

Strategic Flood Risk Assessment

for the Monaghan County Development Plan 2025-2031

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1 INTRODUCTION

1.1 Terms of Reference

This Strategic Flood Risk Assessment (SFRA) was commissioned by Monaghan County Council (CC) as part of the preparation of the Monaghan County Development Plan 2025-2031. The new plan sets out the vision for how Monaghan should develop over the 6-year plan period in compliance with national and regional policies.

As stated in the Planning and Development (Strategic Environmental Assessment) Regulations 2004 (S.I. No. 436 of 2004), a Strategic Environmental Assessment (SEA) must be prepared as part of any county development plan to assess the likely significant effects of the plan's implementation on the environment.

The Planning System and Flood Risk Management Guidelines for Planning Authorities 2009 (the OPW Guidelines) recommend that an SFRA be prepared to support the SEA of a development plan to ensure that flood risk, where identified, is considered as one of the key environmental criteria against which the plan is assessed. The SFRA should ultimately inform policy and land use decisions in areas that have been assessed as being at risk of flooding.

1.2 Purpose and Scope

The purpose of this report is to present a county-scale SFRA for the Monaghan CC administrative area. In accordance with the OPW Guidelines, the scope of this SFRA report includes the following:

- Enable an improved understanding of flood risk issues within the development plan and development management process for County Monaghan and communicate this to a wide range of stakeholders.
- Identify natural floodplain areas that should be safeguarded.
- Produce a suitably detailed Flood Risk Assessment (FRA) that draws on and extends existing data and information and that leads to a suite of flood risk maps that support the application of the sequential approach in key areas where there may be tension between development pressures and avoidance of flood risk.
- Inform, where necessary, the application of the Justification Test and the avoidance of development pressure in areas of flood risk.
- Conclude whether measures to deal with flood risks to areas proposed for development can reduce the risks to an acceptable level while not increasing flood risk elsewhere.
- Produce guidance on flood mitigation measures, how surface water should be managed, and appropriate criteria to be used in the review of site-specific FRAs.

1.3 Approach to the Assessment

The purpose of this SFRA is to provide a high-level assessment of all types of flood risk in Monaghan to inform strategic land use planning decisions. This report should therefore allow Monaghan CC to apply the sequential approach and, where necessary, the Justification Test to identify appropriate areas / sites for development and identify how flood risk can be reduced as part of the development plan process.

A review of available flood risk information has been undertaken to identify any flooding or surface water management issues in Monaghan that warrant further investigation. Based on available data, areas at risk of flooding and Flood Zones were identified in order to supplement the SEA and the development plan. The SFRA can include all levels of flood risk assessment, as described in the OPW Guidelines.

Where flooding is not a major issue in the location of new development, as will be the case in many parts of the county, less detailed mapping approach will be required than in core urban areas with high development pressures and significant flood risk issues. The SFRA will provide more detailed information on the spatial distribution of flood risk within the identified towns and settlements to enable adoption of the sequential approach and to identify where it will be necessary to apply the Justification Test. County SFRAs will contain some detailed investigation of how the sequential approach should be applied in key towns and settlements or to the identification of the location of future strategic infrastructure within flood risk areas.

Having prepared a Strategic Flood Risk Assessment and mapped Flood Zones as part of its development plan review process and any more detailed flood risk assessments as necessary, situations can arise where a planning authority will need to consider the future development of areas at a high or moderate risk of flooding, for uses or development vulnerable to flooding that would generally be inappropriate. In such cases, the planning authority must be satisfied that it can clearly demonstrate on a solid evidence base that the zoning or designation for development will satisfy the Justification Test.

Further detail regarding the required contents of a County SFRA, as outlined in the OPW Guidelines, is included in Section 3.11.

Table 2.1: County Monaghan Towns and Villages

Hierarchy	Function	Settlement
Tier 1	Principal / Key Town	Monaghan Town
Tier 2	Strategic Towns	Carrickmacross Castleblayney
Tier 3	Service Towns	Clones Ballybay
Tier 4	Villages	Ballinode Emyvale Glaslough Inniskeen Newbliss Rockcorry Scotshouse Scotstown Smithborough Threemilehouse Annyalla Clontibret North Doohamlet Oram

2.2 Watercourses

Rivers are, historically, the primary cause of flooding in Monaghan and historically severe flooding events are attributed to fluvial sources ranging from the major rivers. The Erne catchment comprising of the Dromore River, the Finn River and the Bunnoe river systems dominate the west of the county. The Blackwater River system is in the north of county and to the south are the Fane and Glyde river catchments. The Ulster Canal traverses the County from east of Monaghan Town to west of Clones.

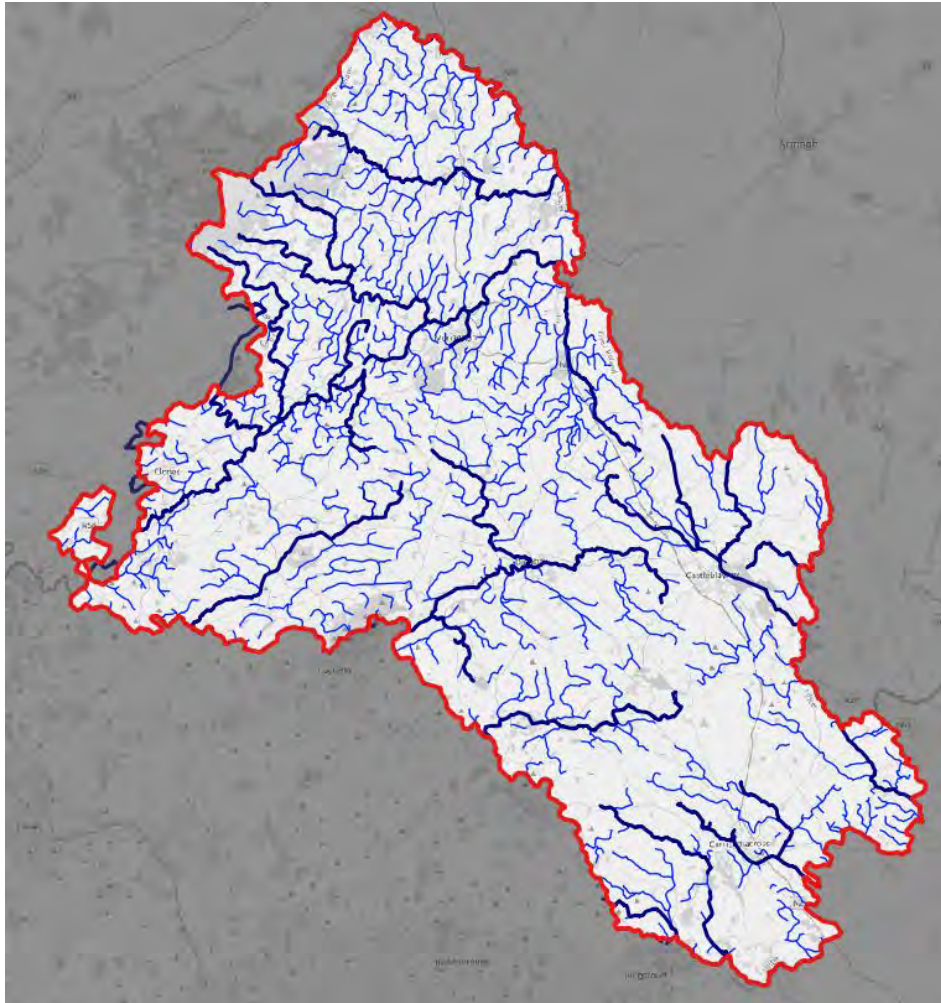
The main watercourses in Monaghan include the Finn, Dromore, Blackwater, Shambles, and Proules. These rivers are important fisheries and wildlife resources and are important for ongoing provision of water services and for management of flood risk.

The catchments in Monaghan are a mix of urban and rural (especially in the north of the county). There are large urban areas located on some of the principal rivers including the Proules, Dromore, Shambles, and Blackwater.

Monaghan CC have provided a GIS shapefile of watercourses within the County as shown in Figure 2.2. The dataset has been combined with the Environmental Protection Agency (EPA) watercourse data to give a comprehensive picture of watercourses in the county. However, it is acknowledged that the EPA watercourse dataset is not intended to be exhaustive and does not capture all open waterbodies within the County as there are minor streams and ditches which will not have been captured / included. The mapped watercourses capture all watercourses with sufficient catchments to be included on Flood Zone datasets (refer to Section 4.2) and as such omission of minor watercourses from the mapped dataset is not a material

consideration in terms of establishing Flood Zones. The topography and hydrology of County Monaghan are such that small, localised drainage ditches are prevalent through much of the county.

Figure 2.2: Map of EPA Watercourses within County Monaghan



2.2.1 List of Watercourses

A list of named notable watercourses in Monaghan is provided in Table 2.2. While the list is not exhaustive, and not all mapped watercourses are named, it gives an indication of the extent of the river and stream network in the County. Watercourse names are generally as per EPA designations. It is acknowledged that some of the streams listed may be known locally by other names. Watercourse names are shown on flood mapping included as Appendices to the SFRA. It is noted that not all watercourses shown in Figure 2.2 are named so may not be included in Table 2.2 and SFRA flood maps.

Table 2.2: List of Named EPA / Monaghan CC Watercourses

River	Tributary / Stream
Blackwater	• Conawary Lower River • Mountain Water • Scotstown River • Shambles River
Bunnoe	
Dromore	• Avaghon Lake Stream
Fane	• Carrickaslane Lough Stream • County Water River • Gentle Owens Stream • Lannat Stream • Inniskeen Stream
Finn	• Magherarney River • Maghery River • Lacky River
Glyde	• Magheracloone Stream • Drumsallagh Stream • Coolderry Stream • Lisanisk Stream • Kilmactrasna Stream • Tullynaskeagh Stream • Drummond Watercourse
Knappagh	
Proules River	• Rossdreenagh River
Shambles River	

2.2.2 Hydrometric Areas

Many of the watercourses in south and east of Monaghan discharge through adjacent counties to the Irish Sea, either directly or via estuaries, and are within EPA Hydrometric Areas 06 (Newry, Fane, Glyde and Dee. Watercourses in the north and west of the county drain to Upper Lough Erne via the River Finn in Hydrometric area 36 (Erne) or to Lough Neagh via the River Blackwater in hydrometric area 03 (Lough Neagh and Lower Bann).

2.2.2.1 Newry, Fane, Glyde and Dee Catchment

The Nanny-Delvin catchment includes the area drained by the Newry, Fane, Glyde and Dee rivers, and by all streams entering tidal water between Murlough Upper and The Haven, Co. Louth. This is a cross-border catchment with a surface area of 2,125km², 1390km² of which is located within the Republic of Ireland (RoI).

The largest urban centre is Dundalk, Co. Louth. The other main urban centres are Carrickmacross, Ardee, Kingscourt, Dunleer and Castleblayney and the total population (in the RoI) is approximately 115,900, with a population density of 83 people per km².

The catchment is characterised by the upland area of the Carlingford Peninsula, which is underlain by granites and other igneous rocks, and undulating land to the south, and a heavily drumlinised (lenticular, steep sloped hills) landscape in the western half of the catchment. There are extensive gravel deposits along much of the coast in this catchment, which are an important local groundwater resource¹.

2.2.2.2 *Erne Catchment*

This catchment includes the area drained by the River Erne and all streams entering tidal water between Aughrus Point and Kildoney Point, Co. Donegal. This is a cross border catchment with a surface area of 4,415km², 2,512km² of which is located within The Republic.

The largest urban centre is Cavan Town. The other main urban centres are Bundoran, Ballyshannon, Clones, Ballybay, Cootehill and Belturbet. The total population (in The Republic) is approximately 85,992 with a population density of 34 people per km².

There are three isolated parts of the catchment located in the Republic, one around Ballyshannon, one near Blacklion and the southern part occupying much of Counties Cavan and Monaghan. The statistics included here refer to the parts of catchment located within The Republic only.

This catchment is dominated by the glacial drumlin landscape of southern Ulster. The patterns of River Erne, its lakes and tributaries, are characterised by the sinuous routes they are forced to follow to escape through this maze of poorly drained low, steep-sided hills.

2.2.2.3 *Lough Neagh and Lower Bann Catchment*

This catchment includes the area drained by the River Bann and by all streams entering tidal water between the Barmouth and Ballyaghan Point, Co. Derry. This is a cross border catchment with a surface area of 5,787km², 374km² of which is located within the Republic of Ireland (RoI).

The largest urban centre in the catchment is Monaghan town. There are no other large towns in this catchment and the total population (in the RoI) is approximately 20,500 with a population density of 55 people per km².

The part of this catchment located south of the border is dominated throughout by a drumlin topography characterised by numerous steep sided, lenticular hills, and the course of the rivers in the catchment is controlled by the location and orientation of these drumlins.

2.3 Climate Change

Climate change is an important theme in the Monaghan Development Plan 2025-2031. It is recognised that the risks associated with climate change (i.e., warmer temperatures, more extreme rainfall events, and sea level rise) will require adaptation and mitigation. It is also recognised that the nature of Monaghan's economy, infrastructure (i.e., roads, electricity networks, water supply and sewer systems), settlement patterns, physical geography, and mixed land use presents a unique set of challenges in terms of the required response to climate change.

The development plan makes provisions for climate change mitigation and adaptation in areas such as flood risk management, transportation, surface water, waste management, water services, urban design, energy, natural heritage, and green infrastructure. Flood risk management challenges identified for Monaghan CC include management of flood risk along watercourses while taking account of the predicted impacts of climate change amid increasing population pressure.

Further information and guidance relating to flood risk impact and considerations of climate change are contained in Section 3.8.

¹ Catchment.IE available at: <https://www.catchments.ie/> [Accessed 16/07/2024]

2.4 Land Use Zonings

The County Development Plan sets out a range of land use zonings and zoning objectives, as shown in Table 2.3. The Flood Zone maps included in Appendix A were prepared to assist with land use zoning decisions in areas that have been assessed as being at risk of flooding.

Land use zoning for the Monaghan County Development Plan 2025-2031 have been overlain with Flood Zone mapping and Section 5 presents Justification Tests where required. Land use zoning vulnerability was agreed through consultation with Monaghan CC, as outlined in subsequent sections.

Table 2.3: Monaghan County Development Plan 2025-2031 Land Zoning Objectives

Zoning	Objective
C2.1- Industry/Enterprise/Employment	To provide for new industrial, enterprise and employment generating development and to facilitate expansion of existing industrial and employment generating enterprises.
C6- Existing Commercial	To provide for established commercial development and facilitate its appropriate expansion.
G3- Landscape Protection/Conservation	To protect important landscape features within the towns from development that would detrimentally impact on the amenity of the landscape, on the natural setting of the town or on the natural attenuation offered by flood plains.
G5- Recreation/Amenity	To protect and provide for recreation, open space and amenity.
M2- Town Centre	To provide, protect and enhance town centre facilities, in addition to and promoting town centre strengthening and compact growth.
R1.3- Proposed Residential A	To provide for new residential development and for new and improved ancillary services.
R1.4- Proposed Residential B	To facilitate the provision of serviced residential sites and low-density residential development in a structured and co-ordinated manner.
R2.6- Existing Residential	To protect and enhance existing residential amenity, to facilitate residential development on small infill sites within established residential areas, the comprehensive redevelopment of brownfield residential sites for sustainable residential development, and to facilitate and encourage the completion of commenced and not yet completed residential developments.
R4.6- Strategic Residential Reserve	To protect lands that are considered strategic in location for future residential development.
S5- Community Services/Facilities	To protect, provide and improve community facilities and services.

3 APPROACH AND METHODOLOGY

3.1 Introduction

The approach and methodology adopted by this SFRA have been informed by the OPW Guidelines and associated Technical Appendices. The OPW Guidelines are therefore implemented and embedded in the context of the Monaghan Development Plan 2025-2031.

3.2 Objectives and Principles of the OPW Guidelines

The SFRA recognises the core objectives of the OPW Guidelines, which are to:

- Avoid inappropriate development in areas that are at risk of flooding.
- Prevent new developments from increasing flood risk elsewhere, including flood risk that may arise from surface water runoff.
- 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.
- 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.

In achieving the aims and objectives of the OPW Guidelines, Monaghan CC need to:

- Adopt a sequential approach to flood risk management, which aims to avoid flood risk where possible, substitute less vulnerable uses where avoidance is not possible, and mitigate and manage the risk where avoidance and substitution are not possible.
- Apply the Justification Test for development in flood risk areas.

A precautionary approach should also be applied to flood risk management to reflect uncertainties in existing flooding datasets and risk assessment techniques and in the ability to predict the future climate, the future performance of existing flood defences, and the extent of future coastal erosion. Development should therefore be designed with careful consideration of likely future changes in flood risk, including the effects of climate change and coastal erosion, to ensure that future occupants are not subject to unacceptable risks.

3.3 Types of Flooding

Flooding is defined in the OPW Guidelines as a temporary covering by water of land not normally covered by water and as a natural process that can occur at any time in a variety of locations. Flooding can occur from different sources, acting alone or in combination, including:

- Coastal flooding (from the sea or estuaries)
- Fluvial flooding (from rivers or other watercourses)
- Pluvial flooding (from intense rainfall events and overland flow)
- Groundwater flooding (typically from turloughs in Ireland)
- Other sources (e.g., blocked drains or pipes)

3.3.1 Coastal Flooding

Coastal flooding occurs when water from the sea (along the coast or in estuaries) overflows onto adjacent land or overtops coastal flood defences where these exist. Coastal flooding is influenced by three factors, which often act in combination: high tide level, storm surges (caused by low atmospheric pressure and exacerbated by high winds), and wave action (dependent on wind speed and direction, local topography, and exposure).

Monaghan is a land-locked county, located more than 13 km inland, and outside of any areas of identified coastal or tidally influenced areas. Therefore, coastal flooding is not considered a source of a potential risk to County Monaghan and no references to coastal / sea flooding are included.

3.3.2 Fluvial (River) Flooding

Fluvial flooding occurs when rivers and other watercourses burst their banks and water flows out onto the adjacent low-lying areas (the natural floodplains). This can occur where the capacity of the channel is exceeded and / or where the channel is blocked or constrained.

A storm of a given rainfall depth and duration may cause flooding in one river but not in another, and some catchments may be more prone than others to prolonged rainfall or to a series of rainfall events. Changes in rainfall patterns (e.g., due to climate change) may also have different impacts on flood magnitude and frequency in different catchments. The response to rainfall events depends on factors such as the size and slope of the river and catchment, the permeability of the soil and underlying bedrock, the degree of urbanisation within the catchment, and the degree to which floodwater can be stored and slowly released by lakes and natural floodplains.

3.3.3 Pluvial (Rainfall) Flooding

Pluvial or surface water flooding occurs when the amount of rainfall exceeds the capacity of urban storm water drainage systems or the ground to absorb it. This excess water flows overland, ponding in natural or man-made hollows and low-lying areas or behind obstructions. This occurs as a rapid response to intense rainfall before the flood waters eventually enter a piped or natural drainage system. This type of flooding is driven in particular by short, intense rainfall events.

3.3.4 Groundwater Flooding

Groundwater flooding occurs when the level of water stored in the ground rises as a result of prolonged rainfall, to meet the ground surface and flows out over it, i.e. when the capacity of this underground reservoir is exceeded. Groundwater flooding tends to be very local and results from the interaction of site-specific factors such as local geology and tidal variations. While water level may rise slowly, groundwater flooding can last for extended periods of time. Hence, such flooding may often result in significant damage to property and disruption.

3.3.5 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 area draining to the system, in particular planning 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 area with under-capacity systems. In the larger events that are less frequent but have a higher consequence, surface water will exceed the capacity of the sewer system and flow across the surface of the land, often following the same flow paths and ponding in the same areas as overland flow.

Foul sewers and surface water drainage systems are spread extensively across the urban areas with various interconnected systems discharging to treatment works and into local watercourses. Whilst such incidents can give an idea of those areas with limited drainage capacity, it is only a record of the hydraulic inadequacies of the sewer systems, not properties at risk of flooding. Therefore it has limited usefulness in predicting future flooding.

3.3.6 Other Sources

The above causes of flooding are all natural; caused by heavy or intense rainfall. Floods can also be caused by the failure or exceedance of capacity of built or man-made infrastructure, such as bridge collapses, from blocked or under-sized drainage systems or other piped networks, or the failure or overtopping of reservoirs or other water-retaining embankments (such as raised canals).

3.4 Definition of Flood Risk

Flooding presents a risk only when people, property, infrastructure, and / or environmental assets are located in the area that could potentially flood. Flood risk is defined as the product of the likelihood of the occurrence of a flood event and the potential consequences arising from that flood event. It is expressed as follows:

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

3.4.1 Likelihood of Flooding

The likelihood of flooding is defined in the Guidelines as the percentage probability of a flood of a given magnitude or severity occurring or being exceeded in any given year. It is generally expressed as a return period or as an annual exceedance probability (AEP). For example, a 1% AEP indicates the severity of a flood that has a 1 in 100 (1%) chance of occurring or being exceeded in any one year. Annual exceedance probability is the inverse of return period, as shown in Table 3.1.

Table 3.1: Return Periods and Annual Exceedance Probabilities

Return Period (Years)	Annual Exceedance Probability (%)
1	100
10	10
50	2
100	1
200	0.5
1000	0.1

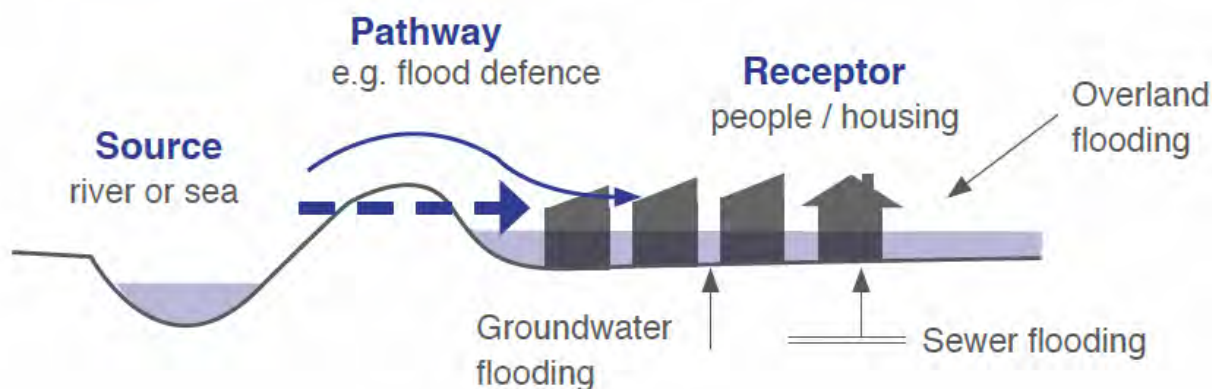
3.4.2 Consequences of Flooding

The consequences of flooding are determined by the hazards associated with the flooding (depth of water, speed, flow, rate of onset, duration, wave action, water quality) and the vulnerability of people, property, and environment assets potentially affected by a flood (age profile of the population, type of development, presence, and reliability of mitigation measures).

3.5 Source-Pathway-Receptor

The Monaghan CC SFRA, in line with the OPW Guidelines, advocates the use of the Source-Pathway-Receptor model in Flood Risk Assessments (FRA) to identify the sources of flooding (e.g. intense or prolonged rainfall leading to increased runoff and increased flow in rivers and sewers), the people and assets impacted by flooding (receptors) and the pathways by which the flood water reaches those receptors (e.g. overland flow, river and coastal floodplains, river channels and sewers). Figure 3.1 shows the source-pathway-receptor model from the OPW Guidelines.

Figure 3.1: Sources, Pathways and Receptors of Flooding



3.6 Flood Zones

Flood Zones are geographical areas within which the likelihood of flooding is in a particular range. The Monaghan SFRA in conjunction with the OPW Guidelines defines three Flood Zones for **flooding from rivers only** as indicated in Table 3.2.

Table 3.2: Flood Zones

Flood Zone	Description	Probability (Rivers)
A	Probability of flooding from rivers is highest	Greater than 1% or 1 in 100
B	Probability of flooding from rivers is moderate	Between 0.1% or 1 in 1000
C	Probability of flooding from rivers is low (i.e., all Plan areas not in Flood Zones A or B)	Less than 0.1% or 1 in 1000

When determining Flood Zones, the presence of flood protection structures should be ignored as areas protected by flood defences still carry a residual risk from overtopping or breach of defences.

Flood Zones are generated without inclusion of factors to allow for climate change. Therefore, land zoning based on delineated Flood Zones will not account for climate change floodplains which, in most instances, will be a wider extent than the present-day scenario.

3.7 Receptor Vulnerability

The vulnerability of development to flooding depends on the nature of the development, its occupation and the construction methods used. The classification of different land uses and types of development as highly vulnerable (including essential infrastructure), less vulnerable, and water compatible is influenced primarily by the ability to manage the safety of people in flood events and the long-term implications for recovery of the function and structure of buildings.

Zone A - High probability of flooding. Most types of development would be considered inappropriate in this zone. 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. Only water-compatible development, such as docks and marinas, dockside activities that require a waterside location, amenity open space, outdoor sports, and recreation, would be considered appropriate in this zone.

Zone B - Moderate probability of flooding. Highly vulnerable development, such as hospitals, residential care homes, Garda, fire, and ambulance stations, dwelling houses and primary strategic transport and utilities infrastructure, would generally be considered inappropriate in this zone, unless the requirements of the Justification Test can be met. Less vulnerable development, such as retail, commercial and industrial uses, sites used for short-let for caravans and camping and secondary strategic transport and utilities infrastructure, and water-compatible development might be considered appropriate in this zone.

In general, however, less vulnerable development should only be considered in this zone if adequate lands or sites are not available in Zone C and subject to a flood risk assessment to the appropriate level of detail to demonstrate that flood risk to and from the development can or will adequately be managed.

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

Table 3.3: Receptor Vulnerability Classifications

Vulnerability Classification	Land Uses / Type of Development *
Highly Vulnerable Development (including Essential Infrastructure)	• Garda, ambulance, and fire stations and command centres required to be operational during flooding • Hospitals • Emergency access and egress points • Schools • Dwelling houses, student halls of residence, and hostels • Residential institutions such as residential care homes, children's homes, and social services homes • Caravans and mobile home parks • Dwelling houses designed, constructed, or adapted for the elderly or other people with impaired mobility • Essential infrastructure, such as primary transport and utilities distribution, including electricity generating power stations and sub-stations, water and sewage treatment, and potential significant sources of pollution in the event of flooding (SEVESO sites, IPPC sites, etc.)
Less Vulnerable Development	• Buildings used for: retail, leisure, warehousing, commercial, industrial, and non-residential institutions • Land and buildings used for holiday or short-let caravans and camping, subject to specific warning and evacuation plans • Land and buildings used for agriculture and forestry • Waste treatment (except landfill and hazardous waste) • Mineral working and processing • Local transport infrastructure.

Vulnerability Classification	Land Uses / Type of Development *
Water Compatible Development	• Flood control infrastructure • Docks, marinas, and wharves • Navigation facilities • Ship building, repairing, and dismantling, dockside fish processing and refrigeration and compatible activities requiring a waterside location • Water-based recreation and tourism (excluding sleeping accommodation) • Lifeguard and coastguard stations • Amenity open space, outdoor sports and recreation and essential facilities such as changing rooms • Essential ancillary sleeping or residential accommodation for staff required by uses in this category (subject to a specific warning and evacuation plan)

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

3.8 Climate Change Adaptation

It is likely that climate change will have an impact on flood risk in Ireland as a result of rising sea levels and more frequent extreme rainfall events. There could be serious consequences for Monaghan, where many of the main urban centres are located beside watercourses. Climate change is a dynamic process that requires a precautionary and flexible approach to ensure appropriate provision for or adaptation to its potential consequences.

Guidance on climate change objectives and actions is set out in Climate Change Sectoral Adaptation Plan published by the OPW in 2019. The first Climate Change Sectoral Adaptation Plan was published in 2015 under the mandate of the National Climate Change Framework. A new plan was prepared in 2019 with updates to the previous plan made based on new information available on climate change and its potential impacts and developments in flood risk management since 2015.

The long-term goal adopted by the OPW on climate adaptation for flooding and flood risk management is "Promoting sustainable communities and supporting our environment through the effective management of the potential impacts of climate change on flooding and flood risk." To deliver on this goal, the OPW has identified the following adaptation objectives:

- Objective 1: Enhancing our knowledge and understanding of the potential impacts of climate change for flooding and flood risk management through research and assessment
- Objective 2: Adapting flood risk management practice to effectively manage the potential impact of climate change on future flood risk
- Objective 3: Aligning adaptation to the impact of climate change on flood risk and flood risk management across sectors and wider Government policy

A number of actions have been identified under each adaptation objective across the areas of activity in flood risk prevention, protection and preparedness and resilience, as well as in further research and capacity building. Flooding has the potential to affect all sectors and local authorities, and coordination is critical towards ensuring a coherent and whole of government approach to climate resilience in relation to flooding and flood risk management.

Based on the Sectoral Adaptation Plans, the OPW adopted two indicative potential futures for flood risk assessment; the Mid-Range Future Scenario (MRFS) and the High-End Future Scenario (HEFS). These were selected to reflect, based on information available at the time, a future in the latter part of the century that would be:

- typical or near to the general average of the future climate projections (MRFS)
- a more extreme future based on the upper end of the range of projections of future climatic conditions and the impacts such changes would have on the drivers of flood risk (HEFS).

The allowances, in flood risk terms, for both the MRFS and HEFS are shown in Table 3.4. For the purposes of the SFRA, climate change flood mapping has been prepared and is included in Appendix C and Appendix D.

Table 3.4: OPW Climate Change Allowances

Parameter	Mid-Range Future Scenario (MRFS)	High End Future Scenario (HEFS)
Peak River Flood Flows	+ 20%	+ 30%
Extreme Rainfall Depths	+ 20%	+ 30%

Due to the uncertainty of the potential effects of climate change, the Monaghan SFRA sets out recommendations in line with the precautionary approach adopted by the Guidelines in terms of managing the effects of climate change. These include:

- Recognising that significant changes in the flood extent may result from an increase in rainfall or tide events and, accordingly, adopt a cautious approach to zoning land in transitional areas.
- Ensuring that the finished levels of structures are designed to protect against flooding such that flood defences, land raising, and ground floor levels are sufficient to cope with the effects of climate change over the lifetime of the development.
- Ensuring that both the structures designed to protect against flooding and the protected development are capable of adaptation to the effects of climate change when there is more certainty about the effects and when there is still time for such adaptation to be effective.

3.9 Stages and Scales of Flood Risk Assessment

3.9.1 Stages of FRA

Flood risk assessments are typically undertaken over three stages, in order of increasing detail, as described in Table 3.5. Progression to a more detailed stage depends on the outcomes of the previous stage. This staged approach ensures that the level of assessment undertaken is appropriate for the scale and nature of the flood risk issues, site or area, and type of development proposed. It also prevents unnecessary flood modelling and development of mitigation and management measures.

Table 3.5: Stages of Flood Risk Assessment

Stage	Purpose
Stage 1: Flood Risk Identification	To identify whether there may be any flooding or surface water management issues relevant to a plan area or proposed development site that may warrant further investigation.
Stage 2: Initial Flood Risk Assessment	To confirm sources of flooding that may affect a plan area or proposed development site and to appraise the adequacy of the existing flood risk information. If necessary, to determine what surveys and modelling approach are appropriate to match the spatial resolution required and complexity of the flood risk issues identified.
Stage 3: Detailed Flood Risk Assessment	To provide a quantitative assessment of flood risk to a proposed or existing development, the effect of the development on flood risk elsewhere, and the effectiveness of any proposed mitigation measures. Typically involves the construction of a hydraulic model that covers a wide enough area to capture catchment-wide impacts and hydrological processes.

3.9.2 Scales of FRA

There are three scales of flood risk assessment described in the OPW Guidelines, summarised in Table 3.6.

Table 3.6: Scales of Flood Risk Assessment

Scale	Purpose	Responsibility
Regional Flood Risk Appraisal (RFRA)	- To appraise the source and significance of all types of flood risk in a region based on readily derivable information to inform the regional planning guidelines and influence spatial allocations for growth in housing and employment. - To identify areas where more detailed studies are required or where flood risk management measures may be required at a regional level to support the proposed growth.	Regional Authorities
Strategic Flood Risk Assessment (SFRA)	- To provide a broad assessment of all types of flood risk in the area to inform strategic land use planning decisions and to identify opportunities for reducing flood risk. - Typically involves up to a Stage 2 – Initial Flood Risk Assessment. - A site-specific flood risk assessment would be recommended where the initial flood risk assessment demonstrates the potential for a significant level of flood risk or where there is conflict with the vulnerability of proposed development.	Local Authorities
Site-specific Flood Risk Assessment (SSFRA)	- To identify and assess all types of flood risk for a proposed new development and to assess the potential effects of climate change, the impact of development on flooding, and residual risks. - To propose appropriate site management and mitigation measures to reduce flood risk to an acceptable level. - If stages 1 and 2 of assessment have been undertaken to appropriate levels of detail, it is likely that the SSFRA will require detailed channel and site surveys and flood modelling.	Planning Applicants

Further details relating to Development Management aspects of SSFRAs are outlined in Section 6.

3.10 The Sequential Approach and Justification Test

3.10.1 Sequential Approach

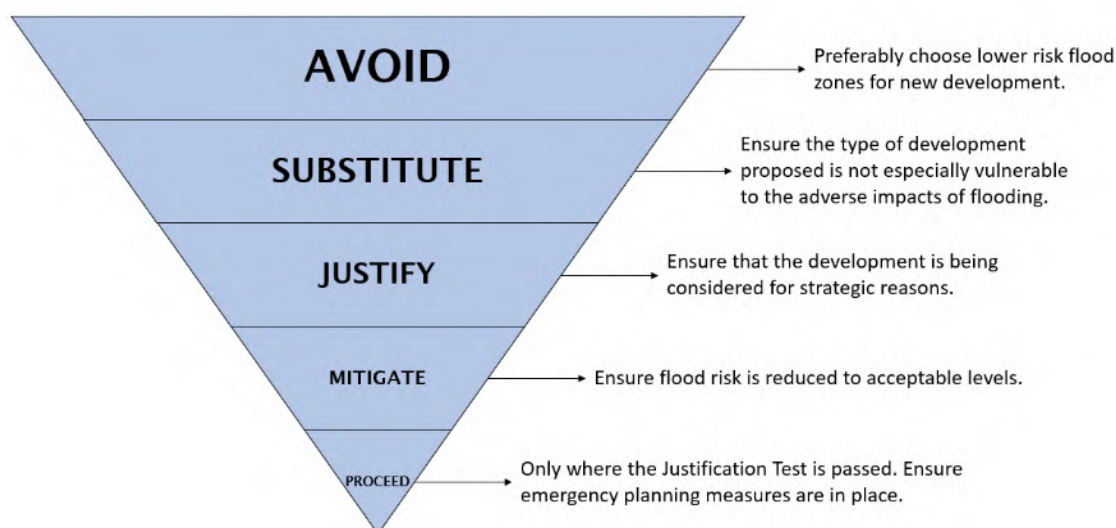
The OPW Guidelines recommend a sequential approach to planning to ensure the core objectives outlined in Section 3.2 are implemented. It is of particular importance at the plan making stage but is also applicable in the layout and design of development at the development management stage. The broad philosophy of the sequential approach in flood risk management from the OPW Guidelines is shown in Figure 3.2.

In general, most types of development would be considered inappropriate in Flood Zone A. In Flood Zone B highly vulnerable development (e.g., hospitals, dwelling houses and primary infrastructure) would be considered inappropriate but less vulnerable development (e.g., retail, commercial and industrial uses)

might be considered appropriate. Development within Flood Zone C is appropriate from a flood risk perspective.

However, this preferred Sequential Approach is not always possible as many urban centres are affected by Flood Zones and are targeted for key social and economic development. To reflect this, the OPW Guidelines outline the Justification Test to facilitate assessment of the balance between consideration of flood risk issues and the need for continued development in towns and cities.

Figure 3.2: The Sequential Approach



3.10.2 Justification Test

The Justification Test has been designed to rigorously assess the appropriateness, or otherwise, of particular developments that, for the reasons outlined above, are being considered in areas of moderate or high flood risk. The test is comprised of two processes:

- **Plan Making Justification Test** – used at the plan preparation and adoption stage where it is intended to zone or otherwise designate land which is at moderate or high risk of flooding.
- **Development Management Justification Test** – 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.

Table 3.7 is a matrix of receptor vulnerability versus Flood Zone to illustrate appropriate development and scenarios where development is required to meet the Justification Test.

Table 3.7: Vulnerability and Flood Zone Matrix for Justification Test

Development Vulnerability	Flood Zone A	Flood Zone B	Flood Zone C
Highly Vulnerable (including essential infrastructure)	Justification Test	Justification Test	Appropriate
Less Vulnerable	Justification Test	Appropriate	Appropriate
Water-compatible	Appropriate	Appropriate	Appropriate

3.10.3 Plan Making Justification Test

The Plan Making / Development Plan Justification Test should be carried out as part of the SFRA using mapped Flood Zones. It applies where land zonings have been reviewed with respect to the need for development of areas at a high or moderate risk of flooding for uses which are vulnerable to flooding and which would generally be inappropriate, as set out in Table 3.2, and where avoidance or substitution is not appropriate. Where land use zoning objectives are being retained, they must satisfy all of the following criteria as per Table 3.4 of the OPW Guidelines included as Table 3.8.

Table 3.8: Plan Making Justification Test

No.	Criteria
1	The urban settlement is targeted for growth under the National Spatial Strategy, regional planning guidelines, statutory plans as defined above or under the Planning Guidelines or Planning Directives provisions of the Planning and Development Act, 2000, as amended.
2	The zoning or designation of the lands for the particular use or development type is required to achieve the proper planning and sustainable development of the urban settlement and, in particular: - Is essential to facilitate regeneration and / or expansion of the centre of the urban settlement - Comprises significant previously developed and/or under-utilised lands - Is within or adjoining the core of an established or designated urban settlement - Will be essential in achieving compact and sustainable urban growth - There are no suitable alternative lands for the particular use or development type, in areas at lower risk of flooding within or adjoining the core of the urban settlement
3	A flood risk assessment to an appropriate level of detail has been carried out as part of the Strategic Environmental Assessment as part of the development plan preparation process, which demonstrates that flood risk to the development can be adequately managed, and the use or development of the lands will not cause unacceptable adverse impacts elsewhere. N.B. The acceptability or otherwise of levels of any residual risk should be made with consideration for the proposed development and the local context and should be described in the relevant flood risk assessment.

In cases where existing zoned lands are discovered to be within flood zones, the Development Plan Justification Test has been applied, and it is demonstrated that it cannot meet the specified requirements it is recommended that planning authorities reconsider the zoning by implementing the following:

- Remove the existing zoning for all types of development on the basis of the unacceptable high level of flood risk
- Reduce the zoned area and change or add zoning categories to reflect the flood risk
- Replace the existing zoning with a zoning or a specific objective for less vulnerable uses
- Prepare a local area plan informed by a detailed flood risk assessment to address zoning and development issues in more detail and prior to any development

If the criteria of the Justification Test have been met, design of structural or non-structural flood risk management measures as prerequisites to development in specific areas, ensuring that flood hazard and risk to other locations will not be increased or, if practicable, will be reduced. The mitigation measures are required prior to development taking place.

3.11 Strategic Flood Risk Assessment

The purpose of this report is to carry out an SFRA at county scale for Monaghan CC but also to assess particular areas of interest at closer (town / city) scale. In addition to the outputs of an SFRA outlined in Section 1.3, the following more detailed requirements are set out in the OPW Guidelines Technical Appendices and have been undertaken where relevant information is available:

- Identify principal rivers, sources of flooding and produce Flood Zone maps for across the local authority area and in key development areas.
- An appraisal of the availability and adequacy of the existing information.
- Assess potential impacts of climate change to demonstrate the sensitivity of an area to increased flows.
- Identify the location of any flood risk management infrastructure and the areas protected by it and the coverage of flood-warning systems.
- Consider, where additional development in Flood Zone A and B is planned within or adjacent to an existing community at risk, the implications of flood risk on critical infrastructure and services across a wider community-based area and how the emergency planning needs of existing and new development will be managed.
- Identify areas of natural floodplain, which could merit protection to maintain their flood risk management function as well as for reasons of amenity and biodiversity.
- Assess the current condition of flood-defence infrastructure and of likely future policy with regard to its maintenance and upgrade.
- Assess the probability and consequences of overtopping or failure of flood risk management infrastructure, including an appropriate allowance for climate change.
- Assess, in broad terms, the potential impact of additional development on flood risk elsewhere and how any loss of floodplain could be compensated for.
- Assess the risks to the proposed development and its occupants using a range of extreme flood or tidal events.
- Identify areas where site-specific FRA will be required for new development or redevelopment.
- Identify drainage catchments where surface water or pluvial flooding could be exacerbated by new development and develop strategies for its management in areas of significant change.
- Identify where an integrated and area based provision of SuDS and green infrastructure are appropriate in order to avoid reliance on individual site by site solutions.
- Provide guidance on appropriate development management criteria for zones and sites.

4 STAGE 1 – FLOOD RISK IDENTIFICATION

4.1 Introduction

The Flood Risk Identification stage involves a review of available flood risk information and identification of any flooding or surface water management issues in Monaghan that warrant further investigation. Following the guidance set out in the OPW Guidelines, both primary and secondary sources of flood risk information have been used to inform this SFRA.

4.2 Primary Sources of Flood Risk Information

Table 4.1 lists the primary sources of flood risk information in chronological order and indicates whether the source has been used to develop the Flood Zone maps produced as part of this SFRA, included in Appendix A. The rationale for use of the nature and suitability of flood data is described in subsequent report Sections 0 to 4.2.6.

The source of flood data used in the SFRA flood maps is shown on maps in Appendix B.

Table 4.1: Sources of Primary Flood Information Summary

Information Source	Year Published	Flooding Type	Used for Flood Zone Mapping?
Preliminary Flood Risk Assessment (PFRA)	2012	Fluvial, pluvial, groundwater	No
Catchment Flood Risk Assessment and Management (CFRAM) Study	2015 / 2016	Fluvial	Yes
Previous Monaghan County Development Plan Strategic Flood Risk Assessment 2019 – 2025 (MCDP)	2017	Fluvial	No
GSI Groundwater Flooding	2020	Groundwater	No
National Indicative Fluvial Mapping (NIFM)	2021	Fluvial	Yes
Past Flood Events Mapping	Historical / Ongoing	Various	No

4.2.1 Preliminary Flood Risk Assessment (PFRA)

The Office of Public Works (OPW) developed Preliminary Flood Maps as part of the Catchment Flood Risk Assessment and Management (CFRAM) Programme. The first stage of the CFRAM process was to produce a Preliminary Flood Risk Assessment (PFRA) that included flood mapping for the entire country.

The PFRA, published by the OPW in 2012, was a national screening exercise that considered risk from coastal, fluvial, pluvial and groundwater flooding. Its purpose was to identify areas of potentially significant flood risk (Areas for Further Assessment) and to provide a scope for the Catchment Flood Risk Assessment and Management (CFRAM) programme (see Section 4.2.2).

The PFRA is a preliminary assessment only, based on available or readily-derivable information. The analysis was undertaken to identify areas prone to flooding but the analysis is indicative. Flood mapping derived is of a national / coarse scale and is not suitable for site-specific flood risk assessment.

Recent guidance from the OPW on the PFRA flood mapping indicates that the dataset is considered superseded by more recent data sources (outlined in subsequent sections) and as such, should no longer be used, so is not referred to / used in this assessment.

4.2.2 Catchment Flood Risk Assessment and Management (CFRAM) Study

As part of the OPW's CFRAM programme, flood extent, depth, and risk maps (generally referred to as 'CFRAM maps') were published in 2015 / 2016 for areas identified by the Preliminary Flood Risk Assessment (PFRA) as being at potentially significant risk of flooding (see Section 0). One of the main purposes of the detailed CFRAM flood maps was to assist Local Authorities in planning and development management.

The CFRAM flood extent maps show the estimated extents, peak water levels, and peak flows associated with flooding from modelled river reaches, estuaries, and coastlines, taking account of flood defences. Flood maps were produced for a range of flood events (10%, 1%, and 0.1% AEP) for the present-day scenario and two future scenarios (the MRFS and HEFS). Flooding from other sources has typically not been considered as part of the CFRAM flood mapping.

Four towns/settlements in Monaghan are covered by the North Western - Neagh Bann CFRAM Study data. Table 4.2 outlines the detailed CFRAM models and associated study waterbodies relevant to Monaghan that have been used to form a component part of the flood outlines used for Flood Zone mapping for the SFRA. CFRAM flood data was provided by the OPW, via Monaghan CC, including climate change flood extents (MRFS and HEFS) included on flood maps in Appendix C and Appendix D.

Table 4.2: CFRAM Data for County Monaghan

CFRAM Model Location	Watercourses
Monaghan Town (UoM 06)	Peter's Lake, Killygowan, Ballymacforban, Tanderagee, Monaghan, Mullaghadun, Triangle, Newgrove, Newgrove 2, Crove, Tullybryan, Derrynagrew, Knockaconny, Cor River, Telaydan
Ballybay (UoM 36)	Dromore River, Cornamucklaglass, Corrybrannan, Dromore River Tributary 1, Shantonagh River
Carrickmacross (UoM 06)	River Glyde (Longfield River), River Coolderry, River Lisanisk, River Kilmactrasna, Tullynaskeagh, Drummond, Kilmactrasna Tributary 2
Inishkeen (UoM 06)	Fane River; Fane River Tributaries (4), Lannat, Inniskeen

4.2.3 [GSI Groundwater Flood Mapping](#)

In response to the extensive groundwater flooding that occurred in the winter of 2015 / 2016, Geological Survey Ireland (GSI) undertook the 'GWFlood' project to address the lack of data on groundwater flooding and fit-for-purpose flood hazard maps necessary to manage groundwater flood risk in vulnerable communities. Project outputs included the Groundwater Flood Maps Viewer, which shows historic and predictive (10%, 1%, and 0.1% AEP) groundwater flood extents, a Groundwater Level Data Viewer, which shows live groundwater hydrometric data, and a comprehensive project report.

GSI Groundwater Flooding Probability Maps show two areas of predicted groundwater flood risk within the Monaghan CC area. These areas are located outside the urban towns and settlements. This information is available through GSI, and through the OPW at floodinfo.ie. Groundwater flooding is not considered within the Flood Zone mapping.

4.2.4 [National Indicative Fluvial Mapping \(NIFM\)](#)

The National Indicative Fluvial Mapping (NIFM) was published by the OPW in 2021. It shows the extent of flooding from modelled river reaches for catchments greater than 5 km² in areas that were not previously mapped as part of the CFRAM programme. Flood mapping was prepared for a range of flood events (5%, 1%, and 0.1% AEP) for the present-day scenario and two future climate change scenarios (the MRFS and HEFS).

NIFM User Guidance Notes state that the maps only provide an indication of areas that may be prone to flooding. They are not necessarily locally accurate and should not be used as the sole basis for defining the Flood Zones nor for making decisions on planning applications. They are by definition of a national indicative quality.

Flood outlines are suitable for use in the Stage 1 Flood Risk Assessment and initial Flood Zone mapping but not suitable for use in site specific flood risk assessment. Where a land zoning allocation is being considered within or adjacent to an initial Flood Zone defined by NIFM flood extents then additional data / information source will be required to form the basis of a Stage 2 Flood Risk Assessment.

NIFM flood data represents best available information for flooding from fluvial sources where no more detailed regional or local-quality data exists, is a component part of the flood outlines used for Flood Zone mapping for the SFRA. NIFM data is also used in SFRA MRFS / HEFS climate change flood mapping in Appendix C and Appendix D.

4.2.5 [Monaghan County Development Plan Strategic Flood Risk Assessment 2019 - 2025](#)

As part of the preparation of the previous Monaghan County Development Plan 2019-2025, a Strategic Flood Risk Assessment was carried out by Monaghan CC. A walkover survey, along with consultation with municipal district engineers was carried out at a number of selected locations throughout the County to help assess flood risk. In particular, settlements where historic flooding has taken place but where no detailed data has been collated were surveyed at times of heavy rainfall. Historical flood records, including reports, photographs and aerial photography, were used to validate the 2019 - 2025 flood zones, identify flood sources and areas vulnerable to flood damage.

This established flood data which include invaluable local knowledge, while not forming part of the Flood Zone mapping produced as part of this assessment, has been incorporated into the flood information mapping presented in Appendix E.

These Flood Information maps are based on a wide variety of sources, of variable confidence, and do not constitute Flood Zones, but are provided for information only as additional for consideration as part of future site-specific flood risk assessments.

4.2.6 [Past Flood Event Mapping](#)

The OPW has recorded and mapped 'Past Flood Events' based on available information including flood reports, news articles, photos, Council meeting minutes and other archived information. Historical records are mostly anecdotal and incomplete but are useful for providing background information. The record is not an exhaustive record of all flooding that has occurred in Monaghan and historic flood events will have

occurred that are not captured by this dataset. These records have been reviewed as part of the SFRA along with emergency services reports and historic flood event records provided by Monaghan CC.

The combined set of flood records has been reviewed and any events that coincide with fluvial mapping included on SFRA Flood Zone Maps has been excluded as, for land zoning purposes, it will be considered under another study / source of data. Figure 4.1 shows the flood events not coinciding with Flood Zones / other predictive flood data, and Table 4.3 provides a description of each past flood event.

It is noted that past flood event mapping is not consistent or comprehensive and are not a component of the flood outlines used for development of Flood Zone mapping for the SFRA. Mapping of single or recurring past flood events may provide useful additional information as an indicator of a risk of flooding on land, and information on the scale and nature of flood risk in a particular location that can be used to inform site-specific flood risk assessment, but records of past flood events should not be taken as the only source of data in assessing flood risk.

Please note, OPW floodinfo.ie records are continually updating and those presented are available at time of access.

Figure 4.1: Map of (filtered) Past Flood Events

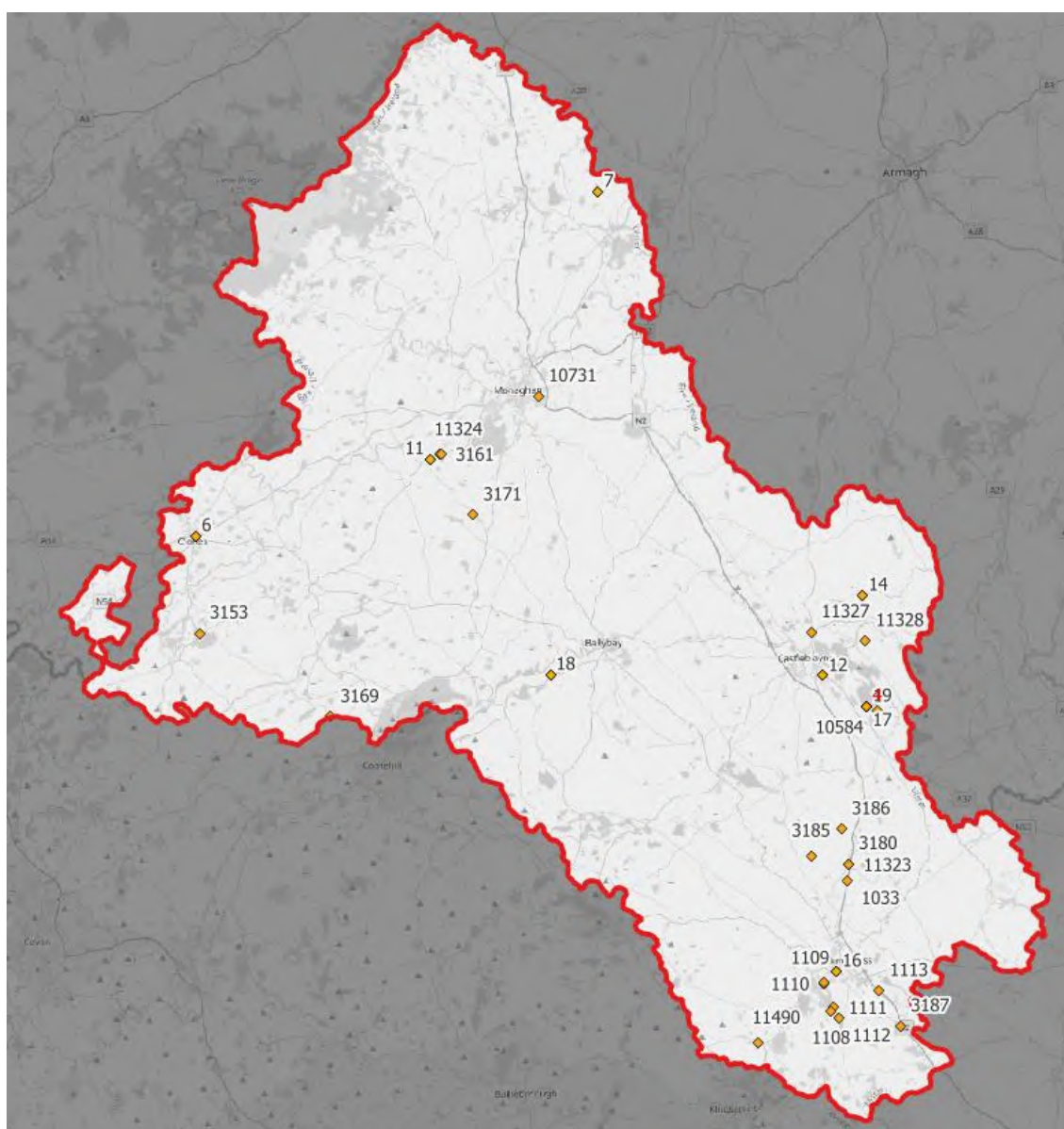


Table 4.3: List of (filtered) Past Flood Events

Flood ID	Source	Date	Location	Description (if available)
4	Emergency Services Report	06/12/2015	Annadrumman, Castleblayney	Ambulance needed help gaining entry to the patient due to floods. Heavy rainfall plus over flowing river Frequency: Always after heavy rainfall
6	Emergency Services Report	06/12/2015	McCurtain Street, Clones	House flooded MN14 from Monaghan and assist with pumping of house Heavy rainfall Frequency: Always after heavy rainfall
7	Emergency Services Report	06/12/2015	Monmurray, Glaslough	Flood water was getting high. Sand bags used to protect the house. Frequency: Always after heavy rainfall
11	Emergency Services Report	28/12/2015	Threemilehouse Village	Road flooded due to heavy rainfall
12	Emergency Services Report	30/12/2015	Annahale, Castleblayney	House was flooded, water was diverted away from the house by putting a hole in the parting wall. Frequency: Never before
14	Emergency Services Report	30/12/2015	Oram Cottages, Oram, Castleblayney	Two people trapped in a car stuck in a flood. Upon arrival they had left the car with aid of a passing tractor. Heavy rainfall Frequency: Always after heavy rainfall
16	Emergency Services Report	02/01/2016	Magheross Road, Carrickmacross	House in danger of flooding, water pumped away and sand bags used. House basement flooded. Over flowed river nearby after heavy rain fall.
17	Emergency Services Report	03/01/2016	Annadrummond, Castleblayney	Civil Defence asked to help get a family out of a house flooded. 3 kids and one woman removed via civil defence boats. Heavy rainfall plus a river over flowing Frequency: Always after heavy rainfall
18	Emergency Services Report	04/01/2016	Cootehill Road, Ballybay	One person trapped in a car stuck in a flood. CSU mobilised but turned back. Heavy rainfall and lake/river nearby Frequency: Many times a year
19	Emergency Services Report	04/01/2016	Annadrummond, Castleblayney	Tractor had to be used to gain access to the patient, patient was air lifted to hospital Heavy rainfall plus a river over flowing Frequency: Always after heavy rainfall
11490	OPW floodinfo.ie	24/10/2011	Magheracloone, Carrickmacross	
11328	OPW floodinfo.ie	17/11/2009	Lough Muckno LP0302 LS07710 Drumleek South Castleblayney	

Flood ID	Source	Date	Location	Description (if available)
11327	OPW floodinfo.ie	17/11/2009	Lough Muckno R81 R182 Derrycreevy Castleblayney	
11324	OPW floodinfo.ie	08/2008 11/2009	Kinaclay Lough Three Mile House	
11323	OPW floodinfo.ie	08/2008 11/2009	Lisnagunnion	Karst limestone underground channel
10731	OPW floodinfo.ie	19/11/2009	Monaghan Town	
10584	OPW floodinfo.ie	16/08/2008	Lough Muckno Toome	
3187	OPW floodinfo.ie	Recurring	Clonturk	Recurring
3186	OPW floodinfo.ie	Recurring	Corlygorm	Recurring
3185	OPW floodinfo.ie	Recurring	Cashlan East Recurring	Recurring
3180	OPW floodinfo.ie	Recurring	Lisnagunnion Recurring	Recurring
3171	OPW floodinfo.ie	Recurring	Corcaghan Lough Recurring	Recurring
3169	OPW floodinfo.ie	Recurring	Crosslea Recurring	Recurring
3161	OPW floodinfo.ie	Recurring	Three Mile House Recurring	Recurring
3153	OPW floodinfo.ie	Recurring	Hilton Park/Demesne Recurring	Recurring
1113	OPW floodinfo.ie	Recurring	Monaltyduff	Turlough
1112	OPW floodinfo.ie	Recurring	Ballyloughlan C	Turlough
1111	OPW floodinfo.ie	Recurring	Ballyloughlan B	Turlough
1110	OPW floodinfo.ie	Recurring	Kilmactrasha B	Turlough
1109	OPW floodinfo.ie	Recurring	Kilmactrasha A	Turlough
1108	OPW floodinfo.ie	Recurring	Ballyloughlan A	Turlough
1033	OPW floodinfo.ie	Recurring	Tonyellida	Turlough
11490	OPW floodinfo.ie	24/10/2011	Magheracloone, Carrickmacross	
11328	OPW floodinfo.ie	17/11/2009	Lough Muckno LP0302 LS07710 Drumleek South Castleblayney	

4.3 Secondary Sources of Flood Risk Information

4.3.1 OPW Drainage Districts

Drainage Districts were carried out by the Commissioners of Public Works under a number of drainage and navigation acts from 1842 to the 1930s to improve land for agriculture and to mitigate flooding. Channels and lakes were deepened and widened, weirs removed, embankments constructed, bridges replaced or modified, and various other work was carried out.

The purpose of the schemes was to improve land for agriculture, by lowering water levels during the growing season to reduce waterlogging on the land beside watercourses known as callows. Drainage Districts cover approximately 10% of the country, typically the flattest areas.

Benefited land is land that was drained as part of the Drainage District. The original maps also identified other land owned by the same landowner so as to calculate the appropriate charge for maintenance. Local authorities are charged with responsibility to maintain Drainage Districts. The Arterial Drainage Act, 1945 contains a number of provisions for the management of Drainage Districts in Part III and Part VIII of the act.

Drainage Districts are areas that Local Authorities have a responsibility to maintain. The Bawn, Leesborough, and Anlore Drainage Districts are located within County Monaghan.

4.3.2 OPW Arterial Drainage Schemes

Arterial Drainage Schemes were carried out under the Arterial Drainage Act, 1945 to improve land for agriculture and to mitigate flooding. Rivers, lakes weirs and bridges were modified to enhance conveyance, embankments were built to control the movement of flood water and various other work was carried out under Part II of the Arterial Drainage Act, 1945.

The purpose of the schemes was to improve land for agriculture, to ensure that the 3-year flood was retained in bank this was achieved by lowering water levels during the growing season to reduce waterlogging on the land beside watercourses known as callows. Flood protection in the benefiting lands was increased as a result of the Arterial Drainage Schemes.

Two primary 'Arterial Drainage Schemes', that the OPW has a duty to maintain, are located within Monaghan:

- The Glyde and Dee Arterial Drainage Scheme, covering 26,300 benefiting acres over Counties Louth, Meath, Monaghan and Cavan, to the north of Monaghan town
- The Monaghan Blackwater, covering 5,850 benefiting acres within Monaghan County, to the south of Carrickmacross

4.3.3 Ulster Canal

The Ulster Canal traverses the County from east of Monaghan Town to west of Clones. While the Canal closed in 1931 and is largely disused / derelict, it is a source of flood risk in parts of the county such as Monaghan Town where it receives fluvial flows and has been observed to flood adjacent development in the past.

4.3.4 Proposed OPW Flood Relief Schemes

Areas that benefit from an existing flood relief scheme or flood defences have a reduced probability of flooding but can be particularly vulnerable due to the speed of flooding when overtopping or a breach or other failure takes place.

The Office of Public Works (OPW) is responsible for leading and coordinating the implementation of localised flood relief schemes to provide flood protection for cities, towns, and villages, either directly or in association with relevant Local Authorities.

There are no completed or ongoing OPW flood defence schemes in County Monaghan. There are a number of OPW 'Minor Works' schemes across the County which can be viewed / accessed via floodinfo.ie. This database will be updated throughout the lifetime of the County Development Plan.

The OPW, through consultation undertaken as part of the SFRA, have requested that Monaghan CC have full regard to the proposed flood relief schemes in three areas as outlined in the following sections.

Following schemes identified by the CFRAM programme, which are intended to be progressed in the future and will be funded under the Office of Public Works' flood relief capital works programme².

4.3.4.1 Ballybay Flood Relief Scheme

The proposed measure for Ballybay that may be implemented after project level assessment and planning or Exhibition and confirmation might include physical works. The proposed Ballybay Flood Relief Scheme measures may consist of a series of flood embankments and walls. These hard defences would protect to the 1% AEP flood event with an average height of 1.6m and a total length of 2.5km.

The scheme has not been implemented at the time of preparation of the SFRA, and SFRA Flood Zone mapping does not include any associated benefitting area.

4.3.4.2 Inishkeen Flood Relief Scheme

The proposed Inishkeen Flood Relief Scheme measures may consist of a series of flood embankments and walls. Hard Defence would also include a 253m long section of raised road where space is restricted for walls or embankments. The raising of the road would require that the soffit level of a critical bridge structure be raised in conjunction with the road raise. These hard defences would protect to the 1% AEP fluvial flood event with an average height of 1.36m and a total length of 0.64 km.

The scheme has not been implemented at the time of preparation of the SFRA, and SFRA Flood Zone mapping does not include any associated benefitting area.

4.3.4.3 Monaghan Flood Relief Scheme

The proposed Monaghan Flood Relief Scheme measures may consist of a series of flood embankments and walls with additional measures in place to protect properties in the Milltown area. These FRM methods would protect properties only to the 1% AEP flood event. The Hard Defences would provide design Standard of Protection with an average height of 1m and a total length of 3km.

The scheme has not been implemented at the time of preparation of the SFRA, and SFRA Flood Zone mapping does not include any associated benefitting area.

² <https://www.floodinfo.ie/scheme-info/>

4.4 Summary

In accordance with the OPW Guidelines, the flood information sources within Monaghan have been identified. The findings of the Stage 1 assessment indicate that lands within the County are at risk of flooding. Therefore, in accordance with the OPW Guidelines, a Stage 2 flood risk assessment, including Justification Test, should be carried out.

Table 4.4: Stage 1 Flood Risk Assessment Summary

Source / Pathway		Relevant to Monaghan CC Area?	Reason
Coastal		No	Monaghan is a land-locked county, located more than 10km inland, and outside of any areas of identified coastal or tidally-influenced areas. Therefore, coastal flooding is not considered a source of a potential risk to County Monaghan.
Fluvial	Natural Floodplain	Yes	Flood mapping indicates that areas within Monaghan are affected by fluvial flooding.
	Flood Defence Failure	No	There are no recorded flood defences benefitting lands in parts of Monaghan.
Pluvial / Surface Water		Yes	Pluvial flooding is likely to be a significant risk in discrete areas throughout the County; however insufficient data is available to allow any spatial analysis of pluvial flood risk.
Urban Drainage		Possible	Flooding from urban drainage networks is likely to cause a significant risk developed / built up areas where extreme rainfall can overwhelm drainage network capacity.
Groundwater		Possible	GSI Groundwater Flood Mapping indicates that the majority of the Monaghan area is not at significant risk of groundwater flooding. However, past flood event records reference groundwater / turlough flooding. Therefore, further assessment should be made at a site-specific level to ascertain the level of potential groundwater flood risk.
Canals		Yes	The Ulster Canal has been identified as a potential source of flood risk in parts of the County.
Reservoirs / Impoundments		No	Monaghan does not have any large reservoirs or other artificial impoundments, removing the risk of flooding due to breach.

5 STAGE 2 – INITIAL FLOOD RISK ASSESSMENT

5.1 Introduction

A Stage 2 SFRA (initial flood risk assessment) was undertaken to:

- Confirm the sources of flooding that may affect lands within Monaghan CC
- Appraise the existing land zonings relative to the Stage 1 flood data / Flood Zone Maps
- Provide clarification on the requirement for a site-specific FRA and Justification Test, based on the proposed use and associated vulnerability of a land zoning

5.2 Vulnerability Classifications

Land use zoning for the Monaghan County Development Plan 2025-2031 have been overlain with Flood Zone mapping and the following section presents Justification Tests where required, whereby land use zonings are located within an inappropriate / not suitable flood zone, based on land use zoning vulnerability. Land use zoning vulnerability was agreed through consultation with Monaghan CC, as outlined in the table below, and in following with the PSFRM Guidelines (see Section 3.7).

Table 5.1: Monaghan CDP 2025-2031 Land Zoning Objectives and Flood Risk Vulnerability

Zoning	Flood Risk Vulnerability	Suitability
Industry / Enterprise / Employment	Less Vulnerable	Inappropriate in Flood Zone A Any proposal for development within Flood Zone B which involves changes in existing ground levels or provision of structures will require site specific flood risk assessment at planning application stage which demonstrates that the proposed development will not be at an unacceptable risk from flooding, and will not cause, contribute to, or exacerbate flooding elsewhere.
Existing Commercial	Less Vulnerable	Inappropriate in Flood Zone A Any proposal for development within Flood Zone B which involves changes in existing ground levels or provision of structures will require site specific flood risk assessment at planning application stage which demonstrates that the proposed development will not be at an unacceptable risk from flooding, and will not cause, contribute to, or exacerbate flooding elsewhere.
Landscape Protection / Conservation	Water Compatible	Appropriate in any flood zone Any proposal for development within Flood Zones A or B which involves changes in existing ground levels or provision of structures will require site specific flood risk assessment at planning application stage which demonstrates that the proposed development will not be at an unacceptable risk from flooding, and will not cause, contribute to, or exacerbate flooding elsewhere.
Recreation / Amenity	Water Compatible	Appropriate in any flood zone Any proposal for development within Flood Zones A or B which involves changes in existing ground levels or provision of structures will require site specific flood risk assessment at planning application stage which demonstrates that the proposed development will not be at an unacceptable risk from flooding, and will not cause, contribute to, or exacerbate flooding elsewhere.

Zoning	Flood Risk Vulnerability	Suitability
Town Centre	Highly Vulnerable	Inappropriate in Flood Zone A and Flood Zone B
Proposed Residential	Highly Vulnerable	Inappropriate in Flood Zone A and Flood Zone B
Existing Residential	Highly Vulnerable	Inappropriate in Flood Zone A and Flood Zone B
Strategic Residential Reserve	Highly Vulnerable	Inappropriate in Flood Zone A and Flood Zone B
Community Services / Facilities	Highly Vulnerable	Inappropriate in Flood Zone A and Flood Zone B

5.3 Justification Tests

5.3.1 Existing Land Zonings

Land use zonings for the 2025-2031 County Development Plan have been provided by Monaghan CC as part of the Development Plan SFRA process.

The zoning objectives have been reviewed as part of the Stage 2 assessment. The review, outlined in the following sections, applies a Plan-Making Justification Test (as per approach set out in Section 3.10.3) for areas identified to include 'inappropriate' land zonings relative to Flood Zones as per the guidance set out in the OPW Guidelines.

This process includes consideration of the specific land use zoning objectives as well as comment on the source / nature of flood risk. Recommendations are presented on how flood risk is proposed to be managed within the area identified.

5.3.2 Plan Making Justification Tests

Plan-making Justification Tests for all land use zonings identified as not suitable / 'inappropriate' in line with the OPW Guidelines have been carried out by Monaghan CC and are included in Appendix F. For each town / area, only land use zonings requiring Justification Tests are shown overlain with Flood Zone mapping. As shown on the map for Clones, there are no land use zonings within the settlement boundary of the town that require a Justification Test.

Each land use zoning has been given a unique reference as shown on the Justification Test maps and associated text is included in Appendix F. In some cases, land use zonings have been grouped as set out in the Justification Test tables.

In line with the OPW Guidelines, not suitable / 'inappropriate' land use zonings are:

- Highly vulnerable uses in Flood Zone A and Flood Zone B
- Less vulnerable uses in Flood Zone A

It is noted that water compatible uses are considered appropriate in any Flood Zone.

6 DEVELOPMENT MANAGEMENT

6.1 Overview

This SFRA has been prepared to support the Strategic Environmental Assessment of the Monaghan County Development Plan 2025-2031, in accordance with the OPW Guidelines. It has considered flood risk information and data from a variety of sources and presented Stage 1 and Stage 2 flood risk assessments.

The SFRA has also set out requirements for all new development in the plan area during the 6-year period of the Monaghan County Development Plan 2025-2031. Development management of flood risk shall be in accordance with the OPW Guidelines, as well as policies in this document to take account of local factors.

The overarching purpose of development management measures is to ensure that:

- Development will not be at unacceptable risk of flooding
- Development will not increase flood risk elsewhere

It should be noted that there are restrictions on the construction, replacement or alteration of bridges and culverts over any watercourse, and that appropriate consent from the Commissioners is required under Section 50 of the Arterial Drainage Act 1945.

6.2 Stages of Flood Risk Assessment

The OPW Guidelines set out in detail the requirements for all scales and stages of FRA, and the subsequent requirements to be applied to proposed development in Monaghan is designed to be implemented alongside that of the OPW Guidelines and associated Technical Appendices.

The three stages of flood risk assessment are (as described in Section 3.9.1):

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

In order to ensure that flood risk is considered at an early stage to protect future development and increase flood resilience and sustainability, when assessing development proposals under the development management process, all development is subject to Stage 1 Flood Risk Identification / flood risk screening as a minimum to establish the need or otherwise for further flood risk assessment. Where a source and pathway for flood risk is identified then further assessment in the form of a Stage 2 FRA (or dependent on the nature of the flood source and pathway, Stage 3 FRA) will be required.

All development subject to a Stage 2 FRA (or greater) will be required to submit a Site-Specific Flood Risk Assessment (SSFRA) in support of any associated planning application(s). It is noted that Stage 1 FRAs may be undertaken without the need for a full SSFRA report.

All SSFRAs must demonstrate that a sequential approach was applied to site layout and design. The scale / stage of SSFRA will depend on the risks identified and the proposed land use as outlined in the following sections.

6.2.1 Flood Risk Assessment

FRAs aim to identify, quantify, and communicate to stakeholders and decision-makers the risk of flooding to land, property, and people. The purpose of an FRA is to provide sufficient information to determine whether applications for proposed development are appropriate. An FRA should therefore:

- Identify whether (and the degree to which) flood risk is an issue
- Identify Flood Zones
- Inform decisions in relation to development of site layouts
- Develop appropriate flood risk mitigation and management measures for proposed developments

Assessment of flood risk is therefore a fundamental component of proposing and planning development. FRAs are typically undertaken over a number of stages with the need for progression to a more detailed

stage dependent on the outcomes of the former stage until the level of detail of the FRA is appropriate to support the proposed development. The following sections summarise the requirements / content of each stage, as per the OPW Guidelines.

6.2.1.1 Stage 1 FRA

A Stage 1 FRA is to identify whether there may be any flooding or surface water management issues related to a proposed development that may warrant further investigation. Identification is the process for deciding whether a proposed development requires a Stage 2 / Stage 3 FRA report and is essentially a desk-based screening exercise based on existing information.

To establish whether a flood risk source affects a site (now or in the future), the site location should be screened against number a range of data sources including, but not limited to:

- SFRA flood maps³ including Climate Change flood maps
- OPW flood maps (floodinfo.ie)
- OPW benefitting land / arterial drainage maps (floodinfo.ie)
- OPW 'Past Flood Events' (floodinfo.ie)
- Flood data obtained from stakeholders (OPW, GSI, Local Authority, landowner etc.)
- Proximity (on plan and elevation) to unmodelled watercourses for which no flood data exists.

All sites must consider the impact of flooding from sources as well as rivers including surface water flood risk. It is an objective of the SFRA that all sites implement surface water drainage (SuDS) measures to manage effects from drainage to flood risk elsewhere.

A Stage 1 FRA will conclude either:

- No potential source of flood risk or surface water management issue has been identified.
- If the site is affected by or proximal to a source of flooding, then a Stage 2 / Stage 3 FRA is required to further assess an identified source of potential flood risk.

A Stage 1 FRA does not necessarily require specialist skills. There may not be a requirement for submission of a SSFRA where the outcomes can be conveyed in another manner (e.g. inclusion on planning drawings).

6.2.1.2 Stage 2 FRA

A Stage 2 FRA is to confirm sources of flooding that may affect a proposed development site, to appraise the adequacy of existing information and to determine what surveys and modelling approach is appropriate for the spatial resolution required / complexity of the flood risk issues.

Appraisal and assessment of flood risk shall be proportionate to the scale and nature of the development proposed, the risk to the development and effect elsewhere, and the complexity of the flood source or pathway.

It is the responsibility of the developer / applicant to seek out an appropriately qualified flood risk professional / hydrologist to undertake such an assessment.

The extent of the risk of flooding should be assessed which may involve preparing indicative flood zone maps. Where existing river models exist, these should be used broadly to assess the extent of the risk of flooding and potential impact of a development on flooding elsewhere and of the scope of possible mitigation measures.

A Stage 2 FRA must be sufficiently detailed to allow the determination of the flood risk to proposed development. The initial assessment may determine that sufficient quantitative information is already available, appropriate to the scale and nature of the development proposed, for the necessary decision to be made. If not, then the onus is on the applicant to produce new flood data (by flood modelling) and the Flood Risk Assessment should progress to Stage 3.

³ Note that flood data shown on SFRA mapping may be superseded or updated within the lifetime of the Plan

A Stage 2 FRA will generally fully incorporate the findings and outcomes of the Stage 1 FRA and expand on the to include the following:

- An examination of all sources of flooding that may affect a site
- An appraisal of the availability and adequacy of existing information
- Produce flood zone map where not available
- Determine what technical studies are appropriate
- Describe what residual risks will be assessed
- Potential impact of development on flooding elsewhere
- Scope of possible mitigation measures and what compensation works may be required and what land may be needed
- Set out requirements for subsequent stages of FRA

There are two possible outcomes of a Stage 2 FRA:

- Potential sources of flood risk or surface water management issues identified in a Stage 1 FRA have been shown to not pose a risk of flooding to the proposed development.
- Stage 3 FRA is required to further assess an identified flood risk (typically requiring hydraulic modelling).

A Stage 2 SSFRA to support a planning application should take the form of a comprehensive FRA report and be submitted to the Local Authority.

6.2.1.3 Stage 3 FRA

A Stage 3 FRA is 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. As per the OPW Guidelines, this will typically involve use of an existing or construction of a hydraulic model across a wide enough area to appreciate the catchment wide impacts and hydrological processes involved.

Where Stage 1 / Stage 2 FRAs indicate that a proposed development is at risk of flooding, a detailed Stage 3 FRA, incorporating findings and outcomes from previous Stages, must be carried out.

Assessment of flood risk and any subsequent mitigation measures principally relies on estimation of flow, level and the performance of the development at an appropriate degree of accuracy that will deliver 'fit-for-purpose' information for decision-making. It is also important that an assessment of flood risk should consider both the actual and the residual risks:

- Actual flood risk is the risk posed to an area, whether it is behind defences or undefended, at the time of the study. This should be expressed in terms of the probability of flooding occurring, taking into account the limiting factors, both natural and manmade, preventing water from reaching the development.
- Residual risks are the risks remaining after all risk avoidance, substitution and mitigation measures have been taken. Examples of residual risks include the failure of flood management measures, blockages and a flood event that exceeds the flood design standard.

Recommended content for a Stage 3 FRA, in addition to that included in Stage 1 and Stage 2 analysis, includes but it is not limited to:

- Initial assessment / Stage 2 summary
- Hydrological calculations
- Hydraulic model assessment / summary
- Assessment of climate change and culvert blockage
- Proposed mitigation measures; freeboard; evaluation of the effect of development on flood risk elsewhere; requirements for Flood Compensatory Storage (FCS) as per Section 6.5.5 etc.
- Supporting information; drawings, maps, calculations etc.

6.2.2 Site Specific Flood Risk Assessment Report

The outcomes of a Stage 2 or Stage 3 flood risk assessment should be reported in an appropriate site-specific flood risk assessment (SSFRA) report. SSFRAs should be carried out in accordance with the OPW Guidelines and requirements established by this SFRA and should present in sufficient detail:

- The potential flood risk to a proposed development based on the Source-Pathway-Receptor model.
- An assessment of existing flood risk in terms of the likelihood of flooding and resultant consequences.
- An assessment of the potential, post-development risks having regard to the design of mitigation and compensation measures.
- Any additional risk of flooding to the proposals due to climate change and culvert blockage.
- Any proposed mitigation measures including setting of FFLs and FGLs.
- Details of the surface water / SuDS drainage proposals.

Further details relating to the content of all Stages of FRA can be found in the OPW Guidelines and associated Technical Appendices.

6.3 Flood Zoning

Flood Zoning for development management shall apply as outlined in Section 3.6 of this report. Flood Zones established by this SFRA, and any new assessments of Flood Zones established by site-specific assessments are to be generated without the inclusion of climate change factors. The presence of flood protection structures should be ignored as areas protected by flood defences still carry a residual risk from overtopping or breach of defences.

Flood Zones represent flood extents for the existing, undefended present-day scenario. Once Flood Zones have been established, proposed development layouts should be prepared in line with the requirements of the OPW Guidelines, as outlined in the following sections. Flood Zones are established based on suitable available information or site-specific hydraulic modelling where identified as necessary by a Stage 2 FRA.

Hydraulic modelling should be proportionate and fit for purpose and shall be undertaken by an appropriately qualified competent and experienced professional. Where a model is intended to challenge or better define SFRA flood zone mapping then any new modelling must be of an equivalent or better standard.

Flood Zones determined on mapping with this SFRA are not exhaustive and 'new' Flood Zones may be developed by SSFRAs and / or new flood risk datasets produced and published during the lifetime of the County Development Plan.

6.4 The Sequential Approach and Justification Test

6.4.1 Sequential Approach

In the preparation of proposed layouts, prior to any planning application, the Sequential Approach outlined in Section 3.10.1 should be followed to ensure that flood risk to development is minimised and greatest protection from flooding is given to higher vulnerability developments.

The sequential approach aims to:

- Avoid flood risk where possible, substitute less vulnerable uses where avoidance is not possible, and mitigate and manage the risk where avoidance and substitution are not possible.
- Apply the Justification Test for development in flood risk areas.

The receptor vulnerability (see Table 3.3) will apply in determining the suitability of any proposed development. Siting of development in an inappropriate Flood Zone, as shown in Table 6.1, will require the application of a Development Management Justification Test (refer to Table 6.2).

Residual risks that have the potential to increase flood extents and levels higher than Flood Zones, such as climate change (see Section 6.5.1) and culvert blockage (see Section 6.5.2) must be considered and presented as part of any SSFRA.

Table 6.1: Vulnerability and Flood Zone Matrix for Justification Test

Development Vulnerability	Flood Zone A	Flood Zone B	Flood Zone C
Highly Vulnerable (including essential infrastructure)	Justification Test	Justification Test	Appropriate
Less Vulnerable	Justification Test	Appropriate	Appropriate
Water-compatible	Appropriate	Appropriate	Appropriate

6.4.2 Development Management Justification Test

Where development is proposed in an 'inappropriate' Flood Zone, a Justification Test must be applied and submitted alongside a Stage 3 SSFRA. The criteria of a development management Justification Test that must be satisfied are set out in Table 6.2, as per the OPW Guidelines.

Where the primary mitigation for a site in Flood Zone A or Flood Zone B is a flood defence that protects the area from being located in functional floodplain, the Justification Test and SSFRA should contain information relating to the standard of protection, nature, and maintenance / monitoring arrangements of the defence.

Table 6.2: Development Management Justification Test

No.	Criteria
1	The subject lands have been zoned or otherwise designated for the particular use or form of development in the Monaghan Development Plan 2025-2031, which has been adopted or varied taking account of the OPW Guidelines.
2	The proposal has been subject to an appropriate flood risk assessment that demonstrates: - The development proposed will not increase flood risk elsewhere and, if practicable, will reduce overall flood risk. - The development proposal includes measures to minimise flood risk to people, property, the economy, and the environment as far as reasonably possible. - 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. - 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.

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.

Applications for minor development, such as small extensions to houses, and most changes of use of existing buildings and or extensions and additions to existing commercial and industrial enterprises, are unlikely to raise significant flooding issues, unless they obstruct important flow paths, introduce a significant additional number of people into flood risk areas or entail the storage of hazardous substances. Since such applications concern existing buildings, the sequential approach cannot be used to locate them in lower-risk areas and the Justification Test will not apply. However, a commensurate assessment of the risks of flooding should accompany such applications to demonstrate that they would not have adverse impacts or impede access to a watercourse, floodplain or flood protection and management facilities. These proposals should follow best practice in the management of health and safety for users and residents of the proposal.

6.5 Flood Risk Mitigation

The primary objective of the OPW Guidelines and Development Management requirements outlined in this SFRA is to ensure development is resilient relative to the design flood event; 1% AEP for less vulnerable development and 0.1% AEP for highly vulnerable development.

In addition, there are further flood events and residual risk that must be considered as outlined on the following sections.

6.5.1 Climate Change

The OPW Guidelines and Monaghan County Development Plan 2025-2031 recognise that climate change, including its potential impact on flood risk, is a key consideration for future development. Allowances for the Mid-Range Future Scenario (MRFS) and High-End Future Scenario (HEFS) are shown in Table 6.3, based on the OPW's Climate Change Sectoral Adaptation Plan, 2019.

The potential impact of climate change on development proposals should be considered for any site where a Stage 2 or Stage 3 FRA has been identified as being required (i.e. flood risk has not been screened out in a Stage 1 FRA). The source of climate change flood risk may be fluvial or pluvial and will generally results in higher flood levels and wider flood extents than present-day projections.

Climate change projections are to be applied depending on the receptor vulnerability as follows:

- HEFS is to be considered for 'highly vulnerable' development
- MRFS is to be considered for 'less vulnerable' development
- Climate change is generally not a critical consideration for 'water compatible' development but if required (e.g. to ascertain flood depths), the MRFS will apply

For mixed use developments, both HEFS and MRFS should be assessed and applied depending on the vulnerability of the part of the development under consideration.

For purposes of site-specific flood risk assessment to inform development management and control:

- Climate change impacts on fluvial flooding where no mapped flood data is available are to be assessed by an appropriate methodology which will normally⁴ require site-specific hydraulic modelling by increasing the estimated flows by the factor shown in Table 6.3.

Table 6.3: OPW Climate Change Allowances

Parameter	Mid-Range Future Scenario (MRFS)	High End Future Scenario (HEFS)
Peak River Flood Flows	+ 20%	+ 30%
Extreme Rainfall Depths	+ 20%	+ 30%

6.5.2 Culvert Blockage

Residual risk associated with the blockage of any watercourse crossing (i.e., culvert, bridge, etc.) that has the potential to increase flooding at the proposed development site should be assessed as part of a Stage 3 SSFRA.

At a minimum, a 50% blockage scenario should be considered. Where there is an established history of blockage or site conditions suggest a greater blockage is likely, then greater %-blockage should be assessed.

⁴ The OPW Guidelines state that in the absence of climate change data, the 0.1% AEP flood can be taken / applied as the 1% AEP + CC flood but this approach should only be used the effect is proportionate the scale and nature of the development

Where multiple watercourse crossings have the potential to increase flooding at the proposed development site, a joint probability analysis of simultaneous cumulative blockages should be assessed.

While flood extents predicted for a blockage scenario do not influence flood zoning, this residual risk to the proposed development should be assessed, and adequate mitigation and management measures should be proposed to manage flood risk to the proposed development.

A site-specific hydraulic model is likely to be required to facilitate assessment of the impact of watercourse crossing blockage.

It should be noted that there are restrictions on the construction, replacement or alteration of bridges and culverts over any watercourse, and that appropriate consent from the Commissioners is required under Section 50 of the Arterial Drainage Act 1945.

6.5.3 Design Levels and Freeboard

A key mechanism for providing flood protection and resilience is the setting of Finished Floor Levels (FFLs), Finished Ground Levels (FGLs), or flood defence levels with appropriate freeboard above the relevant design flood levels.

Freeboard is a safety margin to account for uncertainties in water-level prediction and / or structural performance. It is the difference between the FFL / FGL or flood defence and the adjacent design flood level. Freeboard is designed to account for uncertainty in hydrological predictions, wave action, modelling accuracy, topographical accuracy and the quality of digital elevation models.

Due to the varying sensitivity of development, freeboard is to be applied based on the classification of receptor vulnerability. Where minimum freeboard requirements cannot be met, a lesser standard of protection must be justified within a SSFRA. If achieving freeboard requires raising of ground levels within a floodplain, then the requirement for Floodplain Compensatory Storage as outlined in Section 6.5.5 must be considered. Minimum freeboard requirements when the maximum design flood level is fluvial are as set out in Table 6.4.

In addition to the requirements outlined below, including in areas not predicted to be at risk of flooding, then the siting of building floor levels should seek to ensure resilience to surface water flooding or drainage system failure.

In some instances, where an alternative minimum design level requirement can be shown to be appropriate for the type and / or scale of the development and site characteristics, the stated freeboard requirements may be relaxed if justified as part of a SSFRA and adequate mitigation (including emergency planning) is included in overall site design. Consultation with the Council must take place prior to submission of a planning application in relation to any proposal where a reduction of this minimum design level requirement is proposed.

Table 6.4: Minimum Design Level Requirements for Fluvial Flooding

Receptor Vulnerability	Minimum Design Level Requirements
Highly Vulnerable	Greater of: 0.1% AEP (present day / Flood Zone B) flood level + 500mm freeboard 0.1% AEP HEFS CC flood level + 250mm freeboard
Less Vulnerable	Greater of: 1% AEP (present day / Flood Zone A) flood level + 500mm freeboard 1% AEP MRFS CC flood level + 250mm freeboard
Water Compatible	No minimum design level requirement

6.5.4 Access and Egress

In accordance with the OPW Guidelines, access to and egress from any development should be within Flood Zone C (i.e., outside the 0.1% AEP fluvial floodplain). Where this is not achievable due to on-site or off-site flood risk, a Flood Management Plan for the development will be required. The contents of the Flood Management Plan should be confirmed within a SSFRA.

SSFRA should outline the emergency procedures that will be applied in the event of a flood. Evacuation routes should be identified but if this is not possible then containment may be considered if it is considered safe and practical to do so. If either safe evacuation or containment is not possible, then the development proposal may be refused.

6.5.5 Flood Compensatory Storage / Floodplain Re-Profiling

The likely impact of any displaced flood water on lands elsewhere caused by alterations to ground levels, reducing floodplain attenuation, impeding flood flow routes, or raising flood embankments requires Flood Compensatory Storage (FCS) works to be undertaken.

FCS strategies are divided into direct and indirect. These terms come from UK Construction Industry Research and Information Association (CIRIA) report C624 "Development and flood risk – guidance for the construction industry (2004)".

- Direct or 'level for level' methods, as they are also known, re-grade land and provide a direct replacement for the lost storage volume.
- Indirect methods rely on water entering a defined storage area which then releases it at a slower rate, similar to a surface water attenuation scheme.

The OPW Guidelines state that level for level FCS should apply to any loss in the 1% AEP / Flood Zone A functional floodplain volume. The approach to level for level FCS is summarised as follows:

- A volume of floodplain equal to that lost to the proposed development should be created.
- The equal volume should apply at all levels between the lowest point on the site and the design flood level. Normally this is calculated by comparing volumes taken by the development and the volume offered by the compensatory storage for a number of horizontal slices through the range defined above.
- The thickness of a slice should be typically 0.1 m. In the case of large flat sites or very steep sites this may be varied to 0.2 m or even 0.05 m in order to have about 10 slices to compare.
- Level for level FCS storage should be provided equal to or exceeding that lost as a result of development for each of these slices.

Consultation prior to submitting a planning application is required with the Local Authority on a site-specific basis for proposed developments that proposed to change ground levels / cause land raising in Flood Zone B. FCS / floodplain re-profiling for the 0.1% AEP / Flood Zone B flood event may be required. While less vulnerable development is 'appropriate' within Flood Zone B, FCS may be required to ensure no increase in flood risk elsewhere up to the 0.1% AEP flood. FCS for the 0.1% AEP flood event is to be provided on a level-for-level basis as much as possible but can be undertaken on a 'volumetric' approach if necessary. The approach to volumetric FCS is summarised as follows:

- A volume of floodplain equal to that lost to the proposed development should be created.
- The equal volume should apply between the lowest point on the site and the design flood level, calculated at a number of horizontal slices as far as possible.
- Volumetric FCS storage should be provided equal to or exceeding the total lost as a result of development.
- Provided FCS volume should not be provided at a lower level than existing lowest ground level in an area that will not naturally drain into the watercourse as floodwater subsides.

It is noted that a site-specific hydraulic model is likely to be required to facilitate assessment of the impact of FCS at the site and surrounding areas.

In addition to the requirements listed above, when completing a site-based FRA as part of meeting the requirements of the Justification Test, an assessment will be required of on- and off-site opportunities for

reducing flood risk overall (e.g. flood storage). This will include an appraisal of wider flood risk management measures to which the development can contribute.

6.6 Drainage and Surface Water Management

All development proposals shall carry out a surface water and drainage assessment and shall be compliant with the following to ensure that drainage from the site is managed sustainably:

- Department of Housing, Local Government and Heritage (DHLGH) Rainwater Management Plans – Guidance for Local Authorities (2024)
- DHLGH 'Nature-based Solutions to the Management of Rainwater and Surface Water Runoff in Urban Areas – Water Sensitive Urban Design' (March 2022)
- CIRIA SuDS Manual C753 (2015)

It is noted that updates to the above documents and / or new published documents during the lifetime of the SFRA are to be implemented as part of Development Management where appropriate.

6.6.1 Regional SuDS Measures

The following sections outline SuDS principles that are to be followed as part of any future development within the County. In addition to the site-specific surface water management measures, consideration should also be given to catchment-scale regional controls for managing / storing surface water runoff from a number of sites / sub-catchments.

Such interventions are likely to be most appropriate within 'water compatible land use zonings (i.e. Landscape Protection / Conservation and Recreational / Amenity) or other undeveloped lands. Design criteria outlined in subsequent sections would also apply to regional SuDS measures.

Regional SuDS (i.e. catchment-scale rather than site-specific) could be considered through Rainwater Management Plans (RMPs) in line with the DHLGH guidance listed above which requires settlements / urban areas to undertake RMPs within a specified timeline.

6.6.2 Drainage Hierarchy

The way runoff is dealt with within the County should adhere to the following drainage hierarchy (in order of decreasing preference):

- i. Reuse – Where opportunities arise for rainfall harvesting within proposed development plans, these should be maximised.
- ii. Infiltration – Infiltration could be utilised subject to outcome of site investigation.
- iii. Watercourse – Discharge should be controlled and 'clean' prior to entering natural waterbody.
- iv. Surface Water Sewer – Controlled discharge should not increase flood risk downstream within the sewer network.
- v. Combined Sewer – Last resort, should not increase the risk of CSO spill.

In line with the discharge hierarchy, where the outcome of a site investigation indicates sufficient permeability, the preferred discharge route from any site will be via infiltration of runoff into the ground (where reuse options have been exhausted).

6.6.3 Water Quantity

Sufficient attenuation is to be provided to ensure no unpredictable flooding occurs within any site, future development is protected and does not increase flood risk elsewhere. Flows are to initially be temporarily stored at points of collection (i.e., source controls) along the conveyance route and at the points of proposed storage.

Where infiltration is deemed suitable through site investigation, sufficient storage will be provided to accommodate up to the 1% AEP rainfall runoff with allowance for climate change. Where infiltration is not feasible, surface water attenuation of the 1% AEP rainfall runoff with allowance for climate change should be provided with flows controlled to greenfield runoff rate.

The future impacts of climate change on rainfall should be accounted for in the design of a drainage scheme. Requirements for climate change allowances are set out in the OPW's 'Climate Change Sectoral Adaptation Plan' published in 2019, which recommends a 20% uplift in extreme rainfall depths for the Mid-Range Future Scenario (MRFS) and a 30% uplift for the High-End Future Scenario (HEFS).

In designing for blockage and exceedance, design levels and landscaping should be designed to route exceedance flows away from buildings. Overland flow routes should be managed in a safe manner using the drainage systems, roads, and public spaces to convey and control floodwater during extreme events. Exceedance outflows from any site will be designed to mimic the existing flow patterns and ensure that there is no increased risk to any other areas.

6.6.4 Water Quality

Design of individual SuDS components for water quality treatment should comply with the criteria set out in the CIRIA SuDS Manual (refer to the relevant chapter for each SuDS component).

Where site investigation / infiltration testing indicate that existing ground conditions have sufficient capacity for infiltration, groundwater risk screening (as set out in Chapter 26, Tables 26.5 and 26.6 of the CIRIA SuDS Manual) should be undertaken to demonstrate manageable risk.

If infiltration is deemed suitable or if attenuation is proposed with a positive discharge point from the proposed development site, the 'simple index approach' is to be used to validate design for water quality treatment (as set out in Section 26.7 of the CIRIA SuDS Manual). Application of treatment indices applied in the simple index approach will depend on whether the proposed system is attenuation or infiltration (refer to Sections 26.3 and 26.4 of the CIRIA SuDS Manual, respectively).

Sufficient treatment is to be provided prior to flows being attenuated in any SuDS areas being promoted for amenity / biodiversity function.

6.6.5 Amenity

Amenity focuses on the usefulness and aesthetic elements of SuDS design associated with features 'at or near the surface' and considers both multi-functionality and visual quality.

The following are highlighted for consideration as part of the development of the SuDS design:

- SuDS should be 'legible' (i.e., understandable in terms of their operation to people using the area and to maintenance personnel).
- The visual character of the SuDS component will enhance the development.
- Spaces and connecting routes are multi-functional and can be used when not providing a SuDS function for surface water management.
- The design shall ensure the proposed development is generally accessible and 'safe by design'.
- Consideration should be given to information boarding to inform users of the benefits of the SuDS scheme and also give guidance to the potential of temporary or permanent presence of surface water storage.

6.6.6 Biodiversity

Biodiversity must be considered in the design at both a catchment and site scale to create sympathetic blue-green infrastructure and at local scale to provide habitat and connectivity linkages.

The following are highlighted for consideration as part of the development of the SuDS design:

- Ensure water quality within the water environment by following the steps of the simple index approach (as set out in Chapter 26, Box 26.2 of the CIRIA SuDS Manual).
- Demonstrate ecological design and the creation of habitats within the SuDS corridor.
- Keep water at or near the surface as it flows through the SuDS management train towards to wider landscape to ensure habitat connectivity.
- Confirm management practices to enhance habitat development during maintenance.

7 SUMMARY

7.1 Overview

In achieving the objectives of the OPW Guidelines, Monaghan CC must:

- Adopt a sequential approach to flood risk management, which aims to (1) avoid flood risk where possible, (2) substitute less vulnerable uses where avoidance is not possible, and (3) mitigate and manage the risk where avoidance and substitution are not possible.
- Apply the Justification Test for development in flood risk areas.

A precautionary approach should also be applied to flood risk management to reflect uncertainties in available flood data, risk assessment techniques, climate change projections, and performance of existing flood defences.

This SFRA report has been prepared in accordance with the OPW Guidelines and provides an assessment of all sources of flood risk within the Monaghan area to assist Monaghan CC in making informed strategic land-use decisions. The collation and presentation of flood risk information will support Monaghan CC to apply the requirements of the OPW Guidelines including the Sequential Approach and Justification Test. The SFRA also outlines the requirements of site-specific FRAs through development management.

7.2 SFRA Review and Monitoring

The SFRA will be reviewed and updated every six years in line the County Development Plan review process. Additionally, outputs from future studies and datasets may trigger a review and update of the SFRA during the lifetime of the 2025-2031 Development Plan.

Proposed developments should take account of the most up to date OPW guidance on climate change as part of site-specific Flood Risk Assessments.