

## **Variation 1 to the Kells Development Plan 2013-2019**

**SFRA Report**

**March 2017**



**comhairle chontae na mí**  
*meath county council*

**County Hall  
Navan  
Meath**

## JBA Project Manager

Ross Bryant BSc MSc CEnv MCIWEM C.WEM  
24 Grove Island  
Corbally  
Limerick  
Ireland

## Revision History

Revision Ref / Date Issued	Amendments	Issued to
Draft v1.0 November 2012	First Issue	Meath County Council
Draft v1.1 May 2013	Amendments in relation to Manager's Report	Meath County Council
Report v1.2 November 2013	Additional amendments in relation to Manager's Report	Meath County Council
Draft v1.3 March 2017	Variation 1, First Issue	Meath County Council

## Contract

This report describes work commissioned by Meath County Council, under a signed services contract, dated August 2016. Ross Bryant and David Casey of JBA Consulting carried out this work.

Prepared by ..... David Casey BSc MSc MCIWEM

Senior Engineer

Ross Bryant BSc MSc CEnv MCIWEM C.WEM

Chartered Senior Analyst

Reviewed by ..... Jonathan Cooper BEng MSc DipCD CEng MICE  
MCIWEM C.WEM MloD

Director

## Purpose

This document has been prepared as an SFRA variation for Meath County Council.

## Carbon Footprint



A printed copy of the main text in this document will result in a carbon footprint of 181g if 100% post-consumer recycled paper is used and 231g if primary-source paper is used. These figures assume the report is printed in black and white on A4 paper and in duplex.

JBA is aiming to reduce its per capita carbon emissions.

# Contents

1	Background to the Study .....	1
1.1	Commission.....	1
1.2	Scope of the Study .....	1
1.3	Background .....	1
1.4	Report Structure .....	2
2	Study Area .....	3
2.1	Introduction .....	3
2.2	People, Property and Infrastructure .....	3
2.3	Drainage Catchments.....	3
2.4	Environment .....	5
3	The Planning System and Flood Risk Management Guidelines .....	6
3.1	Introduction .....	6
3.2	Definition of Flood Risk .....	6
3.3	Likelihood of Flooding.....	7
3.4	Definition of Flood Zones.....	7
3.5	Objectives and Principles of the Planning Guidelines .....	8
3.6	The Sequential Approach and Justification Test .....	8
3.7	Scales and Stages of Flood Risk Assessment .....	9
4	Flood Risk in Kells .....	11
4.1	Overview .....	11
4.2	Kells Stormwater Drainage Study (2006) & Kells TCD Newrath Stream Assessment (2007).....	12
4.3	JBA Fluvial Flood Mapping & Methodology .....	13
4.4	National PFRA Study Fluvial Flood Outlines .....	13
4.5	Walkover Survey .....	13
4.6	Summary.....	15
4.7	Historic Flood Review and Consultation with Area Engineer .....	16
4.8	Sources of Flooding.....	18
4.9	Climate Change & Residual Risk.....	21
5	Flood Risk Management .....	23
5.1	Flood Risk Policies and Objectives .....	23
5.2	Development Management - Planning Applications in Kells .....	23
5.3	Existing Development at Risk of Flooding .....	24
5.4	Extension of Duration .....	24
5.5	Policy on the Management of Surface Water .....	24
5.6	Flood Mitigation Measures at Site Design .....	25
6	Development Zoning and the Justification Test .....	27
6.1	Development Land Use Zoning Review in Kells .....	27
6.2	Development Zoning in Kells .....	28
6.3	SFRA Review and Monitoring.....	34



## List of Figures

Figure 2-1 River Blackwater Catchment.....	4
Figure 2-2 Newrath Stream Catchment .....	4
Figure 3-1 Source Pathway Receptor Model.....	6
Figure 3-2 Sequential Approach Principles in Flood Risk Management.....	9
Figure 4-1 Flood Zone Mapping .....	12
Figure 4-2 Site Walkover Photographs.....	14
Figure 4-3 Historic Flood Mapping; Spatial Representation .....	17
Figure 4-4 PFRA Indicative Pluvial Flood Map.....	19

## List of Tables

Table 2-1 Census Population Figures .....	3
Table 3-1 Probability of Flooding .....	7
Table 3-2 Definition of Flood Zones .....	8
Table 3-3 Matrix of Vulnerability versus Flood Zone .....	9
Table 4-1 Flood Data Used to Compile Flood Zone Mapping .....	11
Table 4-2 Historic Flooding Information .....	17
Table 4-3 Allowance for Future Scenarios (100 Year Horizon) .....	21
Table 6-1 Land Zoning Objectives and Vulnerabilities .....	27
Table 6-2 Land Use Zoning and Flood Risk in Kells.....	28

## Abbreviations

1D.....	One Dimensional (modelling)
AEP.....	Annual Exceedance Probability
AFA.....	Area for Further Assessment
CDP .....	County Development Plan
CFRAM .....	Catchment Flood Risk Assessment and Management
DoEHLG.....	Department of the Environment, Heritage and Local Government
DTM .....	Digital Terrain Model
EPA.....	Environmental Protection Agency
FRA.....	Flood Risk Assessment
HEFS.....	High End Future Scenario
JFLOW .....	2-D hydraulic modelling package developed by JBA
KDP .....	Kells Development Plan
LA .....	Local Authority
LiDAR.....	Light Detection And Ranging
MRFS.....	Medium Range Future Scenario
OPW.....	Office of Public Works
OSi.....	Ordnance Survey Ireland
PFRA.....	Preliminary Flood Risk Assessment
SAC.....	Special Area of Conservation, designated under the Habitats Directive
SEA.....	Strategic Environmental Assessment
SFRA.....	Strategic Flood Risk Assessment
SPA.....	Special Protection Area for birds, protected under the EU Birds Directive
SPR.....	Standard percentage runoff
SUDS .....	Sustainable Urban Drainage Systems
Tp.....	Time to Peak

# 1 Background to the Study

## 1.1 Commission

JBA Consulting was commissioned by Meath County Council to undertake a Strategic Flood Risk Assessment (SFRA). This study is to inform Variation 1 to the Kells Development Plan 2013-2019.

The SFRA is a live document that is designed to be updated as further flood risk information becomes available and changes to the development plan are proposed under a formal variation. This version of the SFRA therefore supersedes version 1.2 which was adopted in 2013 under The Kells Development Plan 2013-2019

## 1.2 Scope of the Study

Under the "Planning System and Flood Risk Management Guidelines for Planning Authorities", the purpose for the SFRA is detailed as being *"to provide a broad (wide area) assessment of all types of flood risk to inform strategic land-use planning decisions. SFRAs enable the LA to undertake the sequential approach, including the Justification Test, allocate appropriate sites for development and identify how flood risk can be reduced as part of the development plan process"*.

The Kells Development Plan 2013-2019 (KDP) is the key document for setting out a vision for how Kells should develop during the plan period.

It is important that the KDP is consistent with the Meath County Development Plan 2013-2019 SFRA (Variation 3) and therefore "The Planning System and Flood Risk Management Guidelines for Planning Authorities" (OPW/DoEHLG, 2009) which states that flood risk management should be integrated into spatial planning policies at all levels to enhance certainty and clarity in the overall planning process.

In order to ensure that flood risk is integrated into the KDP, Meath CC has issued a brief to consultants for the provision of a Flood Risk Assessment. As laid out in the tender documents, the main requirements are:

1. Undertake a flood risk assessment for Kells,
2. Undertake flood probability mapping,
3. Prepare a flood risk management plan.

## 1.3 Background

The SFRA considers the broader settlement strategy of the Greater Dublin Regional Planning Guidelines and the countywide policies and objectives of the County Development Plan. It is intended to be read in conjunction with the SFRA for the County Development Plan (2013-2019) as there is a degree of overlap between the two studies and in order to avoid excessive repetition some chapters of this study refer to the county scale SFRA report.

On a more local level, this study considers the development strategy that will form part of the Development Plan for Kells. The context of flood risk in the Kells area is considered with specific reference to people, property, infrastructure and the environment. A range of flood sources are considered including fluvial, pluvial and groundwater.

A two stage assessment of flood risk was undertaken, as recommended in 'The Planning System and Flood Risk Management' guidelines, for the area that lies within the development boundary of the Development Plan. The first stage is to identify flood risk. Historical records and recent events demonstrate that the Kells area has a very limited history of flooding and confirms that a proportion of zoned lands are at flood risk.

The second stage and the main purpose of this SFRA report is to appraise the adequacy of existing information, to prepare flood zone maps, based on re-running the Kells Stormwater Drainage Study Model, and to highlight potential development areas that require more detailed assessment on a site specific level. The SFRA also provides guidelines for development

within areas at potential risk of flooding, and specifically looks at flood risk and the potential for development within the Frontlands and Backlands, as well as other key sites in Kells.

#### 1.4 Report Structure

Section 2 of this report, provides an introduction to the study area and Section 3 discusses the concepts of flooding, Flood Zones and flood risk as they are incorporated into the Planning System and Flood Risk Management.

In Section 4, the available data related to flooding is summarised and appraised, it also outlines the sources of flooding to be considered, based on the review of available data.

Following this, Section 5 provides guidance and suggested approaches to managing flood risk and development; the contents of this section will be of particular use in informing the policies and objectives within the development plan. In Section 6, specific responses to flood risk are discussed in relation to a number of key development sites within Kells. Triggers for the ongoing monitoring and future review of the SFRA are detailed in Section 6.4.



## 2 Study Area

### 2.1 Introduction

The area of interest comprises the development plan boundary of Kells Town which covers the existing urban area and greenfield periphery sites.

The town of Ceanannas Mór (Kells) is situated in the north west of County Meath and is located at the junction of the new M3 and N3 Dublin to Cavan route and the N52 Dundalk to Mullingar National Secondary route, an important connection point to other centres. Kells is circa 64 km from Dublin City Centre and is 16 km from Navan. Kells acts as a service centre for its own population and for a large rural hinterland. There are a number of key land-use activities in the town including the Courts Service, Health Service Executive, schools and employment uses principally in the Kells Business Park.

This section of the report will provide an overview of the study area, the drainage catchment, the population and the nature of settlement, to give context to the study.

### 2.2 People, Property and Infrastructure

Based on the available census figures the population of the defined Town Council area has decreased to 2,208 in 2011 from 2,257 in the 2006 census. The population change demonstrates a negative level of growth of -2.2%. This is offset by the continued growth of the population in the environs of the town which increased by 23.0% during the inter-censal period. The overall population of Kells increased by 12.2% during this period from 5,248 population in 2006 to 5,888 population in 2011, refer to Table 2-1.

Kells was founded as an ecclesiastical settlement and has a rich history. Recent years have seen a slow decline in population numbers and the settlement is identified as a Moderate Sustainable Growth Town.

Table 2-1 Census Population Figures<sup>1</sup>

Area	2006	2011	% Change
Kells Town	2257	2208	-2.2
Kells Environs	2991	3680	+23.0
Kells Combined (1+2)	5248	5888	+12.2

### 2.3 Drainage Catchments

Kells Town lies within the wider River Blackwater catchment which covers approximately 350 km<sup>2</sup> with a significant upper catchment area located in County Cavan that drains in to Lough Ramor before discharging and flowing into County Meath, close to Carnaross. The total length of the River Blackwater flowing through County Meath is approximately 32km. Downstream of Kells the Blackwater flows in a south westerly direction towards Navan where it joins the River Boyne.

The River Blackwater flanks the northern and eastern boundary of the settlement and intersects an area around Maudlin Bridge. There is only one other formal watercourse in Kells; the Newrath Stream, which drains the Backlands and Frontlands areas before flowing into the River Blackwater downstream of Maudlin Bridge.

Some minor field drains exist in the lands located to the south of the Kells Business Park. One of the drains is culverted under the business park and then enters the River Blackwater.

The extent of the Blackwater catchment with respect to Kells Town is illustrated in Figure 2-1, while the Newrath Stream catchment is presented in Figure 2-2.

<sup>1</sup> Source: Central Statistics Office, CSO; [www.cso.ie](http://www.cso.ie)  
2016s4699\_Kells DP SFRA\_v1.3.docx

Figure 2-1 River Blackwater Catchment

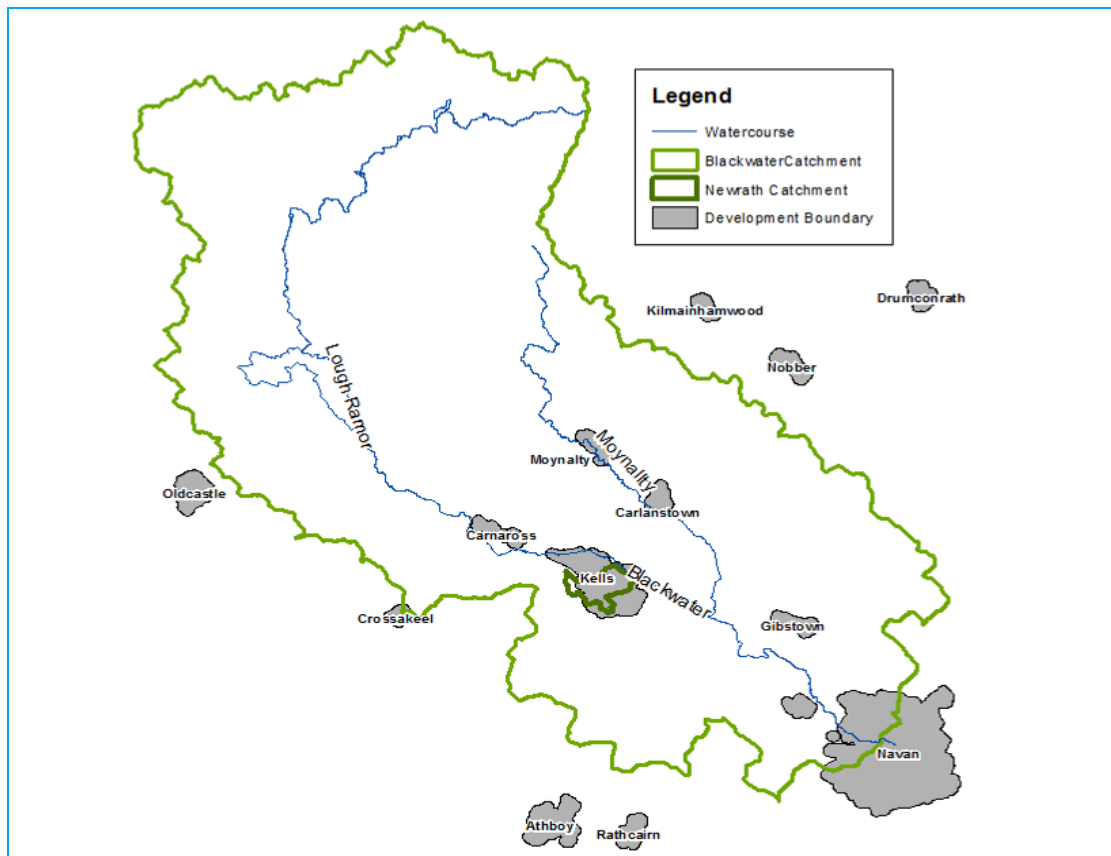
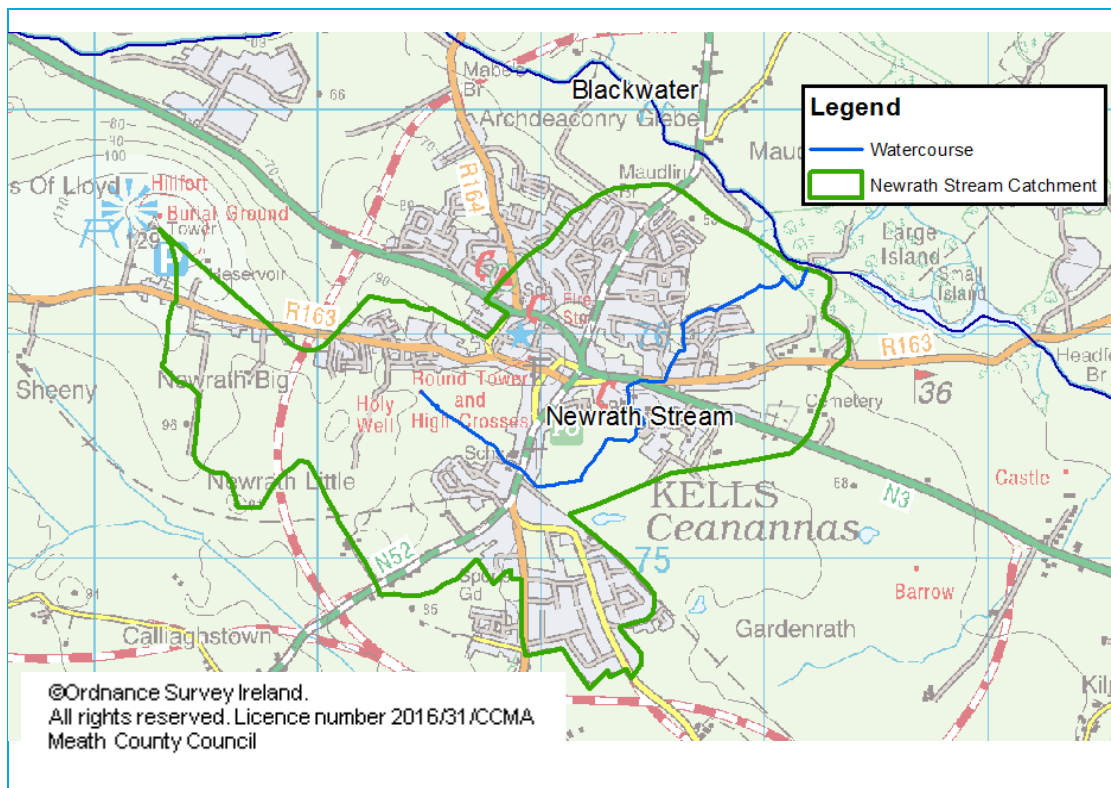


Figure 2-2 Newrath Stream Catchment



## 2.4 Environment

The River Blackwater (in conjunction with the River Boyne) is designated as a SPA (of high ornithological importance) from its junction with the River Boyne in Navan to the junction with Lough Ramor in Co. Cavan (SPA 004232). The designated area runs along the corridor of the River Blackwater and River Boyne.

The River Blackwater (in conjunction with the River Boyne) is also designated as a Special Area of Conservation (SAC 002299).

The management of flood risk within such areas must have regard to potential negative impacts to this environment. Further information is provided in the full Strategic Environmental Assessment (SEA) and AA for the KDP.

## 3 The Planning System and Flood Risk Management Guidelines

This chapter is replicated from the Meath County Development Plan 2013-2019 SFRA document, it is fundamental to understanding the SFRA process and has therefore been repeated.

### 3.1 Introduction

Prior to discussing the management of flood risk, it is helpful to understand what is meant by the term. It is also important to define the components of flood risk in order to apply the principles of the Planning System and Flood Risk Management in a consistent manner.

*The Planning System and Flood Risk Management: Guidelines for Planning Authorities*, published in November 2009, describe flooding as a natural process that can occur at any time and in a wide variety of locations. Flooding can often be beneficial, and many habitats rely on periodic inundation. However, when flooding interacts with human development, it can threaten people, their property and the environment.

This Section will firstly outline the definitions of flood risk and the Flood Zones used as a planning tool; a discussion of the principles of the planning guidelines and the management of flood risk in the planning system will follow.

### 3.2 Definition of Flood Risk

Flood risk is generally accepted to be a combination of the likelihood (or probability) of flooding and the potential consequences arising. Flood risk can be expressed in terms of the following relationship:

$$\text{Flood Risk} = \text{Probability of Flooding} \times \text{Consequences of Flooding}$$

The assessment of flood risk requires an understanding of the sources, the flow path of floodwater and the people and property that can be affected. The source - pathway - receptor model, shown below in Figure 3-1, illustrates this and is a widely used environmental model to assess and inform the management of risk.

Figure 3-1 Source Pathway Receptor Model<sup>2</sup>

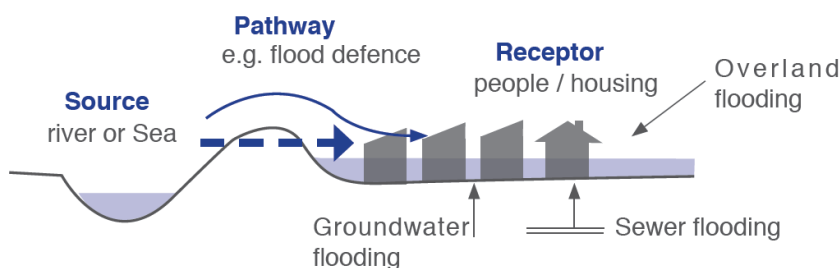


Fig. A1: Sources, pathways and receptors of flooding

Principal sources of flooding are rainfall or higher than normal sea levels while the most common pathways are rivers, drains, sewers, overland flow and river and coastal floodplains and their defence assets. Receptors can include people, their property and the environment. All three elements must be present for flood risk to arise. Mitigation measures, such as defences or flood resilient construction, have little or no effect on sources of flooding but they can block or impede pathways or remove receptors.

The planning process is primarily concerned with the location of receptors, taking appropriate account of potential sources and pathways that might put those receptors at risk.

<sup>2</sup> Figure A1 The Planning System and Flood Risk Management Guidelines Technical Appendices  
2016s4699\_Kells DP SFRA\_v1.3.docx

### 3.3 Likelihood of Flooding

Likelihood or probability of flooding of a particular flood event is classified by its annual exceedance probability (AEP) or return period (in years). A 1% AEP flood indicates the flood event that will occur or be exceeded on average once every 100 years and has a 1 in 100 chance of occurring in any given year.

Return period is often misunderstood to be the period between large flood events rather than an average recurrence interval. Annual exceedance probability is the inverse of return period as shown in Table 3-1.

Table 3-1 Probability of Flooding

Return Period (Years)	Annual Exceedance Probability (%)
2	50
100	1
200	0.5
1000	0.1

Considered over the lifetime of development, an apparently low-frequency or rare flood has a significant probability of occurring. For example:

- A 1% flood has a 22% (1 in 5) chance of occurring at least once in a 25-year period - the period of a typical residential mortgage;
- And a 53% (1 in 2) chance of occurring in a 75-year period - a typical human lifetime.

#### 3.3.1 Consequences of Flooding

Consequences of flooding depend on the hazards caused by inundation (depth of water, speed of flow, rate of onset, duration, wave-action effects, water quality) and the vulnerability of receptors (type of development, nature, e.g. age-structure, of the population, presence and reliability of mitigation measures etc.).

The Planning System and Flood Risk Management guidelines provide three vulnerability categories, based on the type of development, which are detailed in Table 3-1 of the Guidelines, and are summarised as:

- **Highly vulnerable**, including residential properties, essential infrastructure and emergency service facilities;
- **Less vulnerable**, such as retail and commercial and local transport infrastructure;
- **Water compatible**, including open space, outdoor recreation and associated essential infrastructure, such as changing rooms.

### 3.4 Definition of Flood Zones

In the Planning System and Flood Risk Management guidelines, Flood Zones are used to indicate the likelihood of a flood occurring. These Zones indicate a high, moderate or low probability of flooding from fluvial or tidal sources and are defined below in Table 3-2.

It is important to note that the definition of the Flood Zones is based on an undefended scenario and does not take into account the presence of flood protection structures such as flood walls or embankments. This is to allow for the fact that there is a residual risk of flooding behind the defences due to overtopping or breach and that there may be no guarantee that the defences will be maintained in perpetuity.

It is also important to note that the Flood Zones indicate flooding from fluvial and tidal sources and do not take other sources, such as groundwater or pluvial, into account, so an assessment of risk arising from such sources should also be made.

Table 3-2 Definition of Flood Zones

Zone	Description
<b>Zone A</b> High probability of flooding	This zone defines areas with the highest risk of flooding from rivers (i.e. more than 1% probability or more than 1 in 100) and the coast (i.e. more than 0.5% probability or more than 1 in 200).
<b>Zone B</b> Moderate probability of flooding	This zone defines areas with a moderate risk of flooding from rivers (i.e. 0.1% to 1% probability or between 1 in 100 and 1 in 1000) and the coast (i.e. 0.1% to 0.5% probability or between 1 in 200 and 1 in 1000).
<b>Zone C</b> Low probability of flooding	This zone defines areas with a low risk of flooding from rivers and the coast (i.e. less than 0.1% probability or less than 1 in 1000).

### 3.5 Objectives and Principles of the Planning Guidelines

The 'Planning System and Flood Risk Management' describes good flood risk practice in planning and development management. Planning authorities are directed to have regard to the guidelines in the preparation of Development Plans and Local Area Plans, and for development control purposes.

The objective of the 'Planning System and Flood Risk Management' is to integrate flood risk management into the planning process, thereby assisting in the delivery of sustainable development. For this to be achieved, flood risk must be assessed as early as possible in the planning process. Paragraph 1.6 of the Guidelines states that the core objectives 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 run-off;*
- *ensure effective management of residual risks for development permitted in floodplains;*
- *avoid unnecessary restriction of national, regional or local economic and social growth;*
- *improve the understanding of flood risk among relevant stakeholders; and*
- *ensure that the requirements of EU and national law in relation to the natural environment and nature conservation are complied with at all stages of flood risk management".*

The guidelines aim to facilitate *'the transparent consideration of flood risk at all levels of the planning process, ensuring a consistency of approach throughout the country.'* SFRAs therefore become a key evidence base in meeting these objectives.

The 'Planning System and Flood Risk Management' works on a number of key principles, including:

- Adopting a staged and hierarchical approach to the assessment of flood risk;
- Adopting a sequential approach to the management of flood risk, based on the frequency of flooding (identified through Flood Zones) and the vulnerability of the proposed land use.

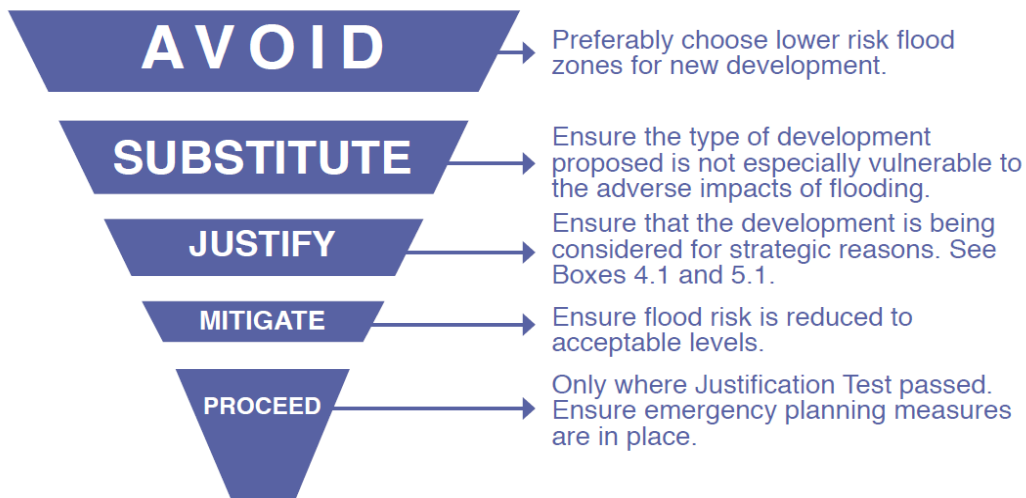
### 3.6 The Sequential Approach and Justification Test

Each stage of the FRA process aims to adopt a sequential approach to management of flood risk in the planning process.



Where possible, development in areas identified as being at flood risk should be avoided; this may necessitate de-zoning lands within the development plan. If de-zoning is not possible, then rezoning from a higher vulnerability land use, such as residential, to a less vulnerable use, such as open space may be required.

Figure 3-2 Sequential Approach Principles in Flood Risk Management<sup>3</sup>



Where rezoning is not possible, exceptions to the development restrictions are provided for through the Justification Test. Many towns and cities have central areas that are affected by flood risk and have been targeted for growth. To allow the sustainable and compact development of these urban centres, development in areas of flood risk may be considered necessary. For development in such areas to be allowed, the Justification Test must be passed.

The Justification Test has been designed to rigorously assesses the appropriateness, or otherwise, of such developments. The test is comprised of two processes; the Plan-making Justification Test, and the Development Management Justification Test. The latter is used at the planning application stage where it is intended to develop land that is at moderate or high risk of flooding for uses or development vulnerable to flooding that would generally be considered inappropriate for that land.

Table 3-3 shows which types of development, based on vulnerability to flood risk, are appropriate land uses for each of the Flood Zones. The aim of the SFRA is to guide development zonings to those which are 'appropriate' and thereby avoid the need to apply the Justification Test.

Table 3-3 Matrix of Vulnerability versus Flood Zone<sup>4</sup>

	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

The application of the Justification Test in the context of specific development sites in Kells is discussed in Section 6.

### 3.7 Scales and Stages of Flood Risk Assessment

Within the hierarchy of regional, strategic and site-specific flood-risk assessments, a tiered approach ensures that the level of information is appropriate to the scale and nature of the

<sup>3</sup> Source: The Planning System and Flood Risk Management (Figure 3.1)

<sup>4</sup> Source: Table 3.2 of The Planning System and Flood Risk Management  
2016s4699\_Kells DP SFRA\_v1.3.docx

flood-risk issues and the location and type of development proposed, avoiding expensive flood modelling and development of mitigation measures where it is not necessary. The stages and scales of flood risk assessment comprise of:

- **Regional Flood Risk Appraisal (RFRA)** – a broad overview of flood risk issues across a region to influence spatial allocations for growth in housing and employment as well as to identify where flood risk management measures may be required at a regional level to support the proposed growth. This should be based on readily derivable information and undertaken to inform the Regional Planning Guidelines.
- **Strategic Flood Risk Assessment (SFRA)** – an assessment of all types of flood risk informing land use planning decisions. This will enable the Planning Authority to allocate appropriate sites for development, whilst identifying opportunities for reducing flood risk. This SFRA will revisit and develop the flood risk identification undertaken in the RFRA, and give consideration to a range of potential sources of flooding. An initial flood risk assessment, based on the identification of Flood Zones, will also be carried out for those areas, which will be zoned for development. Where the initial flood risk assessment highlights the potential for a significant level of flood risk, or there is conflict with the proposed vulnerability of development, then a site specific FRA will be recommended, which will necessitate a detailed flood risk assessment.
- **Site Specific Flood Risk Assessment (FRA)** – site or project specific flood risk assessment to consider all types of flood risk associated with the site and propose appropriate site management and mitigation measures to reduce flood risk to and from the site to an acceptable level. If the previous tiers of study have been undertaken to appropriate levels of detail, it is highly likely that the site specific FRA will require detailed channel and site survey, and hydraulic modelling.

## 4 Flood Risk in Kells

### 4.1 Overview

There are a number of valuable sources of flood data available for the Kells area. The following table lists the core datasets used to compile the flood map for the Kells Development Plan area and gives an assessment of the data quality and the confidence in its accuracy.

#### 4.1.1 Flood Zone Mapping

There are a number of sources of flood data available for the Kells area. The following table lists the core datasets used to compile the flood map for the Kells Development Plan and gives an assessment of the data quality and the confidence in its accuracy.

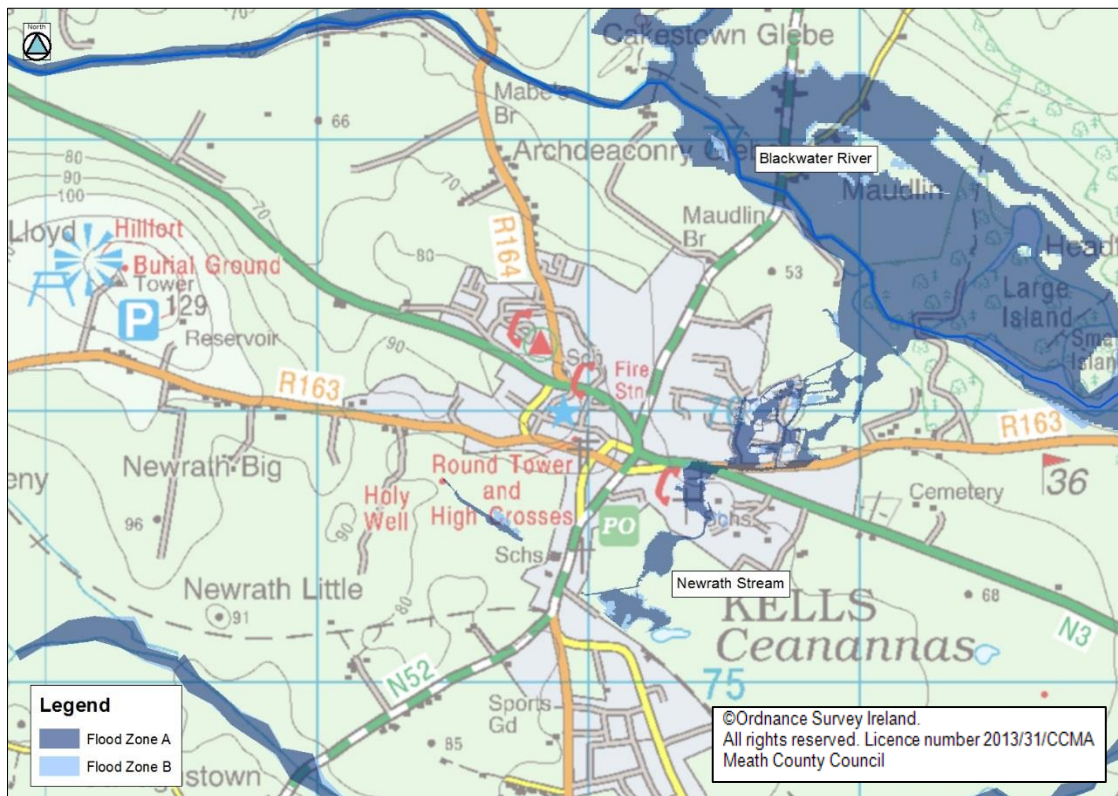
Table 4-1 below represents the final source of flood data used to compile the Flood Zone mapping.

Table 4-1 Flood Data Used to Compile Flood Zone Mapping

Description	Coverage	Quality	Confidence	Used
2016 Revised, combined ISIS and TUFLOW flood extents using Kells Stormwater Drainage Study (2006) survey data and new OSi LIDAR	Newrath Stream as it flows from the Frontlands area upstream of Bective Street, to the confluence with the Blackwater River.	Good	Good	Yes – for the Newrath Stream Flood Zones
2012 Combined ISIS and JFLOW® flood extents using the Kells Stormwater Drainage Study (2006) hydraulic model and new OSi LiDAR.	Newrath Stream as it flows from the Frontlands area upstream of Bective Street, to the confluence with the Blackwater River.	Good	Good	As verification and informative purposes only.
Kells Stormwater Drainage Study (2006) and Kells TCD Newrath Stream Assessment (2007)	Newrath Stream as it flows from the Frontlands area upstream of Bective Street, to the confluence with the Blackwater River.	Good	Moderate	As verification - original studies do not provide sufficient detail
OPW PFRA flood extent maps	Full Study Area	Moderate	Moderate	Yes, for the River Blackwater
Historic Flood Records and Consultation with Area Engineer	Whole county and Kells (Area Engineer specific input)	Various	Various	Yes indirectly to validate Flood Zones & identify other flood sources
Walkover Survey	Kells Town	Moderate	Low	Yes, to validate outlines and flow paths at key locations.

When compiling the Flood Zone mapping, the outlines (from the different sources listed above) have been reviewed against each other and any additional data and have been refined where appropriate. In particular, the datasets that have been used for this purpose are combined ISIS and TUFLOW flood outlines, the finalised OPW PFRA flood outlines, records of historic flood events including extents, design flood levels, local surveyed ground levels, walkover survey and consultation with local area engineers. The resultant Flood Zones for Kells are presented in Figure 4-1.

Figure 4-1 Flood Zone Mapping



#### 4.2 Kells Stormwater Drainage Study (2006)<sup>5</sup> & Kells TCD Newrath Stream Assessment (2007)<sup>6</sup>

Designed to reduce un-necessary urban/sub-urban expansion around Kells and consolidate central development, KS 5 of the 2001-2007 Kells Development Plan paved the way for a significant flood study in Kells:

**KS 5: To prepare a comprehensive environmental study, incorporating a flood detail/relief study of the area of potential development, within the vicinity of the Kells Town Centre. This study will be required to be undertaken prior to any development taking place.**

The specific objective resulted in the completion of the 2006 Kells Stormwater Drainage Study and the subsequent 2007 update to include specific channel diversion assessment for the lands to the east of Bective Street (but assuming all recommendations from the 2006 study are implemented).

The studies resulted in a clear definition of existing flood risk for the Newrath Stream, highlighting areas of significant flooding both up and downstream of Bective Street for the 1 in 200 year return period only. The study then provides a mitigation solution that upgrades culverts, channel sections and employs land raising in order to allow development in both land parcels. The studies include a Kells sustainable drainage masterplan which provides a management strategy for coping with surface water runoff from all potential development lands within Kells.

<sup>5</sup> Kells Stormwater Drainage Study (2006), Carl Bro.

<sup>6</sup> Kells-TCD Newrath Stream Assessment (2007), Grontmij.  
2016s4699\_Kells DP SFRA\_v1.3.docx

### 4.3 JBA Fluvial Flood Mapping & Methodology

Following on from an ISIS/JFLOW model of the Newrath Stream, completed in 2012, JBA Consulting undertook a fluvial mapping study in 2016 as part of the Variation 1 SFRA which updated the Newrath Stream hydraulic model. A 1D/2D hydraulic model was built to represent the Newrath Stream, which was completed using a combination of two software packages: ISIS by Halcrow and TUFLOW by BMT-WBM. When both software packages are used in conjunction with one another, they form what is termed as a 'linked-model'. A linked model allows flow in the river channel and structures to be represented by 1D modelling equations (ISIS) and allows any out-of-bank volumes to be represented by 2D routing equations (TUFLOW).

The 1D/2D hydraulic model built upon the Kells Stormwater Drainage Study and provides the Flood Zone A (1% AEP) & Flood Zone B (0.1%) flood outlines, as required under the planning guidelines. The resulting flood maps provide the main source of flood risk when undertaking the Development Land Use Zoning Review as part of the SFRA in Section 6.

### 4.4 National PFRA Study Fluvial Flood Outlines

The Preliminary Flood Risk Assessment (PFRA) is a national screening exercise that was undertaken to identify areas at potential flood risk. The PFRA is a requirement of the EU Floods Directive and the publication of this work will lead to, and inform, more detailed assessment that is being undertaken as part of the Catchment Flood Risk Assessment and Management (CFRAM) studies. The PFRA study considered flooding from a number of sources; fluvial, tidal, pluvial and groundwater and prepared a suite of broadscale flood maps.

For the preparation of the PFRA fluvial flood maps, flood flow estimates were calculated at nodes every 500m along the entire river network. (The river network is the EPA 'blue-line' network, which, for the most part, matches the rivers mapped at the 1:50,000 scale Discovery Series OS mapping). This flow estimation was based on the OPW Flood Studies Update research programme. An assumption was made that the in-channel flow equates to the mean annual flood and so the out of bank flow for a particular AEP event was determined by deducting the mean annual flood from the flood flow estimate for that probability event.

Using the OPW's 5m national digital terrain model (DTM) a cross section was determined at 100m spacing's. The Manning's equation, a hydraulic equation for normal flow was used to calculate a flood level which was then extrapolated across the DTM to determine the flood extent. This exercise was completed for all river catchments greater than 1km<sup>2</sup>.

This methodology does not take into account defences, channel structures or channel works. Potential sources of error in the mapping include local errors in the DTM or changes to the watercourse flow route due to an error in mapping or new development. In Kells, the PFRA mapping only covers watercourses outside of the plan boundary.

### 4.5 Walkover Survey

A walkover survey of the Newrath Stream and River Blackwater sites was conducted to help assess flood risk and provide a local understanding of the site. Information collated on the site visits was used to inform the Flood Zone mapping process.

Photographs taken on site are presented below in Figure 4-2.



Figure 4-2 Site Walkover Photographs

	
<p>Photo 1: View of Newrath Stream, upstream of Bective Street</p>	<p>Photo 2: 1200mm diameter culvert inlet, Bective Street</p>
	
<p>Photo 3: View across the lands downstream of Bective Street, along the path of the Newrath Stream</p>	
	
<p>Photo 4: Newrath Stream, upstream of 650mm culvert inlet, adjacent to swimming pool</p>	<p>Photo 5: Culvert manhole cover, adjacent to HSE Offices and Church</p>





Photo 6: Newrath Stream channel downstream of culvert outlet, Grand Priory Estate



Photo 7: Newrath Stream channel at the downstream end of Grand Priory Estate



Photo 8: River Blackwater, downstream view from Maudlin Bridge (towards the confluence with Newrath Stream)



Photo 9: River Blackwater, upstream view from Maudlin Bridge

## 4.6 Summary

Building on the initial review of flood risk presented in the current Meath County Development Plan SFRA, the Kells Development Plan SFRA has focussed upon the five sources of flood extent data described in Figure 4-3 to provide a best available estimate of the Flood Zones for the Newrath Stream and the River Blackwater.

## 4.7 Historic Flood Review and Consultation with Area Engineer

Records of past flooding are useful for looking at the sources, seasonality, frequency and intensity of flooding. Historical records are mostly anecdotal and incomplete, but are useful for providing background information.

### 4.7.1 OPW Floodmaps.ie

The OPW hosts a National Flood Hazard Mapping website<sup>7</sup> that makes available information on areas potentially at risk from flooding. This website provides information on historical flood events across the country and formed the basis of the Regional Flood Risk Appraisal. Information is provided in the form of reports and newspaper articles which generally relate to rare and extreme events. Since the establishment of the hazard mapping website, more records are available which identify more frequent and often recurring events. These tend to include memos and meeting records from local authority area engineers, often relating to road flooding.

### 4.7.2 Consultation

A consultation with the Kells Area Engineer was conducted and this helped to clarify and improve on the general appreciation of flood risk in Kells. The Newrath Stream was confirmed as the largest source of risk and the associated Drainage Study provides a useful capture of existing risk.

It was confirmed that;

- The 650mm pipe at the rear of the swimming pool and HSE Offices is the largest single contributing factor to flood risk;
- The culvert and general pipe work (varies over the culvert length) is undersized and also prone to blockage both at the trash screen and along its length;
- During periods of heavy rainfall the trash screen is cleared at regular intervals;
- Although the inlet is 1000mm the culvert diameter drops to 650mm at a point downstream of Murphy's Service Station, at this point there is also a 450mm storm-water inflow from the town;
- There have been a number of previous incidents of blockages and resulting scouring/damage to the culvert in the vicinity of Murphy's Service Station, and the Service Station itself flooded previously due to a localised blockage at that location;
- Previous blockage and flooding instances have resulted in the culvert joints degrading and leakage of flow, leading to the degradation of the road and also mini-springs appearing along the line of the culvert;
- There used to be a historic flooding problem at the R164 Bective Street culvert, but this is now mitigated by the installation of the current 1200mm pipe;
- There is a section of a field drain that is culverted under the Kells Business Park, however there were no reported incidents of flooding of fields or the business park itself.

### 4.7.3 Summary of Historic Flood Risk

The pertinent flood risk history from both the consultation and OPW floodmaps.ie sources are summarised in Table 4-2 and Figure 4-3.

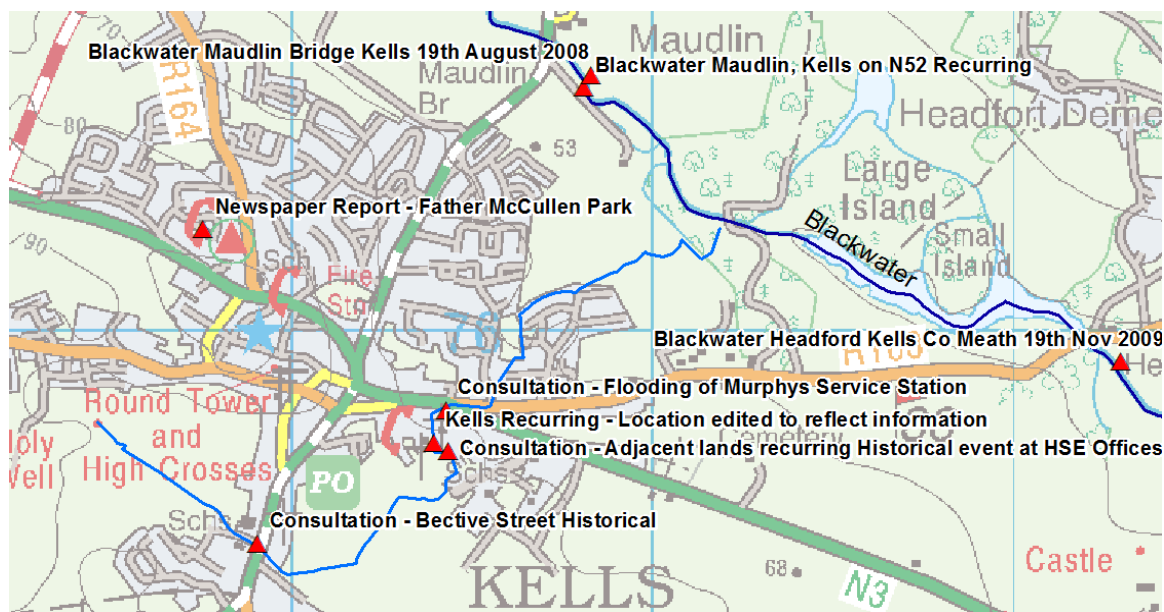
---

<sup>7</sup> [www.floodmaps.ie](http://www.floodmaps.ie)

Table 4-2 Historic Flooding Information

Date of Flood	Description
August 2008	Overtopping of the Blackwater at Maudlin Bridge following peak river levels on 19 <sup>th</sup> August 2008
Recurring	Low lying land adjacent to the Newrath Stream floods every year after heavy rain. Source - Floodmaps.ie.
Recurring	Flooding of the lands adjacent to the 650mm culvert inlet at the lands to the rear of the swimming pool. HSE Offices historically flooded. Source - Consultation.
Unknown	Flooding of Murphy's Service Station - cause likely to be the undercapacity pipe work and presence of 450mm diameter storm-water drainage inflow at this point. Source - Consultation.
Recurring	Formation of mini springs leading to ground and road degradation in the region of the buried pipe work. Source - Consultation.
Unknown	Bective Street (R164) culvert crossing previously lead to flooding, this has now been mitigated by a 1200mm culvert. Source - Consultation.
Recurring	Father McCullen Park - surface water ponding during high intensity rainfall events, no houses reported as flooded, only access routes <sup>8</sup> .

Figure 4-3 Historic Flood Mapping; Spatial Representation



<sup>8</sup> The Meath Chronicle, 9th September 2009: <http://www.meathchronicle.ie/news/kells/articles/2009/09/09/391028flooding-traps-family-in-fr-mccullen-park-kells/>

## 4.8 Sources of Flooding

A review of the flood risk from fluvial, pluvial and groundwater sources was conducted as part of the KDP SFRA. Additional fluvial hydraulic modelling of the Newrath Stream and fluvial Flood Zones are presented in Figure 4-1. It also considers flooding from drainage systems, and other artificial or man-made systems.

The focus of the study is on risk from fluvial flooding from the Newrath Stream and the River Blackwater. There are two main reasons for this decision. Firstly, the review of historical floods shows rivers to be the most common and most damaging. Secondly, Flood Zones in the 'Planning System and Flood Risk Management' are defined on the basis of fluvial, and where appropriate, tidal flood risk. In addition, the SFRA should be based on readily derivable information, and records and indicators for fluvial flood risk are generally more abundant than for other sources of flooding.

The main sources of flood risk relevant to Kells are described below.

### 4.8.1 Fluvial Flooding

Flooding of watercourses is associated with the exceedance of channel capacity during higher flows. The process of flooding on watercourses depends on a number of characteristics associated with the catchment including; geographical location and variation in rainfall, steepness of the channel and surrounding floodplain and infiltration and rate of runoff associated with urban and rural catchments.

In large, relatively flat catchments such as the River Blackwater, flood levels will rise relatively slowly and natural floodplains may remain flooded for several days, acting as the natural regulator of the flow. In smaller catchments, such as the Newrath Stream, local intense rainfall can result in the rapid onset of deep and relatively fast-flowing flooding with little warning - as we have seen upstream of the swimming pool. Such "flash" flooding, which may only last a few hours, can cause considerable damage and possible threat to life.

The form of the floodplain, either natural or urbanised, can influence flooding along watercourses. The location of buildings and roads can significantly influence flood depths and velocities by altering flow directions and reducing the volume of storage within the floodplain. Critical structures such as bridge and culverts can also significantly reduce capacity creating pinch points within the floodplain and this is clearly an issue for the 650mm culvert inlet to the rear of the swimming pool (adjacent to R147/Headfort Place). This structure (and culverts in general) are also vulnerable to blockage by natural debris within the channel or by fly tipping and waste.

In Kells, both the Newrath Stream and the River Blackwater have caused flooding in the past, however there has been a relatively small impact to existing development because the lands at highest probability of flooding (adjacent to open sections of the Newrath Stream) have largely been kept free of development, although they have been historically zoned for potential development. In the past it has been the HSE offices and Murphy's Service station that have been most severely affected.

However, the Flood Zone mapping provides an indication of what might happen during extreme flood events of a magnitude that have not been witnessed in recent years, but could feasibly occur. The results clearly indicate that there is a significant risk of flooding upstream and downstream of the 650mm culvert adjacent to the Swimming Pool and HSE offices. The flooding is largely due to the limited capacity of the culvert and results in overland flow routes that divert excess flow from the culvert in two distinct directions.

1. The northern flow route passes through the HSE Offices, St Colmcille's Church and Murphy's Service Station, across and down the R147 Headfort Place before passing into the Headfort and Grand Priory Estates, following the pattern of the streets and also before flowing back into and around the existing channel before flowing into the River Blackwater.
2. The southern flow route passes through the Swimming Pool lands and Kells Community College and down the approach road to the junction with the R147 before



continuing adjacent to the Grand Priory housing estate and towards the River Blackwater and the waste water treatment plant.

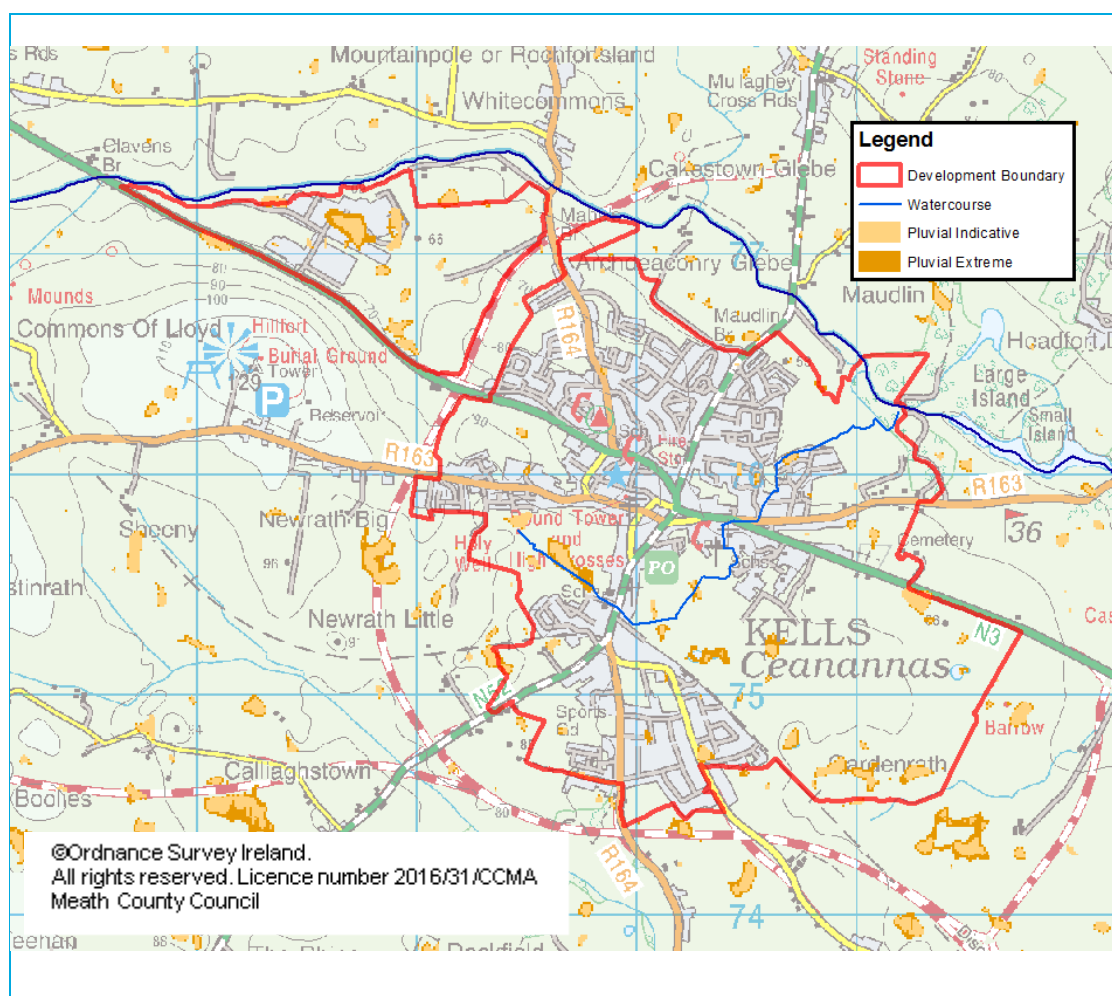
Flood risk to specific potential development sites is discussed in Section 6, and has been used to inform the zoning objectives for the Kells Development Plan. Where particular development is proposed within Flood Zones A or B, the Justification Test must be applied, and passed.

#### 4.8.2 Pluvial Flooding

Flooding of land from surface water runoff is usually caused by intense rainfall that may only last a few hours. Areas at risk from fluvial flooding will almost certainly be at risk from surface water flooding, in Kells this will be more prevalent for the Newrath Stream rather than the River Blackwater.

The OPW PFRA study considered pluvial flood risk and produced a national set of pluvial flood maps. The indicative pluvial map from the PFRA study is presented in Figure 4-4 below it has been used to identify development areas at particular risk of surface water and pluvial flooding.

Figure 4-4 PFRA Indicative Pluvial Flood Map<sup>9</sup>



SFRAs require a strategic assessment of the likelihood of surface water flooding for which overland routing is suitable and appropriate. This includes consideration of the following:

- Are there zoned lands which may need to accommodate and retain surface water flow routes?
- Are there zoned lands which might discharge upstream of an area vulnerable to surface water flooding?

<sup>9</sup> Source: OPW, PFRA Study Data, license to Meath County Council  
2016s4699\_Kells DP SFRA\_v1.3.docx

The review of historical flood extents, and the PFRA pluvial mapping, indicates that the centre of Kells is not particularly vulnerable to surface water flooding, with the exception of Father McCullen Park (however this might be more related to a drainage issue).

The events recorded in the town centre have been attributed to fluvial flooding and pipe failure from the Newrath Stream. However it should be noted that during a large flood event it is often difficult to identify the individual sources of flooding, so the extent to which water from the rivers and pluvial sources combine is unknown.

On this basis, whilst the potential for surface water flow paths or ponding should not necessarily impede or restrict development, applications in such areas need to consider drainage thoroughly to ensure risks do not increase in the future.

Of particular note is Kells Business Park which is identified as being at risk from pluvial flooding. The pluvial modelling does not take into account the design of surface water management systems during the relatively recent construction of this site and during our consultation it was confirmed that the business park has adequate surface water management measures. Recommendations for the management of surface water are provided in Section 4.8.3.

#### 4.8.3 Flooding from Drainage Systems

Flooding from artificial drainage systems occurs when flow entering a system, such as an urban storm water drainage system, exceeds its discharge capacity, it becomes blocked or it cannot discharge due to a high water level in the receiving watercourse.

Flooding in urban areas can also be attributed to sewers. Sewers have a finite capacity which, during certain load conditions, will be exceeded. In addition, design standards vary and changes within the catchment areas draining to the system, in particular planned growth and urban creep will reduce the level of service provided by the asset. Sewer flooding problems will often be associated with regularly occurring storm events during which sewers and associated infrastructure can become blocked or fail. This problem is exacerbated in areas with undercapacity systems.

Foul sewers and surface water drainage systems are spread extensively across the urban area of Kells with various interconnected systems discharging to the treatment works and potentially into the Newrath Stream or the River Blackwater. The network is not well understood and many of the linkages are currently unknown. It is noted that the Father McCullen Park estate has experienced recent and recurring road flooding as a result of this flood source. The most significant issue is with the 650mm culvert to the rear of the swimming pool which is under capacity (maximum conveyance of 1.1 m<sup>3</sup>/s) and has suffered from structural failure and scouring in the past, leading to leakage and the formation of mini springs in the area local to the service station (see Table 4-2).

Maintenance activities, i.e. cleaning gullies, repairing pipes are vital in order to manage this risk. Recommendations for the improvement of the system in Kells is provided by the Kells Stormwater Drainage Study<sup>10</sup> and this has been used to inform the management of the risk as described in Section 5.

#### 4.8.4 Groundwater Flooding

Groundwater flooding is caused by the emergence of water originating from underground, and is particularly common in karst landscapes. This source of flooding can persist over a number of weeks and poses a significant but localised issue that has attracted an increasing amount of public concern in recent years. In most cases groundwater flooding cannot be easily managed or lasting solutions engineered, however the impact on buildings can be mitigated against through various measures.

The PFRA groundwater flood maps<sup>11</sup>, which entailed an evidence-based approach and considered the hydro-geological environment, such as the presence of turloughs, did not show

<sup>10</sup> Kells Stormwater Drainage Study (2006), Carl Bro

<sup>11</sup> Preliminary Flood Risk Assessment Groundwater Flooding, June 2010  
2016s4699\_Kells DP SFRA\_v1.3.docx



any significant risk in the Kells area. Based on the PFRA study the risk of groundwater flooding is not considered significant enough to warrant further investigation in this SFRA.

## 4.9 Climate Change & Residual Risk

Residual risk is the risk that remains after measures to control flood risk have been carried out, or from extreme events that are greater than the level of flooding anticipated by the Flood Zone A and B mapping - therefore Climate Change. Residual risk can arise from overtopping of flood defences and / or from the breach from structural failure of the defences. In Kells there are no formal flood defence structures but there are structures that are subject to blockage and have an associated residual risk of flooding.

### 4.9.1 Climate Change

Climate change should be considered when assessing flood risk and in particular residual flood risk. Areas of residual risk are highly sensitive to climate change impacts as an increase in flood levels will increase the likelihood of defence or culvert blockage and/or failure.

The 'Planning System and Flood Risk Management' recommends that a precautionary approach to climate change is adopted due to the level of uncertainty involved in the potential effects. A significant amount of research into climate change has been undertaken on both a national and international front. This section will briefly examine some of the key findings of the research to date.

The Intergovernmental Panel on Climate Change (IPCC) was established in 1988 and its first report in 1990 justified concern about the effects of climate change on a scientific basis. The more recent IPCC Fourth Assessment Report 2007<sup>12</sup> concludes that climate change is unequivocal. It projects a global average sea level rise of between 0.18m and 0.59m for different SRES emissions scenarios, up to the end of the century. (SRES refers to the IPCC Special Report on Emissions Scenarios, published in 2000. The scenarios explore different demographic, economic and technological forces and resultant greenhouse gas emissions.

More specific advice on the expected impacts of climate change and the allowances to be provided for future flood risk management in Ireland is given in the OPW draft guidance<sup>13</sup>. Two climate change scenarios are considered. These are the Mid-Range Future Scenario (MRFS) and the High-End Future Scenario (HEFS). The MRFS is intended to represent a "likely" future scenario based on the wide range of future predictions available. The HEFS represents a more "extreme" future scenario at the upper boundaries of future projections. Based on these two scenarios the OPW recommended allowances for climate change are given in Table 4-3.

Table 4-3 Allowance for Future Scenarios (100 Year Horizon)

Criteria	MRFS	HEFS
Extreme Rainfall Depths	+20%	+30%
Flood Flows	+20%	+30%
Mean Sea Level Rise	+500mm	+1000mm
Land Movement	-0.5mm / year*	-0.5mm / year*
Urbanisation	No General Allowance - Review on Case by Case Basis	No General Allowance - Review on Case by Case Basis
Forestation	-1/6 Tp**	-1/3 Tp** +10% SPR***
Notes: * Applicable to the southern part of the country only (Dublin - Galway and south of this) ** Reduce the time to peak (Tp) by a third; this allows for potential accelerated runoff that may arise as a result of drainage of afforested land *** Add 10% to the Standard Percentage Runoff (SPR) rate; this allows for increased runoff rates that may arise following felling of forestry		

<sup>12</sup> Inter-Governmental Panel on Climate Change (IPCC), 4<sup>th</sup> assessment report. "Climate Change 2007"

<sup>13</sup> OPW Assessment of Potential Future Scenarios, Flood Risk Management Draft Guidance, 2009.

#### 4.9.2 Residual Risk due to Culvert Blockage or Structural Failure

Blockage or structural failure of culverts and bridges is hard to predict and is largely related to the structural condition and type of the structure. Blockage risk is higher for culverts compared to clear span or arched bridges. Within Kells the flood history and consultation with the Town Engineer has suggested that the Newrath Stream structures and in particular the 650mm culvert at the rear of the swimming pool is at risk of blockage and failure. Maintenance teams regularly clear the culvert trash screen of debris during periods of increased flow but blockage can still occur.

Blockage or failure will usually result in sudden flooding with little or no warning and presents a significant hazard. The volume and impact of flooding will depend on a number of factors including:

- Degree of blockage or failure
- The time that the blockage or failure develops; if this is early on during the flood event the impacts will be more hazardous compared to a blockage or failure at the end of a flood event while level/flow is receding.
- How long the blockage or failure occurs for, leaving those at risk vulnerable to secondary flood peaks on a watercourse.

Flood mitigation and management measures to deal with flood risk are discussed in Section 5.

## 5 Flood Risk Management

The Planning Guidelines recommend a sequential approach to spatial planning, promoting avoidance rather than justification and subsequent mitigation of risk. The implementation of the Planning Guidelines is achieved through the application of policies and objectives within specific development plans.

Section 7.15 'Flood Risk Management' of Volume 1 of the Meath County Development Plan (MCDP) 2013-2019 includes a number of policies and objectives which set out the framework for flood management within the County.

This SFRA is intended to build on the overview of flood risk contained within the County Development Plan and consider flood risk within the Kells Development Plan area in an appropriate level of detail. More specifically this must seek to inform zoning objectives (through the application of the Justification Test) and develop policies and objectives that are tailored to Kells, taking into account all relevant information.

### 5.1 Flood Risk Policies and Objectives

The policies and objectives in the KDP will include consideration of the following:

- The Planning System and Flood Risk Management, Guidelines for Planning Authorities;
- The policies and objectives as set out in the County Development Plan 2013 to 2019;
- A revised strategy and recommendations updating the Kells Stormwater Drainage Study (2006)<sup>3</sup>;
- The content of this SFRA; the Flood Zones and their use as a planning tool;
- The triggers for review of the SFRA as set out in Chapter 6.4;

The third policy recommendation above relates to the Kells Stormwater Drainage Study (2006). This was completed prior to the publication of The Planning System and Flood Risk Management: Guidelines for Planning Authorities, in November 2009 and although the study has contributed a robust management strategy for the Newrath Stream the preferred engineering mitigation options should be re-appraised in accordance with The Guidelines, prior to proceeding to detailed design stage or the formal planning application. **The overarching aim is that Kells is subject to a revised drainage study that seeks to mitigate and manage the risk of flooding created by the Newrath Stream and the stormwater system that is causing significant Flood Risk to the town.**

### 5.2 Development Management - Planning Applications in Kells

To clarify the application of the policy contained within Section 7.15 'Flood Risk Management' of Volume 1 under the CDP under which the Planning System and Flood Risk Management – Guidelines for Planning Authorities are applied. Any instances where an FRA is requested the following text outlines the key requirements relating to the management of development and flood risk:

- Development proposals will require an appropriately detailed flood risk assessment. As a minimum this will include "Stage 1 - Identification of Food Risk". Where flood risk is identified a "Stage 2 - Initial FRA" will be required, and depending on the scale and nature of the risk a "Stage 3 - Detailed FRA" may be required. The requirement for all applications to have an accompanying Stage 1 assessment is important to allow for effective management of surface water risks. For example, a large site located in Flood Zone C may be appropriate in terms of vulnerability, but might be at potential risk of surface water flooding or residual risk of culvert failure. It is noted that this SFRA effectively deals with Stage 1 and can be referred to as such, although all development proposals must be accompanied by a surface water management plan.

- Under the FRA the impacts of climate change and residual risk (culvert/structure blockage) should be considered in setting the finished floor levels (FFL) of new development. In some cases, this may involve modelling at an appropriate level of detail.
- All development proposals will require the FRA to consider surface water management in line with the GDSDS as stated in WS POL 31 of the CDP.

Any proposal that is considered acceptable in principle shall demonstrate the use of the sequential approach in terms of the site layout and design and, in satisfying the Justification Test (where required), the proposal will demonstrate that appropriate mitigation and management measures are put in place.

Ground levels and FFLs must be clearly defined within the site specific FRA and must take into account the land use vulnerability and flood levels, including the impacts of climate change and additional freeboard.

The requirement for new development to have an FRA is specified on a site by site basis in Section 6.

Further guidance on the requirements of a Flood Risk Assessment are provided under the CDP Variation 3 SFRA under Section 4.4 to 4.11 (contained within an Appendix to Volume 5).

### 5.3 Existing Development at Risk of Flooding

For existing developments, it is not feasible to alter the wider land use zoning objective and in most cases will not be possible to re-locate the existing development to an area at lower risk of flooding. For this reason, changes to existing development or reconstruction/new development (within existing developed areas) will require careful management.

Areas of existing development, along with their corresponding land use zoning objective, that are at risk of flooding in Kells are identified in Table 6-1.

Any proposal in an area at high or moderate risk of flooding (Flood Zone A or B) that is considered acceptable in principle must demonstrate that appropriate mitigation measures can be put in place and that residual risks can be managed to acceptable levels through the submission of an appropriately detailed FRA as detailed in Section 5.2.

### 5.4 Extension of Duration

For planning applications that were granted prior to the publication of the Planning System and Flood Risk Management Guidelines in 2009, and are subsequently applying for an extension of duration, it is a requirement that an appropriately detailed FRA should be provided as part of the application (see Section 5.2). If the permitted development is found not to conform with the Planning Guidelines then the application should be refused on flood risk grounds and a new application submitted, allowing for appropriate design and FRA.

### 5.5 Policy on the Management of Surface Water

Development has the potential to cause an increase in impermeable area and an associated increase in surface water runoff rates and volumes. This can lead to potential increase in flood risk downstream due to overloading of existing drainage infrastructure, this is a key issue in Kells and the Kells Stormwater Drainage Study includes a specific management strategy that should be applied to all potential development sites and is summarised below:

- All developments in the Newrath Stream catchment must comply with the recommendations of the Greater Dublin Strategic Drainage Study (GDSDS);
- Surface water drainage infrastructure should be provided by the developer/s as the initial phase of development in this area, to facilitate orderly development and to ensure that the 'developed state' is properly served;
- There should be pre-planning consultation regarding surface water drainage requirements for all development in the Newrath Stream catchment area so that applications for development are fully aware of the requirements;

- Developers shall submit maintenance and management plans for their surface water drainage proposals as part of relevant planning applications.

Managing surface water discharge from new development is crucial in managing and reducing flood risk to other development downstream, in line with appropriate land use zoning objectives, adherence to the above points will ensure the effective management of risk.

#### 5.5.1 Overland Flow Routes

Underground drainage systems have a finite capacity and regard should be given to events larger than the design capacity of the network. This should be considered along with potential surface water flows that may enter a development site from the surrounding area. Master planning should ensure that existing flow routes are maintained, through the use of green infrastructure. Where possible, and particularly in areas of new development, floor levels should at a minimum be 300mm above adjacent roads and hard standing areas to reduce the consequences of any localised flooding.

#### 5.5.2 Sustainable Drainage Systems (SUDS)

A specific requirement of the EU Water Framework Directive is that surface water discharge is controlled and managed so that any impact on its receiving environment is mitigated. This can be achieved through the use of Sustainable Drainage Systems (SUDS). SUDS can reduce the rate of runoff through a combination of infiltration, storage and conveyance (slowing down the movement of water). Sustainable drainage can be achieved through the use of green infrastructure such green roofs and pervious pavements, rainwater harvesting, soakaways, swales and detention basins, ponds and wetlands.

The effectiveness of a flow management scheme within a single site is heavily limited by the land use and site characteristics including (but not limited to) topography, geology and available area. As such, surface water design and management must be carried out at a site specific level for any proposed development.

#### 5.5.3 Run-off Rates and the GDSDS

As suggested in Section 5.5 above, the GDSDS provides comprehensive guidance on the design of drainage systems, which are applicable across the country. It is recommended that drainage design for any site is carried out in accordance with the GDSDS, and in particular the following compliance requirements for development in greenfield lands are noted:

- Demonstrate compliance with limiting discharge requirements for flow rates and volumes;
- Demonstrate no flooding nuisance for the 30yr events;
- Demonstrate no property flooding for the 100yr (1% AEP events);
- Show 100 year (1% AEP) site routing and temporary storage for high intensity events;
- Show that temporary 100 year (1% AEP) flooding is retained on site.

### 5.6 Flood Mitigation Measures at Site Design

Any development proposal in an area at moderate or high risk of flooding that is considered acceptable in principle must demonstrate that appropriate mitigation measures can be put in place and that residual risks can be managed to acceptable levels.

To ensure that adequate measures are put in place to deal with residual risks, proposals should demonstrate the use of flood-resistant construction measures that are aimed at preventing water from entering a building and that mitigate the damage floodwater causes to buildings. Alternatively, designs for flood resilient construction may be adopted where it can be demonstrated that entry of floodwater into buildings is preferable to limit damage caused by floodwater and allow relatively quick recovery.

Further detail on flood resilience and flood resistance are included in the Technical Appendices of the Planning Guidelines, The Planning System and Flood Risk Management.<sup>14</sup>

---

<sup>14</sup> The Planning System & Flood Risk Management Guidelines for Planning Authorities, Technical Appendices, Nov 2009  
2016s4699\_Kells DP SFRA\_v1.3.docx



## 6 Development Zoning and the Justification Test

The purpose of zoning is to indicate to property owners and members of the public the types of development, which the Planning Authority considers most appropriate in each land use category.

Zoning is designed to reduce conflicting uses within areas, to protect resources and, in association with phasing, to ensure that land suitable for development is used to the best advantage of the community as a whole.

The zoning objectives can be related to the vulnerability classifications in the 'Planning System and Flood Risk Management'; highly vulnerable, less vulnerable and water compatible. The vulnerability of the land use, coupled with the Flood Zone in which it lies, guides the need for application of the Justification Test.

### 6.1 Development Land Use Zoning Review in Kells

The purpose of zoning is to indicate to property owners and members of the public the types of development which the Planning Authority considers most appropriate in each land parcel.

Zoning is designed to reduce the instances of conflicting uses within areas, to protect resources and, in association with phasing, to ensure that land suitable for development is used to the best advantage of the community as a whole.

The zoning objectives can be related to the vulnerability classifications in the 'Planning System and Flood Risk Management'; highly vulnerable, less vulnerable and water compatible. The vulnerability of the land use, coupled with the Flood Zone in which it lies, guides the need for application of the Justification Test.

Table 6-1 Land Zoning Objectives and Vulnerabilities

Objective/Use	Vulnerability*	Justification Test Required
A1 - Existing Residential	High	For development in Flood Zone A or B
A2 - New Residential	High	For development in Flood Zones A or B
B1 - Commercial/Town or Village Centre	High / Less	For highly vulnerable development in Flood Zone A or B For less vulnerable development in Flood Zone A
B2 - Retail Warehouse	Less	For development in Flood Zone A
C1 - Mixed Use	High / Less	For highly vulnerable development in Flood Zone A or B For less vulnerable development in Flood Zone A
D1 - Tourism	High / Less / Water Compatible	For highly vulnerable development in Flood Zone A or B For less vulnerable development in Flood Zone A Or appropriate - if water compatible
E1 - High Technology	Less	For development in Flood Zone A
E2 - General Enterprise & Employment	High / Less	For highly vulnerable development in Flood Zone A or B For less vulnerable development in Flood Zone A
F1 - Open Space	Water Compatible	Development is generally appropriate
G1 - Community Infrastructure	High / Less	For highly vulnerable development in Flood Zone A or B For less vulnerable development in Flood Zone A
H1 - High Amenity	Less / Water Compatible	For less vulnerable development in Flood Zone A or appropriate - if water compatible
R1 - Strategic Rail Corridor	High	For development in Flood Zone A or B
WL - White Lands	n/a	not applicable
* Land Use Vulnerability is expressed in relation to Table 3.1 (p25) of the Planning System and Flood Risk Management Guidelines for Planning Authorities. Some Zoning Objectives include a mix of different vulnerabilities of land use and are therefore presented as such in the table above.		

The land zoning objectives and their respective vulnerabilities are shown in Table 6-1. It is important to note that this table is provided as a general guide and the specific development types within the zoning objective must be considered individually, and with reference to Table 3-1 of the 'Planning System and Flood Risk Management'.

It is noted that whilst the Justification Test has been applied to land use zoning objectives in determining their applicability, there is some degree of variance in the vulnerability of the land uses under certain of the objectives in Table 6-1 above. For example the B1, C1, D1, E2 and G1 zonings can include for high or less vulnerable development. This results in a varying requirement for the application of the Justification Test and potential suitability of the development.

Where such conditions exist the draft zoning map provides clarification of the suitability of land use vulnerability within individual land zonings.

## 6.2 Development Zoning in Kells

This review will look at each of the land use zonings in turn and discuss the associated flood risk issues in each area. The screenshots presented in the following sub-sections are based on Development Plan zoning objectives.

Whilst preparing the Draft Kells Development Plan zoning objectives a number of sites have been re-zoned to an Open Space zoning on the basis of the application of the sequential approach.

Table 6-2 Land Use Zoning and Flood Risk in Kells

Land Use Zoning	Intersects Flood Zones?	Area of flood risk
A1 - Existing Residential	Yes	<i>Downstream of R147/R163 in the Grand Priory and Headfort Housing Estates as well as individual properties on R163.</i>
A2 - New Residential	Yes	<i>Downstream of the R163 along the Headfort Park Rd and adjacent to the Blackthorn Close estate.</i>
B1 - Commercial/Town or Village Centre	No	<i>Greenfield lands located within the backlands area.</i>
B2 - Retail Warehouse	No	
C1 - Mixed Use	Yes	<i>Existing HSE building and some lands to the rear on R147/Headfort Place adjacent to the church.</i>
D1 - Tourism	No	
E2 - General Enterprise & Employment	No	
F1 - Open Space	Yes	<i>Concentrated along the immediate environs of the Newrath Stream - as such the land zoning is an appropriate use in flood risk areas.</i>
D1/F1 - Open Space & Tourism	No	
G1 - Community Infrastructure	Yes	<i>Concentrated in the Backlands and the area close to the R147/Headfort Place. Also on eastern edge of Kells, close to the River Blackwater.</i>
H1- High Amenity	Yes	<i>Lands located at the junction between the Newrath Stream and the Blackwater River.</i>

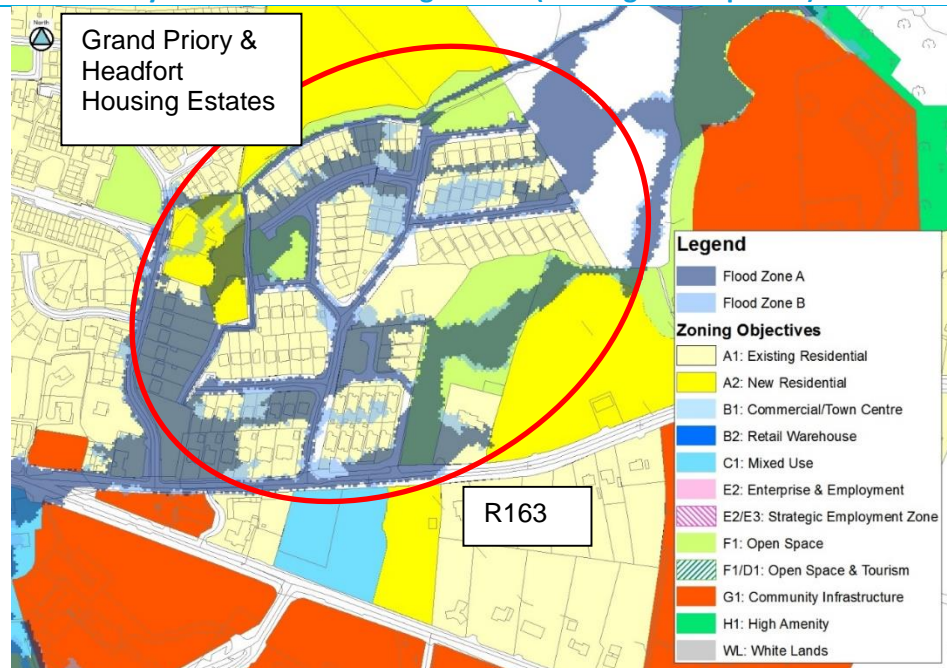
WL - White Lands	No	
Distributor Roads	Yes	<p><i>Proposed roads concentrated within the Backlands and Frontlands. A link road from Bective Street to the R147 crosses Flood Zone A and is considered as essential to the provision of sustainable urban expansion of the town centre. Link roads also cross Flood Zone A adjacent to the swimming pool.</i></p> <p><i>A local distributor road is also proposed within the Frontlands.</i></p> <p><i>Proposed distributor roads are appropriate at these locations, a site specific FRA is required to manage the risk and to demonstrate there will be no impact on adjacent lands.</i></p>

## 6.3 Zoning Review

The following review concentrates on undeveloped land use zoning objectives through the presentation of individual tables highlighting areas at potential risk, with comments and further detail on how it is recommended that flood risk is managed.

### 6.3.1 Existing Residential (A1)

#### Grand Priory and Headfort Housing Estates (existing development)



This zoned land covers the exiting residential housing estates of Grand Priory and Headfort which includes some significant areas at high or moderate risk of flooding as a result of overland flow paths from the Newrath Stream. Some individual properties are impacted on the R163 (on the eastern edge of the map above) but it is noted that the dwellings themselves are within Flood Zone C and at low risk of flooding. Until a wider flood relief/drainage scheme is put in place for Kells the risk of flooding in this area is high.

A proportion of existing residential land (A1) are shown to be at high to moderate risk of flooding (within Flood Zones A and B). Redevelopment that incorporates less vulnerable land uses within Flood Zone A and B is preferable, but changes of use and small extensions can be considered under Section 5.28 of the Planning System and Flood Risk Management Guidelines. A suitably detailed FRA in line with CDP and KDP policy is required.

A2 (New Residential) lands located within Flood Zone A are under council ownership. No highly or less vulnerable development should occur on these lands until a formal flood relief/drainage scheme is implemented to reduce risk to an acceptable level.

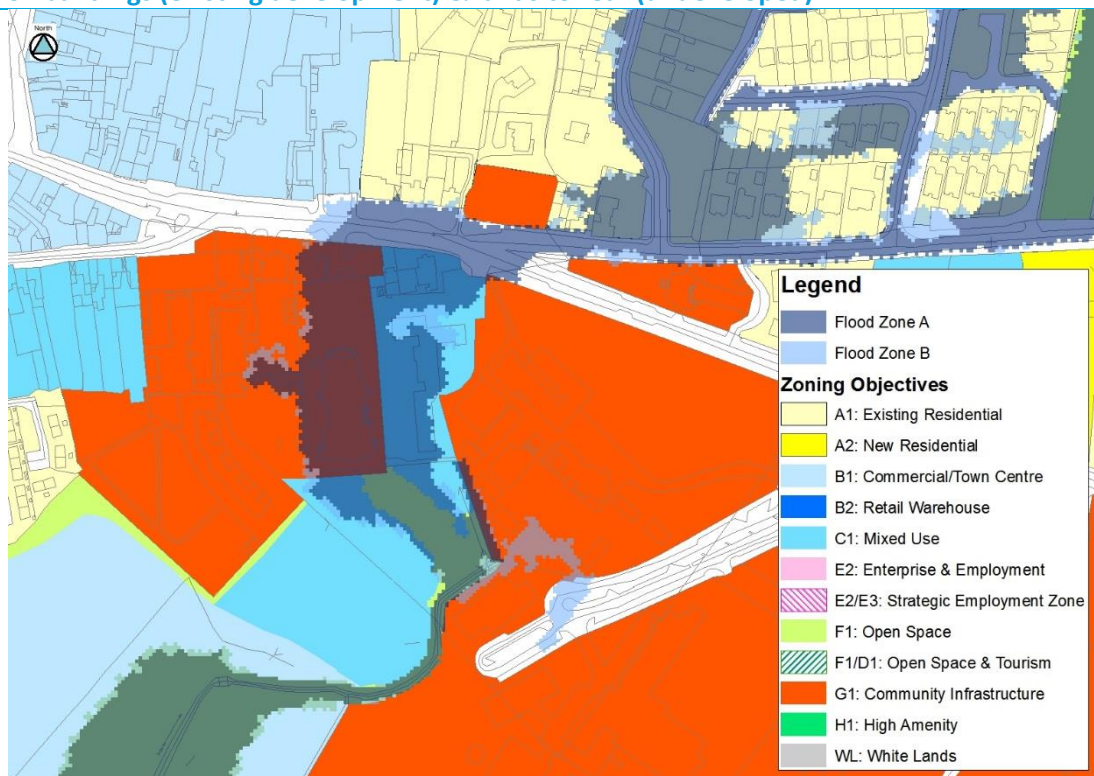
Any future development within sections of the A2 lands which border the Newrath Stream or any of the overland flow routes will require an FRA at development management stage as stated in the policies set out in Section 5 of this report and contained in the CDP Variation 3 SFRA under Section 4.4 to 4.11 (within an Appendix to Volume 5).

#### Conclusions

Prior to any flood relief/drainage works, it is preferential to incorporate open space and amenity within residential zoned land in areas at high or moderate flood risk (i.e. Flood Zone A/B).

A formal scheme as recommended under the Kells Stormwater Drainage Study should be implemented prior to future developments within land zoning A2.

All remaining planning applications should be subject to an appropriately detailed FRA in accordance with the policies and objectives of the KDP and CDP as discussed in Section 5

**HSE buildings (existing development) & lands to rear (undeveloped)**

Lands located to the south of the HSE buildings within Flood Zone A/B have been largely zoned as F1-Open Space, under the application of the sequential approach. The area is at risk of overland flow that surcharges from the Newrath Stream. Remaining undeveloped C1 lands in Flood Zone A or B must also apply the sequential approach and ensure that water compatible use is maintained.

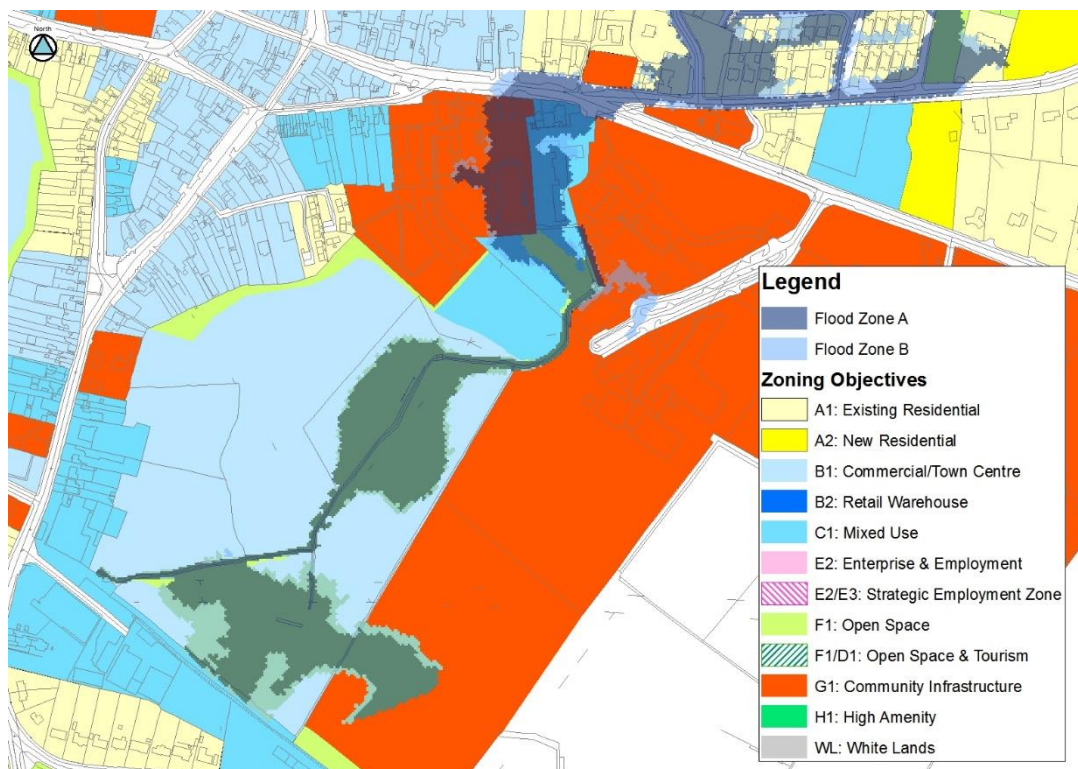
Any planning applications for alterations/extensions/renovations to the existing building at this site will require an appropriately detailed FRA.

For the undeveloped lands, any new development will require an appropriately detailed FRA at Development Management stage that clearly demonstrates the application of the sequential approach. The FRA must be in accordance to the policies set out in Section 5 of this report. Special attention should be given to the impact of climate change and possible culvert blockage.

**Conclusions**

Manage any changes to the existing building with appropriately detailed FRA at Development Management stage (refer to Section 5). For any new development within the undeveloped lands to the south of the HSE building must apply the sequential approach and an appropriately detailed FRA should be completed. All FRAs must provide special attention to the impact of climate change and possible culvert blockage.



**The Backlands (existing and new development)**

The G1 lands include the existing educational institutions of; Eureka Secondary School, St. Colmcille's National School, Kells Community College and Our Lady of Mercy National School and the Eureka Secondary School. Kells Swimming Pool (public) is also included in this area. The lands are subject to varying amounts of flooding from the Newrath Stream which results from the flow restriction at the 650mm culvert adjacent to the swimming pool.

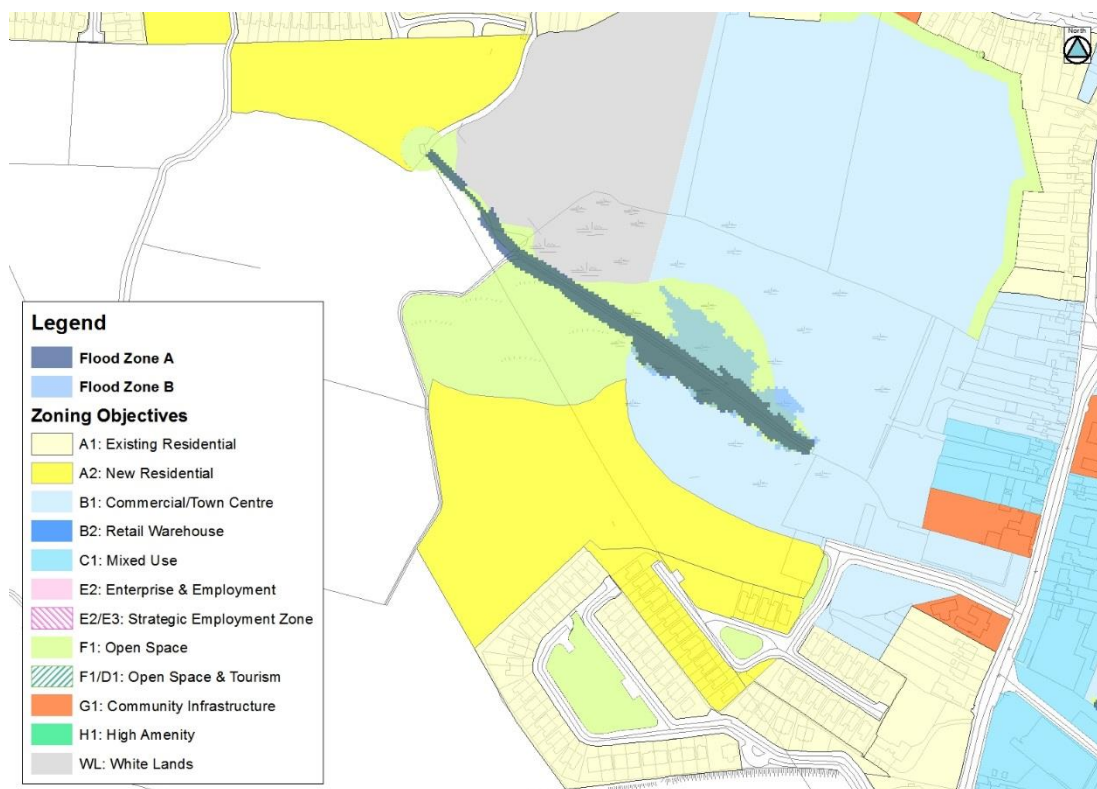
The area of Flood Zone A/B extending into the G1 lands is appropriately zoned F1 Open Space.

Within the backlands the C1 land use zoning objective has an interface with Flood Zone B. All lands within Flood Zone A are appropriately zoned F1 Open Space. There are extant permissions (part constructed) and the sites was not subject to the Justification Test. Any extension of duration application must provide an FRA in accordance to Section 5. If any sites remain unconstructed and the planning application lapses, re-zoning of the land to F1 should be undertaken under the next variation or draft of the KDP if any lands are located within Flood Zone A.

New development under the proposed C1 and G1 land use zoning is appropriate but proposals should include a suitably detailed site-specific FRA at Development Management stage in accordance with the guidance provided in Section 5. Special attention should be given to the impact of climate change and possible culvert blockage.

**Conclusions:**

Sequential approach has been followed when considering zoning but suitably detailed FRA is required at Development Management stage, in line with guidance provided in Section 5. Special attention should be given to the impact of climate change and possible culvert blockage. Any undeveloped extant permissions should be reappraised if subject to an extension of duration application or the planning lapses and the development plan is reviewed.

**Frontlands (existing and new development)**

There is a small amount of ponding upstream of the 1.2m diameter culvert inlet within the frontlands. The area within Flood Zone A/B is appropriately zoned F1, open space.

Future developments located within the B1 & WL zoned lands should be subject to a site-specific FRA, to ensure that the development fully considers and manages flood risk to itself and surrounding lands. Special attention should be given to the impact of climate change and possible culvert blockage which could increase the extent of flooding on the site.

**Conclusions:**

All development in the frontlands should be accompanied by a suitably detailed site specific FRA in accordance with the guidance provided in Section 5. Special consideration should also be given to residual risks such as culvert blockage downstream of the site.

## 6.4 SFRA Review and Monitoring

An update to the SFRA will be triggered by the six year review cycle that applies to Local Authority development plans. In addition there are a number of other potential triggers for an SFRA review and these are listed in the table below.

There are a number of key outputs from possible future studies and datasets, which should be incorporated into any update of the SFRA as availability allows. Not all future sources of information should trigger an immediate full update of the SFRA; however, new information should be collected and kept alongside the SFRA until it is updated. Since Kells is not included as an Area for Further Assessment (AFA) within the CFRAMS programme there will be no further update trigger from this source, however any significant updates to the Kells Stormwater Drainage Study or physical works would need to be considered as part of an update.

Table 6-3 SFRA Review Triggers

Trigger	Source	Possible Timescale
Flood maps of other sources, such as drainage networks	Various	Unknown
Significant flood events	Various	Unknown
Changes to Planning and / or Flood Management Policy	DoEHLG / OPW	Unknown
Detailed FRAs	Various	Unknown
Updates to the Kells Stormwater Drainage Study (2006) or any significant physical works to the channel or structures as a result of recommendations of the study or as part of additional studies.	Likely to be local authority and/or the OPW	Unknown

**JBA**  
consulting

Offices at

[Dublin](#)

[Limerick](#)

Registered Office

[24 Grove Island](#)

[Corbally](#)

[Limerick](#)

[Ireland](#)

t: +353 (0) 61 345463

e: [info@jbaconsulting.ie](mailto:info@jbaconsulting.ie)

[JBA Consulting Engineers and  
Scientists Limited](#)

Registration number 444752



Visit our website  
[www.jbaconsulting.ie](http://www.jbaconsulting.ie)