

# Environmental Impact Statement

## Non Technical Summary

### Bandon River (Bandon) Drainage Scheme



**OPW**

*The Office of Public Works*  
*Oifig na nOibreacha Poiblí*



## 1 NON TECHNICAL SUMMARY

### 1.1 DESCRIPTION OF PROPOSED WORKS

The proposed works comprising the Preferred Option for the Bandon River (Bandon) Drainage Scheme are generally as follows;

- Detailed Site Investigation comprising trial pits, dynamic probes, boreholes, rotary cores and archaeological test trenches;
- Deepening of the existing riverbed by 1.8m just downstream of Bandon Weir to 9.5mOD and dredging for 3.6km (to O'Driscoll's Bridge) at a gradient of 1/1000;
- Underpinning of Bandon Bridge;
- The replacement of the existing Pedestrian Bridge with a new Pedestrian Bridge;
- The provision of flood defence walls at various locations on the right and left banks of the Bandon River through Bandon Town;
- The provision of flood defence walls on the left and right banks of the Bridewell River on New Road;
- The provision of flood defence embankments downstream of Bandon Town on the right bank and in localised areas along the left bank in Bandon Town;
- Improvements to the existing flood defences on the Bridewell River in Bandon Town;
- Improvements to the existing flood defences at the Bandon wastewater treatment plant;
- The provision of removable flood barriers in particular areas;
- The upgrading of an existing culvert and the provision of localised flood defences at the Mill Stream;
- The provision of a rock ramp fish pass and fish counter at Bandon weir;
- The provision of fisheries mitigation measures within the dredged channel including the provision of a thalweg which will generally emulate the existing riverbed features, in so far as possible;
- Miscellaneous ancillary works including local drainage works behind flood defences.

The proposed flood defences will comprise a combination of earthen embankments and reinforced concrete walls.

It is noted that an existing flood defence embankment located on the right bank of the Bandon River upstream of the existing weir, is currently being improved by the owner. On completion of these improvements, the embankment will become part of the Bandon River (Bandon) Drainage Scheme.

### 1.2 LOCATION OF PROPOSED WORKS

The majority of the proposed works are located on the banks and within the channel of the Bandon River. The works on the river channel extend downstream of Bandon Town for 3.6km as far as a property access bridge across the river, generally referred to as "O'Driscoll's Bridge". Proposed works on the banks of the Bandon River extend from the just upstream of the weir on the left bank to

just downstream of the wastewater treatment plant on the outskirts of the town along the N71 towards Inishannon.

The improvements to the flood defences on the Bridewell River are located in the town centre along Market Quay. The new flood defences on the Bridewell River will be located along the Clonakilty Road to the south west of Bandon Town centre.

The proposed works on the Mill Stream culvert are located on the outskirts of Bandon town close to Old Quay Road, off the N71 towards Inishannon.

### **1.3 ANTICIPATED CONSTRUCTION METHODS**

The most significant part of the construction activity required in relation to the proposed works will be the dredging of the river bed. The expected volume of dredged material is approximately 150,000m<sup>3</sup> and will be in a mixture of gravel, silts and rock.

It is anticipated that the majority of the excavation will be carried out with conventional excavating equipment using excavator buckets with rock teeth, rock ripping and localised use of rock breakers where required.

The dredging of the softer materials eg silts, clays, is likely to take place from the river bank, where suitable access is available. The removal of heavier materials, such as gravels, cobbles, boulders and rock will to be carried out from within the channel itself, when flows are suitably low.

A portion of the dredged material is likely to be stored on the riverbank within the construction easement for re-use in the proposed works. Dump trucks will be used to remove the dredged material which cannot be re-used from site. Access routes to and from the site and construction easements are detailed in Drawing 401 of Appendix 3A.

The construction of the reinforced concrete flood defence walls is likely to be carried out by traditional methods. In certain locations, where there is a possibility of flood water passing underneath the flood defence wall foundations or embankments, either sheet piles or grouting techniques will be required to provide a cut-off. The sheet piles may be metal or plastic and would be driven to the required depth using a piling hammer or similar.

The design of the underpinning required at Bandon Bridge will be guided by the detailed site investigation which will take place prior to the construction stage. It is anticipated that the bridge piers are founded on rock and as such the proposed works are likely to comprise of excavation to remove unsuitable material around each of the existing piers, grouting of the retained rock, placing of reinforced concrete around the existing piers and stone cladding (if required) to match existing finish.

The removal of the existing pedestrian bridge between the weir in Bandon and Bandon Bridge and the construction of the new pedestrian bridge is also proposed as part of the project.

### **1.4 CONSTRUCTION PROGRAMME AND SEQUENCING OF PROPOSED WORKS**

The proposed dredging works are likely to be carried out in the first summer season following commencement of the construction works and it is anticipated that the proposed dredging works will take place over two summer seasons. The proposed fish pass at Bandon Weir will be constructed during the first summer season.

During the second summer season, dredging works will be completed and the proposed fisheries mitigation measures will be implemented within the portion of the channel where dredging works will have already taken place in the first summer season. It is likely that the proposed fisheries mitigation

measures will be constructed on the remaining portion of the dredged channel during the summer following the final portion of the proposed dredge works.

The construction of the proposed flood defences, culverts, drainage works and other ancillary works will be ongoing over the duration of the contract.

The actual construction programme will be dependent on the appointed contractor's works proposals, selected construction methods and the time of year when the contract will be awarded. For the purposes of the Environmental Impact Statement, a 24 month construction period is envisaged. This will include the two 5 month summer periods involving the proposed dredging work. The second part of the fisheries mitigation measure implementation will most likely not take place until the first summer after the final dredging works take place.

It is expected that normal working hours would be 8:00am to 6:00pm from Monday to Friday but these working hours are likely to be extended to 7:00am to 9:00pm from Monday to Saturday to facilitate the river dredging work during the summer period.

### **1.5 TEMPORARY CONSTRUCTION WORKS FACILITIES**

Prefabricated temporary buildings will be provided for the site workers during the construction works to include welfare facilities and office space as required. Any effluent generated from the welfare facilities will be discharged to the public sewer. Plant and machinery may also be stored at this location. A wheelwash will be provided at exit points from the works site to ensure that vehicles leaving the works area do not carry excess soil and material onto the adjacent public road infrastructure.

### **1.6 ESTIMATED COST OF PROPOSED WORKS**

The current estimated construction cost of the proposed works is €9.075 million excluding VAT. Other non-contract costs are estimated at €4.725 million, bringing the total cost of the Bandon River (Bandon) Drainage Scheme to approximately €13.8 million excluding VAT.

### **1.7 OPERATION AND MAINTENANCE OF SCHEME**

The main maintenance requirement of the proposed scheme, once it comes into operation, will be in relation to the dredged section of the riverbed. It is anticipated that maintenance dredging will be required at an estimated interval of 5-7 years, depending on the frequency and magnitude of flood events that might occur within the intervening period. Maintenance dredging, when required, will take place during low flow conditions and only deposits visible above low water levels will be removed. No maintenance dredging of deposits below low water level will be required. Maintenance dredging will be carried out in accordance with the OPW Environmental Management Protocols and Standard Operating Procedures which have been drawn up in consultation with Inland Fisheries Ireland.

Regular strimming of the proposed embankments will be required to control vegetation growth. Periodic maintenance of the proposed flood defence embankments may also be required on localised sections of the proposed embankment as a result of minor settlement or flood damage.

### **1.8 IMPACTS ASSESSMENT - HUMAN BEINGS**

The key issues examined in the Human Beings Chapter include population, employment and economic activity, land-use, residential amenity, facilities and services, tourism, and health and safety. Reference is also made to nuisance impacts on human beings such as flooding, dust, noise and traffic.

The major settlements within the Study Area include Bandon and Innishannon. Main employers in the area include the Eli Lilly Pharmaceutical Plant, the Laragh IDA Estate, Henry Good Millers and the agri-food based employers in Bandon, Bandon Co-op, Anglo Irish Beef Processors and the local mart. In addition, employment is also generated from the tourist and services industry. It is estimated that the proposed scheme will employ approximately 30 people during construction over approximately 24 months. There will also be indirect employment during the construction phase.

Angling is an important tourist attraction in the Bandon area. The river provides good fishing for Salmon, Sea Trout and Brown Trout. Much of the Salmon angling on the Bandon River is privately owned or controlled by groups of angling interests. Sea Trout angling is confined to the area from Innishannon upstream as far as Bandon. Brown Trout angling is available throughout the Bandon River system but average fish size is generally small. The best of the Brown Trout fishing is usually in the Bandon area.

Bandon has a long history of serious flood events, which pose a risk to the health and safety of residents and visitors. In the current situation, a substantial health and safety risk exists with regard to the flooding of residences and commercial premises in Bandon Town. Currently 151 residences and 201 commercial properties are at risk of flooding, as well as housing for the elderly, the Garda station, infrastructure such as the N71 National Primary Road and the R586 Regional Road, the telephone exchange and the Wastewater Treatment Plant. The economic risk in Bandon Town would be in the region of €600/1,000m<sup>2</sup>. Therefore the scheme will have a long-term significant positive impact as regards health and safety.

Flooding poses a risk to human health and safety. The OPW document 'The Planning System and Flood Risk Management: Guidelines for Planning Authorities' (OPW, 2009) states that flooding can cause physical injury, illness and loss of life. Deep, fast flowing or rapidly rising flood waters can be particularly dangerous, with increased risk if the floodwater is carrying debris. Some of these impacts may be immediate, the most significant being drowning or physical injury due to being swept away by floods. Floodwater contaminated by sewage or other pollutants (e.g. chemicals stored in garages or commercial properties) can potentially cause illness, either directly as a result of contact with the polluted floodwater or indirectly as a result of sediments left behind. Flood water may also hide other hazards for wading pedestrians, such as manhole openings where the covers have been lifted by flood flows.

The impact on people and communities as a result of the stress and trauma of being flooded, or even of being under the threat of flooding, can be immense. Long-term impacts can arise due to chronic illnesses and the stress associated with being flooded and the lengthy recovery process. The ability of people to respond and recover from a flood can vary. Vulnerable people, such as those who are old, disabled or have a long-term illness, are less able to cope with floods than others. Some people may have difficulty in replacing household items damaged in a flood and may lack the financial means to recover and maintain acceptable living conditions after a flood. The scheme overall will have a significant positive impact on human beings from a social perspective, in addition to reducing the existing health and safety risks within the town in a flood event.

The construction phase of the Scheme will have a temporary impact on traffic volumes in Bandon town and its environs due to the removal of material from the river bed. However, taking into account the large numbers of vehicles using the road network in and in the vicinity of Bandon, it is not anticipated that the construction traffic will significantly affect the flow of traffic. A Traffic Management

Plan will be put in operation, which will ensure the impact of traffic disruption resulting from the works is minimised.

Works proposed to Bandon Bridge have the potential to cause the largest impact on traffic, as the bridge may be closed to heavy goods vehicles for a period of up to 3 months, with bridge closures for all vehicles for shorter periods. Any closure of Bandon Bridge will cause significant disruption to traffic flow in the town as the traffic will need to be diverted by 13km with an estimated additional travel time of 20 minutes. Localised traffic disruptions are also likely to occur. The Bandon Bridge closures will be timed to minimise impacts and if possible work will be carried out at off-peak times. Consultation will be undertaken concerning optimal closure times and residents will be notified in a timely manner of all closures. Traffic disruptions will be minimised through the use of traffic management measures. All road surfaces will be reinstated on completion of the works.

During the periods of in-stream works, local amenities relating to the Bandon River and its use will be impacted. Anglers are the main users of the river amenity, though the visual amenity of the river as well as riverside walks for residents and visitors alike is also of importance. Although in-stream works will be restricted to two five month periods from May to September inclusive, these months coincide with the period of peak amenity usage of the river. Loss of recreational amenity will be limited to the area to be dredged and the area immediately downstream. In addition, the proposed works have the potential to impact negatively on fish stocks. There is potential to impact on salmonid populations throughout the entire Bandon catchment and therefore impact angling on a wider scale. Works will be designed to minimise impacts upon the amenity value of the study area. Mitigation will include measures to minimise pollution of the river, minimise impacts on fish, limit working hours and minimise damage to banks. Although upstream stretches of the River Bandon will remain unaffected and impacts on the water quality of the river downstream of the works will be minimised through mitigation, the amenity of the River Bandon will be inaccessible within much of the study area for the duration of the works. Therefore the impact will remain moderate within and downstream of the works area during the construction phase.

The works have the potential to significantly reduce good fishery habitat diversity within the works area in the long-term, including exceptional salmonid spawning and nursery habitat within the river channel. This has the potential to result in a long term significant impact on angling on the Bandon River in the long-term. Ongoing maintenance will involve the removal of deposited material and could potentially result in disturbance of resident fish populations both directly and indirectly. The works will however be much smaller in scale than the original dredging works and will not significantly impact on the fisheries amenity.

A river rehabilitation programme has been included in the scheme design. This will include the provision of a defined flow path with varying gradients, pools and riffles. Gravels boulders and rocks will be replaced to provide cover for fish and habitat for invertebrates. The stretch of river will be monitored following completion of the works and where possible additional features will be included to improve the angling amenity. With the proposed mitigation in place and with careful monitoring of the construction of the mitigation features the proposed, this section of river has the potential to remain as a productive angling reach despite the reduction in the gradient of the river. The flood relief scheme will provide increased protection to commercial premises and businesses in Bandon Town from flooding. This will constitute a long-term positive effect on the local economy. Any negative impact on the fishery value will be confined to the works area and this will be ameliorated through mitigation within the dredge design.

## 1.9 IMPACT ASSESSMENT - FLORA AND FAUNA

An initial Study Area was determined as part of the Constraints Study which consisted of the channel, floodplain and immediate surrounding areas of the River Bandon. This area encompassed approximately 15 kilometres of the River Bandon, tributaries and adjoining habitat up and downstream of the town of Bandon.

The habitats, flora and fauna of the Study Area were initially assessed by means of a desk study and consultation held with various bodies including the National Parks and Wildlife Service (NPWS) and Inland Fisheries Ireland (IFI). More detailed field surveys were then completed, limited to a more specific area, which ranged from above the weir at Bandon to a point approximately seven kilometres downstream.

The desk study and consultation revealed that the pNHA's within the Study Area had been designated primarily for the protection of the broadleaved woodlands surrounding the river but that the area supported and had the potential to support species that are protected under Annex I of the EU Birds Directive and Annex II of the EU Habitats Directive. These species included Otter, Freshwater Pearl Mussel, Lamprey species, Salmon and Kingfisher. It was also concluded during consultation that the river valley with the combination of fast flowing river, woodlands, agricultural grasslands and wetlands was of considerable biodiversity value. It was concluded that virtually all of the main channel of the Bandon River can be categorized as salmonid spawning, nursery or angling waters.

Extensive field surveys were carried out within the Study Area. Of all the habitats recorded within the Study Area, the unmodified sections of the river and surrounding woodlands are of the greatest significance from a botanical perspective. This section of river has exceptional juvenile salmon and Lamprey populations. This survey also confirms that Salmon and Lamprey spawn throughout the lower river. Otter and Kingfisher are both present and likely to breed within the Study Area. No evidence of Freshwater Pearl Mussel being present in the Study Area was recorded.

One of the main ecological impacts of the proposed works will be the loss of fishery habitat over the 3.6 km works area due to the lowering of the overall gradient within the channel and general removal of the intricate features of the river and its banks that provide habitat diversity. This is mitigated through the design of the dredged area to maintain diversity within the channel with riffles, pools and glides created where possible and a defined flow path present within the channel. The existing features of the reach will be replicated insofar as is possible to minimise the negative impacts on habitat diversity.

Disturbance to faunal species during the construction phase of the works is another important impact of the proposed works. This has been minimised through appropriate timing of the works to avoid the main periods of sensitivity for Salmonid species and the employment of best practice construction methods. There is a residual short term significant negative impact on Lamprey species, which spawn in the area during the summer period when the works will be carried out. Best practice mitigation measures have been put in place to minimise water pollution resulting from in-stream construction activity and siltation.

The proposed works have been designed to improve fish passage through the Study Area with the construction of a rock ramp at the existing weir. This will remove the barrier to the upstream migration of Lamprey species and the existing impediment to Salmon. Fish access to the Bridewell and Mill Stream will be maintained.

With regard to designated sites, the proposed works will result in a permanent minor negative impact on the Bandon Valley (above Inishannon) pNHA as the bed will be modified for a distance of approximately 550 metres within this designated site.

The works will be overseen by an ecologist and mitigation will be constructed in conjunction with Inland Fisheries Ireland where possible. The main excavation of the channel and flow path will be undertaken in the initial phase of works with habitat creation works and other mitigation undertaken afterwards. This will allow the careful placement of boulders, gravels and rubble mats in the locations that they will work most effectively.

An ongoing scheme of monitoring will be undertaken. This will follow on from the initial baseline fish stock survey and will be carried out annually until one year following the first maintenance of the channel.

## **1.10 IMPACT ASSESSMENT - GEOLOGY AND SOILS**

### **1.10.1 Geology and Soils**

In relation to geology and soils, the key impact associated with the construction phase of the Bandon River (Bandon) Drainage Scheme is the excavation, handling, storage, processing and transport of earthworks materials. The estimated volume of excavation anticipated during the construction phase is 150,000m<sup>3</sup> of dredged material from the Bandon River and a further 20,000m<sup>3</sup> as a result of the other works.

There are a number of potentially negative environmental impacts associated with the handling of excavated materials. These impacts can arise directly as a result of on-site excavation and embankment construction activities or indirectly, due to placement of excess unsuitable materials at off-site locations.

The vast majority of the Study Area, and the entire area covered by the proposed works, are underlain by Old Head of Kinsale bedrock. It envisaged that a large portion of the excavation required will include excavating bedrock from the river bed. Although this excavated material will be reused where possible, the volume of excavated material is likely to be greater than can be reused in the proposed works and as such this broken bedrock will be removed from the proposed scheme. Material removed from site will be transported to the closest suitably licensed facility to be processed and used on other construction projects in the vicinity, where possible. The type of bedrock that will be excavated is abundant throughout the Study Area and the portion to be removed will be imperceptible in comparison to the volumes retained and as such will not have a significant impact on the bedrock of the Study Area. It is likely that, with mitigation measures in place, this impact will constitute a Permanent Imperceptible Negative Impact.

The Study Area is underlain by a number of different classifications of subsoil, however proposed works will be predominantly underlain by Alluvium and Made Ground. It is likely that Alluvium will be affected as a result of proposed river dredging works with excavations for flood defences likely to be in Made Ground. The preliminary site investigation recorded that gravels are also present.

Soft silts and alluvium likely to be excavated as a result of river dredging are unlikely to be suitable for reuse elsewhere on the project. The volumes to be excavated will also far exceed those that would be required as fill on site and as such these subsoils will be removed from site. It may be possible to reuse excavated gravels, as recording during site investigation, as part of the fisheries mitigation measures described in the Flora and Fauna section. The impact of the removal of excavated

material from the proposed works will be minimal as these subsoils are in abundance throughout the Study Area, and the county as a whole.

### 1.10.2 Hydromorphology

The catchment of the Bandon River has a number of potential sediment sources in the upper, central and tidal catchments which include bank erosion, remobilisation of stored in-channel sediment, bar remobilisation, supply from tributaries and tidal sources. Overall the sediment supply within the catchment is low, slow and relatively constant.

The width of the Bandon River channel in the reach below Bandon Bridge is of the order of 35 m. This compares with a more natural channel width of between 25 and 30 m upstream of the town. The result of this has been to generate artificially low energy conditions through Bandon town as flood flows recede promoting gravel deposition to restore a more natural channel width. Gravels shoals and bars have accumulated downstream of the bridge with extensive shoaling on the southern bank slightly further downstream. Gravels are also accumulating in the outer bridge arches, away from the main central flow. The gravel bars and shoals developing through the town are generally evolving over periods of years, however, this is dependent on flood magnitude and frequency and periodic rapid change may occur between periods of relative inactivity. As such the hydromorphic state of the reach will be slowly evolving leading to bar development, channel narrowing and relative stability. Bar features of the order of 1 – 1.5m high can be expected to extend several metres into the channel on the northern bank and on the southern bank further downstream.

Repeat dredging of developing gravel features, such as might occur during the operation of the proposed scheme, will not allow equilibrium to develop affecting the local temporal hydromorphic balance. This, however, would only be for a short reach through the town and many other equivalent hydromorphic reaches exist elsewhere. Dredging will periodically disrupt channel morphology and hydraulic habitats but these would redevelop. The major impact would be to sediment movement downstream, with gravel units becoming starved of sediment following repeat removal at Bandon.

Overall, the hydromorphic impact of local dredging through the town will be minimal and short term when viewed against the state of the wider river provided sediment transport continuity is maintained. Upstream changes will be prevented by the bedrock rapid in the vicinity of the weir. The gravels that develop under an infrequent dredging regime are comparable to those created along natural reaches with bar disruption, gravel transfer and sediment redeposition occurring in response to floods.

The hydraulic modeling carried out in relation to the design of the flood relief scheme has shown that the impact of the gravels on flood levels is apparent but low in comparison with bridge and weir effects. As such frequent removal is unnecessary, however, the full development of vegetated gravel bed features will compromise flood relief. Vegetation control and occasional gravel removal and reintroduction downstream is likely to be required. This should be triggered by a threshold to be defined at detailed design stage. It is important for the maintenance of channel dynamics downstream that gravel movement is not disrupted. Reintroduction of the dredged gravels across several riffle and rapid sites downstream, where possible, will ensure that the sediment dynamics downstream are unaffected and channel stability is maintained.

### 1.11 IMPACT ASSESSMENT - WATER

This section describes the existing aquatic environment in the vicinity of the proposed works, and assesses the impact the Bandon River (Bandon) Drainage Scheme may have on the quality of both surface water and ground water along with the hydrological and hydrogeological regimes of the area.

### 1.11.1 Surface Water Quality

During the preparation phase, site clearance and preparatory groundworks including site compound set-up etc. will lead to exposure of bare ground and the potential for the generation of silt-laden run-off. The potential for the generation of silt-laden surface run-off on the adjacent banks and along access and egress routes is likely to continue through the construction phase of the works and until the ground has consolidated. The dredging works proposed as part of the proposed works will involve large-scale, major removal of substrate from the river bed, which will result in a significant increase in suspended solids in the river within and downstream of the working area for the duration of this aspect of the proposed works. Stockpiled excavated material also poses an increased threat of increased siltation in the watercourse. Damage to the river-bank during in-stream works may cause persistent scouring and siltation of the watercourse over time if left unconsolidated.

Excessive suspended sediment in the water column can clog and cause abrasions to fish gills, interfere with fish navigation and feeding, affect egg and fry development, while also affecting populations of aquatic invertebrates, on which the fishes' diet is based. Once deposited, excessive amounts of silt may damage fish habitat by clogging interstices between gravels in spawning grounds, resulting in diminished flow of oxygenated water to eggs and rendering these gravels unsuitable for egg incubation. Deposited sediment may also impact on the habitat of bottom dwelling aquatic invertebrates and damage nursery habitat for young fish. To mitigate these potential impacts, the proposed works will only take place over approximately 60% of the width of the river at any one time, measures to minimise the suspension and transfer of sediment downstream will be employed, the river will be allowed to run clear for 14 hours per day and any stockpiling of materials will be greater than 10 metres from the river bank. An Environmental Management Plan (EMP) will be prepared prior to the commencement of any works in order to ensure all works are carried out in a manner designed to avoid and minimise any adverse impacts on the receiving environment. It is likely that, with mitigation in place, this impact will constitute a Temporary Moderate Negative Impact. This residual impact will be fully identified as the works method statements become finalised and mitigation measures become finalised.

Construction sites, by their nature, have numerous substances, which are potentially polluting to both ground and surface water if not treated. These include fuels, lubricants, cement, mortar, silt, soil and other substances, which arise during construction. Similarly, the washing of construction lorries and equipment poses a pollution risk to watercourses. The use of vehicles and plant on the construction site gives the potential for the spillage of fuel and oil on the site either from leaks in vehicles or fuel tanks or spillages. This may lead to contamination of soils, groundwater and surface water. Such substances entering the Bandon River could damage the habitat of local populations of fish and aquatic invertebrates and also cause direct harm to aquatic fauna. It is likely that, with proper implementation of standard mitigation measures this impact will constitute a Temporary Slight Negative Impact.

### 1.11.2 Hydrogeology

Any potential significant impacts to hydrogeology as a result of the Bandon River (Bandon) Drainage Scheme would be temporary in nature and only have the potential to occur during the construction phase or any future maintenance. There are numerous substances used on construction sites that are potentially polluting to ground water, including fuels, lubricants, cement, silt, soil and other hydrocarbons. Washing of construction plant also poses a risk of polluting ground water.

Should any of the above substances be allowed to contaminate the groundwater in the area, they could potentially lead to the pollution of industrial and public water supplies. In order to avoid any potentially polluting substances infiltrating the ground water during construction and operation phase, there will be a bunded area constructed within the site compound with sufficient volume to contain any spills. All plant refuelling, maintenance or washing will be carried out within the bunded area. Spill kits will also be available at this area to facilitate the quick and effective cleaning of any substances. The site compound will not be located in an area classified as 'extremely' vulnerable to infiltration of ground water to further reduce the risk of pollution to the groundwater. Taking into account these mitigation measures, it is considered that the impact will constitute a Temporary Slight Negative Impact.

### **1.11.3 Flooding**

There is a long history of flooding of the Bandon River. Flooding due to heavy rainfall in the catchment is occasionally exacerbated by high tides in the river estuary. Incidents of flooding on record include flooding in 1975, 1982, 1986, 1988, 2004, 2006 with the most severe flooding on record occurring in 2009. Approximately 200 residential and commercial premises in Bandon Town were flooded in November 2009.

The gradient of Bandon River is steep in the upper reaches of the catchment with this gradient reducing as the river approaches its estuary at Inishannon. This variation in gradient is typical of a large river like the Bandon. This decreased gradient reduces the velocity of water in the channel and therefore the capacity of the channel itself. Evidence of this is the widening of the river channel as the gradient reduces. Typically a river with this characteristic will flood at times of heavy rainfall, possibly coinciding with high tides, as the steep catchment combined with the steeper gradient of the river bed in mountainous regions will convey these rain waters to lower reaches of the river at a greater velocity than this stretch of river can replicate. This typically causes the river level to raise, the bank to be overtopped and flooding of the surrounding landscape. This may be the mechanism by which Bandon Town flooded.

The Bandon River (Bandon) Drainage Scheme provides for the construction and upgrade of flood defence embankments and walls on the Bandon and Bridewell Rivers along with extensive dredging of the Bandon River over a 3.6km length. These works will increase the volume of water that can be conveyed in the channel at times of heavy rainfall due to an increase in the cross sectional area of the channel, and an increase in bank level at critical areas. This increase in capacity will result in the channel having the capacity to convey larger volumes during times of heavy rainfall, reducing the risk of water levels overtopping the bank and flooding the surrounding area.

In November 2009, water levels in the Bandon River rose to such a level that approximately 200 properties were flooded. Increasing the conveyance capacity of the channel will reduce the risk of these properties flooding in the future.

The effect of increasing the channel conveyance capacity may have an impact on water levels downstream of the proposed scheme. The proposed flood defences may also result in an increase in upstream water levels during flood events. The hydraulic modelling undertaken in the design of the drainage scheme indicates that for the 1% AEP flood event, the proposed scheme would result in a slight elevation in flood levels along the stretch of river lying between 500m and 2,000m down river of the end of the dredged section. Defences have been designed to mitigate the potential increase in upstream levels. The extent of the proposed dredging has been designed to ensure a minimal increase in water levels downstream of the scheme during flood events.

Therefore, the residual impact of the Bandon River (Bandon) Drainage Scheme, on upstream and downstream water levels will be slight. It is anticipated that this slight increase will not result in additional flood risk to property or infrastructure.

## **1.12 IMPACT ASSESSMENT - AIR AND NOISE**

### **1.12.1 Air Quality and Climate**

Material handling activities on site may typically emit dust. Whilst construction activities are likely to produce some level of dust during the earth moving and excavating phases of the project, these activities will mainly be confined to particles of dust greater than 10 microns. Particles of dust greater than 10 microns are considered a nuisance but do not have the potential to cause significant health impacts.

Worst-case truck movements during the peak construction period would be about 5 inward and 5 outward / hour. It is unlikely that the emissions of this magnitude will lead to dust deposition levels at the site boundary which exceed the limit value for dust nuisance of 350 mg/(m<sup>2</sup>\*day).

With effective implementation of a dust minimisation plan, the proposed development is expected to have a negligible impact on air quality during the construction phase.

### **1.12.2 Noise and Vibration**

A variety of items of plant will be used in the construction of the proposed works, such as excavators, lifting equipment, dumper trucks, compressors and generators. Sheet piling and rock breaking are expected to be the noisiest activities and the flow of vehicular traffic to, from and along the easement routes is also a potential source of noise and vibration.

Dredging is expected to be the most extensive works activity associated with the scheme. However, there are no plant items which are expected to result in an exceedance of the minimum adopted daytime noise criterion of 70dB LAeq. The likely short term impact of dredging activities on the local environment would not be significant.

Depending on the ground conditions encountered during the detailed site investigation, sheet piling may be required in some cases as part of the flood defence construction. Assuming a 'press-in' piling method is employed, the likely impact of piling noise on the local environment would not be significant. If normal piling is employed, there is likely to be a moderate amount of noise impact although it would be likely to occur over relatively short durations.

The majority of construction activities are not expected to generate perceptible vibrations at the nearby noise sensitive locations, apart from sheet piling, should it be required. If piling operations are conducted through the 'press-in' method described above, vibration transmission would be significantly minimised. If an alternative piling method is conducted to the press-in type, a test pile should be erected at the piling location that is closest to one of the noise sensitive locations. Vibration monitoring should then be conducted to confirm that groundborne vibration will be within the guidance criteria limits.

## **1.13 IMPACT ASSESSMENT - LANDSCAPE**

The Landscape of the Study Area is located primarily within the Landscape Character Area (LCA): Enniskeane/ Bandon/ Ballinhassig. This LCA forms part of the general Landscape Type: Broad Fertile Lowland Valley. The CORINE data for the Study Area shows that pasture is the primary land cover with smaller areas of non-irrigated arable land. Continuous urban fabric occurs at the settlement of

Bandon. The outskirts of Bandon are characterised by discontinuous urban fabric, which gives way to pastoral and arable farmland. To the west, an area of mixed forest is present. The Landscape Type Broad Fertile Lowland Valley, has been assigned an overall Landscape Value and Sensitivity of High. Three Scenic Routes are partially located within the Study Area and a number of scenic landscapes are also present in the area.

The physical landscape unit in which the Study Area is located comprises the lower Bandon River Valley area and reflects the Broad Fertile Lowland Valley Landscape. Landcover within this physical unit comprises mainly of 'highly fertile, regularly shaped fields typically of medium size with mature broadleaf hedgerows'. The topography of this physical landscape unit is evenly undulating with shallow, flat river valleys surrounded by low well-spaced ridges. The highest peaks are in the region of 200 metres O.D.

Views from the Study Area are restricted by the Bandon River valley walls, woodland and urban infrastructure. All views from the site are restricted to within the Bandon valley itself. A series of photomontages has been prepared, which show the proposed scheme from different locations including the existing pedestrian bridge, Bandon Bridge and views downstream of Bandon Bridge, including from O'Driscoll's Bridge, where works end. The main visual impacts of the works include exposure of bedrock on the river banks due to lowering of the river bed, the construction of flood defence walls and embankments, the removal of trees and the replacement of the existing pedestrian bridge with a newly designed bridge. No significant negative visual impacts are evident from these montages.

In the event that the proposed flood relief scheme were not to proceed, the landscape of the Study Area would evolve based on current trends and views to and from the Study Area would remain unaltered. In the event of further major flood events, the visual amenity of the area would be temporarily affected as flood levels increase and flood damage affects Bandon Town and environs.

The construction phase of the proposed scheme will involve the movement of construction vehicles into and out of the working area, the storage of machinery on site and temporary site buildings and building materials on site. These activities will have a slight to moderate negative temporary impact on the surrounding area in terms of landscape and visual impact. Any negative impact will be minimised through the implementation of an Environmental Management Plan (EMP) and a Traffic Management Plan. A construction compound will be used to house materials, plant and machinery, welfare facilities and site offices as part of the EMP and traffic movements will be subject to regulation through the traffic management plan. The residual impact will be reduced to a short-term slight negative impact as a result of the mitigation measures associated with the construction phase of the proposed scheme.

The construction phase will have a slight negative impact on landscape character locally, as construction noise and activity will impinge on landscape amenity. The impact will, however, be a localised, temporary impact and will decrease with distance from the site. Best practice measures for noise control will be adhered to onsite during the construction phase of the proposed development. These measures will reduce the severity of the impact to a short-term slight negative impact.

The proposed scheme will involve the deepening of the river bed of the Bandon River by an average depth of one metre over the length of the dredge from just downstream of the Bandon Weir in Bandon Town as far as O'Driscoll's Bridge approximately 3.6 kilometres downstream. This will alter the appearance of the river over this section of its course. The lowering of the bed will also expose bedrock at the base of the banks above the new average and low water levels. Although these newly

exposed rock surfaces will appear modified in the short-term, the process of succession will result in the revegetation of the banks themselves and also screening by overhanging vegetation. The revegetation of the newly exposed rock surfaces on the banks of the Bandon River will be permitted to proceed and future maintenance works will not involve the removal of bankside vegetation except in particular circumstances. The residual impact is characterised as being a permanent slight negative impact as the natural appearance of the Bandon River over the 3.6 kilometres to be dredged will be modified. Natural regeneration will ameliorate this effect and it is likely that the visual impact of these works will recede.

A number of flood defence walls and flood defence embankments will be constructed within the environs of Bandon Town. In addition, some existing flood defence walls and embankments will be improved. The visual impact of some of proposed flood defence walls can be seen in the photomontages. The proposed flood defence walls will be finished in local stone in order to be more sympathetic to the local built environment and all embankments will be grassed over to provide a natural appearance. As the flood defence walls and embankments will be within the environs of Bandon Town, these works will occur within a generally urban setting and therefore will not constitute a significant impact on visual amenity.

Some treelines and individual trees will need to be removed during construction of the proposed scheme. Natural bankside habitats will also be removed as part of the proposed works. Where possible, bankside vegetation will be retained with the location of access and egress points designed to minimise impacts on trees and treelines in particular. It is however likely that much of the existing bankside habitat will be lost during the works. The proposed scheme will include replanting and rehabilitation works to replace and enhance bankside habitats. Native species will be used wherever possible to preserve the natural character of the area. The planting will be designed to facilitate maintenance of the channel in the future.

The residual impact of the removal of trees and treelines is characterised as a long-term slight negative impact as efforts will be made to retain mature broadleaved trees wherever possible and rehabilitation works will also be incorporated into the scheme. Natural regeneration is also likely to occur.

The existing pedestrian bridge will be removed and replaced by a specially designed new pedestrian bridge. The design concept of the proposed new pedestrian bridge focuses on the natural elements of the Bandon River and references fauna such as Salmon and Herons. The replacement of the existing bridge with a bespoke design will add to the visual amenity of the Bandon River and Bandon Town.

It is anticipated that the future maintenance associated with the proposed works will involve the removal of deposits exposed above low water levels. The works will however be isolated in terms of location and also much smaller in scale than the original works. Therefore the impact on visual amenity will be less than during the original works. The works will be conducted at five year intervals and best practice will be adhered to at all times. This will ensure that the impact on visual amenity is minimal. The residual impact will be long-term but sporadic in nature and will be minor in terms of visual amenity.

#### **1.14 IMPACT ASSESSMENT - CULTURAL HERITAGE**

An assessment was undertaken of the impact on the archaeological, architectural and wider cultural heritage resources (collectively 'cultural heritage') by the proposed Bandon Flood Relief Scheme. The

layout of the scheme has been designed in order to minimise impacts on all identified archaeological sites and structures of architectural heritage significance. The assessment is based on a desk top survey that identified all recorded cultural heritage sites within the study area. The assessment also incorporates the results of an underwater archaeological survey of the sections of the river channel to be impacted by dredging and bridge underpinning. A field survey of the lands to be impacted by the terrestrial elements of the proposed scheme was also undertaken.

The assessment resulted in the identification of twenty cultural heritage sites in close proximity to the scheme. Three of these sites are archaeological monuments listed in the Record of Monuments and Places and comprise: Bandon Bridge (CO110-019009), the projected line of the Bandon town wall (CO110-019014) and a former 19th-century distillery in Ballylangley (CO110-037). The nature of the potential impacts on all of the identified cultural heritage sites is assessed on an individual basis and mitigation strategies are proposed in all cases where potential impacts are foreseen. Where feasible it is recommended that mitigation works be carried out during the pre-development phase.

The proposed scheme will also entail potential impacts on a number of areas with no recorded archaeological sites. Given the potential for discovery of unrecorded, sub-surface archaeological features, it is recommended that, where feasible, a programme of pre-development archaeological investigations is undertaken in these areas. These investigations may include archaeological test trenching and monitoring of site investigation works. It is envisioned that further mitigation strategies, if required, will be formulated based on the results of these investigations. It is noted that the nature and extent of all of the archaeological site investigations will be determined through consultation between the Contract Archaeologist and the National Monuments Service.

### **1.15 IMPACT ASSESSMENT - MATERIAL ASSETS**

The Bandon River (Bandon) Drainage Scheme, comprises mainly of works to and in the vicinity of the Bandon River and Bridewell River. As such, potential impacts to material assets are restricted to these areas. The proposed scheme will have potential to impact on the following;

- Roads Network (incl. increased traffic)
- Pedestrian Bridge
- Wastewater Collection Network
- Surface Water Collection Network
- Water Distribution Network
- Bord Gáis Distribution Network
- Electricity Network
- Telecommunications Network

#### **1.15.1 Traffic and Transportation**

The proposed scheme has the potential to impact on the transport infrastructure in the area, most significantly during the construction phase. Bandon Bridge will need to be underpinned as a result of the proposed dredging to an approximate depth of 1.6m in the area to prevent the bridge being undermined. There is a risk that the bridge structure could be damaged during these works. It is proposed to replace the existing footbridge further upstream with a new footbridge, which will result in the temporary loss of this pedestrian route over the River during the construction phase.

The underpinning works proposed to Bandon Bridge have the potential to cause the largest impact to the flow of traffic in the town. While the detailed design of works proposed at the bridge is not available at this time, it is possible that the bridge may be closed to heavy goods traffic for a period of up to 3 months, with bridge closures for all types of traffic anticipated for shorter periods of time within this period. A traffic survey in Bandon town in 2008, recorded 10,424 vehicles using this bridge daily between the hours of 7am and 7pm. 409 of these were heavy good vehicles. Any closure of the Bandon Bridge will cause significant disruption to the traffic flow in the town as the traffic will need to be diverted to either Innishannon Bridge (6.6km to the north east by road) or the bridge at Carhoon (5.7km south west by road).

The Bandon Bridge closure should be timed to minimise the impact to the flow of traffic throughout Bandon town, and if possible work should be carried out at off peak times to reduce the impact, particularly on heavy goods vehicles. All residents and interested parties should be consulted when planning these bridge closures to optimise the timing of same. A complete schedule of bridge closures should be published in advance of the works commencing to facilitate residents in making alternative arrangements where necessary.

The closure of the Bandon Bridge to facilitate the proposed works is likely to cause a significant temporary impact to the flow of traffic throughout Bandon town. However, there will be no residual impact once the proposed scheme is completed.

#### **1.15.2 Existing Services**

The majority of proposed works pertaining to the Bandon River (Bandon) Drainage Scheme, are located in or in the vicinity of Bandon River and as such there is limited interaction between the scheme and existing services in the area. Detailed Site Investigation will also be carried out in the vicinity of all proposed works to identify existing services. The proposed works have the potential to impact upon existing services, however standard industry methodologies will mitigate this impact.

The wastewater collection network currently includes five pipes crossing under the Bandon River in two separate locations. Both are just downstream of Bandon Bridge. The proposed scheme has potential to have a significant impact on these crossings. In the absence of mitigation measures, these pipes will be left exposed, unsupported and could break apart under the force of the flow in the river. This would lead to sustained pollution of the Bandon River and disruption of the wastewater collection system.

Furthermore, both the treated effluent outfall pipe and a secondary overflow discharge pipe from the Bandon Waste Water Treatment Plant are laid to approximately the centre of the river at or near existing bed level. It is proposed to dredge the river to a level below these pipes at this location. In the absence of mitigation measures, these outfalls will be damaged and the discharges to the river will be impacted. This impact would be temporary but significant.

There are 11 additional discharges to the river from the wastewater network throughout the Study Area. These discharge pipes are unlikely to be affected by the proposed scheme as they do not currently encroach on the river bed, and none appear to be located at the sites where foundation excavation will be required. There is also an additional combined sewer crossing the proposed works. This pipe is strapped to the existing footbridge. As the proposed scheme includes for the replacement of this bridge, this combined sewer will need to be decommissioned for the duration of the works on the pedestrian bridge. This could have a potentially significant temporary impact to the service of the properties served by this sewer.

These pipelines described above will be redesigned and temporary pipelines will be provided during the dredging works. Construction methods will be devised so as not to affect the operation of the wastewater collection network and treatment process during the construction phase. The combined sewer and four rising main pipes will be relaid to a sufficient depth so as to maintain the required cover to the pipe in relation to the proposed bed level prior to the dredging works.

To maintain the operation of the Bandon Wastewater Treatment Plant, the treated effluent outfall pipe will either be relaid following with the proposed dredging. A temporary outfall will be constructed, which will be in operation during the dredging works in the vicinity of the wastewater treatment plant.

A new combined sewer will be laid in the deck of the proposed pedestrian bridge. A temporary pipeline will be provided during the works on the bridge.

There are five existing surface water outfalls, three of which discharge into the Bandon River and the remaining two into the Bridewell River. As these pipelines are not in the bed of the river they will not be affected by the proposed dredging. Two of the five discharge locations are however at proposed works locations, including proposed flood defence wall and upgrade of existing flood defence wall. It is possible that the excavation of foundation could impact on these pipe lines and therefore impact the surface water system. A survey will be carried out to ascertain the depth of the discharge pipework based on the invert level of the outfall. Should it be anticipated that excavation of the foundations for proposed works will impact on this pipework they will be taken into consideration at detailed design stage and replaced or deepened prior to foundation excavation if necessary.

The proposed scheme will potentially impact the water distribution network in three locations, namely Bandon Bridge, the existing Pedestrian Bridge and the proposed Mill Stream culvert.

Should the underpinning of Bandon Bridge cause damage to the structure of the existing bridge, the watermains could be damaged. This could result in a number of properties in the town having no potable water supply. The underpinning of Bandon Bridge will be designed by a suitably qualified and experienced structural engineer working within an accredited quality system. The construction of these works will be carried out by a suitably qualified and experienced contractor who will be supervised to ensure that the works are carried out correctly. This will ensure that the bridge will be underpinned safely and effectively so as to safeguard the structural integrity of the existing structure and in turn safeguard the watermain attached to the bridge.

The replacement of the pedestrian bridge will result in the watermain traversing the bridge being decommissioned for the duration of these construction works. This will result in properties served by this main having their water supply interrupted, if mitigation is not put in place. A temporary watermain will be provided across the river to serve the properties currently supplied by the watermain in the pedestrian bridge. These arrangements will be finalised at detailed design stage prior to construction works commencing to ensure an uninterrupted supply to the properties in question.

Excavation for the upgrade of the culvert on the Mill Stream will encounter a watermain in the road. It is possible that this watermain could be damaged during the construction phase, resulting in properties having no potable water supply. Slit trenches will be carried out prior to excavation of the culvert to locate and record the exact location and depth of the watermain in the road. Should existing watermain level clash with the level of the proposed culvert, this will be taken into consideration during the detailed design stage. The watermain will be raised locally to accommodate the proposed culvert. The Contractor will be supplied with the information obtained in the slit

trenches and the watermain location will be marked prior to excavation in the area. This will reduce the risk of striking the watermain and causing interruption to water supply during the construction phase.

There is also a surface water abstraction point for the Inishannon Regional Water Supply Scheme downstream of the proposed works. It is not predicted that this abstraction will be impacted as any solids generated during construction phase should be settled out before reaching this area.

Taking into account the abovementioned mitigation measures, no residual impact to the watermains following the construction phase is predicted.

There is an extensive gas distribution network throughout Bandon town which interacts with the proposed scheme in a number of places. It is possible that these gas main could be damaged during the construction phase, affecting the supply to a number of properties and potentially causing a fire or explosion. Slit trenches will be carried out prior to excavation of the culvert to locate and record the exact location and depth of the gas main in the road. Should existing gas main level clash with the level of the proposed culvert, this will be taken into consideration during the detailed design stage. The gas main will be raised locally to accommodate the proposed culvert.

The Contractor will be supplied with the information obtained in the slit trenches and the gas main locations will be marked prior to excavation in the area. This will reduce the risk of hitting the gas main and causing damage during the construction phase. The impacts described above are predicted to be temporary and significant.

The proposed scheme may impact on the underground electricity network at a number of locations. Electricity cable laid in the bed of the Bandon River has the potential to be damaged by both the dredging and the construction of the rock ramp. This would result in the loss of power throughout the town and also could prove very dangerous, or even fatal, for site staff if struck during construction operations. Consultation with the relevant authority will be carried out at detailed design stage in order to redesign, and re lay the electrical ducting in the bed of the Bandon River at the pedestrian bridge. This work will have to be carried out in advance of any dredging works, or construction of the rock ramp in order to ensure these cables are not damaged or do not have the potential to cause injury. Upon completion of this diversion work permanent marker posts will be erected to inform site staff of the exact location of the cables to avoid damage during dredging works.

Electrical cables could also be damaged during excavation for other parts of the proposed works. This would also result in the loss of electricity to a number of properties throughout the town and could also prove very dangerous, or even fatal, for site staff if struck during construction operations.

Slit trenches will be carried out prior to works commencing at the locations of the proposed flood defence measures to locate and record the exact location and depth of the electrical cables. The Contractor will be supplied with the information obtained in the slit trenches and the electrical cable locations will be marked prior to excavation in the area. This will reduce the risk of striking the cables and causing damage during the construction phase. Taking into account the abovementioned mitigation measures there will be no residual impact to the electrical infrastructure following the construction phase.

The telecommunications network also intersects the proposed scheme in a number of locations. Should these cables clash with the works they could become damaged during construction phase. The potential impacts are considered to be temporary and moderate. Slit trenches will be carried out in order to ascertain the exact location and depth of cables. In the case of the proposed flood

defence walls (i.e. South bank of Bandon River and along Glasslinn Road) where the cables potentially run along the proposed wall route, these cables will have to be taken into consideration at detailed design stage. The cables may need to be diverted with the consent of the service provider.

The Contractor will be supplied with the information obtained in the slit trenches and the telecommunication cable locations will be marked prior to excavation in each area. This will greatly reduce the risk of striking the cables and causing damage during the construction phase. Taking into account the abovementioned mitigation measures there will be no residual impact to the telecommunications infrastructure following the construction phase.

### **1.15.3 Waste Management**

A Waste Management Plan will be prepared in relation to the proposed works in accordance with 'Best Practice Guidelines for the Preparation of Waste Management Plans for Construction and Demolition Projects (2006)' were published by the former DoEHLG. Excavated material will be reused on site as much as practicable. Where this is not possible, the recycling rates for the Construction and Demolition (C&D) waste produced throughout the construction of the Bandon River (Bandon) Drainage Scheme should be maintained at or above 85% if possible, as outlined in the Waste Management (Planning) Regulations 1997. A collection permit to transport waste must be held by the relevant contractor which has been issued by the Local Authority where the waste has been generated, i.e. Cork County Council. Waste receiving facilities must also be appropriately licensed or permitted for the waste being received. The construction compound for the proposed scheme should have a dedicated Waste Storage Area (WSA) for any construction waste generated. Receptacles/skips or bays will be provided for each recyclable material. Dedicated waste bins should also be provided on any water going vessel/platform to prevent litter from contaminating the River. Taking into account the mitigation measures proposed, the residual impact of the construction phase will be imperceptible.

### **1.16 INTER-RELATIONSHIPS**

In addition to assessing potentially significant adverse impacts on all of the above, the inter-relationships between these factors has been taken into account as part of the Environmental Impact Assessment scoping and assessment process.