An Triantán, Station Road Housing, Kildare

Part 8 Flood Risk Assessment

Kildare County Council

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Executive summary

This report is prepared as part of a planning application submission to Kildare County Council for the proposed 30-unit residential development at Station Road, Kildare Town, Co. Kildare. The report reviews the potential flood risks to the site from Fluvial, Pluvial, Coastal, and Groundwater flooding.

It is determined that the site is located sufficiently outside the flood zone risks for Fluvial, Coastal, and Groundwater. However, the site, as indicated through the Draft Local Area Plan for Kildare Town, shows that there is potential for Pluvial flooding to occur as the site is located within the Pluvial Risk Assessment Zone and is noted to be within lands that have had capacity issues in the past with their drainage networks.

To mitigate against this pluvial flood risk the drainage design will account for the 1 in 100-year event, plus 30% climate change and 10% urban creep factors, with suitable attenuation provisions provided on-site to ensure runoff is restricted to QBar or 2.0 L/sec/ha. In addition to this, finished floor levels throughout the site will be set a minimum of 500mm above the top water level of any attenuation structure and ground levels will fall away from the surrounding units to ensure during exceedance events there is no risk to any internal property flooding.

Sustainable Drainage Systems and Nature Based Solutions will also be provided wherever possible throughout the site and will be designed as such to allow runoff to build up within these areas and infiltrate through the ground during exceedance events. Infiltration rates are considerer very good followed by a site investigation.

Contents

1.0	**Introduction**	**3**
1.1	Background	3
1.2	Objectives	3
1.3	Development Proposals	3
1.4	Report Structure	3
2.0	**Receiving Environment**	**5**
2.1	Site Characteristics	5
2.2	Site Geology	5
3.0	**Planning Guidelines & Flood Risk Assessment**	**8**
3.1	The Planning System and Flood Risk Management, Guidelines for Planning Authorities	8
3.2	Flood Risk Appraisal & Assessment	8
3.3	Flood Zones	9
3.4	Vulnerability v Flood Zone	10
4.0	**Flood Risk Identification**	**13**
4.1	Predictive Flood Data	13
4.2	Flood History	15
5.0	**Initial Flood Risk Assessment**	**17**
5.1	Sources of Flooding	17
6.0	**Management of Flood Risk and Flood Risk Mitigation**	**22**
6.1	Drainage Design	22
6.2	Climate Change	22
6.3	Foul Drainage	22
6.4	Maintenance	23
6.5	Site Layout	23
6.6	Residual Risks	23
7.0	**Conclusion**	**26**

1.0 Introduction

1.0 Introduction

1.1 Background

Cundall Consulting Engineers were hired to conduct a Site-Specific Flood Risk Assessment (SSFRA) as part of a planning application submission to Kildare County Council (KCC) for a proposed residential development at Station Road, Kildare Town, Co. Kildare. The proposed development comprises 30 residential units.

1.2 Objectives

The objective of this report is to inform the planning authority regarding flood risk for the proposed development. This report assesses the lands and zoning proposals per the requirements of "The Planning System and Flood Risk Management Guidelines for Planning Authorities". This report clarifies the lands flood zone category and presents information that would facilitate an informed decision of the planning application in the context of flood risk.

1.3 Development Proposals

The proposed development comprises 30 residential units with 3-unit types; 10No. 1-bed apartments,14No. 2-bed apartments, and 6No. 3-bed apartments.

1.4 Report Structure

As introduced above, this SSFRA seeks to clarify the potential level of influence generated by the proposed residential development. The structure of the report responds to the various stages of this exercise including the key tasks summarised below:

- **Chapter 2** of this report describes the existing site conditions at the proposed development location and surrounding area.
- **Chapter 3** provides a summary of the planning guidelines that influence the design and appraisal of flood risk for developments.
- **Chapter 4** provides a summary of the flood risk identified through the review of the Local Authority development plans and past flood events for the area.
- **Chapter 5** outlines the initial flood risk assessment by reviewing the available information for the different sources of flooding associated with the development.
- **Chapter 6** provides a detailed evaluation of how flood risk will be managed and if any risk mitigation measures are required.
- **Chapter 7** provides a conclusion of the SSFRA.

2.0

Receiving Environment

2.0 Receiving Environment

2.1 Site Characteristics

The proposed development site is located immediately to the east of Station Road and the south of Melitta Road, at National Grid Reference (NGR) N 73008 12548 (ITM coordinates X: 672952, Y: 712574). The existing site is currently a greenfield site, with vegetation and trees present, and the red line boundary is indicated in Figure 2-1 below.

Figure 2-1: Proposed Development Site [Image from Google Maps]

2.2 Site Geology

Geological Survey of Ireland (GSI) web-based Bedrock Geology (1:100,000) and Quaternary Sediments maps were consulted to review the published geology of the site. The quaternary sediment map shows that the site is covered with glaciofluvial gravels coverage (gravels derived from limestones). An area with glacial till (till derived from limestones) is noted just 200m north of the site. The excerpt from the GSI Quaternary Sediment map is shown in Figure 2-2 below.

Figure 2-2: Quaternary Sediment map [source: GSI]

2.3 Ground Investigations

Ground Investigations (GI) have been provided by IGSL which indicates a very good infiltration rate with the stage 3 results from the two trial pits indicating results of 2.10x10-4 m/sec and 2.39x10-4 m/sec. From the four trial pits carried out no groundwater was encountered and the boreholes did not encounter any water strikes with these carried out to a maximum depth of 6.7m below ground level.

3.0

Planning Guidelines & Flood Risk Assessment

3.0 Planning Guidelines & Flood Risk Assessment

3.1 The Planning System and Flood Risk Management, Guidelines for Planning Authorities

The FRM Guidelines provide "mechanisms for the incorporation of flood risk identification, assessment, and management into the planning process….". They ensure a consistent approach throughout the country requiring identification of flood risk and flood risk assessment to be key considerations when preparing development plans, local area plans, and planned development.

"The core objectives of The FRM Guidelines are to:

- Avoid inappropriate development in areas at risk of flooding.
- Avoid new developments increasing flood risk elsewhere, including that which may arise from surface water run-off.
- Ensure effective management of residual risks for development permitted in floodplains.
- Avoid unnecessary restrictions on national, regional, or local economic and social growth.
- Improve the understanding of flood risk among relevant stakeholders; and
- Ensure the requirements of EU and national law about the natural environment and nature conservation are complied with for flood risk management."

The FRM Guidelines outline the key principles that should be adopted by regional and local authorities, developers, and their agents as follows:

- Avoid the risk, where possible.
- Substitute less vulnerable uses, where avoidance is not possible, and
- Mitigate and manage the risk, where avoidance and substitution are not possible.

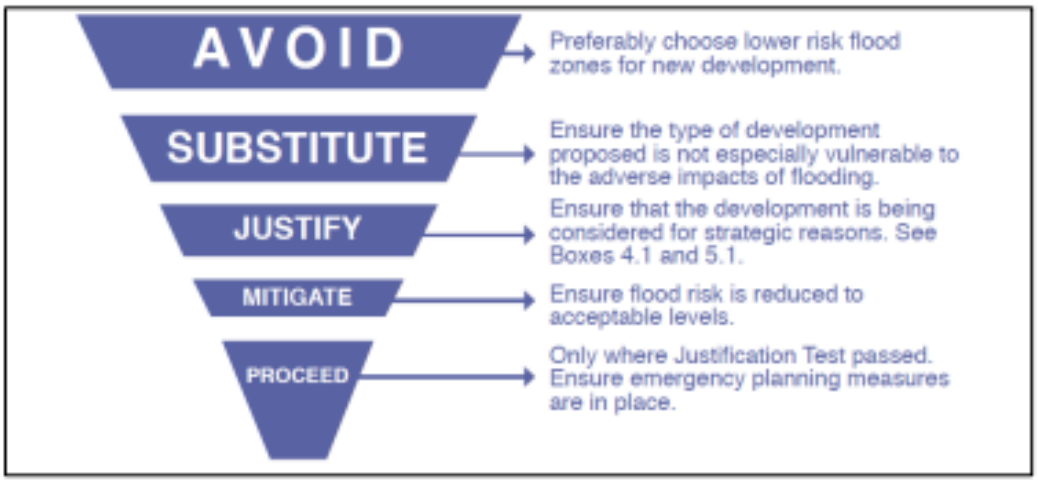

Figure 3-1: Sequential Approach Principles in Flood Risk Management (Extracted from FRM Guidelines)

The Sequential Approach in the Management of Flood Risk is included in Figure 3-1. Where the avoid and substitute principles of the sequential approach are not appropriate, then the Guidelines allow the application of a Justification Test to assess the appropriateness, or otherwise, of developments under consideration in areas of moderate or high flood risk

3.2 Flood Risk Appraisal & Assessment

The assessment of flood risk requires an understanding of where water comes from (the source), how and where it flows (the pathways), and the people and assets affected by it (the receptors).

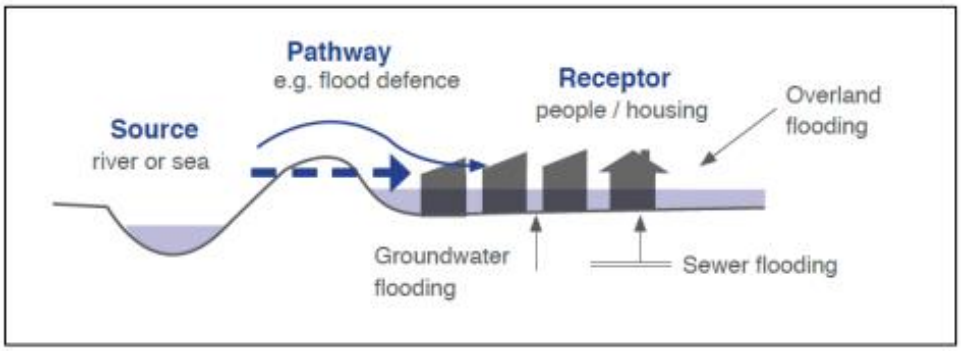

Figure 3-2: Source-Pathway-Receptor Model (Extracted from FRM Guidelines)

The principal sources are rainfall or higher than normal sea levels. The principal pathways are rivers, drains, sewers, overland flow, and river and coastal floodplains and their defence assets. The receptors can include people, their property, and the environment.

The Guidelines further state that "*A staged approach should be adopted, carrying out only such appraisal and or assessment as is needed for decision-making at the regional, development and local area plan levels, and also at the site-specific level. The stages of appraisal and assessment are":*

Stage 1 Flood risk identification – to identify whether there may be any flooding or surface water management issues related to either the area of regional planning guidelines, development plans, and Local Area Plan's (LAP's) or a proposed development site that may warrant further investigation at the appropriate lower-level plan or planning application levels.

Stage 2 Initial flood risk assessment – to confirm sources of flooding that may affect a plan area or proposed development site, to appraise the adequacy of existing information, and to scope the extent of the risk of flooding which may involve preparing indicative flood zone maps. Where hydraulic models exist the potential impact of a development on flooding elsewhere and of the scope of possible mitigation measures can be assessed. In addition, the requirements of the detailed assessment should be scoped; and

Stage 3 Detailed flood risk assessment – to assess flood risk issues in sufficient detail and to provide a quantitative appraisal of potential flood risk to a proposed or existing development or land to be zoned, of its potential impact on flood risk elsewhere, and the effectiveness of any proposed mitigation measures. This SSFRA includes Stages 1, 2, and 3 Flood Risk Appraisal and Assessments related to the planned development.

3.3 Flood Zones

The FRM Guidelines use flood zones to determine the likelihood of flooding and for flood risk management within the planning process. The three flood zone levels are:

- Flood Zone A – where the probability of flooding from rivers and the sea is highest at 1% AEP (Annual Exceedance Probability) for rivers and 0.5% AEP for coastal.
- Flood Zone B – where the probability of flooding from rivers and the sea is moderate (between 0.1% AEP or 1 in 1000 and 1% AEP or 1 in 100 for river flooding); and
- Flood Zone C – where the probability of flooding from rivers and the sea is low (less than 0.1% AEP or 1 in 1000 for both river and coastal flooding). Flood Zone C covers all areas outside zones A and B.

The FRM Guidelines categorises all types of development as either.

- Highly Vulnerable e.g., dwellings, hospitals, fire stations, essential infrastructure,

- Vulnerable e.g., retail, commercial or industrial buildings, local transport infrastructure,
  - Water Compatible e.g., flood infrastructure, docks, amenity open space.

3.4 Vulnerability v Flood Zone

The FRM Guidelines state that *"a sequential approach to planning is a key tool in ensuring that development, particularly new development, is first and foremost directed towards the land that is at low risk of flooding".*

The Sequential Approach restricts development types to occur within the flood zone appropriate to their vulnerability class, as outlined below in Table 1. Alternatively, a Justification Test can be completed to justify development in higher-risk areas, (refer to Figure 3-1 below).

	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 3-3: Matrix of Vulnerability versus Flood Zone to illustrate where development is appropriate for flood zone or where justification test required (Extract from FRM Guidelines)

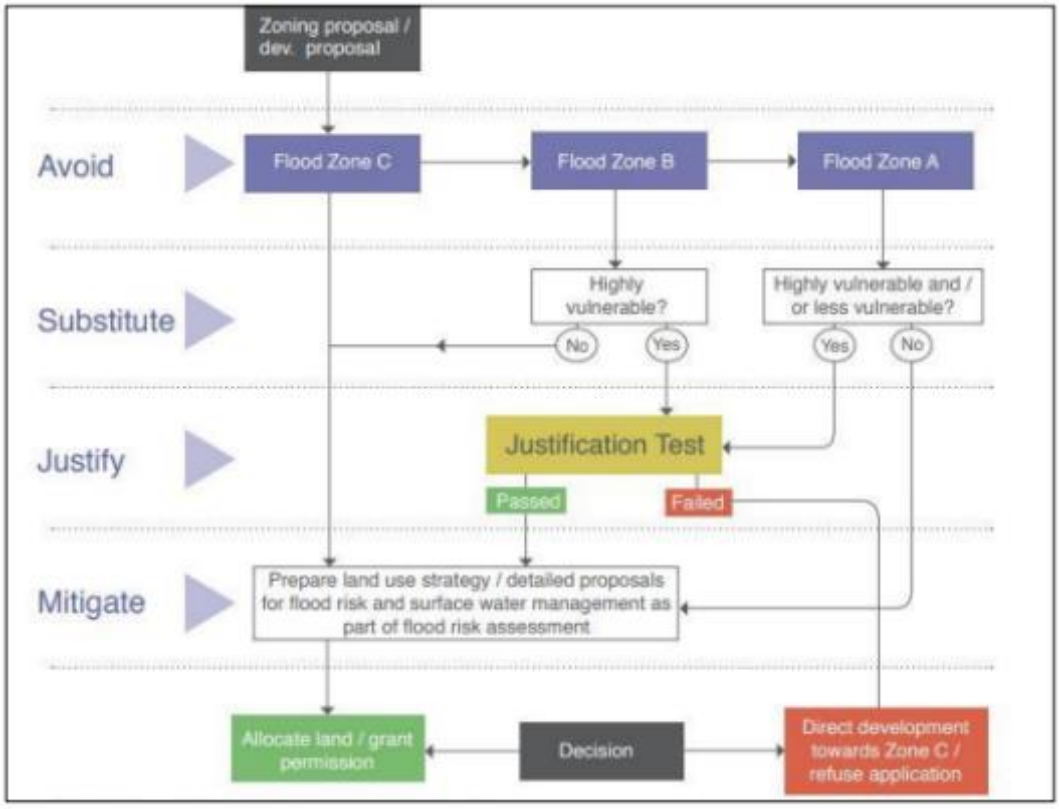

Figure 3-4: Sequential Approach & Justification Test Mechanism in the Planning Process (FRM Guidelines)

The proposed development is classified as a highly vulnerable development (residential and essential infrastructure) in the Guidelines. This class is appropriate to flood zone 'C'.

4.0

Flood Risk Identification

4.0 Flood Risk Identification

The initial flood risk identification stage uses predictive and historical information to identify and confirm whether there may be flooding or surface water management issues for the site in question which may warrant further investigation. Findings from the flood risk identification stage are outlined below:

4.1 Predictive Flood Data

4.1.1 Strategic Flood Risk Assessment (SFRA) of the Draft Kildare County Development Plan 2023-2029

A review was undertaken of the SFRA for the draft Kildare County Development Plan 2023-2029 to assess the flood risk that could potentially be posed by the development. It was noted within the review that Kildare Town was not assessed within the study area and is therefore not considered a flood risk from fluvial flooding.

4.1.2 SFRA Draft Kildare Town Local Area Plan (LAP) 2023-2029

Section 5.5.2 of the report that a National Indicative Flood Mapping (NIFM) study was undertaken to assess the fluvial flood risk for catchments greater than 1km2 which were not included within the CFRAM studies, and it was found that there is no hydraulic connection between the floodplains mapped within the NIFM study and the Kildare Town LAP area.

However, within Appendix A of the Draft Kildare Town LAP 2023-2029 it was noted for the SFRA map that the site is indicated as being within a Pluvial flood risk assessment zone, refer to Figure 4-1 below with the site indicated with a red star.

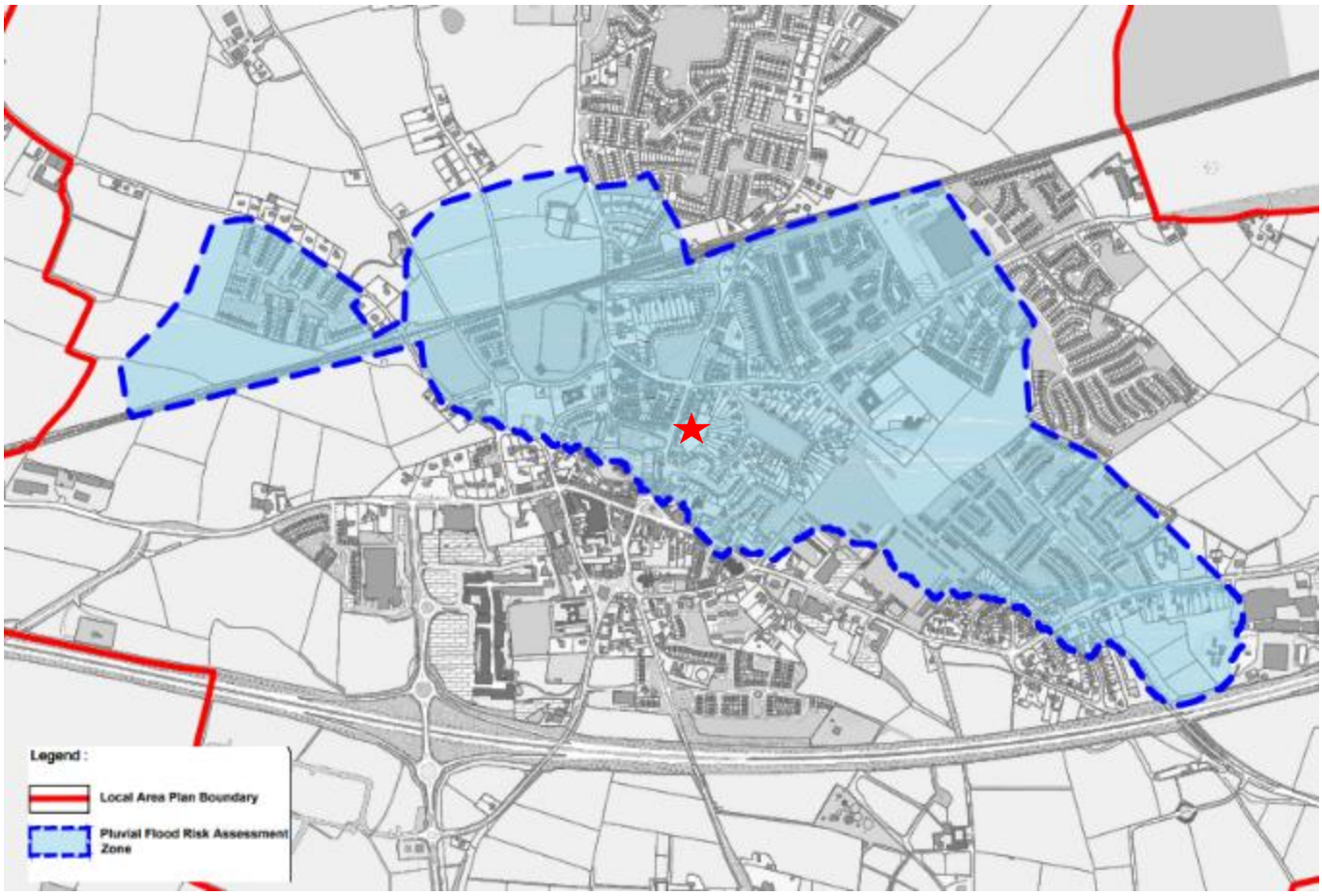

Figure 4-1: SFRA Map [Draft Kildare Local Area Plan 2023-2029]

4.1.3 Kildare Town Surface Water Drainage Study 2022

This study was carried out to identify a municipal-level, multi-site, nature-based solution to surface water management for Kildare Town. It is noted that the site is located on made ground based on the soil hydrology map for the study area with the surface water discharge for the site and surrounding areas generally discharging via infiltration, refer to Figure 4-2 below with the site indicated with a red star.

Figure 4-2: Areas Draining to Infiltration [Kildare Town Surface Water Drainage Study 2022]

However, based on the workshop findings it was noted that the area has had capacity issues in the past indicating that pluvial flood risk could be an issue on site, refer to Figure 4-3 below with the site indicated with a red star.

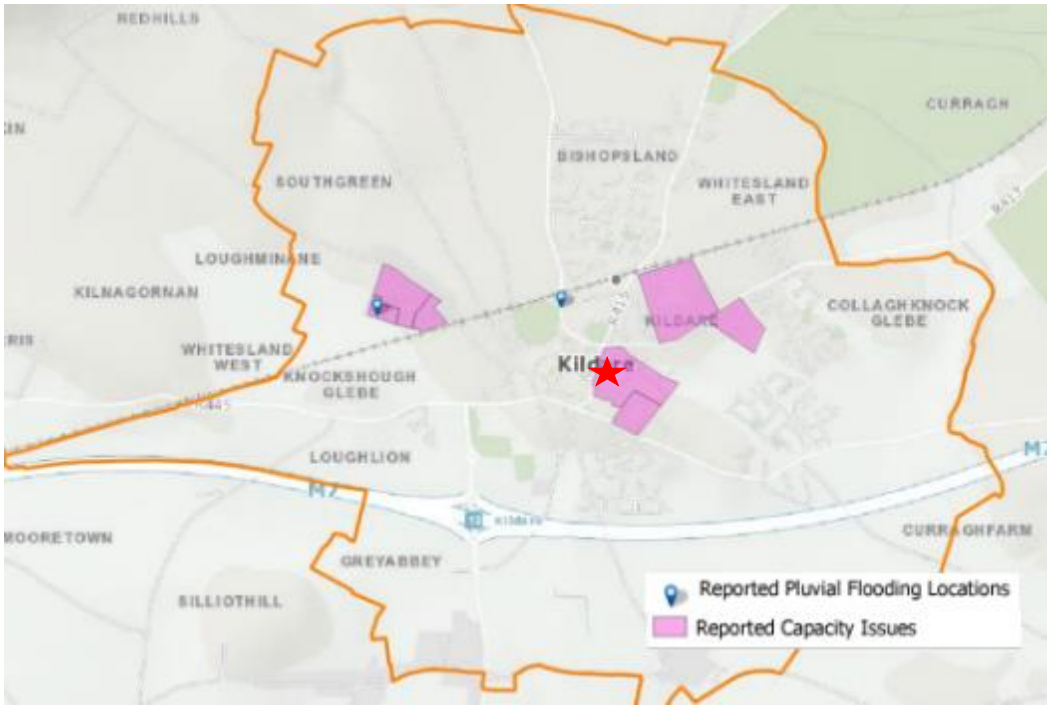

Figure 4-3: Areas with Reported Capacity Issues [Kildare Town Surface Water Drainage Study 2022]

4.2 Flood History

4.2.1 OPW Historic Flood Records & Benefitting Lands

There are no records of flooding on the existing site with no benefiting lands indicated either.

4.2.2 Historical and Recorded Flood Events

A search for recorded flood events near the subject site was carried out using the OPW's floodinfo.ie website and using a general internet search. The floodinfo.ie website provides information on recorded flood events nationwide. There are no historical flood incidences recorded for the subject site or in the immediate vicinity of the site with the closest flooding event located approximately 860m to the southeast of the site, refer to Figure 4-4 below with the approximate site location indicated with a red 'X'.

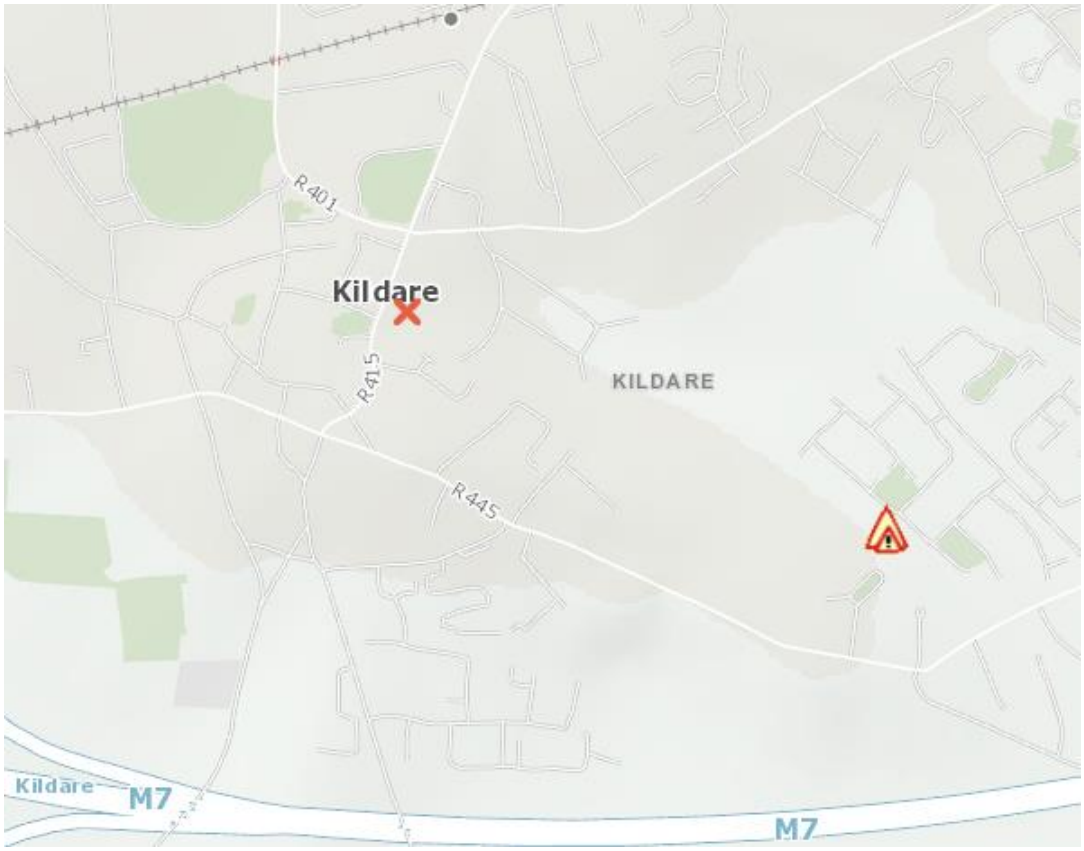

Figure 4-4: Past Flood Event Map [floodinfo.ie]

It was noted that this is a recurring flooding event attributed to low-lying land.

5.0

Initial Flood Risk Assessment

5.0 Initial Flood Risk Assessment

5.1 Sources of Flooding

5.1.1 Fluvial

The PFRA and CFRAM Mapping have indicated the site is within Flood Zone C and not affected by fluvial flooding. Based on information detailed on floodinfo.ie there is currently no flood risk on the subject site, as indicated in Figure 5-1. This includes the present day, Mid-Range Future Scenario (20% increase in rainfall and a sea level rise of 500mm), and the High-End Future Scenario (30% increase in rainfall and a sea level rise of 1000mm).

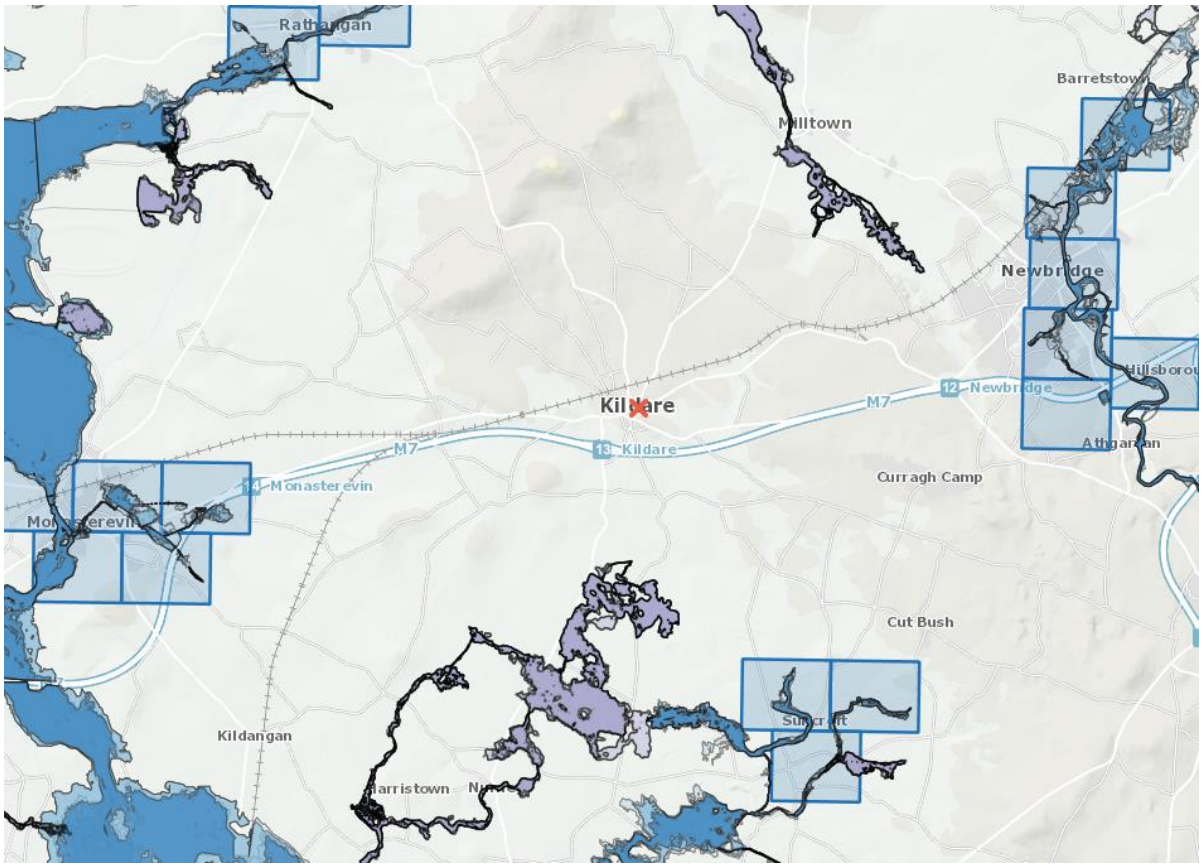

Figure 5-1 CFRAM Flood Risk Mapping [floodindo.ie]

5.1.2 Pluvial

Pluvial or surface water flooding is the result of rainfall-generated flows that arise before runoff can enter a watercourse or sewer. As noted within Section 4.1, of this report, the site is located within the pluvial assessment risk zone and is located in an area that is noted to be affected by capacity issues.

The site is located on lands that are designated as 'Existing Residential / Infill' indicating that the proposed development is suitable for these lands. The development will consist of residential units and would be classed as 'Highly Vulnerable'.

Suitable mitigation measures to combat pluvial flooding are detailed in Section 6.0 of this report.

5.1.3 Coastal

The site is located approximately 50km west of the coast. Therefore, coastal flooding is not considered a source of flood risk to the site.

Figure 5-2: Extract from Google Maps indicating nearest point to Coastline

5.1.4 Groundwater

The OPW PFRA mapping does not indicate any groundwater flooding at the site or surrounding area. The GSI groundwater vulnerability for the site is classified as high, refer to Figure 5-3 below with the site boundary approximately drawn in red.

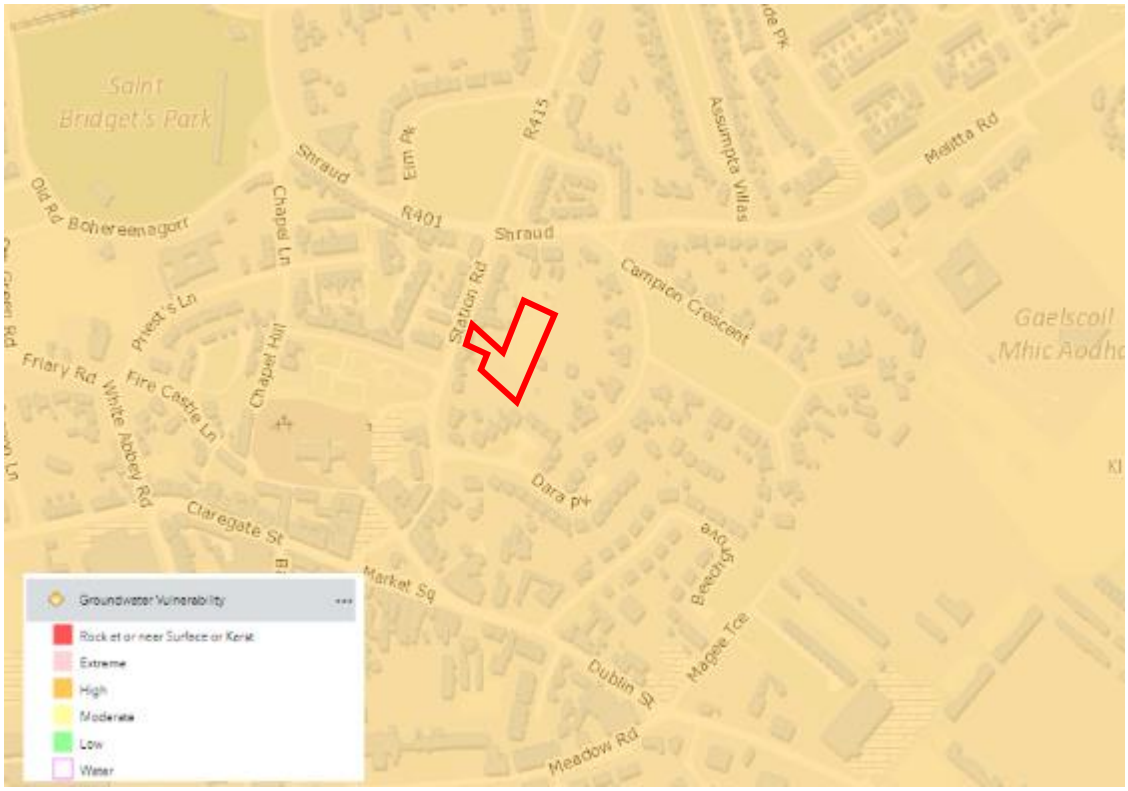

Figure 5-3: Groundwater Vulnerability Map [GSI]

The groundwater subsoil permeability indicates the site is located in 'High' permeable soils, refer to Figure 5-4 below with the site boundary approximately drawn in red.

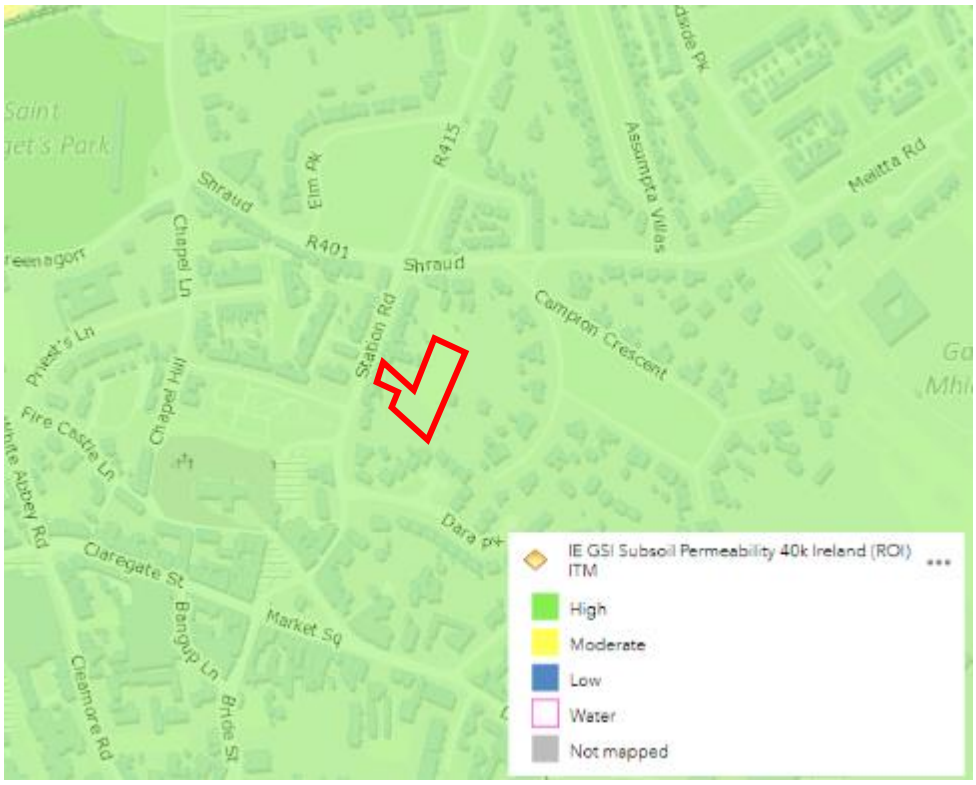

Figure 5-4: Groundwater Subsoil Permeability (GSI)

A review of the available information on floodmaps.ie indicates that there is only one recorded location from the GSI winter 2015/2016 surface water flooding with this located approximately 1.2km to the northwest of the site, refer to Figure 5-5 below with the site indicated with a red 'X'.

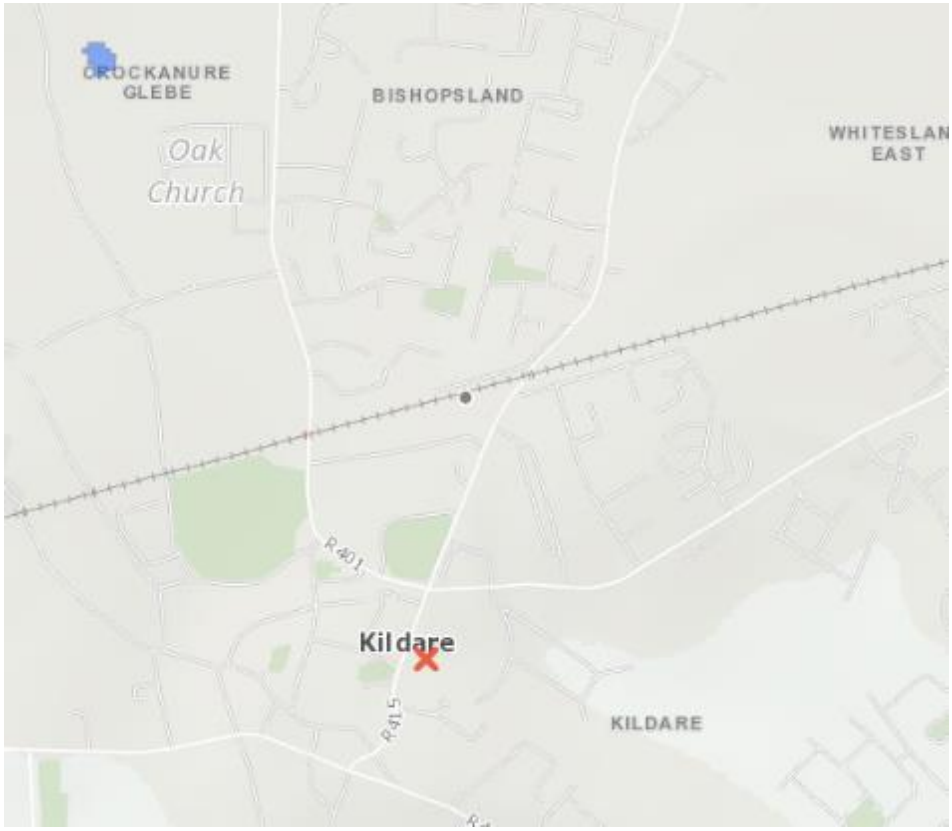

Figure 5-5: GSI Winter 2015/2016 Surface Water Flooding [floodmaps.ie]

Furthermore, there are no karst features in the area which would indicate areas at risk of groundwater flooding. As there is no known risk of groundwater flooding in the site or surrounding area, it is considered that groundwater flooding is not a likely source of flood risk to the site.

6.0

Management of Flood Risk and Flood Risk Mitigation

6.0 Management of Flood Risk and Flood Risk Mitigation

Flood risk to the proposed development will be managed using different strategies as outlined below.

6.1 Drainage Design

6.1.1 Surface Water Sewer & SuDS

Proposed surface water drains have been designed in accordance with the Greater Dublin Strategic Drainage Study (GDSDS), the Department of the Environment's Recommendations for Site Development Works for Housing Areas, the Department of the Environment's Building Regulations "Technical Guidance Document Part H Drainage and Wastewater Disposal" and BS EN 752: 2008 Drain and Sewer Systems Outside Buildings.

As the site has very good infiltration rates and given the limited options to connect to an existing surface water sewer within Station Road, an infiltration design is deemed appropriate for the development. Water shall be retained primarily using the following methods:

- Nature-based retention measures
- Rain gardens
- Tree pits
- Porous paving
- Water butts
- Stormtech attenuation tank

6.1.2 Surface Water Attenuation Storage

The proposed surface water drainage network will collect surface water runoff and convey it towards the primary attenuation features, before discharging via infiltration. Surface water runoff from the site's road network will be captured at source through the proposed porous paving surfacing on the carriageway with impermeable footways discharging to adjacent bio-retention zones, overflows to the main drainage network will also be provided. Porous pavements will collect surface water runoff from parking spaces also. Surface water runoff will also be collected in tree catch pits, which will overflow into the main piped network. Surface water runoff from rooftops will be collected from green roofs and directed to the proposed surface water pipe network via connections from downpipe locations. Rain gardens will be provided wherever possible in the green areas as a form of attenuation and biodiversity.

An additional flood exceedance design has been carried out by assuming the infiltration rates from the tank were reduced by 50%. From the analysis carried out, the tank provides sufficient storage for up to 1 in 30-year critical event. To prevent flooding on site it is proposed to provide an overflow connection set 264mm above the TWL of stormtech chambers for the 1 in 100yr critical storm event site model. Flows from this overflow are restricted to 2 L/sec via a hydro brake flow control device to ensure no downstream areas are negatively impacted.

6.2 Climate Change

The potential impact of climate change has been allowed for in the design of the surface water drainage network and storage system, with an allowance for a 10% increase in rainfall intensities. SuDS features will be designed for a 30% climate change allowance for the 1:100-year storm event, including 10% for urban creep.

6.3 Foul Drainage

The proposed foul drainage network will comprise a series of 150mm and 225mm diameter pipes where applicable. Each residential unit is to be serviced by an individual 100mm diameter connection.

6.4 Maintenance

The proposed drainage system is to be maintained regularly by Kildare County Council to reduce the risk of a blockage. Maintenance of SuDS features should also be carried out in accordance with the recommendations of "The SuDS Manual" (CIRIA C753).

6.5 Site Layout

As a minimum all finished floor levels will be set at a minimum of 500mm above the top water level of the attenuation structures on site.

6.6 Residual Risks

The remaining residual flood risks, following the detailed assessment, include the following.

1. Pluvial flooding from the drainage system is related to a pipe blockage or flood exceedance.
2. Pluvial flooding from the development's drainage system for storms exceeding the design capacity. Mitigation measures to address residual flood risks are as follows:

- Pluvial flooding from the drainage system related to a pipe blockage or from flood exceedance:

  Mitigating Measure M1:

  - The proposed drainage system is to be maintained regularly to reduce the risk of a blockage.
  - Ground levels surrounding the units will be designed to slope away to reduce the risk of internal property flooding.
  - FFL's to be set a minimum of 500mm above the top water level (TWL) on any of the attenuation structures.

- Pluvial flooding from the development's drainage system for storms exceeding the design capacity:

  Mitigating Measure M2:

  - The drainage network is designed per the recommendations of the GDSDS and will provide attenuated outlets and associated storage up to 1% AEP (1 in a 100-year return period event + 30% Climate Change and 10% Urban Creep Factor). The drainage network for the site will be designed to ensure that it can accommodate the 1 in 100-year rainfall event in surcharged conditions with runoff from the site restricted to QBar or 2.0 L/sec/ha, whichever is greater.
  - Proposed site levels will be designed to ensure that during exceedance events there is no risk to any internal properties from flooding.

7.0

Conclusion

7.0 Conclusion

The Site Specific Flood Risk Assessment for the proposed development was undertaken in accordance with the requirements of the Planning System and Flood Risk Management Guidelines for Planning Authorities", November 2009.

Following the flood risk assessment stages, it was determined that the Site is within Flood Zone C for Fluvial, Coastal, and Groundwater flooding as defined by the Guidelines.

However, as noted within Section 4.1, of this report, the site is located within the pluvial assessment risk zone and is located in an area that is noted to be affected by capacity issues.

Based on the Local Area Plan for Kildare Town the site is located on lands that are designated as 'Existing Residential / Infill' indicating that the proposed development is suitable for these lands.

Considering the above and the potential risk of pluvial flooding to the site it is proposed that mitigation measures detailed in Section 5.1.2 and Section 6.0 will be introduced into the design to combat against the pluvial flood risk that could occur. This includes and is not limited to the following:

- Drainage Model designed to cater for 1 in the 100-year event plus 30% Climate Change and 10% Urban Creep factor.
- FFLs set a minimum of 500mm above the TWL of the attenuation storage areas proposed on the site.
- Levels on the site are designed to ensure during exceedance events no flood waters will impact the residential units. Flood waters will be directed towards landscaped areas and infiltrate through the ground. Infiltration rates have been confirmed to be very good by a site investigation.
- Introduction of Nature-Based SuDS solutions wherever possible and other SuDS features.

Therefore, based on the above, it is concluded that the:

- The housing development proposed is appropriate for the Site's flood zone category and land zoning.
- Planning System and Flood Risk Management Guidelines Sequential Approach is met.

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