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Flood Risk Assessment

Residential Development at Clonburris, Adamstown, Co. Dublin

January 2023

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This document has been prepared and checked in accordance with
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1. Introduction

This Flood Risk Assessment has been prepared by Waterman Moylan as part of the documentation in support of a Strategic Housing Development (SHD) planning application for a proposed development on the Clonburris lands, Adamstown, Co. Dublin.

1.1 Flood Risk Assessment: Statement of Design Consistency

This Flood Risk Assessment has been carried out in accordance with the *DEHLG/OPW Guidelines on the Planning Process and Flood Risk Management* published in November 2009. This assessment identifies the risk of flooding at the site from various sources and sets out possible mitigation measures against the potential risks of flooding. Sources of possible flooding include coastal, fluvial, pluvial (direct heavy rain), groundwater, and human/mechanical errors. This report provides an assessment of the subject site for flood risk purposes only.

1.2 Site Description

The subject site is located at Adamstown, Lucan, Co. Dublin, and is bound to the north by the Dublin-Kildare rail line, to the west by the R120, to the south by Lucan pitch & putt club, and to the east by Hayden's Lane, as per *Figure 1* overleaf. It is approximately 2.4km south of Lucan town centre.

The subject site is approximately 13.37ha in area and is bisected by Hayden's Lane. Hayden's Lane as it exits the site on the eastern boundary continues to run southwards as a vehicular carriageway, however, it also runs to the north as a pedestrian/cyclist route forming an overpass of the rail line and Adamstown Avenue Road. The site is greenfield in nature, with a single structure; a cattle-shed and yard on the east. The northern part of the site is traversed east-west by overhead cable on HV electrical pylons.

***Figure 1** | Site Location (Google Earth)*

A topographic survey of the subject site indicates it generally slopes southwest to northeast from a high of 64.52m OD on the southwest to a low of 55.81m OD on the northeast. The survey has also shown that the hedgerow running from north to south contains a local ditch system, which is culverted under Hayden's Lane, and outfalls to the Griffeen River which forms the south-eastern boundary of the site.

The Griffeen River generally flows in a northerly direction, it is culverted under the rail lines and Adamstown Avenue which run in parallel at this location as per *Figure 2* overleaf, which has been extracted from the Clonburris SDZ Planning Scheme 2019. It exits the culvert at Griffeen Valley Park, flowing northwards to Vesey park, before ultimately outfalling to the River Liffey at Lucan.

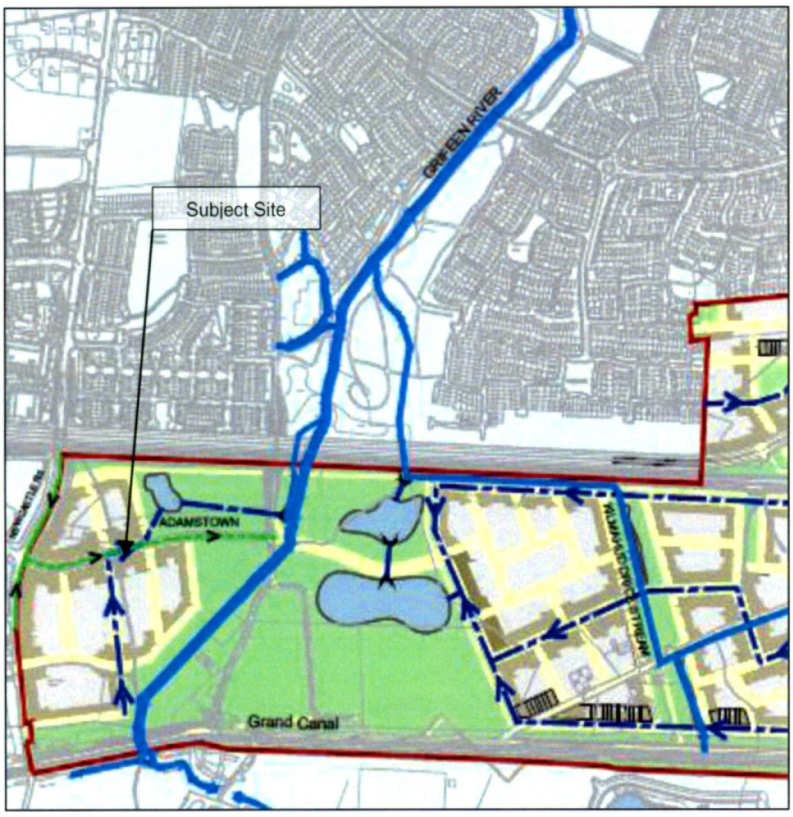

***Figure 2** | Image extracted from the Clonburris SDZ 2019*

1.3 Proposed Development

The proposed development consists of a total of 385 residential units, comprising 139 houses and 154 apartments, and 92 duplex type units as set out in the Schedule of accommodation in *Table 1* below.

Description	1-bed	2-bed	3-bed	4-bed	Total
House	-	-	98	41	139
Duplex	-	21	71	-	92
Apartment	48	106	-	-	154
Total	**48**	**127**	**169**	**41**	**385**

***Table 1** | Schedule of Accommodation*

The proposed development will consist of 385 No. units (139 No. houses, 70 No. 'Build-to-Rent' duplex/apartments, 72 No. duplex/apartments, and 104 No. apartments), ranging between 2 – 6 storeys and all associated and ancillary site development, infrastructural, hard and soft landscaping and boundary treatment works, including: - a single storey tenant amenity building; areas of public open space; car parking spaces; bicycle parking spaces; bin and bicycle stores; plant provided at undercroft level and additional plant provided at roof level of the proposed apartment blocks; 2 No. ESB Sub-stations and demolition of remaining walls and hardstanding associated with a former agricultural building. Permission is also sought for minor revisions to attenuation pond permitted under SDCC Reg. Ref. SDZ20A/0021 as well as connections to water services (wastewater, surface water, and water supply) and connections to permitted cycle / pedestrian paths. All on a site of c. 9.08 Ha in the townland of Adamstown, within the Clonburris Strategic Development Zone (Adamstown Extension – Development Areas AE-51 and AE-52).

1.4 Background to the Report

This Flood Risk Assessment report follows the guidelines set out in the *DEHLG/OPW Guidelines on the Planning Process and Flood Risk Management* published in November 2009. The components to be considered in the identification and assessment of flood risk are as per Table A1 of the above guidelines:

- Tidal – flooding from high sea levels
- Fluvial – flooding from water courses
- Pluvial – flooding from rainfall / surface water
- Groundwater – flooding from springs / raised groundwater
- Human/mechanical error – flooding due to human or mechanical error

Each component will be investigated from a Source, Pathway and Receptor perspective, followed by an assessment of the likelihood of a flood occurring and the possible consequences.

1.4.1 Assessing Likelihood

The likelihood of flooding falls into three categories of low, moderate, and high, which are described in the OPW Guidelines as follows:

Flood Risk Components	**Likelihood: % chance of occurring in a year**		
	Low	***Moderate***	***High***
Tidal	*Probability < 0.1%*	*0.5% > Probability > 0.1%*	*Probability > 0.5%*
Fluvial	*Probability < 0.1%*	*1% > Probability > 0.1%*	*Probability > 1%*
Pluvial	*Probability < 0.1%*	*1% > Probability > 0.1%*	*Probability > 1%*

***Table 2** | From Table A1 of "DEHLG/OPW Guidelines on the Planning Process and Flood Management"*

For groundwater and human/mechanical error, the limits of probability are not defined and therefore professional judgment is used. However, the likelihood of flooding is still categorized as low, moderate, and high for these components.

From consideration of the likelihoods and the possible consequences a risk is evaluated. Should such a risk exist, mitigation measures will be explored, and the residual risks assessed.

1.4.2 Assessing Consequence

There is not a defined method used to quantify a value for the consequences of a flooding event. Therefore, in order to determine a value for the consequences of a flooding event, the elements likely to be adversely affected by such flooding will be assessed, with the likely damage being stated, and professional judgement will be used in order to determine a value for consequences. Consequences will also be categorized as low, moderate, and high.

1.4.3 Assessing Risk

Based on the determined 'likelihood' and 'consequences' values of a flood event, the following 3x3 Risk Matrix will then be referenced to determine the overall risk of a flood event.

		Consequences		
		Low	***Moderate***	***High***
Likelihood	**Low**	*Extremely Low Risk*	*Low Risk*	*Moderate Risk*
	Moderate	*Low Risk*	*Moderate Risk*	*High Risk*
	High	*Moderate Risk*	*High Risk*	*Extremely High Risk*

Table 3 | *3x3 Risk Matrix*

1.4.4 Flood Risk Management

After a risk has been assessed, flood risk management is the next stage. Flood risk management aims to minimize the risks to people, properties, and the environment arising from flooding.

1.4.5 Residual Risk

The residual risk is the risk which remains after all risk avoidance, substitution, and mitigation measures have been implemented.

2. Tidal

2.1 Source

Tidal flooding occurs when normally dry, low-lying land is flooded by seawater. The extent of tidal flooding is a function of the elevation inland flood waters penetrate, which is controlled by the topography of the coastal land exposed to flooding.

2.2 Pathway

The site is approximately 16.2km west the nearest coastline of the Irish Sea at Sandymount, Dublin Bay, as shown in *Figure 3*. This figure is extracted from the OPW's flood information portal and shows that the site is not at risk of coastal flooding for even the 1-in-1,000-year flood event. The Dublin Coastal Projection Project indicated that the 2002 high tide event reached 2.95m OD Malin. The lowest existing ground level on site is 55.81m OD.

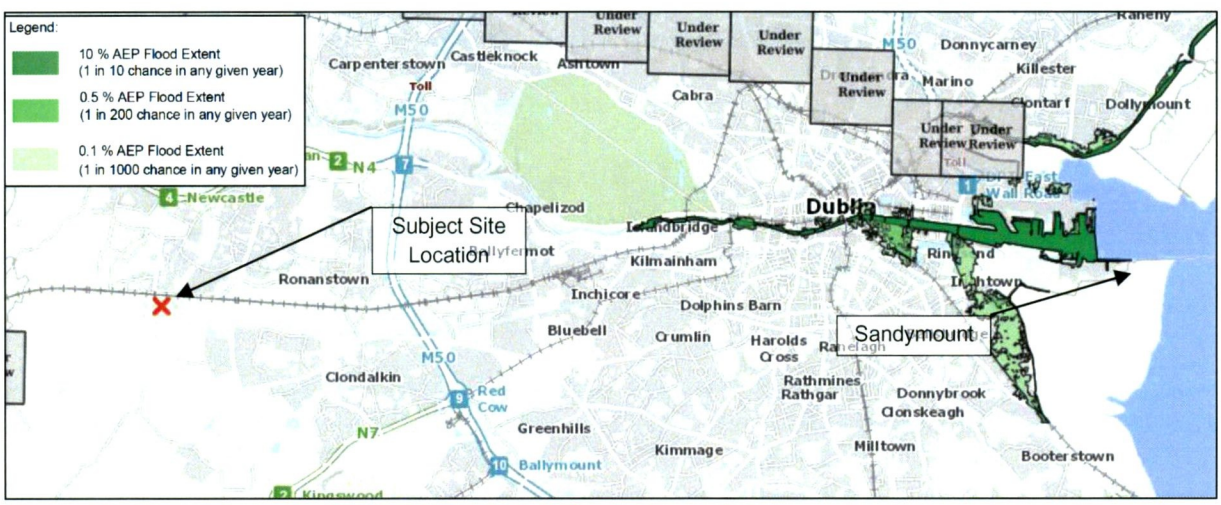

***Figure 3** | Extract from the FEM FRAMS Tidal Flood Extents Map*

High probability flood events, as shown in the above map, are defined as having approximately a 1-in-10 chance of occurring or being exceeded in any given year (10% Annual Exceedance Probability), medium probability flood events are defined as having an AEP of 0.5% (1-in-200-year storm), while low probability events are defined having an AEP of 0.1% (1-in-1,000-year storm). The map indicates that the subject development is not at risk of flooding for even the 1-in-1,000-year event.

Given that the site is located 16.2 kilometres inland from the Irish Sea, that there is at least a 52.86m level difference between the proposed buildings and the high tide and given that the site is outside of the 1-in-1,000-year flood plain, it is evident that a pathway does not exist between the source and the receptor. The risk from tidal flooding is therefore extremely low and no flood mitigation measures need to be implemented.

3. Fluvial

3.1 Source

Fluvial flooding occurs when a river / water course's flow exceeds its capacity, typically following excessive rainfall, though it can also result from other causes such as heavy snow melt and ice jams.

3.2 Pathway

The subject site is located within the Griffeen River catchment which forms the south-eastern boundary of the site. An internal hedgerow ditch also outfalls to the Griffeen River.

The Fingal East Meath Flood Risk Assessment and Management Study (FEM FRAMS) maps, available on the OPW's National Flood Information Portal and extracted below, shows that parts of the site to the northeast and east are subject to flooding from a 0.1% AEP (1-in-1,000-year) rain fall event.

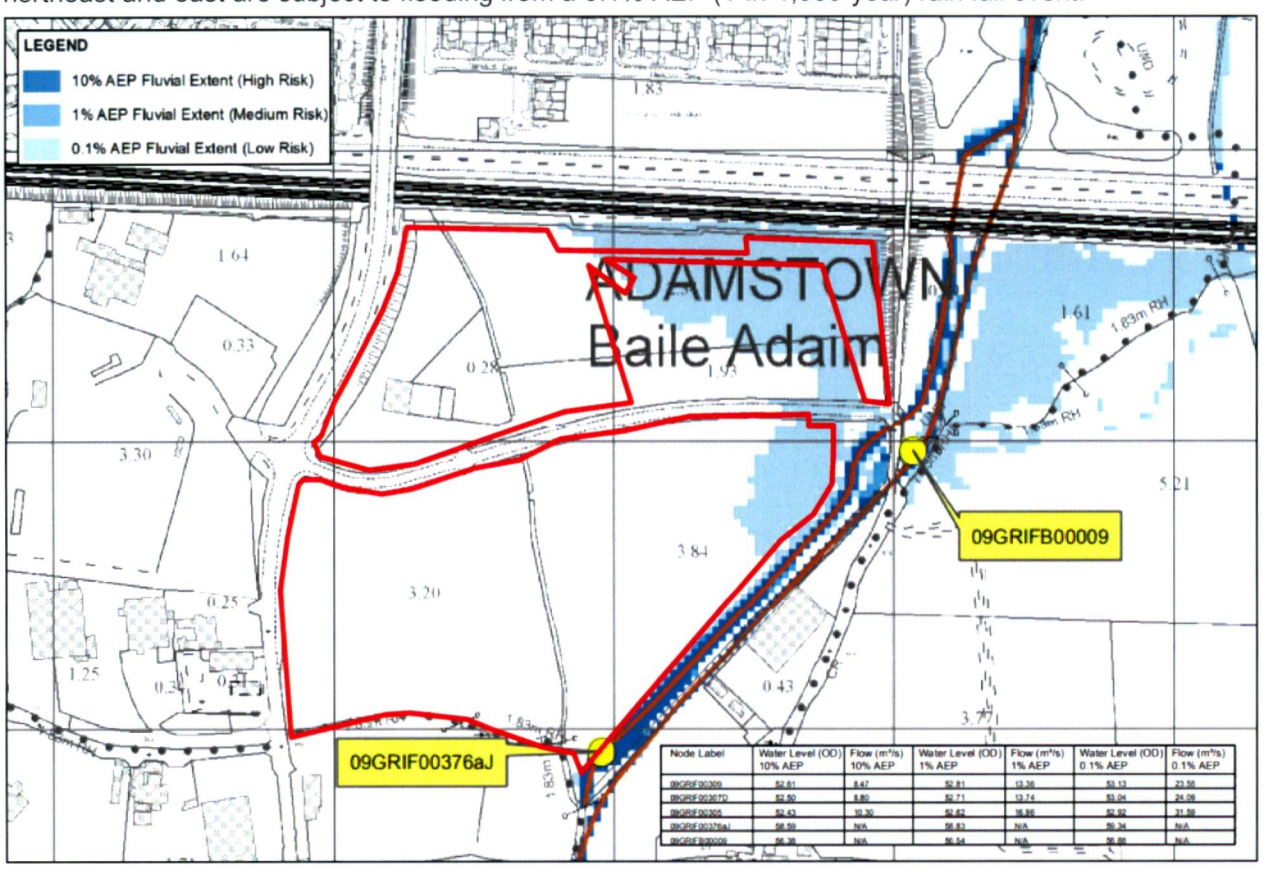

***Figure 4** | Extract from the FEM FRAMS Fluvial Flood Extents Map e09bal_exfcd_f0_11*

The nearest node point, reference number: 09GRIFB00009, located on the Griffeen River, will have a 1-in-1,000-year flood event water height of 56.88m, below the lowest Finished Floor Level (FFL) of 57.95m on the subject lands, thus providing 1.07m of freeboard. The area at risk of flooding is proposed to be retained as open space and will not be subject to construction of residential development.

A review of the available historic records does not indicate that there have been any instances of flooding at the site or in the surrounding area. An extract overleaf, taken from the OPW's online historic event map: floodmap.ie, shows that a flood incident took place on the Griffeen River in November 2000.

The nearest flood event took place 0.6km away from the site, at Griffeen Valley Park. A review of the "South Dublin County Report on Flooding 5th & 6th November 2000" report associated with this flood event advises

that following a heavy rainfall event, there were serious floods in two locations within the Griffeen catchment, at its confluence to the Liffey in Lucan old town and at Griffeen Valley Park. The flood at Griffeen Valley Park led to the flooding of residential areas at the Old Forge and Grange Manor estates. Council crews were mobilised and engaged in the cleaning of the river and culvert screens, freeing of blockages, and distribution of sandbags. There have been no further reports of flooding in the area since.

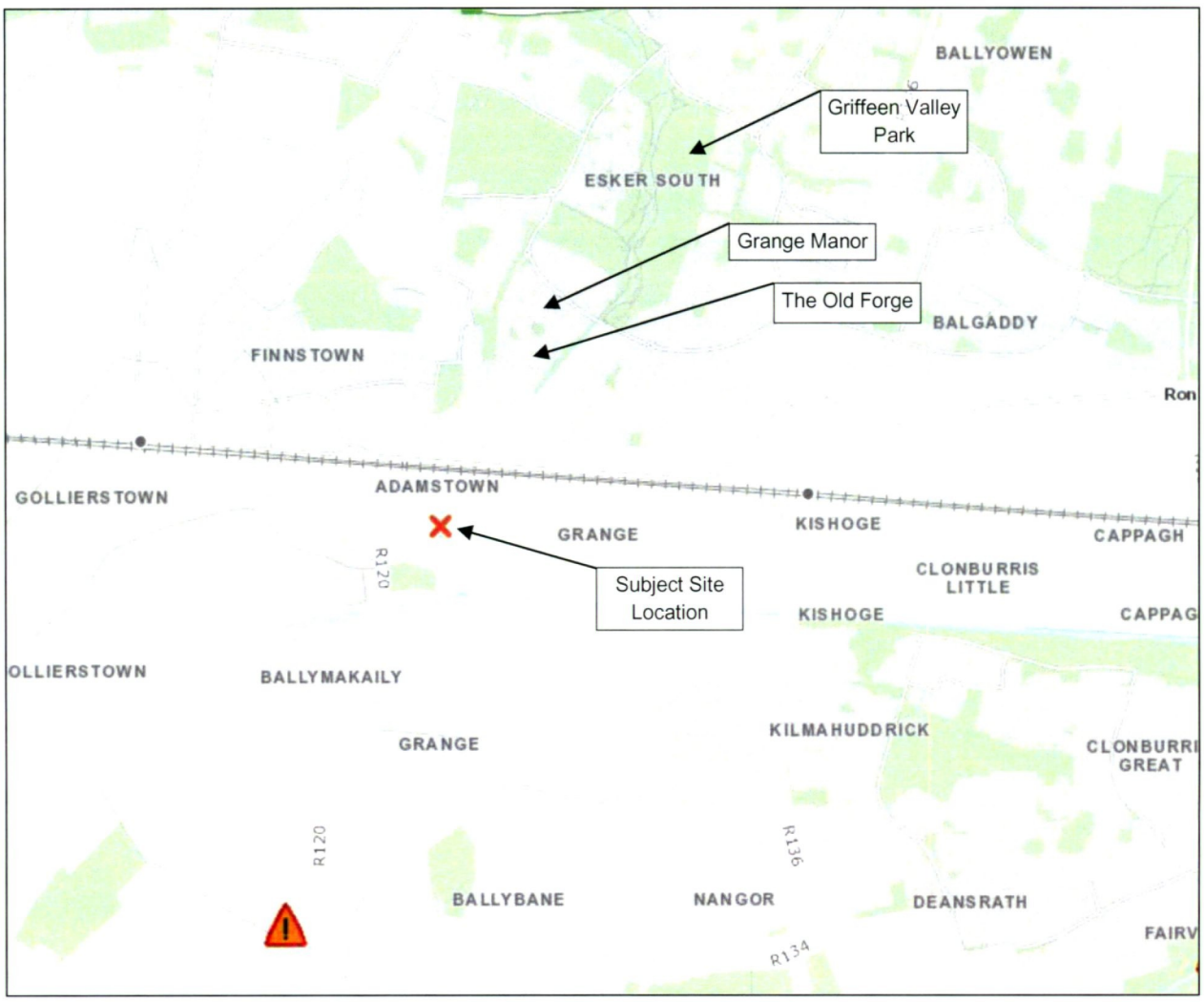

***Figure 5** | Extract from historic flood event map (Source: floodmap.ie)*

3.3 Likelihood

Given that the area of the site to be developed is outside of the 1-in-1,000-year flood plain, a freeboard hight of 1.07m has been provided between the lowest FFL of 57.95m and the calculated flood height of 56.88m for the 1-in-1,00-year storm, and that historic records of previous flood indicate flooding has taken place downstream of the subject site, the likelihood of fluvial flooding is low.

3.4 Consequence

The consequence of fluvial flooding would be some minor inundation to open spaces. Therefore, the consequences of fluvial flooding occurring at the proposed development is considered low.

3.5 Risk

There is an extremely low risk of fluvial flooding as the likelihood is low and the consequence is low.

3.6 Flood Risk Management

The development has been designed to provide overland flood routing via the road network and open space to the Griffeen River, which ultimately drains to the River Liffey as described in Section 1.1. The overland flood routing is shown in full on drawing number: 21-055-P1400, which is extracted overleaf in *Figure 6*.

The proposed development has designed finished floor levels generally over 200mm above the local road network to minimise the risk of flooding from overland flows.

To minimise the risk of downstream flooding, surface water outflow from the site is limited to its equivalent green-field run-off rate via a flow control manhole. The surface water attenuation pond, permitted under Reg. Ref: SDZ20A/0021, has been designed to attenuate flood volumes for a 1 in 100-year event minimising the risk of downstream flooding.

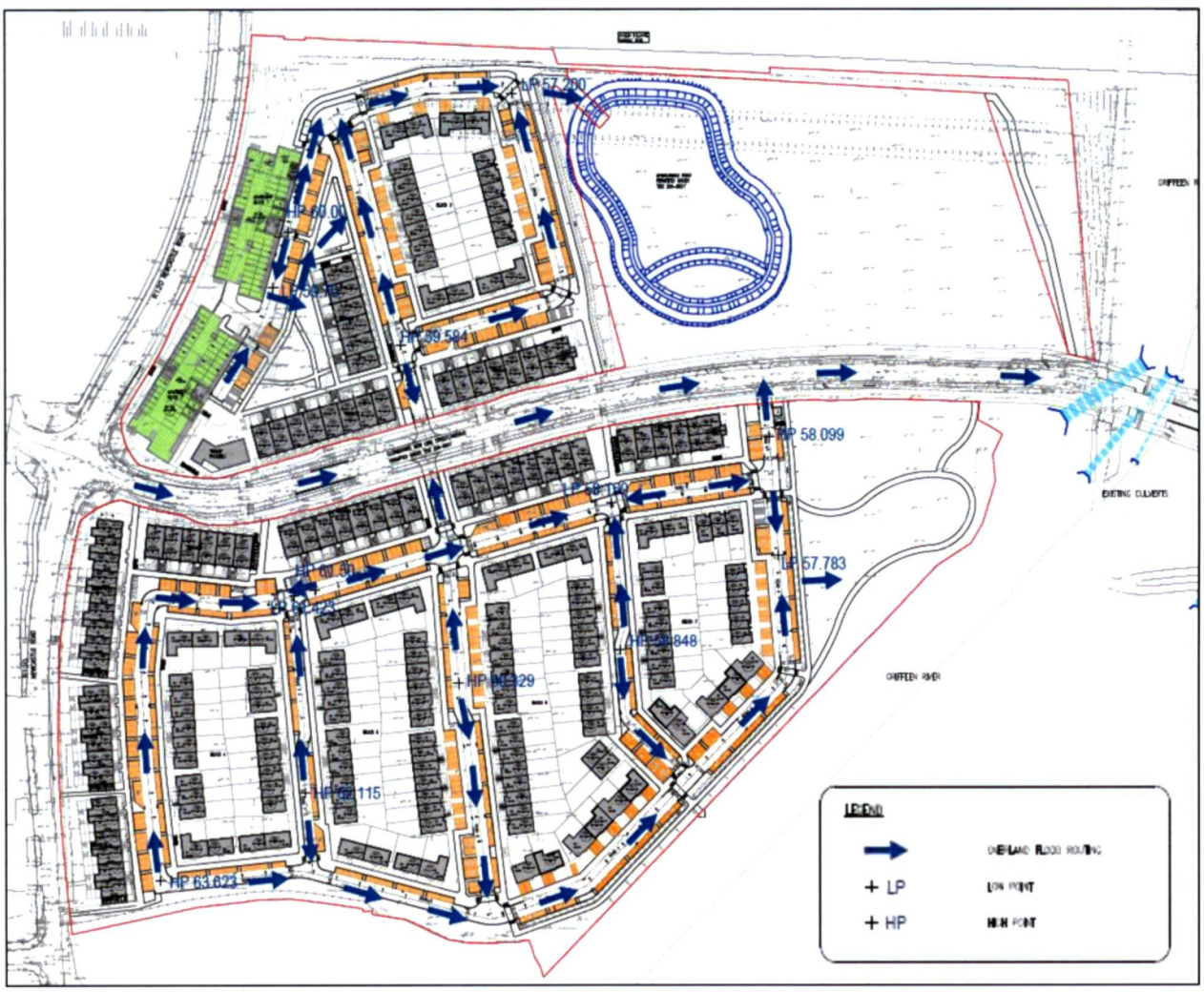

***Figure 6** | Overland Flood Route Extract*

3.7 Residual Risk

The residual risk of fluvial flooding is considered extremely low.

4. Pluvial

4.1 Source

Pluvial flooding occurs when heavy rainfall creates a flood event independent of an overflowing water body. Pluvial flooding can happen in any urban area, including higher elevation areas that lie above coastal and river floodplains.

4.2 Pathway & Receptors

During periods of extreme prolonged rainfall, pluvial flooding may occur through the following pathways:

	Pathway	Receptor
1	Surcharging of the proposed internal drainage systems during heavy rain events leading to internal flooding	Proposed development – properties and roads
2	Surcharging from the existing surrounding drainage system leading to flooding within the subject site by surcharging surface water pipes	Proposed development – properties and roads
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 – properties and roads
5	Overland flooding from the subject site flowing onto surrounding areas	Downstream properties and roads

Table 4 | *Pathways and Receptors*

4.3 Likelihood

The likelihood of each of the 5 pathway types are addressed individually as follows:

4.3.1 Surcharging of the proposed on-site drainage systems:

The proposed on-site surface water drainage sewers have been designed to accommodate flows from a 5-year return event, which indicates that on average 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.

4.3.2 Surcharging from the existing surrounding drainage system:

As discussed in Section 3.2, there has been no record of the site or areas immediately adjacent flooding, however parts of the subject site are at risk from the 1-in-1,000-year flood event.

With no history of flooding in the area due to surcharging, and the open space of the site being potentially at risk for the 1-in-1,000-year storm event, the likelihood of such flooding occurring is considered low.

4.3.3 Surface water discharge from the subject site:

Due to the increase in hard standing area as a result of the proposed development, there is an increased likelihood of surface water discharge from the site leading to downstream flooding. As such, the likelihood can be considered moderate.

4.3.4 Overland flooding from surrounding areas:

With no recorded flood events in the immediate area that could have an impact on the subject site, as per the OPW records referred to previously, it is considered that there is a low likelihood of flooding from surrounding areas.

4.3.5 Overland flooding from the subject site:

Due to the increase in hard standing area as a result of the proposed development, there is an increased likelihood of overland flooding from the site leading to downstream flooding. As such, the likelihood can be considered moderate.

4.4 Consequence

Surface water flooding would result in damage to roads and landscaped areas and could impact the ground floor levels of buildings. The consequences of pluvial flooding are considered moderate.

4.5 Risk

The risk of each of the 5 pathway types is addressed individually as follows:

4.5.1 Surcharging of the proposed on-site drainage systems:

With a high likelihood and moderate consequence of flooding the site from surcharging the on-site drainage system, the resultant risk is high.

4.5.2 Surcharging from the existing surrounding drainage system:

With a low likelihood and moderate consequence of flooding the site from the existing surface water network, the resultant risk is low.

4.5.3 Surface water discharge from the subject site:

With a moderate likelihood and moderate consequence of surface water discharge from the subject site, the resultant risk is moderate.

4.5.4 Overland flooding from surrounding areas:

With a low likelihood and moderate consequence of overland flooding from the surrounding areas, the resultant risk is low.

4.5.5 Overland flooding from the subject site:

With a moderate likelihood and moderate consequence of overland flooding from the subject site, the resultant risk is moderate.

4.6 Flood Risk Management

The following are flood risk management strategies proposed to minimise the risk of pluvial flooding for each risk:

4.6.1 Surcharging of the proposed on-site drainage systems:

The risk of flooding is minimised with adequate sizing of the on-site surface water network and SuDS devices. Open grassed areas with low level planting will ensure that these areas act as soft scape and will significantly slow down and reduce the amount of surface water runoff from the site. Permeable paving in private driveways and parking courts, and filter drains around the perimeter of the open spaces, will provide some treatment volume, with underlying perforated pipes connecting to the storm water sewer network.

These proposed source and site control devices will intercept and slow down the rate of runoff from the site to the on-site drainage system, reducing the risk of surcharging.

Furthermore, a hydro-brake will limit runoff to the equivalent greenfield rate. Excess storm water from the site is to be attenuated in the ponds with sufficient volume for the 1-in-100-year storm (accounting for a 20% increase due to climate change), to limit the runoff from the site and minimise the discharge rate into receiving waters.

As a result of these proposed measures, the likelihood of surcharging of the proposed on-site drainage systems is low.

Please note that some of these regional measures are provided by the permitted planning application, Reg. Ref: SDZ20A/0021, and as discussed in detail in Section 3 of the Engineering Assessment report, submitted under a separate cover.

4.6.2 Surcharging from the existing surrounding drainage system:

The risk of flooding due to surcharging of the existing surface water network is minimised with overland flood routing (refer to the Overland Flood Routing figure in Section 3.6 above) towards the Griffeen River and towards the attenuation pond. Freeboard of 1.07m from the lowest FFL to the 1-in-1,000-year flood height has been provided. The risk to the surrounding buildings is mitigated by setting finished floor levels at least 200mm above the adjacent road channel line.

4.6.3 Surface water discharge from the subject site:

Surface water discharge from the subject site is intercepted and slowed down through the use of source control devices, as described in Section 4.6.1 above, minimising the risk of pluvial flooding from the subject site. Sufficient attenuation storage is provided for the 1-in-100-year storm, accounting for a 20% increase due to climate change.

4.6.4 Overland flooding from surrounding areas:

The risk from overland flooding from surrounding areas is low. Overland flood routing and raised finished floor levels will provide protection for the proposed buildings, as described in Section 4.6.2 above.

4.6.5 Overland flooding from the subject site:

The risk of overland flooding from the subject site is minimised by providing SuDS features to intercept and slow down the rate of runoff from the site to the existing surface water sewer system, as described in Section 4.6.1 above. Sufficient attenuation is provided for the 1-in-100-year storm, accounting for a 20%

increase due to climate change. Thus, even under extreme storm conditions, the surface water can be attenuated without causing flooding downstream.

4.7 Residual Risk

As a result of the design measures detailed above in Section 4.6, there is a low residual risk of flooding from each of the surface water risks.

5. Groundwater

5.1 Source

Groundwater flooding occurs when the water table rises above the ground surface. This typically happens during periods with prolonged rainfall which exceeds the natural underground drainage system's capacity.

5.2 Pathway

The pathway for groundwater flooding is from the ground. Note that although groundwater flooding is typically considered to be when the water table rises above the ground surface, underground services and building foundations could also be affected by high water tables that do not reach the ground surface.

5.3 Receptor

The receptors for ground water flooding would be underground services, roads, and the ground floor of buildings.

5.4 Likelihood

Geological Survey Ireland (GSI) produces a wide range of datasets, including groundwater vulnerability mapping. From the GSI groundwater vulnerability map, extracted below, the site lies predominantly within an area of extreme vulnerability. There is also a strip of rock at or near surface or karst area, which appears to follow the route of the on-site local drainage ditch.

***Figure 7** | Extract of Groundwater Vulnerability Map*

With the site falling within an area with extreme to rock at or near surface or karst groundwater vulnerability, the likelihood of groundwater rising through the ground and causing potential flooding on site during prolonged wet periods is high.

5.5 Consequence

The consequence of ground water flooding would be some minor temporary seepage of ground water through the ground around the proposed buildings. Underground services could be inundated from high water tables. Therefore, the consequence of ground water flooding occurring at the proposed development is considered moderate.

5.6 Risk

With a high likelihood and moderate consequences of flooding due to groundwater, the risk is considered high.

5.7 Flood Risk Management

Finished floor levels have been set above the road levels, as described in Section 3.6, to ensure that any seepage of ground water onto the development does not flood into the buildings. In the event of ground water flooding on site, this water can escape from the site via the overland flood routing, also described in Section 3.6.

The buildings' design will incorporate suitable damp-proof membranes to protect against damp and water ingress from below ground level.

5.8 Residual Risk

There is a low residual risk of flooding from ground water.

6. Human/Mechanical Errors

6.1 Source

The subject site will be drained by an internal private storm water drainage system, which discharges post-attenuation to the existing natural surface water network (the Griffeen River).

The internal surface water network is a source of possible flooding were it to become blocked.

6.2 Pathway

If the proposed private drainage system blocks this could lead to possible flooding within the private and public areas.

6.3 Receptor

The receptors for flooding due to human/mechanical error would be the ground floor levels of buildings, the roads, and the open landscaped areas around the site.

6.4 Likelihood

There is a high likelihood of flooding on the subject site if the surface water network were to become blocked.

6.5 Consequence

The surface water network would surcharge and overflow through gullies and manhole lids. It is, therefore, considered that the consequences of such flooding are moderate.

6.6 Risk

With a high likelihood and moderate consequence, there is a high risk of surface water flooding should the surface water network block.

6.7 Flood Risk Management

As described in Section 3.6, finished floor levels have been designed to be above the adjacent road network, which will reduce the risk of flooding if the surface water network were to block. In the event of the surface water system surcharging, the surface water can still escape from the site by overland flood routing, as also described in Section 3.6, without causing damage to the proposed buildings.

The surface water network (drains, gullies, manholes, AJs, attenuation system) will need to be regularly maintained and where required cleaned out. A suitable maintenance regime of inspection and cleaning should be incorporated into the safety file/maintenance manual for the development.

6.8 Residual Risk

As a result of the flood risk management outlined above, there is a low residual risk of overland flooding from human / mechanical error.

7. Conclusions and Recommendations

The subject lands have been analysed for risks from tidal flooding from the Irish Sea, fluvial flooding from the Grifeen River, pluvial flooding, ground water and failures of mechanical systems. *Table 5*, below, presents the various residual flood risks involved.

Source	Pathway	Receptor	Likelihood	Consequence	Risk	Mitigation Measure	Residual Risk
Tidal	*Irish Sea*	*Proposed development*	*Extremely low*	*None*	*Extremely low*	*None*	Extremely low
Fluvial	*The River Griffeen*	*Proposed development*	*Low*	*Low*	*Extremely Low*	*Setting of floor levels & freeboard, overland flood routing, no localised low points, no structures located in flood zone*	Extremely Low
Pluvial	*Private & Public Drainage Network*	*Proposed development, downstream properties, and roads*	*Ranges from high to low*	*Moderate*	*Ranges from high to low*	*Appropriate drainage, SuDS, and attenuation design, setting of floor levels, overland flood routing, no structures located in flood zone*	Low
Ground Water	*Ground*	*Underground services, ground level of buildings, roads*	*High*	*Moderate*	*High*	*Appropriate setting of floor levels, flood routing, damp proof membranes*	Low
Human/ Mechanical Error	*Drainage network*	*Proposed development*	*High*	*Moderate*	*High*	*Setting of floor levels, overland flood routing, regular inspection of surface water network*	Low

Table 5 | *Summary of the Flood Risks from the Various Components*

As indicated in the above table, the various sources of flooding have been reviewed, and the risk of flooding from each source has been assessed. Where necessary, mitigation measures have been proposed. As a result of the proposed mitigation measures, the residual risk of flooding from any source is low.

UK and Ireland Office Locations