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Flood Risk Assessment

Project:

Residential Development at Greenhills Road, Walkinstown, Dublin 12.

Green Vale
Greenhills

Client:

STEEPLEFIELD LTD.

Project Reference No.:

20189

Report Reference No.:

20189-LDE-ZZ-ZZ-RP-0002

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P	Edvinas Valadka	30-11-2021	Gordon Poyntz	30-11-2021
P1	Edvinas Valadka	08-03-2022	Gordon Poyntz	08-03-2022

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1.0 Introduction

Lohan & Donnelly have been commissioned to prepare a Flood Risk Assessment to support a planning application for a proposed residential development at Greenhills Road, Walkinstown, Dublin 12. The flood risk assessment has been conducted in line with The Planning System and Flood Risk Management Guidelines for Planning Authorities.

1.1 Description of Existing Site

The site is approximately 2.79 hectares in area, located within an industrially surrounded zone and comprises of existing low-rise disused industrial units which are to be demolished as part of the subject proposal. The site currently has 3 vehicular accesses all of which are located along the southern part of the site boundary. The existing development does not have any SuDS measures in place.

Topographical survey of existing site indicates that the site is gradually sloping down from west to east and north to south with a very steep, in places almost vertical ascent/decent transition from the site to the Greenhills Road neighboring the northern site boundary. The western site boundary, abutted to the boundary of the neighboring development is separated via a retaining wall, with a level difference between the site in question and neighboring development of approximately 6 meters.

2.2 Description of Proposed Development

(i) The demolition of the former Chadwicks Builders Merchant development comprising 1 no. two storey office building and 9 no. storage/warehouse buildings ranging in height from 3 m – 9.9 m as follows: Building A (8,764 sq.m.), Building B (1,293 sq.m.), Building C (two-storey office building) (527 sq.m.), Building D (47 sq.m.), Building E (29 sq.m.), Building F (207 sq.m.), Building G (101 sq.m.), Building H (80 sq.m.), Building I (28 sq.m.), and Building J (44 sq.m.), in total comprising 11,120 sq.m.;

(ii) the construction of a mixed-use Build-to-Rent residential and commercial development comprising 633 no. build-to-rent apartment units (292 no. one-beds, 280 no. two-beds and 61 no. three-beds), 1 no. childcare facility and 10 no. commercial units in 4 no. blocks (A-D) ranging in height from 5 to 12 storeys as follows:

(a) Block A comprises 209 no. apartments (102 no. 1 bed-units, 106 no. 2 bed-units and 1 no. 3-bed units) measuring 5 - 10 storeys in height. (b) Block B comprises 121 no. apartments (53 no. 1 bed-units, 45 no. 2 bed-units and 23 no. 3 bed-units) measuring 8 - 10 storeys in height. (c) Block C comprises 130 no. apartments (38 no. 1-bed units, 71 no. 2-bed units and 21 no. 3-bed units) measuring 8 - 12 storeys in height. (d) Block D comprises 173 no. apartments (99 no. 1 bed-units, 58 no. 2 bed-units and 16 no. 3 bed-units) measuring 6 - 10 storeys in height. All apartments will be provided with private balconies/terraces;

(iii) provision of indoor communal residential amenity/management facilities including a co-working space, communal meeting room/ work space, foyer, toilets at ground floor of Block A; gym, changing rooms, toilets, resident's lounge, studio, laundry room, communal meeting room/ work space, multi-function space with kitchen at ground floor of Block B; games room with kitchenette, media room, co-working space, resident's lounge, communal meeting room/ work space, reception area, management office with ancillary staff room and toilets, toilets, parcel room at ground floor of Block C;

(iv) the construction of 1 no. childcare facility with dedicated outdoor play area located at ground floor of Block A;

(v) the construction of 8 no. commercial units at ground floor level of Blocks A, B and D, and 2 no. commercial units at second floor level (fronting Greenhills Road) of Block C as follows: Block A has 3 no. units at ground floor comprising 79.46 sq.m., 90.23 sq.m., and 121.39 sq.m., Block B has 1 no. unit at ground floor comprising 127.03 sq.m., Block C has two units at second floor comprising 120.85 sq.m. and 125.45 sq.m., and Block D has 4 no. units at ground floor comprising 84.45 sq.m., 149.77 sq.m., 155.48 sq.m. and 275.59 sq.m.;

(vi) the construction of 3 no. vehicular entrances; a primary entrance via vehicular ramp from the north (access from Greenhills Road) and 2 no. secondary entrances from the south for emergency access and services (access from existing road to the south of the site) with additional pedestrian accesses proposed along Greenhills Road;

(vii) provision of 424 no. car parking spaces comprising 398 no. standard spaces, 21 no. mobility spaces and 5 no. car club spaces located at ground floor level car park located within Block A and accessed via the proposed entrance at Greenhills Road, a two-storey car park located within Blocks C and D also accessed from the proposed entrance at Greenhills Road and on-street parking at ground floor level adjacent to Blocks A and C. Provision of an additional 15 no. commercial/ unloading/ drop-off on-street parking spaces at ground floor level (providing for an overall total of 439 car parking spaces). Provision of 4 no. dedicated motorcycle spaces at ground floor level parking area within Blocks C and D;

(viii) provision of 1363 no. bicycle parking spaces comprising 1035 no. residents' bicycle spaces, 5 no. accessible bicycle spaces and 7 no. cargo bicycle spaces in 9 no. bicycle storerooms in ground and first floor parking areas within Blocks A, C and D, and 316 no. visitors' bicycle spaces located externally at ground floor level throughout the development;

(ix) provision of outdoor communal amenity space (5,020 sq.m.) comprising landscaped courtyards that include play areas, seating areas, grass areas, planting, and scented gardens located on podiums at first and second floor levels; provision of a communal amenity roof garden in Block C with seating area and planting (176 sq.m.); and inclusion of centrally located public open space (3,380 sq.m.) adjacent to Blocks B and C comprising grassed areas, planting, seating areas, play areas, water feature, flexible use space; and incidental open space/public realm;

(x) development also includes landscaping and infrastructural works, foul and surface water drainage, bin storage, ESB substations, plant rooms, boundary treatments, internal roads, cycle paths and footpaths and all associated site works to facilitate the development.

This application is accompanied by an Environmental Impact Assessment Report (EIAR).

2.0 Methodology For Site Specific Flood Risk Assessment

The method which will be implemented for the site specific flood risk assessment, assessing the risk of flooding for the proposed development will based on and in accordance with "The Planning System and Flood Risk Management Guidelines for Planning Authorities, 2009" document.

2.1 Flood Risk Assessment Stages

For this Flood Risk Assessment (FRA), in accordance to Flood Risk Management (FRM) guidelines, a staged approach consisting of three stages will be adopted to evaluate the potential flood risk that the development may be exposed to. The three stages are as follows:

- Stage 1: Flood Risk Identification
- Stage 2: Initial Flood Risk Assessment
- Stage 3: Detailed Flood Risk Assessment

2.2 Flood Zones

The FRM guidelines categorize the flood zones into three categories. The categories are based on the probability and source of flooding. This FRA will adopt one of these zones, appropriate to the proposed development. The three zones are as follows:

- Flood Zone A – where the probability of flooding from rivers and the sea is highest (greater than 1% or 1 in 100 for river flooding or 0.5% or 1 in 200 for coastal flooding)
- Flood Zone B – where the probability of flooding from rivers and the sea is moderate (between 0.1% or 1 in 1000 and 1% or 1 in 100 for river flooding and between 0.1% or 1 in 1000 year and 0.5% or 1 in 200 for coastal flooding); and
- Flood Zone C – where the probability of flooding from rivers and the sea is low (less than 0.1% or 1 in 1000 for both river and coastal flooding). Flood Zone C covers all areas of the plan which are not in zones A or B.

2.3 Sequential Approach

The core concept of flood risk management set out within FRM guidance document is to adopt a risk-based sequential approach with the primary focus to avoid developing in areas which are considered at risk to flooding. Figure 2.1 below captures all the steps contained within the sequential approach.

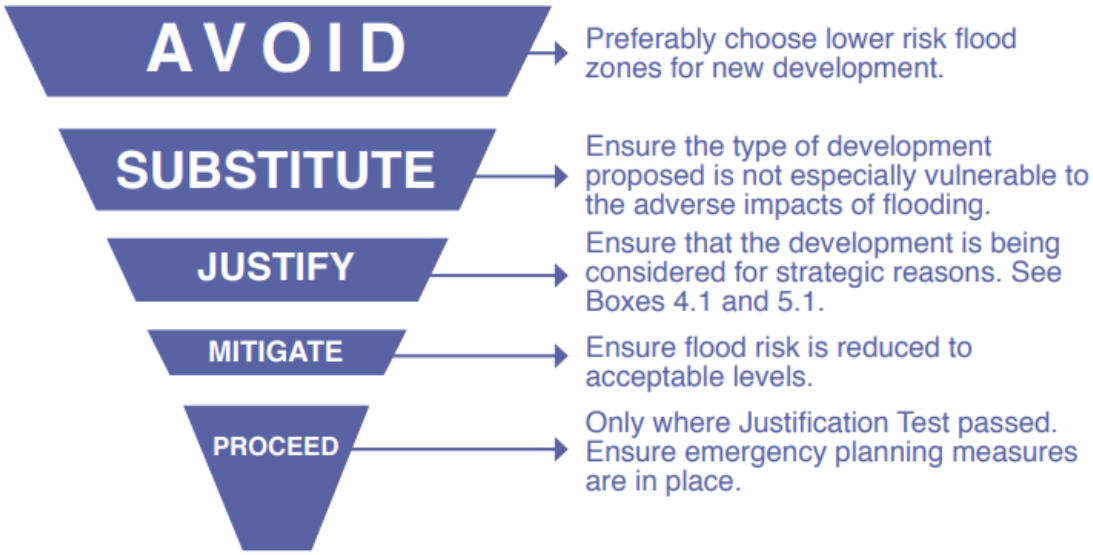

Figure 2.1: Sequential Approach Principles in Flood Risk Management.
Source: "The Planning System and Flood Risk Management Guidelines for Planning Authorities, 2009".

If the proposed development is predicted to flood and avoidance or substitution of land use cannot be achieved, exceptions can be made to allow development to proceed alongside the occurrence of potential predicted flooding. This can be achieved through the use of a justification test, in which appropriate measures of managing the flood risk to an acceptable level are demonstrated.

Refer to figure 2.2 below in which the approach mechanism for a sequential approach is clearly illustrated. Following this approach successfully will ensure that developments (especially new) are either situated in a flood risk free zone or appropriate measures are implemented to mitigate the risk of flooding.

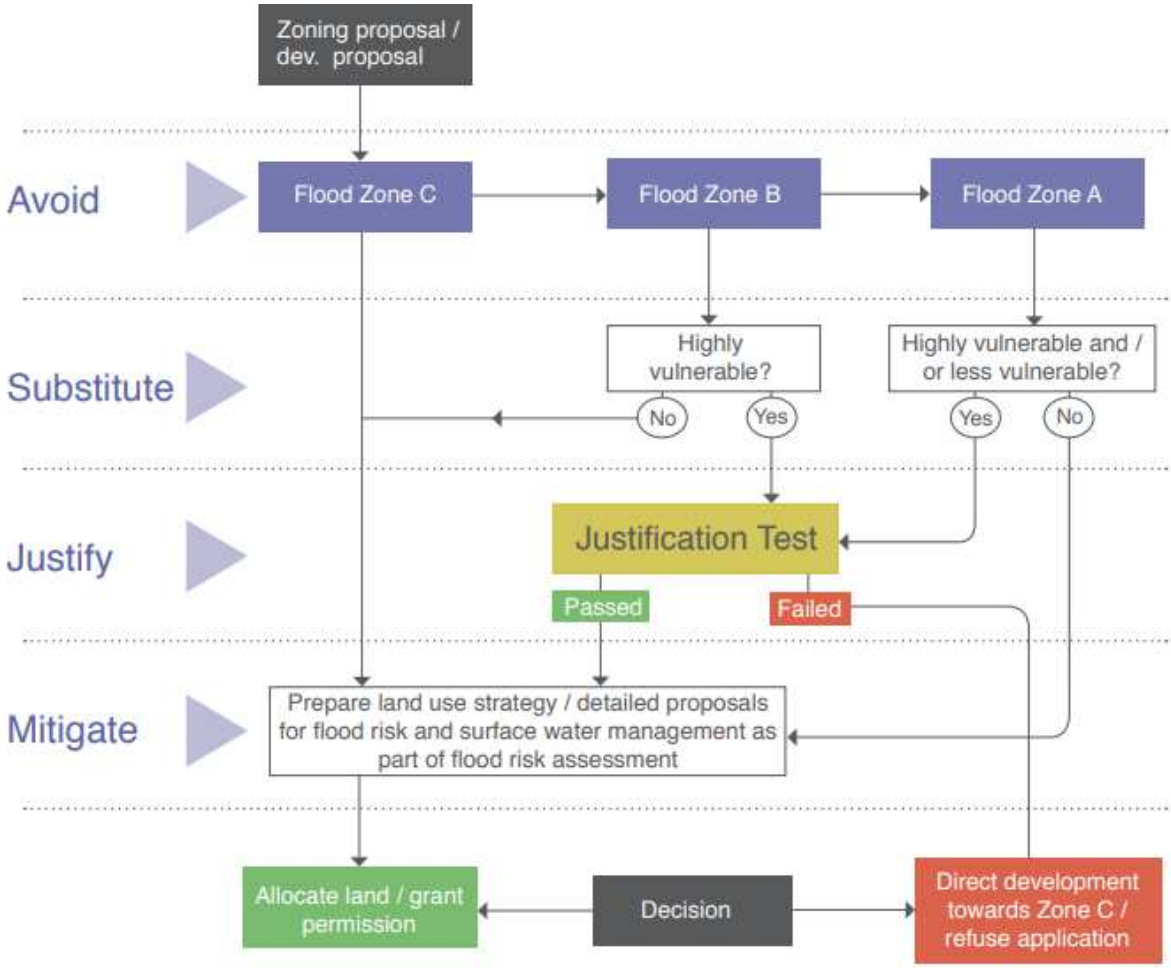

Figure 2.2: Sequential Approach Mechanism in the Planning Process
Source: "The Planning System and Flood Risk Management Guidelines for Planning Authorities, 2009".

Vulnerability class	Land uses and types of development which include*:
Highly vulnerable development (including essential infrastructure)	Garda, ambulance and fire stations and command centres required to be operational during flooding; Hospitals; Emergency access and egress points; Schools; Dwelling houses, student halls of residence and hostels; Residential institutions such as residential care homes, children's homes and social services homes; Caravans and mobile home parks; Dwelling houses designed, constructed or adapted for the elderly or, other people with impaired mobility; and Essential infrastructure, such as primary transport and utilities distribution, including electricity generating power stations and sub-stations, water and sewage treatment, and potential significant sources of pollution (SEVESO sites, IPPC sites, etc.) in the event of flooding.
Less vulnerable development	Buildings used for: retail, leisure, warehousing, commercial, industrial and non-residential institutions; Land and buildings used for holiday or short-let caravans and camping, subject to specific warning and evacuation plans; Land and buildings used for agriculture and forestry; Waste treatment (except landfill and hazardous waste); Mineral working and processing; and Local transport infrastructure.
Water-compatible development	Flood control infrastructure; Docks, marinas and wharves; Navigation facilities; Ship building, repairing and dismantling, dockside fish processing and refrigeration and compatible activities requiring a waterside location; Water-based recreation and tourism (excluding sleeping accommodation); Lifeguard and coastguard stations; Amenity open space, outdoor sports and recreation and essential facilities such as changing rooms; and Essential ancillary sleeping or residential accommodation for staff required by uses in this category (subject to a specific warning and evacuation plan).

Figure 2.3: Classification of vulnerability.
Source: "The Planning System and Flood Risk Management Guidelines for Planning Authorities, 2009".

	Flood Zone A	Flood Zone B	Flood Zone C
Highly vulnerable development (including essential infrastructure)	Justification Test	Justification Test	Appropriate
Less vulnerable development	Justification Test	Appropriate	Appropriate
Water-compatible development	Appropriate	Appropriate	Appropriate

Figure 2.4: Matrix of vulnerability versus flood zone.
Source: "The Planning System and Flood Risk Management Guidelines for Planning Authorities, 2009".

The proposed development comprises mostly of 'built-to-rent' residential apartments and therefore, in accordance to FRM guidelines is considered as a "highly vulnerable development", as can be seen highlighted in figure 2.3 above. However, as the site is not subjected to incur either tidal or fluvial flooding or the combination of both, at any capacity, as can be seen in Stage 1 of this Site Specific Flood Risk Assessment. The site is therefore deemed to be located in a **Flood Zone C** category as can be seen highlighted in figure 2.4 above, meaning a justification test will not be required.

3.0 Stage 1 – Flood Risk Identification

3.1 Site Location

The site is located at Greenhills Road, Walkinstown, Dublin 12, as shown in Figure 3.1 of map below.

Figure 3.1: Site Location.
(Source: Google Earth 2020)

3.2 Previous Flooding Occurrences

Upon inspecting past flooding's in the areas surrounding the site, three recorded flood events have been found. None of the three had any impact on the land mass enclosed within the current site boundary. Refer to Figure 3.2 below for the past flooding events, detailed flooding reports available at floodinfo.ie.

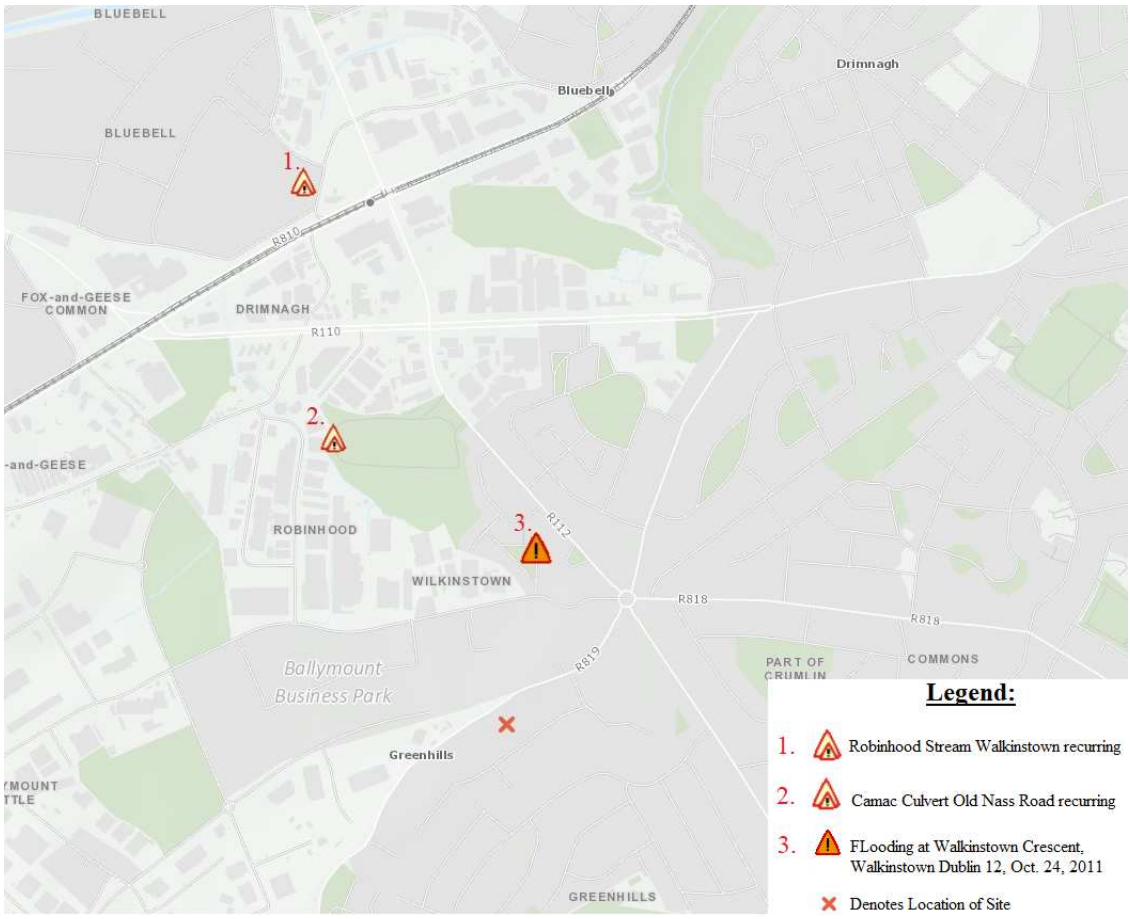

Figure 3.2: Past Flood Events
Source: Floodinfo.ie

3.3 Likelihood of Flooding

3.3.1 Tidal Flooding

In accordance with clause 5.8.2 of the "Strategic Flood Risk Assessment for South Dublin County Council Development Plan 2016-2022" tidal flooding is not a concern for South Dublin County Council (SDCC). Inspection of the Tidal flooding probability maps contained on and accessible through floodinfo.ie further proves that the proposed site is not vulnerable to tidal flooding in any scenario (i.e. 10%, 0.5% or 0.1% AEP).

Figure 3.3: Tidal Flooding
Source: Floodinfo.ie

3.3.2 Fluvial Flooding

Inspection of the Fluvial flooding probability maps contained on and accessible through floodinfo.ie show that the proposed site is not vulnerable to fluvial flooding in any scenario (i.e. 10%, 1% or 0.1% AEP).

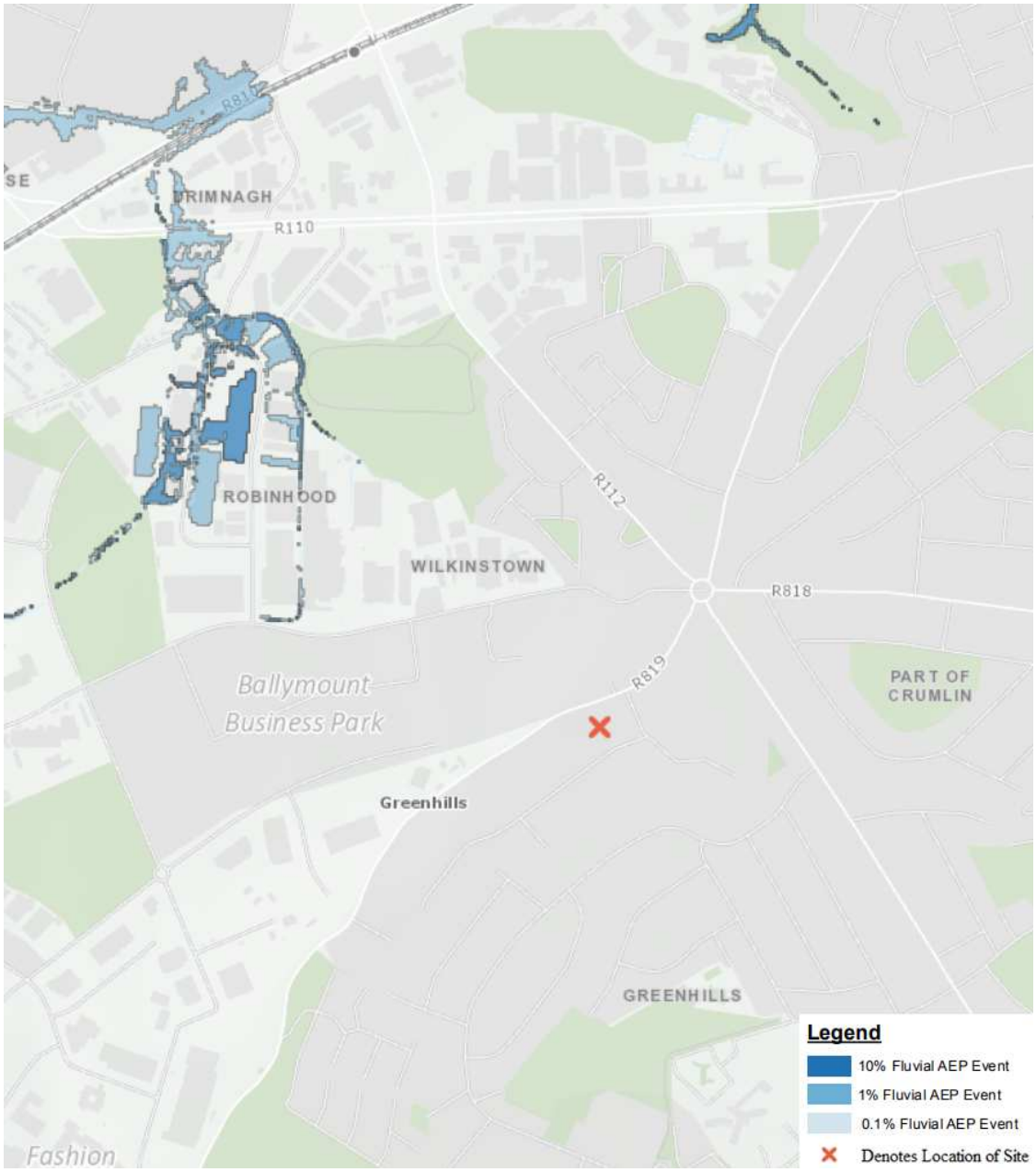

Figure 3.4: Fluvial Flooding
Source: Floodinfo.ie

3.3.3 Pluvial Flooding

Inspection of the Pluvial flooding probability maps contained on and accessible through floodinfo.ie show that the proposed site is vulnerable to pluvial flooding in any scenario (i.e. 10%, 0.5% or 0.1% AEP).

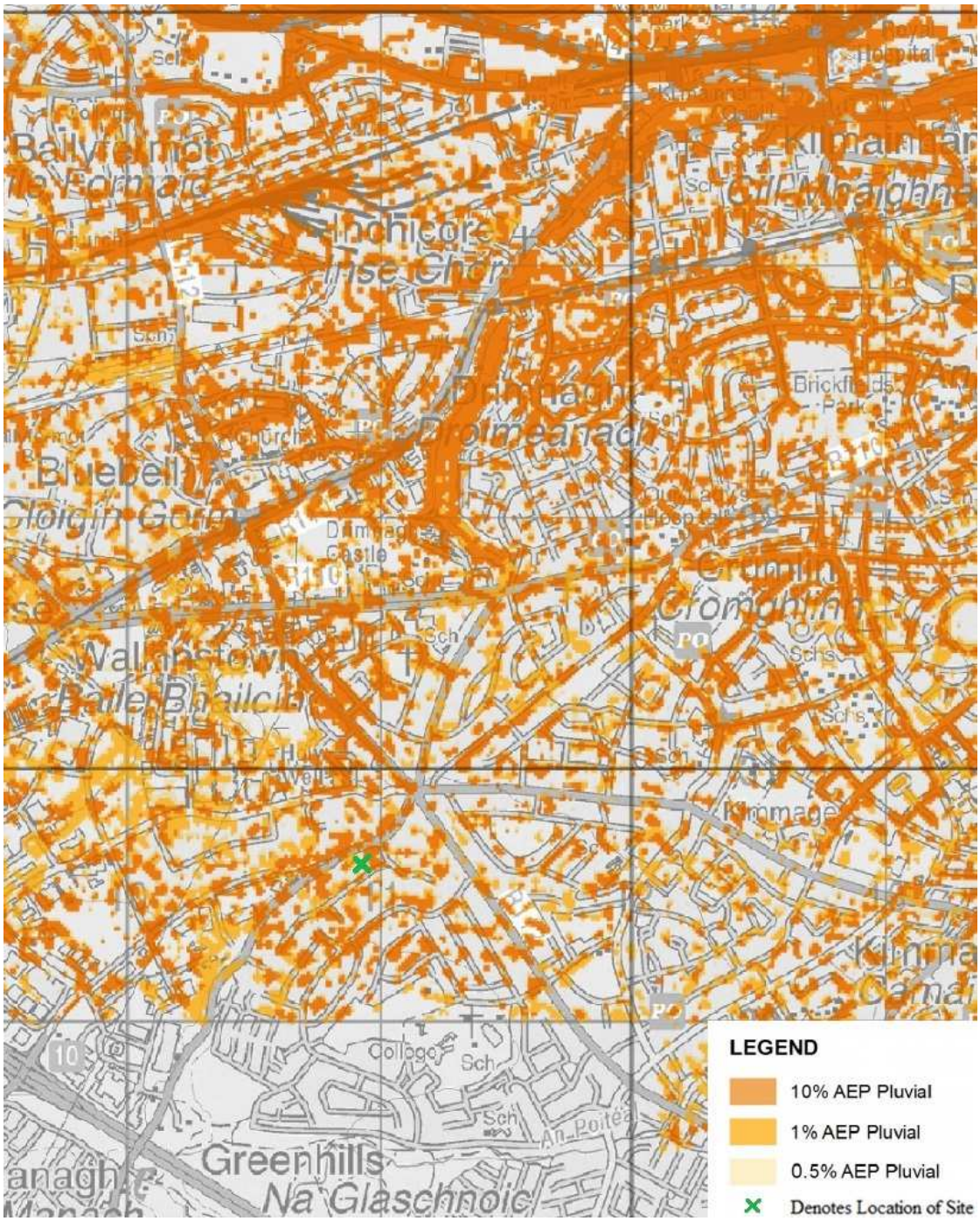

Figure 3.5: Pluvial Flooding
Source: Floodinfo

3.3.4 Groundwater Flooding

Inspection of geological survey of Ireland groundwater vulnerability maps contained on and accessible through gsi.ie show that the proposed site is in a Moderate/High vulnerability zone for groundwater flooding.

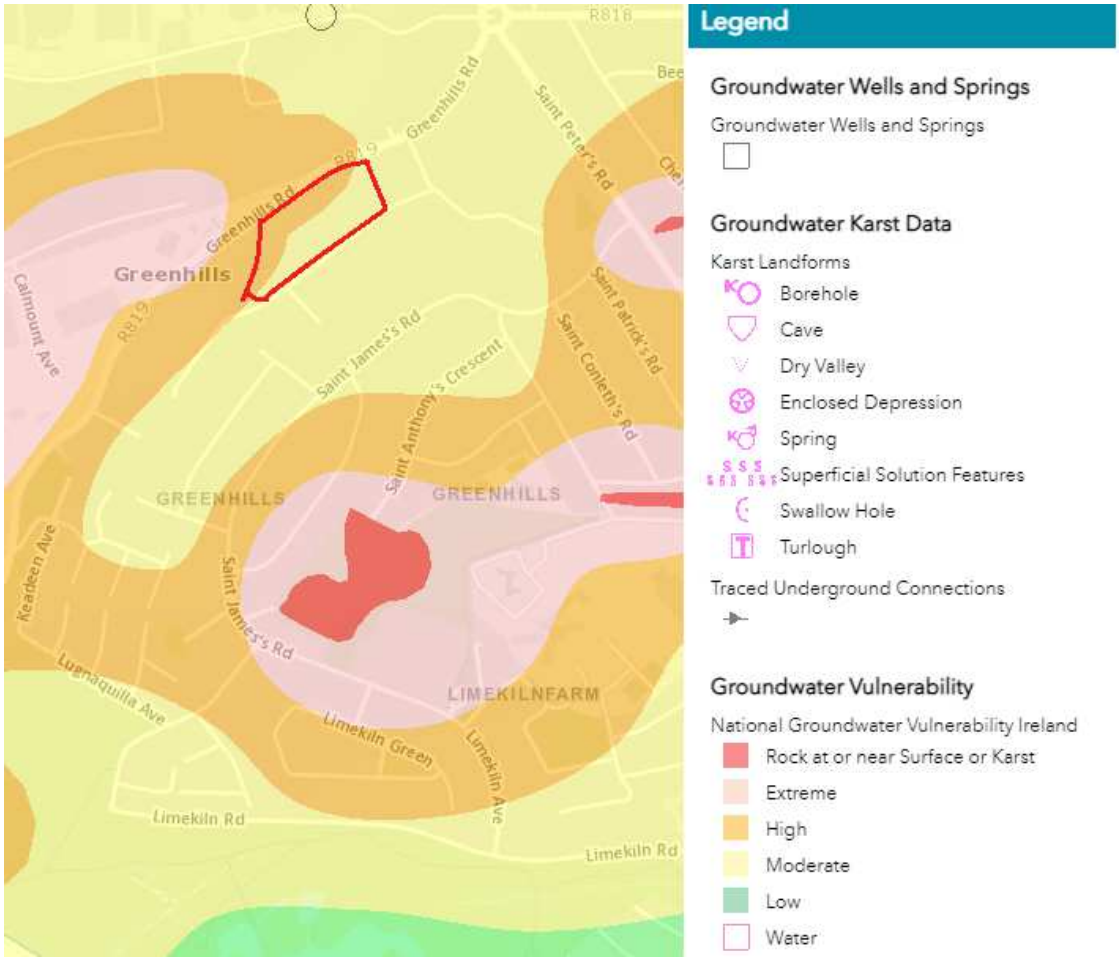

Figure 3.6: Groundwater Vulnerability
Source: Geological Survey of Ireland

3.4 Source Pathway Receptor Model

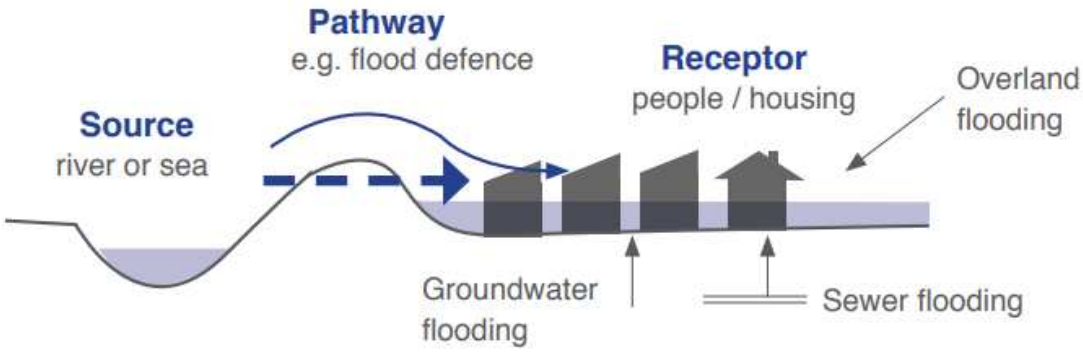

Figure 3.7: Source-Pathway-Receptor Model
Source: "The Planning System and Flood Risk Management Guidelines for Planning Authorities, 2009".

To summarize the sources, pathways and the consequential receptors of all floodings described in Stage 1 of this FRA, a Source-Pathway-Receptor model has been created. The model has been created in accordance with and based on figure 3.7 above extracted from the FRM guidelines.

Source	Pathway	Receptor	Likelihood	Impact	Risk
Tidal	N/A.* Proposed development is not within Tidal flood zone	Proposed Development	Very unlikely	N/A*	N/A*
Fluvial	N/A.* Proposed development is not within Tidal flood zone	Proposed Development	Very unlikely	N/A*	N/A*
Pluvial	Flooding of proposed surface water drainage infrastructure system as a result of heavy rainfall	Proposed Development	Unlikely	Medium	Low
Groundwater	Rising water table on site	Proposed Development	Unlikely	Low	Low

* N/A – Not Applicable

Table 3.1: Source-Pathway-Receptor Model

Review of the results of source-pathway-receptor model tabulated in table 3.1 above indicate that there is a small risk pluvial and groundwater flooding. Pluvial flooding can occur if the proposed surface water drainage sewer is designed incorrectly or incurs blockages during a storm event. Groundwater flooding may happen in the event that the water table on site rises. Both flooding types will be discussed in further detail in stage 2 of this FRA.

3.0 Stage 2 – Initial Flood Risk Assessment

The initial flood risk assessment will look at the identified flood risks from Stage 1 in more detail, determining the origin of the flood, the means of justifying it and if necessary the mitigation measures which need to be implemented.

4.1 Pluvial Flooding

Based on Stage 1 of this FRA and the Source-Pathway-Receptor model tabulated in table 3.1, a risk of potential pluvial flooding has been identified. The cause of pluvial flooding would be the combination of a heavy rainfall event and blockage of the surface water sewer serving the development.

Upon further inspection of the pluvial flood depth maps for the 10% (1 in 10 year flood event) and 1% (1 in 100 year flood event) AEP (Annual Exceedance Probability) flood events, it was determined that the site, without any flood alleviation measures would incur pluvial flooding of up to a maximum depth of 1.5m. As denoted in figures 4.1 & 4.2 below, the site is primarily predicted to flood along the western side in both 10% and 1% AEP flood event scenarios. Other predicted flooding locations within the area of the site include the middle and small patches along the southern, western & northern sides, extents clearly denoted in figures 4.1 & 4.2 below.

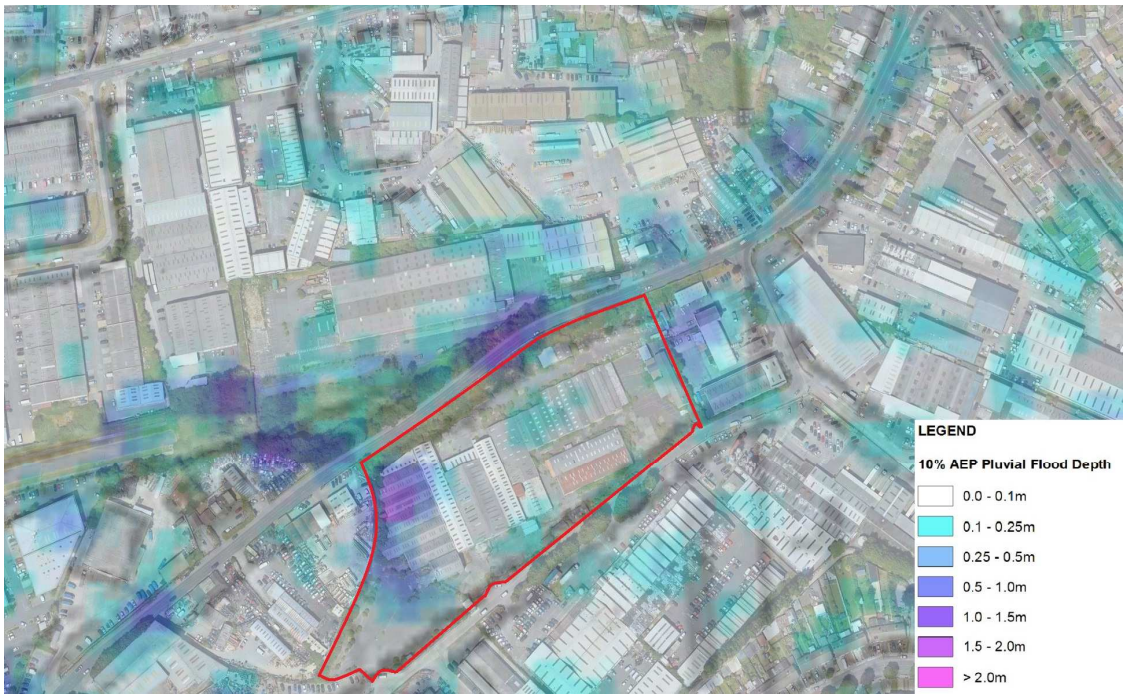

Figure 4.1: 10% AEP Pluvial Flood Depth
Source: Floodinfo.ie

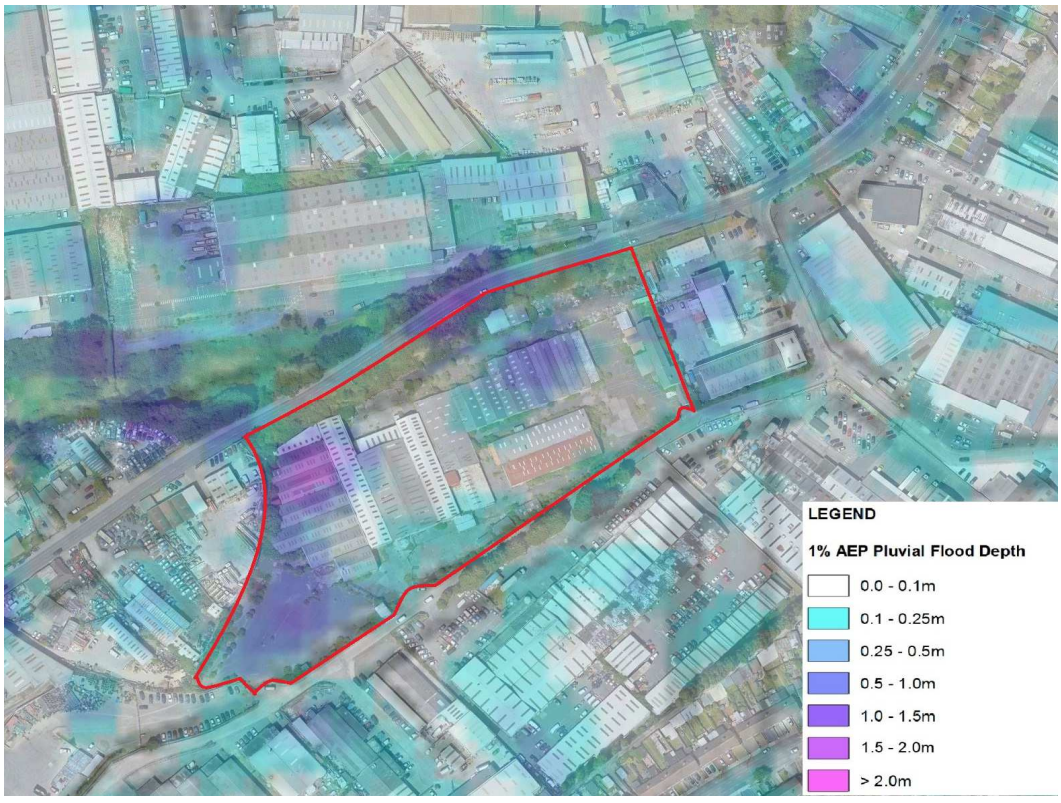

Figure 4.2: 1% AEP Pluvial Flood Depth
Source: Floodinfo.ie

As mentioned above, the site is predicted to flood as a result of pluvial flooding however, this is only true if flood prevention measures are not implemented. As the site will be designed to cater for a 1 in 100 year flood event, the risk of any potential pluvial flooding denoted in figures 4.1 & 4.2 will be mitigated.

Furthermore, in both flood scenarios (i.e. 10% 1% AEP), pluvial flooding on Greenhills Road is shown to be accumulating. Greenhills Road is neighboring the northern site boundary, the possibility of the proposed development being subjected to flooding as a direct result of this will therefore be addressed in further detail. Not the entire road is predicted to flood, the flood depth for the parts which area range from 0.1m to a maximum of 1.5m in an isolated location for both flooding scenarios (i.e 10% & 1% AEP). Review of the road levels, obtained from a topographical survey conducting by Murphy Surveyors indicate that the Greenhills Road is continuously sloping from western towards the eastern direction. See figure 4.3 below, showing the Greenhills Road with the levels extracted from Murphy Surveyors. The total difference in levels between north-west and north-east corners of the site is approximately 7 meters. Flood water entrapment occurrence on a continuously high slopping road is considered very unlikely and therefore the accumulation of pluvial flood water on Greenhills Road is considered as not realistic hence, no risk to the proposed development could be identified.

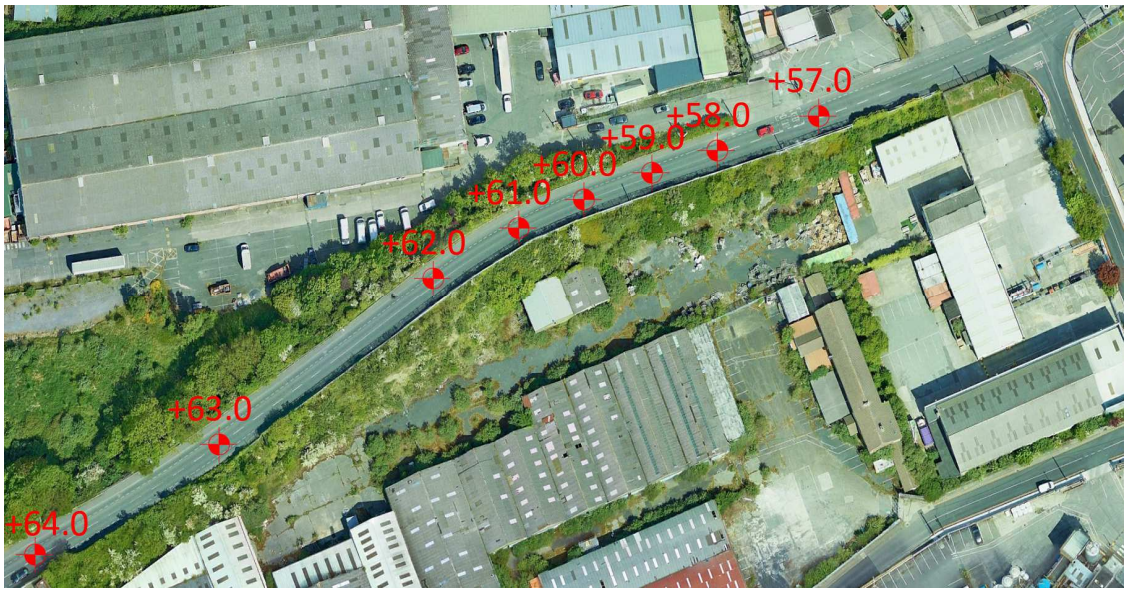

Figure 4.3: Greenhills Road Levels
Source: Google Maps & Murphy Surveyors

4.2 Groundwater Flooding

Based on Stage 1 of this FRA and the Source-Pathway-Receptor model tabulated in table 3.1, a risk of potential groundwater flooding has been identified. The cause of groundwater flooding would be the result of rise of the water table. However, upon the review of ground investigation results, the water table for the site (based on 3 No. of boreholes) was established at an average level of 2.35m below ground level (BGL). As the proposed development will not have a basement, the likelihood of encountering groundwater during construction or the water table rising by 2.35m is considered very unlikely.

Furthermore, there are no groundwater karst features within the area that would indicate a risk of groundwater flooding as can be seen from figure 3.6. Additionally, the OPW Preliminary Flood Risk Assessment does not indicate groundwater to be a risk for the site or the surrounding areas, therefore groundwater will be considered as an unlikely source of flooding for the proposed development and will not progress to Stage 3 of this FRA.

4.3 Flood Alleviation Measures

4.3.1 Permeable Paving

It is proposed to incorporate a permeable paving system into the paved areas surrounding the development, with the aim of reducing run-off from the site in times of precipitation and improving the quality of run-off generally. A minimum of 300mm depth of 63mm-10mm sub base with approximately 30% voids is to be used to provide additional sub-ground storage volume for rainfall events. The intention is to provide a sustainable form of storm water source control within the site that will reduce the total runoff from the site by temporarily retaining the runoff within the pavers/bedding, promoting evaporation and facilitating infiltration into the sub-soil. The quality of run-off from the site shall also be improved due to the filtering process of the paving, which retains silts and degrades hydrocarbons.

4.3.2 Blue Roof

It is proposed to provide an extensive blue roofing system by Bauder, covering 60% of the total roof area with the aim, similarly to a green roof to reduce runoff from the site in times of precipitation and remove the atmospherically deposited urban pollutants. A blue roof will act as a roof level attenuation tank, minimizing the in-ground attenuation tanks at ground level. Rainwater on the blue roof will be absorbed by the vegetation layer, for heavier storm events, when the vegetation layer is no longer capable of retaining any more water. The water will then be deposited into a 100mm deep "Bauder attenuation cell 100" and used by the vegetation layer once it has recovered. In heavy 1 in a 100 year storm event, when the water can no longer be held within the vegetation layer or attenuation cells it will discharge into the surface water sewer located at ground level at a controlled rate via flow restrictors of 2 l/s. In a 1:100yr storm event, with 20% increase in storage volume to allow for climate change and total blue roof area of 5058m^2, the total required attenuation volume equates to 228.45m^3. Refer to the Engineering Services Report, page 1 of Appendix D for attenuation calculations. The total provided attenuation by the blue roofs is 505.8m^3.

4.3.3 Tree Pits

It is proposed to provide a total of 21 tree pits along the southern boundary as can be seen on drawing "20189-LDE-07-00-DR-SC-1C01a". The tree pits will provide a natural source of surface water infiltration & attenuation with the intent of attenuating the adjacent grass verge and cycle path, thus minimizing the in ground attenuation storage requirements. To enable infiltration into the sub-soil, the tree pits will be interlinked together via a 150mm perforated pipe. As a secondary measure of precaution and to prevent damage to trees from too much water ingress, the 150mm perforated pipe will be connected to the last surface water manhole on site SW02. In a 1:100yr storm event, with 20% increase in storage volume to allow for climate change and total area to be attenuated of 1185m^2, the total required attenuation volume equates to 31.668m^3. Refer to the Engineering Services Report, page 2 of Appendix D for attenuation calculations. The total provided attenuation by the tree pits is 54.337m^3.

4.3.4 Green Podium

Similarly to a green roof, it is proposed to incorporate a combination of a soft and a hard landscaping system into the design to form an accessible, intensive green podium. For hard & soft options to be considered as a green roof/podium system, both have to be permeable, capable of filtering the water through into the water storage and drainage layers. The top layers of soft landscaping will consist of an intensive vegetation layer on an intensive substrate layer, while hard landscaping will be consisting of paving blocks on granite chipping/gravel base. The intention is to provide an additional natural and sustainable form of attenuation within the site that will reduce the total runoff from the site by temporarily retaining the runoff within the sedum layer and promoting evaporation. Additionally, green roof/podium surface water treatment process removes atmospherically deposited urban pollutants. Refer to Figure 4.1 below for typical build-up layers of soft & hard landscaped green roofs.

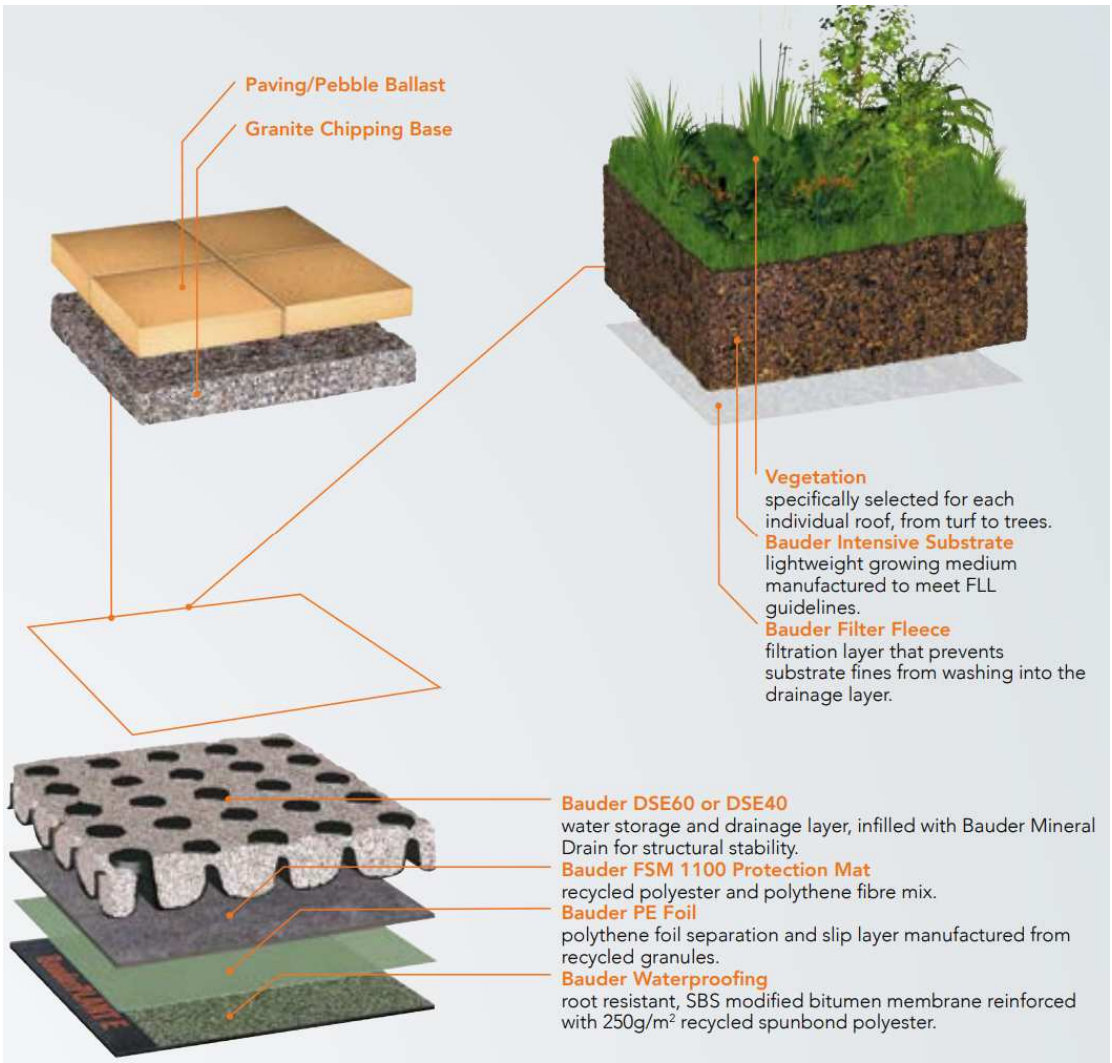

Figure 5: Build-up for soft & hard landscaped Green Roof systems.
(Source: Bauder Green Roof technical design guide 2020).

4.3.5 Attenuation Chambers

It is proposed to provide Stormtech MC-3500 attenuation chambers for the 1:100yr storm event and a 20% increase in storage volume to allow for climate change, equating to a total required attenuation volume of 895.74m^3. Refer to the Engineering Services Report, page 3 of Appendix D for attenuation calculations. The podium slab over the car parking areas is taken as a green podium area and is approximately 8500m^2. This area, the proposed permeable paving areas (6526m^2) and grassed areas (3621m^2) equal to a total area of 18647m^2. For all of the listed areas above, the following impermeability factors have been applied:

- Green podium – 60%
- Permeable paving – 60%
- Grassed areas – 15%

Applying the impermeability factors to the total area (excluding blue roof, tree pits and their associated areas which are not attenuated by an in ground attenuation system) of 18972m^2, a total required impermeable attenuation area of 11984m^2 is generated. For a return period of 2 years, the maximum anticipated run-off is approximately 187.77 l/s. Additionally, the proposed attenuation chambers allow for the removal of total suspended solids and provides easy access for inspection and maintenance. To increase the process of percolation, the attenuation chambers are to be surrounded with a permeable geotextile to promote infiltration.

4.3.6 Rain Gardens

It is proposed to provide rain gardens at both sides of the 6.0m internal access road servicing the development, in-between blocks A and B. The rain gardens will be enclosed within a raised kerb system. To allow rainwater surrounding the rain gardens to enter, the continuous kerb around the perimeter of the rain gardens will be dropped to achieve level access between the rain gardens and the adjacent pavement. Rain gardens be composed of a landscaped area with high permeability soil. Rain gardens will provide treatment to the collected rainwater and promote evaporation. For a heavy rainfall event, to mitigate any potential over flooding of the rain gardens, a 150mm diameter perforated pipe will be provided to drain any excess surface water to the surface water drainage network servicing the development.

4.3.7 Hydro-brake

The maximum run-off for the site has been calculated to be 187.77 l/s. To ensure that the existing surface water sewer is not over capacitated, the flow of surface water leaving the last manhole “SW02” on site (as per Greater Dublin Regional Code of Practice for Drainage Works, Rev 6) will be limited to 8.021 l/s via a hydro-brake, a

flow control device capable of managing the flow rate of water. Refer to the Engineering Services Report Appendix E & F for Q-Bar and run-off calculations.

4.3.8 Petrol Interceptor

All surface water from the car parks will go through a petrol interceptor to separate any hazardous chemicals and petroleum prior to joining the externally situated surface water sewer.

4.0 Stage 3 – Detailed Flood Risk Assessment

The detailed flood risk assessment will go into a detailed explanation of how the development is proposed to mitigate the flood risks from the identified sources.

4.1 Pluvial Flooding

The strategy for managing surface water and mitigating the risk of pluvial flooding for the development is through the use of appropriate SuDS measures. The measures include permeable paving, blue roof, green podium, attenuation tank and a flow control device, all of which are described in detail in clause 4.3 of this FRA. These proposed SuDS measures along with proper implementation of operation and maintenance of the drainage system in accordance with CIRIA 753 and The SuDS Manual will significantly reduce the risk of pluvial flooding as a result of human, mechanical failure or a heavy rainfall event. By designing the surface water drainage infrastructure to withstand a 1 in 100 year storm event the risk of pluvial flooding is deemed to be within acceptable limits.

4.2 Justification Test

As per clause 2.3 of this FRA, the development is considered as a "highly vulnerable" development as can be seen in figure 2.3. However, as the site is not subjected to incur either tidal or fluvial flooding or the combination of both, at any capacity, the development is deemed to be located in a **Flood Zone C** category. In accordance with figure 2.4, the development is considered appropriate and does not require a justification test.

5.0 Conclusions

- Historically, with reference to OPW's past flooding's, the site has never experienced flooding of any kind or capacity.
- The only source of flooding has been identified to be pluvial as a result of sewer blockage, surcharge or a heavy rainfall event. The risk has been mitigated by designing the surface water drainage infrastructure to withstand a 1 in 100 year storm event and introducing regular maintenance and inspection of the surface water network.
- This Flood Risk Assessment for the proposed development has been undertaken in accordance with "The Planning System and Flood Risk Management Guidelines for Planning Authorities, 2009" & "Strategic Flood Risk Assessment for South Dublin County Council Development Plan 2016-2022" documents.
- The development is considered as a highly vulnerable development and is located in a **Flood Zone C** category. This flood zone in accordance with the "The Planning System and Flood Risk Management Guidelines for Planning Authorities, 2009" is considered to be of the lowest significance type flood zone, having a very remote chance and consequential outcome of flooding.
- With reference to the above, it is our opinion that the risk of flooding for the development is minimal and within the acceptable limits.

Mr. Edvinas Valadka B.Eng., **Date: 8th March. 2022**
Engineer,
For Lohan & Donnelly Consulting Engineers.