

## 2. BACKGROUND TO THE PROPOSED DEVELOPMENT

### 2.1. INTRODUCTION

The proposed flood protection measures are located to the south of Crossmolina town, in Co. Mayo. The area includes parts of the townland of Cartrongilbert, where the River Deel flows adjacent to a local road. The proposed channel to be constructed extends eastwards through agricultural land, and southwards to the townland of Mullenmore North with washlands extending eastwards as far as the shores of Lough Conn. A site location map is presented in Figure 2.1.

The project is located in the rural environs of Crossmolina with a population density that is generally low, and in proximity to wetland on the shores of Lough Conn. The Grid Reference co-ordinates for the approximate centre of the catchment study area are (E 114245, N 316446). The land within and around the site boundary is gently undulating to the west, in the region of the proposed spillway and in between this and the Regional Road R315. To the west and southwest of this, the land becomes flatter as it nears the shores of Lough Conn.

#### 2.1.1. Site Access

The proposed development site is accessed via several roads along the length of the works. To the west, the local road at Poulnacross provides access, while the Regional Road R315 and the local road to Gortnor Abbey and Lough Conn and provide most of the direct site access. Private roads off these local roads will also be used for access.

#### 2.1.2. Physical Characteristics of Site and Surrounding Lands

The site is located within the Landscape Character Area G North Mayo Drumlins. The Landscape Appraisal of County Mayo notes that this landscape unit is characterised by low lying drumlins at the southern end, near Lough Conn, while steeper drumlins are found in the foothills of the mountains to the northwest and also in the Ox Mountains which lie to the east.

The topography of the catchment area is undulating in most areas but flattens out towards the shores of Lough Conn. The topography is generally less than 20 metres OD.

Current land-use in the area surrounding the proposed works comprises mainly agricultural fields, local and regional roads, with some dwellings along the roads. Closer to the shores of Lough Conn are areas of woodland and wetlands.

The nearest European site is the River Moy Special Area of Conservation (SAC). The proposed flow control structure is located within the River Deel, which is designated for conservation as part of this SAC. The proposed spillway, weir and diversion channel are located adjacent to the SAC at their western end. The European designated site: Lough Conn and Lough Cullin Special Protection Area (SPA) is located approximately 300m downstream of the proposed works and within the washlands. The nearest site of national importance is the proposed National Heritage Area (pNHA) at Lough Conn and Lough Cullin

(000519) which lies 0.3 kilometres to the east of the proposed works. Further details regarding the designated areas are provided in Chapter 5 of this EIAR on Biodiversity and in the NIS for the project.

The Zone of Influence of the proposed development varies throughout each section of the EIAR and is specific to the assessments being undertaken. However, the initial study area covered a wide area extended along the channel, flood plains and surrounding lands of the River Deel from Ballycarroon to Lough Conn and includes three tributaries, their flood plains and surrounding lands. The Study Area is centred around Crossmolina Town. Several tributary streams join the River Deel within the Study Area along with larger tributaries including the Torreen River and the Rathnamagh River. Following a detailed and comprehensive consideration of options, the zone of influence was reduced in most cases, to those areas that will be physically affected by the scheme through its physical presence or as a result of changes to the flooding regime. In some instances, the zone of influence extended downstream in the River Moy catchment to take account of potential impacts on water quality resulting from the proposed development.

## **2.2. NEED FOR THE PROPOSED DEVELOPMENT**

There has been a long history of flooding along the River Deel and in Crossmolina Town. The three most recent flood events were in 1989 and 2006 and 2015 (twice) and resulted in flooding in the three main streets of the town as well as many other areas within the town. The floods led to significant effects on homes, businesses and amenities within the town. Shops, pubs and other businesses were forced to close and homeowners were severely disrupted. The proposed development will protect the residents and businesses within the town from future flood events and will allow for future commercial expansion within the town. The proposed development will also prevent the pollution that inevitably washes into the river following a flood event.

A number of studies have been undertaken regarding flooding in Crossmolina and the River Deel. These studies led Mayo County Council to commission the Office of Public Works (OPW) to carry out a Feasibility Study. This established the potential viability of a Flood Relief Scheme for the River Deel.

During these studies, it was concluded that the risk of flooding may increase with time. Future changes, which have the potential to increase the risk of flooding include:

- Climate change resulting in higher rainfall;
- Geomorphological processes, such as (i) Sedimentation transport, which affects the area of conveyance of the river channel and (ii) Erosion;
- Development within the catchment of the Deel River which does not conform with the principles of Sustainable Drainage, and which adversely affect the response of the catchment to rainfall; and
- Changes in land use, including forestation and land drainage.

## 2.3. STRATEGIC PLANNING AND DEVELOPMENT CONTEXT

### 2.3.1. National Level

#### National Flood Policy

The Office of Public Works has the main responsibility for devising and implementing measures to deal with flooding. This responsibility is assigned by Government Decision S 28507 of 7 March 1995. In addition, the Arterial Drainage (Amendment) Act, 1995 affords responsibility to the OPW for undertaking local flood relief work schemes.

The National Flood Policy that was adopted by Government in 2004 identified OPW as the lead agency in coordinating the management of flood risk in the State. The Policy introduced a shift away from solely structural to non-structural measures to protect against flooding. The report prepared by the Flood Management Review Group outlined that future Flood Management policy in Ireland would be:

*'to minimise the national level of exposure to flood damages through the identification and management of existing, and particularly potential future, flood risks in an integrated, proactive and river basin based manner'.*

It encompasses a series of measures regarding sustainable flood prevention, protection and mitigation. An implementation plan of work programmes and associated resources that would be required to put the new policy into effect was developed by OPW.

In November 2007 the EU Floods Directive (Directive on the Assessment and Management of Flood Risks - 2007/60/EC) came into effect. The existing national Flood Policy described above is in line with the Directive.

#### 2.3.1.1. Climate Action Plan 2019

Section 16.2 of this plan states:

*'Effective climate adaptation can minimise risks and costs and also protect lives and property by building resilience into existing systems. This can ultimately help minimise the emergency response that is necessary in response to severe weather events. Work undertaken in the area of flood risk management to date is a good illustration of this principle. Flood risk prevention strategies often make use of assessments of long-term changes in flood intensity and frequency based on climate projections. This can build long term resilience into flood defences to cope with conditions that may arise in the future.'*

The proposed development not only meets the current design objectives of the project but also provides protection against future potential higher flood levels that may occur as a result of climate change.

#### **2.3.1.2. Flood Risk Management - Climate Change Sectoral Adaption Plan**

The Climate Action Plan 2019 describes the National Adaption Framework (NAF) This framework identifies 12 key sectors where Sectoral Adaption Plans (SAP) are to be submitted. One of these is Flood Risk Management and the lead Department for this plan is the OPW. The Flood Risk Management SAP that was prepared by the OPW includes the following Objective/Action:

*2.B The Brief for the detailed development of flood relief schemes to include a requirement for a Scheme Adaption Plan that will set out how climate change has been taken into account during the design and construction, and what adaptation measures might be needed and when into the future.*

The proposed development not only meets the current design objectives of the project but also provides protection against future potential higher flood levels that may occur as a result of climate change.

#### **2.3.1.3. River Basin Management Plan for Ireland 2018 -2021**

**The Environmental Objectives and Priorities of the plan include the following:**

- Ensure full compliance with relevant EU legislation
- Prevent deterioration
- Meet the objectives for designated protected areas
- Protect high-status waters

The proposed development has been specifically designed to comply with all relevant EU Legislation, to protect the high status waters in which it is situated and not to cause their deterioration whilst still achieving the aims of the project in respect of flood relief. The NIS that is prepared in support of this application ensures that a Habitats Directive Assessment can be facilitated and the objectives of European Designated Protected Areas will not be obstructed.

### **2.3.2. Regional Level**

#### **2.3.1.4. Regional Planning Guidelines for the West 2010 – 2022**

The Regional Planning Guidelines (RPGs) for the West Region 2010 – 2022 provide a framework for long-term strategic development in the West Region, which comprises the administrative areas of Galway City, Galway County, County Mayo, and County Roscommon. The RPGs aim to ensure the successful implementation of the National Spatial Strategy at regional, county and local level. A key aspect of the RPGs is to maintain a balance between protecting and enhancing the environment and sustainable economic development of the West Region. Flood protection is identified in Chapter 4 of the guidelines.

Policy SPP11 includes the following text:

*'Development of catchment management strategies and design of flood management works will be informed by the Habitats Directive Assessment process and/or other relevant environmental assessment.'*

This EIAR and the NIS that accompanies this application facilitate these assessments.

Objective SPO31 of the Guidelines reads as follows:

*'To ensure that where flood alleviation works take place, the natural heritage and landscape character of rivers, streams and watercourses are protected and enhanced to the greatest extent possible, and that there are no negative impacts on the Conservation Objectives of NATURA 2000 sites through Habitats Directive Assessment.'*

The proposed development has been specifically designed to avoid and minimise effects on natural heritage, landscape character and to protect the sensitive rivers, streams and watercourses whilst still achieving the aims of the project in respect of flood relief. The NIS that is prepared in support of this application ensures that a Habitats Directive Assessment can be facilitated.

#### **2.3.1.5. Mayo County Development Plan 2014 - 2020**

The Mayo County Development Plan 2014 - 2020 sets out the overall strategy for the proper planning and sustainable development of the administrative area of Mayo County Council.

Chapter 4 of the Development plan recognises the importance of the natural and cultural heritage assets of the County, and notes that:

*The sensitive development and conservation of these resources is essential to the economy and quality of life of our citizens in that they provide amenity and recreation; water supplies; food; fuel; flood protection; coastal protection; and nutrient recycling.*

The proposed development achieves this in its provision of flood protection for the town of Crossmolina.

The specific Objectives of the Mayo County Council with regards to flooding include:

*CC-01 It is an objective of the Council to support the National Climate Change Strategy and methods of reducing anthropogenic greenhouse gases on an ongoing basis through implementation of supporting objectives in this Plan, particularly those supporting use of alternative and renewable energy sources, sustainable transport, air quality, coastal zone management, flooding and soil erosion and promotion*

*of the retention of, and planting of trees, hedgerows and afforestation subject to no significant adverse effects on the environment including the integrity of the Natura 2000 network.*

The proposed development achieves this by providing flood protection with no adverse effects on the integrity of the Natura 2000 network (as evidenced in the NIS that accompanies this project)

*FS-01 It is an objective of the Council to restrict inappropriate development in areas at risk of flooding (inland or coastal) as identified on flood risk maps, erosion and other natural hazards or would cause or exacerbate such a risk at other locations. As part of this, the Planning Authority shall require a Flood Risk Assessment and/or a Landslide Risk Assessment for any new development.*

*FS-02 It is an objective of the Council to require certain developments in the settlements identified in the Core Strategy and Settlement Strategy to incorporate "Sustainable Urban Drainage Systems" as part of the development proposals. Surface Water Management Systems should be designed in accordance with Sustainable Urban Drainage Systems (SUDS).*

Flooding is also mentioned with reference to Green Infrastructure as follows:

*P-08 It is a policy of the Council to ensure a high level of green infrastructure (e.g. communal green space, private gardens, institutional land, local parks, river corridors, floodplains) provision in each of the Key Towns.*

#### **2.3.1.6. Catchment Flood Risk Assessment and Management Programme (CFRAM)**

The proposed development is specifically referenced in the Flood Risk Management Plan (Moy & Killala Bay) as an existing flood risk management measure that is in the design stage and will continue to be progressed.

## **2.4. SCHEME DESIGN PROCESS**

The design process comprises a number of steps involving co-ordination of project engineering and environmental teams. The following steps have been completed in the design and assessment process:

- Constraints Study;
- Hydrology Analysis and Hydraulic Modelling;

- Preliminary Site Investigation;
- Flood Risk Assessments;
- Cost Benefit Analyses;
- Selection of Preferred Option;
- Appropriate Assessment Screening; and
- Environmental Impact Assessment

The consultation and outcome of the above assessments are discussed below and within the various relevant EIA chapters in this document.

## **2.5. CONSTRAINTS STUDY**

An environmental constraints study was completed at the outset of the project to identify the key environmental issues relating to the River Deel (Crossmolina) Drainage Scheme. These included features which had the potential to be impacted by the possible flood alleviation measures and/or impose constraints on the viability or the design of the measures proposed. The report was prepared taking into account all potential Flood Risk Management Strategy Options contained in Appendix M of the OPW Brief.

As part of the study, information was gathered on engineering, socio-economic, environmental, cultural heritage and geotechnical constraints. Environmental constraints were investigated under the following headings:

- Human Beings
- Biodiversity
- Water
- Soils and Geology
- Archaeology and Cultural Heritage
- Landscape
- Air and Climate
- Material Assets

Under each heading, the assessment methodology was first outlined followed by a description of the defined Study Area or 'receiving environment'. The constraints study area extended along the channel, flood plains and surrounding lands of the River Deel from Ballycarroon to Lough Conn and includes three tributaries, their flood plains and surrounding lands. The Study Area is centred around Crossmolina Town. Several tributary streams join the River Deel within the Study Area along with larger tributaries including the Torreen River and the Rathnamagh River. This allowed a full assessment of the potential constraints and a comprehensive

consideration of options. Finally, a summary of the key constraints and implications for the proposed scheme was noted.

In addition to the assessments carried out, a public consultation was held to present the Study Area to the public and invite feedback regarding the proposed scheme. Information gathered during this public consultation was included in the Constraints Study Report. More information is contained below. The following is a summary of the key constraints identified as part of this study.

#### HUMAN BEINGS

In designing the proposed scheme, the value (both cultural and economic) of any buildings (Residential, Retail, etc) close to river edge or likely to be adversely affected by the scheme should be taken into account. In addition, adverse impacts on buildings or structures of conservation interest should be minimised or avoided where possible.

Any design proposals should ensure that Bridge links between eastern and western sides of the town are maintained so that temporary or permanent disruption on local transport links in the town and route along the N59 between Ballina and West Mayo are minimised.

The design of the scheme should consider the public amenity value of the Study Area. Impacts on public amenity areas adjacent to the river should be considered, with replacement mitigation proposed if necessary. Access by anglers and visibility of the river as a tourist attraction should be given consideration as part of any proposed scheme.

Impacts on especially sensitive receptors e.g. schools, church, day care centre, should be considered in the flood risk assessment.

#### ECOLOGY

Given the sensitivity of the river habitat, factors that materially affect the function of the river under normal flow conditions such as water depth, velocity and changes to the shape of the bed should be given consideration, so that the existing function of the river can be maintained. Impacts to areas up and downstream of the Study Area should also be considered as part of the assessment.

In salmonid spawning areas, in-stream works are generally not permitted during the period October – March (inclusive), as this is the sensitive time for spawning. Given that the river is also an important angling and nursery area, it is likely that further constraints will need to be considered.

The River Deel is designated as part of the River Moy SAC and flows into Lough Conn, which is designated both as part of the River Moy SAC and the Lough Conn and Lough Cullin SPA. Negative impacts on qualifying interests of the sites and other habitats or species of conservation importance have the potential to negatively affect the status of these designated sites.

Consideration should be given to areas of higher biodiversity and ecological sensitivity, such as woodlands, wetlands and riparian vegetation along the river corridor. If works are required in these areas, care should be taken to mitigate significant effects.

Appropriate measures should be taken to ensure that the spread of any invasive species is not accelerated by any proposed works.

Regard should be had to the Biodiversity & Generic Recommendations for Crossmolina Community Council Ltd commissioned by Crossmolina's Tidy Towns Committee 2011.

#### WATER

The design of the proposed scheme should take into account the impacts on water (both Quality and Quantity) that any proposed flood relief scheme will have on the yields of existing groundwater abstractions, taking into account productive gravel aquifers in the area.

The design of the proposed scheme should take into account the main objectives of the Water Framework Directive River Basin District Management Plan (RBDMP) by ensuring that any works proposed do not result in the deterioration of water quality.

#### LANDSCAPE

The Study Area includes areas and features designated as vulnerable and sensitive in the Landscape Appraisal for County Mayo, which is included as an Appendix to the Mayo County Development Plan (CDP) (2008-2014) (this was the current plan at the time of the consultation – it is equally relevant to the 2014 - 2020 CDP). Many of these features are associated with Lough Conn. Although there are no scenic routes or highly scenic vistas within the Study Area, there are a number of scenic routes and one highly scenic vista within 10 kilometres of the Study Area. Appropriate design, siting and mitigation measures are therefore required to integrate the proposed scheme within the landscape. Particular regard should also be had to the potential visual impact on views available from the three stretches of designated Scenic Route and the areas of Scenic Landscape, which are located within the Study Area.

#### AIR QUALITY

Prior to the selection of a preferred flood relief scheme as part of the Engineering Study, it is recommended that the short listed flood alleviation measure be assessed in relation to the impact of noise and vibration during the construction phase of the project.

It is recommended that mitigation measures be put in place to reduce the impacts on air quality and the noise environment during the construction phase of any proposed flood relief scheme.

It is recommended that the effects of vibration during the construction phase be considered in the selection process for a potential flood alleviation measures.

Meteorological and climatological data should be consulted in the engineering design process.

The potential impacts of climate change should be assessed with regard to the prediction of flood risk and should be taken into account in the design of a proposed flood relief scheme.

#### MATERIAL ASSETS

It is recommended that the existing and proposed location of watermains and underground services in the vicinity of any proposed flood relief scheme be ascertained as part of the Engineering Study. It is

recommended that Mayo County Council and other utility providers with services in the area be consulted regarding the location and priority of existing and proposed services. It is further recommended that the services be protected as part of any proposed flood relief scheme.

It is recommended that the Crossmolina Waste Water Treatment Plant remains operational at all times.

It is recommended that any proposed change in the hydrological regime of the River Deel and its tributaries be assessed in relation to the assimilative capacity of the river at the locations of the two discharges from Wastewater Infrastructure within the Study Area.

It is recommended that Mayo County Council and the National Roads Authority be consulted in relation to any effects on the existing and proposed roads infrastructure in the Study Area from a proposed flood relief scheme.

**Table 2.1 Summary of the key constraints identified for the River Deel (Crossmolina) Drainage Scheme**

## 2.6. CONSIDERATION OF REASONABLE ALTERNATIVES

Article IV of the EIA Directive as amended by Directive 2014/52/EU states that the information provided in an Environmental Impact Assessment Report (EIAR) should include a description of the reasonable alternatives studied by the developer which are relevant to the project and its specific characteristics and an indication of the main reasons for the option chosen, taking into account the environmental effects. The consideration of alternatives typically refers to alternative design, technology, location, size and scale but is specific to the type of project being considered. In this case, the key alternatives were considered and their potential for environmental effects was then assessed under the above parameters.

This section of the EIAR contains a description of the reasonable alternatives that were considered for the proposed drainage scheme in terms of site selection, other land-use options for the site as well as site layout and transport route options to the site. This section also outlines the design considerations in relation to the drainage scheme, including all associated works such as the diversion channel, intake weir, flow control structure and energy dissipation structure along with ancillary elements such as the washlands, construction compounds, access requirements and ongoing maintenance of both the River Deel and the bypass channel. It indicates the main reasons for selecting the chosen option with regards to its environmental impacts.

The consideration of alternatives is an effective means of avoiding, reducing or minimising environmental impacts. As set out in the 'Draft Guidelines on The Information to be Contained in Environmental Impact Assessment Reports' (Environmental Protection Agency, 2017), the presentation and consideration of reasonable alternatives investigated is an important part of the overall EIA process.

It is important to acknowledge that although the consideration of alternatives is an effective means of avoiding environmental impacts, there are the existence of other non-environmental factors to consider when considering alternatives. These include hierarchy, non-environmental factors and site-specific issues as outlined below.

### Hierarchy

The Environmental Protection Agency's draft guidelines (EPA, 2017) state that in some instances neither the applicant nor the competent authority can be realistically expected to examine

options that have already been previously determined by a higher authority, such as a national plan or regional programme for infrastructure.

### **Non-environmental Factors**

EIA is confined to the potential significant environmental effects that influence consideration of alternatives. However, other non-environmental factors may have equal or overriding importance to the developer of a project, for example project economics, land availability, engineering feasibility or planning considerations.

### **Site-specific Issues**

The EPA guidelines state that the consideration of alternatives also needs to be set within the parameters of the availability of the land, i.e. the site may be the only suitable land available to the developer, or the need for the project to accommodate demands or opportunities that are site-specific. Such considerations should be on the basis of alternatives within a site, for example design and layout.

#### **2.6.1. Guidance on Methodology**

The EU Guidance Document (EU, 2017) on the preparation of EIAR outlines the requirements of the EIA Directive and states that, in order to address the assessment of reasonable alternatives, the Developer needs to provide the following:

- A description of the reasonable alternatives studied; and
- An indication of the main reasons for selecting the chosen option with regards to their environmental impacts.

There is limited European and National guidance on what constitutes a ‘reasonable alternative’ however the EU Guidance Document (EU, 2017) states that reasonable alternatives “*must be relevant to the proposed project and its specific characteristics, and resources should only be spent assessing these alternatives*”.

The guidance also acknowledges that “*the selection of alternatives is limited in terms of feasibility. On the one hand, an alternative should not be ruled out simply because it would cause inconvenience*

*or cost to the Developer. At the same time, if an alternative is very expensive or technically or legally difficult, it would be unreasonable to consider it to be a feasible alternative”.*

The current Draft EPA Guidelines (EPA, 2017) state that *“It is generally sufficient to provide a broad description of each main alternative and the key issues associated with each, showing how environmental considerations were taken into account in deciding on the selected option. A detailed assessment (or ‘mini-EIA’) of each alternative is not required.”*

Consequently, taking into account the guidance and complying with the EIA Directive requirements, this chapter addresses alternatives from an Environmental perspective in the following sections.

### **2.6.2. Consideration of Alternatives**

Following on from the initial Constraints Studies, an Options Assessment Report was initially produced for this scheme in 2014 and has been updated as the scheme has progressed thereafter. This contains a description, assessment and appraisal of the various options which were considered. A copy of the Options Assessment Report will be available to download from the OPW project website and includes a comparative assessment of the options considered.

The options report summarises the various supporting documentation, modelling and studies that have been undertaken between 2003 and 2020 and which provide the background to the scheme requirements, design and constraints.

Following this, the options report provides a preliminary assessment of all potential Flood Risk Management (FRM) Strategy Options. Each FRM is then assessed in terms of its Technical, Social, Economic and Environmental viability. The assessment of these options is summarised in this chapter and a full assessment of the environmental impacts of each option is provided.

The options assessment then shortlists a smaller number of viable options for more detailed assessment and provides an appraisal of all viable options, which includes a Multi-Criteria Analysis (MCA) benefit score, where each option is assessed against technical, social, environmental and economic criteria. The Economic Benefit for each option has been derived from the Damages Report for the scheme. This has been used along with cost estimates for each

option, which are provided in Section 4 of the Options Report to work out an Economic BCR for each option.

### **2.3.1.7. Preliminary Assessment of OPW Flood Risk Management Strategy Options**

#### **Do Nothing (i.e., implement no new flood risk management measures and abandon any existing practices)/Existing Regime (continue with any existing flood risk management practices, such as reactive maintenance)**

The options assessment considered this solution unviable due primarily to its social unacceptability and to the fact that no economic benefit will accrue as a result of a 'Do Nothing' Scenario. An environmental assessment was carried out and it was found that in the do nothing scenario there would be no negative effects on environmental receptors during non-flood conditions. This is the majority of the time and would be considered the 'natural' environmental scenario. However, in flood events, in the do nothing scenario, there is a risk to water quality, ecological status of the waterbody and associated habitats and species including fisheries, where pollution may arise from damage to waste or sewerage infrastructure (e.g. septic tanks) or other sources e.g. chemicals or other potential pollutants stored in yards and within basements or buildings which become inundated during flood conditions. In addition there is significant impacts on population and human health as a result of flooding of infrastructure, homes, businesses and public amenities.

The Do Nothing/ Maintain Existing Regime Flood Risk Management Strategy Option does not warrant further consideration in this EIAR.

#### **Do Minimum (i.e., implement additional minimal measures to reduce the flood risk in specific problem areas without introducing a comprehensive strategy)**

The 'Do Minimum Scenario' would inevitably involve an annual dredge of the river, the trimming of vegetation and other localised flood protection measures. This solution was considered unviable due to the negligible impact it would have in providing flood relief and also the potential environmental damage that would result from an annual dredge of the river. All the same negative effects that were identified in respect of the 'do nothing scenario' would also still arise with this option.

The 'Do Minimum Option' does not warrant further consideration in this EIAR.

#### **Non-Structural Measures (Existing and / or Potential Future Development)**

- Planning and development control measures (zoning of land for flood risk-appropriate development, prevention of inappropriate incremental development, review of existing

- Local Authority policies in relation to planning and development and of inter-jurisdictional co-operation within the catchment, etc.);
- Building regulations (regulations relating to floor levels, flood-proofing, flood-resilience, sustainable drainage systems, prevention of reconstruction or redevelopment in flood-risk areas, etc.);
  - Sustainable urban drainage systems;
  - Installation of a flood forecasting and warning system and development of emergency flood response procedures;
  - Targeted public awareness and preparedness campaign;
  - Individual property flood resistance (protection / flood-proofing) and resilience;
  - Land use management, including creation of wetlands, riparian buffer zones, etc.

The options assessment considered this solution unviable on its own, due primarily to its social unacceptability and to the fact that no economic benefit will accrue as a result of the above 'non-structural' measures. An environmental assessment was carried out and it was found in this scenario that there would be no negative effects on environmental receptors during non-flood conditions. This is the majority of the time and would be considered the 'natural' environmental scenario. However, as identified in the do-nothing scenario, in flood events, there is a risk to water quality, ecological status of the waterbody and associated habitats and species including fisheries and population and human health with flooding of homes, businesses, infrastructure and amenities. The Early Warning System and other precautionary measures may reduce the potential risk to water quality during flood events from infrastructural damage or chemical pollution.

Overall, this option is not considered acceptable on its own due to excessively high level of residual risk and the time required for implementation. It is not considered further on its own, however many of the non-structural measures listed above, including a Flood Early Warning System and Flood Emergency Response Plan can be put in place at relatively low cost in combination with other Flood Risk Management Strategy Options that are assessed below.

### **Structural Measures (Potential Future Development)**

Strategic development management for necessary floodplain development (pro-active integration of structural measures into development designs and zoning, regulation on developer-funded communal retention, drainage and / or protection systems, etc.)

- Structural Measures
  - Storage (single or multiple site flood water storage, flood retardation, etc.)
  - Flow diversion (full diversion / bypass channel, flood relief channel, etc.)

- Increase conveyance (in-channel works, floodplain earthworks, removal of constraints / constrictions, channel / floodplain clearance, etc.)
- Construct flood defences (walls, embankments, demountable defences, etc.)
- Rehabilitate, improve existing defences
- Relocation of properties
- Localised protection works (e.g., minor raising of existing defences / levels, infilling gaps in defences, etc.)
- Channel or Flood Defence Maintenance Works / Programme
- Other works that might be of particular relevance to, or suitability for, a given location

These options are detailed in the Options Report but are not viable for technical and social reasons and do not provide any economic benefit. In addition, environmentally, there are no negative impacts on environmental receptors during non-flood conditions. This is the majority of the time and would be considered the 'natural' environmental scenario. However, in flood events, there is a risk to water quality, ecological status of the waterbody and associated habitats and species including fisheries, where pollution may arise from damage to e.g. waste or sewerage infrastructure or other sources e.g. chemicals or other potential pollutants within basements or buildings which become inundated during flood conditions. There is also a potential impact on population and human resulting from the flooding of homes, businesses, infrastructure and amenities. The use of structural measures to prevent potential future risk may reduce the potential risk to water quality during flood events from infrastructural damage or chemical pollution, but residual risk of such instances would still apply.

The use of structural methods for future potential development on their own would not reduce the current level of risk for existing developments and would result in potential for the same negative effects as with the 'do nothing scenario'. Overall, this option is not considered acceptable on its own due to the excessively high level of existing risk and it is not considered further on its own. It would be appropriate to use with other methods for future developments.

### **Structural Measures (Existing Development)**

Following an initial feasibility report that was prepared by the OPW for Mayo County Council in 2012, it was concluded that, based on the information available at the time, structural measures for existing risk (defence walls combined with dredging, widening and underpinning of Jack Garrett Bridge) appeared to be the most viable Flood Relief Scheme for Crossmolina. The options report assesses the full range of structural measures including the following:

- Increased Conveyance:

Increasing conveyance of the existing channel through widening, deepening or increasing capacity locally at constrictions or existing structures, e.g. construction of a flood eye or replacing a bridge.

- Flood Defences:

Construction of flood defences to contain the flood flows within the channel of the river

- Storage:

Attenuation of peak flows through the provision of on-line or off-line storage upstream of the area at risk of flooding

- Flow Diversion:

Full or partial diversion of flood flows away from the area at risk of flooding

- Rehabilitation of existing defences:

Rehabilitate, improve existing defences, e.g. flood defences, which have been damaged over the years or porous embankments

- Relocation of Properties

- Minor Localised Works:

e.g., minor raising of existing defences / levels, infilling gaps in defences, etc.)

The assessment of each option is summarized below.

### ***Increased Conveyance***

The following options have been considered as a means of increasing the conveyance of the River Deel within, and downstream of, the study area:

- Widening
- Deepening (dredging)
- Replacing the Jack Garrett Bridge (either as a standalone solution or in combination with other solutions)

River Channel widening has not been considered on its own due to the presence of existing development along the river banks in Crossmolina Town, particularly at critical sections, such as at the Jack Garrett Bridge. The 1D-2D linked ISIS TUFLOW hydraulic model confirmed at an

early stage that minor modifications to the width of the river channel outside this constrained area do not have a significant impact on flood levels.

The hydraulic modelling indicates that neither dredging nor bridge replacement offer a standalone solution to the Q100 flood event – i.e. neither reduce the flood levels sufficiently to prevent substantial flooding. The existing bridge structure would need to be replaced with a purpose designed bridge capable of accepting the imposed loadings from a raised parapet in the case of dredging.

Two dredging scenarios were modelled as part of the preliminary assessment of options in 2014. Option 1 involves dredging of 350m of river channel, centred approximately at Jack Garrett Bridge with a reduction in bed levels of 730mm at the bridge. This option will only eliminate flooding in the 1% AEP flood event (1:100 year flood) in combination with flood defences and bridge replacement.

Option 2 involves dredging of 1.7km of river channel with a reduction in bed levels of 1.1m at Jack Garrett Bridge. The resultant reduction in flood waters at the bridge is 470mm, which to put it in context, is still above the soffit of the existing bridge and would still require flood walls and potentially major works to/ replacement of Jack Garrett Bridge if it was to be effective in the 1% AEP event.

Four additional dredging options were assessed as part of the review of the hydraulic model which was carried out in 2018. The updated hydraulic model confirmed that additional measures would be required in order to provide an adequate standard of protection against the 1% AEP flood event for the four dredge options. The option of dredging alone is therefore not brought forward for detailed consideration.

In addition, all dredge options would require ongoing maintenance dredging due to the transfer and deposition of sediment. It is considered that dredging Option 2, and its impact on adjacent structures and utilities, in conjunction with required ongoing maintenance would make this option very difficult to achieve due to the sensitive environmental designation of the river.

A preliminary assessment of the dredge options was carried out and it was found that dredge Option 1 was a technically viable solution when applied in combination with flood defences and

bridge replacement. It was also the most socially preferred option (following public consultation). Dredge option 1 was found to be potentially economically viable also. However, the environmental assessment that was undertaken in the consideration of options found that there were significant issues associated with any potential dredge option. Large scale dredging poses a significant ecological risk to sensitive ecological receptors. Receptors are at risk from direct damage through loss of habitat and reduction in water quality (including short term increase in turbidity and levels of suspended solids), in addition to potential indirect damage which can arise out of loss of food sources or species upon which lifecycles are dependent. For some species such as Salmonids and Lamprey, mitigation (e.g. through timing of works) may be possible, but for others such as freshwater pearl mussel, there is no mitigation which can guarantee that no impact will arise. This is especially significant for species which are less mobile, including Freshwater Pearl Mussel and White Clawed Crayfish, which are listed as Annex II species under the Habitats Directive and known to be present in the river. In addition to loss of habitat and impacts on water quality, dredging can impact on the hydrological functioning of the water body, increasing or decreasing the flow, etc., which has the potential to reduce the quality of the habitat for fish and other species if mitigation is not considered. The River Deel is designated for conservation as part of the River Moy SAC

Option 1 involves a relatively short and shallow dredge (350m). Generally speaking, the risks associated with dredging are increased based on the extent of dredging (distance) required. Deeper depth of dredge may not significantly increase the risks associated, with the exception of the potential for a longer duration for in-stream works and impacts on flow pattern caused by decreasing the gradient of the watercourse. Impacts on visual amenity and landscape character are also likely as a result of dredging, although (depending on the level of maintenance dredging required) this may be in the short term as the level of impact can decrease as the banks, etc. re-vegetate over time. Deeper dredging can have a more significant impact on visual amenity with regard to a greater level of exposed banks than the existing vista. A shallower dredge can have less of an impact on visual amenity as there are less areas of exposed banks and therefore less of a change to the existing view. Maintenance dredging poses an ongoing risk of disturbance to habitats and species which are dependent on water quality and substrate (among other factors). Dredging may also have an impact on underwater archaeology in the river channel and will necessitate alterations to the bridge piers, the original sections of which were identified in the constraints report as being of potential archaeological significance.

Replacement of the bridge, whilst not offering a stand alone option, was considered to be a technically and economically viable option, which is likely to be socially acceptable (following public consultation). It is considered that the potential environmental effects associated with bridge replacement could be minimised through appropriate design and construction methods to avoid significant environmental effects.

Both the dredging (Option 1 only) and bridge replacement option were brought forward for further consideration in combination with other Flood Risk Management Strategy Options.

### ***Flood Defences***

A standalone flood defence solution has been modelled for Q100 Design Flows. It has been determined from the model output that flood defences would be required along both river banks up and downstream of Jack Garrett Bridge and along both faces of the bridge. Details of this modelling are available in the Options Report and associate appendices.

The modelled flood defences take the form of 'glass walls'; imaginary vertical walls which prevent overbank flow and flooding outside the river channel. The 'glass walls' coincide with real existing flood defences such as existing building walls in some instances. It is also assumed that instream structures such as the pedestrian walkway joining Bridge Street with the car park on the left bank of the river upstream of the bridge are contained within the defended river channel.

As set out in the bridge assessment report, the existing bridge structure would need to be replaced with a purpose designed bridge capable of accepting the imposed loadings from a raised parapet required to contain flood waters within the river channel.

A preliminary assessment of the flood defences option concluded that the flood wall options are technically viable. Whilst they may not be the first preference of the majority of stakeholders, there appears to be some level of public acceptance (based on public consultation). Initially, the provision of walls was considered to be economically viable. However, following discovery that the construction of flood walls would also require the replacement of the Jack Garrett Bridge, the economic benefits were reduced.

The environmental assessment of the flood defence option is provided below.

The risks to ecological receptors associated with flood defences in the form of walls up and downstream of the river include those associated with loss of habitat during or as a result of the installation of the walls and the disturbance impacts associated with the construction of the walls. There are also potential indirect impacts to water quality which may affect sensitive habitats and species downstream. Visual impact associated with the installation of defence walls will vary depending on the location of the works (e.g. lesser impact if in a location where there are existing walls) and mitigation through landscaping and appropriate use of surface materials is possible. It is noted from the constraints report that there are no recorded archaeological features along the routes of the proposed flood defences. Construction of flood walls would require the demolition of property boundary walls at certain locations. Flood walls may require limited excavation in the river channel and may therefore have an impact on underwater archaeology and the existing bridge piers and foundations, the original sections of which were identified in the constraints report as being of potential archaeological significance. Bridge replacement will be required in combination with flood defences in order to protect against the 1% AEP design flood. Impacts associated with the replacement of the bridge include risks to water quality during the construction phase of the scheme. In-stream works associated with the installation/construction of the bridge are likely to be required and pose risks to the habitat substrate, disturbance (to humans and sensitive ecological species) associated with construction activities including noise, dust, vibration and lighting, although mitigation for these activities is possible, minimizing adverse impacts. Bridge replacement may require demolition of, or significant modifications to, the existing bridge piers, the original sections of which were identified in the constraints report as being of potential archaeological significance. It may also have an impact on underwater archaeology in the river channel. However, it is considered that the potential environmental effects associated with this option could be avoided or minimised to insignificance through appropriate design and mitigation.

The flood defence solution has been brought forward for further consideration in combination with bridge replacement and dredging.

### **Storage**

The provision of upstream on-line and off-line flood storage was considered in the options assessment. This would have entailed the use of large areas of agricultural and forestry lands along with peatland. Flood storage was found to be technically unviable, socially unacceptable and economically unviable. The environmental assessment of this option found that storage has

the potential to change the existing regime in terms of hydrological or hydrogeological features of the area with possible indirect impacts to sensitive habitats and species in the surrounding area. Reliance on engineered maintenance of water levels poses a risk for sensitive species in the event of failure or poor maintenance. The karstic nature of the area increases the level of difficulty in terms of design and maintenance of engineered hydrological systems.

The upstream storage option was not considered further.

### ***Flow Diversion***

Following extensive modelling as set out in the Options Report, the maximum safe flow at Jack Garrett bridge in the 1% AEP Event is 95.6 m<sup>3</sup>/sec, therefore a diversion channel would need to be sized for a design flow of 92.2 m<sup>3</sup>/sec. The diversion channel would be required to have a capacity equivalent to the River Deel itself at Crossmolina.

The diversion channel would commence at an intake weir on the right river bank. From there it would cut through elevated terrain before following the route of an existing stream to Lough Conn. Variations of this proposal were also considered such as creating a permanent aquatic habitat at the upstream section of the diversion channel and moving the intake weir away from the river bank. Three different routes for the diversion channel were considered with the option chosen avoiding any works within the Lough Conn & Lough Cullin SPA. Extensive hydrogeological and hydrological surveying was undertaken to ensure that this option was viable without resulting in significant effects on the functioning of the River Deel. Details of these surveys are provided in Section 7 of this EIAR and the associated appendices.

The diversion channel was found to be technically viable and likely to be socially acceptable. Whilst the estimated cost is high, the level of flood protection provided is higher than with all other options and thus the economic benefit is potentially greater as the residual flood risk is lower.

The environmental assessment of this option is provided below.

This option minimises the requirement for instream works in the River Deel, although impacts as a result of water pollution during construction could potentially result in impacts on the River Deel and the downstream, Lough Conn. The washlands are located on the shores of Lough Conn. As

Lough Conn is part of an SPA in addition to being part of the River Moy SAC, there is potential for this option to result in direct impacts on two European Sites as a result of the channel.

In addition to potential impacts on water quality during the construction phase, impacts could also potentially result in changes to the hydrological and hydromorphological regime within the River Deel and the prevention and minimisation of this was a primary consideration in the design process.

The diversion channel option would involve minimal loss or alteration of habitats within the River Moy SAC (confined only to the footprint of the river flow control structure) and would avoid any works within the Lough Conn SPA. The channel itself will be located within undesignated agricultural lands that are of local importance for biodiversity and do not support habitats or species that are important at the regional, national or international scale.

Visual amenity would be affected by the construction of a channel within an area which currently only has a series of drains through agricultural land. However, this area is less visible to the general public than works within the town and would essentially appear like what could be a 'natural feature' in the landscape. There would be a reduction in visual impact and visibility of the channel as regeneration of vegetation occurs following construction. It is likely that after a number of years, the channel would not be discernible as a 'new' feature in the landscape. There are no recorded archaeological features along the three route options identified for consideration in the 2012 OPW Feasibility Report.

The flow diversion option was brought forward for further consideration.

#### ***Rehabilitation of Existing Defences***

Crossmolina currently has a disjointed network of flood defences which have been constructed in a piecemeal fashion, are not capable of withstanding flood events and are not fit for purpose. A full and thorough assessment of the potential rehabilitation of these defences was undertaken in the Options Assessment.

This option was not found to be technically viable or socially acceptable and provided little economic benefit. The environmental assessment of this option did not raise any significant issues that could not be overcome through good design and the implementation of mitigation and best practice during construction.

Rehabilitation of existing defences will not address flooding issues on its own. However, further consideration was undertaken of this option in combination with the other Flood Risk Management Strategy Options that are assessed.

### ***Channel or Flood Defence Maintenance Works/Programme***

The following are considered under this Flood Risk Management Strategy Option:

- Programme of inspections of hard flood defences (if proposed)
- Annual dredging of river bed/ other channel (e.g. diversion channel)
- Trimming of vegetation (also considered under the 'do minimum' option)

A preliminary assessment of the Channel or Flood Defence Maintenance Works / Programme option was undertaken and whilst the measures were technically viable and likely to be socially acceptable, little economic benefit was identified with the implementation of these measures on their own (not in combination with other options). In addition, the environmental assessment found that there is potential for significant negative impacts on environmental receptors, including water quality, ecological status of the waterbody, impacts to designated habitats and species, especially sensitive species and fisheries, depending on the level and frequency of local dredging. Dredging on a regular basis poses an ongoing disturbance to habitats and species which are dependent on water quality and substrate (among other factors). Unless combined with another option to eliminate the 1% AEP flood event, residual risks of significant water pollution arising from damage to wastewater infrastructure and potential chemical pollution in the event of a large scale flood event are still present within this option.

Overall, this option was not considered further on its own, however many of the maintenance works listed above, including dredging are components of the other Flood Risk Management Strategy Options and were therefore assessed in combination with those options.

#### ***2.3.1.8. Detailed Assessment of Options***

Following the preliminary assessment of options, the following options were shortlisted for further consideration:

1. Flood defences incorporating bridge replacement

2. Combination of flood defences incorporating bridge replacement and increased conveyance (dredging)
3. Diversion Channel

The options assessment report provides a full description of the assessment of each of the above options and the summary of this section of the Options Report is provided below.

A comparative summary of Options 1, 2 and 3 is provided in Table 2.2. This makes a comparison of the options in the present climate and in both the Mid Range Future Scenario (MRFS), which is defined a 20% increase in River Flow combined with a 0.5m increase in sea level and the High End Future Scenario (HEFS) which is defined as a 30% increase in River Flows combined with a 1.0m increase in sea level.

	Option 1 – Flood Defences (Including Bridge Replacement)	Option 2. Combination of flood defences and increased conveyance (dredging)	Option 3 – Diversion Channel
General Overview	<ul style="list-style-type: none"> <li>• Construction of flood defences</li> <li>• Replacement of the Jack Garrett Bridge</li> <li>• 4 no. Surface Water Pumping stations</li> </ul>	<ul style="list-style-type: none"> <li>• Construction of flood defences</li> <li>• 350 m dredge</li> <li>• Replacement of the Jack Garrett Bridge</li> <li>• 4 no. Surface Water Pumping stations</li> </ul>	<ul style="list-style-type: none"> <li>• 1km diversion channel and creation of washlands</li> <li>• Construction of a river flow control structure, intake structure, energy dissipation structure</li> <li>• 2 new road bridges</li> <li>• Realignment of Lake Road and roads</li> </ul>
Variations Considered	<ul style="list-style-type: none"> <li>• Types of flood walls: reinforced concrete walls, glass walls, earthen embankments, demountable defences, piled defences</li> <li>• Replacement bridge design options</li> </ul>	<ul style="list-style-type: none"> <li>• Types of flood walls: reinforced concrete walls, glass walls, earthen embankments, demountable defences, piled defences</li> <li>• Replacement bridge design options</li> <li>• Several dredging scenarios</li> </ul>	<ul style="list-style-type: none"> <li>• Diversion channel routes and geometry</li> <li>• Design and locations of the intake weir and river flow control structure</li> <li>• Energy dissipation structure design and locations</li> <li>• Road realignment/ bridge options</li> </ul>

<p>Future Adaptability</p>	<p>Flood defences are adaptable for the Mid Range Future Scenario (MRFS), but may be supplemented with another solution, such as natural water retention measures, dredging, bridge replacement or a diversion channel in the High End Future Scenario (HEFS).</p>	<p>Flood defences are adaptable for the Mid Range Future Scenario (MRFS), but may be supplemented with another solution, such as natural water retention measures or a diversion channel in the High End Future Scenario (HEFS).</p>	<p>The diversion channel is highly adaptable for the Mid Range Future Scenario (MRFS), given that flows in excess of Q100 are shared between the River Deel and the diversion channel.</p> <p>The diversion channel may be supplemented with another solution, such as natural water retention measures, flood defences, dredging or bridge replacement in the High End Future Scenario (HEFS).</p>
<p>Technical Viability</p>	<p>Technically viable.</p>	<p>Technically viable.</p>	<p>Technically viable.</p>
<p>Social Acceptability</p>	<p>Following public consultation, the flood defence heights may not be acceptable to the public. Flood walls would also require significant construction in and about the centre of Crossmolina. The replacement of the Jack Garrett Bridge and construction of flood walls in the vicinity of the bridge and potential removal of the walkway upstream of the bridge would impact on the public during the construction phase.</p> <p>Flood defences will create a permanent barrier between local residents/ the general public and a public amenity - the river and its</p>	<p>The option of dredging is generally well received by the public.</p> <p>Following public consultation, the flood defence heights may not be acceptable to the public. Flood walls would also require significant construction in and about the centre of Crossmolina. The replacement of the Jack Garrett Bridge and construction of flood walls in the vicinity of the bridge and potential removal of the walkway upstream of the bridge would impact on the public during the construction phase.</p>	<p>The option would be the most socially acceptable for the residents of Crossmolina, however it may be opposed by landowners and residents along the route of the diversion channel.</p>

	banks. The effect of this will be greatest immediately upstream of Jack Garrett Bridge, where flood defences will have their greatest visual impact.	Flood defences will create a permanent barrier between local residents/ the general public and a public amenity - the river and its banks. The effect of this will be greatest immediately upstream of Jack Garrett Bridge, where flood defences will have their greatest visual impact.	
Environmental Viability	With mitigation measure in place, no significant impact is anticipated.	Dredging as part of Option 2 is likely to impact directly on White Clawed Crayfish, Atlantic Salmon and Lamprey Species, all of which are among the qualifying interests of the River Moy SAC. In addition, Freshwater Pearl mussel will also be affected, if present. This species is listed on Annex II of the EU Habitats Directive, but is not a qualifying interest of the River Moy SAC.	With mitigation measure in place, no significant impact is anticipated.
Economic Viability	The cost estimate for Option 1 is estimated at €10.55 M, including VAT, and covers both contract and non-contract costs corresponding with the requirements of Appendix I of the Project Brief and based on the best available information.  The economic benefit accruing from Option 1 has been calculated at €14.71 M using the	The cost estimate for Option 2 is estimated at €10.79 M, including VAT, and covers both contract and non-contract costs corresponding with the requirements of Appendix I of the Project Brief and based on the best available information.  The economic benefit accruing from Option 1 has been calculated at €14.71 M using the	The cost estimate for Option 3 is estimated at €12.1 M, including VAT, and covers both contract and non-contract costs corresponding with the requirements of Appendix I of the Project Brief and based on the best available information.  The economic benefit accruing from Option 3 has been calculated at €16.96 M using the

	<p>Flood Hazard Research Centre Multi Coloured Manual (FHRC MCM 2010).</p>	<p>Flood Hazard Research Centre Multi Coloured Manual (FHRC MCM 2010).</p>	<p>Flood Hazard Research Centre Multi Coloured Manual (FHRC MCM 2010).</p> <p>It should be noted that the economic benefit of Option 3 is greater than that for the other two options due to the fact that the residual risk of flooding for events &gt;1% AEP is reduced by the considerable additional conveyance capacity achieved by constructing the diversion channel.</p>
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**Table 2.2. Comparative summary of Options.**

### 2.3.1.9. Options Appraisal

Each option was given a score as follows:

- Multi Criteria Analysis (MCA) Benefit Score
- MCA Benefit to Cost Ratio (MCA BCR, € Cost/MCA score)
- Economic Benefit to Cost Ratio (EBCR)

The assessment is set out in the following section, at the end of which, the most appropriate Flood Relief Scheme for the River Deel and Crossmolina is identified.

#### Multi Criteria Analysis Benefit Score

Using Multi Criteria Analysis (MCA), the options have been assessed against technical, social, environmental and economic criteria. The assessment has been structured around standard OPW flood risk management objectives and sub-objectives for each of the four criteria. Global and local weightings have been attributed to each sub-objective, having been selected based on the procedures set out in the OPW National 'CFRAM' Programme Technical Methodology Note – Option Appraisal and the Multi-Criteria Analysis (MCA) Framework (2018) to ensure consistency in the assessment of flood risk management objectives nationally. Each option has then been allotted a score based on OPW Guidance and by exercising professional judgement where allowed by OPW Guidance.

The environmental assessment that was undertaken as part of the MCA is summarised in Table 2.3 below. This table shows, which of the options was ranked 1<sup>st</sup>, 2<sup>nd</sup> and 3<sup>rd</sup> in relation to a number of environmental parameters. This assessment was undertaken on the basis of potential impacts and in the absence of design and mitigation measures, which may overcome many of the potential environmental effects identified.

Environmental Parameters	Option		
	1	2	3
Support the objectives of the Water Framework Directive	Green	Orange	Green
Minimise the risk to potential sources of environmental pollution	Green	Orange	Green
Support the objectives of the Habitats Directive	Green	Red	Orange
Avoid damage to, and where possible enhance, the flora and fauna of the catchment	Green	Red	Orange
Protect, and where possible enhance, fisheries resource within the catchment	Green	Orange	Green
Protect, and where possible enhance, landscape character and visual amenity within the river corridor	Orange	Red	Green
Avoid damage to or loss of features of cultural heritage importance and their setting	Red	Orange	Green

Protect Soil Function			
Minimise detrimental impacts of climate change on the environment resulting from flood risk management activities			

**Table 2.3. Environmental Ranking MCA.**

The full MCA for River Deel (Crossmolina) Drainage Scheme including an assessment of Technical, Economic and Social parameters is included in Appendix E to the options report and is summarised in Table 2.4 below. This puts a numeric value on each of the criteria and the final outcome of the MCA is the option that scores the highest when taking into account Technical, Social, Economic and Environmental criteria.

Parameter	Option		
	1	2	3
Technical	300.0	200.0	700.0
Economic	680.0	680.0	825.0
Social	920.0	920.0	1,042.5
<b>Environmental</b>	<b>60.0</b>	<b>-337.5</b>	<b>25.0</b>
<b>MCA Benefit Score</b>	<b>1,960.0</b>	<b>1,462.5</b>	<b>2,592.5</b>

**Table 2.4. Overall MCA Scores.**

The MCA found that although Option 3, the diversion channel, was ranked second in the MCA environmental assessment, it was ranked first in the technical, economic and social criteria and was overall the preferred option in the MCA.

### Multi Criteria Analysis Benefit to Cost Ratio (BCR)

The MCA Benefit Score has been used along with the cost estimates to work out a MCA BCR ratio for each option and thus to determine the most beneficial drainage scheme.

### Economic Benefit to Cost Ratio

The Economic Benefit for each option has been derived from the Damages Report for the scheme. This has been used along with cost estimates for each option, which are provided in Section 4 of the Options Report to work out an Economic BCR for each option. The results of the MCA BCR are summarised in Table 2.5.

Flood Defences	Option
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Parameter	1	2	3
<b>Multi Criteria Analysis</b>			
<b>MCA Benefit Score</b>	<b>1,960.0</b>	<b>1,462.5</b>	<b>2,992.50</b>
<b>Economic Assessment</b>			
<b>Cost Estimate (Excl. VAT)</b>	€ 11.11 M	€ 11.66 M	€ 13.40 M
<b>Economic Benefit</b>	€ 14.71 M	€ 14.71 M	€ 16.96 M
<b>MCA Benefit to Cost Ratio</b>	<b>176</b>	<b>129</b>	<b>229</b>
<b>MCA BCR Ranking</b>	2nd	3rd	1st
<b>Economic Benefit to Cost Ratio</b>	<b>1.3</b>	<b>1.3</b>	<b>1.3</b>
<b>ECBR Ranking</b>	<b>1st</b>	<b>=</b>	<b>=</b>

**Table 2.5 Final Options Appraisal**

**Option 3** has been identified as the most appropriate drainage Scheme for the River Deel and Crossmolina based on the options appraisal and in particular the following:

1. Option 3 offers more benefit to Crossmolina Town for events with AEP > 1%, as the residual risk of flooding is reduced by the considerable additional conveyance capacity achieved by constructing the diversion channel. There is also minimal operational risk associated with the option as there is no reliance on mechanical, electrical or electronic systems or on human intervention in order to operate or perform successfully.
2. With mitigation measure in place, no significant environmental impact is anticipated.
3. With mitigation measures in place, no adverse effects on the integrity of any European Site are anticipated in view of their conservation objectives.
4. Option 3 is likely to be the most socially acceptable for the residents of Crossmolina (based on feedback from the public consultation), however it may be opposed by landowners and residents along the route of the diversion channel. The design of the channel was rationalised to minimise the landtake in so far as possible and the chosen channel route does not require the demolition of any existing premises.

## 2.7. CUMULATIVE ASSESSMENT

The EIA Directive requires that the description of likely significant effects of a project includes an assessment of cumulative impacts that may arise as a result of the interaction of each element and factor of a project. The factors to be considered in relation to cumulative effects include, inter alia, population and human health, biodiversity, soil, water, landscape and cultural heritage. Each chapter of this EIAR has included a cumulative impact assessment section, which provides a thorough assessment of the potential for cumulative effects resulting from each factor of the project.

## **2.8. IN COMBINATION ASSESSMENT**

The potential impact of the proposed development when considered in combination with other relevant plans and projects has been carried out in each chapter, with the purpose of identifying what influence the proposed development will have on the surrounding environment when considered in combination with relevant permitted, proposed and constructed projects in the vicinity of the proposed site.

The material was gathered through a search of relevant online Planning Registers, reviews of relevant environmental documents, planning application details and planning drawings, and served to identify past and future projects, their activities and their potential environmental impacts.

In general, projects which have the potential for cumulative effects are referred to where relevant, in the individual chapters of this report. A summary of relevant plans and projects which have the potential to cause cumulative effects, and which are relevant to every chapter, are included below

### **2.8.1. Ongoing Programmes on the River Deel**

The following ongoing maintenance operations and plans were considered when undertaking this cumulative impact assessment:

- OPW drainage maintenance programme, which includes the River Deel up as far as the Jack Garrett Bridge in Crossmolina. OPW complete drainage maintenance operations on the lower reaches of the River Deel as part of their obligation under the 1945 Arterial Drainage Act. These works are undertaken following the OPW's Drainage Maintenance & Construction Environmental Guidance (2019). Additional works such as vegetation and gravel berm removal are from time to time undertaken. Any such works have been considered in this cumulative impact assessment.
- OPW/IFI/Mayo County Council, Japanese Knotweed eradication programme. The ongoing management of invasive species has been considered in this cumulative impact assessment.

### **2.8.2. Projects**

The potential for the proposed works to contribute to cumulative or in combination effects on the environment was considered in combination with other projects in the local area. The online planning system for Mayo County Council was consulted on the 12/05/2020. Projects identified in the townlands of Cartrongilbert and Mullenmore North, where the proposed scheme is located, include:

- Permission to construct new dwelling house, garage, waste water treatment system and all associated site works (Planning Ref: 15227).
- Permission to retain a dwelling house, domestic shed and retain and upgrade proprietary effluent treatment system (Planning Ref: 1684).
- Permission to construct a new vehicular and pedestrian entrance, roadway and carpark and all ancillary works to the existing cemetery (Planning Ref: 18789).
- Permission to construct a single storey ASD unit extension to existing school building comprising of classrooms and ancillary accommodation together with alterations to existing building and site works (Planning Ref: 17869).
- Permission for the retention of existing dwelling house and shed to the rear including retention of boundaries and all other associated works/services (Planning Ref: 17821).
- Permission to construct dwelling house incorporating a basement with connections to public sewer and public water main including all other ancillary site works and services (Planning Ref: 16324).
- Permission to construct a single storey extension within the school site, the block will include 5 no. classrooms, sanitary facilities, storage and circulation of approx 443 sqm gross floor area in total. the development will also include an extension to existing car park and all associated site works and connections to existing services (Planning Ref: 15670).
- Permission for the extension to existing school building, comprising of 1 no. classroom and 3 no. special education tuition rooms, including all associated development works and services. (Planning Ref: 19814).
- Permission for the extension to the existing school building, comprising 1. no staff room and minor alterations to existing storage room including all associated development works and services (Planning Ref: 19953)
- Permission for the extension to the existing school building, comprising of a new classroom and a new staff room facility, including all associated development works and services (Planning Ref: 19117).

- Permission to construct dwelling house incorporating garage and septic tank with percolation area including all other ancillary site work and services (Planning Ref: 18545).

## 2.9. SCOPING & CONSULTATION

Consultation with statutory and non statutory bodies and the public in relation to the project has been completed on a number of occasions at various stages in the design process with the dates and details provided below. These have included broad general consultation at the Constraints Study stage with stakeholders, statutory and non statutory bodies and an associated Public Information Event and Questionnaire. Subsequently, the emerging preferred option was presented to the public in a second Public Information event and informal (non-statutory) scoping as part of the Environmental Impact Assessment process was undertaken. The EIAR for this project was put on public display in accordance with the Arterial Drainage (Amendment) Act (1995), in Crossmolina Library and the offices of Mayo County Council for a period of four weeks between May 21st 2018 and the 15th June 2018. A public exhibition of the scheme was undertaken in Crossmolina Town Hall on the 21st and 29th May 2018 and the 6th and 15th June 2018. Since that time, detailed hydrological and hydromorphological surveys and modelling has been continued along with detailed design of the scheme. This has led to some design changes to the scheme such as the inclusion of a flow control structure within the River Deel and an energy dissipation structure within the diversion channel along with other minor changes to the design.

The following sections outline the consultation completed to date.

### 2.9.1. Constraints Study Scoping

Consultation has taken place with statutory and non-statutory consultees as part of the initial scoping process. A list of consultees is presented in Appendix 2F.

The replies to this scoping are presented in Appendix 2A and have been considered in this EIAR.

#### 2.9.1.1. First Public Information Day

In addition to the assessments carried out, a public consultation was held in Crossmolina Town Hall on the 14<sup>th</sup> September 2012 from 4pm to 8pm to present the preliminary study to the public and invite feedback regarding the proposed scheme. Information gathered during this public consultation was included in the Constraints Study Report. A copy of the brochure is contained in Appendix 2B.

As part of the public consultation, when asked if they had a preference for the type of flood alleviation method (from a selection of six measures) most respondents expressed their first preference as dredging and cleaning/deepening of the River Deel. Channel widening and construction of walls/embankments also ranked as the next highest preferences for most respondents. Overall numbers of individuals who rated answers to this question are provided in Table 2.6 below.

Preference Rating	1	2	3	4	5	6
No Works				1		1
Early Flood Warning System	1			1	1	
Walls & Embankments	1	1				
River Dredging						
River Widening			3			
Relocation of Properties				1	1	1

**Table 2.6 Responses to Questionnaires**

Most respondents also made their own suggestions as to flood alleviation measures. Many of the respondents mentioned the 'infilling of swallow holes' which happened previously and believe that removal of the infill would allow the passage of water and reduce the risk of flooding. Cleaning the river of debris and widening the river at locations where development has narrowed the channel, in addition to the creation of flood plains on agricultural land were other suggestions the respondents made.

It is noted that there were only six respondents to the questionnaire, all of whom are directly affected by flooding in the town. The feedback recorded during the Constraints Study has been taken into account in the assessment of options further in the Options report.

#### **2.9.1.2. Second Public Information Day**

A subsequent Public Information Event was Crossmolina Town Hall on Friday the 13<sup>th</sup> June 2014 from 2pm to 7pm, at which a draft version of the scheme was on display.

Advertising of the Public Consultation Event was undertaken by the Environmental Team, in the local press in the week preceding the event. The event was advertised in the Western People newspaper on the 9<sup>th</sup> June 2014.

#### **2.9.1.3. Literature Available for the Consultation**

**Brochures and Questionnaires** were available at the exhibition on the 13<sup>th</sup> June.

A Public Consultation brochure was produced for the scheme, which showed the options and the preferred option (Option A) and provided a brief explanation as to the process involved and the options being considered. Brochures were freely available to the members of the public and interested parties, both during and after the exhibition. A copy of the brochure is attached in Appendix 2C.

A questionnaire with pre-printed questions was provided to each attendee, in association with the brochure. The questionnaire was accompanied by a stamped addressed envelope. This provided an opportunity for members of the public to express their views on the information shown and to provide information regarding

flooding in their area, in addition to other comments they may have had relating to the design or the Environmental Constraints Study. A copy of the blank questionnaire is attached in Appendix 2D.

#### ***Public Consultation Exhibition Posters***

The format of the second Public Consultation exhibition was based on a number of scheme posters and some photomontages were also displayed. The posters included:

- Scheme Objectives and Overview
- Progress
- Constraints Study
- Flood Extents
- Options Development
- Optioneering
- Emerging Preferred Option
- Public Exhibition

A copy of the exhibition posters are included in Appendix 2E.

#### ***Public Attendees and Response to Public Information Day***

Members of the public visiting the second public exhibition were invited to sign a visitor's book to enable a record of the number of attendees to be maintained. A total of 40 attendees signed the attendance book at the event in Crossmolina Town Hall. Contact details were taken from members of the public who had additional information. A total of 4 questionnaires were returned either at the exhibition or shortly thereafter by post.

##### ***2.9.1.4. Third Public Information Day***

The third Public Information Day for the River Deel (Crossmolina) Drainage Scheme was held in Crossmolina Town Hall on 8<sup>th</sup> April 2016 from 2-7pm. The purpose of this third Public Information Day was to provide information to the local community on the draft flood relief scheme options.

A total of 95 people signed the attendance book at the event in Crossmolina Town Hall. Approximately 33 people returned completed questionnaires (Appendix 2D).

At the Public Information Day on the April 8<sup>th</sup>, posters (Appendix 2E) were displayed describing the process to date. As mentioned in this chapter, as set out in the Options Report in 2014, Option A was the preferred Option. However, as was subsequently discovered, for the proposed works in the town to go ahead, the

Jack Garrett bridge would have to be replaced at significant additional cost. The increased cost of the proposed works because of the bridge replacement required the main alternative option of a diversion upstream of the town, which had been discounted earlier due to its higher cost, to be re-assessed and with this in mind, the consultants were instructed to review the flood defence options, along with a review of the hydrology data, which will include a revision of the hydraulic model. Following detailed analysis, the number of options considered was reduced and these were presented. Brochures were also available (Appendix 2B).

The majority of people that attended the Public Information Day reacted positively to the proposals presented on the day. The following was noted in relation to people's verbal and written comments on the day:

A number of people viewed the Diversion Channel as an appropriate solution.

- Several comments noted preference for a diversion channel
- Maintain river so it is free from debris and fallen trees/branches which block flow under bridge and cause build up.
- Flooding in Crossmolina can only be resolved by a diversion channel. With the onset of global warming, the rainfalls are getting heavier.
- Raise the bridge, remove trees and remove stones/rocks from river
- Suggestions to open up underground caverns off Deel River.
- Suggestions to open up blocked swallow holes
- Dredging of river was suggested
- Suggestions to build or raise walls along river channel

The comments and queries raised at the Public Information Day were considered in the scheme design and during the preparation of the Environmental Impact Assessment Report.

### **2.9.2. EIAR Scoping**

Scoping was undertaken in accordance with the EC '*Environmental Impact Assessment of Projects Guidance on Scoping*' (2017). Scoping is the process of determining the content, depth and extent of topics to be covered in the environmental information to be submitted to a competent authority for projects that are subject to an Environmental Impact Assessment Report (EIAR). This is not the formal scoping that is undertaken by the Competent Authority during their Environmental Impact assessment. This process is conducted by contacting

the relevant statutory and non statutory authorities and Non-Governmental Organisations (NGOs) with interest in the specific aspects of the environment likely to be affected by the proposal. These organisations are invited to submit comments on the scope of the EIA and EIAR and the specific standards of information they require. Comprehensive and timely scoping helps ensure that the EIAR refers to all relevant aspects of the proposed development and its potential effects on the environment and provides initial feedback in the early stages of the project, when alterations are still easily incorporated into the design. In this way scoping not only informs the content and scope of the EIA, it also provides a feedback mechanism for the proposal design itself. The organisations that were consulted with during the various rounds of scoping are listed in the appendices to this chapter

### 2.9.3. First Round Scoping

An EIA scoping report, providing details of the works and emerging preferred flood relief option, was prepared by MKO in association with Ryan Hanley and circulated on 21st July 2013. Comments of the relevant personnel/bodies in their respective capacities as consultees with regards to the EIA process were requested.

#### **Scoping Responses**

Appendix 2F lists the consultees who were circulated copies of the EIA scoping document in July 2013. A copy of the EIA scoping document and cover letter is presented in Appendix 2G. Copies of all scoping responses received are included in Appendix 2B of this EIAR and a summary of the responses is outlined in Table 2.7 below. The recommendations of the consultees have informed the EIA process and the contents of the EIAR.

Consultee	Response
Inland Fisheries Ireland	Instream works must be carried out between April and September in accordance with IFI method statements. Refers to the need to take climate change into account in modelling. Works method statements are required in relation to prevention silt or direct discharges to the Deel River. Controls on the location of oil containment units and refuelling of machinery are also included. Controls regarding concrete washings are also included. Measures to prevent spread of invasive species are also included.
An Bord Pleanála	No comments.
Department of Agriculture, Food & Marine	No comments
An Taisce	Notes increasing use of 'soft' engineering and encourages consideration of restoring natural

	hydrological connection between the river and floodplain, and also retaining/restoring 'rough or woody floodplain surfaces. Concern expressed relating to the Moy SAC and Lough Conn and Lough Cullinn SPA and the Bellacorrick SAC/pNHA
Environmental Sciences Association of Ireland	No comment.
Failte Ireland	Attached Guideline outlining treatment of Tourism in EIS.
Geological Survey of Ireland	No specific comments, but general comments on mapping and datasets included
IFA Aquaculture	No comments
Institute of Geologists	No comments
Mayo County Council	Further information should be included in scoping document, particularly: site location, description of works, and references to Freshwater Pearl Mussel in the Moy/Deel in the AA Screening and the Flora and Fauna chapter of the EIS. Also references to predicted impacts to be included in scoping document.
Minister for Justice	No comment.
National Roads Authority	Comments relate to best practice in relation to matters which may affect the National Road network.

**Table 2.7 Consultee Scoping response summaries**

#### 2.9.4. Second Round Scoping

Following the change to the preferred scheme option (due to the requirement to replace the Jack Garrett Bridge) and the emergence of a new preferred option, a second scoping letter was prepared by MKO in association with Ryan Hanley in 2017, prior to the preparation of this EIAR. This provided information relating to the reason for re-scoping of the project, and details of the updated scheme and was circulated on the 12<sup>th</sup> December 2017. Comments of the relevant personnel/bodies in their respective capacities as consultees with regards to the EIA process were requested.

#### Scoping Responses

Appendix 2G lists the consultees who were circulated copies of the EIAR scoping letter in October 2017. A copy of the EIAR scoping letter and cover letter is presented in Appendix 2G. Copies of all scoping responses received by 4<sup>th</sup> April 2018 are included in Appendix 2H of this EIAR and a summary of the responses is outlined in Table 2.8 below.

In addition, two meetings were held, with the NPWS and the Inland Fisheries Ireland (IFI) on March 22 and 23, 2018, respectively.

CONSULTEE	RESPONSE SUMMARY
Irish Aviation Authority	No response
Mayo County Council	Notes that an EIAR should be prepared in accordance with the 2017 EPA Guidelines and the directive 2014/52/EU. It also noted that the EIAR should include an assessment on the overall environment of Lough Conn, separate to the impact on the SAC/SPA. The EIAR should set out a clear rationale on environmental grounds on the alternatives rejected, as well as in the impact on the environment on the proposed wash lands. It also suggests that the scheme should be designed for a flood frequency of 1 in 17 years.
Transport Infrastructure Ireland	General guidelines on the preparation of an EIAR which may affect the National Road Network.
Minister of Justice	No comment
Minister for Business, Enterprise and Innovation	No comment
Inland Fisheries Ireland	Adequate baseline information on existing aquatic habitat in the River Deel and at the proposed washlands must be established so changes can be measured. A dedicated section should consider the impact on the aquatic habitat and aquatic species. The potential for fish to be diverted along this channel and subsequently becoming stranded must be considered and mitigated against. Surface water controls must be put in place during the construction phase of the development to ensure no silt/sediment or other pollutants discharge to the River Deel or Lough Conn. The location of the deposition site for the 160000 m <sup>3</sup> of excavated material must be identified and surface water controls put in place to prevent sediment runoff to watercourses. The impacts of the road and bridge construction and associated drainage must be assessed.

	Measures must be included to ensure no invasive species are spread as a result of this development.
Irish Peat Conservation Council	A number of comments including recommendations to consult the BOGLAND study for information, which contains Best Practice Guidelines. Includes recommendations regarding the River Moy SAC, Lough Cuillin and Lough Conn SPA and Bellacorick Bog Complex SAC. Also included are recommendations regarding Bats, Curlew and Invasive Species.
Gas Networks Ireland	No comments
National Museum of Ireland	The OSI map viewer also shows corn mill and corn kiln and lime kiln in the same location, so it would seem that a thorough and proper industrial archaeological investigation should be part of the EIA as an essential. Specific expertise would be required, to recognise and understand features of particular industrial processes such as iron smelting.

**Table 2.8 Consultee Scoping response summaries**

### 2.9.5. Exhibition

A number of submissions were made at or following the public exhibition of the scheme during May and June 2018. These are summarised below in Table 2.9. The OPW replied to these submissions where relevant.

CONSULTEE	RESPONSE SUMMARY
IFI	IFI note the sensitivity of the River Deel from a fisheries perspective. They request that the timing of the works is undertaken to minimise the potential for any instream works to impact on migrating fish species. They raise concerns about the potential for fish species to become stranded in the bypass channel in the wake of flood/overflow events and request that a structure be introduced to prevent fish accessing the channel from the downstream end during flood events. They also identify an opportunity for improvement to the overall catchment by removing an obstacle to fish passage that is located upstream of the proposed scheme.
Development Applications Unit (Dept. Culture, Heritage & Gaeltacht)	The department concurred with recommendations made in the Archaeological Impact Assessment presented in the EIAR recommended that all archaeological mitigation is carried out by a suitably qualified and experienced archaeologist and that

	<p>an underwater archaeological assessment be carried out if in-river works are required.</p> <p>In respect of nature conservation, the Department requested further information on the following:</p> <ol style="list-style-type: none"> <li>1. Consideration of alternatives</li> <li>2. Complete project details</li> <li>3. Further details of the mitigation measures proposed</li> <li>4. Further details of the construction methods and works area.</li> <li>5. Further details of the hydrological/hydrogeological model and assessment.</li> <li>6. Provide details of emergency procedures to be followed.</li> <li>7. Determine the size of the contribution area to the Mullenmore Spring</li> <li>8. Take account of climate change predictions re: hydrology</li> <li>9. Provide detailed assessment of the potential effects on freshwater pearl mussel</li> <li>10. Describe and characterise the baseline environment downstream of the proposed works in the benefitting lands</li> <li>11. Describe and characterise the woodlands and fen habitats.</li> <li>12. Clarify the extent of otter surveys carried out</li> <li>13. Provide details of white clawed crayfish surveys carried out</li> <li>14. Include and integrate the necessary hydrological and hydrogeological assessment conclusions into the NIS</li> <li>15. Undertake robust analysis in line with the conservation objectives and integrity of the River Moy SAC in the NIS</li> </ol>
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**Table 2.9 Consultee Scoping response summaries**

### 2.9.6. Additional consultation 2020

Following the exhibition of the Crossmolina FRS in 2018, there was further development of the hydrological and hydromorphological modelling and a design review of the scheme. Additional elements were added. These included a flow control structure within the River Deel, which is designated as part of River Moy SAC, alterations to the intake weir and diversion channel and the inclusion of an energy dissipation structure within the diversion channel.

As the scheme design had changed and additional elements were added, a briefing note, advising the IFI and Development Applications Unit of the Department of Culture, Heritage & the Gaeltacht, both of whom had made submissions following the exhibition, of these changes was issued. The changes were not considered material but did have the potential for impact on fisheries and wildlife habitat and thus the extended consultation was limited to the affected landowners and the two afore-mentioned agencies. In May 2020, they were invited to comment on the changes to the scheme and the further hydrological and ecological studies undertaken and to make any further comment on the EIAR.

To date an email response from the IFI has been received. This is summarized in Table 2.10 below.

CONSULTEE	RESPONSE SUMMARY
IFI	<p>The revised NIS and EIAR should include an assessment on the impact the flow control will have on gravel deposition and any maintenance programme required for the structure including the removal of gravel upstream of the culvert. This gravel should be made available to IFI for habitat improvement work elsewhere in the catchment if suitable are required. Details on the operation and control of the adjustable steel plates should also be provided.</p> <p>These comments have been taken account of in the EIAR</p>

**Table 2.10 Consultee Scoping response summaries**