

Flood Risk Assessment

Phase 2 of Proposed Residential Development at Southgreen, Co. Kildare

March 2026

Waterman Moylan Consulting Engineers Limited
Block S, EastPoint Business Park, Alfie Byrne Road, Dublin 3
www.waterman-moylan.ie

Client Name: Pousterle Limited
Document Reference: 25-003r.002
Project Number: 25-003

Quality Assurance – Approval Status

This document has been prepared and checked in accordance with
Waterman Group's IMS (BS EN ISO 9001: 2015, BS EN ISO 14001: 2015)

Issue	Date	Prepared by	Checked by	Approved by
No. 1	11 July 25	C Maher	P Ingle	I Worrell
No. 2	02 March '26	P. Ingle	I Worrell	

Comments

Disclaimer

This report has been prepared by Waterman Moylan, with all reasonable skill, care and diligence within the terms of the Contract with the Client, incorporation of our General Terms and Condition of Business and taking account of the resources devoted to us by agreement with the Client.

We disclaim any responsibility to the Client and others in respect of any matters outside the scope of the above.

This report is confidential to the Client, and we accept no responsibility of whatsoever nature to third parties to whom this report, or any part thereof, is made known. Any such party relies on the report at its own risk.

Content

1. Introduction 1

2. Subject Site 2

2.1 Existing Site Location 2

2.2 Existing Site Description 3

2.3 Existing Watercourses 4

2.4 Proposed Development 5

3. Flood Risk 7

3.1 Introduction 7

3.1.1 Assessing Likelihood 8

3.1.2 Assessing Consequence 8

3.1.3 Assessing Risk 8

3.2 Flood Zones 9

3.3 Sequential Approach and Justification Test 9

3.3.1 Sequential Approach 9

3.3.2 Justification Test 11

4. Coastal Flooding – Irish Sea 13

4.1 Source 13

4.2 Pathway 13

4.3 Receptor 13

4.4 Likelihood 14

4.5 Consequence 14

4.6 Risk 15

4.7 Flood Risk Mitigation Measures 15

5. Fluvial Flooding 16

5.1 Source 16

5.2 Pathway 16

5.3 Likelihood 16

5.4 Consequence 16

5.5 Risk 16

5.6 Flood Risk Mitigation Measures 16

6. Pluvial 17

6.1 Source 17

6.2 Pathways & Receptors 17

6.3 Likelihood 17

6.3.1 Surcharging of the proposed internal drainage systems leads to internal flooding 19

6.3.2 Surcharging from the existing surrounding drainage system leads to internal flooding 22
6.3.3 Surface water discharge from the subject site leads to downstream flooding 22
6.3.4 Overland flooding from surrounding areas 22
6.3.5 Overland flooding from the subject site causes downstream flooding 23
6.4 Consequence 24
6.5 Risk 24
6.6 Flood Risk Mitigation Measures 24
6.7 Residual Risk 25
7. Groundwater 26
7.1 Source 26
7.2 Pathway 26
7.3 Receptor 26
7.4 Likelihood 26
7.5 Consequence 27
7.6 Risk 27
8. Human / Mechanical Errors 28
8.1 Source 28
8.2 Pathway 28
8.3 Receptor 28
8.4 Likelihood 28
8.5 Consequence 28
8.6 Risk 28
8.7 Flood Risk Mitigation Measures 28
8.8 Residual Risk 28
9. Conclusions and Recommendations 29

List of Figures

Figure 2-1: Site Location Map 2
Figure 2-2: Aerial View of Subject Site (Google Maps) 3
Figure 2-3: Subject Site Topography and Spot Elevations 4
Figure 2-4: Subject Site Location relative to Existing Watercourses 5
Figure 3-1: Source-Pathway-Receptor S-P-R Model 7
Figure 3-2: Indicative flood zone map extract from the Guidelines (DEHLF/OPW) 9
Figure 3-3: Sequential Approach Principles in Flood Risk Management 10
Figure 3-4: Sequential Approach Mechanisms 10
Figure 3-5: Vulnerability Classes 11
Figure 4-1: Google Earth Extract showing Subject Lands in relation to the Irish Sea 13

Figure 4-2: Predictive Flood Map for Kildare Town (Source: Kildare Town LAP SFRA) 14
Figure 6-1: Extract of Kildare LAP Map 10.2 Pluvial Flood Risk Areas Map 18
Figure 6-2: Extract of Kildare LAP SFRA Pluvial Flood Risk Map due to lack of Infiltration Capacity 18
Figure 6-3: Existing Ground Contours of the Subject Lands (Existing Flow Route Analysis) 20
Figure 6-4: Indicative Sketch of Surface Water Flow Paths in Sub-Catchments (Modified Flow Analysis).....21
Figure 6-5: OPW Past Flood Event Summary.....23
Figure 7-1: Extract of GSI Groundwater Flooding Map 26
Figure 7-2: Extract of GSI Groundwater Vulnerability Map 27

List of Tables

Table 3-1: Guidelines for Assessing Likelihood 8
Table 3-2: 3x3 Risk Matrix.....8
Table 3-3: Flood Zone Types according to the Guidelines (DEHLF/OPW) 9
Table 3-4: Matrix of vulnerability vs. flood zone - Justification Test 12
Table 6-1: Pluvial Pathway and Receptor Summary.....17
Table 6-2: Pathway – Residual Risk Identified.....25
Table 9-1: Summary of Flood Risks for the Site.....29

1. Introduction

This Flood Risk Assessment has been prepared by Waterman Moylan Engineering Consultants, on behalf of the Client, Pousterle Ltd, as part of a planning submission for a proposed 146 No. housing development and creche at the proposed Phase 2 Development at Southgreen, Kildare Town, Co. Kildare.

This FRA 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 Flood Risk Assessment references the Eastern CFRAM Study Catchment Analysis. 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.

Supplementary documentation referred to when compiling this report, includes:

- Greater Dublin Strategic Drainage Study (GDSDS) Regional Drainage Policies Volume 2, for New Developments
- The SuDS Manual (CIRIA C753)
- Kildare Town Local Area Plan 2023-2029
- Kildare County Development Plan 2023-2029
- Strategic Flood Risk Assessment of the Kildare County Development Plan 2023-2029
- Strategic Flood Risk Assessment of the Kildare Town Local Area Plan 2023-2029
- Kildare Town Surface Water Study Stage 1 (November 2022)
- Kildare Town Surface Water Study Stage 2 (January 2023)
- Kildare County Council (KCC) Sustainable Drainage Systems (SuDS) Guidance Document.

2. Subject Site

2.1 Existing Site Location

The site is located at Southgreen Road, approximately c. 750 m northwest of Kildare Town in Co. Kildare (as the crow flies) as shown in Figure 2-1, below. The site is bound by Southgreen Road to the west, open lands to the north, Old Road (L7016) to the east, and by the Internal Link Road (SILR) and South Green Phase 1 to the south.

The lands, which are currently in agricultural use, slope generally from west to east. The site area, and area of the redline boundary, is approximately c. 6.13 hectares (ha).

Refer to Waterman Moylan Drawing No. SOU-WMC-PH2-XX-DR-C-P0010 – Site Location Map for the precise site location and surrounding lands.

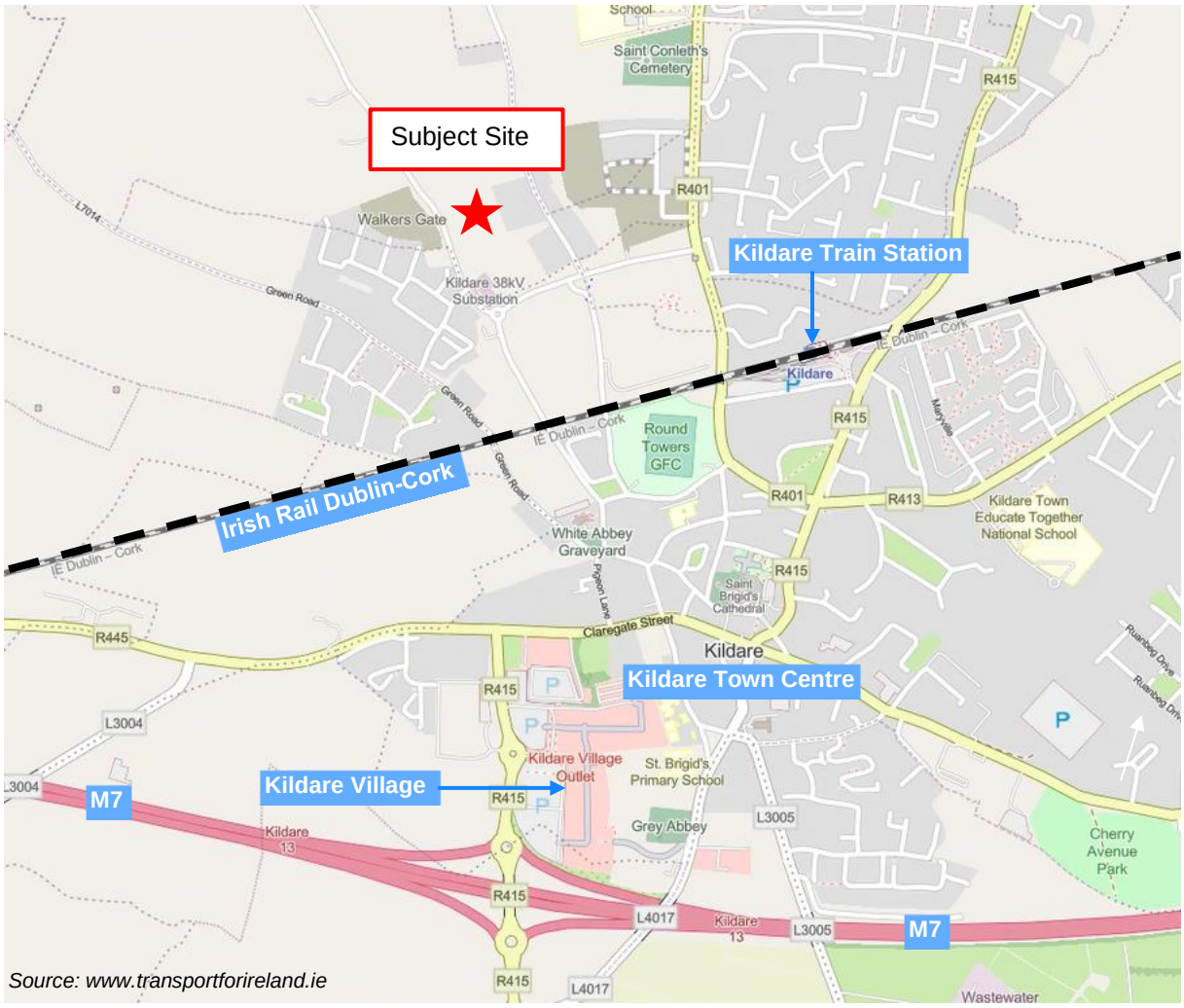


Figure 2-1: Site Location Map

An aerial view of the subject site can be seen in Figure 2-2, below.

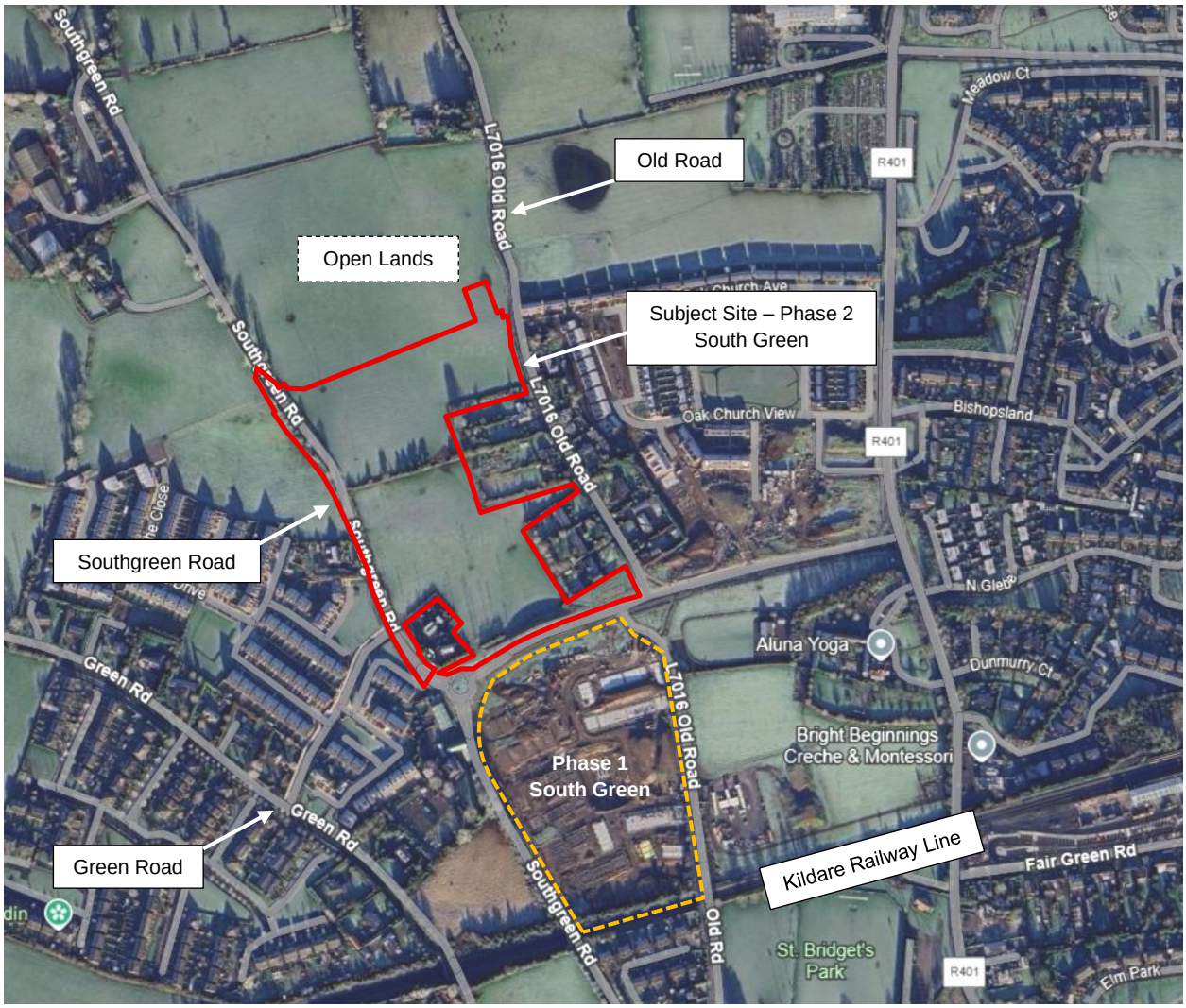


Figure 2-2: Aerial View of Subject Site (Google Maps)

2.2 Existing Site Description

The site has an area, and redline boundary, of c. 6.13 ha and is currently 100% greenfield. The site falls from west to east with a steep gradient of approximately 1 in 25, and less. The site is currently in greenfield condition and is used for agricultural purposes.

The existing topography consists of naturally high ground elevations along the western boundary of the site, with levels ranging from 111.19m OD Malin to 113.79m OD Malin. The site falls to the east where the lowest ground elevations are distributed, these levels range from 106.85m OD Malin to 104.03m OD Malin. The local high point on the site (113.79m OD Malin) is located in the northwest portion of the lands and the local low point (104.03m OD Malin) is located in the central far east area of the lands.

Refer to Figure 2-3 for an illustration of the subject site and existing ground elevations within same.

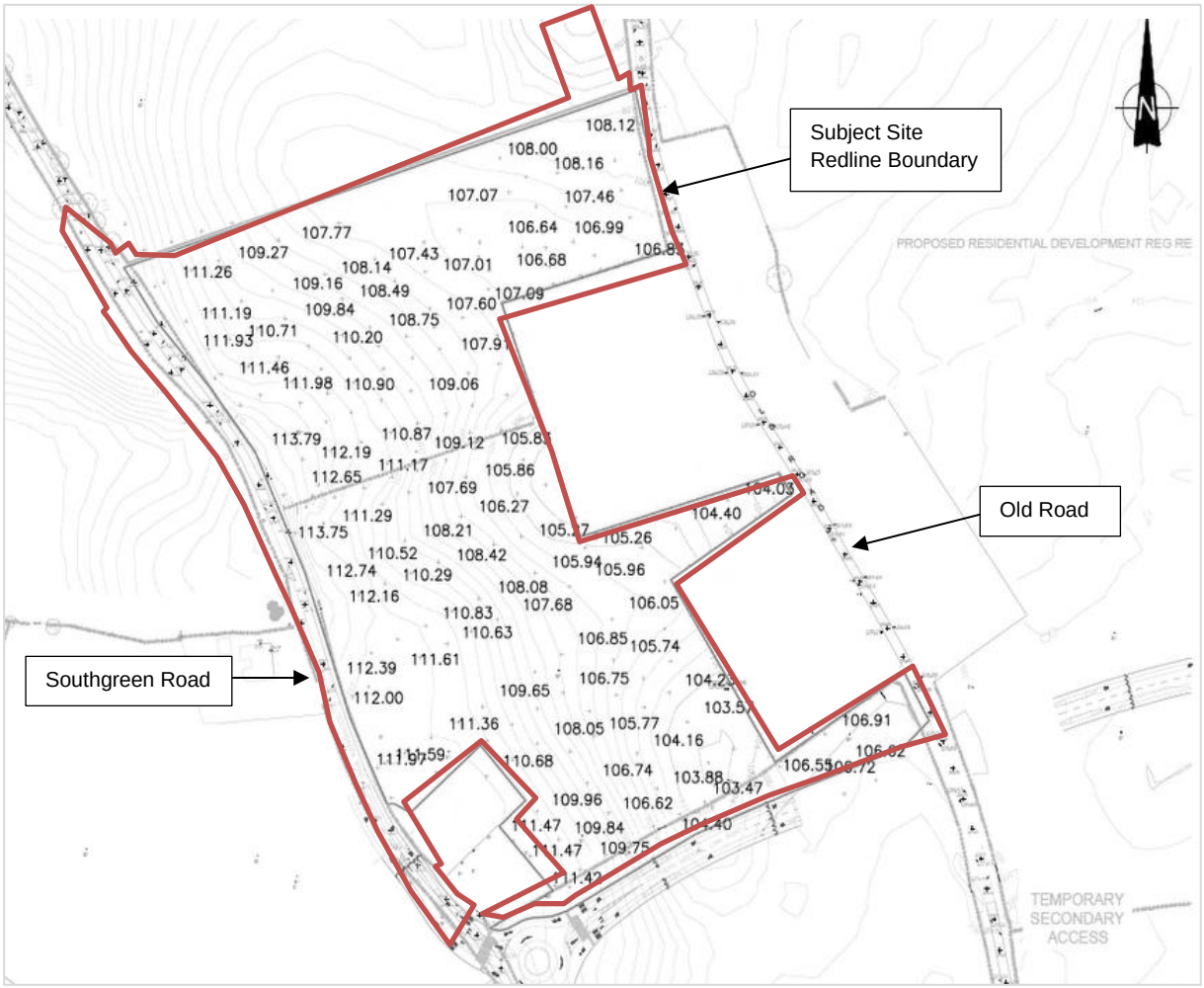


Figure 2-3: Subject Site Topography and Spot Elevations

2.3 Existing Watercourses

The subject development is not situated adjacent to any major watercourses. The surrounding area is primarily characterised by urban and agricultural land with limited surface water features. The nearest notable watercourse is the Tully Stream, located south of the M7 motorway, which flows away from the site and does not have a direct hydrological connection to it. No rivers, streams, or open drainage channels traverse or border the subject lands. As such, the influence of fluvial sources on the site's flood risk is considered to be low.

Refer to Figure 2-4 for an extract from the Environmental Protection Agency (EPA) website, showing a location of the subject lands in relation to the existing watercourse mentioned above.



Figure 2-4: Subject Site Location relative to Existing Watercourses

2.4 Proposed Development

Pousterle Limited intend to apply for permission for development of a Large - Scale Residential Development (LRD) on a site of approx. 6.13 ha at Southgreen Road, Kildare, Co. Kildare. The site is generally bounded to the north by agricultural fields; to the south by the recently constructed Southern Internal Link Road; to the west by Southgreen Road and an existing Electricity Station; and to the east by Old Road and existing residential properties.

The proposed development will consist of:

- The construction of a new residential scheme of 146 no. residential units ranging in height from 1-3 storeys as follows:
    - 136 no. houses (7 no. 2 bed units; 102 no. 3 bed units; and 27 no. 4 bed units) in a mixture of bungalow, detached, semi-detached, and terrace style units ranging in height from 1 – 2 storeys.
    - 10 no. duplex apartment units (5 no. 1 beds, 3 no. 2 beds, and 2 no. 3 beds) in new Block A ranging in height from 2-3 storeys
- Each residential unit will be afforded with private open space in the form of a front/rear/side garden for houses or terrace / balconies for duplex apartment units.

- The provision of a new creche facility (approx. 161 sq m GFA) and associated areas of external open space (approx. 60 sq m) located at Block A.
- Public open space (approx. 6,992 sq m) is proposed in the form of 2 no. new large public open space areas within the site (approx. 3,046 sq m and 3,946 sq m respectively).
- Communal open space (approx. 82 sq m) is proposed adjacent to Block A.
- A total of 321 no. car parking spaces (305 no. for residential units and 16 no. for the creche facility) are provided. This provision includes 2 no. accessible spaces and 17 no. visitor spaces.
- A total of 527 no. cycle parking spaces (517 no. for residential units and 10 no. for the creche facility) are provided. This provision includes 75 no. visitor spaces. Resident cycle parking is proposed in the form of secure bicycle store enclosures to the front of terraced units; on curtilage spaces to the rear of units with side access; and a bicycle store for apartment units located within Block A. Visitor parking is proposed in the form of Sheffield stands.
- The development shall be served via 2 no. new vehicular access points from Southgreen Road. An additional private vehicular access point is proposed via Old Road to service 1 no. new bungalow (4 no. bed residential unit). Provision is also made for future vehicular access via Southgreen Road to serve the open space and amenity zoned lands to the north of the main development site.
- Pedestrian and Cyclist access is also proposed via Southgreen Road and via a new secondary access point from the Southern Internal Link Road to the south of the site and Old Road to the east of the site.
- Upgrades/widening to Southgreen Road including the provision of 2 no. directional single lane cycle tracks and pedestrian footpaths on either side of the Southgreen Road, together with amendments to the existing cycle tracks and footpaths on Southgreen Road north of Southern Internal Link Road are proposed.
- A new pedestrian/cycle link is also delivered to the north of the main development site connecting South Green Road to Old Road.
- The associated site and infrastructural works include provision for an ESB Sub Station; water services; foul and surface water drainage and connections; attenuation proposals; permeable paving; all landscaping works; boundary treatment; PV/Solar Panels; internal roads and footpaths; waste storage areas, all electrical services and all associated site development works.

3. Flood Risk

3.1 Introduction

The flood risk assessment of a development should be carried out in accordance with the Planning System and Flood Risk Management Guidelines for Planning Authorities (2009), published by the Department of Environment, Heritage and Local Government in conjunction with the Office of Public Works (EHLG/OPW). This document will be referred to as the 'Guidelines (EHLG/OPW)' in this report.

The types of possible flooding to be considered in the identification and assessment of flood risk are described in Chapter 2 of the Guidelines (EHLG/OPW) and are summarised below:

- Coastal – flooding from higher sea levels than normal
- Fluvial – flooding from watercourses
- Pluvial – flooding from heavy rainfall/surface water
- Ground Water – flooding from springs / raised groundwater
- Human/mechanical error – flooding due to human or mechanical error

Each type 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. An illustration of this model can be seen in Figure 3-1, taken directly from the Guidelines (EHLF/OPW).

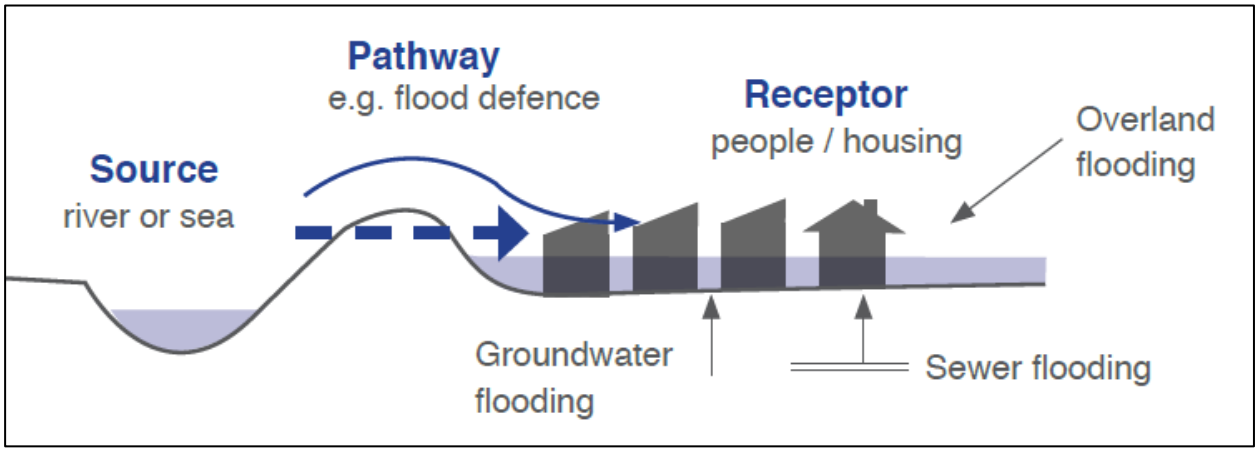


Figure 3-1: Source-Pathway-Receptor S-P-R Model

A flood risk assessment combines these above components and maps or describes the risks on a spatial scale so that the consequences can then be analysed.

The likelihood and the consequences of flooding (overall risk) fall into three categories; low, moderate and high, as described in the Guidelines (EHLF/OPW) and set out in Table 3-2.

The aim of a flood risk assessment is to establish the risk of flooding for a subject site, this can be assessed using two components, summarised below:

Flood Risk = Likelihood of flooding X Consequences of flooding

3.1.1 Assessing Likelihood

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

Table 3-1: Guidelines for Assessing Likelihood

LIKELIHOOD	LOW	MODERATE	HIGH
Coastal	Probability < 0.1%	0.5% > probability > 0.1%	Probability > 0.5%
Fluvial	Probability < 0.1%	1.0% > probability > 0.1%	Probability > 1.0%
Pluvial	Probability < 0.1%	1.0% > probability > 0.1%	Probability > 1.0%

Note: Probability denotes the likelihood of occurrence in a given year.

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

3.1.2 Assessing Consequence

There is no 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 to determine a value for consequences. Consequences will also be categorized as low, moderate, and high.

3.1.3 Assessing Risk

Based on the determined 'likelihood' and 'consequences' values of a flood event and the above equation of Flood Risk = Likelihood of flooding x Consequences of flooding, the 3x3 Risk Matrix seen in Table 3-2 will then be used to determine the overall risk of a flood event.

Table 3-2: 3x3 Risk Matrix

		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

3.2 Flood Zones

Flood zones are used to identify the likelihood, and therefore vulnerability, of flooding in a particular area. The zones are geographical areas with associated ranges of the likelihood of flooding and are essential in the creation of flood risk management plans. According to the Guidelines (DEHLG/OPW) flood zones can be categorised into 3 types or levels of flood zones, namely:

Table 3-3: Flood Zone Types according to the Guidelines (DEHLF/OPW)

Type	Description	Probability of flooding
Zone A	Where the probability of flooding from rivers and the sea is highest	Greater than 1% (1:100 year) for fluvial flooding, or greater than 0.5% (1:200 year) for coastal flooding
Zone B	Where the probability of flooding from rivers and the sea is moderate	Between 0.1% (1:1000 year) & 1% (1:100 year) for fluvial flooding, and 0.1% (1:1000 year) & 0.5% (1:200 year) for coastal flooding
Zone C	Where the probability of flooding from rivers and the sea is low	Less than 0.1% (1:1000 year) for both fluvial and coastal flooding

Flood zone maps are used to establish the level of flooding for a site, an example of this can be seen in the indicative map shown in Figure 3-2.



Figure 3-2: Indicative flood zone map extract from the Guidelines (DEHLF/OPW)

3.3 Sequential Approach and Justification Test

3.3.1 Sequential Approach

A sequential approach to planning is a vital tool in ensuring that development, particularly new development, is first and foremost directed towards the land that is at low risk of flooding. Sequential approaches are already established and working effectively in other areas in the plan-making and development management processes. The sequential approach principles are described in Figure 3-3, taken from the

Guidelines (DEHLF/OPW). The sequential approach should be applied to all stages of the planning and development management process, particularly the planning stage. The mechanism for use of the sequential approach can be seen in Figure 3-4.

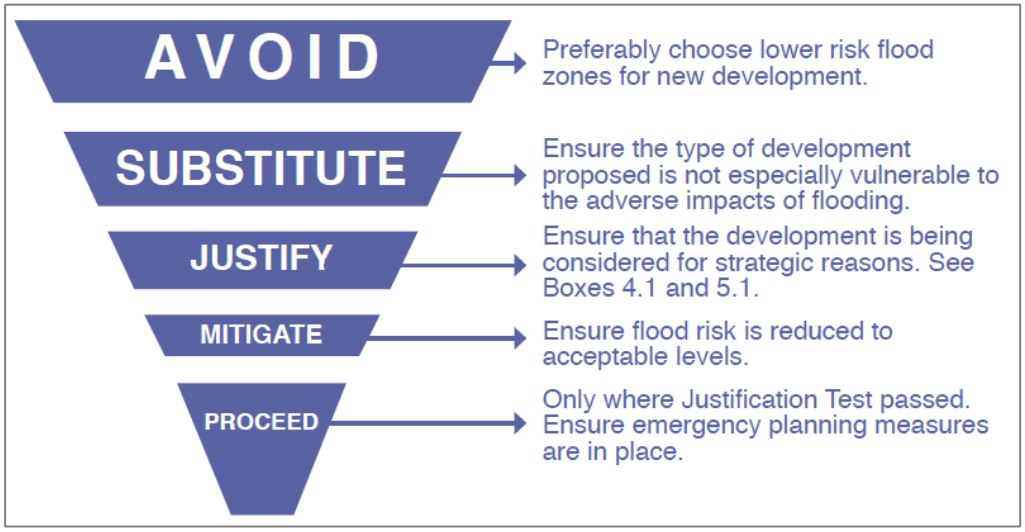


Figure 3-3: Sequential Approach Principles in Flood Risk Management

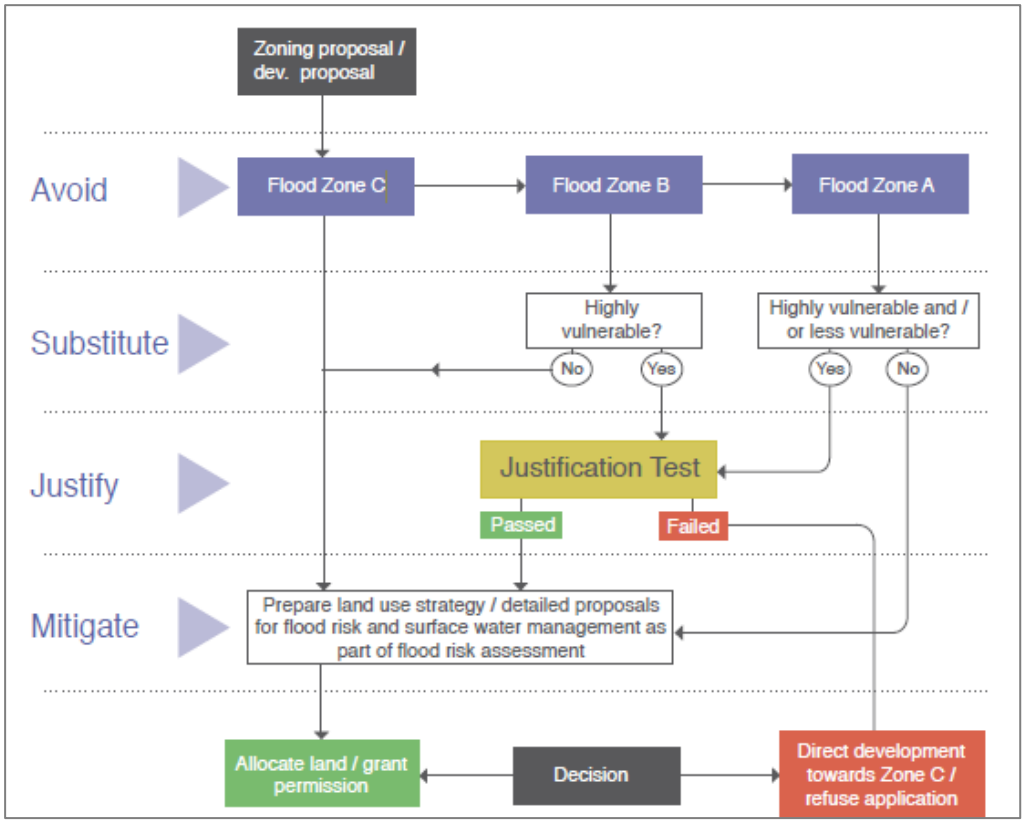


Figure 3-4: Sequential Approach Mechanisms

If the subject site does not fall within the 'Avoid' or 'Substitute' tiers of the sequential approach principle, a Justification test is required.

3.3.2 Justification Test

A matrix of vulnerability versus flood zone clearly outlines which types of development require a Justification Test.

The vulnerability of a site is categorized into 3 levels, highly vulnerable, less vulnerable, and water compatible. Figure 3-5 taken from the Guidelines (DEHLG/OPW) illustrates these categories.

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).
*Uses not listed here should be considered on their own merits	

Figure 3-5: Vulnerability Classes

The resulting matrix of vulnerability vs. flood zone, taken from the Guidelines (DEHLG/OPW), illustrates which type of developments require a Justification Test, and can be seen below.

- **The Subject Site's Vulnerability Class**

  As this subject site falls within the 'Highly-vulnerable development' category according to Figure 3-5, when assessing the matrix vs. vulnerability of the development – with a Flood Zone C development – it is considered to be an "appropriate" development and therefore does not require a Justification Test be completed. Refer to Table 3-4 for the matrix of vulnerability vs. flood zone relevant to the subject site.

Table 3-4: Matrix of vulnerability vs. flood zone - Justification Test

Type	Flood Zone A	Flood Zone B	Flood Zone C
Highly vulnerable development	Justification Test	Justification Test	Appropriate
Less vulnerable development	Justification Test	Appropriate	Appropriate
Water compatible development	Appropriate	Appropriate	Appropriate

Thus, it is considered an appropriate development and **does not require a Justification Test** or further flood mitigation measures other than what is described in this report.

Details pertaining to the Flood Zone of the subject site, Flood Zone C, are discussed in detail in the sections to follow within this report.

4. Coastal Flooding – Irish Sea

4.1 Source

Coastal flooding occurs due to elevated sea levels, mainly driven by storm surges. This results in the overflowing of the sea or tidally influenced rivers onto the land. This type of flooding is primarily influenced by high tides and storm surges, which are caused by factors like low atmospheric pressure and strong winds, along with wave action.

4.2 Pathway

The Irish Sea is approximately c. 56 km east of the subject site. The lowest FFL of the proposed development is set at 106 m OD Malin. The location of the subject lands in relation to the Irish Sea is shown in a Google Maps image extracted to Figure 4-1.

Given the position and elevation of the subject site in relation to the Irish Sea, there is no risk of coastal flooding. It is therefore evident that a pathway does not exist between the source and the receptor. A risk from coastal flooding is therefore considered negligible and no flood mitigation measures need to be implemented.



Figure 4-1: Google Earth Extract showing Subject Lands in relation to the Irish Sea

4.3 Receptor

As there is no possible or practical pathway for coastal flooding to the subject site, no receptor of coastal flooding exists.

4.4 Likelihood

There is no likelihood of flooding from coastal sources to the subject site as there is no pathway of this type of flooding.

The Kildare Town Local Area Plan 2023-2029 – Strategic Flood Risk Assessment (SFRA) indicates no areas in the town of Kildare are at risk of flooding from coastal or fluvial sources and that the town in its entirety is within Flood Zone C. An extract of Figure 5-3 from the referenced document can be seen in Figure 4-2 below. The map includes flooding events for the following:

- Catchment-based Flood Risk Assessment and Management (CFRAM) 0.1% Annual Exceedance Probability (AEP)
- CFRAM 1% AEP
- CRFRAM 10% AEP

The 0.1% AEP would illustrate the most severe of the flooding possibilities of the above flood events and corresponds to the 1-in-1000-year flood event for both the coastal and fluvial flooding events. As can be seen in the below figure, the subject site is not at risk of the 0.1% AEP flood event from coastal flooding.

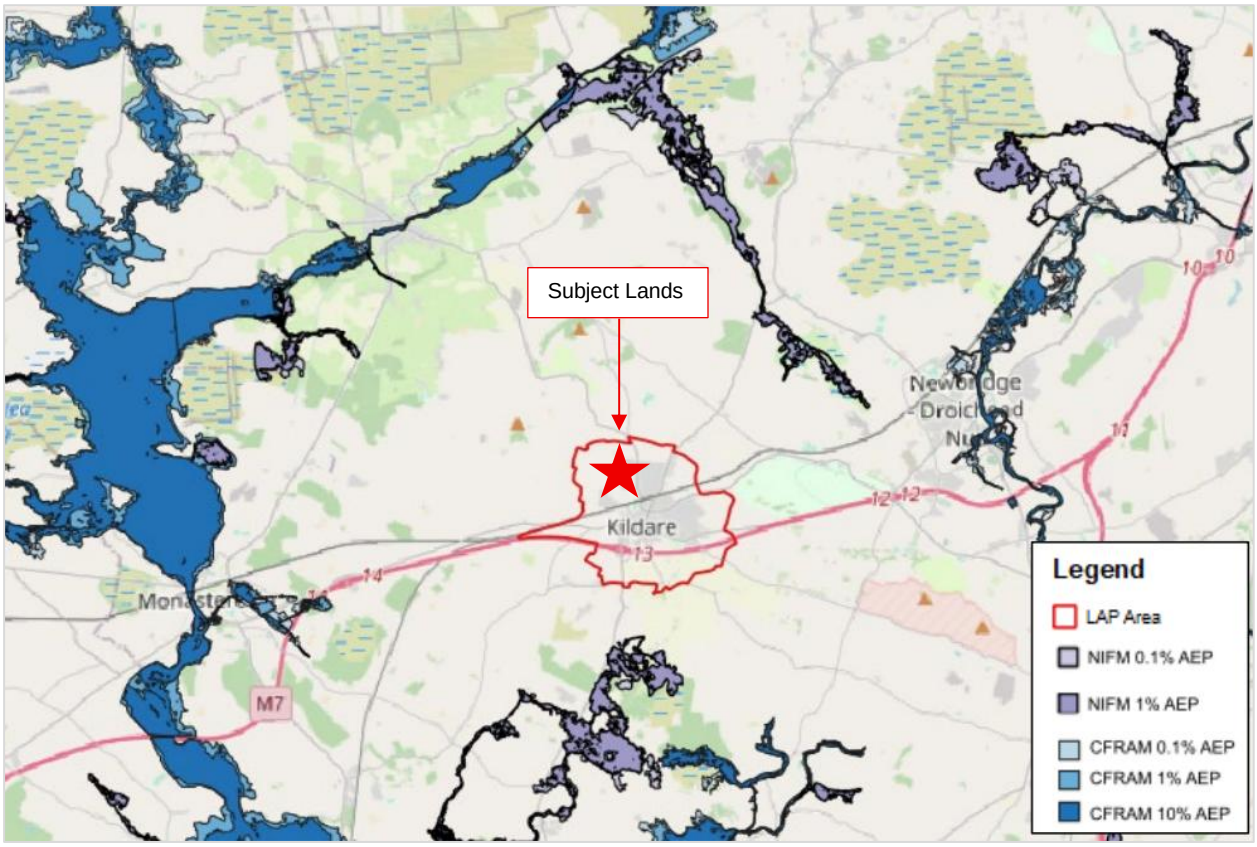


Figure 4-2: Predictive Flood Map for Kildare Town (Source: Kildare Town LAP SFRA)

4.5 Consequence

With no likelihood of coastal flooding, the consequence is thus considered negligible.

4.6 Risk

With a negligible likelihood and negligible consequence of flooding from coastal sources, the resultant risk is also considered to be negligible for the subject development.

4.7 Flood Risk Mitigation Measures

None required.

5. Fluvial Flooding

5.1 Source

Fluvial flooding is caused by rivers, watercourses or ditches exceeding their capacity and excess water spilling out onto the adjacent floodplain.

5.2 Pathway

The potential pathway for fluvial flooding from existing watercourses would involve overland flow through developed lands and across the M7 motorway, originating from flood extents to the south, where the Tully Stream is located. The estimated length of this potential flood pathway is approximately 2.1 kms.

5.3 Likelihood

According to Google Earth, the estimated ground level at the closest segment of the Tully Stream to the subject site is c. 89 m OD Malin. Considering the unlikely potential pathway through open lands and the M7 and considering the lowest proposed FFL of the development is set at 106 m OD Malin, c. 20 m above the stream level, the likelihood of flooding from this fluvial source is considered to be low.

Referring again to Figure 4-2 of the to the Kildare LAP 2023-2029 SFRA's predictive flood map for the Town of Kildare, the subject site is not at risk of the 0.1% AEP flood event from fluvial flooding.

5.4 Consequence

The consequence of fluvial flooding would include flooding of the internal roads network and open green space areas. The consequence of such flooding is considered to be low.

5.5 Risk

With a low likelihood and low consequence of flooding from fluvial sources, referring to Table 3-2, the resultant risk is considered to be low for the subject development.

5.6 Flood Risk Mitigation Measures

As the risk is considered low, there are no mitigation measures required.

6. Pluvial

6.1 Source

The source of pluvial flooding is heavy rainfall.

6.2 Pathways & Receptors

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

Table 6-1: Pluvial Pathway and Receptor Summary

	Pathway	Receptor
1	Surcharging of the proposed internal drainage systems during heavy rain events leading to internal flooding.	Proposed development – internal roads, footpaths and green space areas
2	Surcharging from the existing surrounding drainage system leads to flooding within the subject site by surcharging surface water pipes	Proposed development – internal roads, footpaths and green space areas
3	Surface water discharging from the subject site to the existing drainage network leads to downstream flooding	Downstream properties and public roads
4	Overland flooding from surrounding areas flowing onto the subject site	Proposed development – internal roads, footpaths and green space areas
5	Overland flooding from the subject site flowing onto surrounding areas	Downstream properties and roads

6.3 Likelihood

Areas where potential pluvial flood risk exists (i.e. flooding caused by high intensity overland rainfall) in the town of Kildare is outlined in Map 10.2 of the Kildare Town LAP (2023-2029) Appendix A Maps, extracted to Figure 6-1, below. According to the figure, the northeast corner of the subject development falls under an area of potential risk of pluvial flooding. The subject lands will be assessed for pluvial flood risk and appropriate mitigation measures discussed, under this Chapter of the report.

According to the Kildare Town LAP SFRA, several areas within Kildare Town have been identified as experiencing infiltration capacity issues. These areas, where surface water infiltration into the ground is limited, are illustrated in Figure 6-2**,** below.

Figure 6-2 also highlights locations at risk of pluvial flooding as a result of these infiltration constraints. It is noted that the subject lands are not situated within any of the areas identified as being at risk of pluvial flooding from infiltration constraints.

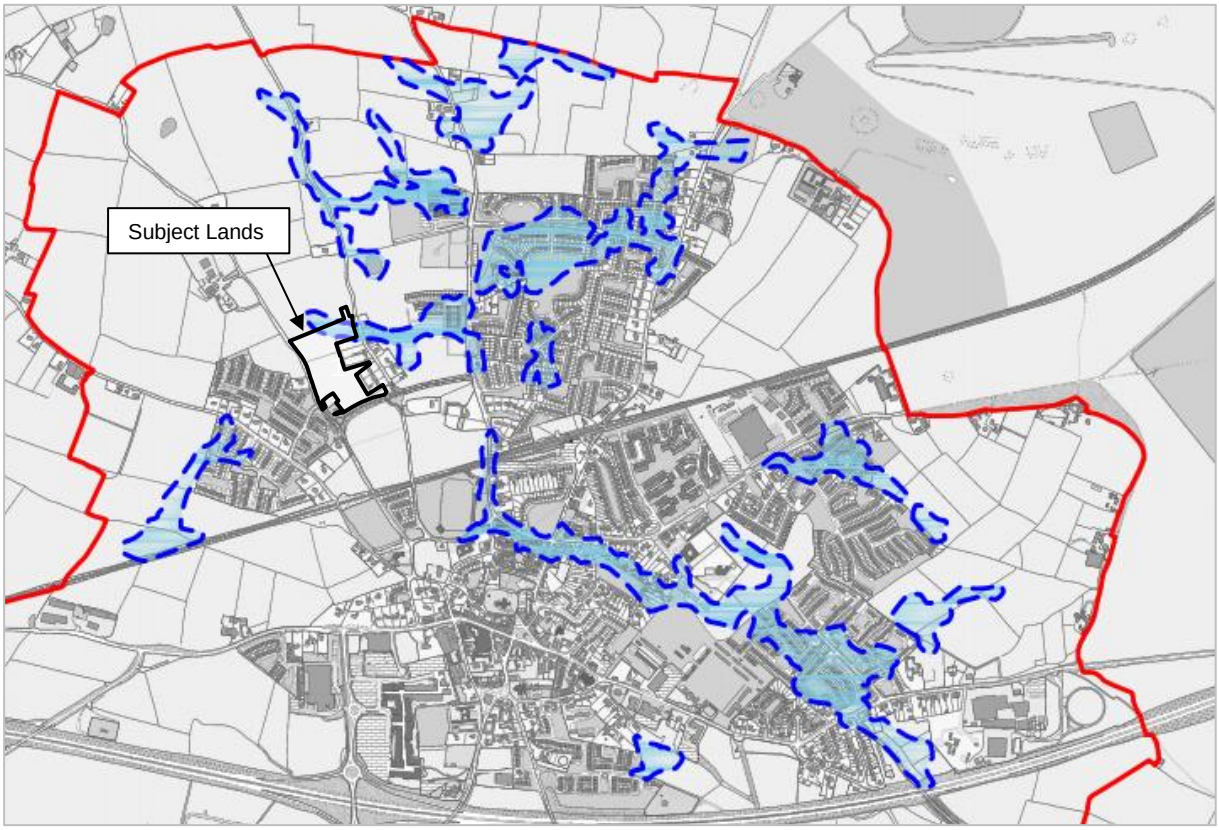


Figure 6-1: Extract of Kildare LAP Map 10.2 Pluvial Flood Risk Areas Map

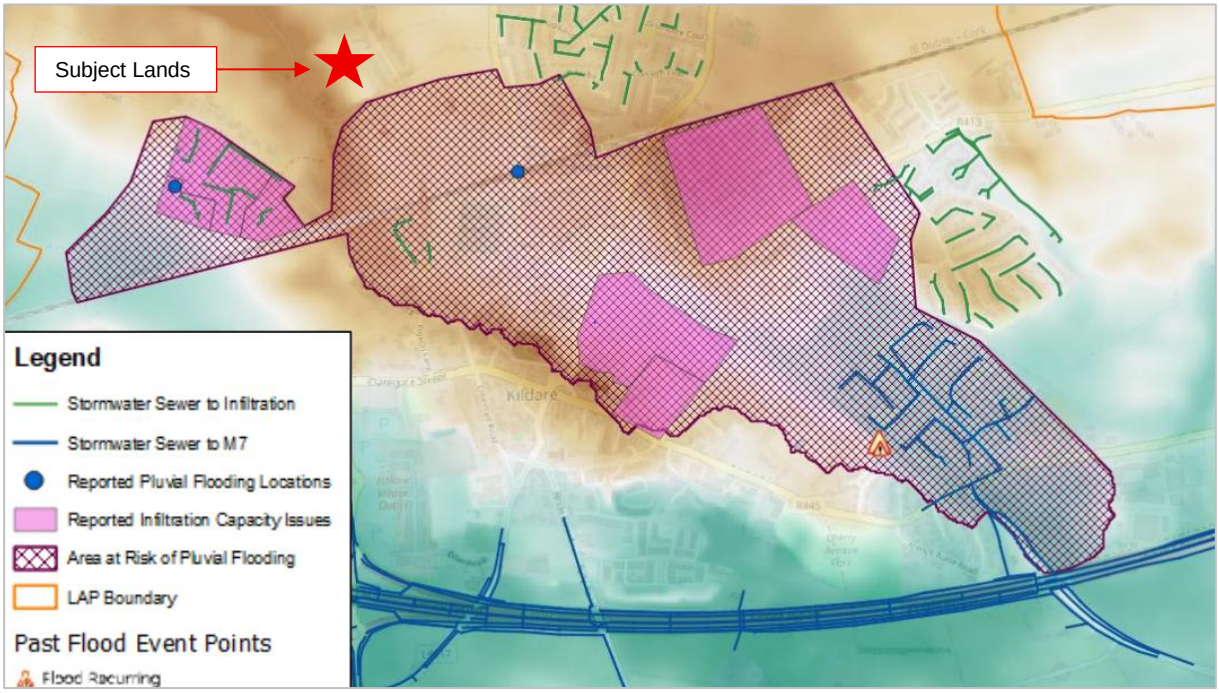


Figure 6-2: Extract of Kildare LAP SFRA Pluvial Flood Risk Map due to lack of Infiltration Capacity

Flooding may occur through any of the pathways outlined in Figure 6-1, the likelihood of flooding via. each of the pluvial pathways is discussed below.

6.3.1 Surcharging of the proposed internal drainage systems leads to internal flooding

The proposed on-site drainage strategy includes the discharge of surface water into attenuation areas that include an above ground detention/retention basin and below ground infiltration system within Catchments A, B1, and C (south, centrally, and north of the subject development). The system has been preliminarily sized to accommodate flows from a 1-in-100-year storm event, incorporating an additional 30% allowance for climate change and 10% for urban creep, in line with best practice guidance.

Given that the drainage network is designed primarily for attenuation and infiltration, surcharging of the on-site system during higher return period storm events is unlikely to result in surface flooding, provided the infiltration performance is achieved in practice.

A detailed hydrogeological investigation of the subject lands was undertaken by Verde in December 2025. The Hydrogeological Report with reference S45476 provides a comprehensive understanding of the groundwater system within the lands. The Verde Report is included as part of this subject application under a separate cover.

Borehole tests were undertaken at the proposed attenuation areas within the subject development. According to the Verde Report the permeability can be summarised as "*Overall, it can be seen from the permeability tests that the subsoils at the proposed SuDS location have permeability rates which are considered moderate within the silty, sandy, GRAVEL subsoils of the regionally important Curragh West sand and gravel aquifer. Moderate vulnerability includes a wide range of permeability values (1 x 10^{-4} m/s down to about 1 x 10^{-8} m/s) (WFD Strive Programme 2007-2013).*"

In general, the upper 4-5 m soils below ground level (BGL) were found to be low permeability silty / gravelly CLAY with soils below 4-5 m BGL found to be silty, sandy GRAVELS with proven permeability. Essentially, permeability only becomes viable once the gravel horizon is intercepted.

The sustainable urban drainage systems (SuDS) proposed for the subject development include swales located adjacent to hardstanding roads and footpaths areas, permeable paving below all parking spaces and private driveways, bio-retention tree pits strategically placed adjacent to hardstanding areas, above ground detention basins, and below ground infiltration systems.

The use of distributed SuDS features offers a resilient solution by capturing and managing runoff close to source, reducing the load on conventional pipe networks. Therefore, the risk of resultant flooding is considered low due to the robustness and redundancy built into the proposed attenuation and infiltration systems.

In addition, the designed levels fall away from the buildings to route any surcharged surface water away from structures and overland, either flowing towards the attenuation areas or exiting the subject lands via an appropriate exceedance route. An existing and modified flow route analysis has been completed for the proposed development. The existing flow route analysis for the subject lands is included in Figure 6-3, below. This analysis represents the direction of rainfall runoff within the subject lands based on the existing contours and site slopes.

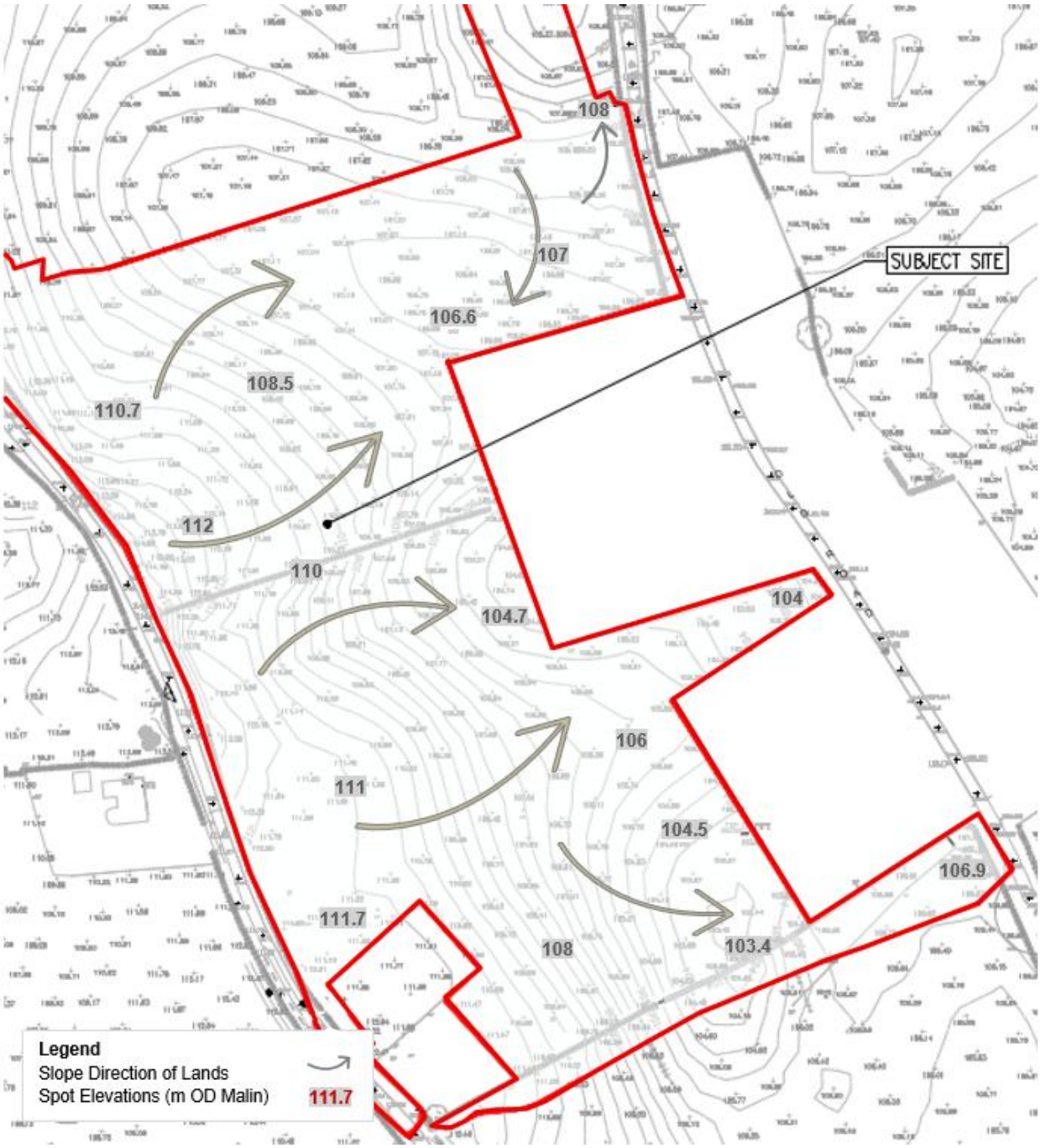


Figure 6-3: Existing Ground Contours of the Subject Lands (Existing Flow Route Analysis)

The modified flow route analysis, also representing the exceedance route, of the proposed development based on the designed site levels can be seen in Figure 6-4, below. Figure 6-4 is extracted from Waterman Moylan Drawing No. SOU-WMC-PH2-XX-DR-C-P0235 Existing & Modified Flow Paths, submitted as part of the subject application. As shown in the below figure, surface water flows overland within the subject development to the internal roads network. As part of the surface water management strategy, an exceedance route is included to the north of the development, into the open green space area and the norther attenuation area (above ground detention/retention basin and below ground infiltration system). A

secondary exceedance route exists with runoff conveyed to the 2 No. open green space and attenuation areas within the proposed development and ultimately to the existing road south of the development, external to the site.

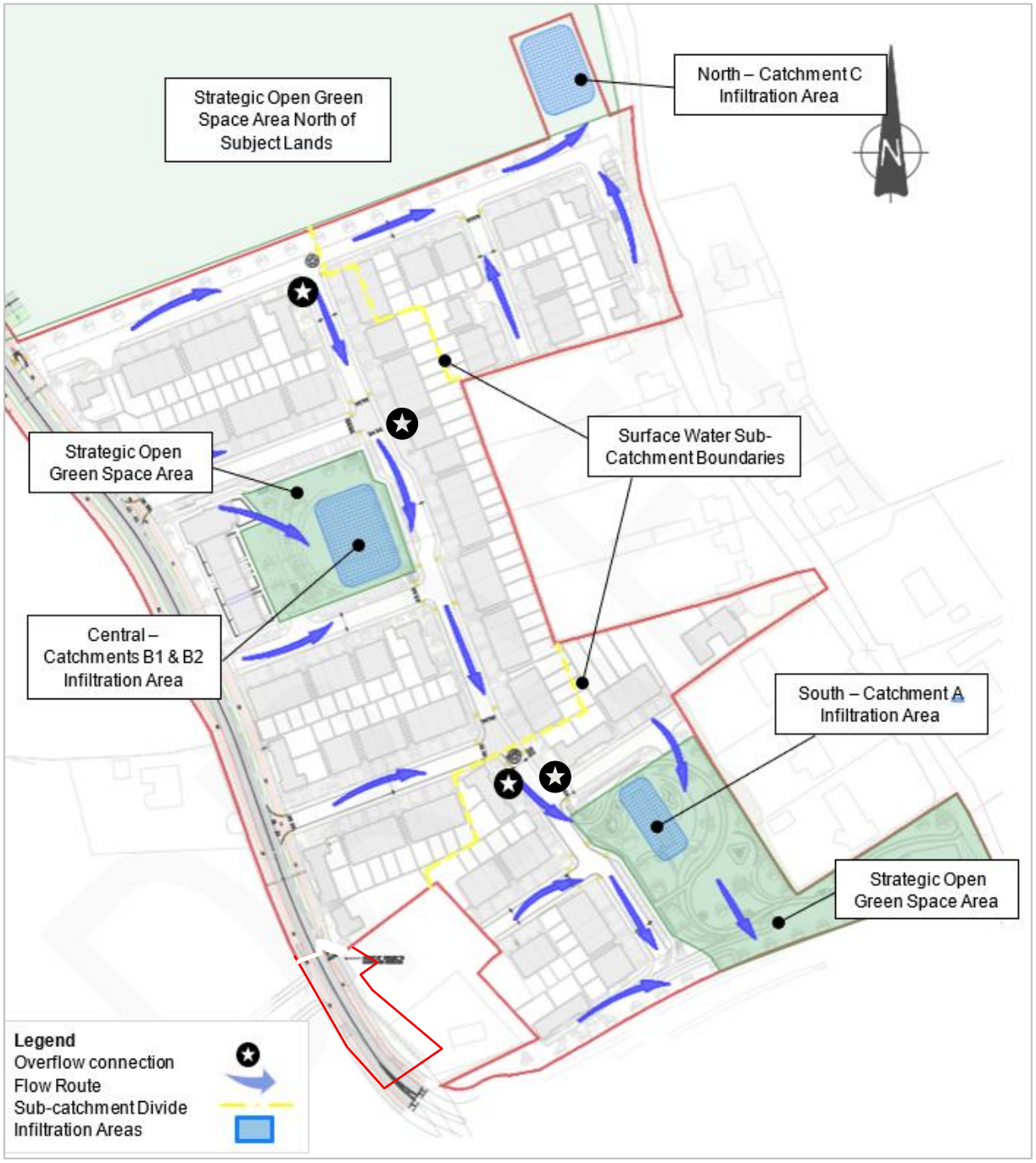


Figure 6-4: Indicative Sketch of Surface Water Flow Paths in Sub-Catchments (Modified Flow Analysis)

The likelihood of the subject development flooding due to surcharging of the proposed internal drainage system is considered to be low.

6.3.2 Surcharging from the existing surrounding drainage system leads to internal flooding

There is no existing surface water drainage surrounding the subject site and therefore the likelihood of flooding is low.

Surcharging of the subject lands from the areas at risk of pluvial flooding due to infiltration overload (Figure 6-2) does not present a flood risk to the subject lands, owing to the existing site levels and topographical contours. In general, the lands located north of the Kildare Railway Line slope from north to south, directing surface water away from the subject site.

The likelihood of flooding on the subject development due to surcharging from the existing surrounding drainage system is considered to be low.

6.3.3 Surface water discharge from the subject site leads to downstream flooding

The proposed development site is 100% greenfield. The development, as designed, will increase the impermeable area on site. As a result, the volume and rate of run-off from the site will increase. However, in order to mitigate this, various SuDS features are proposed as part of the surface water management strategy for the proposed development, as discussed under Chapter 6.3.1, above. These SuDS features will capture, collect, slow, and reduce the volume of run-off within the site during storm events. The surface water will be attenuated on site and allowed to percolate into the ground fully at the designated attenuation areas within each sub-catchment.

No rainfall runoff is intended to leave the site. However, as part of due diligence, in the event of a system failure, an exceedance route is designed within the proposed development to convey runoff overland, on the internal roads network. The overland flood route leads to the proposed attenuation areas or externally to existing roads networks where runoff will fall with the slope of the roads network.

The likelihood of the proposed development resulting in pluvial flooding downstream of the site is therefore considered moderate.

The control measures implemented to prevent flooding and to ensure that access is maintained along the internal estate road network during high rainfall events include the following:

- Attenuation areas designed to cater for up to the 1-in-100-year storm event with an additional 30% climate change and a 10% urban creep factor. This will result in runoff being stored within the attenuation area during the extreme storm event and not within the road network.
- Adequate exceedance routes through the site to which diverts runoff towards the attenuation areas.
- Setting of finished floor levels generally at least 500 mm above the proposed top of water level in the proposed detention basins and 300 mm above road levels. This provides adequate freeboard in the event of surface water surcharging of the surface water network. The surcharged surface water will flow within the road network and be diverted towards the attenuation areas or the external roads network through flood routing.

6.3.4 Overland flooding from surrounding areas

The Office of Public Works (OPW) records for predictive and historic flood maps have been consulted for recorded flood events in the vicinity of the subject site. There is a singular. historic flood event in the vicinity

of the subject site (within a 2.0 km radius). Refer to Figure 6-5 for an extract of the past flood event local area summary report retrieved from floodinfo.ie, for details.

The nearest reoccurring flood event to the subject lands has a flood ID of 1487. Figure 6-1 indicates various historical flooding events within the Kildare Town area. There are 1 recorded recurring instances of flooding in this area. This flood location is c. 1.8 km from the subject site (as the crow flies) and does not reflect a flood risk to the development. Based on available and recorded information as outlined, the development site is considered not to have been subject to flooding in recent history.

The likelihood of overland flowing of the subject development from surrounding areas is thus considered to be low.

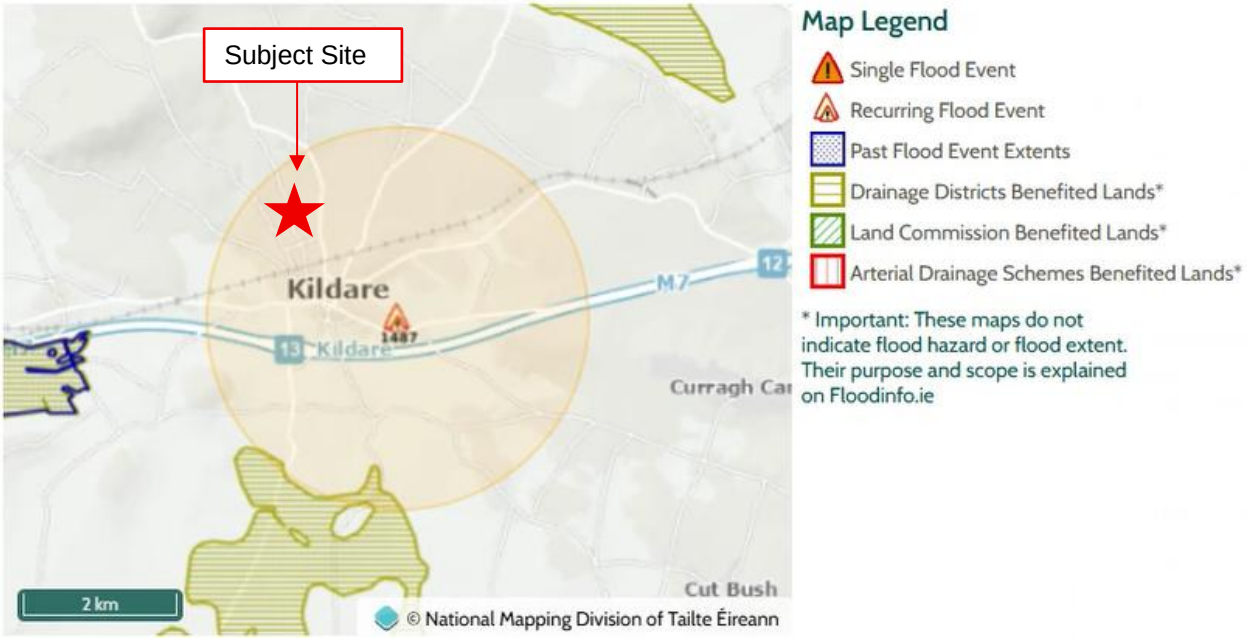


Figure 6-5: OPW Past Flood Event Summary

6.3.5 Overland flooding from the subject site causes downstream flooding

Similarly to Chapter 6.3.1 discussed above, the control measures implemented to prevent flooding within the site and downstream flooding of external sites during high rainfall events include the following:

- Attenuation areas designed to cater for up to the 1-in-100-year storm event with an additional 30% climate change and a 10% urban creep factor. This will result in runoff being stored within the attenuation area during the extreme storm event and not within the road network.
- Adequate exceedance routes through the site to which diverts runoff towards the attenuation areas.
- Setting of finished floor levels generally at least 500 mm above the proposed top of water level in the proposed detention basins and 300 mm above road levels. This provides adequate freeboard in the event of surface water surcharging of the surface water network. The surcharged surface water will flow within the road network and be diverted towards the attenuation areas or the external roads network through flood routing.

The likelihood of overland flooding from the subject development causing downstream flooding is considered to be moderate.

6.4 Consequence

The consequence of surface water flooding arising from the 5 No. pathway types mentioned above is moderate as internal roads, green space areas, potentially private driveways and rear gardens may be at risk of minor flooding. Downstream properties may experience similar flooding in the event of an extreme storm event and lack of mitigation measures outlined above.

6.5 Risk

Referencing Table 3-2: 3x3 Risk Matrix, the following risks are noted for the 5 No. pathway types:

6.5.1 Surcharging of the proposed on-site drainage systems leads to internal flooding

With a low likelihood and moderate consequence of flooding from this type of pluvial flooding and referring Table 3-2: 3x3 Risk Matrix, the resultant risk is low.

Mitigation measures are not required.

6.5.2 Surcharging from the existing surrounding drainage system leads to internal flooding

With a low likelihood and moderate consequence of flooding from this type of pluvial flooding and referring Table 3-2: 3x3 Risk Matrix, the resultant risk is low.

Mitigation measures are not required.

6.5.3 Surface water discharging from the subject site causes downstream flooding

With a moderate likelihood and moderate consequence of flooding from this type of pluvial flooding and referring Table 3-2: 3x3 Risk Matrix, the resultant risk is moderate.

Mitigation measures are required.

6.5.4 Overland flooding from surrounding areas leads to internal flooding

With a low likelihood and moderate consequence of flooding from this type of pluvial flooding and referring Table 3-2: 3x3 Risk Matrix, the resultant risk is low.

Mitigation measures are not required.

6.5.5 Overland flooding from the subject site causes downstream flooding

With a moderate likelihood and moderate consequence of flooding from this type of pluvial flooding and referring Table 3-2: 3x3 Risk Matrix, the resultant risk is moderate.

Mitigation measures are required.

6.6 Flood Risk Mitigation Measures

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

6.6.1 Surcharging of the proposed on-site drainage systems

None required.

6.6.2 Surcharging from the existing surrounding drainage systems

None required.

6.6.3 Surface water discharging from the subject site

- Appropriately sized surface water attenuation systems and network
- Appropriate exceedance routes designed within subject development
- Appropriate FFLs set above adjacent road levels and top of water levels of detention basins.

6.6.4 Overland flooding from surrounding areas

None required.

6.6.5 Overland flooding from the subject site

- Appropriately sized surface water attenuation systems and network
- Appropriate exceedance routes designed within subject development
- Appropriate FFLs set above adjacent road levels and top of water levels of detention basins.

6.7 Residual Risk

Table 6-2: Pathway – Residual Risk Identified

	Pathway	Residual Risk
1	Surcharging of the proposed internal drainage systems during heavy rain events leading to internal flooding	Low
2	Surcharging from the existing surrounding drainage system leading to flooding within the subject site by surcharging surface water pipes	Low
3	Surface water discharging from the subject site to the existing drainage network leading to downstream flooding	Low
4	Overland flooding from surrounding areas flowing onto the subject site	Low
5	Overland flooding from the subject site flowing onto surrounding areas	Low

As a result of the design measures detailed above and summarized in Table 6-2, it is clear that the likelihood of these events happening is low, as there are no recorded events in the close proximity of the site. There is a low residual risk of flooding from each of the surface water risks. The flood risk management measures set out in will minimise the risk, ensuring that any overland flooding from surface water will result in the flooding of the internal roads only.

The overall residual risk of pluvial flooding is therefore considered to be low.

7. Groundwater

7.1 Source

During periods with prolonged rainfall, the groundwater can rise towards ground level.

7.2 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.

7.3 Receptor

The receptors for ground water flooding would be underground services and the ground floor of the proposed building.

7.4 Likelihood

According to the Geological Survey Ireland (GSI) groundwater flooding map, flooding of this type has not occurred in or around the subject site. Refer to Figure 7-1 for an extract of the groundwater flooding map.

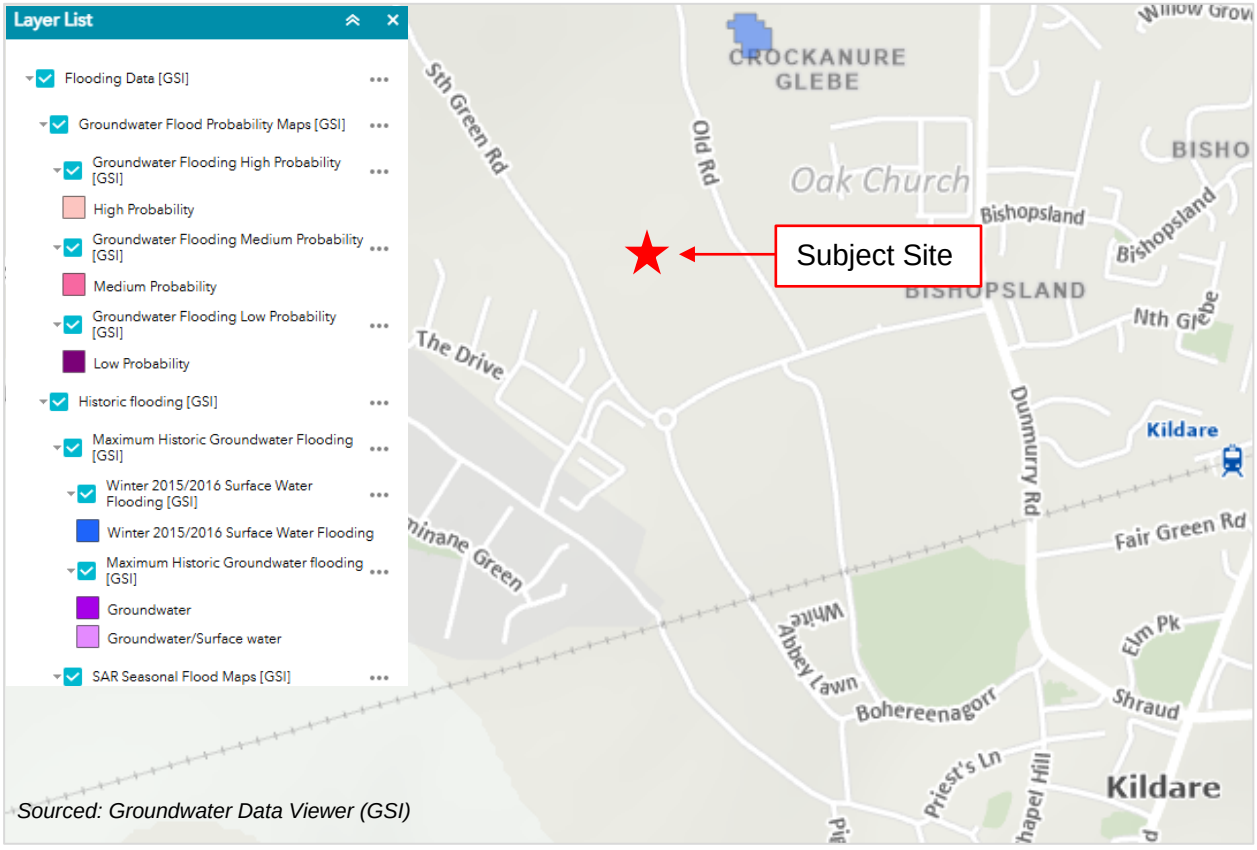


Figure 7-1: Extract of GSI Groundwater Flooding Map

The likelihood of flooding from groundwater is thus considered to be low.

Additionally, according to the GSI groundwater vulnerability map, the subject development is located within an area of high vulnerability, refer to Figure 7-2 for details.

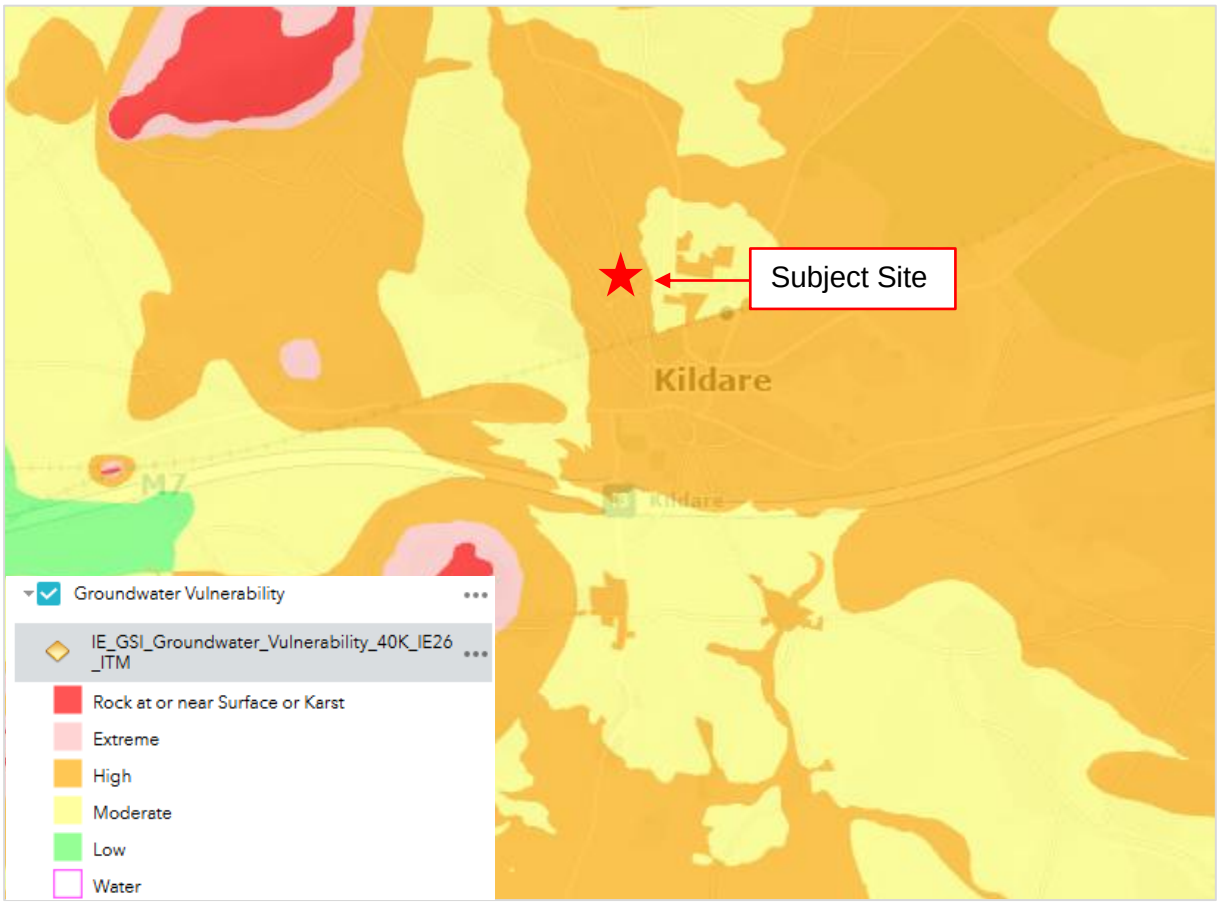


Figure 7-2: Extract of GSI Groundwater Vulnerability Map

7.5 Consequence

There is a moderate consequence from groundwater flooding, with underground services and building foundations exposed to the rising water levels.

7.6 Risk

Given a low likelihood and moderate consequence, referring to Table 3-2: 3x3 Risk Matrix, the resulting risk is considered low. Flood mitigation measures are not required, however any findings from the specialist hydrogeological report to be undertaken for the subject lands related to potential mitigations measures (if advised to be implemented for groundwater flooding) will be included within the design of the proposed development.

8. Human / Mechanical Errors

8.1 Source

This surface water network within the subject site is the source of possible flooding from the system if it was to become blocked.

8.2 Pathway

The pathway is via gulleys, manhole lids, and the above ground detention basins within the development.

8.3 Receptor

If the proposed private drainage system blocks this could lead to possible flooding within the open spaces, the internal roads, footpaths, and private gardens.

8.4 Likelihood

There is a high possibility of flooding on the subject site if the surface water network was to block.

8.5 Consequence

The surface water network would surcharge and overflow through gullies, and manhole lids and over the top of the proposed attenuation areas, it is therefore considered that the consequence of such flooding is moderate.

8.6 Risk

Referencing Table 3-2: 3x3 Risk Matrix, with a high likelihood and moderate consequence, there is a high risk of surface water overflowing within the development, should the surface water network block.

8.7 Flood Risk Mitigation Measures

The following flood mitigation measures have been implemented for the development:

- Levels on-site have been designed such that in the event of the surface water system surcharging, surface water can still escape from the site and away from building structures, onto the adjacent public road, by overland flood routing. This ensures flood routing without damaging properties.
- The FFLs of the proposed buildings are designed above the adjacent road levels.
- The surface water network must be inspected and maintained to ensure blockages do not occur.

8.8 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.

9. Conclusions and Recommendations

The subject lands have been analysed for risks from flooding from the Irish sea, fluvial flooding (rivers), pluvial flooding (heavy rainfall), groundwater, and failures of mechanical systems. Through careful design and appropriate mitigation measures, the risks and consequences of flooding have been mitigated across the development.

Surface water runoff from the site does not impact developments upstream or downstream of the subject site. Refer to Table 9-1 for the summary of risks and mitigation measures for each of the potential flooding sources/types.

Table 9-1: Summary of Flood Risks for the Site

Source	Pathway	Receptor	Likelihood	Consequence	Risk	Mitigation Measure	Residual Risk
Coastal	Overland from East	Proposed Development	Negligible	Negligible	Negligible	None needed	**None**
Fluvial	Overland from South	Proposed Development	Low	Low	Extremely Low	None needed	**Low**
Pluvial	Private and Public Drainage Systems	Proposed Development	Low	Moderate	Low	Appropriate drainage design, setting FFLs & appropriate exceedance routes	**Low**
Ground Water	Ground	Proposed Development	Low	Moderate	Low	None needed	**Low**
Human / Mechanical Error	Drainage network	Proposed Development	High	Moderate	High	Appropriate drainage design, setting FFLs & appropriate exceedance routes	**Low**

UK and Ireland Office Locations

