Waterman Moylan
Engineering Consultants

Tack Sandyford SHD

Flood Risk Assessment

March 2022

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Comments

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1. Introduction

This Preliminary Flood Risk Assessment (FRA) has been prepared by Waterman Moylan on behalf of Sandyford Environmental Construction Ltd to accompany an SHD application to An Bord Pleanala (ABP) for a residential development on a brownfield site at the junction of Carmanhall Road and Ravens Rock Road, Sandyford, Dublin 18. See Figure 1.

This PFRA has been carried out in accordance with the Department of Housing and Local Government (DEHLG) and the Office of Public Works (OPW) document *"The Planning Process and Flood Risk Management Guidelines for Planning Authorities"* published in November 2009. This Assessment identifies and sets out possible mitigation measures against potential risks of flooding from various sources. Sources of possible flooding include coastal, fluvial, pluvial (direct heavy rain), groundwater and human/mechanical error.

This report provides an assessment of the subject site for flood risk purposes only.

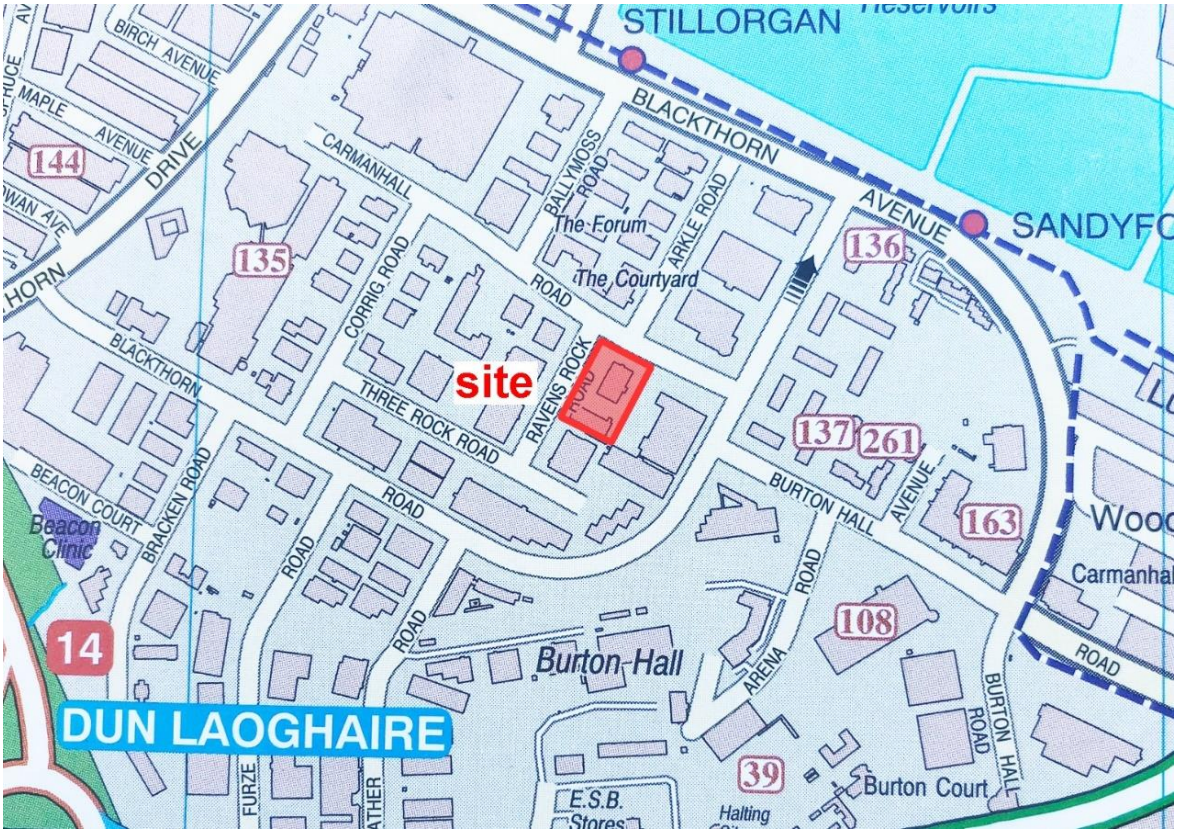

Figure 1 Location Map

2. Site Description

2.1 Site Location

The subject site is located at Sandyford in south County Dublin at the junction of Carmanhall Road and Ravens Rock Road, Sandyford, Dublin 18. The existing access to the site is from Ravens Rock Road. See Figure 1.

The site has an area of 0.57ha (1.4 acre) but for the purpose of encompassing the proposed access junctions, services connections and landscaping, the area within the red line for the planning application has been extended to 0.7ha.

The site was formerly occupied by Tack Packaging but at the time of writing in March 2022, the site was unoccupied save for a number of empty buildings.

The site falls from southwest to northeast ranging in level from 88.0mOD in the southwest to 84.0mOD in the northeast.

The adjoining site to the east at the junction of Carmanhall Road and Blackthorn Road is the location for a concurrent development and was formerly occupied by Avid Technology. It extends to 0.81 ha ((2.0 acre). See Figure 2.

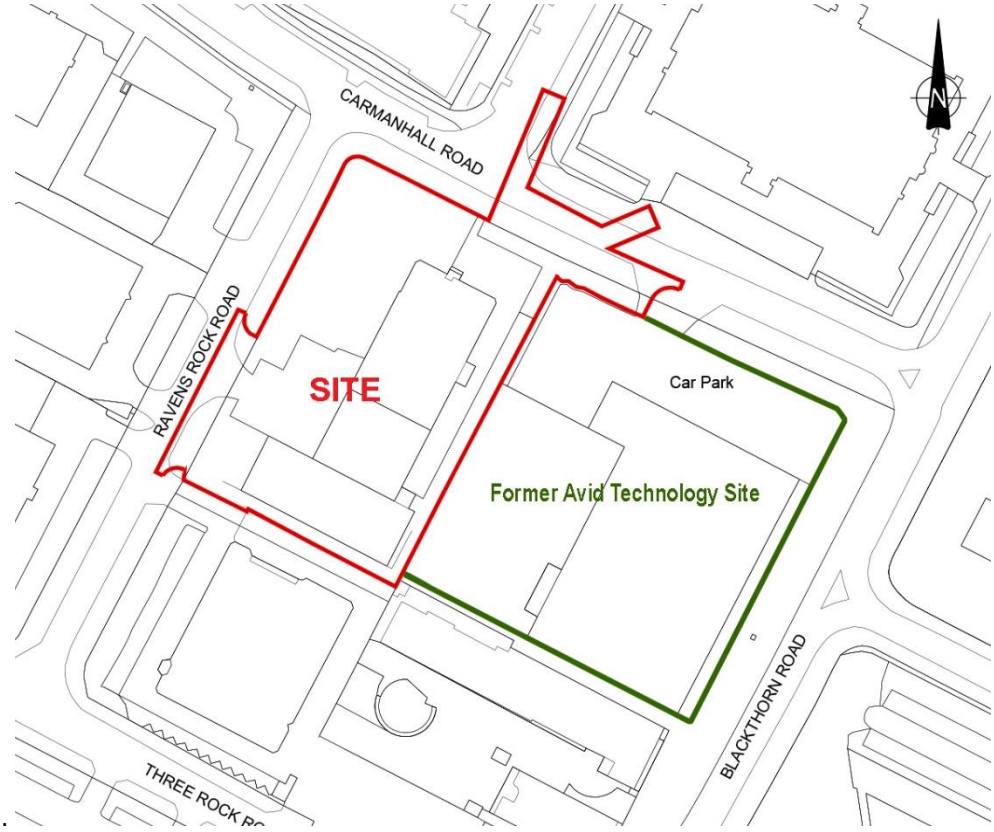

Figure 2 Existing Site Layout

2.2 Proposed Development

The proposed development will comprise some 207 Build-to-Rent residential units with a Creche (306sqm) and Shared Amenity Space (415 sqm). See Figure 3.

Car parking with a total of 79 car spaces will be provided at Lower Ground Level and Basement. Cycle parking with 288 spaces will be provided at Lower Ground Level. Access is proposed from Ravens Rock Road with egress onto Carmanhall Road.

The public realm around the site will incorporate an upgrade of the pedestrian and cycle environment.

The development includes all associated infrastructure to service the development including access junctions, footpaths and cycle paths together with a network of watermains, foul water drains and surface water drains.

A concurrent development with its own Flood Risk Assessment on the former Avid Technology site to the east will comprise 336 Build-to-Rent residential units and 118 car parking spaces at Lower Ground Level and Basement. Access will be from Carmanhall Road and egress onto Blackthorn Road.

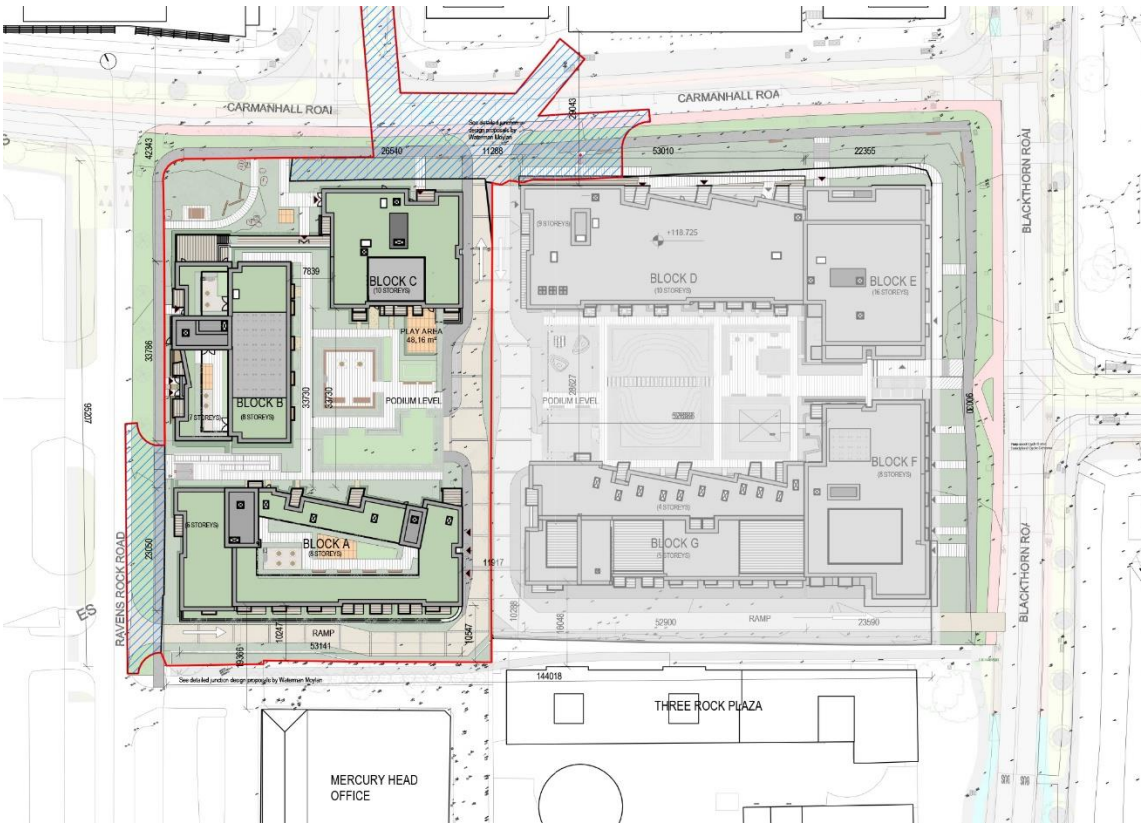

Figure 3 Proposed Site Layout

2.3 Proposed Floor Levels

The proposed floor levels for Blocks A, B and C on the former Tack Packaging site are set out in Table 1.

Table 1 Schedule of Floor Levels

Block	Basement	Lower Ground	Podium
A	81.60	84.15	88.50
B	81.60	84.15	88.50
C	-	84.15	88.50

2.4 Proposed Road and Street Levels

The proposed levels at the access and internal roads within the site are presented in Table 2.

Table 2 Proposed Road and Street Levels

Location	Function	Level
Ravens Rock Road	Entrance	87.70 mOD
Site	Inner Street	84.00 – 84.80 m OD
Carmanhall Road	Exit	83.95 mOD

2.5 Construction Program

At the time of writing in March 2022, it is likely that construction of the proposed development could commence in 2023 for completion in 2026

3. Flood Risk

3.1 Introduction

The components to be considered in the identification and assessment of flood risk are set out in Table A1 of the DEHLG/OPW guidelines on the Planning Process and Flood Risk Management and are summarised below:

- Tidal – flooding from high sea levels.
- Fluvial – flooding from water courses.
- Pluvial – flooding from rainfall / surface water.
- Ground Water – flooding from springs / raised ground water and
- Human/mechanical error – flooding due to human or mechanical error.

Each component will be investigated from a source, pathway and receptor perspective and the likelihood of flood occurring and the possible consequences will be assessed.

The likelihood of flooding falls into three categories; low, moderate and high, as described in the OPW Guidelines and set out in Table 1.

Table 3 OPW Guidelines

Likelihood	Low	Moderate	High
Tidal	Where probability < 0.1 % chance of occurring in a year	0.5 % chance of occurring in a year > probability > 0.1 % chance of occurring in a year	Where probability > 0.5 % chance of occurring in a year
Fluvial	Where probability < 0.1 % chance of occurring in a year	1 % chance of occurring in a year > probability > 0.1 % chance of occurring in a year	Where probability > 1 % chance of occurring in a year
Pluvial	Where probability < 0.1 % chance of occurring in a year	1 % chance of occurring in a year > probability > 0.1 % chance of occurring in a year	Where probability > 1 % chance of occurring in a year

For ground water and human/mechanical error, the limits of probability are not defined and therefore professional judgment is used. However, the likelihood of flooding is still categorised as low, moderate and high for these components. The likelihood and possible consequence of each event is considered, and the risk is evaluated. Risks will be mitigated where possible and the residual risks will then be considered as part of this assessment.

This report has considered the Eastern Catchment Flood Risk Assessment & Management (CFRAM) Study and maps prepared by RPS Group Ireland for the OPW. In addition, the Strategic Flood Risk

Assessment (SFRA) prepared as part of the Dun Laoghaire Rathdown County Development Plan 2016-2022 has been considered.

3.2 Tidal – Irish Sea

Source

The subject site is located in the catchment of the Carysfort Maretimo Stream as illustrated in Figure 4. The Carysfort Maretimo Stream discharges into the Irish Sea in Blackrock where the highest tide level is 4.5 metres OD (Malin).

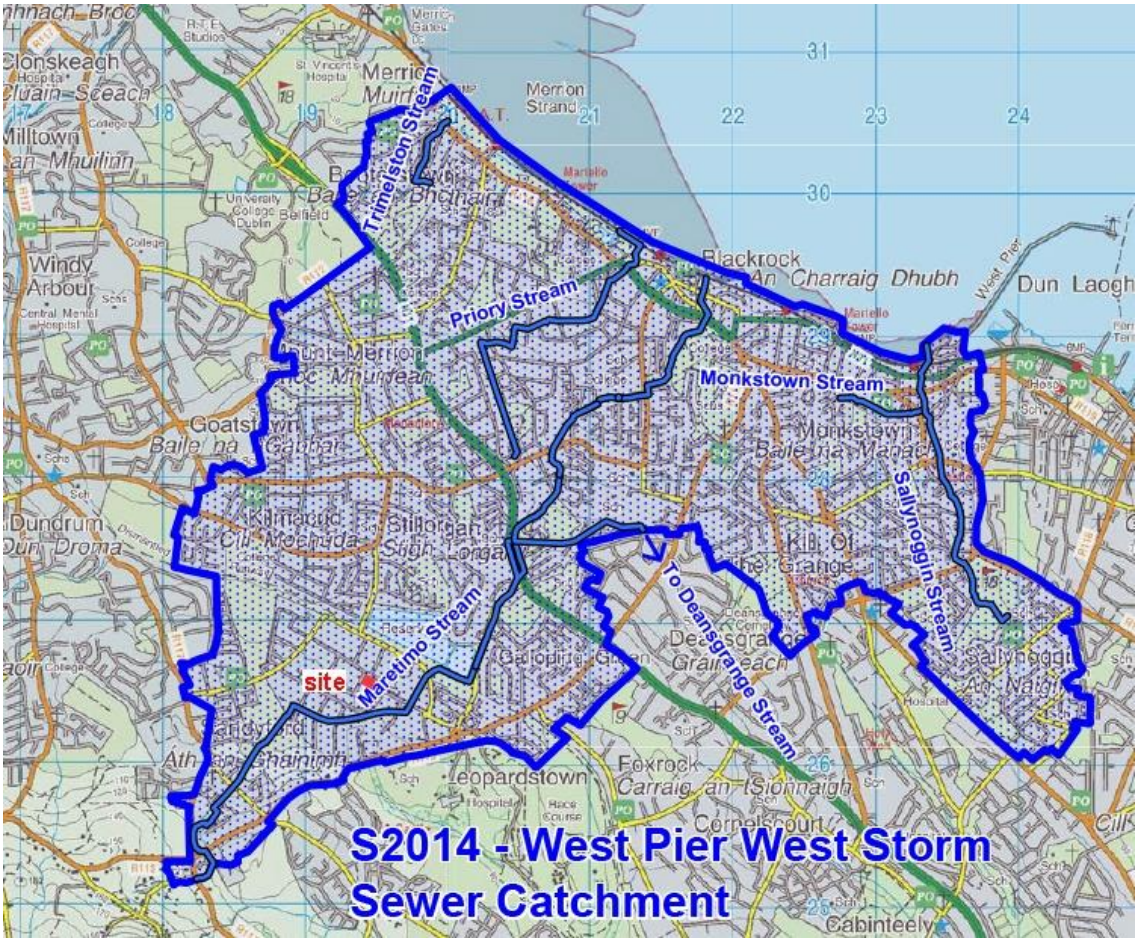

Figure 4 Extract from GDSDS Fig-9.3.15-S2014-West-Pier-Storm-Sewer-Catchment

Receptor

The receptor is the proposed development with a ground floor level of 88.50 mOD, a lower ground floor level of 84.15 mOD and a basement level of 81.50 mOD. The lowest level at which tidal water could enter the proposed development would be from Carmanhall Road at a level of 84.00 mOD and along the Inner Street which will have a level of 84.0 - 84.8mOD. All ventilation and other openings below this level will be bunded to a minimum level of 84.5 mOD.

Pathway

The subject site is located some 4 km from the Irish Sea at in Blackrock at an elevation of 84.0 mOD (Malin) compared to a high tide level of below 5.0m OD (Malin) at Blackrock.

Given that the site is located some 4 km inland from the Irish Sea and that there is a significant difference of 79 metres in level between the subject site and high tide, there is no pathway between the source and the receptor.

Risk of Flooding

Given that the site is located inland from the Irish Sea and that there is a significant difference in level between the subject site and high tide, the risk from tidal flooding is insignificant.

Mitigation Measures

As the risk from tidal flooding is insignificant, no flood mitigation measures were required to be considered.

3.3 Fluvial

Source

The subject site is located in the catchment area of the Carysfort Maretimo Stream. The Carysfort Maretimo Stream rises to the southwest of Sandyford Village. It flows in a north easterly direction through the Sandyford Business District and Stillorgan before discharging into Dublin Bay at Blackrock at an elevation of 4.5 metres OD (Malin). See Figure 4.

Documents Consulted

The following documents including flooding reports and records were consulted by Waterman Moylan during the preparation of this Flood Risk Assessment: -

- Carysfort Maretimo Improvement Scheme, Part Planning Report, Final Issue, DLRCC, March 2008.
- Strategic Flood Risk Assessment, Appendix 13, DLR County Development Plan, 2016 – 2022
- Carysfort Maretimo Fluvial Flood Extent, Page 5 of 7, OPW, 2017.

Carysfort Maretimo Improvement Scheme 2010

The Carysfort Maretimo Flood Relief Scheme was completed by DLRCC in 2011. The objective of the Scheme was to deliver solutions for flooding by enhancing channel capacity and dealing with other deficiencies in the stream following a number of severe flooding events during the previous decade particularly following a very localised, high intensity storm in July 2007.

As part of the Scheme, works were carried out at various locations along the stream between Brewery Road at Stillorgan Reservoir and Blackrock.

The works carried out included the following measures: -

- Provision of flood protection walls.
- Upgrading of existing trash screens and provision of new trash screens.
- Modification to existing stream structures, including weirs and chambers.
- Removal of structures acting as flow obstructions.
- Provision of additional culverts and manhole chambers.
- Stream training and channel widening.
- Culvert inlet improvement measures.
- Provision of access to trash screens for maintenance purposes.
- Stream bank protection measures.
- Removal of scrub and vegetation where these act as flow obstructions.
- Associated works such as service and utility diversions.

The listed works were carried out downstream of the subject site works were carried out at various locations along the stream between Brewery Road at Stillorgan Reservoir and Blackrock.

Strategic Flood Risk Assessment, Appendix 13, DLR Development Plan 2016 -2022

Section 5.3.7 *Carysfort Maretimo* of the Strategic Flood Risk Assessment in Appendix 13, DLR Development Plan 2016 -2022 advises that

> *The CFRAM shows flood risk along the majority of the Carysfort Maretimo River, being a combination of Flood Zone A and B and covering a range of land existing land uses, including open space, residential and office and enterprise (Figure 5-7).*
>
> *In particular, flooding is indicated at Blackrock Bypass, Brookfield, Carysfort Avenue, Avondale Lawn, Carysfort Hall, Avoca Park, Grove Paddock, Stillorgan Grove, Stillorgan Road and Brewery Road, Blackthorn Avenue and Blackthorn Road, Corrig Road, Blackthorn Drive, Lakelands, Moreen Estate, along M50 at Sandyford Interchange, Sandyford Park, Coolkill, Sandyford Downs and Sandyford Village (15).*
>
> *Where there is existing residential housing, and supporting infrastructure, Part 1 and 2 of the Justification Test have been applied and passed and flood risk can be managed through nonstructural responses. Future development within Flood Zone A and B should be limited to extensions, changes of use and small-scale infill and flood risks can be managed through a site specific FRA, which should include consideration of culvert blockage (where appropriate) and the impact this could have on flood risk at lower return periods.*

The majority of flood risk highlighted in the Sandyford Business District and surrounding area is shown to be Flood Zone B, with small pockets indicated to be Flood Zone A. Where less vulnerable development is proposed within or near Flood Zone A or B a site specific flood risk assessment should be undertaken with the aim of a) refining the delineation of flood risk based on local topography and surface water systems; b) demonstrating that the proposed development will not increase flood risk to neighbouring lands; and c) developing flood management measures appropriate to the development proposed.

There is a length of defence along this watercourse which runs parallel to Rockfield Park (16). These defences are of robust construction, although consideration of the impacts of overtopping, either through higher return period events or with the impact of climate change on river flows, should be taken into account in any site specific flood risk assessment. Breach assessment is unlikely to be required.

The extent of flooding along the Carysfort Maretimo Stream is illustrated in Figure 5 which was reproduced from Fig 5.3.7 SFRA, Appendix 13, DLR Development Plan 2016-2022.

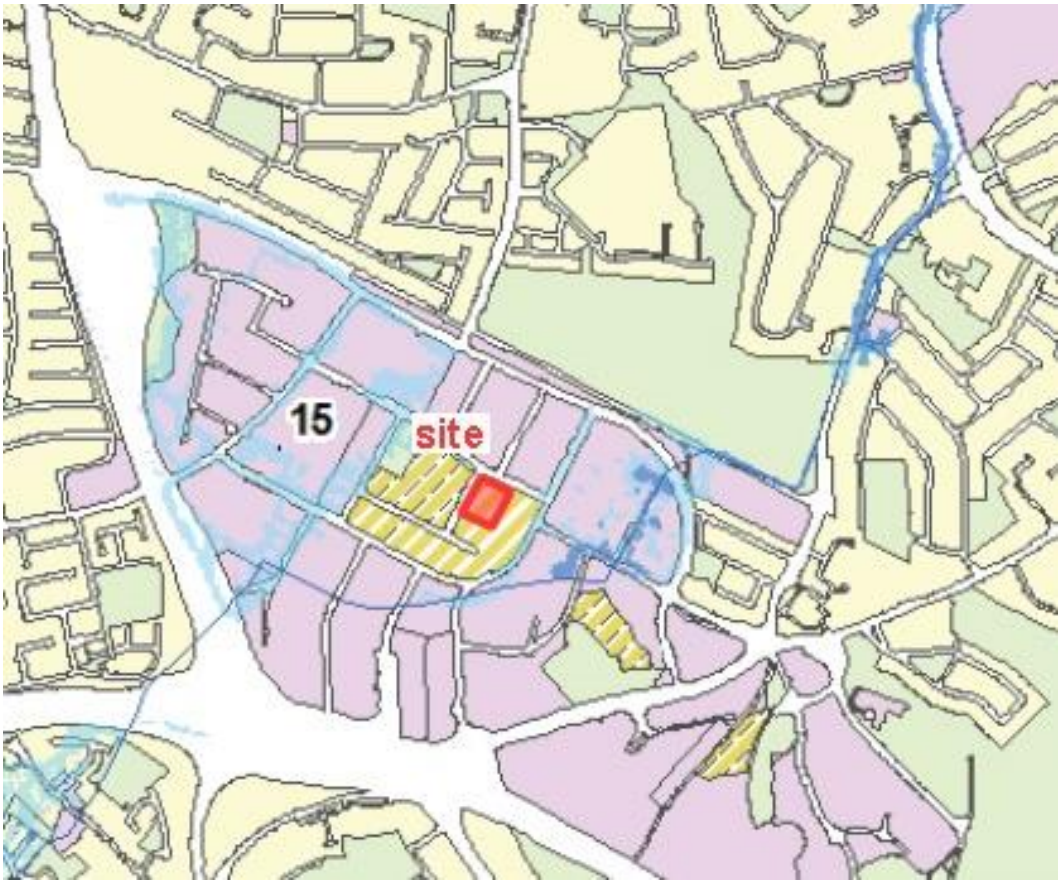

Figure 5 Carysfort Maretimo Stream

(Reproduced from Fig 5.7 SFRA, Appendix 13, DLR Development Plan 2016-2022

Flood Extent Mapping 2017

The location of the proposed development is shown on Map 5 of the Carysfort Maretimo Flood Extent Mapping published by OPW in October 2017. See Figures 6 and 7.

The predicted 1 in 1,000 water level shown on this map for the 0.1% Fluvial AEP event at Node SO 19267035 some 175 metres to the southeast of the subject site is 84.37mOD which is below the ground level at the subject site.

Due to the topography in the surrounding area, any floodwater will flow to the east and north away from the subject site.

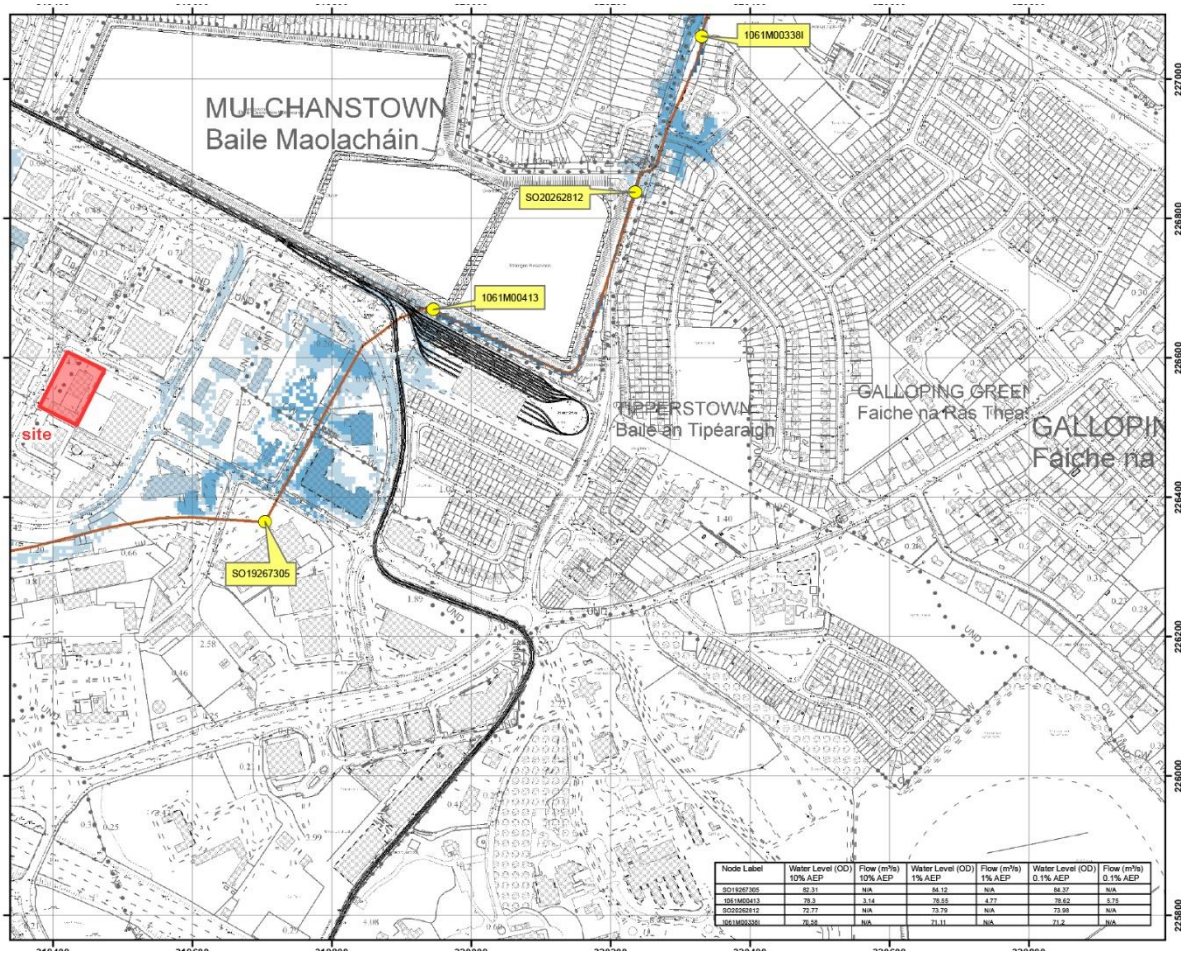

Figure 6 Carysfort Maretimo Flood Map 5, OPW, 2017

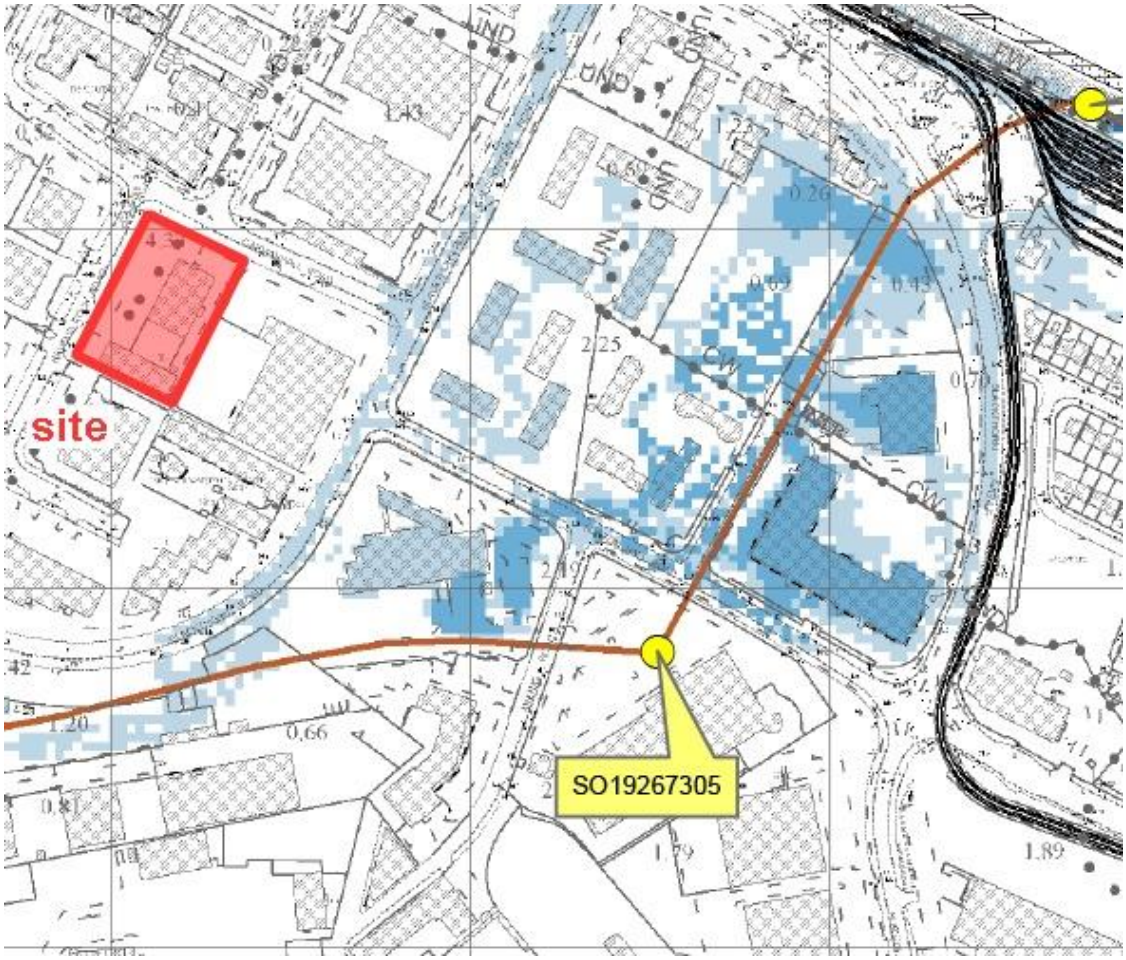

Figure 7 Extract from Carysfort Maretimo Flood Map 5, OPW, 2017

Receptor

The receptor is the proposed development with a ground floor level of 88.50 mOD, a lower ground floor level of 84.15 mOD and a basement level of 81.50 mOD. The lowest level at which tidal water could enter the proposed development would be from Carmanhall Road at a level of 84.00 mOD and along the Inner Street which will have a level of 84.0 - 84.8mOD. All ventilation and other openings below this level will be bunded to a minimum level of 84.5 mOD.

Pathway

The subject site is located at an elevation of 84.0 – 88.0metres OD (Malin).

Attenuated surface water drainage from the subject site will discharge into the existing public drain on Carmanhall Road with a cover level of 84.0 mOD and an invert level of 81.0 mOD.

This drain in turn discharges outfalls into the Carysfort Maretimo Stream in the area of the Luas Sandyford Depot.

The closest section of the Carysfort Stream to the proposed development is Node SO19267305 more than 200 metres to the southeast of the subject site.

The tabulated water level predictions at Node SO19267305 are

- 0.1% AEP: 84.37 mOD
- 1% AEP: 84.12 MOD
- 0.1% AEP: 82.31 MOD

Given that the site is located more than 200 metres away the Carysfort Maretimo Stream and that there is level difference between the subject site and the Stream, there is no pathway between the source and the receptor.

In addition, other low-lying areas located between the node and Blackthorn Road will store flood water as confirmed by Map 6 which is based on topography. In this way, any flood water will be prevented from reaching the site due to the topography of the area. Flood water on Blackthorn Road will in fact flow north, as the existing topography of the road falls in that direction.

Risk of Flooding

Given that there is no pathway between the source and the receptor, the risk from fluvial flooding is insignificant.

In addition, the various flood maps and reports published by OPW during the past decade confirm the absence of any fluvial flooding in the area of the subject site or its immediate environs.

Mitigation Measures

As the risk from fluvial flooding is insignificant, no flood mitigation measures were required to be considered.

3.4 Pluvial

Pluvial flooding is from heavy rainfall and is often referred to as flooding from surface water. Surface water flooding can occur as a result of overland flow or ponding during periods of extreme prolonged rainfall. Flooding may occur through any of the pathways outlined in Table 2 and the risk associated with each pathway is outlined below.

Table 4 Pathways/Receptors

	Pathway	**Receptor**
1	Surcharging of the proposed internal drainage systems during heavy rainfall events leading to internal flooding	Proposed development – Basement and buildings
2	Surcharging from the existing surrounding drainage system leading to flooding within the subject site by surcharging surface water pipes	Proposed development – Basement and buildings

3	Surface water discharging from the subject site to the existing drainage network leading to downstream flooding	Downstream properties and roads
4	Overland flooding from surrounding areas flowing onto the subject site	Proposed development – Basement and buildings
5	Overland flooding from the subject site flowing onto surrounding areas	Downstream properties and roads

3.4.1 On-site drainage system surcharging

The proposed on-site surface water drains have been designed to accommodate flows from a 5-year return event which indicates that the internal system may surcharge during rainfall events with a return period in excess of five years. Therefore, the likelihood surcharging of the on-site drainage system is considered high over the lifetime of the building. The risk of flooding is mitigated however by providing attenuation for the development which can store water for the 1 in 100-year storm event plus a 20% allowance for climate change and therefore the residual risk is low.

3.4.2 Flooding from the existing surrounding drainage system surcharging

The existing drainage system is a separate foul and surface water drainage systems and the existing site drains to the separate foul and surface water public sewers on Carmanhall Road. The surface water drainage from the proposed development will be attenuated on site and will have a restricted outflow to the public surface water sewer, reducing the rate of run-off to the sewer and further reducing the risk of the sewer surcharging. Therefore, the likelihood of flooding due to surcharging the existing drainage network is considered low.

3.4.3 Surface water discharge from the subject site causing downstream flooding

The proposed development site is already 100% hard surfaced. The development, as designed, will increase the permeable area due to the installation of permeable paving, planters, green roofs and podium areas and swales all of which will help reduce the volume of run-off from the site during low storm events. Surface water discharging from the development will be limited by a hydro-brake with a peak discharge of 2 l/s/ha. This will reduce the effects of the development on the local drainage network further reducing the risk of downstream flooding. The likelihood of the proposed development resulting in pluvial flooding downstream of the site is therefore considered extremely low.

3.4.4 Overland flooding from surrounding areas

A map showing all flood events within close proximity of the subject site is provided below in Figure 8. No single or recurring flood events are recorded in the area of the subject site.

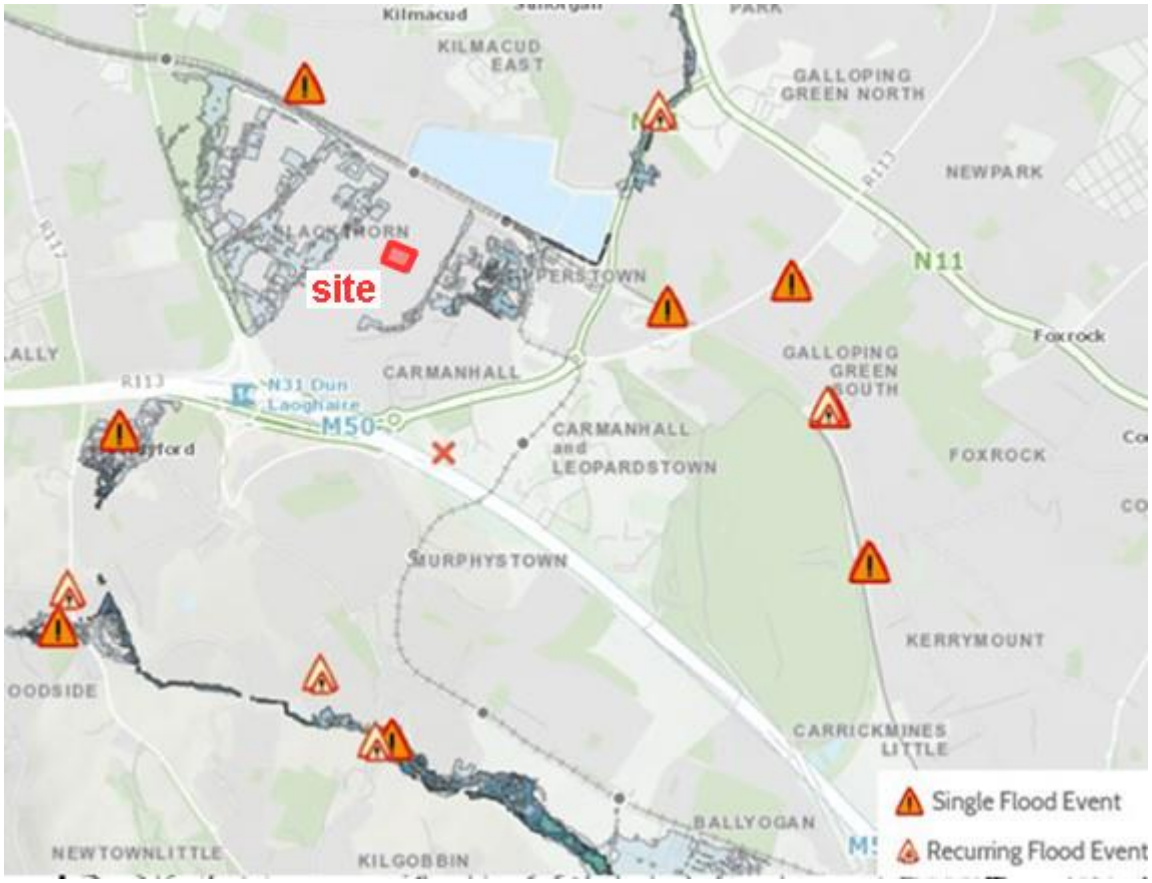

Figure 8 Past Flood Events

3.4.5 Overland flooding from the subject site

Positive drainage in the form of gullies and ACO drains as well as SUDS systems such as permeable paving and swales will be provided to collect and discharge rain falling on hard standing areas to the attenuation tanks. External pavement will be laid so that water will be directed away from building entrances towards the drainage gullies and channels. Building maintenance will be responsible for ensuring the gullies and channels are kept free of debris and therefore, the risk to both the development and the surrounding areas from overland flooding from the development is considered low.

3.5 Groundwater

Source

On-site groundwater is a potential source of flooding but unlikely due to the elevated location of the site.

Pathway

During periods with extreme prolonged rainfall groundwater might come to the surface and flood the proposed development.

Receptor

The receptor is the proposed development with a ground floor level of 88.50 mOD, a lower ground floor level of 84.15 mOD and a basement level of 81.50 mOD. The lowest level at which tidal water could enter the proposed development would be from Carmanhall Road at a level of 84.00 mOD and along the Inner Street which will have a level of 84.0 - 84.8mOD. All ventilation and other openings below this level will be bunded to a minimum level of 84.5 mOD.

Likelihood

The likelihood of ground water flooding for the subject site is remote as the site is located in a relatively elevated area.

Consequence

The consequence of ground water flooding would be the damage to property and loss of amenity.

Risk

For the subject site, there is a low risk of ground water flooding.

Flood Risk Management

In the event of ground water flooding on site, this water can escape from the site in a south-westerly direction.

3.6 Human / Mechanical Errors

The subject land will be drained by an internal private storm water drainage system which discharges to the public surface water network to the north of the subject site. This internal surface water network is a source of possible flooding from the system if it were to block. If the proposed private drainage system blocks this could lead to possible flooding on the podium levels, within the private areas and basement levels and within the private access road and landscaped areas.

In order to mitigate against the risk of flooding from blockages the surface water network must be regularly maintained and where required cleaned out. The building management team will be expected to prepare and follow a maintenance schedule which ensures all drainage is checked and cleared at least annually and after a heavy storm event.

Tree pits, green roofs and permeable paving and catch-pit gullies and manholes will be provided in order to minimise the volume of debris entering the drainage system and mitigate the risk of flooding.

Should a partial or total blockage occur within the drainage system the surrounding ground levels have been set so that the resulting flood water is directed away from the building entrances.

Should the surface water system along the landscape areas and access road suffer a 50% blockage, the overland flood route will direct this runoff water to the access road at the eastern boundary of the site and finally north to Carmanhall Road.

Should a 50% blockage occur in the basement system, the flood water will flow to the basement -2 level which has the lowest level at 81.60m OD where it will be stored within the carpark before being pumped out to the public sewer.

Any flood water in the basement will be instantly recognisable to the site management team which will allow for a fast response. The total volume required to be stored within the attenuation tank for the 1 in 100 year storm plus 30% climate change is 354 m^3.

Should a 50% blockage occurred, a total volume of 177 m^3 would be flooded within basement -2 carpark. The total B2 car park areas is in excess of 1,320m^2 therefore, if the basement were to flood in a 1 in 100 year plus 30% climate change event, 135 mm of water across the basement floor would accommodate 179 m^3 of storage.

The likelihood of this occurring is extremely low considering the steps outlined above to prevent a blockage occurring therefore the residual risk is considered low and therefore the risk to the residential dwellings is reduced.

Upon adoption of the proposed flood risk management strategies, outlined above, there is a **low** residual risk of overland flooding from human / mechanical error.

4. Sequential Test

A sequential approach to planning is a key tool in ensuring that development, particularly new development, is first and foremost directed towards land that is at low risk of flooding. The sequential approach is set out in *"The Planning System and Flood Risk Management Guidelines for Planning Authorities, 2009"* and shown in Figure 9.

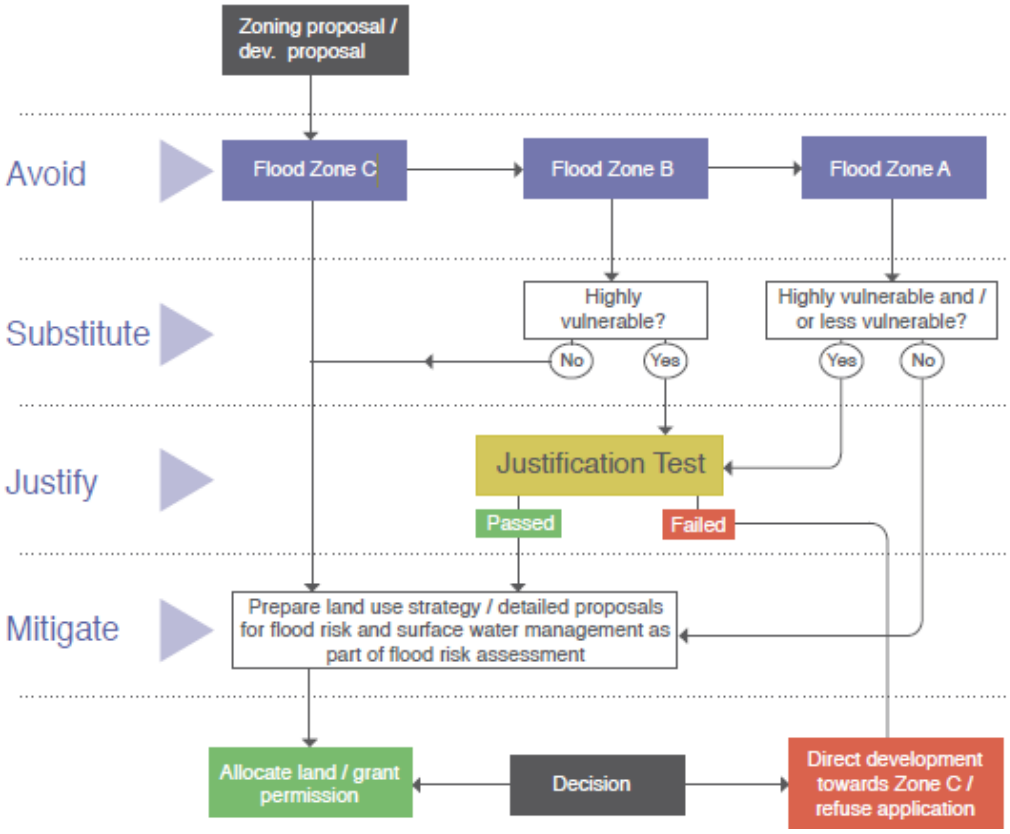

Figure 9 Sequential Approach (extract from DCC Development Plan 2016-2022 SFRA)

Figure 5.2 lists the vulnerability classes assigned to each land use and type of development. Figure 5.1 outlines the matrix of vulnerability versus flood zone. Both tables have been taken from the *Planning and Flood Risk Management Guidelines for Planning Authorities, 2009, OPW*.

All of the lands that are proposed to be developed on site are within Flood Zone C as they are at a low risk of flooding from all sources. Therefore, the proposed development is deemed an appropriate use of the site, following the sequential approach.

5. Conclusions and Recommendations

The subject site has been analysed for risks from flooding from the Irish Sea / Dublin Bay, the Carysfort Maretimo Stream, the internal and external surface water network, ground water and failures of mechanical systems.

Through careful design and appropriate mitigation measures, the risks and consequences of flooding have been mitigated across the development.

The Flood Risk Assessment is summarised in Table 4 below.

Table 5 Summary of the Flood Risks from each flooding type.

Source	**Pathway**	**Receptor**	**Likelihood**	**Consequence**	**Risk**	**Mitigation Measures**	**Residual Risk**
Tidal	None	People, Property	Remote	None	Low	None Required	Low
Fluvial	None	People, Property	Remote	None	Low	None Required	Low
Foul Water	Drainage network	People, Property	Remote	Possible damage to property and loss of amenity	Low	None Required	Low
Surface Water	Drainage network	People, Property	Remote	Possible damage to property and loss of amenity	Low	None Required	Low
Ground Water		People, Property	Remote	Possible damage to property and loss of amenity	Low	None Required	Low
Human Error Mechanical Error	Drainage network	People, Property	Possible	Possible damage to property and loss of amenity	Low	Required	Low

UK and Ireland Office Locations