remains within Flood Zone C during a 1% + CC AEP event. As a result of these modelled scenarios, this stream is not considered a risk to the site.

A review of the model also shows water levels in the stream at 98.87mOD for the 1% + climate change AEP event post-development. These levels will need to be considered for the warehouse design finished floor levels. This will be discussed further in Section 4.

3.3.2 Pluvial

Pluvial or surface water flooding is the result of rainfall generated flows that arise before run-off can enter a watercourse or sewer. The OPW PFRA mapping does not indicate a risk of pluvial flooding within the site boundary.

This is currently an existing greenfield site; the development works will increase the hardstanding area at the site. This increase will result in a corresponding increase in surface water run off post development. The potential for flooding can be managed as part of the surface water design for the proposed development. Careful consideration should be given to overall site design as poor design of stormwater systems, roads and finished floor levels can influence the specific flood risk to the site. A stormwater system has been designed in order to mitigate any increase surface water flows from the development. Details of this design system is discussed in Section 4.

3.3.3 Groundwater

The OPW PFRA mapping does not indicate any groundwater flooding at the site or surrounding area. The geological Survey of Ireland (GSI) groundwater vulnerability for the site is classified as 'Extreme'. The bedrock however is not exposed, it is covered with subsoil with a permeability classification. There were no karst features, wells or springs identified at the site. Groundwater is not considered a likely source of flood risk to the site.

3.3.4 Coastal

This site is inland, approximately 19km from the coastline. Coastal flooding is therefore not considered a flood risk to the site.

4 Flood Risk Assessment

4.1 Flood Risk

Having reviewed the available sources of flooding outlined in Section 3, CFRAM flood maps show the site to be within Flood Zone C. Historical events and predictive mapping confirmed that the surrounding local area (in particular Greenogue Business Park) has experienced flooding from the Griffeen and Baldonnel Rivers downstream of the site, but no indication of flooding on site has been found.

Based on available information, the main source of flood risk to the site is from the unnamed stream which flows in an open channel east of the site boundary. This stream was not directly modelled as part of the ECFRAM study but has been modelled for a previous commercial development adjacent to the site. The results from the model shows site C is not at risk during the 1% + CC AEP event. Water levels during the 1% + CC AEP event for this stream have been considered for recommendation on minimum finished floor levels (FFL). The site is located in Flood Zone C.

4.2 Mitigation Measures

In response to risks identified from fluvial flooding, mitigation measures have been recommended to minimise any flooding to the site.

4.2.1 Finished Floor Levels

The appraisal of the appropriate FFL for the site will be based on the predicted water levels for the unnamed stream east of the site during the 1% + CC AEP Event. Figure 4-1 shows a cross section of the stream channel at the east boundary of the site with flood extents post-development from planning number SD18A/0265.

The peak flow during the 1% + CC AEP scenario is 0.6m³/s. The water levels during this event were found to be 98.87mOD. A minimum freeboard allowance of 0.5m is also required to protect the proposed buildings from any potential overland flow paths. This provides a recommended minimum FFL of 99.4mOD for the proposed warehouse building.

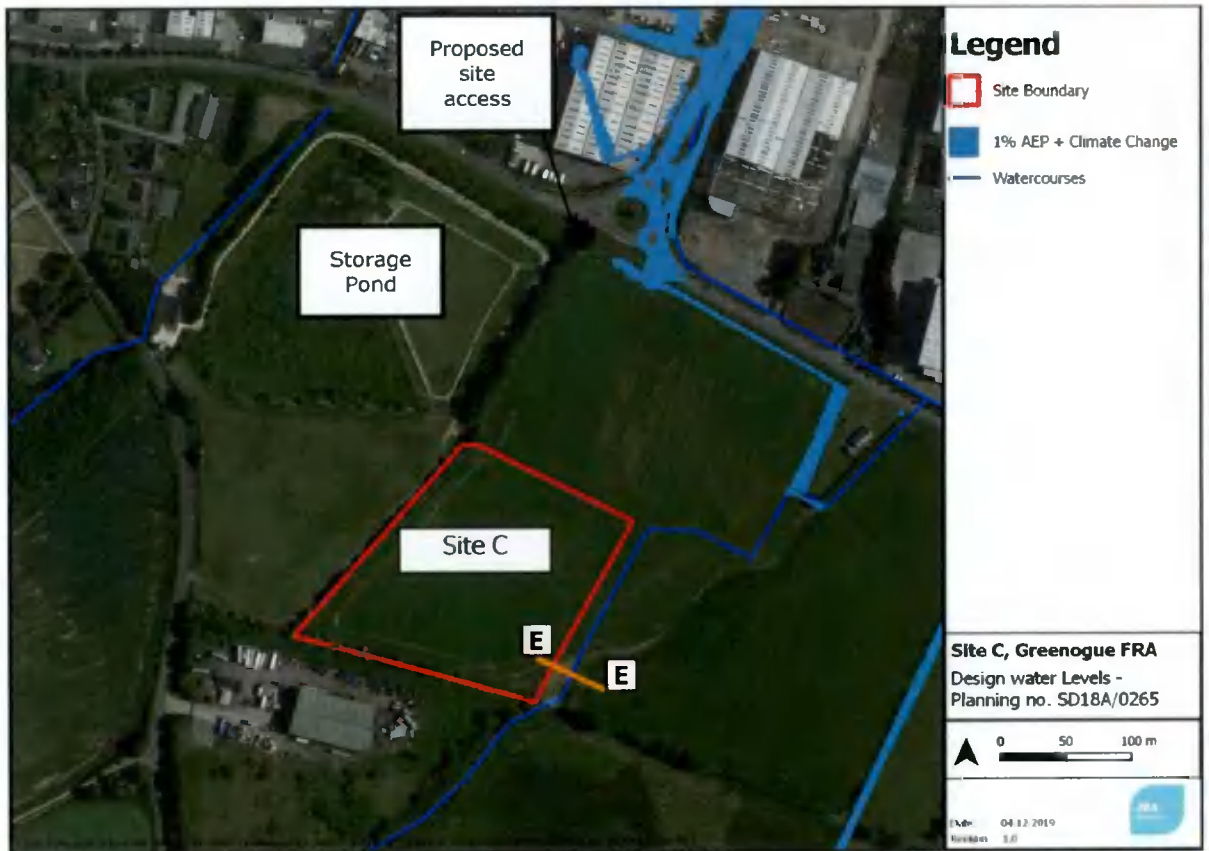


Figure 4-1: Post Development Water Levels from Planning SD18A/0265

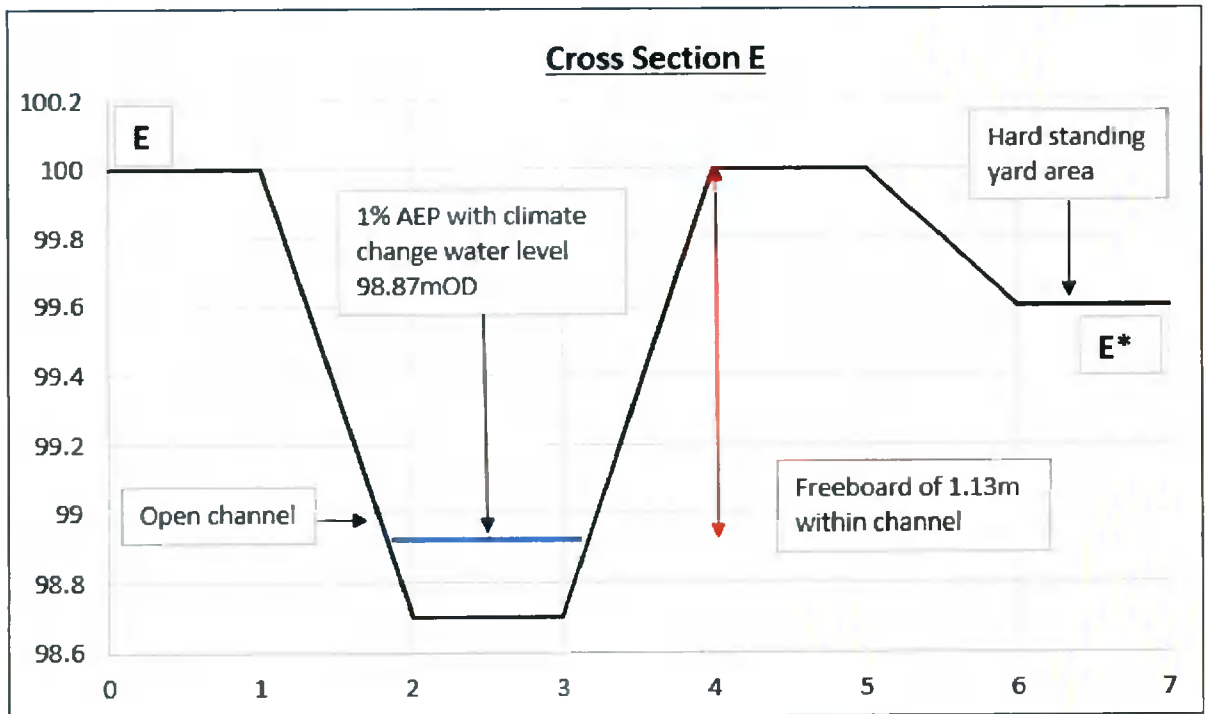


Figure 4-2: Cross Section E-E from Planning SD18A/0265

4.2.2 Access and Egress

The primary access road onto the site is from the Newcastle Road (R120) north of the site boundary. During the 1% AEP event there is some predicted flooding noted along the Newcastle Road (refer Figure 4-1), however flood depths are modelled to be <100mm and still provide vehicular access without obstruction.

4.2.3 Drainage Design

This is currently an existing greenfield site, the development works will increase the hardstanding area at the site. This increase will result in a corresponding increase in surface water run off post development, if not mitigated against.

Runoff from the development will be collected in gullies and directed to an onsite stormtech attenuation system underground in the concrete yard at the south west corner of the site. The attenuation system calculations have been carried out by Kavanagh Burke Consulting Engineers. Rainfall data was used from the 1 in 30-year storm event. The tank is designed to a volume of 1940m³ including a capacity for temporary storage for a 6hr 100 year storm event with an additional 10% for climate change. In the event that the attenuation system capacity is exceeded, the topographic slope on the site is away from the building which will be sufficient to protect the building from any overland flows.

Figure 4-3 outlines the location of the proposed attenuation system for the site.

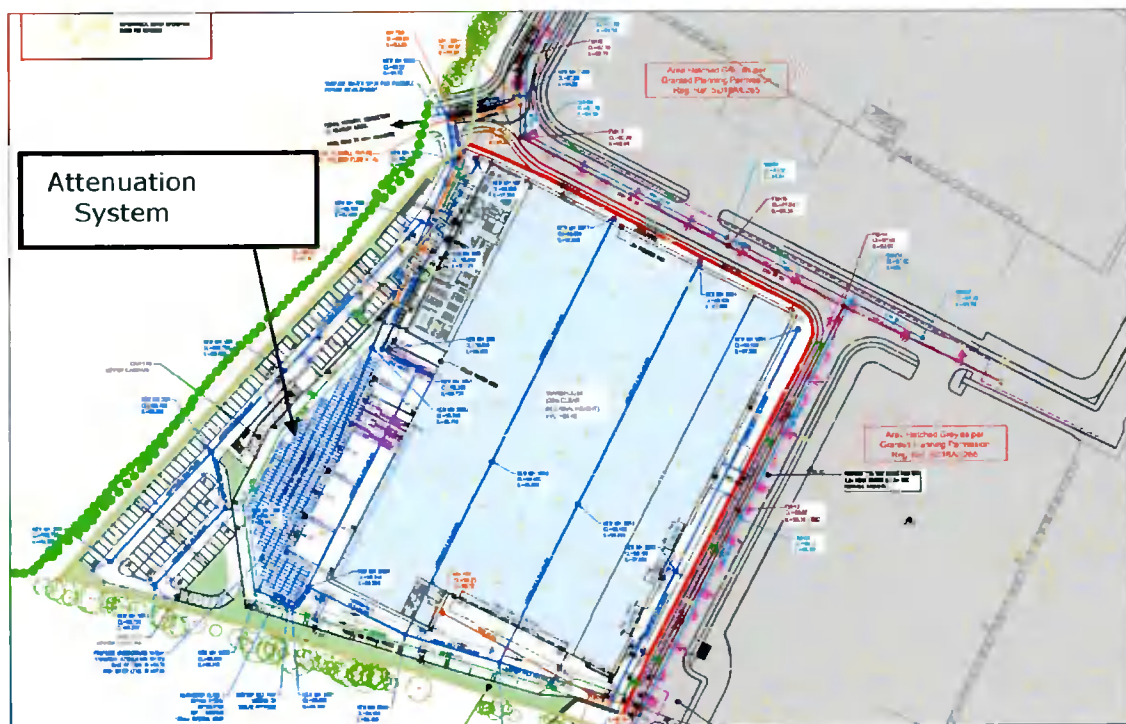


Figure 4-3: Drainage Design (Source: Kavanagh Burke Drawing D165B-D3-PL3)

4.2.4 Residual Risk

Residual risks are the risks that remain after all risk avoidance, substitution and mitigation measures have been taken. The residual risks are summarised in Table 4-1.

Table 4-1: Summary of Residual Risk

RESIDUAL RISK	MITIGATION MEASURES
Climate Change Impacts	FFLs have been recommended based on climate change model scenarios of the unnamed stream east of the site. A freeboard of 0.5m has also been used.
Failure of the Griffeen Storage Pond	<p>The topography of the area slopes from south to north. In the extreme event of a bund breach, overland flows would predominantly flow over the Newcastle road away from the site.</p> <p>The proposed finished floor levels will provide sufficient protection in the event of a failure.</p> <p>The risk of berm failure is extremely low and appropriate given the industrial usage of the site (Commercial Warehouse).</p>
Drainage system failure	A Stormwater drainage system is designed to contain a 1% AEP storm event. The design FFLs for the warehouse provide sufficient freeboard above surrounding ground levels to protect against surface water system failure.

5 Conclusions

JBA Consulting has undertaken a flood risk assessment for the proposed warehouse development at Site C of College Lane, Rathcoole.

Having reviewed the available sources of flooding information on the site there has been no record of historical flooding within the site boundary, however the surrounding area of Greenogue and wider Rathcoole area has been subject to several flooding events from fluvial flooding in the past.

Review of the OPW PFRA, South Dublin County Council SFRA and ECFRAM flood mapping indicates that the site is located outside the 0.1% AEP flood extents and within Flood Zone C.

The unnamed stream to the east of the site was considered to pose the greatest flood risk. This stream was not directly included as part of the ECFRAM study, however it has been assessed by JBA previously as part of planning number SD18A/0265 which proposed two warehouses to the north and east of this development site. Results from the detailed model scenarios shows the site within Flood Zone C during the 1% + CC AEP Event. The water levels during this event were found to be 98.87mOD. A minimum freeboard allowance of 0.5m has been included to protect the proposed buildings from any potential overland flow paths. This provides a recommended minimum FFL of 99.4mOD for the proposed warehouse building.

The OPW PFRA flood maps shows no predicted pluvial flooding within the site boundary however changing the existing greenfield site to predominantly hardstanding area increases the risk of surface water flooding. To address this risk a stormwater system will be incorporated into the development to manage surface water flows on site. Runoff from the development will be collected in gullies and directed to an onsite stormtech attenuation system underground in the concrete yard at the south west corner of the site. Rainfall data was used from the 1 in 30 year storm event. The tank is designed to a volume of 1940m³ including a capacity for temporary storage for a 6hr 100year storm event with an additional 10% for climate change. The additional freeboard provided for in the finished floor levels will protect the development from any potential residual risk of failure of the proposed stormwater system.

In summary, the site is shown to be in Flood Zone C and therefore is appropriate for commercial development at this location.

The Flood Risk Assessment was undertaken in accordance with 'The Planning System and Flood Risk Management' guidelines and is in agreement with the core principles contained within.

Appendices

A Understanding Flood Risk

Flood risk is generally accepted to be a combination of the likelihood (or probability) of flooding and the potential consequences arising. Flood risk can be expressed in terms of the following relationship:

$$\text{Flood Risk} = \text{Probability of Flooding} \times \text{Consequences of Flooding}$$

A.1 Probability of Flooding

The likelihood or probability of a flood event (whether tidal or fluvial) is classified by its Annual Exceedance Probability (AEP) or return period (in years). A 1% AEP flood has a 1 in 100 chance of occurring in any given year.

In this report, flood frequency will primarily be expressed in terms of AEP, which is the inverse of the return period, as shown in the table below and explained above. This can be helpful when presenting results to members of the public who may associate the concept of return period with a regular occurrence rather than an average recurrence interval, and is the terminology which will be used throughout this report.

Table B-1: Conversion between return periods and annual exceedance probabilities

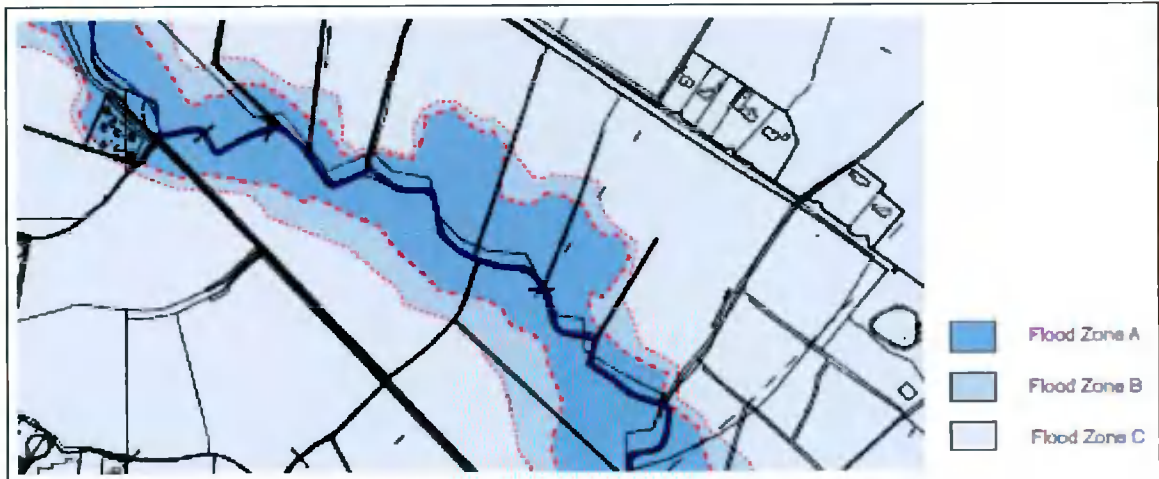
Return period (years)	Annual exceedance probability (%)
2	50
10	10
50	2
100	1
200	0.5
1000	0.1

A.2 Flood Zones

Flood Zones are geographical areas illustrating the probability of flooding. For the purposes of the Planning Guidelines, there are 3 types or levels of flood zones, A, B and C.

Zone	Description
Flood Zone A	Where the probability of flooding is highest; greater than 1% (1 in 100) from river flooding or 0.5% (1 in 200) for coastal/tidal flooding.
Flood Zone B	Moderate probability of flooding; between 1% and 0.1% from rivers and between 0.5% and 0.1% from coastal/tidal.
Flood Zone C	Lowest probability of flooding; less than 0.1% from both rivers and coastal/tidal.

It is important to note that the definition of the flood zones is based on an undefended scenario and does not take into account the presence of flood protection structures such as flood walls or embankments. This is to allow for the fact that there is a residual risk of flooding behind the defences due to overtopping or breach and that there may be no guarantee that the defences will be maintained in perpetuity.



A.3 Consequence of Flooding

Consequences of flooding depend on the hazards caused by flooding (depth of water, speed of flow, rate of onset, duration, wave-action effects, water quality) and the vulnerability of receptors (type of development, nature, e.g. age-structure, of the population, presence and reliability of mitigation measures etc.).

The 'Planning System and Flood Risk Management' provides three vulnerability categories, based on the type of development, which are detailed in Table 3.1 of the Guidelines, and are summarised as:

- **Highly vulnerable**, including residential properties, essential infrastructure and emergency service facilities;
- **Less vulnerable**, such as retail and commercial and local transport infrastructure;
- **Water compatible**, including open space, outdoor recreation and associated essential infrastructure, such as changing rooms.



JBA
consulting

Offices at

Dublin
Limerick

Registered Office
24 Grove Island
Corbally
Limerick
Ireland

+353(0)61 345463
info@jbaconsulting.ie
www.jbaconsulting.ie
Follow us:  

JBA Consulting Engineers and
Scientists Limited

Registration number 444752

JBA Group Ltd is certified to:
ISO 9001:2015
ISO 14001:2015
OHSAS 18001:2007

