



SITE SPECIFIC FLOOD RISK ASSESSMENT

PROPOSED LOUGHREA FIRE STATION, ATHENRY
ROAD, LOUGHREA, CO. GALWAY

APRIL 2022



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1.0 INTRODUCTION

- 1.1 This report has been prepared by Flood Risk Consulting Ltd (FRC). The brief for the study was to carry out a Site Specific Flood Risk Assessment (SSFRA), in regulation with The Planning System and Flood Risk Management: Guidelines for Planning Authorities (OPW, 2009) for the proposed Loughrea Fire Station at Athenry Road, Loughrea, Co. Galway. This report is not carried out in direct response to a Further Information Request issued by the Galway County Council, as at the time of writing it is FRC's understanding that none has been issued.
- 1.2 The proposed site is not located within the floodplains of any water features which have been identified by the National Indicative Fluvial Mapping (NIFM) study or modelled in detail under the Catchment Flood Risk Assessment and Management (CFRAM) study. This SSFRA will seek to identify and assess the Flood Zones at the proposed development based on current available mapping.
- 1.3 FRC retains sole and exclusive ownership of the copyright of, and moral rights over, the content of this report (and all earlier or draft versions and preparatory materials) and no amendment or misrepresentative extraction is permitted to be made of any element of this report or such other materials without FRC's prior written consent.
- 1.4 FRC has used reasonable care, skill and diligence in compiling this report but accepts no responsibility for any documents or information supplied to FRC by others or any conclusions or developments based on such documentation or information. It is expressly stated that no independent verification of any documents or information supplied by others has been made by FRC.
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- 1.6 It should be noted that there are no circumstances in which the risk of flooding can be removed entirely. This report should not be considered a guarantee against future flooding events but instead aiming to evaluate the risk of flooding at the site and then propose mitigation measures that may reduce the impact of such flooding.

2.0 DESCRIPTION OF SITE

2.1 Plate 2.1 presents mapping of the proposed site (identified by the red marker on Google Maps).

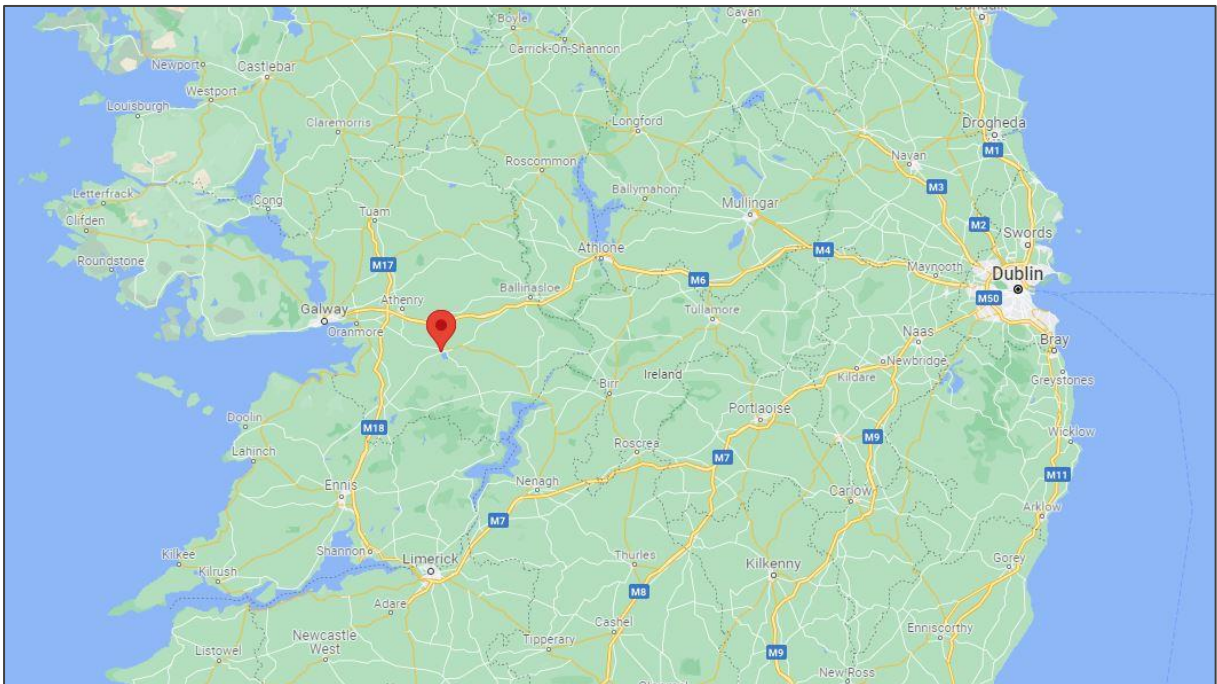


Plate 2.1: Google mapping showing the location of the proposed site

2.2 Plate 2.2 presents lower scale Google mapping of the site relative to Loughrea, where the site can be seen to be located on the western side of the town. The site is located north of Lough Rea.

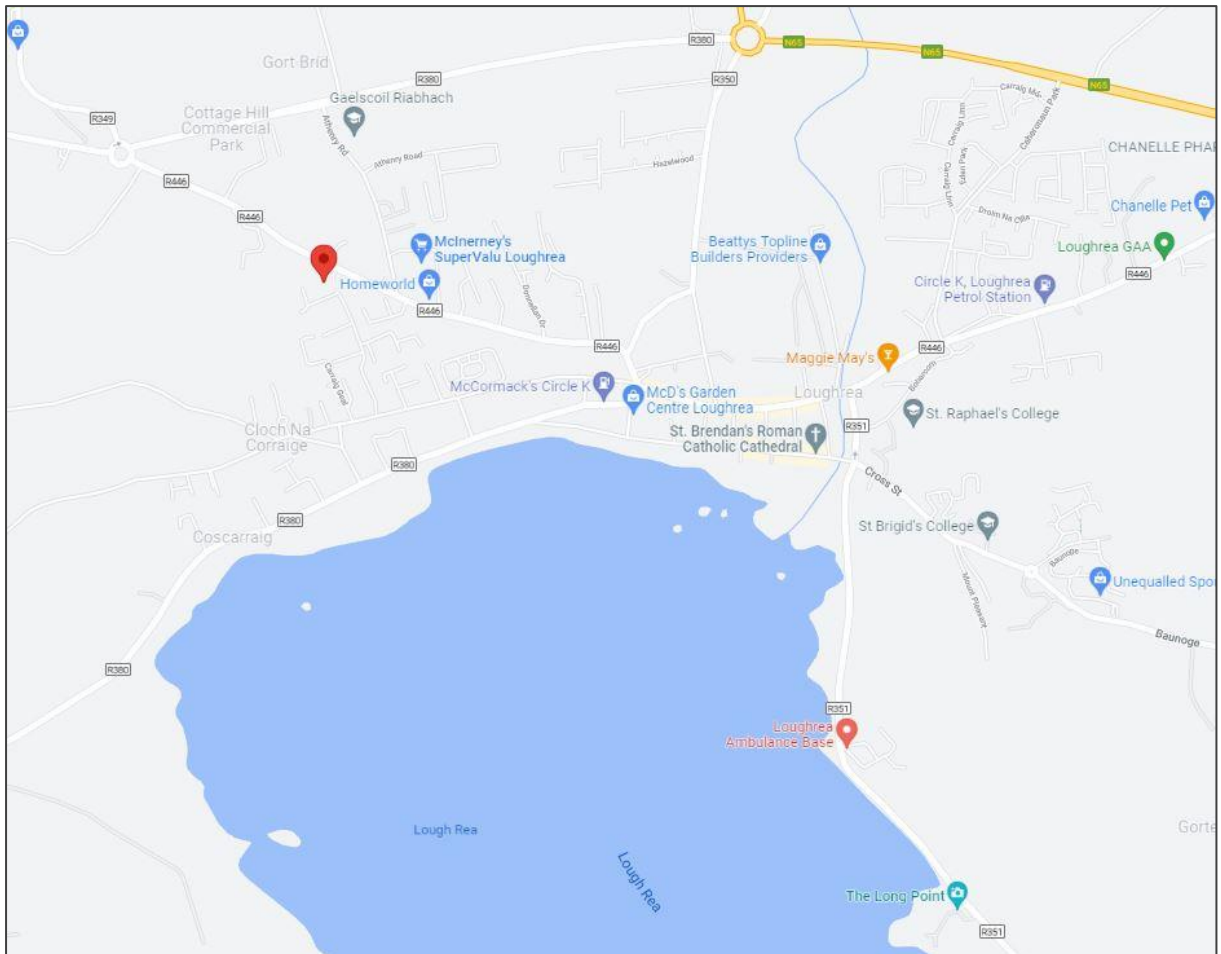


Plate 2.2: Lower scale Google mapping of the location of the proposed site

2.3 Plate 2.3 presents a site location map, with the proposed site outlined in red. Access to the proposed site will be via the Athenry Road which bounds the northern side of the site. No open watercourses are shown on this mapping within the vicinity of the site.

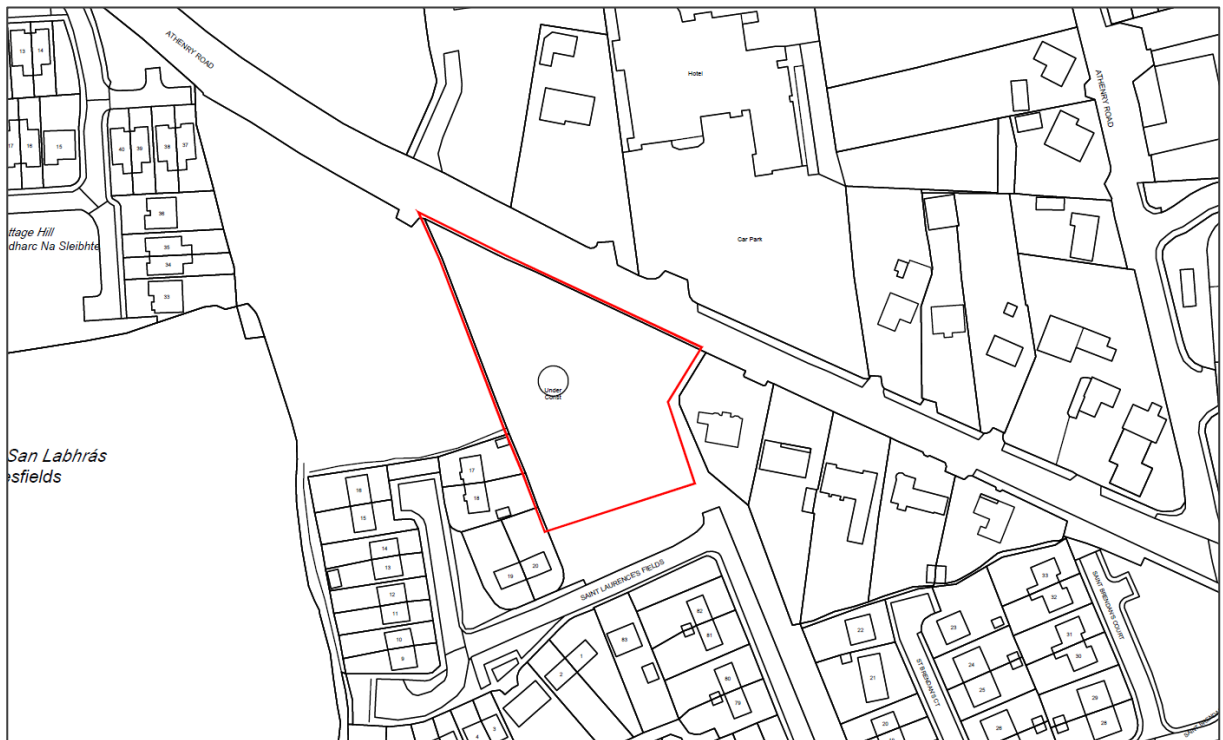


Plate 2.3: Site location map

2.4 Plate 2.4 presents OSI/EPA mapping of the area with the location of the proposed site approximately indicated by the red triangle. The route of a watercourse is identified by the blue arrowed line a distance south west from the site. Lough Rea is indicated by the solid blue hatched area south east of the proposed site. No water features are shown in the immediate vicinity of the site location.

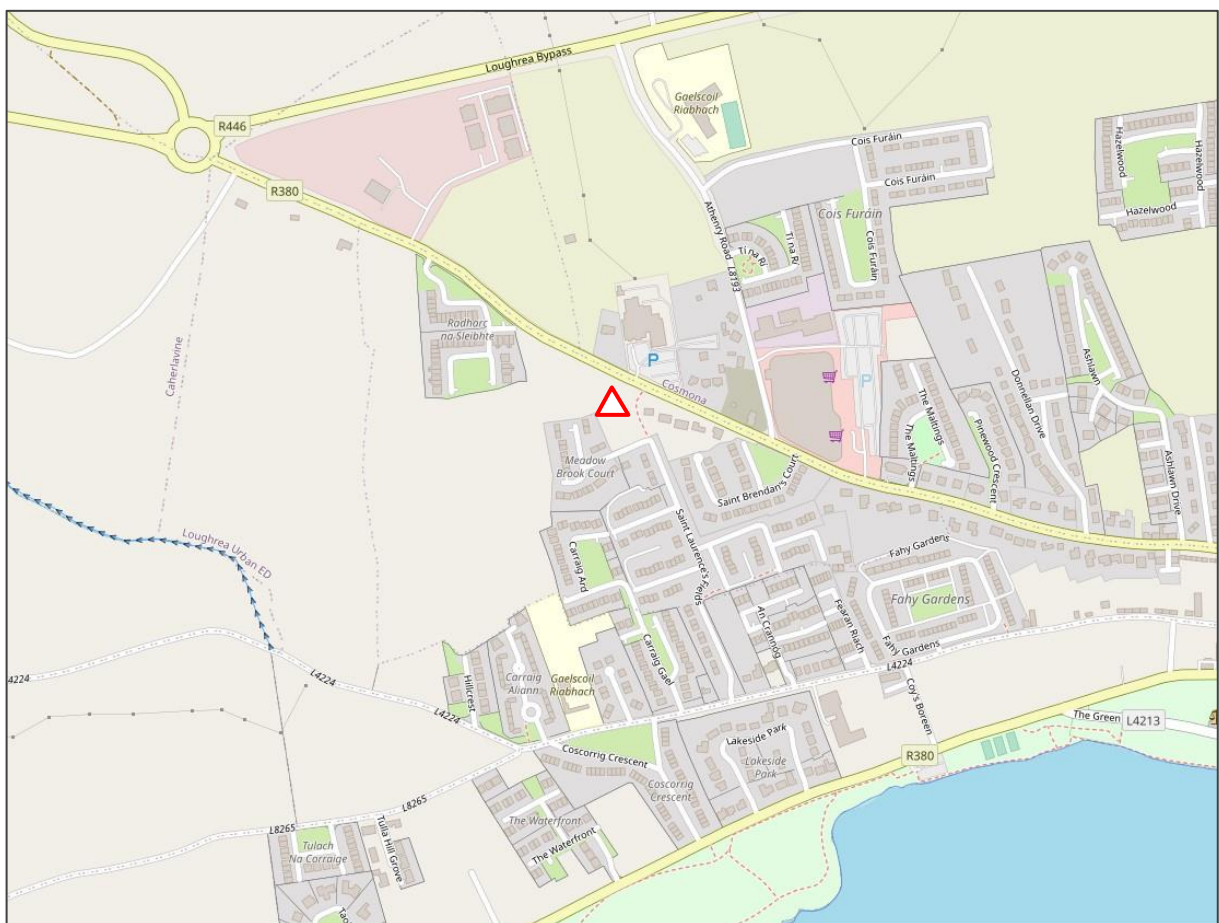


Plate 2.4: OSI/EPA mapping of the proposed site

2.5 Plate 2.5 presents OSI mapping of the area with 10m contour lines, with the proposed site location again approximately indicated by the red triangle. The contours on this mapping illustrate that Lough Rea is generally surrounded by higher ground on its eastern, southern and western sides, with lower ground to the north of the lough. The site is located above the 90m OD contour line, which indicates that it is higher than the lough. In addition, the 90m contour surrounding the site suggests that the site is located within a plateau of elevation ground relative to lower lying ground in all directions at further distance from the site.

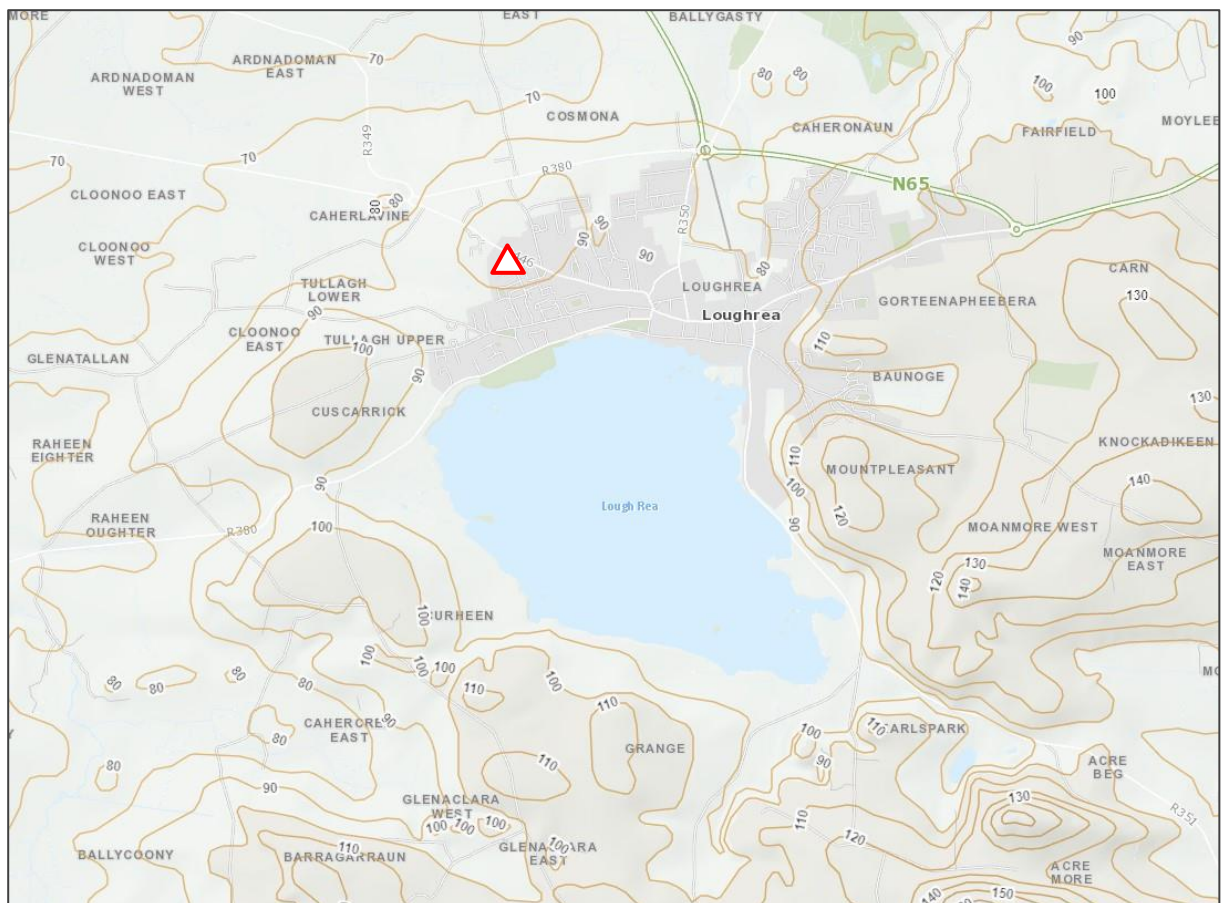


Plate 2.5: OSI mapping of the proposed site

2.6 Plate 2.6 presents historic OSI mapping of the area, again with the site location approximately identified by the red triangle. This mapping does not indicate any historic watercourses within the immediate vicinity of the proposed site.

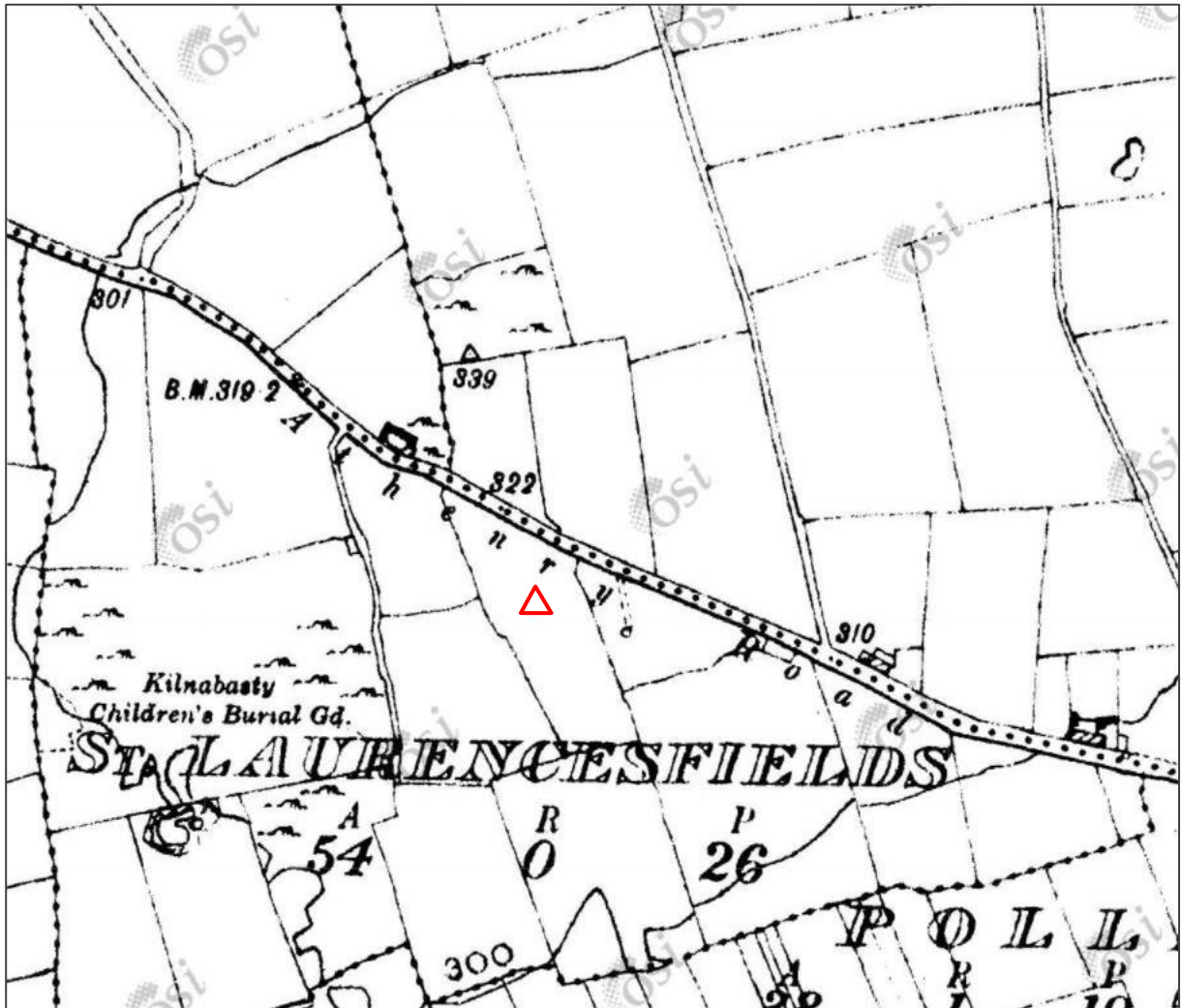


Plate 2.6: Historic OSI mapping of the proposed site

2.7 Plate 2.7 presents OSI aerial photography of the proposed site, dated 2000. This image shows that the proposed site is undeveloped at the time of photography was recorded.



Plate 2.7: OSI aerial photography of the proposed site

2.8 Plates 2.8 and 2.9 present Google Streetview images of the proposed site from Athenry Road at the site's north eastern and north western corners respectively. The site area is indicated by the red triangles on both plates. These images indicate that the site is generally a flat undeveloped field. Land higher than the site can be seen on the LHS of Plate 2.9, where a hotel and fields are located north of the site (on the opposite side of Athenry Road).



Plates 2.8 and 2.9: Google Streetview images of the site

3.0 INFORMATION FROM FLOOD MAPS

3.1 Plate 3.1 presents the NIFM predicted fluvial flood extents mapping for the area of the site for the present day scenario (site location approximately identified by the red triangle). This map shows the local indicative Q100 and Q1000 predicted floodplains of the water features considered in this study do not reach close to the proposed site.

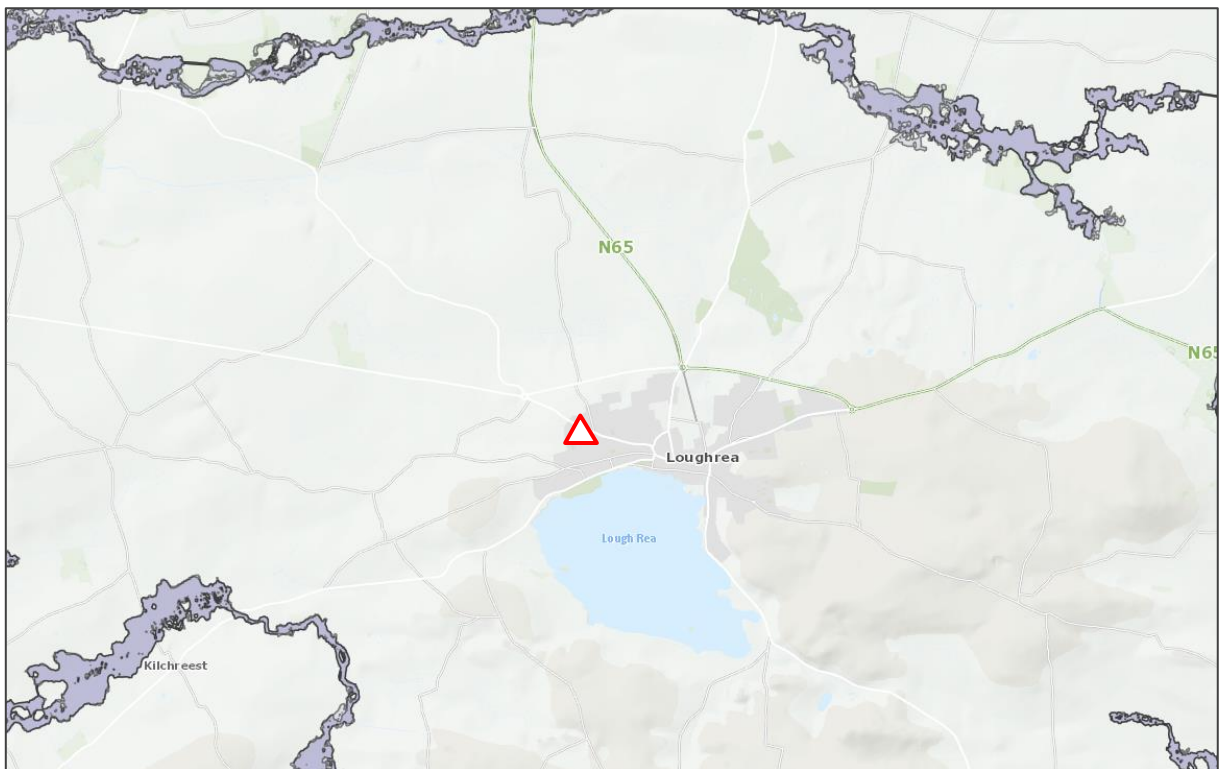


Plate 3.1: NIFM present day fluvial flood extents at the proposed site

3.2 Plate 3.2 presents the NIFM indicative high range future climate change fluvial flood extents mapping for the area of the site (location approximately identified by the red triangle). Again, the local Q100 and Q1000 indicative climate change floodplains do not reach close to the proposed site.

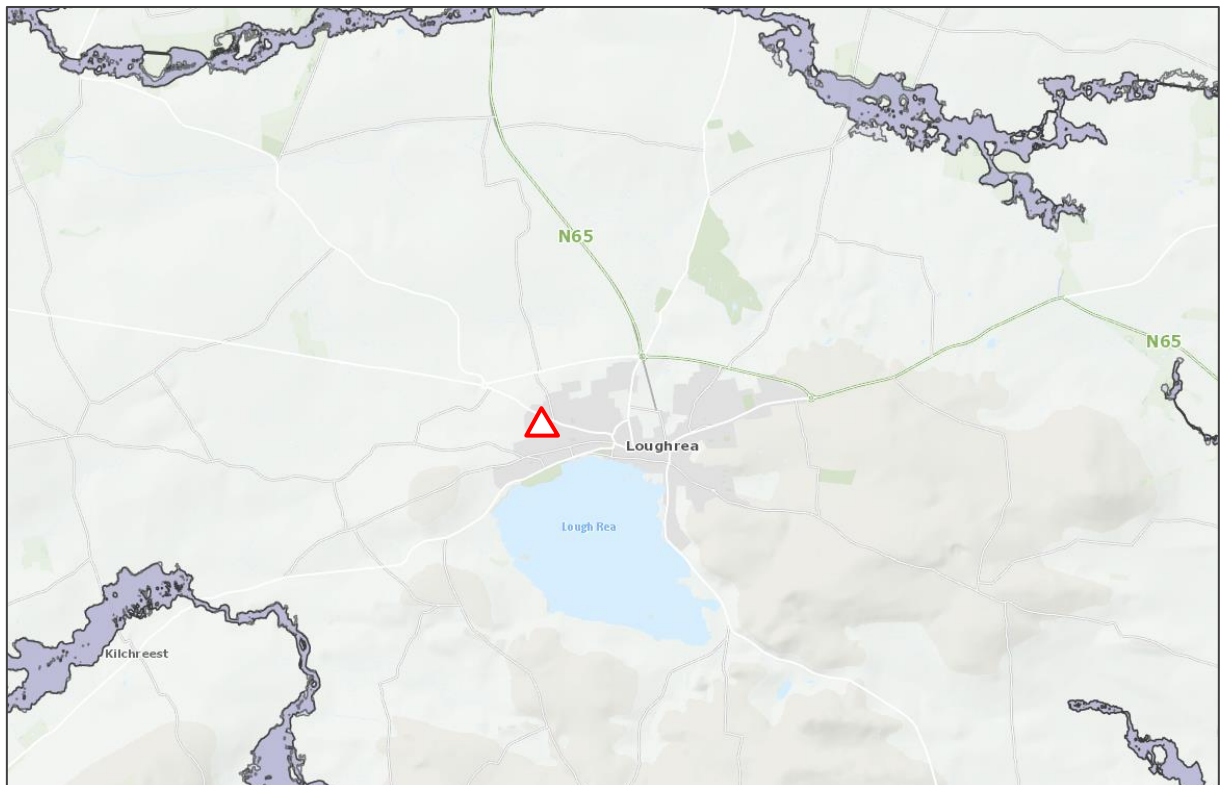


Plate 3.2: NIFM high range future climate change fluvial flood extents at the proposed site

3.3 Plates 3.3 presents the local CFRAM predicted fluvial flood extents mapping for the present day scenario (site location approximately identified by the red triangle). This map shows that the northern bank of Lough Rea and downstream watercourse were considered in this study. The resulting predicted Q10, Q100 and Q1000 floodplains do not reach into the proposed site.



Plate 3.3: CFRAM present day fluvial flood extents at the proposed site

3.4 Plates 3.4 presents the local CFRAM predicted fluvial flood extents mapping for the high range future climate change scenario (site location approximately identified by the red triangle). The modelled floodplains in this instance again do not reach into the proposed site area.



Plate 3.4: CFRAM high range future climate change fluvial flood extents at the proposed site



3.5 Plate 3.5 presents an extract of the detailed CFRAM fluvial flood extents mapping for the present day scenario, where the site location is identified by the red triangle on the top of the plate. This map shows the predicted floodplains along the northern bank of Lough Rea a distance south of the site and identifies that flood risk along the north western lough bank have not been mapped. Examination of this wider CFRAM mapping confirms that the watercourse seen on the RHS of Plate 3.3 flows northward, downstream from Lough Rea, as per the contours shown on Plate 2.5. The predicted Q1000 fluvial flood levels of the watercourse exiting Lough Rea to the east of the site are generally below 81m OD. Where the site is shown on Plate 2.5 to be above the 90m OD contour line, this places the site above the locally modelled CFRAM Q1000 flood levels.

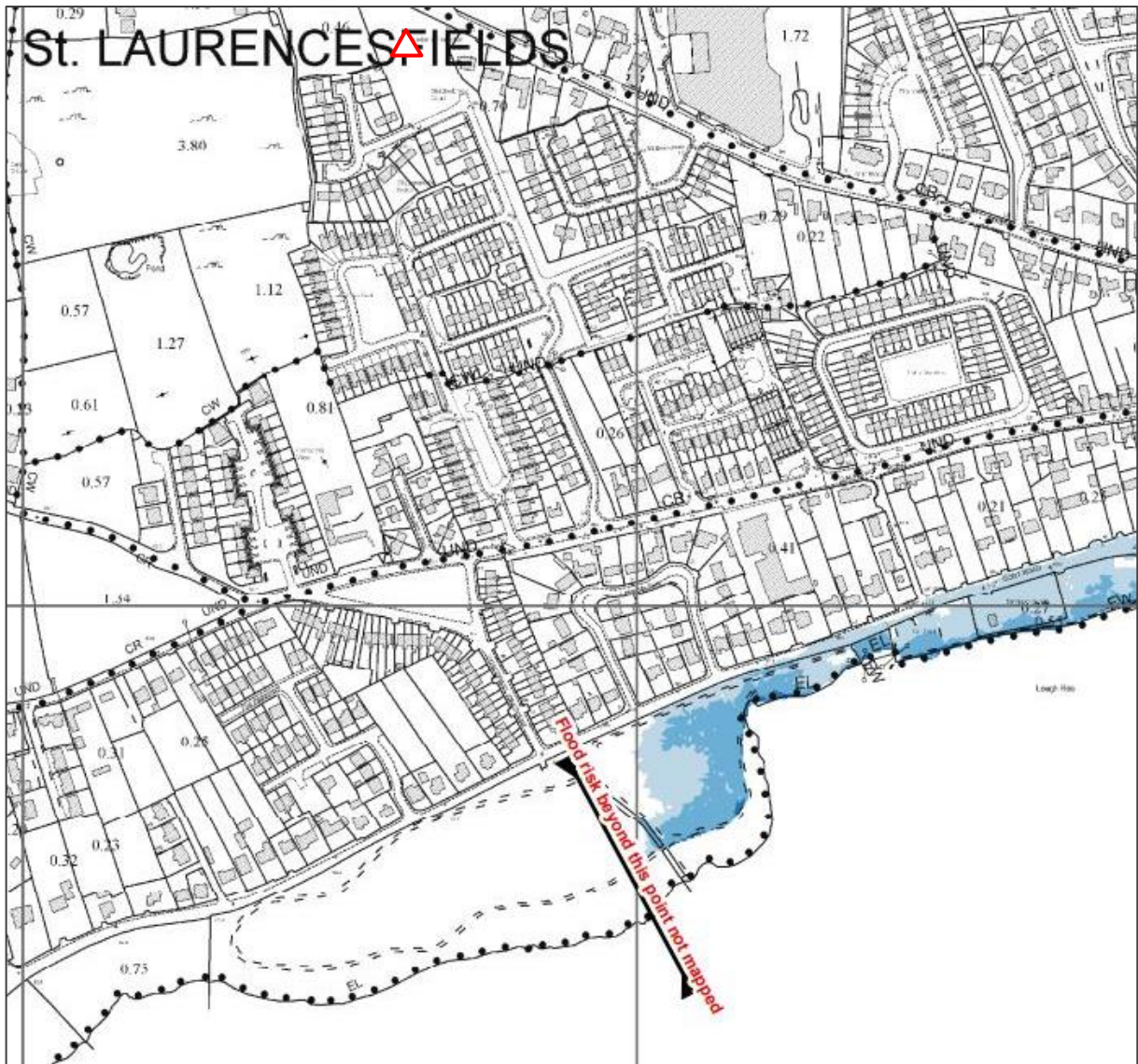


Plate 3.5: Detailed view of present day CFRAM fluvial flood extent mapping

3.6 Plate 3.6 presents OPW mapping of locations of recorded historical flooding (warning triangles) within the vicinity of the proposed site (identified by the red triangle with white centre). This plate shows that historic flooding has been recorded at Lough Rea to the south of the site. However, no historic flood records are indicated at the site or in its immediate vicinity. Available reports of historic flooding in County Galway were reviewed and no reported incidents were found to be located within close proximity to the proposed development a distance north of Lough Rea.

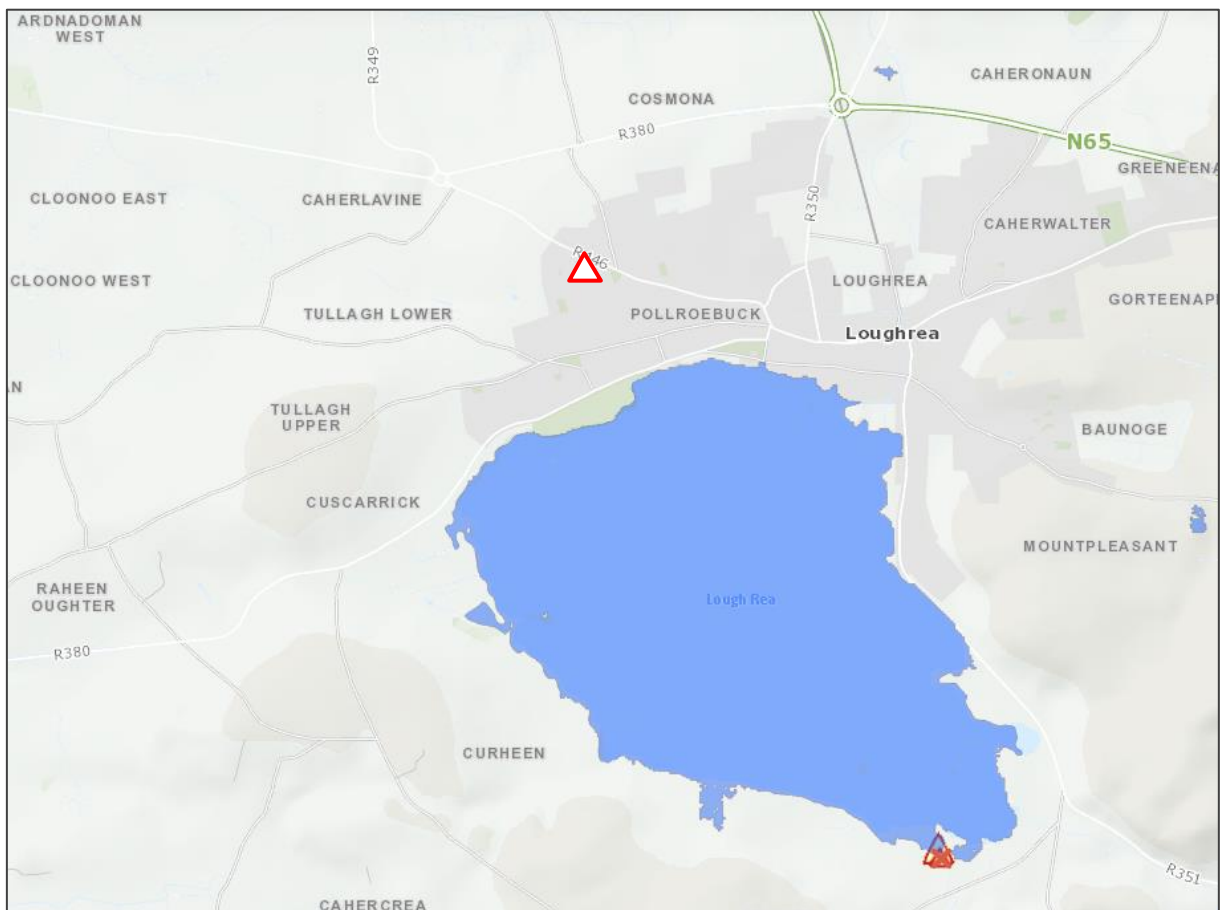


Plate 3.6: OPW mapping of recorded historical flooding within the vicinity of the site

3.7 Geological Survey Ireland (GSI) mapping of local predicted groundwater flooding is presented on Plate 3.7 (site location indicated by the red triangle). This plate shows no GSI predicted ground water flooding predicted in the area of the proposed site.

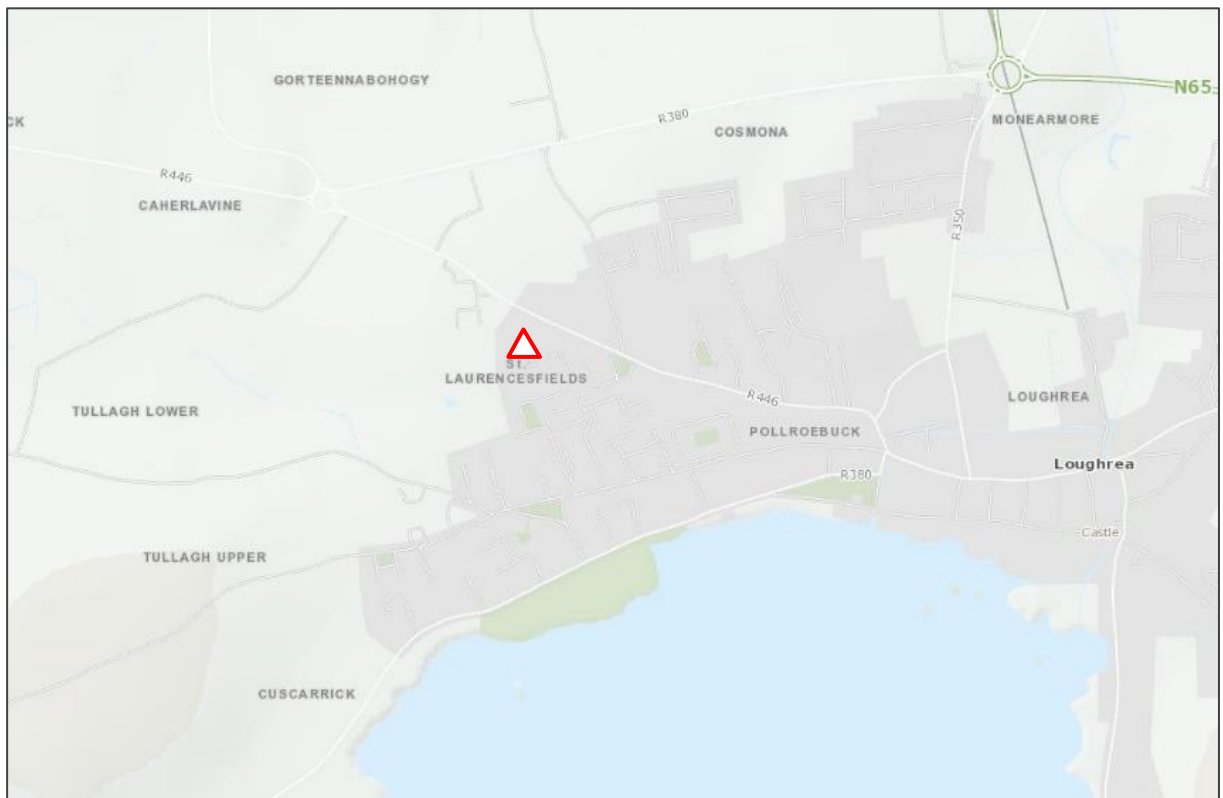


Plate 3.7: GSI predicted ground water flooding within the vicinity of the site

3.8 Plate 3.8 presents GSI mapping of local historic groundwater flooding (site location indicated by the red triangle). This plate shows no GSI records of historic ground water flooding in the area of the proposed site.

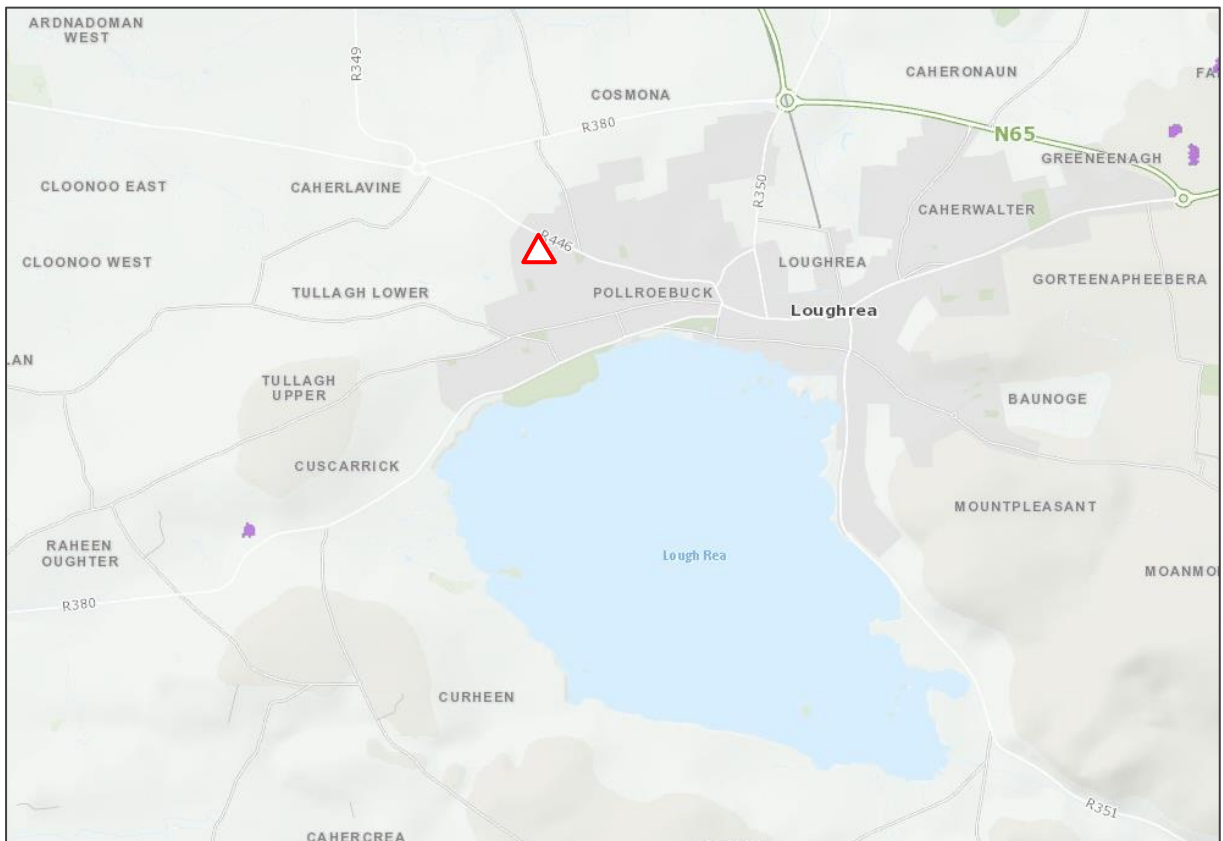


Plate 3.8: GSI historic records of ground water flooding within the vicinity of the site

3.9 Plate 3.9 presents mapping of CFRAM predicted rainfall flooding, which shows no modelled predicted rainfall flooding in the vicinity of the proposed site (indicated by the red triangle).



Plate 3.9: CFRAM predicted rainfall flooding within the vicinity of the site

3.10 Based on the above available mapping it is concluded that Flood Zone A (100 year) and Flood Zone B (1000 year) from the locally modelled water features do not affect the proposed site. Therefore, **the footprint of the proposed development is determined to be within Flood Zone C.** The Flood Zones will be further discussed in the following sections of this report. Other water features, not shown on the above mapping, may affect the site and have not been assessed in this report.

4.0 PROPOSED DEVELOPMENT

- 4.1 No topographical survey of the proposed site area was provided to FRC at the time of writing.
- 4.2 Plate 4.1 present an extract of the proposed development layout, which consists of a fire station with associated facilities and parking. The entrance to the development can be seen to located along Athenry Road at the approximate mid-point of the northern boundary.



Plate 4.1: Proposed site layout



5.0 GUIDELINES ASSESSMENT OF THE PROPOSED DEVELOPMENT

5.1 General

5.1.1 This section will assess whether the proposed development satisfies the document 'The Planning System and Flood Risk Management; Guidelines for Planning Authorities (OPW, 2009)'. The above document shall be referred to within this report as the 'Guidelines'. The assessment has been undertaken by qualified professional civil engineers with experience in hydraulic engineering as required by the above document.

5.1.2 Some of the core objectives of these Guidelines are to avoid inappropriate development in areas at risk of flooding, to avoid new developments increasing flood risk elsewhere (including that which may arise from surface water runoff) and avoiding the unnecessary restriction of national, regional or local economic and social growth.

5.1.3 In achieving the aims and objectives of the Guidelines, the key principles that should be adopted should be to:

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

5.1.4 With reference to the last bullet point, Paragraph 1.11 of the Guidelines states that "proper planning and sustainable development may at the same time require in exceptional circumstances some development in areas of flood risk, provided that the issue of flood risk is managed properly.

5.1.5 Flood risk is a combination of the likelihood of flooding and the potential consequences arising. The Guidelines therefore recommend a staged approach to flood risk assessment that covers both the likelihood of flooding and the potential consequences.



- 5.1.6 The likelihood of flooding is normally defined as the percentage probability of a flood of a given magnitude or severity occurring. The consequences of flooding depend on the hazards associated with the flooding (e.g. depth of water, speed of flow, rate of onset) and the vulnerability of people, property and the environment potentially affected by a flood (e.g. the age profile of the population, the type of development, presence and reliability of mitigation measures etc).
- 5.1.7 A staged approach is therefore recommended within the Guidelines, carrying out only such appraisal and or assessment as is needed for the purposes of decision-making 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 the proposed site
 - Stage 2 Initial flood risk assessment – to confirm sources of flooding that may affect a 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, of its potential impact on flood risk elsewhere and of the effectiveness of any proposed mitigation measures.
- 5.1.8 At regional level the focus will be on Stage 1 (identification of flood risk), where, in general, the need for more detailed flood risk assessments is flagged for city/country and local area plans. In order to allow this Stage 1 identification to occur, flood zones must be considered. Flood zones are geographical areas within which the likelihood of flooding is in a particular range. There are three types of levels of flood zones:



- 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 1,000 and 1% or 1 in 100 for river flooding and between 0.1% or 1 in 1,000 year and 0.5% or 1 in 200 for coastal flooding);
- **Flood Zone C – where the probability of flooding from rivers and the sea is low (less than 0.1% or 1 in 1,000 for both river and coastal flooding). Flood Zone C covers all areas of the plan which are not in zones A or B.**

5.1.9 In addition to identifying the above zones, there is a great deal of uncertainty in relation to the potential effects of climate change, and therefore a precautionary approach should be adopted. An example of a precautionary approach is to ensure that floor levels are sufficient to cope with the effects of climate change over the lifetime of the development.

5.2 Flood Zones

5.2.1 Flood Zone A

5.2.1.1 Most types of development would be considered inappropriate in Flood Zone A. However, water-compatible development, amenity open space, outdoor sports and recreation and essential facilities such as changing rooms would be considered appropriate in this zone.

5.2.1.2 Apart from the above types of development, the Guidelines state that development in this zone should be avoided and/or only considered in exceptional circumstances, such as in city and town centres, or in the case of essential infrastructure that cannot be located elsewhere, and where the Justification Test has been applied.



5.2.2 Flood Zone B

5.2.2.1 The Guidelines state that highly vulnerable development, such as hospitals, schools, residential care homes, caravan and mobile home parks, Garda, **fire** and ambulance stations, dwelling houses and primary strategic transport and utilities infrastructure, would generally be considered inappropriate in Flood Zone B, unless the Justification Test can be met.

5.2.2.2 Less vulnerable development, such as retail, leisure, warehousing, commercial, industrial and non-residential institutions, land and buildings used for holiday or short-let caravans and camping, land and buildings used for agriculture and forestry, waste treatment and secondary strategic transport and utilities infrastructure would be considered appropriate for this zone.

5.2.3 Flood Zone C

5.2.3.1 Development in this zone is appropriate from a flood risk perspective (subject to assessment of flood hazard from sources other than rivers and the coast) but would need to meet the normal range of other proper planning and sustainable development considerations.

5.3 *Sequential approach*

5.3.1 A risk-based sequential approach is therefore required to manage flood risk. The sequential approach includes the following:

- Avoid development in areas at risk of flooding
- Inappropriate types of development that would create unacceptable risks from flooding should not be planned for or permitted
- Exceptions to the restrictions of development due to potential flood risks are provided for through the use of a Justification Test, where the planning need and the sustainable management of flood risk to an acceptable level must be demonstrated.

5.3.2 Plate 5.1 presents Fig 3.1 from The Guidelines, which sets out the broad philosophy underpinning the sequential approach.

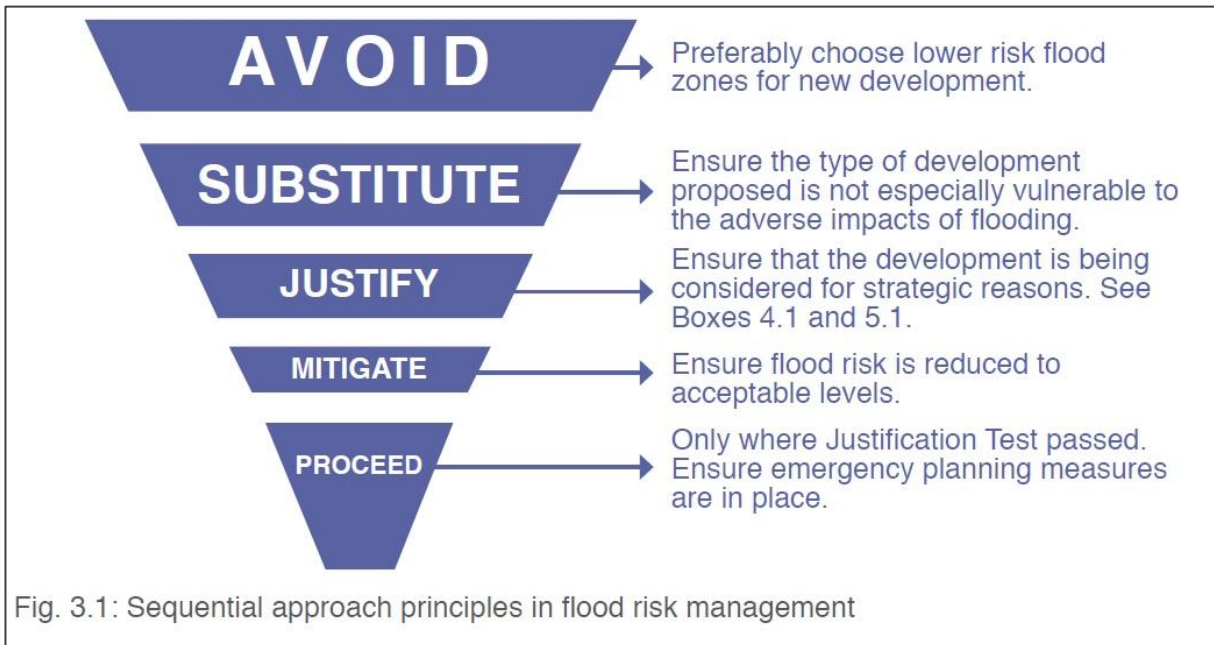


Plate 5.1: Broad philosophy underpinning the sequential approach

5.3.3 A sequential approach to planning is a key tool in ensuring that development, particularly new development, is first and foremost directed towards land that is at low risk of flooding.

5.3.4 Table 5.1 illustrates those types of development that would be appropriate to each flood zone and those that would be required to meet the Justification Test.

	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, open space and recreation	Appropriate	Appropriate	Appropriate

Table 5.1: Types of development that are appropriate for each flood zone



- 5.3.5 The Justification Test has been designed to rigorously assess the appropriateness, or otherwise, of particular developments that are being considered in areas of moderate or high flood risk. The test is comprised of two processes; the Plan-making Justification Test and the Development Management Justification Test. The Development Management Justification Test is the process that is relevant to this FRA report, as it is used at the planning application stage where it is intended to develop land at moderate or high risk of flooding for uses or development vulnerable to flooding that would generally be inappropriate for that land.
- 5.3.6 Section 5.0 of the Guidelines states that where flood risk may be an issue for any proposed development, a site-specific FRA should quantify the risks and the effects of any necessary mitigation, together with the measures needed or proposed to manage residual risks. This site-specific FRA will therefore seek to consider mitigation measures and to manage residual risk at the proposed development.
- 5.3.7 The Justification Test as outlined in Box 5.1 of the Guidelines is presented on Plate 5.2. Therefore, in order for a proposed development to pass the Justification Test, the site-specific FRA must;
1. ensure that the proposed development will not increase flood risk elsewhere,
 2. Include measures, proportional to the nature of the development and associated flood risk, to minimise flood risk to people, property, the economy and the environment as far as reasonably possible.

Box 5.1 Justification Test for development management (to be submitted by the applicant)
<p>When considering proposals for development, which may be vulnerable to flooding, and that would generally be inappropriate as set out in Table 3.2, the following criteria must be satisfied:</p> <ol style="list-style-type: none"> 1. The subject lands have been zoned or otherwise designated for the particular use or form of development in an operative development plan, which has been adopted or varied taking account of these Guidelines. 2. The proposal has been subject to an appropriate flood risk assessment that demonstrates: <ol style="list-style-type: none"> (i) The development proposed will not increase flood risk elsewhere and, if practicable, will reduce overall flood risk; (ii) The development proposal includes measures to minimise flood risk to people, property, the economy and the environment as far as reasonably possible; (iii) The development proposed includes measures to ensure that residual risks to the area and/or development can be managed to an acceptable level as regards the adequacy of existing flood protection measures or the design, implementation and funding of any future flood risk management measures and provisions for emergency services access; and (iv) The development proposed addresses the above in a manner that is also compatible with the achievement of wider planning objectives in relation to development of good urban design and vibrant and active streetscapes. <p>The acceptability or otherwise of levels of residual risk should be made with consideration of the type and foreseen use of the development and the local development context.</p> <p>Note: See section 5.27 in relation to major development on zoned lands where sequential approach has not been applied in the operative development plan.</p> <p>Refer to section 5.28 in relation to minor and infill developments.</p>

Plate 5.2: Box 5.1 of the Guidelines



5.4 *Application of the Justification Test to the proposed development*

5.4.1 Should the justification test be applied to the proposed development?

5.4.1.1 It has been demonstrated that the full extent of the proposed site is located outside of the predicted 100 year and 1000 year floodplains. **Therefore, the proposed development is considered located within Flood Zone C.** Table 5.1 shows that the Justification Test is accordingly not required for the proposed development. This is based on information from examined public body flood mapping. The developer should ensure that flood risk at the site is considered for all local flood sources, including any which may exist but are not identified on the available flood maps presented in Section 3.0 of this report. The design team should consider Technical Appendix B of the Guidelines in order to consider appropriate measures that could be implemented at detailed design stage for the proposal.

5.4.2 *Ensuring the proposed development will not increase flood risk elsewhere*

5.4.2.1 Risk to coastal and fluvial flooding elsewhere

5.4.2.1.1 As the entire proposed development is located within Flood Zone C, any required infilling within the site will not impact the 100 year or 1000 year floodplains.

5.4.2.2 Risk to pluvial flooding elsewhere

5.4.2.2.1 As the proposed development will cause an increase in the hardstanding area, the risk to pluvial flooding elsewhere has to be considered.



5.4.2.2.2 Proposals for surface-water management should be applied to the development according to sustainable drainage principles to ensure that surface water runoff from the proposed development does not increase beyond that which presently discharged from the existing greenfield site.

5.4.2.2.3 Measures such as the use of on-site storm water storage, with appropriate approved storm discharge, are recommended to ensure that the proposed development will not have a negative impact on pluvial flooding elsewhere. Alternatively, an appropriately designed soakaway may be used to address surface water runoff from the proposed development. All required appropriate storm water permissions should be acquired by the design team.

5.4.2.2.4 Subject to the implementation of the above recommendations and mitigation measures, the proposed development to not have a negative impact on local pluvial flooding.

5.4.3 *Measures to minimise flood risk to people, property, the economy and the environment*

5.4.3.1 Coastal and fluvial flooding at the proposed development

5.4.3.1.1 A freeboard of 500mm above the predicted 1000 year flood level is considered appropriate to take account of uncertainties in water level prediction, hydrological predictions, modelling accuracy, topographical accuracy and the unknown of future climate change.

5.4.3.1.2 Plate 2.5 has presented OSI contour mapping which indicates that the site is located above the 90m OD contour line. A topographical site survey was not available to FRC at the time of writing. Local CFRAM mapping indicates Q1000 fluvial flood levels below 81m OD along the watercourse a distance east of the site (downstream from Lough Rea). Based on this information, the site is located at a sufficient freeboard above the local modelled CFRAM fluvial flood levels. This should be confirmed by a topographical site survey. The watercourse a distance west of the site was unmodelled by the CFRAM study.



5.4.3.1.3 The developer may wish to take a precautionary approach, beyond current planning policy, and implement additional measures to address any flood risk related to high range future climate change scenarios. The document “Improving the Flood Performances of New Buildings” published by the Department of Communities and Local Government in the UK is a valuable resource.

5.4.3.1.4 The developer should satisfy themselves that the proposed site is not at risk of fluvial flooding from any other local water feature, and that fluvial flood risk is not increased due to the development.

5.4.3.2 Pluvial flooding at the proposed development

5.4.3.2.1 The Guidelines state that a site-specific FRA should not only consider fluvial risk at the proposed development but also consider other risks of flooding such as surface water and exceedance.

5.4.3.2.2 Exceedance conditions result in above ground flood flow occurring either when the capacity of the drainage system is exceeded and/or where the rate of runoff exceeds the inlet capacity of the drain. Without good design, flood flow will follow default pathways and this can lead to indiscriminate flooding of property. It is possible to avoid this by identifying and designing above ground flood routes.

5.4.3.2.3 With the above in mind, this report shall consider at a preliminary level exceedance of the development’s proposed storm network.

5.4.3.2.4 The client may wish to have detailed design undertaken in the future to ensure that no flooding of property will occur as a result of a 100 year storm event.



5.4.3.2.5 The primary risk is that the proposed storm network is exceeded during an extreme storm rainfall event and so surcharge within the development. It is predicted that exceedance waters would generally flow southward, given the assumed topography of the area. This should be confirmed by the topographical survey of the site and local vicinity. The design team should ensure that the development's design would not restrict exceedance and would allow overland exceedance to follow the natural flow regime for the area. This could be achieved with features such as drop kerbs to direct overland flow. In addition, the internal FFLs of the proposed development should be suitably located above external ground levels, typically a minimum of 150mm, so that overland storm exceedance flooding does not enter buildings. The design team may wish to consider a precautionary approach and locate internal FFLs more than 150mm above external ground levels to provide additional mitigation.

5.4.3.2.6 In addition, if surface water from the development is proposed to discharge to local storm or watercourse features, it is recommended that the drainage design ensure that the storm system will not be at risk of flooding during a downstream flood event. This could be achieved through the use of features such as non-return valves.

5.4.3.2.7 The above preliminary design consideration of an exceedance event has therefore shown that the layout of the proposed development does not need to be revised if appropriate mitigation measures are employed. The design team should consider Technical Appendix B of the Guidelines in order to consider appropriate measures that could be implemented at detailed design stage for the proposal.



6.0 CONCLUSIONS

- 6.1 The primary objective of the study was to carry out a Site Specific Flood Risk Assessment (SSFRA) in regulation with The Planning System and Flood Risk Management: Guidelines for Planning Authorities (OPW, 2009) proposed Loughrea Fire Station at Athenry Road, Loughrea, Co. Galway.
- 6.2 The report presents the results of a detailed desk top study. The NIFM and CFRAM studies mapping show that flooding is not predicted in the vicinity of the proposed site from any considered water features, for present day and high range future climate change scenarios. **Based on this available mapping, it is concluded that the proposed site is located within Flood Zone C and a Justification Test was not deemed necessary for the proposed development. Therefore, it is concluded that predicted flood risk from the examined public body data sets does not prohibit development at the proposed site.**
- 6.3 Based on available information, the site is assumed to be located at a sufficient freeboard above the local modelled CFRAM fluvial flood levels. This should be confirmed by a topographical site survey. The developer should ensure that flood risks at the site, and appropriate freeboards, are considered for all local flood sources, including any which may exist but are not identified on the available examined flood maps.
- 6.4 In addition, it is necessary to ensure that the proposed development will not increase pluvial flood risk elsewhere. Proposals for surface-water management should be applied to the development according to sustainable drainage principles. All required appropriate storm water permissions should be acquired by the design team.



- 6.5 Consideration of the risk of pluvial flooding due to an exceedance event predicted that exceedance waters would flow generally southward (to be confirmed by a site survey). It is recommended that the development's design should allow overland exceedance to follow the natural flow regime for the area. In addition, the internal FFLs of proposed buildings should be suitably located above external ground levels to address overland pluvial flood risk to the property.
- 6.6 The design team should consider Technical Appendix B of the Guidelines in order to consider appropriate measures that could be implemented at detailed design stage for the proposal.
- 6.7 Subject to the implementation of the above recommendations, the proposed development is considered to comply with the OPW planning guidelines.

Dr Philip Hull PhD BEng BTh CEng MICE MIEI

Director for Flood Risk Consulting Limited