

# **River Slaney (Enniscorthy) Drainage Scheme**

Non-Technical Summary

23 April 2019



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## Non-Technical Summary

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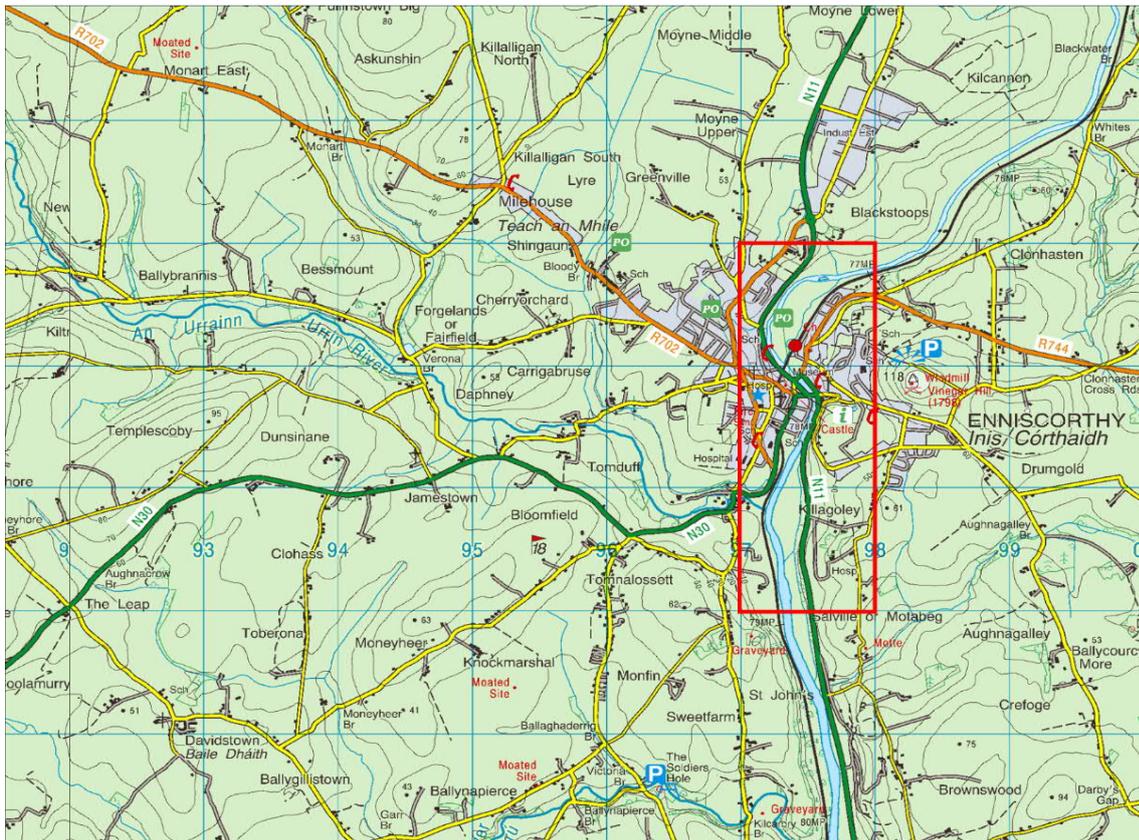
## Introduction

This Environmental Impact Assessment Report (EIAR) has been prepared on behalf of Wexford County Council, to inform the application for confirmation to be submitted to the Minister of Public Expenditure and Reform. Confirmation for the River Slaney (Enniscorthy) Drainage Scheme, also referred to as the Enniscorthy Flood Defence Scheme, is sought from the Minister of Public Expenditure and Reform under the Arterial Drainage Act (1945) as amended.

## Study Area

Enniscorthy town is located on the banks of the River Slaney in Co. Wexford. The proposed scheme extends approximately one and half kilometres upstream of the Enniscorthy Bridge (known locally as the 'Old Bridge') and two kilometres downstream of the bridge. The proposed scheme incorporates works to improve flow conveyance, as well as containment measures to prevent flooding within Enniscorthy town. The scheme contains several localised measures including the removal of Seamus Rafter Bridge and its replacement with a new road bridge downstream of the Riverside Park Hotel and construction of a new footbridge within the town.

**Figure 1: Proposed Enniscorthy Flood Defence Scheme Study Area**



Source: Mott MacDonald 2017

## Project Need

Over the years Enniscorthy has experienced significant infrequent flooding, the most recent flooding event occurring on 30 December, 2015. The town has suffered from at least five flood events in the last century, these occurred in 1924, 1947, 1965, 2000 and 2015. The most recent flood event to occur on the Slaney at Enniscorthy occurred on the afternoon of 30 December, 2015. Hydrograph data obtained from Hydrometric Station 12002 at Enniscorthy Bridge recorded a peak water level of 4.464m at 13:00 hours. This water level corresponds to that level predicted to occur during a return period of 8-year event. The peak flow is estimated to be approximately 372m<sup>3</sup>/s. It is reported that more than 100 properties were flooded during this event. A drone survey carried out over the town in 2015 illustrates the extent of flooding during this time. Imagery taken from this survey is reproduced below.

**Figure 2: Aerial image of Shannon Quay flooded during 2015 Flood Event**



Source: Skypix.ie

With a history of severe flooding in Enniscorthy town, the OPW in consultation with Wexford County Council developed a flood defence scheme for the town of Enniscorthy, Co. Wexford. If the flood defence scheme is not implemented in Enniscorthy, the possibility of future flood events, similar to those that occurred in 2015, will continue to persist and possibly increase with climate change predications. The proposed scheme has been designed to take cognisance of the 1 in 100-year flood event. There is a 1% chance of a flood of this magnitude, or larger, occurring in every year. This means that, with a scheme in place, Enniscorthy will flood in the future albeit at a significantly reduced frequency. The flood walls are designed so that they are adaptable to the increase in flood level resulting from the 20% increase in flow. The Pedestrian and Road Bridges are both designed so that their soffits<sup>1</sup> are above the flood level likely in the design event following climate change. That is the underside of the bridges will be above the 100-year flood level including an allowance of 20% increase in flood flow and a 500mm increase in sea level, to cater for uncertainty associated with climate change.

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<sup>1</sup> Soffits- the visible underside of the bridge deck.

## Alternative Flood Scheme Options

The design standard investigated by the Office of Public Works (OPW, 2009) for flood alleviation at Enniscorthy provides protection from flooding up to and including a 1 in 100-year event. The OPW considered a number of non-structural and structural engineering measures;

1. Do Nothing (i.e. no new flood alleviation measures)
2. Non-Structural Measures;
  - a. Installation of an early warning flooding system;
  - b. Local measures such as Individual property protection
3. Relocation of properties and/or infrastructure;
4. Reconstruction of properties and/or infrastructure to a higher level;
5. Flow reduction;
  - a. Upstream catchment management (i.e. reduce runoff)
  - b. Upstream flood storage (single site or multiple sites);
6. Flood Containment through Construction of Flood Defences
  - a. Permanent Walls or embankments;
  - b. Demountable Walls;
7. Increase Conveyance (upstream, through and/or downstream of the town);
  - a. Remove or reduce local key constraints (e.g. bridges, bends, throttles, infill material on a floodplain etc);
  - b. Reduce the roughness of the channel /floodplain (remove vegetation, lining, etc)
  - c. Specify ongoing channel /floodplain maintenance;
  - d. Change the channel section (re-grade the riverbed by dredging and/ or widen the channel by excavation)
  - e. Change the floodplain section and/or grade by excavation;
8. Flow diversion (around and just downstream of the town)
  - a. Diversion of entire river;
  - b. Flood flow bypass channel
9. Sediment deposition and possible sediment traps;
10. Pump storm waters from behind flood defences; and
11. Measures specific to the Study Location.

The OPW determined that there is one key feasible option (Option 6- Flood Containment) that could potentially benefit from other options, which although unacceptable as standalone options would contribute to lowering water levels throughout Enniscorthy, and hence reducing the level of wall heights required for flood defence purposes. Subsequently, the OPW examined a number of technically feasible options to provide the basis for the preferred design option.

Three possible options were identified and these, along with a do-nothing situation comprise the four alternative options assessed in detail for their potential effects on the environment;

- Option A - Do Nothing;
- Option B- Flood Walls (Demountable)
- Option C- Flood Walls, Local Alleviation Measures and Limited Dredging; and
- Option D- Flood Walls, Local Alleviation Measures and Dredging.

The recommendations of the option appraisal concluded that Option D was the preferred scheme and this option was progressed to next stage of design development by the OPW.

### **Alternative Foot Bridge Design**

Six technically feasible proposed footbridge design options were considered. The proposed crossing location for the bridge is limited to the area in the immediate vicinity of the existing Seamus Rafter Bridge between Shannon and Abbey Quay. The existing bridge is used for both pedestrian and cycle access, so the proposed replacement option will be used to maintain these traffic flows in the town. Following the detailed evaluation, the proposed preferred design will be comprising Bowstring Arch.

### **Alternative Road Bridge Designs**

On appointment Roughan and O'Donovan (ROD) completed a project review of the proposed road bridge location and structural arrangement. A report was issued to the Transport Infrastructure Ireland (TII) and TII have confirmed acceptance in principle for the preferred structural arrangement.

The bridge alignment options were assessed and a multicriteria analysis (MCA) was used to determine the preferred option under key criteria, having regard to technical, ecological and financial requirements.

Following this evaluation an alternative to the previous presented cable stay bridge form is now proposed. The proposed bridge alignment sought to address the key observations raised by the statutory authorities regarding potential visual impacts, bird strike collision, ecological considerations within Enniscorthy.

### **Current Proposed Enniscorthy Flood Defence Scheme**

As noted in the above section, the development of the proposed scheme process has now been underway for in excess of 12 years. Throughout the preparation of the previous EIS (2009) and EIS addendum (2012) and in preparing the current EIAR the design of the proposed scheme has been revised and refined. Following feedback from the general public and stakeholders, and input from the technical assessments, modifications have been incorporated into the design of the proposed scheme that is currently assessed in this EIAR. Hydraulic modelling of the proposed scheme was revised to reflect such refinement and modification in the design. The modelling ensured technical acceptability of the proposed scheme.

The proposed scheme utilises works to improve flow conveyance, and containment measures to prevent flooding in Enniscorthy town. The proposed scheme contains a number of localised measures including the removal of Seamus Rafter Bridge and its replacement bridge downstream of the Riverside Park Hotel. The design as presented in this report has been developed in sufficient detail to confirm the positions and dimensions of all the principle elements including the earthworks, structures, road pavements, and drainage. The design development drawings for all measures proposed are found in Appendix A of the EIAR. The following is a list of works to be undertaken as part of the flood defence scheme;

- Increase carrying capacity of the river
  - River Dredging
  - River Widening
  - Permanent deposition zone
  - Instream Sediment trap
  - Debris Trap
  - Compound Channel
  - Flow deflectors
- Flood Defences
  - Flood Protection Walls
  - Glass-Wall Flood Protection walls
  - Raising Roads/Ground levels
  - Pumping Storm Waters from Behind the Flood Defences

- Underpinning of the Enniscorthy Railway Bridge and Old Bridge
- New Road Bridge across the River Slaney, Junction with the existing N11 and N30 and Approach Roads;
- New Pedestrian Bridge within the town; and
- Restoration of North Island Back Channel

## Construction Approach

A Contractor will not be appointed until the scheme is confirmed by the Minister for Public Reform and Expenditure. In advance of construction works Wexford County Council will ensure that there is a contractual obligation for the appointed Contractor to prepare and implement a Construction Environmental Management Plan (CEMP) and a Construction Traffic Management Plan (CTMP). The preparation of the CEMP must by necessity occur post-confirmation for two reasons: (a) it must have the ability to incorporate specific conditions of confirmation applied by the Minister of Public Expenditure and Reform; (b) it is prepared by the contractor appointed by WCC to undertake the work (such appointment only occurs when a project is confirmed) and to which the contractor can be bound.

A CEMP has been prepared by Mott MacDonald in advance of seeking confirmation for the scheme. A copy of the CEMP is provided in Appendix A of the EIAR. This CEMP will also help to inform the preparation of the Contractors CEMP and associated detailed Method Statements.

During construction, a CEMP and Construction Traffic Management Plan (CTMP) will be implemented and adhered to in order to minimise the impacts on the environmental and sensitive receptors. The appointed constructor will be required to prepare detailed Method Statements, for approval by Wexford County Council (WCC) prior to commencement of any works. The Contractor(s) Method Statements will set out the detailed approach and methodology which they will follow in scheduling and undertaking the work and will incorporate the control (mitigation) measures detailed in the CEMP in addition to specified conditions that may be prescribed in the confirmation for the project, the mitigation measures described in the Natura Impact Statement and the EIAR and any commitments given by WCC in relation to environmental protection associated with the activities outlined in the CEMP. The Contractor's Method Statement will be detailed and may incorporate alternative details provided it can be demonstrated that it provides the same performance criteria (or higher) that those outlined in the EIAR.

It is the responsibility of WCC to ensure that the requirements of this CEMP and any associated Method Statements are implemented in full.

During operation, measures such as the implementation of an ecological monitoring programme for the scheme and the implementation of a programme of maintenance for the sediment trap are to be undertaken.

Details regarding the construction and operational mitigation measures that are to be implemented will be summarised and presented in the Mitigation Register in the CEMP.

## Construction Programme

The construction activities are divided between three primary work streams, which are described hereunder;

- The construction of the new road bridge downstream of the Riverside Park Hotel will be carried out in advance of the main flood defence scheme. The removal of the Seamus Rafter Bridge will only commence following the completion of the new road bridge and its approach roads;
- Flood Defence Civil Engineering works- construction of flood walls, underpinning of Railway Bridge and Enniscorthy Bridge, construction of the new pedestrian bridge and construction of new flood defence walls.

- River Slaney Instream Works- comprises dredging (deepening) and/or widening and filling along various sections of the river in and adjacent to Enniscorthy town and associated measures such as the depositional zone and compound channel and regrading and reprofiling of the Back Channel on the North Island. For the purpose of this stage of works, it is necessary to isolate and de-water the work area to create dry working conditions. Dry works areas reduce the risk of pollution and significant sedimentation in the river. Further details on the dry works areas is set out below. It is also envisaged that the proposed Back Channel restoration works will be constructed in advance of the main channel works.

Flood Defences will also have to be constructed at the Promenade and the Leisure Centre and the construction of the new road bridge before the instream work can take place.

### **Operation and Maintenance of Scheme**

The main maintenance requirement of the proposed scheme, once it comes into operation, will be maintenance to the sediment trap and debris trap on the North Island. The design of the sediment trap eliminates the need for regular maintenance dredging of the entire reach of the river channel in Enniscorthy. Maintenance of the proposed scheme will be carried out by the OPW under their obligation set out in the Arterial Drainage Act, 1945 as amended.

Gravel will have to be removed from the sediment trap periodically. Gravel will be deposited here when high velocity flows carry large sized sediment down the River Slaney during a flood event. When the flow enters the sediment trap the velocity of the flow will reduce and the large sediment will drop out of suspension. It is estimated that such a high flow event will occur on average once every 5-7 years, depending on the frequency and magnitude of flood events that might occur. The gravel will be removed from the left bank of the channel during low flows in the summer when the gravel is exposed. Works will be carried out in dry working conditions only in consultation with Inland Fisheries Ireland. Maintenance will be carried out in accordance with the latest OPW Environmental Management Protocols and Standard Operating Procedures which are currently being updated by the OPW.

Floating debris of a size that could cause a risk of blockage at the Irish Rail bridge will be trapped in the debris trap. Following a major flood event, the debris trap will be inspected and, if necessary, trapped debris will be removed using a long reach excavator from the bank on the North Island.

### **EIA Methodology**

This EIAR has been completed having due regard to the relevant published guidelines. Data relating to each of the addressed environmental topics has been collected as part of the EIA process. The data requirements for each topic have been determined by technical specialists, and are driven by relevant legislation, guidelines, and policy requirements.

The proposed Enniscorthy Flood Defence scheme has the potential to impact on the receiving environment during both the construction and operational phase of the scheme. All specialist technical contributors to this EIAR have reviewed the design of the proposed scheme, and the information contained in the project description. Measures that are 'embedded' in the overall design of the scheme are assessed in the impact assessment under each environmental topic. Such 'embedded' mitigation is evident in the high level of environmental consideration given to the design of the proposed scheme as well as the proposed construction approach for the Enniscorthy Flood Defence Scheme. Where potential impacts were identified, mitigation measures were identified to minimise the potential for significant effect.

These residual impacts are identified, and the relevant ones are described in detail and assessed (where appropriate) in terms of a combination of magnitude and significance.

## Environmental Impact Assessment

The Environmental Impact Assessment was undertaken under the following principal headings;

- Population and Human Health;
- Biodiversity;
- Hydrology and Geomorphology;
- Geology and Soils;
- Landscape and Visual;
- Archaeological, Architectural and Cultural Heritage;
- Air quality and Climate;
- Noise and Vibration;
- Traffic and Transport;
- Material Assets and Land; and
- Interactions between the Foregoing

## Population and Human Health

This assessment describes the potential impacts to population and human health with a specific focus on land use and demographic profile; housing; health and wellbeing; tourism, recreation and amenities; and economic activity. The proposed scheme will offer flood protection to approximately 105 residential properties and approximately 127 commercial properties.

Enniscorthy is an important market town for the wider rural hinterland. The town serves a wide rural catchment area. The town centre predominately comprises independent retailers, although there is a number of large supermarkets, community and healthcare facilities serving the town.

The Enniscorthy Plan emphasise the promotion and facilitation of the Enniscorthy Flood Defence Scheme within the town through its strategies and objectives set out in the Plan. The Plan states all development proposals within Enniscorthy should have regard to the 'River Slaney (Enniscorthy) Drainage Scheme'.

As of 2016, Wexford County is now also included under the Fáilte Ireland umbrella destination known as 'Ireland Ancient East'. Ireland Ancient East is a touring guide rather than a specific route and is designed to offer tourist a region with 5000 years of Irish history. An ancient Norman stronghold dominates the town of Enniscorthy, and this medieval origin is evident in its strategic location in an elevated location immediately west of and overlooking the River Slaney. The River Slaney is also a valuable resource in terms of amenity. The main public open spaces in the town, both natural and man-made, include the river valley with its linear parks and riverside walks, Promenade Walk, Vinegar Hill, Turret Rock, Fairgreen, Pig Market, Abbey Square and Market Square.

### *Potential Impacts*

Centres of population are recognised as vulnerable receptors to flooding and often host services and facilities that, if flooded, will impact a broader catchment of people than that directly impacted by the flood event itself. If the proposed scheme were not to proceed, the existing river channel would remain as it is. Maintaining the present-day condition is to accept flood damages in the town, resulting in significant economic and social damages. The proposed scheme will result in temporary disruption during the duration of the construction works. There is also the potential for temporary disruption to economic activity within the town due to the proposed construction activities. This would predominantly be as a result of traffic and access restrictions which could have the potential to reduce footfall into local businesses, with noise and dust from the works adding to this temporary impact on local businesses.

During construction phase access to existing footpaths alongside the river and the channel will be restricted.

The implementation of the proposed scheme will have a major positive impact on population and human health of Enniscorthy and its wider hinterland, by preventing flooding in the town. The proposed scheme will have a major positive impact on residents and business that were directly impacted by flooding in the town. A major positive impact is anticipated in terms of offsetting the local economic costs of flood event. The proposed scheme will ensure that access to the town and its services and business no longer cut off and restricted access into and through the town.

Access to the riverside is inhibited during a flood event, floodwater is a safety issue that prevents people from enjoying the amenity of the riverside. Extensive stretches of the riverside in the town are affected, in particular, the popular amenity walkway on the west side of the river. A flood event also precludes recreation including angling, and navigation activities due to the potential health and safety risks that arise. This disturbance would occur for the duration of high river levels and flows i.e. several days. Flooding can have significant temporary impacts on some of the more vulnerable members of society including the sick and vulnerable. The majority of community services are not directly at risk from flooding, however, during a flood event access to all of them is very restricted or they are closed. The management of storm water behind the defence line is a key component of the proposed scheme.

The national primary road network and rail infrastructure can become impassable during the flood event. The traffic management improvements associated with proposed scheme in combination with the opening of the Enniscorthy PPP Bypass will have an overall positive effect on the town.

The potential for adverse impacts associated with the natural environment and nuisance are discussed in the subsequent headings e.g. Biodiversity, hydrology, Air Quality & Climate, Noise & Vibration, and Traffic and Transportation. It is not considered that any specific mitigation is required in the context of population and human health discussed, beyond the measures specified in the relevant chapters of this EIAR as mentioned above.

Due to the ecological sensitivities associated with the project, an Environmental Clerk of Works (EnCoW) will be appointed by Wexford County Council on behalf of the OPW to ensure that the mitigation measures are executed in the construction of the proposed scheme. The EnCoW will form part of the Employers Site Representative Team. Wexford County Council will ensure that he/she is delegated sufficient powers under the construction contract so that he/she will be able to instruct the Contractor to stop works and direct the carrying out of emergency mitigation /clean-up operations. The EnCoW will be responsible for carrying out regular monitoring of the CEMP and Environmental Operation Plan.

The successful implementation of the proposed scheme will result in flood protection for Enniscorthy town and it is expected to have an overall positive impact.

## Biodiversity

This assessment considered the potential impacts affecting ecological features of interest (biodiversity) arising from the proposed scheme. The habitats, flora and fauna of the study area were initially assessed by means of a desktop study and consultation held with various bodies including the National Parks and Wildlife Services (NPWS) and Inland Fisheries Ireland (IFI). More detailed baseline ecological surveys were then undertaken to identify the habitats and species present within the zone of influence of the proposed scheme. The assessment identifies the ecological evaluation of all ecological receptors taking into consideration legal protection, conservation status and local abundance. The assessment was conducted to ascertain the potential impacts of the construction and operation of the proposed scheme on ecological features of interest in the ecological study area.

Surveys recorded a total of 24 habitat types including semi-natural habitat associated with the terrestrial and aquatic corridor along the River Slaney and modified urban habitats within Enniscorthy town centre. No badger setts were recorded within the scheme extent, *ad-hoc* harbour seal sightings were noted. Otters were recorded regularly commuting and foraging along the River Slaney with four otter holts and two resting sites were identified. Four species of bat were recorded using the survey area, but no bat roosts were identified. Other mammals present included red fox, rabbit, house mouse and hedgehog.

The proposed scheme area supports a high diversity of waterbird species, with a total of 25 species recorded including wintering, passage and resident breeding bird species, some in nationally-important numbers. Juvenile River/Brook Lamprey were recorded along with fish species Minnow, European eel, Three-spined stickleback, Stone loach, Flounder, Atlantic Salmon and Brown Trout. Freshwater pearl mussel and duck mussel were also recorded during aquatic baseline surveys.

The scheme is located within two European designated sites, the River Slaney Valley Special Area of Conservation (SAC), which is designated for estuarine and fluvial habitats, woodland, aquatic lamprey, fish and mussel species, otter and harbour seal, and Wexford Harbour and Valley Special Protection Area (SPA) which is designated for supporting nation and internationally important winter water birds, and two breeding species little tern and hen harrier.

#### *Potential Impacts*

Potential significant impacts include temporary habitat loss and habitat degradation mainly arising from instream works, a change in hydrological conditions and potential spread of non-native invasive species, temporary disturbance and displacement during the construction phase, loss of resting or breeding or nesting sites largely resulting from the removal of riparian and instream habitat, and potential bird mortality arising from a collision risk with the new road bridge.

#### *Management Measures*

To avoid, minimise or reduce these potentially significant impacts, the mitigation set out in Chapter 6 has been proposed: The proposed scheme, when assessed alone and cumulatively with surrounding plans and projects and following the full implementation of the mitigation measures, will result in temporary residual impacts on ecological features which will range in level of significance from local to county-geographic scale.

## Hydrology and Geomorphology

Over the years the town has experienced significant infrequent flooding, the most recent flooding event occurring on 30 December 2015. The town has suffered from at least five flood events in the last century, these occurred in 1924, 1947, 1965, 2000 and 2015. The most recent flood event occurred in 2015, over 100 properties were damaged from that flood event.

The River Slaney channel at Enniscorthy has been historically modified and is currently constrained by development on both banks. At Enniscorthy, the River Slaney starts to have a tidal influence. South of Enniscorthy, the River Slaney continues to flow and has confluences with two further tributaries, the Rivers Urrin and Boro.

This assessment involved desktop research supported by a review of water survey and modelling data and included a review of information on fluvial geomorphology and catchment characteristics of the River Slaney. The hydraulic model was constructed using survey data gathered on the existing river channel flood plains and bridge structures in the Study Area.

The water level record at Enniscorthy Bridge confirms that the River Slaney is tidal at Enniscorthy. The tidal and freshwater boundary is the Old Bridge in Enniscorthy. During high tides, the river discharge can be delayed in moving downstream, with a degree of a tidal 'impounding' effect through Enniscorthy.

There are two floodplains within the project study area, namely the North Island and Bare Meadows. Hydraulic modelling carried out by the OPW indicates currently the both floodplains flood with high frequency. Modelling indicates that in the existing situation, the North Islands floods more frequently than once a year. Following the completion of the proposed scheme, despite the fact that extreme flood levels will be between 1m and 1.4m lower than the current scenario, that part of the North islands has not been infilled and the area of active floodplain will be maintained and will continue to flood more frequently than once a year.

Flood hydraulics on the Bare Meadows in the southern floodplain also currently flood with high frequency. The existing ground level in the Bare Meadows ranges from 0.3-3.2mOD. The lowest point in the floodplain is in the centre, where there is generally water standing year-round. The ground level rises to the east and west from the centre of the floodplain. An existing channel drains the Bare Meadows, this channel discharges at the downstream end of the Bare Meadows. At the existing River Slaney bank the levels varies between 1.8m and 2.5mOD. The predicted flood level at the Bare Meadows for the existing scenario for the 1 in 1 flood year event at this floodplain is approximately 2.2mOD. When the water level in the River Slaney rises during a flood event, water flows back up the drainage channel into the Bare Meadows and floods out into the Bare Meadows outwards from the low point in the centre of the floodplain. Currently, during a low flow condition the sea level at Wexford dictates the water level in the River Slaney and at the Bare Meadows.

#### *Potential Impacts*

The deepening of the channel bed has the potential to generate silt and suspended solids during the works. In order to reduce the risk of discharging sediment into the River Slaney during the river dredging and widening operations, it is proposed to carry out all of these works in a dry works area. The dry works area will be formed by isolating the works area from the River Slaney by installing an impermeable barrier between the flowing river and the works area. No more than 50% of the river channel width will be impacted by the dry works area at a time. The existence of a temporary impermeable barrier within the channel, will have a direct impact on the cross section of the channel and is expected to give rise to localised changes in water depth, velocities and sediment erosion/deposition. These changes are expected to be temporary and the effects are expected to be confined to the study reach only. The removal of the barrier has also the potential to increase the turbidity levels downstream of the works areas. This increase is considered to be temporary and flushing would occur.

The site enabling works and establishment of the permanent depositional zone will potentially lead to exposure of bare ground and the potential for generation of silt laden run off in works areas along the river bank. The management of the depositional zone and temporary works areas during construction phase to prevent siltation through runoff will be required.

In the absence of mitigation, numerous substances used on construction sites have the potential to pollute water if not properly managed and treated. Such substances include fuels, lubricants, cement, silt and other substance which arise during construction. Accidental spillage or leaking of fuel or oil has the potential to contaminate soils, groundwater and surface water. Such substances entering the watercourses could damage habitat and local populations of fish, birds and aquatic invertebrates

The Enniscorthy Flood Defence Scheme will result in small permanent impacts on the hydrology of the Bare Meadows. The construction of the compound channel and the river dredging at the Bare Meadows is not expected to have an impact on low flow levels as these are currently governed by the low tide level. In the post works scenario this will continue to be the case. The channel construction adjacent to the Bare Meadows will not affect in any way the day to day functioning of the Bare Meadows as a floodplain for frequent flood events.

The overall impacts during operation relate to the permanent impact that the proposed scheme has on water and change in depths. With the scheme in place, it is predicted that there is negligible or minor difference in velocities during a low flow scenario. In the open sections of river channel, the velocities are predicted to be less variable, however, the differences are expected to have a minimal change downstream of Seamus Rafter Bridge. Most of the predicted changes in velocity are considered minor, changes in velocity will become less pronounced as the tide rises and fills the river channel.

Changes to water levels and velocities may result in changes to sediment erosion and deposition. Two areas with a potential increase in velocity post works occur at the upstream extent of the river, and between Enniscorthy and Seamus Rafter Bridges. This is primarily as Seamus Rafter Bridge would be removed, so it would no longer act as a constraint to flow. In all cases, the increases in velocity are less than  $1 \text{ m/s}^{-1}$ , and are not predicted to result in significant erosion or transport of gravel-sized sediments.

In summary, proposed scheme will not have a significant effect on the sediment transport processes in the River Slaney. This is primarily because the river is a low energy river with very limited geomorphic activity occurring under current conditions, and the proposed works will not substantially change this characteristic.

There is potential for localised changes to existing erosion and deposition processes, given the significant change to the long-profile of the river by re-profiling. However, the potential changes to erosional processes are negligible under normal flow conditions, and only minor changes are likely to occur during significant flood events (1 in 100yr events) and as such is not considered to be significant.

#### *Management Measures*

Following adherence to the mitigation measures and best practice site management set out in the EIAR and the Natura Impact Statement (NIS), residual impacts to the River Slaney, its floodplains and downstream of the Flood Defence Scheme will be not significant during the construction and operational phases.

### **Geology and Soils**

A desk-based study was undertaken to establish the baseline soils, geology and hydrogeology information within the immediate environs of the proposed scheme works. PGL Priority conducted a preliminary site investigation in 2017, which consisted of trial pit excavations, slit trench excavations, soil sampling and in-situ testing. The geology of the area around Enniscorthy generally comprises rocks of Lower Palaeozoic age, which makes up part of the Campile Formation. Structural geology indicated faulting in Enniscorthy occurring in a North-South direction. Groundwater was encountered between 1.6m below ground level (bgl) and 9.2m bgl. Bedrock encountered within the study area was variable and comprised of mainly of shale and dolerite and limestone. The shale was encountered at the northern part of the site, with the boundary between shale and dolerite occurring southeast of the railway bridge and around the location of the leisure centre. Dolerite was encountered mainly on the southern part of the site.

#### *Potential Impacts*

Overall, construction phase activities will result in temporary impacts which, without the implementation of mitigation measures, would result in a significant impact on the receiving environment. The operational phase activities will result in permanent impacts which, without the implementation of mitigation measures, would result in a moderate impact on the receiving environment.

#### *Management Measures*

It is predicted that subject to the mitigation measures identified in Section 8 of the EIAR being adhered to that there will be slight impacts on the soils, geology and hydrogeology environment during the construction and operational phases of the proposed scheme.

The need for concrete, tarmac and other quarry products in the construction of the development are unavoidable. Material will only be sourced from quarries which are operating in accordance with the Planning and Development legislation and associated environmental licences and permits.

## Landscape and Visual

This assessment describes the landscape/townscape context of the proposed works and assesses the likely impacts of the scheme on the receiving environment, in terms of both landscape character and visual amenity.

### *Potential Impacts.*

Whilst the sensitivity of landscape and visual receptors within the study area tends to be in the mid to high range in this distinctive and age-old riverside settlement, this is balanced by landscape and visual effects that tend towards the mid to low end of the spectrum. When weighed together this results in a visual impact significance of 'Moderate' in 9 of the 25 viewpoints, 'Moderate-slight' in 6 viewpoints, 'Slight' in 7 viewpoints, 'Slight-imperceptible' in 1 viewpoint, and 'Imperceptible' in 2 viewpoints.

The proposed works occur within a 3km corridor which transitions between rural/agricultural, peri-urban and town centre. Over 60% of the viewpoints result in a visual impact significance of 'Moderate-slight' or below, while none of them have a visual impact significance any higher than 'Moderate.'

Based on the assessment presented in Chapter 9, it is not considered that the proposed Enniscorthy Flood Defence Scheme will give rise to any significant landscape/townscape or visual impacts. Instead, the proposed scheme represents the necessary balance between protecting the settlement of Enniscorthy from future, and increasingly frequent, flood events in an effective and sustainable manner, while also be wholly cognisant and respectful of the deep and enduring relationship the Slaney River has, in this sensitive landscape and visual setting, with the identity and amenity of Enniscorthy and its past, present and future residents.

## Archaeological, Architectural and Cultural Heritage

This chapter provides an assessment of the proposed Enniscorthy Flood Defence Scheme and its impacts on the receiving archaeological, architectural and cultural environment. Its primary aim is to assess the likely impact that the proposed scheme will have on this environment and to provide suitable mitigation measures to safeguard any monuments, features and finds that may be of cultural heritage merit within the study area. The assessment was informed by desktop and baseline field survey work and archaeological monitoring of geotechnical investigations carried out within the footprint of the proposed study area.

The archaeological assessment extended along a 3.1km stretch of the River Slaney's main channel. A total of thirteen features of cultural heritage interest were identified as part the archaeological walkover, riverine and underwater surveys that lie within or directly beside locations of impact from the proposed works.

The work has highlighted the potential for the river channel generally to retain material of cultural heritage significance. A previously un-recorded building has been identified at the north end of the Island and has been surveyed in detail.

Substantial sections of bonded masonry relating to a previous bridge structure have been identified underneath and upstream of Enniscorthy Bridge and suggest the potential to recover the remains of early bridge features.

A boat wreck was observed downstream towards the southern extent of the Bare Meadows. It is thought to be the remains of a Slaney Cot and is not of great antiquity, but it will need to be removed archaeologically.

The features of architectural heritage noted are identified as buildings that are typical for an Irish river town of the 19th century primarily based on the milling industry. By the intrusive nature of a flood defensive system, the impact on cultural heritage will not be neutral in every instance and individual compromises will be required. However, every effort will be made not to substantively affect the adjacent urban landscape.

The proposed scheme has been designed to ensure new build masonry will replicate the original or vernacular of the area, using salvage or similar materials and design detailing.

The principal impacts arising from the scheme will be focussed on the in-water river dredging of the channel, adjustment of the river banks, associated impacts on identified features, and the construction of embankments and related remedial measures. The works will have significant and permanent impacts on the river and its cultural heritage assets.

#### *Management Measures*

Pre-construction phase archaeological investigation will be carried out in advance of the proposed works, to clarify the nature of the material observed and to assess its archaeological risk. Pre-construction phase building survey will be required prior to impacts occurring.

The principal cultural heritage mitigation for the proposed scheme will take place as archaeological and architectural monitoring of the construction phase works. The mitigation measures will resolve these matters and will present important opportunities to add knowledge and insight to the history of Enniscorthy and its development over time.

### **Air Quality and Climate**

This assessment included the potential air quality and climate impacts associated with the construction and operational phases of the proposed scheme. Construction activities such as demolition, excavation, earth moving, and backfilling may generate quantities of dust, particularly in dry and windy weather conditions.

#### *Potential Impacts*

During the construction phase the primary air quality issue will derive from dust generation. Construction dust has the potential to cause local impacts through dust nuisance at nearby sensitive receptors. The potential impacts associated with the construction phase of the proposed scheme are temporary in nature. The results of the assessment are used to determine the appropriate level of dust mitigation required during the construction phase.

The impact of the development on climate during the construction phase of the project is determined by a qualitative assessment of the nature and scale of the construction activities associated with the proposed scheme.

Construction traffic and machinery would be expected to be the dominant source of greenhouse gas emissions as a result of the construction phase of the development. Construction vehicles and machinery will give rise to carbon dioxide (CO<sub>2</sub>) and nitrogen dioxide (NO<sub>2</sub>) emissions during construction of the proposed scheme. The entire construction period will be approximately three years in duration with the works undertaken in phases. Based on the phased and temporary nature of impacts, the potential impact on climate and transboundary pollution from the proposed scheme is deemed to be slight, negative and short-term.

The impact of the proposed scheme in terms of NO<sub>2</sub> has been determined as being negligible or slightly beneficial.

The potential impact of the proposed scheme with regard to PM<sub>10</sub>, PM<sub>2.5</sub>, CO and benzene has been determined to be negligible.

The potential impact of the proposed scheme on national greenhouse emissions will not be significant in terms of Ireland's obligations under the EU Commission's Climate and Energy policies and legislative framework.

The proposed scheme was assessed to determine its vulnerability to climate change in addition to determining the nature and magnitude of greenhouse gas emissions. Climate change has the potential to cause extreme weather events and increased likelihood of flooding. The proposed flood defence scheme is being constructed to help mitigate against an increased risk of flooding as a result of climate change. The proposed measures to be implemented as part of the Enniscorthy Flood Defence Scheme will provide sufficient capacity for adaptation to future increased rainfall and potential flooding events as a result of climate change.

### *Management Measures*

It is proposed that the contractor will also prepare a workable and transparent dust control strategy as part of the CEMP. The dust control strategy will be formulated by drawing on best practice guidance from Ireland, the UK and the USA. It is recommended that dust deposition monitoring be put in place to ensure dust mitigation measures are adequately controlling emissions. Specific measures are outlined in Section 11.5 of the EIAR. The pro-active control of fugitive dust will ensure that the prevention of significant emissions, rather than an inefficient attempt to control them once they have been released, will contribute towards the satisfactory performance of the contractor.

No significant impacts to air quality or climate are predicted to occur during the operational phase of the proposed scheme. If all mitigation measures outlined in Section 11.5 of the EIAR are implemented, there will be no residual impacts of significance on air quality or climate from the construction or operation of the proposed scheme.

## **Noise and Vibration**

This assessment presents a summary of the ambient noise in the proposed study area and how noise environment may change as a result of the construction and operation of the Enniscorthy Flood Defence Scheme.

### *Potential Impacts*

In the absence of appropriate mitigation, construction activities will have significant adverse impacts on sensitive receptors, but these impacts are localised and temporary in nature. To facilitate the instream works, it will be necessary to install impermeable barrier in the river i.e. piling activity. It is considered that although the level of noise from piling activity will be high, these works are transient in nature and the maximum level of noise drops off appreciably as distance from any particular sensitive receptor increases, the overall potential impact will be slight to moderate.

Instream works will also require the use of heavy plant and lorries. While the focus of work will move along the river, exposure to noise at closest sensitive receptor locations are likely to be for durations of weeks rather than days. It will be essential to use all practicable means, including proper maintenance of equipment so as to mitigate the effects of noise at sensitive receptors in the vicinity of the work. Excavated material downstream of Seamus Rafter Bridge will be transported off site via the N11 south of the town. Haulage takes place during daytime hours only, it is considered that the impact of such noise will not be significant.

The intensity of works will not occur for the full duration of the 3 years. The construction of the works is set out in a multi stage approach. The construction of the new road bridge will occur over an estimated 18-month period. The construction of the instream works will be carried out over a 3-month duration over 2 years. The effect of noisiest activities during this stage of works is likely to result from enabling works i.e. piling operations, and excavation for the new road bridge.

The construction of the works will inevitably result in the emission of high noise levels at certain periods all practicable steps are taken to minimise noise and vibration.

### *Management Measures*

The appointed contractor on site will have responsibility for the management to ensure that the noise and vibration levels set out in Best Practice Guidance do not significantly impact on sensitive receptors and will be carried out. It is also recommended that a comprehensive noise and vibration monitoring protocol will be set out within the Noise and Vibration Construction Management Plan. Construction noise and vibration levels shall be monitored and assessed.

The proposed traffic management in the town will result in alteration in local traffic through the town. However, comparison of predicted traffic flow levels with existing noise levels indicates that there will not be an appreciable impact of traffic noise at noise sensitive properties along principle routes through the town.

The application of binding noise limits, hours of operation, along with implementation of appropriate noise and vibration control measures, will ensure that noise and vibration impacts will be reduced as far as is reasonably practicable. The resultant residual noise impact from this source will be of negative, medium, short term impact.

## **Traffic and Transport**

This chapter examines the potential impacts of the proposed flood defence scheme on the receiving environment with respect to traffic conditions, transport routes, general traffic and transport safety. The proposed scheme includes the removal of the existing Seamus Rafter Bridge, construction of the new road bridge and pedestrian bridge and associated changes to the local traffic arrangements within Enniscorthy Town. The scheme has been designed by developing a traffic management study and traffic modelling for the road network in the town. The potential effects of the proposed scheme have been examined through traffic modelling.

Following consultation with key stakeholder the preferred traffic management solution for Enniscorthy town was presented. The proposals take account of the M11 Gorey to Enniscorthy Scheme, which will divert a significant volume of through traffic from Enniscorthy Town and result in a redistribution of traffic on the existing road network in the town. The proposed traffic management layout was recommended as it was the preferred option based on network capacity, emergency vehicles accessibility and its benefit to the public realm.

### *Potential impacts*

The construction of the proposed scheme will have a temporary impact on traffic volumes in Enniscorthy town. This assessment focuses on the traffic impacts associated with the busiest phase of each works of the proposed scheme (anticipated to be around the construction works associated with the new road bridge and instream works proposed downstream of Seamus Rafter Bridge including the demolition of the bridge).

For the purpose instream works it is necessary to isolate and de-water the work area to create dry working conditions. The Contractor will be permitted to haul this material within the dry works area i.e. along the river bed. Site construction traffic during this phase of work will be limited within dry works areas only. Therefore, negligible traffic impacts associated with this phase of works are expected on the local

traffic. Whereas, material downstream of the dry works area on the downstream of the Seamus Rafter Bridge will be removed by truck to a licence facility via the Bare Meadows along the N11 Wexford Road. The M11 Gorey to Enniscorthy Scheme is also expected to be operational at this stage. Traffic generated during the instream works will access the strategic national road N11 Wexford Road via the new roundabout junctions either side of the new road bridge. Traffic will be directed away from Enniscorthy town. Access to the bridge site will be required from both the N30 and the N11 routes either side of the river.

The highest volume of construction HGV traffic will be generated during the main earthworks phase. It is estimated that this equates to 10% of the existing N11 Wexford Road traffic less than 1% of the existing N30 traffic. The proposed bridge goes over the Dublin Rosslare Railway Line. The majority of construction activities can be carried out during the day behind temporary trackside safety fences. Works to enable the construction of the main span over the railway will need to be carried out during possessions of the railway, which may be carried out at night or at the weekend as agreed with Iarnród Éireann.

The proposed works include for the raising and regrading sections of the Riverside Road and along the N11 on the east of the town, modifications to the traffic system from Abbey Square to Abbey Quay, Enniscorthy (Saint Senan's) Bridge and Shannon Quay. This element of works will be in so far as possible undertaken outside of peak traffic periods and will require localised temporary signed diversions and a traffic management and will result in temporary major adverse on local traffic.

The last part of the works will be the completion of the proposed traffic management plan including the street works and junctions from Abbey Square to Abbey Quay, Enniscorthy Bridge and along Shannon Quay to Spring Valley and Wexford Road. These works will be phased and carried out outside of peak traffic periods so as to minimise traffic impacts.

The main construction activities of the flood defences wall will be carried out following the completion of the proposed Slaney Road Bridge and the M11 Gorey to Enniscorthy Scheme when national road through traffic has been removed from the town.

The proposed scheme includes the demolition of the existing Seamus Rafter Bridge an essential part of the flood defence proposals, along with its replacement with a new bridge located approximately 600m downstream along the River Slaney connecting the N11 and the N30 and a new Pedestrian bridge within the town. The proposed Enniscorthy Flood Defence Scheme traffic management works, in conjunction with the M11 Gorey to Enniscorthy Scheme will have a significant positive impact on traffic conditions along the Quays and the immediate surrounds.

#### *Management Measures*

Prior to the commencement of the proposed works, the appointed contractor will prepare a construction Traffic Management Plan (CTMP). The purpose of the CTMP is to set out management and mitigation measures to prevent or minimise the transport impacts during the proposed construction phase.

### **Material Assets and Land**

Material assets are resources that have an intrinsic value to an area. These resources can have defined economic values through to a value based on its importance as part of the overall cultural heritage of an area. Material assets include not only resources of man-made origin but also include natural resources. This chapter of the EIAR has been prepared with respect to material assets with a specific focus on built services, infrastructure and management of waste.

Consultations were held with the known utility providers that would be impacted by the proposed scheme, namely, Irish Water, ESB, Eircom.

The scheme proposes 14 No. pumping stations which will pump water from behind the wall to the River Slaney. The proposed scheme includes the construction of 14no. new pumping stations will result in permanent positive impact on the stormwater network in Enniscorthy.

### *Potential Impacts*

Waste management has been intrinsic on the design of the flood defence scheme with waste generated planned to be re-used on-site, wherever possible. The dredged material has been recognised as a resource for habitat development of the North Island. Waste on-site will be managed in accordance with the Waste Management Hierarchy and in accordance with all relevant Irish and EU waste management legislation. As demonstrated, waste will be re-used on-site where possible; opportunities for recycling will be employed for any waste that cannot be used. Waste will only be sent for disposal if no other economically or technically feasible alternative is found.

### *Management Measures*

A Project Construction and Demolition (C&D) Waste Management Plan shall be prepared and maintained by the main-contractor constructing the scheme. Demolition of the Seamus Rafter Bridge will be subject to a detailed structural demolition plan. The Project C&D Waste Management Plan will be incorporated into the Construction Environmental Management Plan (CEMP).

The mitigation measures will reduce the environmental impact of the proposed scheme, but certain impacts cannot be avoided in the short term such as the relocation of utilities. Residents will suffer short-term inconvenience of water main, foul water and ESB stoppage for several hours during relocation. All possible precautions will be taken to avoid unplanned disruptions to any services during the proposed works. This will include thorough investigations to identify and reconfirm the location of all utility infrastructure within the works areas, and the implementation of a robust procedures when undertaking works in the around known infrastructure services

Prior notification of disruptions shall be given to all impacted properties. There will be no additional impact once services are resumed. No significant residual impacts are anticipated provided that the mitigation described above is implemented.

### **Interactions between the Foregoing**

The Environmental Impact Assessment Report (EIAR) contains a description of likely significant impacts on defined environmental topics (air, soil, water etc.) due to the construction and operation of the proposed scheme. Some impacts will affect more than one environmental topic because interactions are recognised to occur.

A matrix is presented below has been developed to identify impact interactions. The purpose of the matrix is to highlight key interactions that are recognised to be specific to this project and warranting special consideration in the EIAR. In the matrix, a white square indicates no interaction, while a green square indicates that a key interaction exists.

Technical Chapter	Population and Human Health	Biodiversity	Hydrology and Geomorphology	Soils and geology	Landscape and Visual	Archaeological, Architectural and Cultural Heritage	Air Quality and Climate	Noise and Vibration	Traffic and Transport	Material Assets
Population and Human Health	Grey		Teal				Teal		Teal	
Biodiversity		Grey	Teal					Teal		
Hydrology and Geomorphology	Teal	Teal	Grey							
Soils and Geology				Grey						Teal
Landscape and Visual	Teal				Grey	Teal				
Archaeological, Architectural and Cultural Heritage	Teal				Teal	Grey				
Air quality and Climate	Teal						Grey		Teal	
Noise and Vibration	Teal	Teal						Grey	Teal	
Traffic and Transportation	Teal			Teal			Teal		Grey	Teal
Material Assets	Teal			Teal					Teal	Grey

