

Scrub (WS1) is present on the eastern bank of the river. Narrow strips of dry meadow and grassy verge (GS2) with nettle, reed canary grass, American willowherb and meadowsweet, water pepper (*Persicaria hydropiper*), marsh woundwort (*Stachys palustris*) and water horsetail (*Equisetum fluviatile*), and mature treelines (WL2) of sally willow and alder (*Alnus glutinosa*) are also present along the river within this section.

#### **Fitz's Boreen to Blackpool Retail Park**

This section of the Bride (North) is heavily industrialised and flows through largely built areas categorised as buildings and artificial surfaces (BL3). A narrow strip of dry meadow and grassy verge (GS2) is present on the river margin of the eastern bank which is bordered by flood walls. Species include nettle, reed canary grass, American willowherb and meadowsweet. Short treelines (WL2) of sally willow and alder are also present along the river banks within this section on the eastern and western banks of the channel. A Japanese knotweed stand (approx 10m long) is present along the treeline on the eastern bank of the river close to Sunbeam Industrial Estate.

The Bride (North) downstream of the culvert at Millfield Industrial Estate flows through an area of scattered trees and parkland (WD5) and amenity grassland (GA2). Narrow strips of amenity grassland within the vicinity of Blackpool Retail Park are interspersed with planted areas of Flower beds and borders (BC4) and ornamental non-native shrub (WS3) along the river banks.

#### **Blackpool Retail Park to Watercourse Road**

Downstream of Blackpool retail park the river side habitats consist of mature dense Treelines (WL2) of sally willow, sycamore with ash, alder and occasional cherry laurel, beech, oak, white willow, lime and downy birch, an area of mown Amenity grassland (GA2), Scattered trees and parkland (WD5) and buildings and artificial surfaces (BL3). Large stands of Japanese knotweed are present along both banks of the river in Orchard Court, close to where the river is culverted underground. The river between Orchard Court and Watercourse Road where the works are located is all culverted underground. This area is largely built land categorised as buildings and artificial surfaces. (BL3)

The full list of habitats within the study area and the works which lie in close proximity to these habitats are listed below. For information on the works refer to Drawings in Appendix 3A, listed in Table 5.4 below.

**Table 5.4 List of habitats within the study area and works in proximity to these habitats**

Habitat	Fossitt Code	Works in close proximity to habitat (refer to Appendix 3A drawings for works details and locations)
Treelines	WL2	C08_L01, C08_E01, C08_B01, C08_B02, C06-E01, C06_L05, C12_L15, C12_L16, C06_B04
Hedgerow	WL1	
Scattered trees and parkland	WD5	C06-E01
Mixed broadleaved woodland	WD1	C08_L02 & C08_L03, C08_R02 C06-C01

Habitat	Fossitt Code	Works in close proximity to habitat (refer to Appendix 3A drawings for works details and locations)
Scrub	WS1	C08_L02 & C08_L03 C06-C01
Dry meadow and grassy verge	GS2	C06_L05, C06_L08, C06_L11, C06_L15, C06_C03
Amenity grassland	GA2	C08_L01, C08_E01, C08_L04, C08_E02 & C08_E03, C08-B02, C06-E01, C06_E02, C06_L22, C06_LL23, C06_B04
Agricultural grassland	GA1	C08_R02
Flower beds and borders	BC4	C06_L22, C06_LL23
Ornamental non-native shrub	WS3	C06_L22, C06_LL23
Buildings and artificial surfaces	BL3	All
Lowland Depositing River	FW2	All, C06-C01(instream), C06_C03 (instream), C06_B04

A number of non-native species are present along the Glenamought and the Bride (North), including montbretia (*Crocsmia x crocosmiiflora*), snowberry (*Symphoricarpos albus*) and the highly invasive Japanese Knotweed. The locations of a number of these species are described in greater detail in Section 5.3.1 below.

No Annex II listed plant species or Flora Protection Order (FPO) species were recorded during the field surveys.

### 5.3.1.3 Floating River Vegetation

Floating River Vegetation (FRV) habitat is widely distributed throughout the River Lee from Inniscarra Dam to Cork City. Smaller more localised stands of *Ranunculus* sp. with very low cover, *Fontanalis* moss with low cover and *Calitriche* sp. with low cover were present on the River Bride (North) and the Glenamought River. No pondweeds were recorded. While these examples of FRV habitat exist, the percentage cover is low and therefore they are not considered good examples of the habitat. Along the middle reaches of the Bride (North), these stands of FRV alternate along the margins of the river. At Oldcourt, where the river is to be culverted the moss species *Fontinalis antipyretica* (more nutrient tolerant moss) occurs. The Glenamought River in the Kilnap area contained small pockets of *Ranunculus* vegetation typically between 1 – 5% cover per 100m<sup>2</sup> of river habitat upstream of the Viaduct but between 5-10% cover per 100m<sup>2</sup> of river habitat downstream of the viaduct. The distribution was typically clumped at more open areas of river given light facilitated growth and was limited or absent as the river becomes canopied (typically upstream of the Glen Distillery Business Park and Glenamought Bridge). The generalist moss species *Fontanalis antipyretica* was

present locally on large cobble and boulder habitat and typically covered 1% by surface area per 100m<sup>2</sup> of river habitat. Near Sweeneys Hill the river contained moderately clean spawning gravels and localised *Ranunculus* stands instream.

Within the Bride (North) and Glenamought rivers the Floating River Vegetation was not of Annex I habitat quality given the extent of fragmentation.

#### **5.3.1.4 Invasive Plant Species (See also Appendix 5C)**

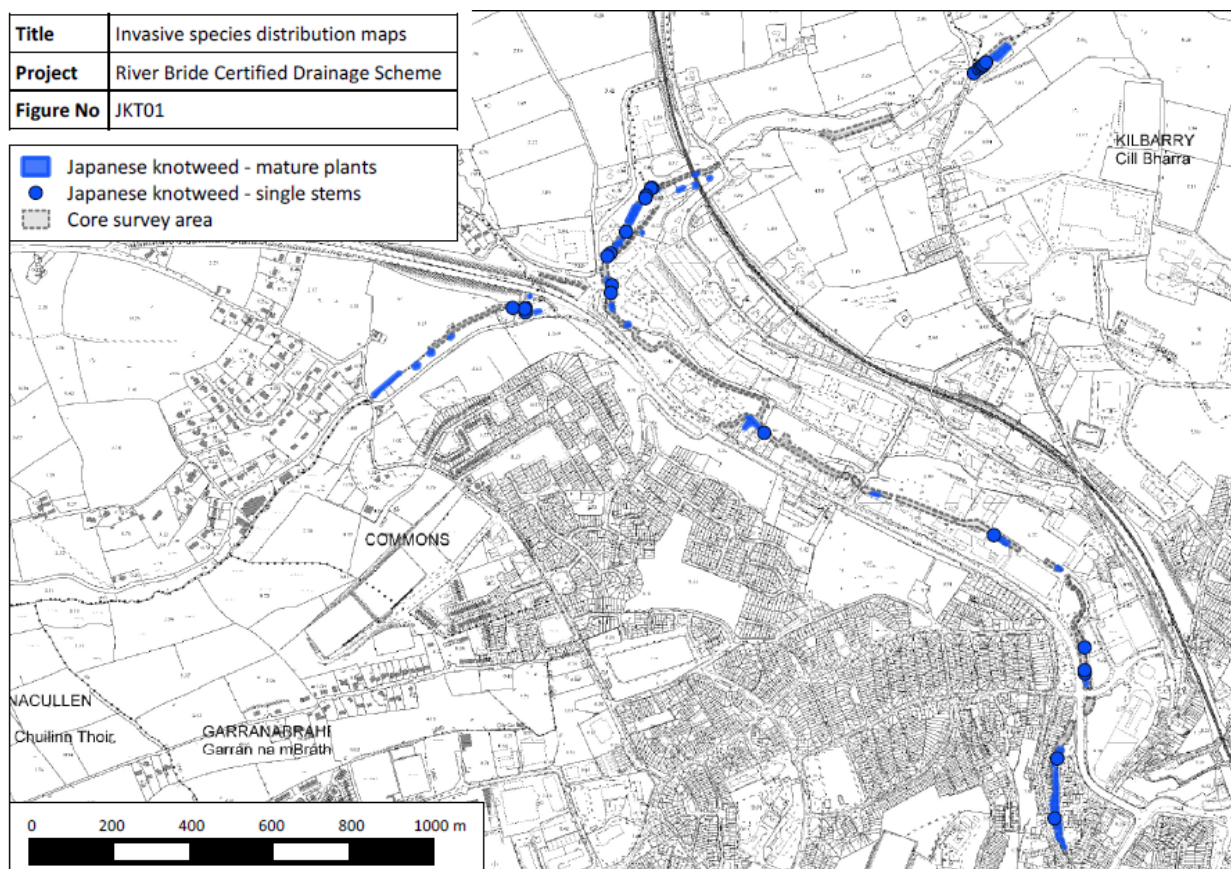
A targeted invasive plant species survey was carried out to establish the distribution of invasive plants within the footprint of the proposed works. The survey targeted the invasive species Japanese Knotweed (*Fallopia japonica*), Giant Hogweed (*Heracleum mantegazzianum*), Giant Rhubarb (*Gunnera tinctoria*) and Himalayan Balsam (*Impatiens glandulifera*).

Two invasive species, Japanese knotweed and giant rhubarb, were recorded in the works area for the Blackpool.

Japanese Knotweed was the only invasive species recorded along the Glenamought River channel listed above. It was recorded at four locations in 2015 and in a further three locations in 2017. Two of the stands of Japanese Knotweed identified in 2017 had been treated with herbicide prior to field assessment. The distribution of invasive species along the Bride River (North) and the Glenamought River is shown in Figure 5.2 below.

13 No. records for invasive species were documented along the Bride (North). Japanese knotweed accounted for 12 of the 13 No. records for invasive species recorded along the Bride (North) river channel. A single giant rhubarb plant was also present in the amenity park adjacent to Blackpool Retail Park.

**Fig 5.2: Map showing invasive species recorded along the River Bride (North) and Glenamought River, Blackpool, Cork City carried out as part of OPW Management Plan.**



### 5.3.2 Significance of the Flora

The floating river vegetation within the study area is fragmented and occurs in low frequency. Although floating river vegetation further downstream on the River Lee corresponds to the Annex I Habitat 'Watercourses of plain to montane levels with the *Ranunculus fluitantis* and *Callitriche-Batrachion* vegetation (3260)', floating river vegetation within the Rivers Bride (North) and Glenamought is fragmented, occurs in low frequency and does not have strong links with the Annex I habitat 'Watercourses of plain to montane levels with the *Ranunculus fluitantis* and *Callitriche-Batrachion* vegetation (3260)'. The importance of this habitat within the works area lies predominantly in its association with salmonid fish and invertebrates as it acts as both a food source and a resting habitat.

Mature treelines, hedgerows and areas of scrub provide commuting and foraging corridors for mammals and bat species within in the area and nesting sites for bird species.

No protected plant species (Annex II, IV or FPO) were recorded at any of the locations during the field walkover survey.

The habitats most common and with low botanical significance are those which are either highly modified through agriculture, amenity or urbanization. These habitats include Built land (BL3) improved agricultural grassland (GA1) and Amenity grassland (GA2) located throughout the study area at various locations.

### 5.3.3 Fauna

#### 5.3.3.1 Birds

All bird species seen or heard during the field surveys were recorded and are shown in Table 5.5. The bird species recorded were typical of the habitats found within the study area.

##### Kingfisher

A series of targeted kingfisher (*Alcedo atthis*) surveys were carried out on the Bride River (North) and Glenamought Rivers in order to identify the distribution of kingfishers in the catchment of the flood relief works in the Blackpool area and also to highlight any nesting areas if visible. The survey areas included sections of river channel overlapping the proposed works areas.

Bank walkover surveys were conducted to target areas where suitable nesting bank was located, along with areas containing appropriate riparian resting perches and good prey availability and which overlapped with proposed works areas along the relevant river channels.

Kingfisher was recorded along the Glenamought River, during a bank walkover survey, no kingfisher was identified in the Bride (North).

On the Glenamought River a survey was carried out on the River in 2014. One Kingfisher nest (recently active) was identified east of Kilnap Bridge. An active nest site was identified in a section of steep, relatively open bank composed of soft mud and clay situated amongst an area of riparian scrub (WS1) and mixed woodland (WD1). Two sightings of kingfisher were observed during walkover surveys flying upstream under the Glenamought Viaduct (at the commencement of the scheme) and upstream at Kilnap Bridge. In 2016 and 2017 further survey was carried out on the Glenamought River. A kingfisher nest was found present in an open faced steep muddy embankment upstream of Kilnap Business Park during historical surveys. The embankment containing the nest historically now appeared to have collapsed into the river as a result of flooding. No kingfisher activity was recorded in 2017 despite several walks up and down the river channel in early morning. The status of the species remains dubious as future prospects are considered poor following the discovery of a predated nest site downstream of Glenamought Bridge during September 2014 and no further records since that time.

No kingfisher records (i.e. sightings, feeding observations or nest sites) were obtained from the River Bride (North). The absence of multiple nesting sites can be explained by the lack of suitable bank sides for nest excavation along the rivers. Very little of the banks along the Glenamought were deemed suitable for nesting kingfisher and risk of predation was evident in the form of evidence of mink predation on existing nest sites. The failure to record kingfisher nests along the Bride (North) is reflective of no suitably composed or aligned bank in which to burrow and poor prey availability (the Bride (North) shows a low density of small fish which are preferred prey for Kingfisher).

##### Other bird species

The Glenamought River adjoining the Collins residence was considered a good feeding area for dipper *Cinclus cinclus* that were seen flying though this section of the river. Dipper feed on instream invertebrates that are attached to cobble and gravel being a characteristic riparian bird species of spate channel rivers such as the Glenamought. Dipper use the riparian corridor frequently at Woodpark and are often seen.

An active dipper nest was recorded in an existing culvert. The nest was attached to old pipes inside the culvert adjoining Millfield Industrial Estate. A second active dipper nest and one grey wagtail nest was observed in large crevices in walls of the culvert immediately downstream of Orchard Court.

Grey wagtail *Motacilla cineria* are frequently seen at Woodpark perched on instream rocks and woody debris.

No species listed on the Birds of Conservation Concern in Ireland (BoCCI) Red List were recorded during the field surveys.

### 5.3.3.2 Mammals

The study area was searched for signs of mammal activity with dedicated surveys undertaken for Otter (*Lutra lutra*) and Bats. Potential badger (*Meles meles*) habitat was recorded in the Riparian woodland at the Glenamought Storage Area but no signs were recorded within the study area for the lower Glenamought or the Bride (North) river channels. Other species that are likely to occur in the area but were not recorded include Fox (*Vulpes vulpes*), Rat (*Rattus norvegicus*), Stoat (*Mustela ermina*), European Hedgehog (*Erinaceus europaeus*), Pygmy Shrew (*Sorex minutus*), and Brown Hare (*Lepus europaeus*).

#### Otter

The entire length of the River Lee and its first order tributaries offers suitable habitat for Otter (*Lutra lutra*) with ample vegetation for cover along the river banks and likely good fishing within the river. The River Lee and its 1<sup>st</sup> order tributaries within the city environs are also known to support a population of foraging/commuting Otters. Overall Otter records were more localised or absent in the tributaries of the River Lee, i.e. the Bride (North) and Glenamought, than in the River Lee main channel. In 2014 and 2015 surveys two records in the form of spraints were recorded from the River Bride (North) at Kilnap Bridge and behind the Common's Inn on the N20 (see Figure 5.3). In 2017 surveys of the Glenamought river identified further signs of otter. Otter spraint was recorded at two locations just down stream of Glenamought Bridge (adjoining the area with exaggerated meanders). The presence of otter using this area is likely consequential of the good foraging habitat present. Due to disturbance from properties, dogs and people the habitat adjoining the Collins Residence is considered good for transient foraging but not for breeding or resting. An otter spraint was recorded on instream boulders at the location of the proposed structure C08\_L02 and C08\_L03. No otter records were seen again until Kilnap Viaduct. Otter spraint were recorded upstream of Kilnap Bridge near the area proposed for the trash screen installation on large instream boulders.

A walkover survey and subsequent Cameral Survey of Otter was carried out on the River Bride between late June and October 2016.

Otter activity was widespread across the Lower River Bride during the summer and early autumn of 2016. The survey area that was located between the North Point Business Park and the Heineken Brewery in Blackpool encountered numerous sprainting sites with 1 holt site and numerous couch sites. One area of special note was a 'dig site' where multiple otter latrines were located. This area of the River Bride immediately south of the West Link Business Park was situated in an area of marsh and willow trees where sand and mud accumulations provided digging substrata for otter. These areas have not been documented widely in the literature as very little is known about them. However, they appear to be used by more than one otter and have much higher densities of marking via latrines and associated spraints given evident accumulations of such otter signs concentrated at 'dig areas'. In association with the dig area two regularly used otter 'couches' or resting areas were identified, indicating that this area is frequently utilised by otter.

Further east (downstream) on the catchment (i.e. east of the Commons Inn), regular otter signs in the form of sprainting and resting areas were identified. The abundant scrub, dry meadow habitat and mature treelines that formed a habitat mosaic in this area provided excellent cover for otter coupled with good salmonid densities as observed from the shoals of fish seen in pools.

Further downstream of the North Point Business Park, through the Sunbeam area the channel of the Bride becomes channelized and held between retaining walls with limited riparian habitat. At the area of the River Bride immediately north and adjacent to the Millfield Industrial Estate two number culvert systems are situated where regular sprainting and otter activity was observed. The existing culverts have built in concrete ledges that provide important trackways for otter. Indeed, further downstream at Dunnes Stores two existing bridge culverts also have concreted ledges that are also regular otter sprainting sites. To the south of this area the river is to be culverted as far downstream as Orchard Court inclusive of the small open area at Blackpool Church. One couch area was identified under scrub adjoining domestic gardens north of Orchard Court with intermittent sprainting sites bordering the area to be culverted. The river in this area is heavily infested with Japanese Knotweed but remains a moderate quality salmonid holding area. In the last open section of the River Bride before it becomes extensively culverted in Blackpool, a known breeding holt exists. An otter couch was also present at the opening of the downstream connecting culvert system. This area has a very high density of brown rat that are known to be an important prey item of otter.

Camera traps were positioned at strategic locations. The frequency of triggers and the animal type responsible for the triggers are summarised on Table 3.1 below. The highest frequency of triggers for otter was captured at Camera 1 at the Millfield Industrial Estate. Here two sub adult otters were frequently utilising a couch site created by a debris dam under the culvert structure. They were identified as sub adults given their relative size comparable to adults captured on the river. These two otters regularly utilised this section of the river and areas upstream. Further downstream an adult male otter was detected frequently at Dunnes Stores.

Occasional triggers were detected in the Orchard Court area but these were animals on the move with no stationary triggers. Interestingly camera C5 in the culvert system immediately downstream of Orchard court (near Blackpool Church) did not detect any otter activity despite being situated for 12 weeks in the culvert while further downstream at the Heineken Brewery activity was much more heightened with a mother (Female adult) and sub adult otter frequenting this area particularly late in the season. These animals did not appear to venture upstream and moved between the culvert system adjoining the River Lee to the River Bride (refer to camera C8). It is thought that these animals are not crossing into the territory of other otters living upstream (i.e. Orchard Court and further upstream).

The area of the Brewery had a very high density of brown rat and this likely accounted for the mother and sub adult otter foraging in this area given the heavily polluted water at this point with no evident fish stocks. It is likely that the mother otter and sub-adult otter utilise the River Lee as their main habitat given the short area of foraging habitat that they were detected in near the Heineken Brewery. This was considered given the absence of camera triggers in the upstream culverted area near Blackpool Church (i.e. camera C5). It would seem probable that these otters may move between the Lee and the River Bride given their detection in the culvert network connecting the Lee and the River Bride (i.e. last 800m where extensive culverting exists).

**Table 5.5 – Holt Survey Records from trail camera surveillance**

Camera Numbers	Area	Number of Camera Triggers	Animal Detected (number of triggers in parenthesis)
Camera 1	Culvert, Millfield Industrial Estate	56	Otter (31); Dipper (5); Grey Wagtail (1); Rat (8); Mouse (11)
Camera 2	Dunnes Stores, Culvert	27	Otter (21); Rat (1); Heron (5)
Camera 3	Orchard Court	14	Otter (5); Mouse (3); Domestic Cat (6)
Camera 4	Orchard Court	6	Otter (6)
Camera 5	Culvert south of Orchard Court	>80	Mallard (30); Rat (>50)
Camera 6	Culvert Heineken Brewery	>100	Otter (18), Rat (>100), Domestic Cat (11)

A walkover survey of the Bride and Glenamought was carried out in April 2018 to inform any derogation licence required as part of the proposed Drainage Scheme. The survey confirmed previous works with a high-level activity throughout, a number of spraints, couches and latrines were identified and a potential holt site in the river culvert at the Heineken Brewery with latrine and spraints identified to the south.

### Bats

During the walkover survey, potential habitat for foraging bats was recorded at the following locations: in Blackpool along the Bride (North) at Orchard Court and Common's Road, along the Glenamought River. No potential roosting habitat was identified.

### 5.3.3.3 Fish

A number of fisheries surveys were undertaken on the River Lee and several of its tributaries, to assess the overall fisheries habitat value in the lower River Lee and selected tributaries (i.e. Bride (North) and Glenamought Rivers), particularly in relation to Annex II lamprey and salmonid species. (Appendix 5B).

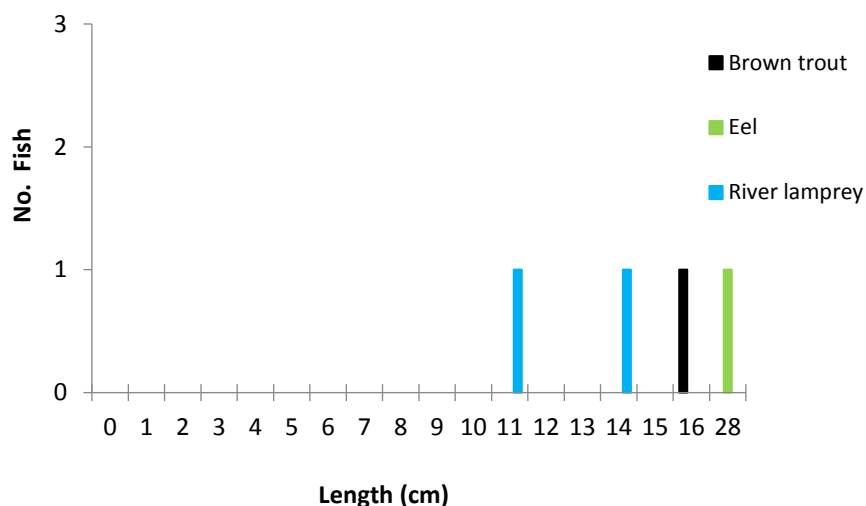
Electro-fishing surveys of the existing fish stocks at selected sites on the Bride (North) ( $n=3$ ) and Glenamought ( $n=1$ ), the results of the surveys outlined below.

#### River Bride (North) – u/s N20 culvert (site B1)

A low diversity and abundance of fish species was recorded from the River Bride (North) site upstream of the N20 culvert (overpass), with River lamprey transformers ( $n=2$ ) and single examples of Brown trout and

European eel captured from a low-flow site choked with *Apium nodiflorum* (>90% cover). A length-frequency plot for each species recorded is presented in Figure 5.3.

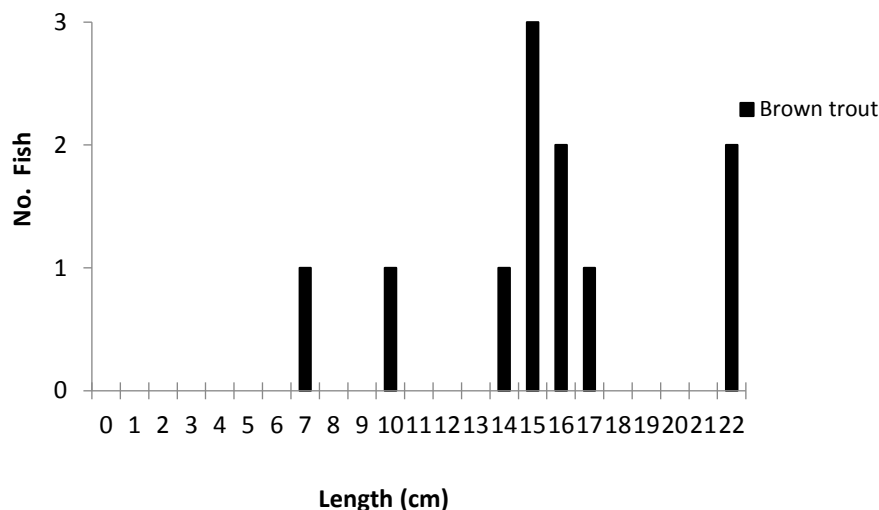
**Fig 5.3: Length-frequency distribution plot for all fish species recorded at River Bride (North) – u/s N20 culvert (site B1) September 2014**



#### **River Bride (North) – Commons Inn (site B2)**

The Bride (North) on the Commons Road becomes increasingly encroached by industrial development. However it maintains a semi-natural channel and the better quality water from upstream is likely to in maintaining some salmonid habitat. The Bride (North) site in the vicinity of the Commons Inn was found to hold a single species only, namely Brown trout ( $n=11$ ). A length-frequency plot for the Brown trout recorded is presented in Figure 5.4.

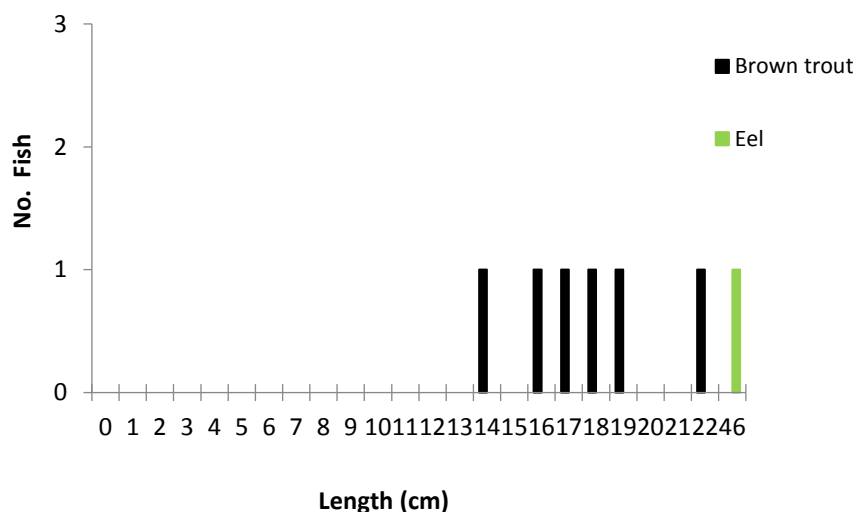
**Fig. 5.4: Length-frequency distribution plot for all fish species recorded at River Bride (North) Commons Inn (site B2) September 2014**



**River Bride (North) – Orchard Court, Blackpool (site B3)**

Similar to the other surveyed sites on the Bride (North) at Orchard Court contained a low fish diversity. In this area the Bride (North) forms its last natural area of habitat before being heavily culverted in Blackpool. Brown trout were, again, the dominant species, although their abundance was relatively low ( $n=6$ ). A single large European eel was also recorded. A length-frequency plot for both species recorded is presented in Figure 5.5.

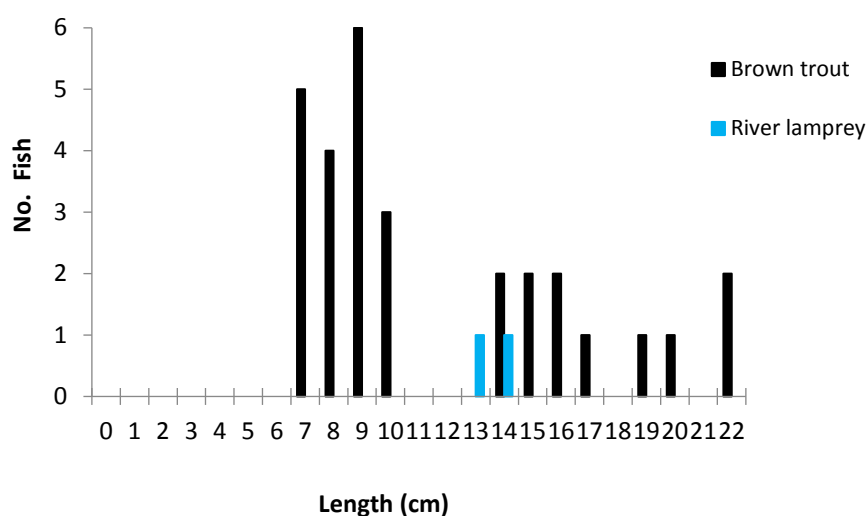
**Fig 5.5: Length-frequency distribution plot for all fish species recorded at River Bride (North) – Orchard Court (site B3) September 2014**



### Glenamought River – d/s Viaduct (site GL1)

Two species were recorded from the single surveyed site on the Glenamought River, a tributary of the River Bride (North). Brown trout were abundant at the site ( $n=31$ ) and a wide range of size classes was present in the section characterised by a clean cobble substrate, riffle/glide system and a relatively high flow rate. Two River lamprey transformers were also recorded, indicating suitable lamprey spawning habitat upstream of the site. A length-frequency plot for both species recorded is presented in Figure 5.6.

**Fig 5.6: Length-frequency distribution plot for all fish species recorded at Glenamought River – d/s Viaduct (site B4) September 2014**



### Glenamought River 2017

Surveys carried out in 2017 identified the Glenamought River downstream of Glenamought Bridge where the exaggerated meanders are visible to have some of the best brown trout *Salmo trutta* holding habitat (considered very good) and adjoining very deep pool habitat harbours shoals of adult trout.

The Glenamought River at Woodpark comprised very clean riverine cobble and gravels and was considered a very good brown trout nursery despite extensive gabion basket placement to contain the channel downstream of the Kilnap viaduct, in addition to localised concrete retaining walls. An impassable weir structure was also present downstream of the residential property at Woodpark and likely restricts the movement of fish upstream. However, anadromous Atlantic salmon *Salmo salar* and European eel *Anguilla anguilla* are not known from the Glenamought River, likely as a result of the extensive and likely impassable culvert network downstream of Blackpool.

Very good trout habitat existed in the Glenamought River adjoining the Glenamought Bridge area and continued downstream to the nearby Kilnap viaduct. This area of the middle Glenamought had not been significantly altered in the vicinity of the viaduct or from water pollution sources. Consequentially, relatively clean sandstone boulder, cobbles and river gravels exist with more localised pockets of sand and silt (30% boulder, 30% cobble, 20% coarse and medium gravels, 10% sand/ silt). The Glenamought River had an excellent river profile for a peri-urban river habitat containing 30% pool and 30% riffle and 40% glide. These characteristics made the river a good trout holding and spawning habitat and an even better nursery (considered very good). Juvenile trout were observed in all of the pool habitat in the Kilnap area. The

Glenamought in the Kilnap area may be considered as very important for the contribution of juvenile salmonids to parts of the catchment downstream where pollution from surface water drains and locally open sewers is contributing to a decline in viable spawning habitat. Despite historical gabion basket installations downstream of Kilnap Viaduct, the river retained very good trout nursery characteristics, with clean fast flowing water and ample glide and riffle habitat, broken up by abundant instream cobble and localised boulder.

The Glenamought River north of the North Point Business Park is a very good salmonid nursery and also contains lamprey in adjoining riverine silt and sand. Despite evident historical straightening and bankside works (i.e. retaining wall of right hand bank facing d/s and straightened channel), very good numbers of salmonids were recorded here during historical electro-fishing surveys. The river contained moderately clean spawning gravels and localised *Ranunculus* stands instream.

### 5.3.4 Significance of Fauna

River Lamprey, listed on Annex II of the EU Habitats Directive was recorded in low numbers in both the River Bride (North) and the Glenamought River.

Brown Trout was the most frequently recorded species throughout the Bride (North) and the Glenamought River. Although Brown Trout has no legal protection, it is an important indicator of the ecological status of stream health and remains important in an overall biodiversity, conservation and management context. Removal of Brown trout has consequences for a stream meeting 'good status' under the Water Framework Directive (2000/60/EC).

European eel was recorded in the Bride (North) in low numbers. European eel is critically endangered and has protective status under the European Eel Regulation EC No. 1100/2007 to facilitate the recovery of the eel stocks since a large decline in the 1980's.

In addition, the river and surrounding vegetation provide habitat for two further species that are protected under European legislation. These are Otter (Annex II, Habitats Directive) and Kingfisher (Annex I, Birds Directive). Kingfisher was historically recorded on the Glenamought River, whereas Otter was recorded along both the Glenamought River and the Bride (North).

No evidence of Freshwater Pearl Mussel (Annex II, Habitats Directive) was recorded during the walkover surveys.

All bat species are protected under Annex IV of the EU Habitats Directive and are likely to use the area for foraging.

In addition to the above species, most of which are protected under European Legislation, the study area includes a wide diversity of aquatic and terrestrial habitats. The rivers provide suitable habitat for a range of aquatic species. The woodlands, tree lines and bank side vegetation provide cover and feeding areas for a wide range of mammal and birds.

## 5.4 IMPACTS AND MITIGATION MEASURES

### 5.4.1 Do nothing Scenario

In a do-nothing scenario it is likely that the current regime of management and maintenance on the river would continue with the nature of the river being maintained essentially as it is. It is likely that maintenance works would include the removal of debris and build-up of sediments in the town and around the bridges,

along with bank protection works where necessary. It is likely that these works would be undertaken in consultation with the IFI to minimise impacts on fisheries.

## 5.4.2 Impact on Loss of Habitat

### Slight to Moderate Negative Impact

#### 5.4.2.1 Instream Habitats

The construction phase will involve works in channel and along the banks of the Bride (North), the Glen and the River Glenamought.

Temporary and permanent loss of instream habitat will result during construction of the works. In general, the study area is of poor quality habitat although occasionally floating river vegetation is present (primarily adjacent Commons Road in small and fragmented sections and the Glenamought). The floating river vegetation is poor in quality and quantity and is considered important not for its links to the Annexed I Habitat namely 'water courses of plain to montane levels with the *Ranunculion fluitantis* and *Callitricho-Batrachion* vegetation' but as a habitat for resting and feeding brown trout.

There will be some loss of this habitat during construction of instream structures: culverts, bridges, winter channel and sediment traps. Construction of bridges will require flow diversions to allow for pier construction. However, flow will be maintained at all times on one side of the river. Post construction river bed gravels will be reinstated at all bridge locations and any floating river vegetation will have opportunity to recover post construction.

Approximately 506m of culverts are proposed at 5 locations throughout the scheme. A 342m long section of reinforced concrete culvert downstream of Blackpool Bypass at Orchard Court and terminating under Old Commons Road to the north of the church is the most significant of these structures which will result in the loss of habitat during construction and in the long term. Additional habitat will be impacted as a result of the construction for 4 other culverts (See Chapter 3 for full details of proposed scheme). For all culverts there will be a requirement for flow diversions or over pumping. There will be limited loss of floating river vegetation habitat during construction of all culverts, with the most significant loss at the Orchard Court Culvert.

A roughing screening is proposed upstream of Kilnap Bridge and a Sediment Trap is proposed at the upstream end of the Sunbeam Industrial Estate.

The sediment controls at Sunbeam will capture fluvial sediments (primarily small cobble sized material), help minimise the risk of large sediments settling downstream and within the Blackpool culvert system. This will affect the hydromorphology of the river by reducing sedimentation.

In addition to the above features, removal of sediment from the river channel will form a key part of the sediment management regime.

Floating River Vegetation will not be directly impacted on the Glenamought River and is generally limited in extent, of poor quality and does not correspond to Annex 1 habitat on the River Bride. However the vegetation provides important shading and protection for brown trout. Impacts are slight negative on this habitat type.

Downstream of the Sunbeam Sediment Trap a 70m long culvert will be removed as part of the scheme. The removal of this culvert will afford the opportunity of new habitats to form in this area. This opportunity is

limited however due to changes in hydromorphology from the upstream sediment trap and the proposed maintenance regime.

Construction of a Winter Channel is proposed on the Bride (North) where sharp bends contribute to elevated flood levels occurring along the Commons Road (N20). A winter channel will help with high flows by cutting a secondary flow route into the existing bank. In normal flow conditions the river will be confined to the main channel and the winter channel will be used only during periods of high flow. The existing main channel (low flow channel) will remain unaltered. There will be no permanent impact on the existing low flow channel with regard to habitats in this location.

Impacts may also arise as a result of silt release and pollution incidents during construction and during routine maintenance which could adversely impact on the river and its habitats, this could result in temporary decline in water quality, increased turbidity, fine sediment redistribution and nutrient enrichment.

The impact on habitats is considered **slight-moderate negative** due to both permanent and temporary loss of floating river vegetation habitat during construction and risk of habitat loss due to sediment and pollution events. Upon completion of works aquatic flora affected by the construction phase impacts will recolonise from upstream sources. Gravel beds will be reinstated at the locations of all four bridges and smaller culverts. There will be a permanent loss of habitat for approximately 342m. Sediment traps and roughing screens will result in reduced sediment and gravel availability resulting in changes to the morphology of the river channel downstream. There will be a potentially positive impact on habitat as a result of the removal of 70m of culvert and regrading of river bed at Sunbeam.

#### 5.4.2.2 Terrestrial Habitat

Terrestrial works are largely confined to the Bride (North), Glen and Glenamought River banks and adjoining areas as well as temporary construction compounds and access routes. Amenity grassland (local importance (lower level) conservation interest) is common along the Glenamought River and the Bride (North) with occasional mature trees lines of Local (higher) level Importance conservation interest. A small area of mixed broadleaved woodland will be lost as a result of the construction of the winter channel (Local (higher) level Importance) while small areas of scrub (Local (higher) level) will also be lost.

Japanese knotweed is frequent along the length of the Bride (North) and within the footprint of the works. The majority of works proposed are located on artificial surfaces with occasional strips of grassy verge. A loss of treelines, woodland and scrub is considered to be the most significant impact on terrestrial habitat resulting in a **slight negative** permanent Impact.

#### 5.4.2.3 Mitigation Measures

- A Project Ecologist will be appointed for the duration of the works.
- The footprint of works will be identified at the onset and will be demarcated to avoid unnecessary disturbance to habitats outside the works area. Method Statements detailing the construction footprint and access routes to the proposed works will be approved prior to construction.
- Upon completion of the works channel vegetation will be allowed to recolonise naturally.
- Introduce spawning gravels at morphologically/hydraulically appropriate locations i.e. where removal of culvert is proposed

- Upon completion of the works the new embankment, and in any other grassland areas disturbed during the construction works, will be re-sown with an appropriate species rich grass and wildflower seed mix.
- Hedgerow/tree line planting will be undertaken to replace the length of hedgerow/treeline lost to accommodate the new flood embankment. Hedgerows will be replanted as close to the existing alignment and location as possible and will use native, locally sourced species.
- Works will only be undertaken during normal working hours (8:00am – 6:00pm).
- All works undertaken on the banks will be fully consolidated to prevent scour and run off of silt. Consolidation may include use of protective and biodegradable matting (coirmesh) on the banks and also the sowing of grass seed on bare soil.
- Appropriate mitigation measures will be implemented prior to the construction phase to ensure that water quality is not adversely affected through pollution incidents and silt mobilisation. This mitigation will include:
  - All material including oils, solvents and paints will be stored within temporary bunded areas or dedicated bunded containers;
  - Where possible refuelling will take place in a designated bunded area away from surface water gullies, drains and water bodies, in the event of refuelling outside of this area, fuel will be transported in a mobile double skinned tank;
  - All machinery and plant used will be regularly maintained and serviced and will comply with appropriate standards to ensure that leakage of diesel, oil and lubricants is prevented.
  - Spill kits and hydrocarbon absorbent packs will be available and drip trays will be used during refuelling;
  - All relevant personnel will be fully trained in the use of this equipment;
  - Where soil/made ground and subsoil stripping occur, the resulting excavated soil fractions will be segregated into inert, non-hazardous and /or hazardous fractions (in accordance with Council Decision 2003/33/EC, the EPA water classification criteria at certain licensed landfills in Ireland);
  - The excavation and handling of inert material will be carefully managed in such a way as to prevent any potential negative impact on the receiving water environment;
  - Where possible the excavated spoil would not be stored beyond the working day, however in the event that this is not practical appropriate precautions in relation to the material will be taken. These precautions will include appropriate storage and covering;
  - All associated hazardous construction waste will be stored within temporary bunded storage areas prior to removal by an appropriate EPA or Local Authority approved waste management contractor;
  - The guidelines provided by the Department of the Marine and Natural Resources, with respect to concrete wash waters, CIRIA, the UK Environment Agency and Environment and Heritage Service, the UK Department of the Environment and Inland Fisheries Ireland will be

adhered to in order to ensure that there is a neutral impact on the water environment during the construction phase of the proposed development.

- All cofferdams, or other structure installed within the river channel, to allow working in dry conditions must be designed by a competent person, be constructed of appropriate materials and take account of site conditions (i.e. depth of water, available space, bed substrate, flow velocities, flow patterns, duration of works, accessibility and potential ingress of water). During any working with cofferdams the following will be adhered to:
  - The cofferdam will be inspected daily for any movement, leakage and general deterioration; any defects found will be remedied immediately.
  - The working area will not be de-watered directly into the river; the removed water must receive treatment before discharge.
  - Before removal of the cofferdam at completion of the works all materials, debris, tools, plant and equipment will be removed from the work area and any potential sources of pollution/contamination within the cofferdam will be cleaned up.
  - The de-watered area will be re-watered before the cofferdam is removed to avoid the sudden ingress of water which may cause erosion of the replaced substrate.
  - When re-watering is undertaken, the pump inlets will be screened appropriately to prevent the intake of fish or other aquatic animals.
- During all works the weather forecast will be monitored and a contingency plan developed to prevent damage or pollution during extreme weather and high flow events.

#### **5.4.2.4 Residual Impact**

##### **Permanent Slight – Moderate Negative Impact**

The proposed mitigation will ensure that habitat diversity is maintained as much as possible within the channel and adjoining terrestrial habitat, however there is unavoidable loss of habitats of conservation interest namely floating river vegetation. While a permanent loss of habitat is anticipated, the quality and quantity is low. The residual impact is therefore remains as Permanent Slight- Moderate Negative Impact.

#### **5.4.3 Impact on Floral Species**

##### **Permanent Slight Negative Impact**

No protected flora, rare or flora of conservation interest have been identified within the study area, therefore impact on flora is considered negligible.

##### **5.4.3.1 Invasive Species**

Construction activities in areas infested with non-native invasive species have the potential result in their spread to locations previously un-infested. The Japanese Knotweed stands recorded on the Glenamought River and in several locations along the Bride (North) within the footprint of the works. Consequently, this species could be spread should appropriate measures not be followed; this could have a negative impact, if the plant is transferred to a habitat of high ecological value.

### 5.4.3.2 Mitigation

- A survey will be carried out to map the extent of invasive species and an Invasive Species Management Plan will be put in place prior to commencement of construction.
- An eradication programme will be put in place which will also prevent spread during construction.
- Treatment / monitoring will be carried out for a minimum of 3 years.
- Treatment will be carried out by a suitably qualified person and will involve the use of herbicides approved for working in proximity to an aquatic environment.
- A bio-security protocol will be put in place during the construction phase of the development. This will ensure that all plant machinery and equipment will be thoroughly cleaned and inspected for any fragments of knotweed prior to leaving site.
- All construction staff will receive training in the identification and management of the invasive species, including identification of knotweed rhizomes, to verify the clearance of any area.

### 5.4.3.3 Residual Impact

#### Permanent Neutral Impact

With proper mitigation in place for the control and eradication of Japanese knotweed in place, there is a significantly reduced risk of spread of the plant to sensitive environments and there will be eradication of Japanese Knotweed locally. The impact on flora is therefore reclassified as Permanent Neutral Impact.

### 5.4.4 Impact on Fauna

#### Terrestrial Animals

#### Permanent Very Significant Negative Impact

There will be a potential impact on mammals and birds as a result of the proposal and during the construction phase in particular otter and birds.

#### 5.4.4.1 Otter

Otter are known to forage along the Bride (North) and Glenamought River. Spraints were identified in in the Glenamought River, in the vicinity of Kilnap Bridge and at Commons Inn, Millfield Industrial Estate, Dunnes Stores and the Heineken Brewery. Survey suggest that there may be two or more groups of otter utilising the Rivers. Camera Survey suggest that there is some partition between the otter using the river (i.e. upper groups between Orchard Court and the West Link Business Park and a lower group (i.e. between Heineken Brewery and the River Lee).

According to the Ecological Guidance for Local Authorities & Developers, Scott Cawley (2013) key threats to otter as a result of development include the following:

- Loss of and damage to bankside, coastal and in-stream habitats causing loss of shelter and holt sites by drainage, removal of wet areas, removal of vegetation or landscape features and pollution of waterbodies.
- Fragmentation of commuting routes between feeding areas caused by bridge works, roads, weirs and culverts.
- Loss of feeding areas caused by infilling of wetlands or depreciation of water quality.

- Effects of lighting, noise, vibration and human activity during construction and operation near areas used by otter

Specifically, impacts relating to the proposals in the River Bride include disturbance and the removal of habitat. Disturbance relates to both the operational and construction phases of the development. This include large machinery disturbance during site clearance and the build phases. Works will be largely carried out during daylight hours thus minimising disturbance to nocturnal feeding activity. There will be no direct loss of holts as part of the proposed scheme.

Culverting of watercourse (including existing reconstruction and new culverts), introduction of sediment traps and other hard engineering will result in the loss of habitat and consequently the loss of prey items for otters. Given the limited prey availability currently found on the Bride (North) and the extensive territory covered by otters the impact on otters is considered as a Very Significant Negative impact to the local population in the absence of mitigation.

#### 5.4.4.2 Otter Mitigation

- See also mitigation measures for protection of habitats (Section 5.4.2)
- Night-time working be restricted to emergency works only.
- To minimise the potential for Otters becoming trapped, all excavations will be left open for the minimum possible time, and not over-night. If excavations have to be left open over-night they will either be covered securely or fitted with an escape ramp (no more than 45°) to allow accidentally trapped animals to escape. Materials to cover excavations or create escape ramps will be on site at all times so that all excavation areas can be made safe before leaving site.
- In order to compensate for loss of habitat it is proposed to provide artificial holts along the length of the scheme which will enhance suitable habitat available.
  - The artificial holt construction will follow the wooden box type design as utilized by IRD Duhallow given the successful evidence of usage (IRD Duhallow, 2015). The holt design used was that described by the Sussex Otters & Rivers Project.
  - Suitable locations for perspective holts have been identified on the north bank of the River Bride. Much of the south bank is readily accessible by dogs and people making it less suitable. The identified areas offer seclusion, have adjoining scrub, treelines and grassy embankment areas, are not readily accessible by the public and are above typical flood levels. Due to the sensitive nature of otter holts and their need for minimal disturbance the locations have not been identified within this report. In total 3 areas have been identified for the provision of artificial holts.
  - The design of the holt areas will be overseen by an ecologist with significant experience of an Ecological Clerk of Works role and otter ecology. The tailoring of the holt construction will be conducive to maximizing the naturalness and attractiveness of the constructed holts to otter.
  - Monitoring of the success of the holt construction in terms of otter utilization of the newly constructed habitat is essential to evaluate success of the compensatory habitat. This could be achieved by using remote trail cameras overtime. The detailed design of the otter holt constructions inclusive of their final positioning should be agreed in conjunction with the NPWS.

- Otter Ledges will be provided within all culvert designs. The otter ledge will traverse the entire length of the new proposed culverted areas and will follow the specifications of the National Roads Authority Guidance in relation to otters (NRA, 2008). Most significantly, otter ledge will extend from the upstream end of Orchard Court to Maddens junction on Watercourse Road. The ledge will tie into the adjoining riverbanks and will be screened with trees to provide seclusion for otter entering and exiting the culvert network. (See Appendix 5E).
- The detailed design of the tie in areas will be undertaken in conjunction with an ecologist with knowledge of otter usage of the area. Furthermore, the detailed design of the final ledge layouts should be agreed in conjunction with the NPWS.
- Light wells will be provided within the culvert at intervals to provide limited natural light within the culvert and to provide as natural a condition as possible.

#### 5.4.4.3 Kingfisher

No nesting kingfisher were found in proximity to the works. Foraging kingfisher were observed in proximity to the works at Glenamought River during early surveys, however these birds were no longer present in 2017 survey periods. In any case these birds are unlikely to be significantly disturbed during construction. Works at the Glenamought River consist of the construction of a roughing screen, flood defence embankments and walls, access road improvement works, and two bridge replacements. Potential impacts are limited to disturbance to foraging habits, loss of instream foraging habitat or impact on water quality and therefore prey item impacts. Given recent survey results disturbance to breeding sites is not considered significant.

In the absence of mitigation impacts on Kingfisher are considered Slight Negative/ Neutral Impact.

#### 5.4.4.4 Other Birds

The impact of the proposed works on the overwintering water bird population which Cork Harbour supports is discussed as part of the Screening for Appropriate Assessment. This section considers impacts on the wider bird population within the study area, including breeding bird populations and non-waterbird populations in winter. By the nature of the construction works involved in this scheme, a degree of disturbance to birds present in the vicinity of the works areas is inevitable. The magnitude of this impact, however, depends on a number of characteristics of the works, including:

- The timing of the construction activities
- The level of disturbance, both spatially and temporally
- The availability of equivalent habitats outside of the influence of disturbance to accommodate displaced birds.

The works proposed in this scheme will be conducted in relatively localised areas where levels of disturbance are already relatively high as result of its urban location. This, in combination with the substantial amounts of similar habitats outside the likely zone of influence, should minimise the potential for long-term population impacts from disturbance throughout the construction phases.

The removal of vegetation, hedgerows, treelines and woodland required prior to construction has the potential to impact on nesting birds as does works to bridges and culverts where nesting dippers and wagtails are known to nest. Impact on nesting birds in the absence of mitigation is Significant Negative Impact.

#### 5.4.4.5 Birds Mitigation

- See also mitigation measures for protection of habitats (Section 5.4.2)
- All vegetation clearance works and site preparatory works will be conducted outside of the bird nesting season (March to September inclusive). If this is not possible, a breeding bird survey will be undertaken in advance of the works to ensure that there will be no impacts on nesting birds. If nests are found, they will be safeguarded, with an appropriate buffer, until the chicks have successfully fledged. Particular regard will be had for nesting dippers and wagtails that are currently known to use the system.
- Artificial Nesting boxes will be provided for dipper and wagtail to replace any lost habitat;
- Hedgerow /treeline planting will be undertaken to replace the length of hedgerow/treeline lost. Hedgerows/treeline will be replanted as close to the existing alignment and location as possible and will use native, locally sourced species appropriate to the locality.

#### 5.4.4.6 Bats

Bats are not expected to use the study area in significant numbers. However, it is expected that bats would be found in low densities in the Blackpool area and Glenamought. There are no potential bats roosts in existing bridge or culvert structure along the Bride (North) and Glenamought River. There is no bat roosting potential along the existing flood protection walls in Blackpool. There is potential roosting opportunity for bats in mature trees along the length of the scheme although none were identified as part of the survey. There is potential impact for loss of bats roosting in mature trees as a result of the scheme. In addition, all treelines, woodland and scrub is likely to provide commuting or foraging habitat for bats. The potential impact of site clearance on bats is considered slight negative.

#### 5.4.4.7 Bats Mitigation

- See also mitigation measures for protection of habitats (Section 5.4.2)
- Outside of emergency works, there will be no night working during the construction phase.
- Any new lighting required as part of the project will be of as low a wattage as possible and will be directed away from the surface of the water.
- Prior to the commencement of site clearance, tree surveys will be carried out on trees identified as potential for bat roosts. If roosts are found or their potential cannot be ruled out, an appropriate mitigation strategy will need to be devised and a derogation licence will need applied from NPWS.
- Removal of trees with bat roost potential will be carried out in September/ October and under the supervision of a bat ecologist.
- A Bat box scheme will be put in place to mitigate for loss of trees and suitable foraging habitat for bats. Approximately 4 bat boxes will be provided for on stone walls faces or mature trees (as deemed appropriate). Bat boxes will be woodcrete bat boxes such as those manufactured by Schwelger and will be put in place as per the recommendations identified in NPWS Irish Wildlife Manual (2006) Bat Mitigation Guidelines for Ireland.

#### 5.4.4.8 Residual Impacts on Terrestrial Fauna

##### Permanent Moderate / Significant Negative impact

With mitigation measures in place there is no significant risk to bats, birds, or other mammal populations (excluding otters) within the study area. Loss of foraging habitat and prey species will result in some loss of terrestrial species using the area. During construction, there will be temporary disturbance to dipper and wagtail nesting habitat where they currently use culverts/bridges and seasonal restrictions to the works may apply. In the long term and the impact is considered moderate.

However, there is a significant level of otter activity within the study area. Therefore, there is potential for loss of foraging habitat for otter. The introduction of a new culvert at Blackpool has the potential to result in increased risk of severance of this species from the River Lee and the River Bride (although it is considered that the two-populations identified on the Bride may not cross over). This extension of culverted river may result in reduced success of otters in an already urbanised system. Mitigation in the form of artificial holts, ledges and fisheries enhancement will minimise as much as possible the impact on otters. The residual impact on Otters is considered Significant.

#### 5.4.5 Impact on Fisheries

##### Permanent Significant Negative Impact

The habitat suitability and water quality is generally poor along the River Bride (North) for fish species. However Brown trout nursery and holding habitat is generally good to moderate although spawning substrata has been degraded due to siltation. Brown trout are the most common fish found here in relatively low abundance with occasional lamprey and eel. The most significant populations of Brown trout is within the Glenamought both upstream and downstream of the viaduct where trout are abundant. Salmon are not known in the Bride (North) as their movement is significantly impeded by the culverting of the lower Bride (North) from Watercourse Road to its outfall to the River Lee.

During construction phase works will be required within the channel for bridge replacement and culvert construction, culvert removal and construction of sediment traps and winter channels. These works can potentially result in disturbance including noise, visual and vibrations which would displace fish from the works area and result in a temporary impediment to fish passage along the Bride (North) and Glenamought rivers. There is also potential for direct fish mortalities as a result of in-channel works, though entrapment over pumping etc. for stream diversions during works. Should in channel works be carried out during spawning then the impact may be particularly severe and while any disturbance impact will be temporary it can potentially result in reduction in spawning success and result in loss of a year class. The magnitude of the impacts due to construction activities is considered to be low resulting in a minor negative impact.

In addition to disturbance impacts, the construction works may directly impact upon fish habitats within the river, including areas identified as potential spawning habitat. In particular there is risk to habitat on the lower reaches of the Glenamought River where two bridges will be constructed. All other in channel works are located outside of those are identified as good fisheries habitat. The majority of instream works will be concentrated at the River Bride (North) which is identified as being of poor fisheries quality.

Instream works on the Bride (North) will have a significant impact on brown trout during the construction and operational phase (albeit in low numbers). Construction of 503m length of culvert (both new and existing rehabilitation) will result in the permanent loss of habitat at these locations.

A Sediment Trap is proposed on the upstream end of the Sunbeam Industrial Estate. The sediment controls at Sunbeam will capture fluvial sediments (primarily small cobble sized material) and help minimise the risk of large sediments settling downstream and within the Blackpool culvert system. This will affect the hydromorphology of the river by reducing sedimentation. In addition to the above features, removal of sediment from the river channel will form a key part of the sediment management regime.

The sediment control will affect the hydromorphology of the river most significantly between the sediment trap and the existing culvert at Old Commons Road, limiting sediment deposition over a distance of approximately 1 km incorporating culverts and open channel. The currently engineered existing river channel through Blackpool Retail Park currently displays patterns of natural sedimentation, with typically 40% riffle, 40% glide and 20% pool. The river has moderate nursery habitat and moderate spawning habitat. The riverbed at this location suffers from moderate siltation. The changes to morphology of the river bed has therefore the potential to result in a Permanent significant negative impact on fisheries.

To the north of Sunbeam Industrial Estate, the proposed removal of a 70m long culvert and instream rehabilitation works will be carried out. The removal of this works will result in a positive impact for fisheries locally.

A very low density of lamprey transformers has been identified within the study area given the significant impact of existing culverting of the Bride (North) between the River Lee and Watercourse Road. However, the presence of River Lamprey demonstrates that unlike salmon they can bypass the Blackpool culvert which under low flow conditions is very shallow. There will be loss of habitat, as a result of the works, on lamprey, in addition the provision of a newly culverted section of the river at Old Commons Road will potentially result in the River Bride (North) becoming impassable by lamprey.

As for Lamprey, European eel have been found in very low densities along the Bride (North). This is due to significant impediments of movement of migratory fish in the extensively culverted sections of the river. There will be an extension to the sterilisation of these habitats with the extension of culverting of the Bride (North) potentially resulting in the Permanent exclusion of European eel to the River Bride (North).

Construction impacts may also arise on the fish populations through silt mobilisation and pollution incidents which could impact upon water quality, turbidity levels and could also result in the smothering of spawning gravels. Declines in water quality and the smothering of spawning gravels could potentially impact upon the ability of fish populations to survive within the river over the short to medium term.

The impact of the works on fisheries overall is a **Permanent Significant Negative Impact**.

#### 5.4.5.1 Fisheries Mitigation

- See also Fisheries Enhancement Proposals – North Bride in Appendix 5E of this EIAR.
- See also mitigation measures for protection of habitats (Section 5.4.2).
- All works will be carried out in consultation with Inland Fisheries Ireland, in particular the design of a sediment trap upstream of Commons Inn Hotel (if required) will be designed in consultation with IFI.
- In channel working will be minimised, where possible, method statements will identify access routes and works areas prior to commencement in consultation with the Project Ecologist.
- In-channel working during the salmonid spawning season will not be permitted (November to March inclusive).

- During the construction phase, fish passage will be maintained in areas of in-channel working.
- Any pumps used for over-pumping must be 'fish-friendly' and fitted with appropriate screens.
- Avoid working in areas identified as being suitable for fish spawning, where practicable.
- The removal of the culvert near Sunbeam will include the regrading of the river to ensure removal of the existing weirs.
- Works will introduce spawning gravels upstream of Sunbeam Industrial Estate where culvert is to be removed (assuming morphologically/hydraulically conditions are appropriate).
- The winter channel will be constructed as such that there is no risk of fish being retained in the channel as flood water subsides. This will be ensured out by appropriate grading of the channel.
- Ensure that the proposed trash screens have an appropriate mesh size to allow for movement of salmonid species and that culverts and trash screen are designed and installed in line with published best practice (e.g. Armstrong et al 2010; Turnpenny & O'Keefe 2005).
- Compensation measures for permanent loss of riverine habitat will be carried out in agreement with Inland Fisheries Ireland. Enhancement measures have been identified for the Bride and the recommendation of O'Grady (2016) *Draft Fisheries Enhancement Proposals* will be carried out as part of the scheme. The proposal includes rehabilitation of the River Bride immediately downstream of McDonalds to the location of the proposed trash screen adjacent to Blackpool Shopping Centre. It is the opinion of the author (O'Grady that the works will significantly improve the rivers capacity to support a brown trout population and the net gain in fish stock terms will more than offset the permanent loss caused by culverting in the lower reaches of the proposed drainage scheme.

#### 5.4.5.2 Residual Impact

##### Permanent Significant Negative Impact

Mitigation measures will minimise the impact on fisheries from the construction phase, however the permanent loss of habitat cannot be mitigated in the context of this assessment. While compensatory measures will be carried out in agreement with IFI with regard to salmonid habitat, impact on Fisheries within the Bride (North) catchment remains a Permanent Significant Negative Impact.

## 5.5 ASSESSMENT OF CUMULATIVE IMPACTS

A search in relation to plans and projects that may have the potential to result in cumulative impact on the environment was carried out as part of the EIAR. Data sources included the following:

- Cork County Development Plan 2014
- Cork City Development Plan 2015
- Relevant Local Area Plans
- South Western River Basin Management Plan
- Lee CFRAMS including the Lower Lee Flood Relief Scheme
- An Bord Pleanála Website (Planning Searches)
- Myplan.ie
- Web search for major infrastructure projects in Cork City and County

A synopsis of the search results is provided in Table 5.6. In addition to the plans and projects listed in Table 5.6 a number of small scale development of dwelling house/extensions were identified from the wider area

surrounding the proposed flood relief scheme. Given their small size and scale and their location on existing residential and made ground the potential for cumulative impact is not considered significant and therefore not considered further in this assessment.

**Table 5.6 Potential Impact in combination with other Plans and Projects**

Plans and Projects	Description and Key Issues / Policies/ Objectives Related to the zone of influence	Potential impact on Biodiversity	In-combination Impact
Existing activities: discharges and agricultural practices upstream.	Risk to water quality, Glenamought River has an unpolluted, good status water quality (Q4) while the River Bride has moderate status of slightly polluted water where urban encroachment and storm drain sources of pollution are evident.	Water quality impacts are resultant of agricultural practices upstream and the existing discharges into the Rivers Glenamought and Bride (North).	None  The proposed Drainage scheme does not increase the risk of nutrient enrichment or water quality issues. There will be no increase in discharge to river or changes to natural attenuation in adjoining areas.
Existing activities: Dulux Paints	Production of paint, IPC licence for Solvent Use. SW discharges to the River Bride. Non-compliances recorded with regards to discharge of waste paint to River, non-certified bunds.	Pollution to watercourse from SW discharge as a result of spills and accidents. Bunds not certified: risk of discharge of material stored into River.	Potential impact on river water quality and fish health from unauthorised discharges. Flood Scheme may exacerbate risk in the absence of proper pollution control mitigation that are outlined in Section 5.4.
Lee CFRAMS  Examines and aims to solve risk of flooding, now and in the future, from rivers and tidal waters.	For the Lee Catchment “Seek to minimise the level of exposure to flood damages through the identification and management of existing, and particularly potential future, flood risks in an integrated, proactive and river basin-based manner”.  The following areas are considered:	The SEA for lee CFRAMS predicted that there will be no additional negative in-combination effects between all related components of the CFRAM (including the River Bride) taking into account the	None

	<p>The River Lee &amp; its main tributaries (including Rivers Bride, Curragheen Dripsey, Glasheen, Laney, Kiln, Shournagh, Sullane,) and estuary;</p> <p>Other main rivers flowing into Cork Harbour – Rivers Tramore, Owenboy, Glashaboy and Owennacurra and their estuaries; and</p> <p>Cork Harbour.</p>	<p>interrelationships between environmental topics.</p>	
<p>Cork County Development plan 2014</p>	<p>Policy for protection designated sites protection (NHAs, SAC and SPAs); Protected Plant and Animal Species; wetlands, trees and woodlands (TPOs and general tree cover); invasive species; and Biodiversity outside of Protected areas (retain areas of local biodiversity value, ecological corridors and habitats)</p>	<p>Potential Positive Impact</p>	<p>None</p>
<p>Cork City Development Plan 2015 – 2021</p>	<p>Overall Natural Heritage and Biodiversity Objectives are to protect, enhance and conserve designated areas of natural heritage, biodiversity and protected species.; To ensure that sites and species of natural heritage and biodiversity importance in non-designated areas are identified, conserved and managed appropriately; To protect and maintain the integrity and maximise the potential of the River Lee and its associated watercourses; To protect and enhance the city's trees and urban woodlands; To promote best practice guidelines for management, control and eradication of invasive alien species; and to acknowledge and adhere</p>	<p>Potential Positive Impact</p>	<p>None</p>

	to all relevant biodiversity and natural heritage legislation.		
<p>North Blackpool Local Area Plan 2011</p> <p>To transform the area into mixed use with retail, residential and employment both sides of the River Bride and Gleanamought</p>	<p>Policies and Objectives include to provide and protect the open spaces along the River Bride for recreational needs and to preserve and enhance the biodiversity of the area and provide for recreational uses, open space and amenity.</p>	<p>Potential Neutral Impacts. Protection from development that is planned, potential impact from amenity must be assessed prior to development.</p>	<p>None</p>
<p>Farranferris Local Area Plan 2009 – 2015 (as extended)</p> <p>To promote the social, economic, cultural and physical development of the plan area and create an integrated, vibrant and sustainable living, working and recreational environment.</p>	<p>Policy to protect and promote the conservation of biodiversity in areas of natural heritage importance, outside of designated areas and to encourage the management of features which are important for wild flora and fauna such as rivers, tree groups and hedgerows. The City Council shall seek to assess, manage and protect the Urban-Sylvian character of the Farranferris Ridge by requiring detailed site surveys and appropriate protection measures as part of any development proposals. The local area plan states that it shall seek to protect and strengthen all significant trees and tree groups on site through the use of Tree Preservation orders. All development proposals shall include measures to protect and enhance existing trees and tree groups.</p>	<p>Potential Positive Impact</p>	<p>None</p>
<p>South Western River Basin Management Plan</p>	<p>In order to meet the requirements of the EU Water Framework directive, it sets specific standards for the</p>	<p>Potential Positive Impact</p>	<p>None</p>

	<p>maintenance and improvement of the ecology and chemical water quality of water bodies in the Lee Catchment.</p>		
<p>Proposed Projects</p>	<p>Planning permission granted but currently under appeal consisting of: Demolition of industrial buildings and construction of residential units (approx. 81 dwelling) at Sunbeam</p>	<p>Brownfield site, no loss of habitat.</p> <p>Silt runoff may pose a direct potential impact on the River Bride if carried out at the same time as the scheme these impact by be cumulative.</p> <p>Potential impact from runoff during construction phase. No potential impact during operational phase, waste water will be sent to city WWTP.</p>	<p>Silt runoff.</p> <p>Mitigation is provided for potential impact during construction phase on water quality for which strict adherence is required.</p>

### 5.5.1 Conclusion of Cumulative Impact Assessment

It is considered that the design of the proposed River Bride (Blackpool) Certified Drainage Scheme, the scale of the works and the implementation of effective mitigation and best practice will ensure that the proposed development, when considered on its own, will minimise as much as possible significant impacts on Biodiversity, flora and fauna. The proposed project has been considered also, in combination with a number of plans and projects. Following a detailed assessment of the receiving environment, the potential for any further impact when considered in combination with any or all of the above plans and projects. It was found that there was no potential for significant cumulative impacts on Biodiversity as a result of the proposed works.

## 6 LAND USE, GEOLOGY AND SOILS IN THE EXISTING ENVIRONMENT

The Study Area is located to the north of Cork City and comprises of the Bride (North) catchment area. The Bride (North) catchment area includes the area surrounding the Bride (North)/ Kiln river, the Glenamought stream and the Glen River.

This chapter of the EIS presents available information on the soils and geology of the Study Area along and in the vicinity of the proposed Drainage Scheme. It investigates how the existing soil and geological environment may be altered in both the short and long-term by the construction and operation of the proposed scheme. Should significant impacts be identified on the soil and geology, mitigation measures will be proposed insofar as practicable.

The River Bride (Blackpool) Certified Drainage Scheme construction phase will include the following works relevant to soils and geology;

- detailed site investigation;
- site preparation;
- replacement and construction of culverts;
- construction of reinforced concrete walls;
- construction of earthen embankments;
- construction of sedimentation trap;
- services and utility diversions;
- re-instatement of footpaths / roadways / green areas.

### 6.1 METHODOLOGY AND LIMITATIONS

This chapter was compiled in accordance with the EPA publication entitled 'Guidelines on the information to be contained in Environmental Impact Assessment Reports' (DRAFT August 2017) along with 'Advice Notes on Current Practice in the preparation of Environmental Impact Statements'. The Institute of Geologists of Ireland also published a guidance that was consulted during the preparation of this Chapter, entitled 'Geology in Environmental Impact Statement – A Guide'.

A desktop study was carried out in order to ascertain a comprehensive baseline for the Study Area and give a description of the existing environment. This information was then used in assessing the potential impact the Drainage Scheme will have on the geology and soils within the Study Area. It was then possible to propose practicable mitigation measures to ensure that any potential impacts identified will not have a significant impact on the environment during the construction and operational phase.

No significant difficulties were encountered in the compilation of this Chapter.

#### Published Material

The baseline study of the existing soil and geological environment throughout the proposed Study Area was prepared using the Geological Survey of Ireland's (GSI) online database and the GSI publication; 'Geology of South Cork' (1994), along with additional source material. A comprehensive list is included below;

- The Geology of South Cork (Sleeman and Pracht, GSI, 1994)

- The GSI online database
- Cork City Development Plan (2015 - 2021)
- Cork County Council Development Plan (2014)
- Cork City Council Planning and Development (Applications for Registration of Quarries under Section 261, Planning and Development Act 2000)
- Cork County Council Planning and Development (Applications for Registration of Quarries under Section 261, Planning and Development Act 2000)
- Concrete Products Directory (Irish Concrete Federation)
- Aerial Photography
- ENVision Mines Site, the EPA's online Historic Mines Inventory
- General Soil Map of Ireland
- Explanatory Bulletin to Soil Map of Ireland 1980

A ground investigation contract was carried out which consisted of boreholes, trial pits and slit trench excavations spread throughout the Study Area. The recorded data was used to confirm and verify information obtained from the above sources.

A study carried out by JBA Consulting entitled 'Lower Lee Flood Relief Scheme Blackpool Hydraulic Modelling Report' was also consulted.

### Definitions

Land is introduced into the Environmental Impact Assessment as per the 2014 Directive as a prescribed factor addressing the issues of land take. Environmental and agricultural scientists generally understand the word 'soil' to refer to the fertile, organic rich layer which occurs on the surface of the Earth and the underlying layers which interact with it in terms of nutrient, ion, water and heat exchange. Using this definition, the depth of the soil layer is typically 0.3m to 1.0m thick. Geologists and engineers, on the other hand, generally understand the word 'soil' to refer to all unconsolidated (non-lithified) organic and inorganic deposits which occur above bedrock.

For the purpose of this EIS, the term 'soil' refers to the unconsolidated, organic rich material closest to the Earth's surface ('topsoil'), while the term 'subsoil' (Quaternary Geology) is used to refer to all other unconsolidated (non-lithified) materials which occur above bedrock.

## 6.2 LAND

The assessment of land use generally considers land take or acquisition and changes in land use. The CORINE (Co-ordinated Information on the Environment) data series was established by the European Community (EC) as a means of compiling geo-spatial environmental information in a standardised and comparable manner across the European continent. The land in the Study Area is classified as follows:

- Glennamought and upper Bride - Heterogeneous agricultural area principally occupied by agriculture with significant areas of natural vegetation in the form of riparian habitat.
- Remainder of Study Area - Artificial Surfaces comprising land used for industrial and commercial purposes.

### **Potential Impact – Agricultural Land**

The land in Glennamought is made up of a wooded area adjacent to the river and river access points. There will be a loss of approximately 445m<sup>2</sup> of agricultural lands as a result of embankment construction. This loss represents an 11% loss in area to the effected farmer and is not significant regionally. It is expected that this impact will constitute a Permanent Imperceptible Negative Impact.

### **Potential Impact – Industry and Commercial**

The proposed scheme will provide protection to industry lands from flooding. The proposed land take is insignificant it is expected that this impact will constitute a Permanent Slight Positive Impact. There will be no direct impact on properties as a result of the scheme.

## **6.3 GEOLOGY**

### **Geomorphology**

The topography of the South Cork region is controlled by its geological structure, with the anticlines forming upland areas and the synclines occupied by valleys. These valleys were formed during the Pleistocene glaciations, which occurred 2 million to 10 thousand years ago. Prior to this, the regional topography sloped southwards and the region was drained by southerly flowing rivers. This Tertiary drainage was truncated by glaciers advancing outwards from the mountainous regions of western Ireland, preferentially exploiting the weaker shales resulting in the development of a large number of broad u-shaped valleys, where previously there has only been north-south drainage patterns. Superimposed on these u-shaped valleys are a number of buried valleys infilled with sand and gravel.

At the peak of the last glaciation, 15,000 years ago, when much of Europe was covered in ice, sea levels fell to approximately 130m lower than present day. As a result, the rivers eroded down to the new base level cutting new steep sided gorges. When temperatures subsequently improved the ice sheets receded, sea levels rose and the gorges rapidly became infilled with fluvio-glacial sand and gravels as the rivers responded again to the changing base level. The south of Ireland continues to sink and so sea levels are still rising. Milenic & Allen, 2002, estimate this rise as being 16m over the past 8,000 years.

### **Bedrock Geology**

The bedrock of South Cork is much less varied than in many parts of the country. With one exception all the rocks exposed are sedimentary and were deposited during the late Devonian and Carboniferous Periods, between about 310 to 370 million years ago.

Sedimentary rocks are deposited in beds or strata. For the purposes of description and mapping related beds of rocks are commonly grouped together into formations. These formations can then be sub-divided into members, which usually represent a distinctive feature or local variations.

The Geology of South Cork (Sleeman and Pracht, GSI, 1994) and the 'Geological Survey of Ireland Online Database' (shown in Appendix 6B of this document) indicates that the majority of the Study Area is underlain by Devonian "Old Red Sandstone" rocks which comprises the Ballytrasna Formation purple mudstone and sandstone and Gyleen Formation sandstone with mudstone and siltstone.

A portion of the Study Area to the north of Blackpool is underlain by Old Head Sandstone Formation which comprises flaser-bedded sandstone and minor mudstone. Another portion of the study area to the south is underlain by Cuskinny Member which comprises flaser-bedded sandstone and mudstone.

The findings of the ground investigation, which was carried throughout the proposed Study Area are broadly in line with the bedrock as described above. Bedrock encountered in rotary core boreholes in the study area comprised purple/brown Mudstone and purple Siltstone and Sandstone with quartz veining.

### **Geological Heritage**

Geological heritage encompasses the earth science component of nature conservation. This includes both bedrock and unconsolidated (soil) deposits close to the surface and processes (past and present) that shaped the land surface. The identification of geological heritage is achieved by finding sites or areas that best demonstrate particular types of geology, processes or phenomena that rank as noteworthy. A site selection process is being undertaken by the Geological Survey of Ireland (GSI), through the Irish Geological Heritage (IGH) Programme.

The IGH programme is a partnership between GSI and the National Parks and Wildlife Service (NPWS) and aims to identify, document the wealth of geological heritage, and protect and conserve it against threats through local authority planning and promote its value with landowners and the public. The primary national site designation for geological heritage (and nature conservation in general) is the Natural Heritage Area (NHA) designation. Designation of national sites is the responsibility of the National Parks and Wildlife Service (NPWS), working in partnership with the IGH programme. The second tier designation is that of County Geological Site (CGS). While a County Geological Site is not statutorily protected, the designation is intended to provide recognition for the site and protection through inclusion within the County/ City Development Plan Policy and Objectives.

The Cork City Development Plan (2015 - 2021) states that the Council '*recognises the need to maintain and preserve important features of geological interest in the city and will work with the Geological Survey of Ireland, as appropriate, to conserve the sites identified as being of geological interest.*'

The Cork City Development Plan identifies 7 sites of geological and geomorphological interest in the county as proposed Natural Heritage Areas (pNHAs). None of the 7 sites are located within the Study Area.

### **Economic Geology**

The term 'economic geology' refers to commercial activities involving soil and bedrock. The activities involved principally comprise aggregate extraction (sand and gravel pits and quarries) and mining. A number of sources were examined for information on such commercial activities within the Study Area, including:

- Cork City Council Planning Department (Application for Registration of Quarries under Section 261, Planning and Development Act 2000)
- Cork County Council Planning Department (Application for Registration of Quarries under Section 261, Planning and Development Act 2000)
- Cork City Development Plan (2015 - 2021)
- Cork County Council Development Plan (2014)
- Concrete Products Directory (Irish Concrete Federation)
- Aerial Photographs (2005)
- ENVision Mines Site, the EPA's online Historic Mines Inventory

- EPA Map Viewer

The sources consulted above indicate that there are no active quarries within the Study Area. The nearest active quarries are presented on Table 6.1:

**Table 6.1 Quarries in close proximity to the Study Area**

Location	Status	Operators
Classic Pit, c. 1.5km outside Study Area	Active	Roadstone Ltd.
Garryhesta Pit, c. 1.7km outside Study Area	Active	Roadstone Ltd.

The locations of these quarries are shown on Drawing SG001 in Appendix 6A.

As the abovementioned quarries are outside the Study Area, it is not envisaged that there will be any impact on these facilities from the proposed Drainage Scheme.

### Geohazards

Upon consultation with the GSI National Landslide Database for Ireland, it was found that there are no recorded landslides in the area. There are no known geohazards within or in the immediate vicinity of the Study Area.

### Quaternary Geology (Subsoil)

The Quaternary Period, which extended from the beginning of the Ice Age to the present day, is the final one of geological time scale. Most of the surface deposits of this area were deposited during the Quaternary Period, largely during the Ice Age itself. They were deposited either directly by glacier ice or by glacial meltwater. As the ice flowed over the underlying rock surface, pieces of protruding and loose rock became attached to its base. As these were carried along they both abraded the underlying rock and were ground down themselves. The rock that was picked up by the ice and partly ground down was later deposited either directly from the base or margin of the ice, or by meltwater flowing from the ice. In the former case it became till and in the latter case it was separated out and deposited as gravel, sand, silt or clay. The composition of these sediments reflects the type of rock or substrate over which the ice flowed.

Subsoils deposited since the end of the last glaciation are typically referred to as 'recent deposits'. The most widespread recent deposits in Ireland is peat, which occurs both as upland blanket peat and lowland raised bog. Other recent deposits include silt and clay rich alluvium, typically deposited by and along rivers.

According to the 'Geological Survey of Ireland Online Database' the Study Area is comprised of the following subsoils (Extract from GSI Database presented in Appendix 6B);

- Made Ground
- Till derived from mixed Devonian Sandstones
- Alluvium

There are also a number of bedrock outcrops to the north of the Study Area.

### 6.3.1 Made Ground

Made Ground is defined as material, including soil, which has been deposited on land and/or altered by anthropogenic (human) activity. Made Ground is shown in the urbanised areas of the Study Area.

The key risk associated with made ground is its uncertain origin and potential for contamination. However, no evidence of historical activities which could potentially have contributed to soil contamination was identified along or in the vicinity of the proposed scheme.

### 6.3.2 Glacial Till

Glacial till is a generic term which applies to glacially derived and/or transported soil which is deposited beneath or on the margins of a glacier or ice sheet. The Teagasc subsoil map, as presented on the Geological Survey of Ireland Online Database, indicates that glacial till is the predominant subsoil occurring in the north of the Study Area and is principally derived from Devonian sandstones.

It is unlikely that the proposed scheme will impact on this Glacial Till.

### 6.3.3 Alluvium

Alluvium is a young sediment that was recently eroded and carried off the hill side by a surface watercourse. It is ground into finer and finer grains each time it moves downstream, a process that can take thousands of years.

Alluvium soils are typically found at or in the vicinity of a surface watercourse and as such, a large stretch of the Shournagh River within the Study Area is situated within Alluvium subsoils. As these subsoils are located in the immediate vicinity proposed works, it is likely that there will be an interaction with the proposed Drainage Scheme.

### Potential Impacts on Geology

The key impact associated with the construction phase of the River Bride (Blackpool) Certified Drainage Scheme is the excavation, handling, storage, processing and transport of earthworks materials. The estimated volume of excavation anticipated during the construction phase is presented on Table 6.2.

**Table 6.2 Volumes of Excavated Material**

Origin of Excavation	Volume of Material
Wall Foundations	2,200m <sup>3</sup>
Embankment Foundations	910m <sup>3</sup>
Culverts	6,675m <sup>3</sup>
Pipeline Trenches	600m <sup>3</sup>
Other (Pumping Stations, bridge upgrades, sediment trap, winter channel)	4,550m <sup>3</sup>
<b>TOTAL</b>	<b>14,935m<sup>3</sup></b>

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.

Detailed site investigation works will also be carried out prior to the construction stage. These works will include intermittent coring of the bedrock, but impact is predicted to be imperceptible and as such has not been assessed below.

#### **6.3.4 Loss of Bedrock**

##### ***Potential Permanent Slight Negative Impact***

The vast majority of the Study Area is underlain by Devonian “Old Red Sandstone” rocks which comprises the Ballytrasna Formation purple mudstone and sandstone and Gyleen Formation sandstone with mudstone and siltstone, as described above in Section 6.2.2.

As the type of bedrock that will be excavated is abundant throughout the Study Area 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. In addition, the preliminary site investigation indicates that rock is present at significant depths and will therefore not be impacted by the scheme.

##### ***Mitigation Measures***

Where it is necessary to remove bedrock to facilitate construction of the proposed scheme, suitable material will be reused elsewhere where possible. 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.

##### ***Residual Impact – Potential Permanent Imperceptible Negative Impact***

It is likely that, with the mitigation in place this impact will constitute a Permanent Imperceptible Negative Impact. This residual impact will be fully identified as the works method statement become finalised.

#### **6.3.5 Loss of Geological Heritage**

##### ***Neutral Impact***

There are no sites in the vicinity of the proposed works of sufficient geological or geomorphological importance on a national or county scale to merit consideration for designation as a Natural Heritage Area (NHA) or designated as a County Geological Site. Due to possible exposure of bedrock as a result of proposed excavation works it is just as likely that the impact will be positive as negative.

Should there be exposure of new geological surfaces, especially in bedrock, it may serve to facilitate greater understanding and appreciation of local geological heritage and earth science.

#### **6.3.6 Loss of Quaternary Geology**

##### ***Potential Permanent Slight Negative Impact***

As described in Section 6.2.6, the Study Area is predominantly underlain by Made Ground, till derived from mixed Devonian Sandstone and Alluvium. It is likely that excavations for flood defences are to be in Made Ground. The site investigation recorded that gravels are also present.

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.

A large portion of the proposed flood defence measures are underlain by made ground and therefore there is a risk that contaminated material may be encountered. No evidence of historic activities which could potentially have contributed to soil contamination were identified in the immediate vicinity of the proposed scheme. Although the key risk with Made Ground is its uncertain origin, on the basis of available evidence and taking into consideration the small volume of made ground to be excavated, the potential impact is regarded as being imperceptible.

### **Mitigation Measures**

Excavated subsoils will be reused as fill, or for the construction of flood defence embankments where possible. Any remaining volumes of unsuitable materials will be transported to the closest suitably licensed facility to be processed and reused in other construction projects in the vicinity, where possible.

### **Residual Impact – Potential Permanent Imperceptible Negative Impact**

It is likely that, with the mitigation in place this impact will constitute a Permanent Imperceptible Negative Impact. This residual impact will be fully identified as the works method statement become finalised.

## **6.4 SOILS**

Soil is the top layer of the earth's crust. It is formed by mineral particles, organic matter, water, air and living organisms. It is an extremely complex, variable and living medium and its characteristics are a function of parent subsoil or bedrock materials, climate, relief and the actions of living organisms over time.

Soil can take thousands of years to evolve and is essentially a non-renewable resource. Soil performs many vital functions. It supports food and other biomass production (for example forestry and biofuels) by providing anchorage for vegetation and storing water and nutrients long enough for plants to absorb them. Soil also stores, filters and transforms other substances including carbon and nitrogen. It has a role supporting habitats and serves as a platform for human activity, landscape and archaeology.

### **Soil Formation**

There are three principal soil formation processes that take place in Ireland, leaching, gleisation and calcification.

Through the *leaching* process, soluble constituents are carried down through the soil profile, the soil becomes progressively more acidic until relatively insoluble constituents such as iron, aluminium and humus are washed deeper into the soil. Organic matter may accumulate on the surface and an iron pan may be formed at a lower level in the soil. At this point the leaching process may be referred to as podzolisation.

*Gleisation* is the soil-forming process resulting from the water-logging, possibly due to high water tables, or the impermeable nature of the soil itself. The movement of water through the soil is highly restricted and as a result leaching is very limited. Due to anaerobic conditions many soil constituents are converted by chemical processes into reduced forms. The soil usually takes a grey or blue colour as a result of the reoxidation processes.

*Calcification* is a process resulting in the redistribution of calcium carbonate in the soil profile without complete removal of it. Regions where rainfall is typically 750mm or less are affected by this process. Since the rainfall is low, the percolation of water through the profile is not sufficient to completely remove the calcium carbonate that existed in the parent material or that was produced by reaction between carbonic acid and the calcium hydrolysed from silicate minerals. Accumulation of carbonates at some point in the profile is typical of calcification. Calcium also tends to keep fine clay in a granular condition resulting in very little downward clay movement.

Due to the climate in Ireland, Leaching and Gleisation are the two most common soil formation processes.

### **Soil Associations**

The General Soil Map of Ireland classifies the Study Area as Rolling Lowland. These lands have slopes between 2 and 6 degrees with soils typically derived from shales, sandstone, granite or mica schist.

The Study Area comprises principally of Brown Podzolic soil (60%). Associated soil classifications are defined as Acid Brown Earths (20%) and Gleys (20%). These soils have been derived from sandstone and Lower Avonian Shale glacial till which is consistent with ground conditions as recorded in boreholes carried out as part of the site investigation. Site Investigation records suggest that the soils in the area are shallow, with the deepest level recorded being 1.2 metres below ground level. Made Ground from the surface was recorded in a number of locations.

*Brown Podzolic* soils have been formed through the leaching process as described above. They are less depleted than other soils formed through this process, and the profile usually consists of a surface in which organic matter is mixed with mineral matter. This overlies a reddish-brown layer in which iron, aluminium and sometimes humus have accumulated and there is no iron pan. Brown Podzolics have desirable physical characteristics and as a result are often devoted to cultivated cropping and pasture production. The low nutrient levels are easily overcome with the addition of lime and fertiliser.

*Brown Earths* are relatively mature, well drained, mineral soil with a relatively uniform profile. These soils have not been extensively leached with the result that there are no obvious signs of removal and deposition of iron oxides, humus or clays. In many cases a certain degree of leaching has taken place resulting in the translocation of soluble constituents, notably calcium and magnesium. The majority of Brown Earths result from lime deficient parent minerals and are therefore acid in nature. The desirable structure and drainage characteristics results in these soils being the most extensively cultivated soils, making up for a relatively low nutrient status by responding well to manorial amendments.

*Gleys* are soils in which the effects of poor drainage dominate and which have developed under the influence of waterlogging, characterised by the Gleisation process described above. Most gleys have poor physical conditions which make them unsuitable for cultivation or for intensive grassland farming. Their productive capacity is also affected by restricted growth in spring and autumn.

## **Potential Impacts on Soil**

### **6.4.1 Loss of Soil**

#### ***Potential Permanent Imperceptible Negative Impact***

As the proposed scheme does not traverse large tracts of agricultural land, and soil was not encountered in all boreholes carried out to date, it is unlikely that the scheme will have a significant impact on the soil in the area. Considering that the majority of the proposed works are to be carried out to existing structures or in urban areas the loss of soil will be minimal.

Any loss of soil, or other potential impacts will be during the construction phase and likely to be associated with excavation, handling, storage, processing and transport of earthworks materials. Where soils are disturbed, excavated and/or stored for re-use during construction, they are prone to erosion by surface water run-off. In-situ soils may be compacted by construction machinery, reducing their ability to store water, which in turn may lead to increased run-off and soil erosion.

As any soils underlying the proposed works are abundant on a local and regional scale, they are of relatively low environmental and/or ecological value. The volume of soils encountered throughout the construction phase will be also be relatively small in comparison to the volume of excavated material generated.

### **Mitigation Measures**

The construction and operation of the River Bride (Blackpool) Certified Drainage Scheme is not likely to have a significant impact on the soil in the area due to the small volumes, if any, of undisturbed soils that are likely to be encountered. Any excavated topsoil is likely to be reused in the construction of the flood defence embankments. It is necessary however to put in place mitigation measures in order to maximise the preservation of soil throughout the scheme.

In order to control the potential loss of soils as a result of erosion due to surface water run-off, a surface water management system will be put in place where necessary. As well as minimising soil erosion, a surface water management system will also minimise the volume of suspended solids transported by surface water run-off and discharged into local watercourses. The following measures will be implemented during the construction phase where applicable;

- Vegetation and soil will be left in place for as long as possible prior to excavation and stockpiling of soil to be minimised during wet weather periods.
- Soil stockpiles will be shaped so as to shed water.
- Surface water run-off from exposed soil surface will be intercepted and channelled to sumps and to silt traps thereafter.
- Granular materials will be placed over bare soil, particularly in the vicinity of watercourses, to prevent erosion of fines and/or rutting by construction machinery.

### **Residual Impact – Neutral Impact**

Taking into account the relatively small volume of soil anticipated to be encountered throughout the construction phase, in conjunction with the mitigation measures as outlined above, the residual impact of the proposed scheme on the soil in the area is insignificant. This impact will constitute a **Neutral Impact**.

#### **6.4.2 Contaminated Land**

##### **Potential Temporary Moderate Negative Impact**

Potential impacts that may result from the improper management, storage and handling of fuels and lubricants for plant and machinery and of non-hazardous or hazardous liquid and solid wastes during the construction phase of the proposed scheme. Localised contamination of soils could result from an accident, spill or leak.

### **Mitigation Measures**

In order to reduce the risk of soil contamination as a result of accidents spill or leaks the following measures will be implemented;

- Fuels, chemicals, liquids and solid wastes will be stored on impermeable surfaces
- Plant refuelling shall be undertaken on impermeable surfaces within a suitably constructed bund in accordance with best practice guidelines. No refuelling will be permitted in or near soil or rock cuttings.
- All hydrocarbons and other potential contaminants will be stored within suitably constructed bunds in accordance with best practice guidelines.
- Spill kits will be provided at refuelling areas and at high risk/sensitive sites.

### ***Residual Impact – Potential Temporary Slight Negative Impact***

It is likely that, with the mitigation in place this impact will constitute a **Potential Temporary Slight Negative Impact**. This residual impact will be fully identified as the works method statements become finalised.

## **6.5 HYDROMORPHOLOGY**

Hydro morphology is similar to geomorphology in that it is the study of the structure, evolution and continued morphology of water courses over time.

The material in this section is based on a report prepared by JBA Consulting entitled 'Hydromorphic audit of the Lower Lee watercourse'.

### **Hydromorphological Characteristics**

The watercourses of the Lower Lee are a mixture of semi-natural and heavily modified water bodies. The upper reaches of the Bride channel contain a mixture of pool-riffle-point bar morphology interspersed between impacted reaches where impoundments and historic channel modifications have created extended ponded pool and glide biotopes. Large culverts have been constructed on the Bride River, influencing the channel processes and modifying the natural course of the channel. Fine and coarse sediment supply is low and comes from sources such as bank erosion and glacial sediment re-working. Sediment accumulation issues in the channel are a result of modification to the channel processes including impoundment disrupting the downstream transport of sediment, over widening which increases sedimentation due to reduced channel velocity, narrowing which decreases sedimentation due to increased channel velocity and poor placement of channel features and structures.

The Bride River flows through a confined urban area in which the channel's natural corridor has been reduced and confined by concrete walls in several sections, reducing connectivity to the floodplain. Restoration works such as re-profiling banks have been carried out in a number of areas to improve the channel morphology within the constrained environment. Despite being heavily modified, the channel continues to exhibit a gravel bed with a pool - riffle - run morphology.

The channel is predominantly narrow within the modified sections. The channel remains confined at the Blackpool shopping centre. The channel at Blackpool is heavily modified and enters a series of culverts before reaching the River Lee.

### **Potential Impacts on Hydromorphology**

#### ***Potential Permanent Significant Negative Impact***

The proposed works include culverting an open section of river channel between Old Commons Road and the existing culvert under the Commons Road (N20), local channel widening (winter channel) and the construction of a sediment trap at Sunbeam Industrial Estate, both on the River Bride.

It is envisaged that the winter channel will increase the channel capacity by providing a secondary route into the existing bank during high flow conditions. The existing channel will be undisturbed apart from cutting back vegetation and, during normal flow conditions, the river is confined to the existing channel. Therefore, it is envisaged that the impact on the channel hydromorphology as a result of the winter channel will be imperceptible.

The purpose of the sediment trap at the Sunbeam Industrial Estate is to capture fluvial sediments (primarily small cobble sized material), to help minimise the risk of large sediments settling in the Blackpool culvert

system, which would reduce hydraulic capacity. The river channel along the route of the proposed culvert will be constructed, currently contains natural sediment deposits, but will cease to do so following construction of the proposed scheme and successful implementation of the sediment control measures proposed as part of the scheme upstream of the culvert.

In addition to the above features, removal of sediment from the river channel will form a key part of the sediment management regime.

### ***Mitigation Measures***

It has been observed that stone, silt and sand accumulate at hydraulically sensitive locations in the existing culvert system. If left unchecked, sediment has the potential to collect and accumulate at culvert inlets, bridge piers, channel bends etc, increasing the risk of flooding. Therefore, in order to maximize hydraulic capacity and minimize defence height upstream, it is necessary to ensure that the culvert system is maintained as clean as possible.

Sediment management and sediment control will be an ongoing issue and will form a fundamental part of the scheme.

Sediment removal and sediment controls upstream of Sunbeam Industrial Estate will be carried out in consultation with Inland Fisheries Ireland, so as to minimise the volumes of sediment removed and the resultant impact on the morphological diversity upstream of the sediment trap at Sunbeam, while not compromising on the function of sediment control as a fundamental element of the proposed scheme.

### ***Residual Impact – Potential Permanent Significant Negative Impact***

The sediment controls will affect the hydromorphology of the river most significantly between the sediment trap and the existing culvert at Old Commons Road, limiting sediment deposition over a distance of approximately 1km incorporating culverts and open channel. Although the existing river channel through Blackpool Retail Park has been engineered, the river channel through Orchard Court along which the culvert is proposed currently displays patterns of natural sedimentation, with typically 40% riffle, 40% glide and 20% pool. Therefore, it is envisaged that the impact on the channel hydromorphology over this 1km stretch as a result of the sediment controls at the Sunbeam Industrial Estate will have a **Permanent significant negative impact**. It is noted however that the significant negative impact is localised to this section of channel.

In addition, the proposed sediment controls will reduce the sediment contribution from the catchment of the River Bride to the intertidal zone of the River Lee downstream of the point of confluence at Christy Ring Bridge (N20). It is also noted that the river channel is dredged downstream of Custom House, so the channel affected is less than 1km in length. The reduction in sediment volumes may therefore have a **Permanent moderate negative impact**.

## 6.6 ASSESSMENT OF CUMULATIVE IMPACTS

A search in relation to plans and projects that may have the potential to result in cumulative impact on the environment was carried out as part of the EIAR. Data sources included the following:

- Cork County Development Plan 2014
- Cork City Development Plan 2015
- Relevant Local Area Plans
- South Western River Basin Management Plan
- Lower Lee CFRAMS including the Lower Lee Flood Relief Scheme
- An Bord Pleanála Website (Planning Searches)
- Myplan.ie
- Web search for major infrastructure projects in Cork City and County

A synopsis of the search results is provided in Table 6.6. In addition to the plans and projects listed in Table 6.6 a number of small scale development of dwelling house/extensions were identified from the wider area surrounding the proposed flood relief scheme. Given their small size and scale and their location on existing residential and made ground the potential for cumulative impact is not considered significant and therefore not considered further in this assessment.

**Table 6.6 Potential Impact in combination with other Plans and Projects**

Plans and Projects	Description and Key Issues / Policies/ Objectives Related to the zone of influence	Potential impact on Biodiversity	In-combination Impact
Lee CFRAMS Examines and aims to solve risk of flooding, now and in the future, from rivers and tidal waters.	For the Lee Catchment “Seek to minimise the level of exposure to flood damages through the identification and management of existing, and particularly potential future, flood risks in an integrated, proactive and river basin-based manner”. The following areas are considered: The River Lee & its main tributaries (including Rivers Bride, Curragheen Dripsey, Glasheen, Laney, Kiln, Shournagh, Sullane,) and estuary; Other main rivers flowing into Cork Harbour – Rivers Tramore, Owenboy, Glashaboy and Owennacurra and their estuaries; and Cork Harbour.	There is potential for impact on lands use as a result of some options for Lee CFRAMs however impacts are limited to the local area. Positive impact as a result of lands impacted by flooding River Bride has no significant impact on soils, geology or land use.	None
Cork County Development plan 2014	Policy for protection of greenfield land by maximising the use of brownfield sites. Encourage sustainable extraction of non-renewable resources.	Potential Positive Impact	None
Cork City Development Plan 2015 – 2021 (including LAPS for Blackpool, Farranferris and North west Cork)	Development of regions using where possible existing urban and brownfield sites.	Potential Positive Impact	None
Proposed Projects	Planning permission granted but currently under appeal consisting of: Demolition of industrial buildings and construction of residential units (approx. 81 dwelling) at Sunbeam	Brownfield site, no significant changes in land use. Soils and geology: no significant impact.	None

### **Conclusion of Cumulative Impact Assessment**

It is considered that the design of the proposed River Bride (Blackpool) Certified Drainage Scheme, the scale of the works and the implementation of effective mitigation and best practice will ensure that the proposed development, when considered on its own, will minimise as much as possible significant impacts on land use, soils and geology. Overall, the reduced risk of flooding will have a positive impact on land use in the Blackpoll area. The proposed project has been considered also, in combination with a number of plans and projects. Following a detailed assessment of the receiving environment, the potential for any further impact when considered in combination with any or all of the above plans and projects. It was found that there was no potential for significant cumulative impacts on Lands, soils and geology as a result of the proposed works.

## **7 WATER – HYDROLOGY & HYDROGEOLOGY**

### **7.1 INTRODUCTION**

This Chapter of the Environmental Impact Statement covers the potential impact of the proposed River Bride (Blackpool) Certified Drainage Scheme on the Water Environment. The chapter discusses the existing aquatic environment, the potential impacts of the scheme and remedial measures on both surface water and groundwater along with the hydrological and hydrogeological regimes of the Study Area. Impacts on Water: Hydrology and Hydrology are broken down into the following sections:

- Surface Water Quality;
- Hydrogeology;
- Flooding and Hydrology.

### **7.2 SURFACE WATER QUALITY**

#### **7.2.1 Legislative Review**

##### **7.2.1.1 Water Framework Directive**

The EU Water Framework Directive (WFD) was adopted on the 23<sup>rd</sup> of October 2000 and came into effect on the 22<sup>nd</sup> December 2000. It is the most significant piece of water legislation to be introduced by the European Commission in twenty years.

The Directive takes a broad approach to the protection, enhancement and restoration of all coastal waters, rivers, lakes, estuaries and groundwaters in Europe. It requires all countries to control, manage and protect their water resources from all impacts – physical, polluting or otherwise. Under the Directive, all waters within Europe must achieve at least 'Good' status by December 2015 unless otherwise agreed upon by the relevant authority and the European Commission and the status of any waters must not deteriorate.

##### **7.2.1.2 The European Communities Environmental Objectives (Surface Water) Regulations, 2009 and Amendment Regulations 2012**

The European Communities Environmental Objectives (Surface Waters) Regulations, 2009 came into effect on the 30<sup>th</sup> July 2009. They have a significant effect on the Water Framework Directive and also the Dangerous Substances and Priority Substances Directives.

The Directive, similar to the requirements of the Water Framework Directive, requires that all waters must be maintained at or improved to at least 'Good Status' by 22 December 2015. No deterioration in quality is permitted.

'Status' is a descriptor term that incorporates ecological and hydrochemical data and facilitates catchment comparisons on an EU scale. The catchment scale is referred to as the 'macro-scale'. Its status cannot be used to assess the potential impacts at a micro-scale i.e. a point discharge on a river, without there first being validation by monitoring data at the source of the point discharge. The EPA is responsible for assigning Status.

The European Communities Environmental Objectives (Surface Waters) Regulation, 2009, specify the conditions and physico-chemical concentrations that should be considered in the assessment of Status.

The 2012 Regulations set standards for a range of pesticide, herbicide and heavy metals in surface waters. It clarifies the role of public authorities in the protection of surface waters, include standards and sets limits for priority hazardous substances.

Table 7.1 below shows the surface water quality standards applied across a range of relevant legislation.

**Table 7.1 Mandatory levels for physiochemical parameters for specific legislation**

Parameter	Units	European Communities (Quality of Surface Water Intended for the Abstraction of Drinking Water) Regulations, 1989 (S.I. No. 294/1989)*	European Communities Environmental Objectives (Surface Water) Regulations (S.I. No. 272 of 2009)	European Communities Drinking Water Regulations (S.I. 106 of 2007)	Salmonid Water Regulations (Mandatory Level) (S.I. No. 293 of 1988)
BOD	mg/l	5 – A1 & A2 7 – A3	High status $\leq 1.3$ (mean) or $\leq 2.2$ (95%ile)  Good status $\leq 1.5$ (mean) or $\leq 2.6$ (95%ile)	N/A	$\leq 5$
Suspended Solids	mg/l	50	N/A	N/A	$\leq 25$
pH	-	5.5-8.5 – A1 5.5-9.0 – A2 & A3	4.5-9.5 (Soft Water) 6.0-9.0 (Hard Water)	$\geq 6.5$ & $\leq 9.5$	$\geq 6$ & $\leq 9$
Conductivity	$\mu\text{S}/\text{cm}$	1,000	N/A	2,500	N/A
Phosphates	mg/l $\text{P}_2\text{O}_5$	0.5 – A1 & A2 0.7 A3	N/A	N/A	N/A
Molybdate Reactive Phosphorus (MRP)	mg/l P	N/A	High status $\leq 0.025$ (mean) or $\leq 0.045$ (95%ile)  Good status $\leq 0.035$ (mean) or $\leq 0.075$ (95%ile)	N/A	N/A
Chloride	mg/l Cl	250	N/A	250	N/A
Ammonium	mg/l $\text{NH}_4$	0.2 – A1 1.5 – A2 4 – A3	N/A	N/A	$\leq 1.0$

Parameter	Units	European Communities (Quality of Surface Water Intended for the Abstraction of Drinking Water) Regulations, 1989 (S.I. No. 294/1989)*	European Communities Environmental Objectives (Surface Water) Regulations (S.I. No. 272 of 2009)	European Communities Drinking Water Regulations (S.I. 106 of 2007)	Salmonid Water Regulations (Mandatory Level) (S.I. No. 293 of 1988)
Total Ammonia	mg/l N	N/A	High status $\leq 0.040$ (mean) or $\leq 0.090$ (95%ile)  Good status $\leq 0.065$ (mean) or $\leq 0.140$ (95%ile)	N/A	N/A
Nitrate	mg/l NO <sub>3</sub>	50	N/A	50	N/A
Nitrite	mg/l NO <sub>2</sub>	N/A	N/A	0.5	$\leq 0.05$
Dissolved Oxygen	-	>60% - A1 >50% - A2 >30% - A3	Lower limit: 95%ile > 80% saturation  Upper limit: 95%ile < 120 %saturation	N/A	50% $\geq 9$ mg/l
Total Hardness	mg/l CaCO <sub>3</sub>	N/A	N/A	N/A	N/A
Copper	mg/l Cu	0.05 – A1 0.1 – A2 1.0 – A3	5 - water hardness $\leq 100$ mg/l CaCO <sub>3</sub> 30 - water hardness > 100mg/l CaCO <sub>3</sub>	2.0	$\leq 0.005$ [1, 6] $\leq 0.022$ [2, 6] $\leq 0.04$ [3, 6] $\leq 0.112$ [4, 6]
Zinc	mg/l Zn	3 – A1 5 - A2 & A3	0.008 - water hardness $\leq 10$ mg/l CaCO <sub>3</sub> 0.05 - water hardness > 10 $\leq 100$ mg/l CaCO <sub>3</sub> 0.1 - water hardness > 100mg/l CaCO <sub>3</sub>	N/A	$\leq 0.03$ [1, 6] $\leq 0.2$ [2, 6] $\leq 0.3$ [3, 6] $\leq 0.5$ [5, 6]
Total coliforms	no/100ml	5,000 – A1 25,000 – A2 100,000 – A3	N/A	N/A	N/A
Faecal coliforms	no/100ml	1,000 – A1 5,000 – A2 40,000 – A3	N/A	0	N/A

[1] At water hardness 10 mg/l CaCO<sub>3</sub>; [2] At water hardness 50 mg/l CaCO<sub>3</sub>.; [3] At water hardness 100 mg/l CaCO<sub>3</sub>; [4] At water hardness 300 mg/l CaCO<sub>3</sub>; [5] At water hardness 500 mg/l CaCO<sub>3</sub>; [6] To be conformed with by 95% of samples over a period of 12 months where sampling is carried out at least once a month; where sampling is less frequent, to be conformed with by all samples.

\*S.I. No. 294/1989 is superseded by S.I. No. 272 of 2009. If a particular parameter is not found in SI 272 of 2009 then the 1989 value applies.

## 7.2.2 Methodology

### 7.2.2.1 Desk Study

A desk study of relevant hydrological data was conducted. The following documentation and sources were reviewed:

- Environmental Protection Area (EPA) water quality database and maps (<http://gis.epa.ie/Envision>)
- Cork City Council Surface Water Results for the River Lee
- South Western River Basin District Management Plan (2009 – 2015)
- The Water Framework Directive website [www.WFD.ie](http://www.WFD.ie)

### 7.2.2.2 Field Assessment

Q Values were determined for the River Bride (North) and Glenamought in order to determine the baseline biological water quality for the study area.

Q Values are biotic indices used to express biological water quality and are based on changes in the macro invertebrate communities of riffle areas brought about by organic pollution. Q1 indicates a seriously polluted water body and Q5 indicates unpolluted water of high quality. A value of Q3 indicates moderately polluted water. These Q value ratings are shown in Table 7.2. In addition, various chemical parameters are also tested by the EPA and are available for some of the monitoring points.

**Table 7.2 Q value classification**

Quality Ratings	Quality Class	Pollution Status	Condition (re beneficial uses)
<b>Q5, Q4-5, Q4</b>	Class A	Unpolluted	Satisfactory
<b>Q3-4</b>	Class B	Slightly Polluted	Unsatisfactory
<b>Q3, Q2-3</b>	Class C	Moderately Polluted	Unsatisfactory
<b>Q2, Q1-2, Q1</b>	Class D	Seriously Polluted	Unsatisfactory

Kick samples of aquatic macro-invertebrates were collected on the Bride River (North) and the Glenamought River between the 2nd and 5th May 2015. Where possible the macro-invertebrate sampling stations were situated in the vicinity upstream or downstream of the works areas, given the selection of the sampling sites also depended on the presence of riffle/ glide habitat from which samples could be collected. Kick sampling was carried out at 4 locations in the River Bride (North) and the Glenamought River. Kick sampling was performed for 2.5 minutes in the faster flowing areas (riffles) of the river. The kick sample was taken moving across the riffle zone and also involved washing large rocks from the riffle zone to ensure a full representation of the species composition from this micro-habitat type. Collected samples were elutriated, refrigerated and identified live within 24 hours of each site visit. The samples were identified using a Nikon

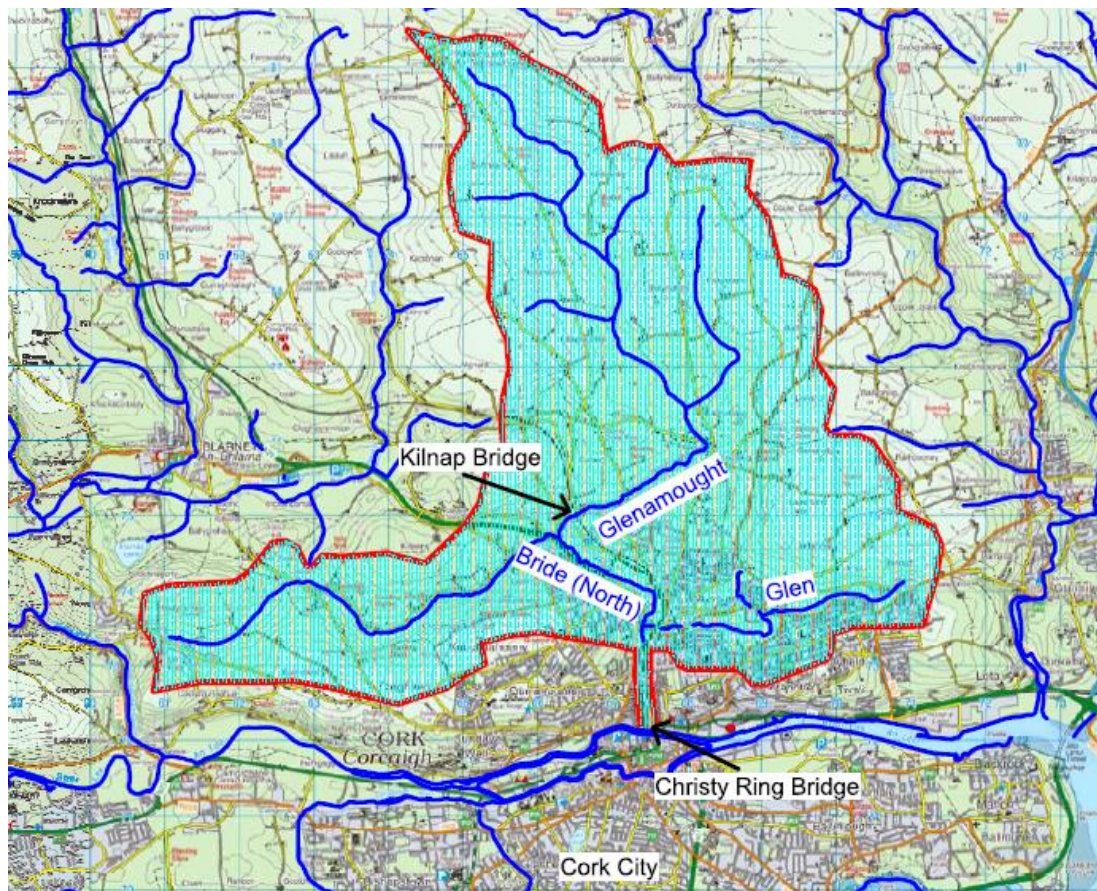
SMZ 1000 stereo microscope and numerous Freshwater Biological Association invertebrate keys. Invertebrate taxa were identified to species level where possible. The relative proportions of taxonomic groups were recorded based on the EPA categories (i.e. 8 categories ranging from present to excessive) (Appendix I of Toner et al., 2005). Biological water quality data as prescribed by the Environmental Protection Agency (EPA; Toner et al. 2005), group invertebrates into classes whereby very pollution intolerant species are denoted class A, and species with greater pollution tolerance fall into successive classes (B through E respectively). As such the presence or absence of these groups and their relative abundances facilitates an assessment of biological river health. Using Appendix 1 of the Environmental Protection Agency publication Water Quality in Ireland, Q values were determined for all sites sampled, based on the faunal assemblage found at each sampling location.

### 7.2.3 Description of the Study Area

The Study Area consists of the of the River Bride (Blackpool) Certified Drainage Scheme which will alleviate flooding in the Blackpool area on the River Bride (North) of Cork City. The study area encompasses three major water courses: the Bride (North), the Glenamought and the Glen. The total catchment area upstream of Blackpool Village is 41.7km<sup>2</sup>.

The Bride (North) rises in the townland of Ballycannon, near Healy's Bridge, before flowing in an easterly direction towards Cork City. It is the most easterly tributary of the River Lee joining it east of Ovens. The Glenamought River rises in Whitechurch and flows in a southerly direction before making an abrupt right-turn in the townland of Ballincrokig. The Bride (North) and the Glenamought meet each other in a culverted system at the North Point Business Park on the N20. The Glen River flows in a westerly direction from Mayfield, through the Glen River Park, before entering a culvert under Spring Lane. It then merges with the Bride (North) in a large culvert junction under Madden's Buildings, 100m downstream of Blackpool Church. Downstream of the confluence of the Bride (North) and the Glen, the watercourse has traditionally been known as the Kiln River. The Kiln River discharges to the River Lee at Christy Ring Bridge. The culverted system in Blackpool has been incrementally constructed since the early the 1980s as part of the Glen-Bride-Kiln River Improvement Scheme which was commissioned by Cork Corporation in 1981. The topography of the entire catchment varies between 188mOD at Whitechurch and 25mOD in the Blackpool river valley.

Figure 7.1 Study Area Catchment and Rivers



### 7.2.3.1 EPA Water Quality Data

The EPA website, <http://gis.epa.ie/Envision>, contains information regarding water quality in selected Irish rivers based on surveys carried out by the EPA as part of the Water Framework Directive (WFD) Monitoring Programme. Biological information is provided in the form of Q values. The River Bride (North), the Glenamought River and the Glen River do not have any monitored points within the study area, therefore no EPA monitoring data was available for the River Bride (North), Glenamought River or the Glen River.

The closest EPA monitoring point on the River Lee, into which the Bride (North) flows is at Leemount Bridge, > 5km upstream of the confluence of the River Bride (North) and the River Lee. The water quality status at this monitoring point is Q4 “Good” status. The River Lee, approximately 3km upstream of the confluence of the River Lee and the River Bride (North) has “moderate” status under The River Waterbody Water Framework Directive (2010-2012 monitoring results).

The lower reaches of the River Lee, into which the River Bride (North) is a transitional coastal waterbody, i.e. the Lee (Cork) Estuary upper. The Lee (Cork) Estuary Upper Transitional Waterbody and the Lee (Cork) Estuary Lower Transitional Waterbody, which lies downstream of the confluence both have “moderate” status under the Transitional Waterbody Water Framework Directive Status (2010-2012 monitoring results).

### Water Framework Directive Operational Monitoring Data

Water quality monitoring, as required under the terms of the Water Framework Directive (WFD), is one of the functions of the Environment Section of Cork County Council and Cork City Council. The most recent

physico-chemical data from monitoring points within and close to the Study Area taken by Cork City Council are presented in Table 7.3.

**Table 7.3 Cork City Council Physico-chemical Monitoring Data for the River Lee**

Parameter	Unit	River: Bride North. Station name and reference: Blackstone Bridge RS19B140110			
		13/01/2015	14/04/2015	18/08/2015	06/10/2015
Temperature	°C	6.4	11.07	14.7	13.1
Dissolved Oxygen	mg/l	9.06	10.65	6.47	7.43
pH	pH units	7.8	8.1	7.5	7.8
Conductivity @20°C	µS/cm	303	307	319	311
Biochemical Oxygen	mg/l O <sub>2</sub>	1.0	1.0	2.9	1.0
Ammonia	mg/l N	0.010	0.050	0.040	0.010
Nitrogen	mg/l N	4.74	5.13	4.23	2.40
Ortho-phosphate	mg/l P	0.047	0.023	0.060	0.033
Suspended solids	mg/l	3.0	4.0	17.0	2.5
Parameter	Unit	River: Bride North. Station name and reference: Kilnap RS19G880990			
		13/01/2015	14/04/2015	01/07/2015	06/10/2015
Temperature	°C	6.5	11.2	15.8	13.3
Dissolved Oxygen	mg/l	10.01	11.02	8.19	8.48
pH	pH units	7.8	8.3	8.0	7.8
Conductivity @20°C	µS/cm	268	288	301	284
Biochemical Oxygen	mg/l O <sub>2</sub>	1.7	2.3	1.1	1.2
Ammonia	mg/l N	0.030	0.040	0.060	<0.01
Nitrogen	mg/l N	3.21	5.36	3.19	3.21
Ortho-phosphate	mg/l P	0.047	0.092	0.080	0.125
Suspended solids	mg/l	4.0	19.0	3.0	4.0
Parameter	Unit	River: Bride North. Station name and reference: Fitz's Boreen RS19B140300			
		13/01/2015	14/04/2015	01/07/2015	06/10/2015
Temperature	°C	6.8	11.8	15.9	13.9
Dissolved Oxygen	mg/l	9.77	10.65	7.60	8.79
pH	pH units	7.9	7.9	8.1	7.8
Conductivity @20°C	µS/cm	285	299	313	296
Biochemical Oxygen	mg/l O <sub>2</sub>	1.2	1.1	1.2	1.0
Ammonia	mg/l N	0.040	0.060	0.070	0.020
Nitrogen	mg/l N	4.34	5.91	3.01	5.21
Ortho-phosphate	mg/l P	0.082	0.060	0.115	0.098
Suspended solids	mg/l	4.8	6.0	2.4	3.2
Parameter	Unit	River: Bride North. Station name and reference: Blackpool RS19B140800			
		13/01/2015	14/04/2015	01/07/2015	06/10/2015
Temperature	°C	6.8	1.05	15.4	13.7
Dissolved Oxygen	mg/l	9.89	10.05	7.32	8.33
pH	pH units	7.4	7.4	8.0	7.3
Conductivity @20°C	µS/cm	310	317	342	310

Biochemical Oxygen	mg/l O <sub>2</sub>	1.1	1.0	1.4	1.0
Ammonia	mg/l N	0.020	0.030	0.050	0.140
Nitrogen	mg/l N	4.07	6.30	3.37	4.29
Ortho-phosphate	mg/l P	0.072	0.058	0.120	0.098
Suspended solids	mg/l	3.6	4.0	7.3	2.0
Parameter	Unit	River: Glen. Station name and reference: Glen Rec. Park RS19G090400			
		13/01/2015	14/04/2015	01/07/2015	06/10/2015
Temperature	°C	6.5	10.6	14.4	13.4
Dissolved Oxygen	mg/l	9.81	9.12	7.23	8.41
pH	pH units	7.6	7.8	8.2	7.7
Conductivity @20°C	µS/cm	334	335	342	320
Biochemical Oxygen	mg/l O <sub>2</sub>	1.3	1.0	1.6	2.1
Ammonia	mg/l N	0.050	0.150	0.090	0.050
Nitrogen	mg/l N	4.52	4.86	3.50	1.63
Ortho-phosphate	mg/l P	0.097	0.098	0.167	0.145
Suspended solids	mg/l	6.8	4.0	5.6	10.0
Parameter	Unit	River: Glen. Station name and reference: Spring Lane RS19G090800			
		13/01/2015	14/04/2015	01/07/2015	06/10/2015
Temperature	°C	6.5	10.9	15.4	13.7
Dissolved Oxygen	mg/l	10.18	9.72	7.52	8.23
pH	pH units	7.5	7.7	7.9	7.6
Conductivity @20°C	µS/cm	443	340	347	325
Biochemical Oxygen	mg/l O <sub>2</sub>	1.4	1.0	1.4	1.2
Ammonia	mg/l N	0.050	0.080	0.080	0.030
Nitrogen	mg/l N	4.69	4.74	2.41	4.44
Ortho-phosphate	mg/l P	0.093	0.108	0.150	0.115
Suspended solids	mg/l	4.4	2.0	5.0	1.6
Parameter	Unit	River: Kiln. Station name and reference: Leitrim St. RS19K750900			
		13/01/2015	14/04/2015	01/07/2015	06/10/2015
Temperature	°C	7.3	11.4	16.3	14.7
Dissolved Oxygen	mg/l	10.20	6.64	3.73	7.20
pH	pH units	6.9	7.0	7.4	6.9
Conductivity @20°C	µS/cm	330	434	10420	372
Biochemical Oxygen	mg/l O <sub>2</sub>	3.5	23.0	60.0	23.7
Ammonia	mg/l N	0.060	0.370	2.40	0.140
Nitrogen	mg/l N	4.71	6.24	6.42	5.04
Ortho-phosphate	mg/l P	0.123	9.50	0.607	0.038
Suspended solids	mg/l	4.0	10.0	61.2	4.0

### 7.2.3.2 Water Framework Directive

The Study Area is located within the Water Framework Directive (WFD) South Western River Basin District (SWRBD). The main objectives of the SWRBD Management Plan is to prevent deterioration, restore good status, reduce chemical pollution in surface waters and to achieve protected areas objectives. The programme of measures designed to achieve these objectives include the following:

- Control of urban waste water discharges;
- Control of unsewered waste water discharges;
- Control of agricultural sources of pollution;
- Water pricing policy;
- Sub-basin management plans and programmes of measures for the purpose of achieving environmental water quality objectives for Natura 2000 sites designated for the protection of Freshwater Pearl Mussel populations;
- Pollution reduction programmes for the purpose of achieving water quality standards for designated shellfish waters; and
- Control of environmental impacts from forestry.

Information on status, objectives and measures in the SWRBD has been compiled for smaller, more manageable geographical areas than river basin districts, termed Water Management Unit Action Plans. There are twenty-eight Water Management Units (WMUs) in the SWRBD. These units represent smaller river and lake basins where management of the pressures, investigations and measures are focussed and refined during implementation of the plan. In addition, action plans focusing on groundwater and a transitional and coastal water management have been prepared for the SWRBD. WMU Action Plans are a key background document to the plan.

The Study Area is within the Lower Lee Owenboy Water Management Unit (WMU). There are 43 river water bodies in the Lower Lee Owenboy WMU with the following status:

- 9 High;
- 9 Good;
- 11 Moderate; and
- 14 Poor Status.

The status of the various water bodies in this area is calculated using the EPA data described above, physio-chemical data and fish status data.

The status of the Lee including its tributaries is described in the Lower Lee Owenboy WMU Action Plan (2010) as follows:

- 2001: Satisfactory apart from Inishcarra Bridge (0600) where again highly eutrophic. The protected pearl mussel has apparently become scarce in the river in the past two decades.
- 2005- Major disruption to fauna at first location, upstream of Gouganebarra Lake (0010), where salmonid parr and other age classes had been killed. Further downstream the water quality status was the same as that of the previous survey with highly eutrophic conditions again recorded at Inishcarra Bridge (0600).
- 2008- Satisfactory apart from at Inishcarra Bridge where again poor ecological quality was recorded. 2009: Poor status dictated by Q score

The identified pressures/risks in this WMU Action Plan include the following:

- Nutrient Sources: Main source of TP is from unsewered industry (64%) and agriculture (26%). P

- Point Pressures: There are 24 Waste-water Treatment Plants (WwTP), 2 Water Treatment Plants (WTP), 21 Section 4 licenced facilities, 26 Integrated Pollution Prevention and Control (IPPC) licenced facilities and 1 contaminated site within the WMU.
- Quarries: There are 14 quarries and 5 landfills within the WMU. 3 WB are at risk from quarries
- Agriculture: 39 water bodies have been determined to be at risk from agriculture within the WMU.
- On-site Water Treatment Systems (OSWTS): There are 15275 septic tanks in this WMU. 963 of these are located in areas of very high or extreme risk.
- Forestry: Significant area of SW\_19\_1910 is under forestry
- Morphology: There are 3 water bodies that have been determined to be at risk from morphology within the WMU. Water Regulation and Impoundments - Inniscarra Reservoir is a HMWB. (the local authority also note some drainage & channelisation of WB 19-1584 in the past particularly between Ballinhassig & Halfway when road was realigned, also some drainage upstream of Halfway in 2006)
- Abstractions: One water body has been determined to be at risk from abstractions within the WMU : SW\_19\_1663

### Q Rating / Biological Water Quality

A full description of the sampling locations and the results of each sample taken are presented in Appendix 5 to this EIS.

Results of kick samples showed that only small numbers of very clean water (class A) invertebrates were present at sites sampled on the River Bride (North), while only one species from class B was present (also indicative of clean water). The sites were dominated by class C (moderately pollution tolerant) invertebrate species that included good numbers of the mayfly species *Baetis rhodani*, a mayfly species characteristic of slightly polluted waters. In summary the water quality at sites on the River Bride (North) were indicative of Q3-4 moderate status, slightly polluted water.

Both sites sampled on the Glenamought River had a good diversity of clean water stoneflies and mayflies present indicating good quality water. Pollution tolerant invertebrate forms were virtually absent apart from the leech species *Haemoptis sanguisuga* (class D) at one site. In summary the invertebrate composition encountered at sites 8 and 9 were representative of Q4 unpolluted, good status water quality.

**Figure 7.2 Q Ratings Blackpool**

The Glenamought River was among the cleanest of the river sites surveyed with Q4, good status water quality recorded at both sites sampled. The Glenamought River was located in a non-urbanised environment and rises in a wooded river valley with limited human interference. The river retained a very natural profile with riffle, glide and pool habitat. While some localised realignments have occurred in its lower reaches the water quality appears to be unaffected. The Glenamought River between the Viaduct and the Industrial Estate downstream near its confluence with the River Bride (North) had very high densities of salmonids as observed during electro-fishing surveys in 2014 (See Chapter 5). The river had clean swift flowing water and clean substrata which evidently have helped maintain the rivers unpolluted status. Along the River Bride (North) the water quality deteriorated. This was likely as a result of urban encroachment and associated storm drain point sources of pollution that are entering the river. As such the water quality was recorded as Q3-4 slightly polluted (moderate status).

### 7.2.3.3 Surface Water Abstraction

The Lee Road Water Treatment Plant is the main source of drinking water for Cork City (70%) with the remaining supplied for the Cork Harbour and City Scheme (30%). Surface water is abstracted from the River Lee for the Lee Road Plant and at Inniscarra Lake for the Cork Harbour and City Supply Scheme. Neither abstraction locations, treatment plants nor their associated reservoirs are within the zone of influence of the proposed River Bride (Blackpool) Certified Drainage Scheme.

## 7.2.4 Impacts and Mitigation for Surface Water Quality

### 7.2.4.1 Generation of Silt-Laden Run-off & Increase in Suspended Solids

#### **Short-term Moderate Negative Impact**

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 in works areas along the river bank. 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. Stockpiled excavated material also poses an increased threat of increased siltation in the watercourse.

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 (See also Chapter 5, Flora and Fauna).

#### **Mitigation Measures**

- Measures to minimise the suspension and transfer of sediment downstream will be implemented. These measures are likely to include the use of silt barriers downstream of the works areas and removal of any accumulated silt, construction of silt sumps downstream of the works areas, cofferdamming and dewatering of works areas where concrete and other building works are proposed. Any stockpiling will also be greater than 10 metres from the river bank.
- All works undertaken on the banks will be fully consolidated to prevent scour and run off of silt. Consolidation may include use of protective and biodegradable matting (coirmesh) on the banks and also the sowing of grass seed on bare soil.
- Works will only be undertaken during normal working hours (8:00 – 6:00) thus allowing the river to run clean for 14 hours per day.
- 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

#### **Residual Impact - Temporary Slight Negative Impact**

It is likely that, with mitigation measures in place this impact will constitute a Temporary Slight Negative Impact.

### 7.2.4.2 Use of Potential Water Contaminants

#### **Potential Temporary Moderate to Significant Negative Impact**

Numerous substances used on construction sites have the potential to pollute both ground and surface water if not properly managed and treated. Such substances include fuels, lubricants, cement, mortar, silt, soil and other substances which arise during construction. The washing of construction vehicles and equipment also poses a pollution risk to watercourses. The spillage or leaking of fuel or oil from fuel tanks or construction

vehicles has the potential to contaminate soils, groundwater and surface water. Such substances entering the River could damage the habitat of local populations of fish and aquatic invertebrates and also cause direct harm to aquatic fauna.

### **Mitigation Measures**

- All concrete works will be carried out in dry conditions with no in-stream pouring of concrete.
- There will be no refuelling of machinery within the river channel. Refuelling will take place at designated locations at distances of greater than 30 metres from the watercourse.
- No vehicles will be left unattended when refuelling and a spill kit including an oil containment boom and absorbent pads will be on site at all times.
- Any fuel that is stored on the site will be in a double skinned, banded container that will be located within a designated works compound at a location that is removed from the river. All other construction materials and plant will be stored in this compound. The compound will also house the site offices and portaloos. This compound will either be located on ground that is not prone to flooding or will be surrounded by a protective earth bund to prevent inundation.
- All vehicles will be regularly maintained and checked for fuel and oil leaks.

### **Residual Impact – Neutral Impact**

It is likely that, with proper implementation of the above mitigation this impact will constitute a slight negative short term impact and a Neutral long-term impact.

## **7.3 HYDROGEOLOGY**

This section describes the existing hydrogeological environment within the Study Area and assesses the potential impacts of the River Bride (Blackpool) Certified Drainage Scheme.

### **7.3.1 Methodology**

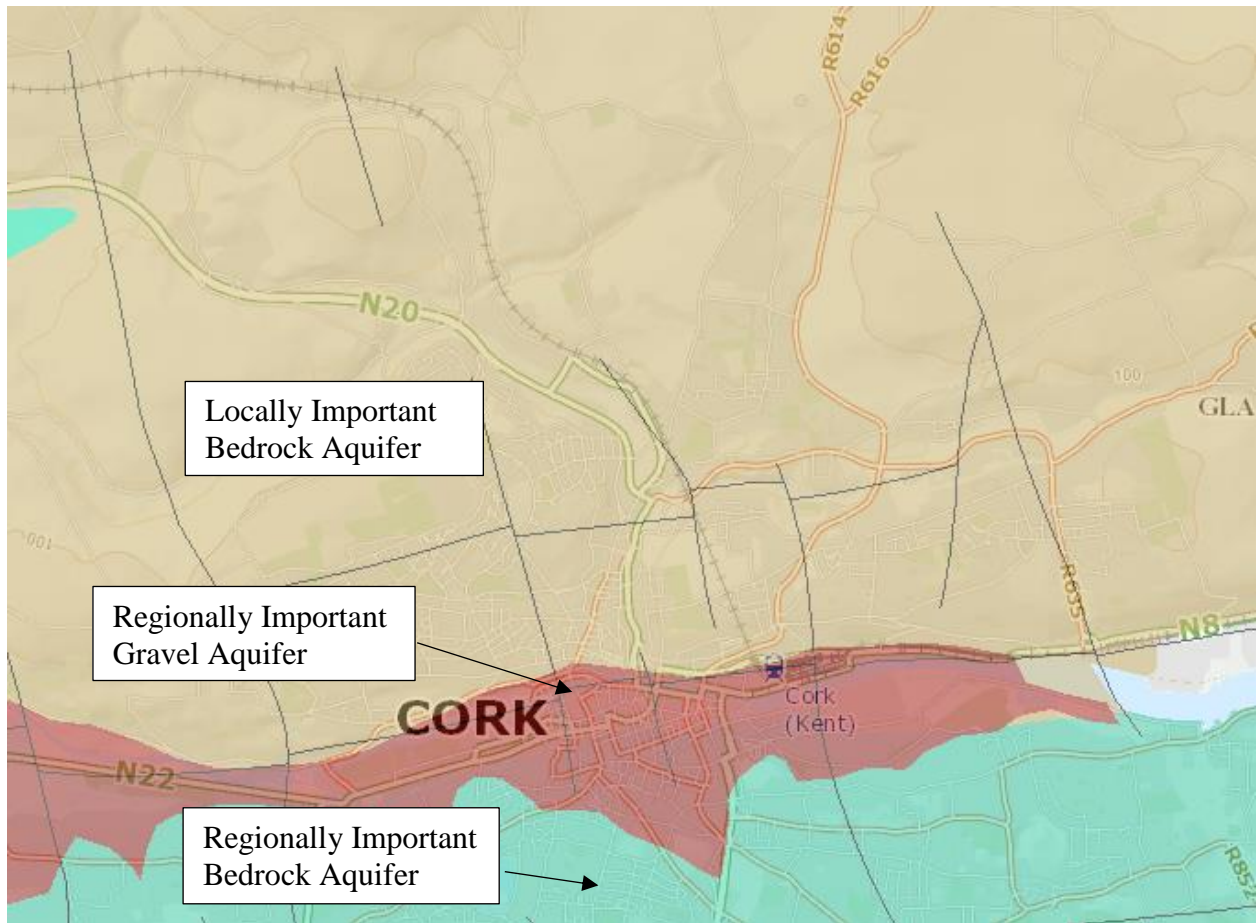
A desktop study was carried out in order to ascertain a comprehensive baseline for the Study Area and give a description of the existing environment. This information was then used in assessing the potential impact the proposed works will have on the hydrogeology within the Study Area.

The following documents were consulted during the preparation of this section:

- The Geology of South Cork (1994)
- The Geological Survey of Ireland (GSI) online database

### **7.3.2 Hydrogeology in the Existing Environment**

The Geological Survey of Ireland (GSI) online database shows the Study Area as being underlain by Devonian Old red sandstone with dinantian mudstone and sandstone. The site is locally important aquifer with bedrock which is moderately productive only in Local Zones. Groundwater flows through fractures, fissures or joints in the bedrock. The groundwater body is generally covered by till derived from its sandstone parent material. An extract from the GSI Online Database is provided.

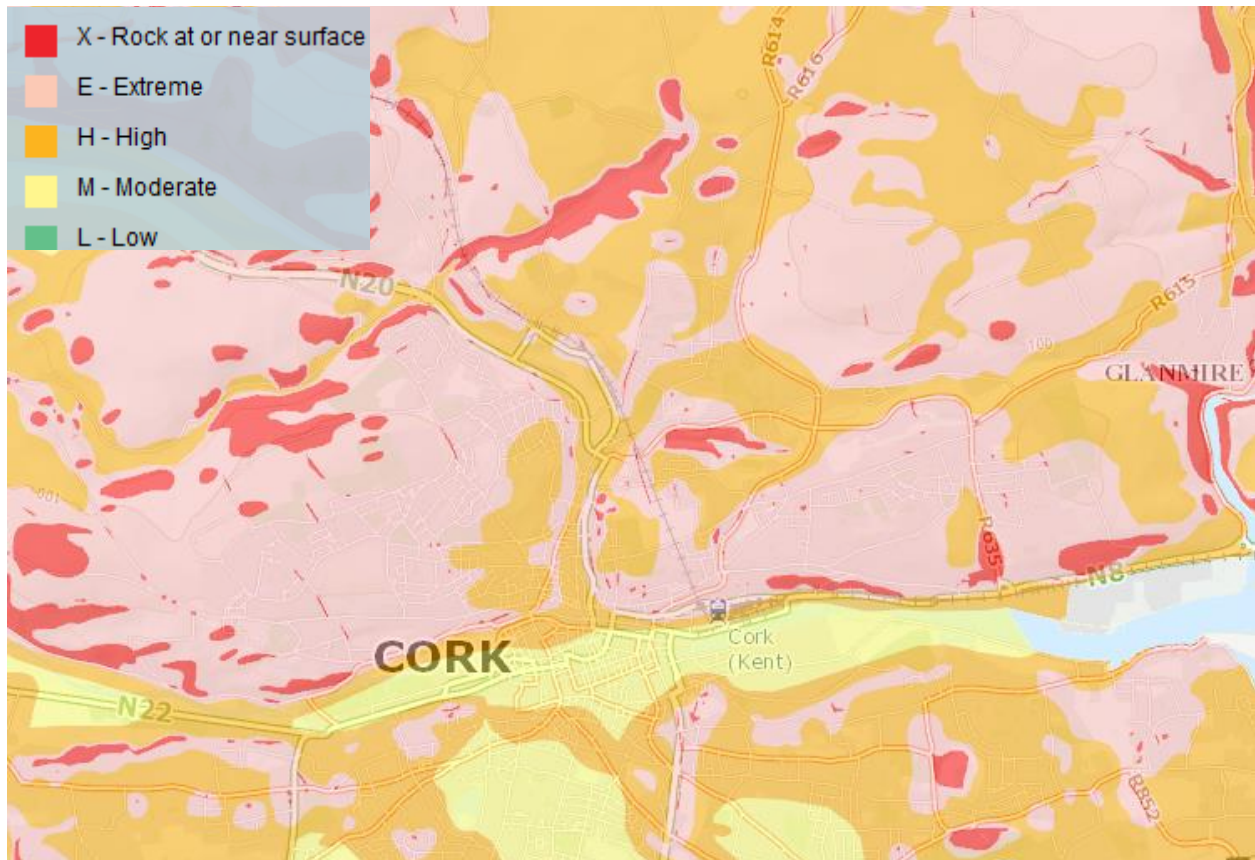
**Figure 7.3 GSI Groundwater Resources (Aquifers) ([www.gsi.ie](http://www.gsi.ie))**

The direction of groundwater flow is likely to be influenced by the topography of the surrounding area. Groundwater within the Study Area is more than likely hydraulically connected to the River Lee and its tributaries including the River Bride (North), River Glen and River Glenamought.

#### Groundwater Vulnerability

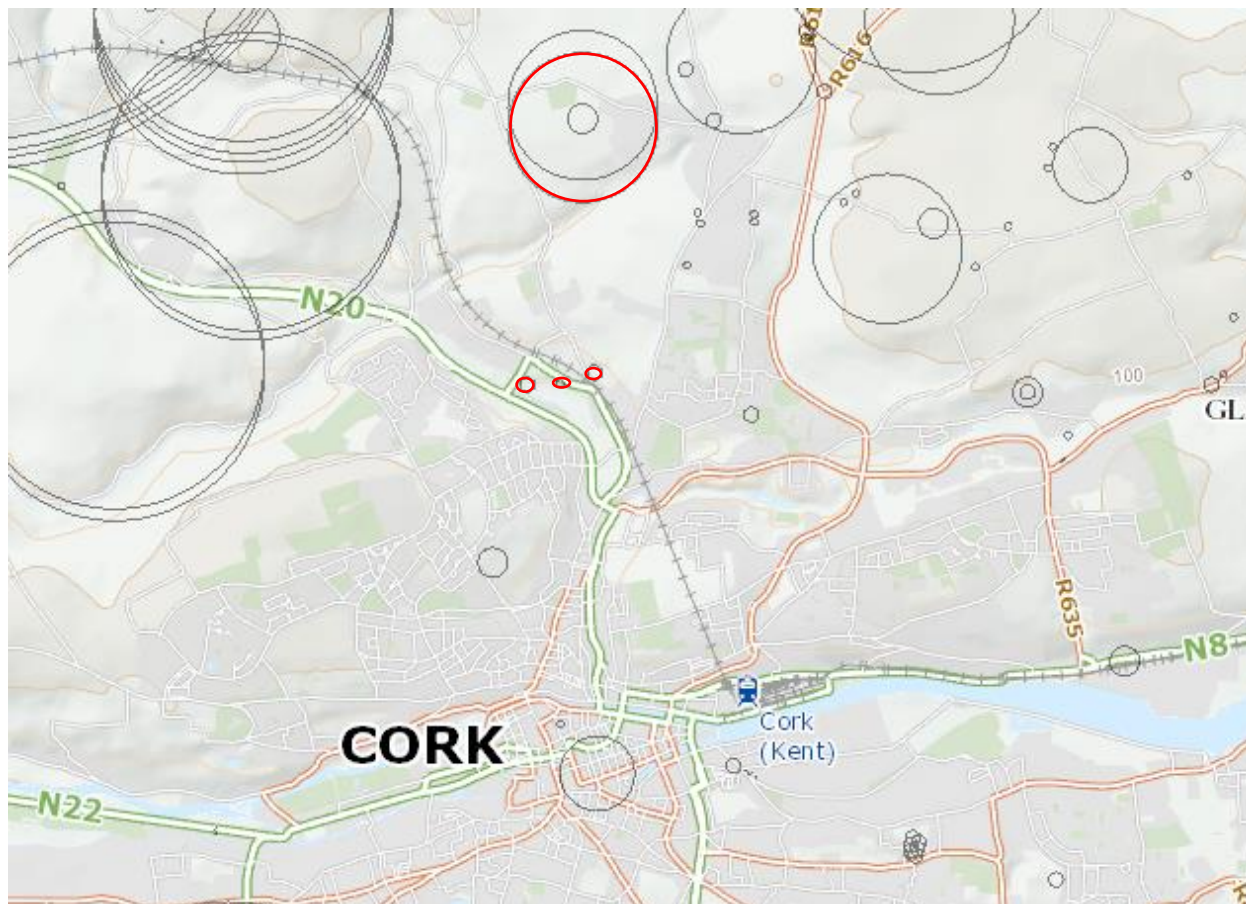
Groundwater vulnerability is a term used to represent the intrinsic geological and hydrogeological characteristics that determine the ease with which groundwater may be contaminated by human activities.

The Geological Survey of Ireland (GSI) online database was referenced regarding the vulnerability of the local aquifers to contamination from ground waters. The vulnerability mapping indicates that the local aquifers are generally highly or extremely vulnerable within the Study Area. An extract from the GSI Online Database is included below.

**Figure 7.4 GSI Aquifer Vulnerability (www.gsi.ie)**

#### Wells and Boreholes

The well card data by the Geological Survey of Ireland (GSI) indicates that a number of wells are in proximity to the scheme, in particular three wells are identified to the east of the scheme at Mallow Road. All other wells are either a sufficient distance for gradient that they are not within the zone of influence of the scheme. An extract from the GSI Online Database is included in Figure 7.5 the locations of the groundwater wells within the Study Area. Where wells protection areas overlap with the study area these have been shown in red.

**Figure 7.5 GSI Wells and Springs**

A list of abstractions for is provided in Table 7.6.

**Table 7.6 – GSI Well Card Data (Boreholes)**

Townland	Depth (m)	Depth to Rock (m)	Source Use	Yield Class	Yield (m <sup>3</sup> /day)
Kilcully	38	4.6	Unknown	Poor	38
Kilnap	91	4	Industrial	Moderate	50
Kilnap	60	2	-	-	-
Kilbarry	99.1	6.1	Unknown	Good	272

### 7.3.3 Potential Impacts on Hydrogeology

#### *Potential Temporary Slight Negative Impact*

There are numerous substances that will be used during the construction phase such as fuel, oil, lubricants, cement, silt, soil and other hydrocarbons which have the potential to pollute ground water. Washing of construction vehicles and machinery also poses a risk of polluting ground water. The impacts to hydrogeology as a result of the River Bride (Blackpool) Certified Drainage Scheme are temporary and not significant. Any impacts associated with the scheme will occur during the construction or maintenance phase.

As set out in Section 7.3.2 above, the aquifers in the study area are classified as highly to extremely vulnerable to infiltration but are very poor aquifers. Should any of the above-mentioned substances

contaminate the ground water in the study area presence of a poor aquifer means that there is limited risk to any ground water supply.

#### **Mitigation Measures**

A bunded area will be constructed within the site compound in order to avoid any polluting substances infiltrating the ground water during the construction and operation phase of the Scheme. All plant refuelling, maintenance and washing will be carried out within the bunded area. Spill kits will be available at the bunded area in order to ensure the quick and effective cleaning of any substances.

#### **Residual Impact - Potential Negligible Impact**

Taking into account the abovementioned mitigation measures, it is considered that the impact will constitute a Negligible Impact.

### **7.4 FLOODING**

This section describes the existing hydrological environment within the Study Area and potential impacts of the proposed works on Flooding. Mitigation measures are also provided for any potentially significant impacts identified.

#### **7.4.1 Methodology**

A desktop study was carried out in order to obtain a baseline for the Study Area and provide a description of the existing environment. The information was then used to assess the potential impact the Scheme will have on the hydrology of the Study Area.

The following documents were consulted during the preparation of this section:

- Ryan Hanley McCarthy Keville and O'Sullivan (2014) Lower Lee Flood Relief Scheme – Constraints Study;
- The Office of Public Works (2010) Lee Draft Catchment Flood Risk Management Plan;
- JBA Lower Lee Hydrology Report Final Report (February 2017)

#### **7.4.2 Flooding and Hydrology in the Existing Environment**

There has been a history of extensive flooding in the Blackpool area of Cork City in recent years. Prior to the early 2000s the primary source of flood risk came from the Glen River. However, in recent years this risk appears to have transferred over to the River Bride (North). Figure 7.6 below summarises the flood history and illustrates the transition of risk between watercourses.

**Figure 7.6 Timeline and source of recent flood events in Blackpool**



The River Bride (Blackpool) Certified Drainage Scheme proposes a combination of flood defence measures at specific locations and a rigorous and organised channel maintenance programme through the reach of the catchment.

The channel maintenance programme will include the River Bride (North) from its confluence with the Glenamought River, down along the Kiln to its outfall into the River Lee (approximately 3,470m). The maintenance programme also includes the predominantly culverted Brewery Branch reach of the Kiln River (approximately 825m). The channel maintenance programme will pay particular attention to locations where debris is likely to accumulate, such as at structures, sharp bends, culverts inlets etc.

The locations and extents of the proposed flood defence measures are outlined in the scheme drawings contained in Appendix 3 of the EIS and will include the following:

- Site investigation,
- Construction of new culverts,
- Replacement of four existing bridges/ culverts,
- Construction of new flood walls/ earthen embankments,
- Constructing bridge parapets,
- Local channel widening of the River Bride (referred to as a 'Winter Channel'),
- Construction of a sedimentation trap on the left bank of the River Bride,
- Removal of approximately 100m of existing culvert and restoration of open channel (River Bride) at this location,
- Construction of a new trash screen and roughing screens, and removal of existing trash screens on the River Bride (north) and Glen and Glenamought Rivers,
- Modifications to the existing foul and surface water collection networks in the vicinity of the proposed works, including construction of pumping stations, in order to prevent flooding,
- Removal of an existing sluice structure in the channel of the River Bride to the rear of the Dulux factory,
- Localised regrading of ground levels, erection of fencing and access to gates, to facilitate pedestrian /vehicular access to and around flood defences, or to redirect overland surface water flow paths,

- Filling in an existing open watercourse,
- Introduction of a flow control structure on the entrance to the Brewery culvert on the River Bride and the Spring Lane culverted branch of the River Glen, and
- Regular maintenance of the river channel and pumping stations.

### 7.4.3 Potential Impacts on Flooding

#### Impact on Flooding and Hydrology

##### *Permanent Significant Positive Impact*

The River Bride (Blackpool) Certified Drainage Scheme improves flood protection with the provision of a suite of measures including replacement of culverts, embankment works and defence wall improvements and therefore reduces the risk of water levels overtopping the bank and flooding the surrounding area.

#### Impact on Water Levels Upstream and Downstream of Proposed Works

##### *Permanent Negligible Impact*

The Flood improvements works will not affect the water levels upstream and downstream of the proposed scheme during normal flow conditions. During a storm event the flood defence measures will prevent waters flooding the surrounding area and therefore water levels downstream of the proposed flood defence walls may increase slightly over short stretches.

### 7.5 ASSESSMENT OF CUMULATIVE IMPACTS

A search in relation to plans and projects that may have the potential to result in cumulative impact on the environment was carried out as part of the EIAR. Data sources included the following:

- Cork County Development Plan 2014
- Cork City Development Plan 2015
- Relevant Local Area Plans
- South Western River Basin Management Plan
- Lower Lee CFRAMS including the Lower Lee Flood Relief Scheme
- An Bord Pleanála Website (Planning Searches)
- Myplan.ie
- Web search for major infrastructure projects in Cork City and County

See also Chapter 5.5 for impact on water quality in relation to biodiversity flora and fauna. A synopsis of the search results is provided in Table 7.6. In addition to the plans and projects listed in Table 7.7 a number of small scale development of dwelling house/extensions were identified from the wider area surrounding the proposed flood relief scheme. Given their small size and scale and their location on existing residential and made ground the potential for cumulative impact is not considered significant and therefore not considered further in this assessment.

**Table 7.7 Potential Impact in combination with other Plans and Projects (See Table 5.5 for Water Quality Impacts on the River Bride)**

Plans and Projects	Description and Key Issues / Policies/ Objectives Related to the zone of influence	Potential impact on Biodiversity	In-combination Impact
Existing activities: discharges and agricultural practices upstream.	Risk to groundwater quality from agriculture and discharges.	No risk to groundwater as a result of flood scheme. No increased risk of flood as a result of scheme. Scheme has been designed to take into account the existing conditions upstream of the site.	None
Lee CFRAMS Examines and aims to solve risk of flooding, now and in the future, from rivers and tidal waters.	For the Lee Catchment “Seek to minimise the level of exposure to flood damages through the identification and management of existing, and particularly potential future, flood risks in an integrated, proactive and river basin-based manner”. The following areas are considered: The River Lee & its main tributaries (including Rivers Bride, Curragheen Dripsey, Glasheen, Laney, Kiln, Shournagh, Sullane,) and estuary; Other main rivers flowing into Cork Harbour – Rivers Tramore, Owenboy, Glashaboy and Owennacurra and their estuaries; and Cork Harbour.	The SEA Scoping study for Lee CFRAMS identified that the potential impact on groundwater is limited and therefore not considered relevant to flood risk management. No groundwater supplies are identified within the catchment.	None
Cork County Development plan 2014	Policy for protection of groundwater as a natural resource and for its ecological and economic value.	Potential Positive Impact	None
Cork City Development Plan 2015 – 2021	Policy for maintaining the quality of groundwater.	Potential Positive Impact	None
South Western River Basin Management Plan	In order to meet the requirements of the EU Water Framework directive, it sets specific standards for the maintenance and improvement of the ecology and chemical water quality of water bodies in the Lee Catchment.	Potential Positive Impact	None

<p>Proposed Projects</p>	<p>Planning permission granted but currently under appeal consisting of: Demolition of industrial buildings and construction of residential units (approx. 81 dwelling) at Sunbeam</p>	<p>Brownfield site. Construction works may pose a direct potential impact on groundwater. Mitigation required to minimise impact. Potential impact from runoff during construction phase. Flood Risk Assessment required for the development.</p>	<p>Mitigation is provided for potential impact during construction phase on water quality for which strict adherence is required.</p>
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### 7.5.1 Conclusion of Cumulative Impact Assessment

It is considered that the design of the proposed River Bride (Blackpool) Certified Drainage Scheme, the scale of the works and the implementation of effective mitigation and best practice will ensure that the proposed development, when considered on its own, will minimise as much as possible significant impacts on Water Quality, Hydrology and Hydrogeology. The proposed project has been considered also, in combination with a number of plans and projects. Following a detailed assessment of the receiving environment, the potential for any further impact when considered in combination with any or all of the above plans and projects. It was found that there was no potential for significant cumulative impacts on Water as a result of the proposed works.

## 8 AIR QUALITY & CLIMATE / NOISE & VIBRATION

This section, prepared by McCarthy Keville O'Sullivan Ltd. with Damian Brosnan Acoustics, assesses both the air quality & climate and the likely noise & vibration impact of the proposed works, in the context of current relevant standards and guidance, and identifies any requirements or possibilities for mitigation.

The proposed works will not have any air quality or noise and vibration impact during its operational phase. As a result, it is only considered necessary to assess the potential noise and vibration impact on the surroundings during the construction phase.

The construction phase will be short term and transient in nature and will comprise of that identified in chapter 3 of this EIAR.

### 8.1 AIR QUALITY & CLIMATE – EXISTING ENVIRONMENT

#### Meteorological Data

A key factor in assessing temporal and spatial variations in air quality is the prevailing meteorological conditions. Depending on factors such as wind speed, individual receptors may experience very significant variations in pollutant levels under the same source strength (i.e. traffic levels). Wind is of key importance in dispersing air pollutants and for ground level sources, such as traffic emissions, pollutant concentrations are generally inversely related to wind speed. Thus, concentrations of pollutants derived from traffic sources will generally be greatest under very calm conditions and low wind speeds when the movement of air is restricted. In relation to PM<sub>10</sub>, the situation is more complex due to the range of sources of this pollutant. Smaller particles (less than PM<sub>2.5</sub>) from traffic sources will be dispersed more rapidly at higher wind speeds. However, fugitive emissions of coarse particles (PM<sub>2.5</sub> – PM<sub>10</sub>) will actually increase at higher wind speeds. Thus, measured levels of PM<sub>10</sub> will be a non-linear function of wind speed.

County Cork has a temperate oceanic climate, resulting in mild winters and cool summers. The Met Éireann weather station at Cork Airport is the nearest weather and climate monitoring station to the proposed development site located approximately 5.8 kilometres south of the site. Meteorological data recorded at Cork Airport over the 30-year period from 1981-2010 is shown in Table 8.1 overleaf. The wettest months are October and December, and July is usually the driest. July is also the warmest month with an average temperature of 18.7° Celsius.

**Table 8.1 Data from Met Éireann Weather Station at Cork Airport, 1981 to 2010**

	Monthly and Annual Mean and Extreme Values												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Year
<b>TEMPERATURE (degrees Celsius)</b>													
Mean daily max	8.2	8.3	9.9	11.8	14.4	17	18.7	18.5	16.5	13.2	10.3	8.5	12.9
Mean daily min	3	3.1	4	4.9	7.4	10	11.8	11.8	10.2	7.7	5.2	3.7	6.9
Mean temperature	5.6	5.7	6.9	8.4	10.9	13.5	15.3	15.2	13.3	10.5	7.8	6.1	9.9
Absolute max.	16.1	14	15.7	21.2	23.6	27.5	28.7	28	24.7	21.4	16.2	13.8	28.7
Absolute Min.	-4.3	-1.6	1.4	5	7.6	10.7	12.8	11.9	10.4	6	0.6	-3.2	-4.3
Mean No. of Days With Air Frost	10.6	10.6	10.9	11.4	15.1	16.2	19	18.4	17.3	15.4	12.8	11.6	19
Mean No. of Days With Ground Frost	-8	-4.7	-4.3	-2.3	-0.9	3.7	6.7	5.3	2.3	-0.9	-3.3	-7.2	-8
<b>RELATIVE HUMIDITY (%)</b>													
Mean at 0900UTC	89.8	89.4	87.8	83.1	80.6	81.3	83.2	85.4	88.4	90.1	90.7	90.5	86.7
Mean at 1500UTC	83.7	78.9	75.5	71.3	70.9	71.5	72.9	72.8	75.4	80.4	83.4	85.4	76.8
<b>SUNSHINE (Hours)</b>													
Mean daily duration	1.8	2.4	3.3	5.3	6.2	5.8	5.4	5.2	4.3	3	2.3	1.7	3.9
Greatest daily duration	8.5	10	11.5	13.6	15.5	16	15.3	14.4	11.9	10.3	8.7	7.6	16
Mean no. of days with no sun	10.1	7.9	6.3	3.1	2.1	2.5	2	2.6	3.6	6.4	8.6	11.9	67.1
<b>RAINFALL (mm)</b>													
Mean monthly total	131.4	97.8	97.6	76.5	82.3	80.9	78.8	96.8	94.6	138.2	120	133.1	1227.9
Greatest daily total	45.7	49.9	55.2	34.2	34.9	59.7	73.2	60.9	58.9	52.1	47.9	41.9	73.2
Mean num. of days with $\geq 0.2$ mm	20	17	19	16	15	14	15	15	16	19	19	19	204
Mean num. of days with $\geq 1.0$ mm	16	13	14	11	12	10	10	11	11	15	14	15	152
Mean num. of days with $\geq 5.0$ mm	9	6	5	5	5	5	5	5	5	8	7	8	73
<b>WIND (knots)</b>													
Mean monthly speed	12.1	12	11.6	10.3	10.1	9.4	9	9	9.4	10.7	10.9	11.6	10.5
Max. gust	78	83	70	62	59	49	57	54	58	75	66	80	65.9



Max. mean 10-minute speed	52	54	43	40	40	33	40	38	39	48	46	56	44.1
Mean num. of days with gales	2.3	1.8	1.3	0.3	0.3	0	0.1	0.2	0.3	1	1.2	1.9	10.8
WEATHER (Mean No. of Days With:)													
Snow or sleet	3.1	3.1	2	0.7	0	0	0	0	0	0	0.3	2.2	11.3
Snow lying at 0900UTC	0.7	0.5	0.2	0.1	0	0	0	0	0	0	0	0.5	2
Hail	1	1.1	1.4	1.9	0.7	0.2	0.1	0	0.1	0.3	0.2	0.4	7.4
Thunder	0.2	0.1	0.1	0.1	0.6	0.5	0.8	0.3	0	0.4	0.1	0.1	3.3
Fog	7.8	6.8	8.5	7.5	7.6	7.6	8.4	8.8	9.1	8.7	7.6	8.4	96.8

### Available Background Data

Air quality monitoring programs have been undertaken in recent years by the EPA and Local Authorities. The most recent annual report on air quality "Air Quality Monitoring Report 2010", details the range and scope of monitoring undertaken throughout Ireland. The Environmental Protection Agency (EPA) has designated four Air Quality Zones for Ireland:

- Zone A: Dublin City and environs
- Zone B: Cork City and environs
- Zone C: 16 urban areas with population greater than 15,000
- Zone D: Remainder of the country.

These zones were defined to meet the criteria for air quality monitoring, assessment and management described in the Framework Directive and Daughter Directives. The site of the proposed development lies within Zone B, which represents Cork city and its environs.

The EPA publishes Air Monitoring Station Reports for monitoring locations in all four Air Quality Zones. The ambient air quality monitoring carried out closest to the proposed development site is at Blackpool, Co. Cork, located adjacent to the proposed development site. EPA air quality data is available for Blackpool in the report 'Ambient Air Monitoring at Blackpool, Cork City 19th January 2000 to 31st May 2000', as detailed below. This monitoring location also lies within Zone B. Similar measurement values for all air quality parameters would be expected for the proposed development site as it lies directly adjacent to this monitoring location.

### Sulphur Dioxide (SO<sub>2</sub>)

Sulphur dioxide data for the 2000 monitoring period in Blackpool is presented in Table 8.2. A technical problem with the monitor meant that no data was collected between 29th March and 18th May 2000.

**Table 8.2 Sulphur Dioxide Data Blackpool January to May 2000**

Parameter	Measurement
No. of hours	3,188
No. of measured values	1,952
Percentage Coverage	61.2%
Maximum hourly value	161.3 µg/m <sup>3</sup>
98 percentile for hourly values	96.1 µg/m <sup>3</sup>
Mean hourly value	25.3 µg/m <sup>3</sup>
Maximum 24-hour mean	58.3 µg/m <sup>3</sup>
98 percentile for 24-hour mean	47.3 µg/m <sup>3</sup>

During the period of operation there were no exceedences of the 350 µg/m<sup>3</sup> hourly limit for the protection of human health. There were two exceedences of the 50 µg.m-3 lower assessment threshold. The directive stipulates that the lower assessment threshold should not be exceeded more than three times in the calendar year. The mean hourly value of 25.1 µg/m<sup>3</sup> exceeds the limit value for the protection of ecosystems. However, the report states that this limit may not be relevant to monitoring in an urban environment. It would be expected that SO<sub>2</sub> values at the proposed development site (directly adjacent to this monitoring location) would be similar to those recorded at the Blackpool monitoring site.

### Particulate Matter (PM10)

Particulate matter (PM<sub>10</sub>) data for the 2000 monitoring period in Blackpool is presented in Table 8.3.

**Table 8.3 Particulate Matter (PM10) Data Blackpool January to May 2000**

Parameter	Measurement
No. of days	133
No. of measured values	117
Percentage Coverage	87.9%
Maximum daily value	239.4 µg/m <sup>3</sup>
98 percentile for daily values	111.5 µg/m <sup>3</sup>
Mean daily value	49.1 µg/m <sup>3</sup>

The 24-hour limit for the protection of human health was breached 46 times during the measurement period; the Directive permits the limit value to be exceeded only 35 times in a calendar year. The mean of the daily values during the measurement period (49.1 µg/m<sup>3</sup>) also exceeds the annual limit value for the protection of human health (40.0 µg/m<sup>3</sup>). It would be expected that PM<sub>10</sub> values at the proposed development site would be similar to those recorded during the 2000 Blackpool monitoring period.

### Nitrogen Dioxide (NO<sub>2</sub>)

Nitrogen dioxide and oxides of nitrogen (NO<sub>x</sub>) data for the 2000 monitoring period in Blackpool is presented in Table 8.4. No data was collected between 29th February and 18th May because of a technical problem with the monitor.

**Table 8.4 Nitrogen Dioxide and Oxides of Nitrogen Data Blackpool January to May 2000**

Parameter	Measurement
No. of hours	3,188
No. of measured values	1,254
Percentage Coverage	39.3%
Maximum hourly value (NO <sub>2</sub> )	107.1 µg/m <sup>3</sup>
98 percentile for hourly values (NO <sub>2</sub> )	72.9 µg/m <sup>3</sup>
Mean hourly value (NO <sub>2</sub> )	26.8 µg/m <sup>3</sup>
Mean hourly value (NO <sub>x</sub> )	55.4 µg/m <sup>3</sup> NO <sub>2</sub>

All hourly mean NO<sub>2</sub> values were below the lower assessment threshold (100 µg/m<sup>3</sup>) except for one exceedence. The Directive stipulates that the lower assessment threshold should not be exceeded more than 18 times in a calendar year. The mean hourly NO<sub>2</sub> value (26.9 µg/m<sup>3</sup>) during the period of measurement was below the annual limit for the protection of human health (40 µg/m<sup>3</sup>) but just above the annual lower assessment threshold for the protection of human health (26 µg/m<sup>3</sup>). The mean hourly value of NO<sub>x</sub> (55.1 µg/m<sup>3</sup> NO<sub>2</sub>) during the measurement period exceeds the annual limit value for the protection of vegetation (30 µg/m<sup>3</sup> NO<sub>x</sub>). However, the report states that the applicability of this limit to urban air pollution monitoring is questionable. It would be expected that NO<sub>2</sub> and NO<sub>x</sub> values at the proposed development site would be similar to those recorded during the 2000 Blackpool monitoring period.

## Carbon Monoxide (CO)

Carbon monoxide data for the 2000 monitoring period in Blackpool is presented in Table 8.5. A limited dataset from 19th January until 13th February is available due to a technical problem with the carbon dioxide monitor.

**Table 8.5 Carbon Monoxide Data Blackpool January to February 2000**

Hourly Values	Result
No. of hours	3,188
No. of measured values	601
Percentage Coverage	18.8%
Maximum hourly value	21.8 mg/m <sup>3</sup>
98 percentile for hourly values	2.9 mg/m <sup>3</sup>
Mean hourly value	0.9 mg/m <sup>3</sup>
Maximum 8-hour mean	10.9 mg/m <sup>3</sup>
98 percentile for 8-hour mean	3.8 mg/m <sup>3</sup>

During the monitoring period there was an exceedence of the 10 mg/m<sup>3</sup> limit. This was an isolated result and may have been attributable to a local effect at the sampling location. Otherwise, all data is below the lower assessment threshold for the protection of human health. It would be expected that carbon monoxide values at the proposed development site would be similar to those recorded during the 2000 Blackpool monitoring period.

## Dust

A study by the UK ODPM gives estimates of likely dust deposition levels in specific types of environments. In open country a level of 39 mg/(m<sup>2</sup>\*day) is typical, rising to 59 mg/(m<sup>2</sup>\*day) on the outskirts of town and peaking at 127 mg/(m<sup>2</sup>\*day) for a purely industrial area. As a worst-case, a level of 127 mg/(m<sup>2</sup>\*day) can be estimated as the existing dust deposition level for the current location.

## 8.2 NOISE & VIBRATION – BASELINE SCENARIO

### 8.2.1 Noise receptors

The study site follows the course of the River Bride and its tributaries from the fringes of the city into Blackpool. The noise environment graduates from semi-rural to entirely urban over the approximately 4 km length of the study site. The chief feature of the noise environment is road traffic noise, particularly traffic on national route N20 which becomes the Blackpool bypass. From north to south, the noise environment consists of the following zones:

- The most northerly zone lies in the vicinity of Glennamought Bridge on the Old Whitechurch Road, on the fringes of Cork City. A cluster of one off houses represents the final development of significance before the landscape becomes predominantly rural. An inclined site immediately adjacent to the river, between the Old Whitechurch Road and the Mallow Road, is occupied by a several commercial premises. The noise environment in this area is dominated local road traffic.
- As the river crosses the Mallow Road, the environment quickly transforms from semi-rural to urban, particularly at North Point Business Park. A number of one-off houses are located in this area, one of which lies in a secluded position between the business park and Mallow Road, adjacent to the base of the railway bridge. The noise environment here is dominated by traffic on the local road

network in this area, in addition to N20 traffic which runs to the west and south. Receptors close to the Glenamought River are also affected by water flow noise.

- A detached dwelling at the end of the Killeens off-ramp from the N20 northbound forms a small isolated zone. Although this location lies only several hundred metres from the area described in the previous paragraph, the noise environment is markedly different due to (a) the dwelling's position immediately adjacent to a road junction, and (b) its location close to the N20, albeit at a lower elevation. The noise environment here is consequently dominated by road traffic noise.
- The N20 corridor forms the largest zone in the study site, extending from the Killeens interchange to Blackpool Shopping Centre, a distance of almost 2 km. The zone is dominated by traffic on the N20 which runs parallel to the Bride here. The zone may be divided into a number of sub-zones. The most northerly of these is occupied by the Commons Inn. Downstream of the hotel, nine dwellings form a short length of ribbon development adjacent to the N20. Immediately downstream of these, the area becomes decidedly commercial, and consists of a mixture of old and new commercial and industrial premises, several of which lie in the grounds of the former Sunbeam complex. At the southern end of the zone, Blackpool Retail Park consists of several commercial buildings, a number of which include office floors. To the south of the retail park lies Blackpool Shopping Centre, most of which is occupied by carpark spaces. Apart from the nine dwellings identified, there are no receptors located in proximity to the watercourse. A number of receptors along the southern side of the N20 are situated 70 m or more from the proposed works area. These include apartments at Brideholm, ribbon development opposite the former Sunbeam complex, and dwellings on the Old Commons Road opposite Blackpool Retail Park.
- Downstream of Blackpool Shopping Centre, the River Bride runs to the rear of terraced dwellings along Old Commons Road over a distance of approximately 350 m, and this marks the next zone. A land bank between the river and the N20 is occupied by Orchard Court, a suburban residential development of approximately 50 dwellings with limited retail space at its southern end. The river flows between Orchard Court and the rear of the Old Commons Road terraces. At the northern end of this zone, the noise environment is dominated by N20 traffic which gradually becomes elevated above Orchard Court. The southern end of the zone is less affected by N20 and Blackpool bypass traffic due to increased separation distance and screening provided by buildings. Although N20 traffic remains nonetheless significant at the southern end of the zone, its reduced contribution allows other sources to become audible, including traffic on surrounding streets, and typical residential estate activities such as local car movements, dog barking, pedestrian voices, birdsong and playing children.
- The most southerly zone is entirely urban, following Watercourse Road from Blackpool Church to Madden's Buildings, which marks the southern extent of the flood relief works area. A number of terraced dwellings lie alongside Watercourse Road, or on side roads. The noise environment here is dominated by road traffic, both on Watercourse Road itself and on the N20 which runs to the immediate east.

Descriptions of the various noise environments above relate to daytime hours, as the proposed works will chiefly be carried out during the daytime. The descriptions are based on site inspections, and particularly on a noise survey undertaken across the study site as described below. The evening noise environment in each zone is likely to be similar to the daytime environment, as traffic noise is likely to continue into evening hours. Indeed, previous surveys undertaken by Damian Brosnan Acoustics in relation to other

projects in the local area indicate that road traffic noise on both urban streets and on the N20 continues right through the evening and into the night. The most recent such survey, undertaken September 2015 on Watercourse Road, indicated elevated street traffic noise throughout the evening. Night-time ambient levels are also likely to remain elevated due to N20 traffic noise intrusion

Traffic is the chief noise source present across the study site, arising on the N20 and Blackpool bypass, on streets such as Old Commons Road, Watercourse Road and Thomas Davis Street, and through residential estates and retail parks. The only other noise source of significance noted during site inspections is commercial/industrial noise from scattered premises. These include sources at premises across the Sunbeam site, and industrial emissions at the Dulux facility.

On the margins of the city, in the vicinity of Mallow Road and Old Whitechurch Road, traffic noise is also the chief contributor, although traffic movements are more intermittent. Railway movements occur at intervals. The soundscape in the vicinity of the commercial premises immediately downstream of Glennamought Bridge is influenced by operations at the premises.

The EPA defines a noise sensitive location (NSL) as:

*'Any dwelling house, hotel or hostel, health building, educational establishment, place of worship or entertainment, or any other facility or area of high amenity which for its proper enjoyment requires absence of noise at nuisance levels.'*

NSLs across the study site consist almost entirely of residential dwellings. Bedrooms at the Commons Inn hotel may warrant NSL status. While Blackpool Retail Park includes a number of office floors, these are not considered to be NSLs in the context of the proposed project for several reasons:

- The office floors lie at a significantly higher elevation than the works zone, several floors above ground level.
- These floors are likely to be exposed to elevated traffic noise levels on the N20.
- A cursory inspection indicates that the office floors are fitted with acoustic grade windows.
- The proposed floor relief works will be undertaken at ground level, to the rear of several commercial units. None of these opens to this area.

### **8.2.2 Noise survey methodology**

Existing daytime ambient noise levels (see glossary in Appendix 8A) across most of the study site were quantified through a noise survey undertaken Thursday October 22 2015. Following a decision to extend the works zone northwards to Glennamought Bridge, additional monitoring was undertaken on 23 October 2017. Survey methodology, equipment specifications and weather conditions are listed in Appendix 8B. Monitoring was undertaken at eight stations, designated N1-N8, as described in Table 8.6, shown in Figures 8.1-8.7, and shown in Photographs 8.1-8.8. Stations were selected on the basis of the following criteria:

- Flood relief works are proposed locally.
- Dwellings are located in proximity.
- The noise environment is likely to be different to those at other stations, due to geography, terrain, road layout, screening, etc.

A preliminary inspection indicates that there are no sensitive receptors in Sunbeam commercial estate, and monitoring was not carried out here. While a multi-storey office development at Blackpool Retail Park includes office space which overlooks a proposed flood relief works zone, monitoring was not conducted here as the office floors lie several floors above ground level.

**Table 8.6: Noise station locations.**

Station	ITM NGR	Location
N1	567414 573130	T&A Builders Providers carpark, 6 m from Watercourse Rd. verge, 10 m from rear wall of Madden's Buildings terrace. Selected to represent dwellings at Madden's Buildings and in vicinity of Foley's Row.
N2	567404 573351	Paved area at Blackpool Church, 8 m N of NE corner. Selected to represent terraced receptors in vicinity of Watercourse Rd., Thomas Davis St. and Old Commons Rd.
N3	567382 573436	NW side of square at S end of Orchard Court, 17 m from Old Commons Rd. Selected to represent dwellings around square.
N4	567388 573611	N end of Orchard Court, 10 m from nearest dwelling façade. Selected to represent Orchard Court dwellings. Also selected to represent noise environment in rear gardens of riverside terraced dwellings along Old Commons Rd.
N5	566565 574475	Near S corner of carpark at Commons Inn, 30 m NNE of rear façade at dwelling SE of Commons Inn entrance. Selected to represent noise environment of rear gardens of 9 dwellings on Commons Rd. between Commons Inn and unoccupied commercial premises.
N6	566020 574737	Paved area 27 m NW of dwelling adjacent to roundabout at end of N20 N-bound Killeens off-ramp. Selected to represent adjacent dwelling.
N7	566380 575019	Front lawn of secluded dwelling in valley SW of Kilnap railway bridge, 12 m SW of dwelling SW corner. Selected to represent local noise environment at dwelling.
N8	567191 575352	Front lawn of secluded dwelling in valley, immediately E of Glennamought Bridge, 10 m W of dwelling front façade. Selected to represent adjacent dwelling, in addition to dwelling on incline on opposite bank of river.

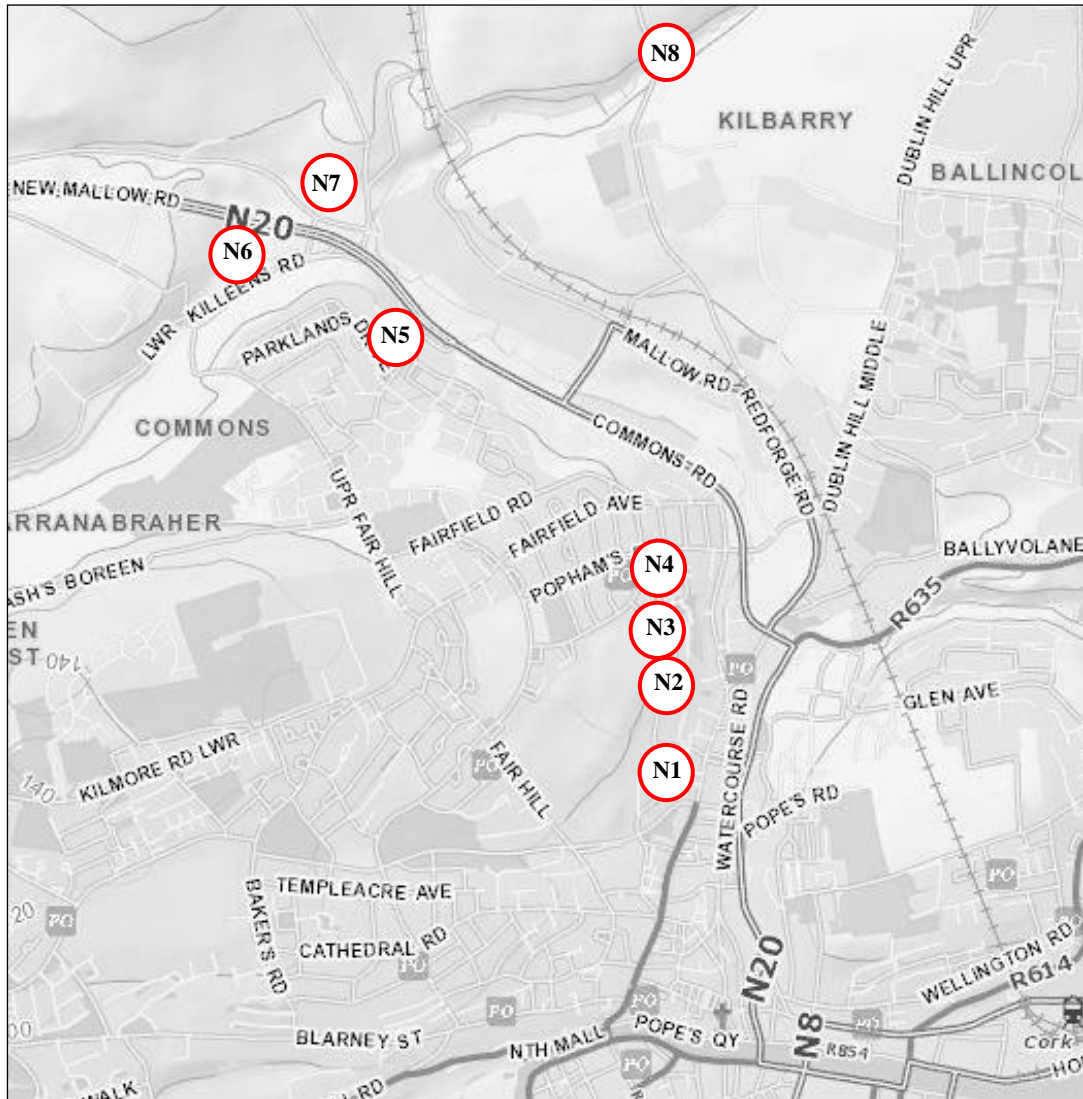


Figure 8.1: Monitoring locations overview.

N0

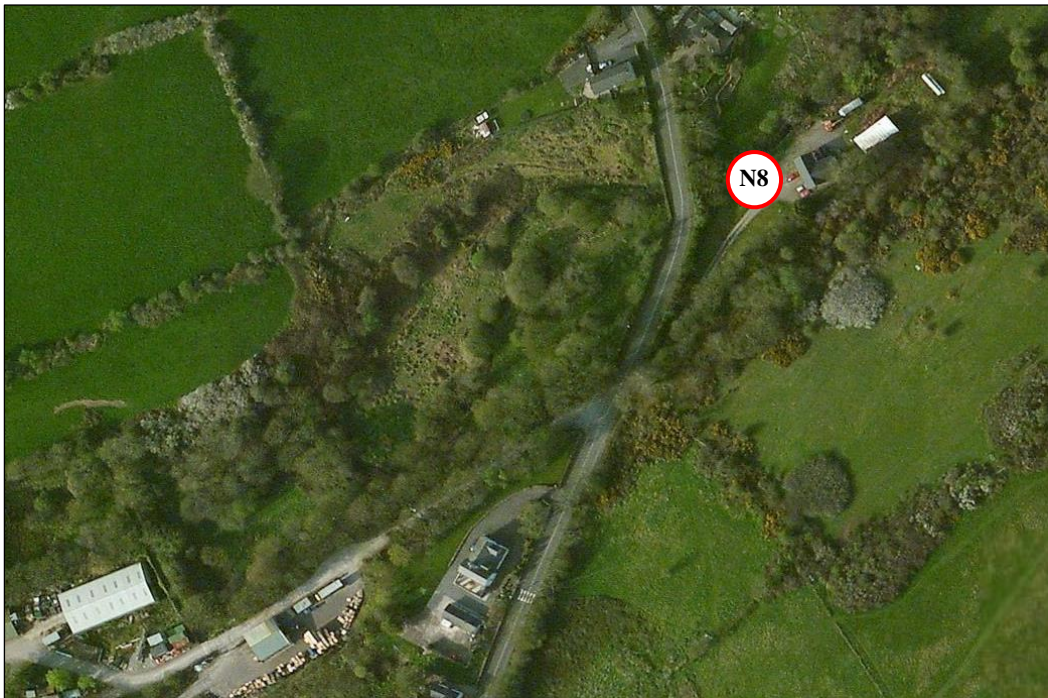


Figure 8.2: Station N8 location.

N0

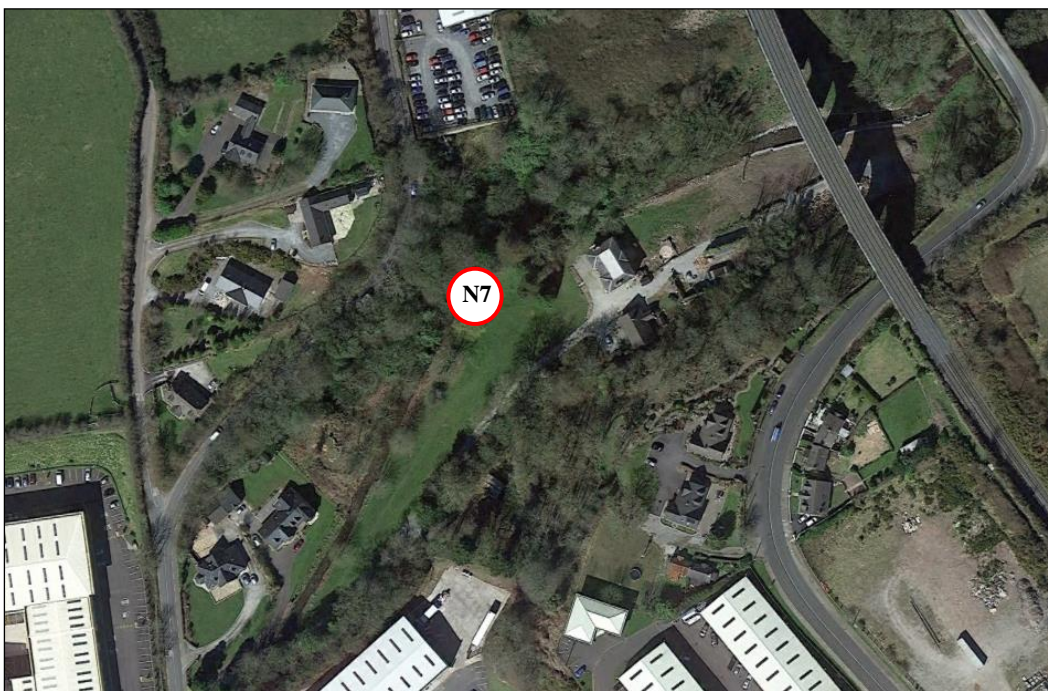


Figure 8.3: Station N7 location.

N0

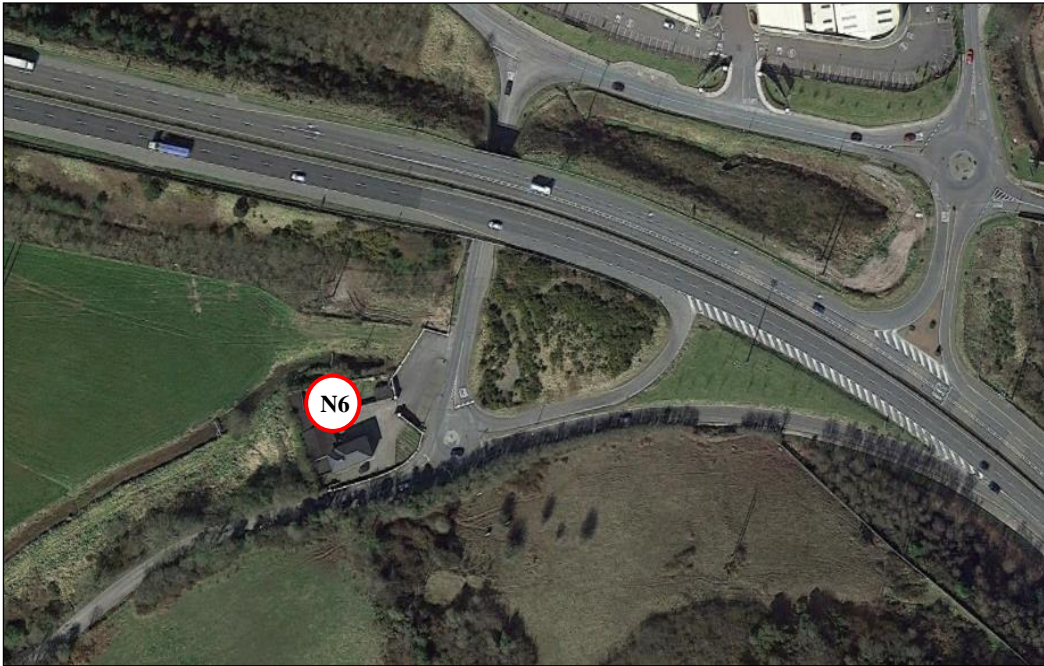


Figure 8.4: Station N6 location.

N6

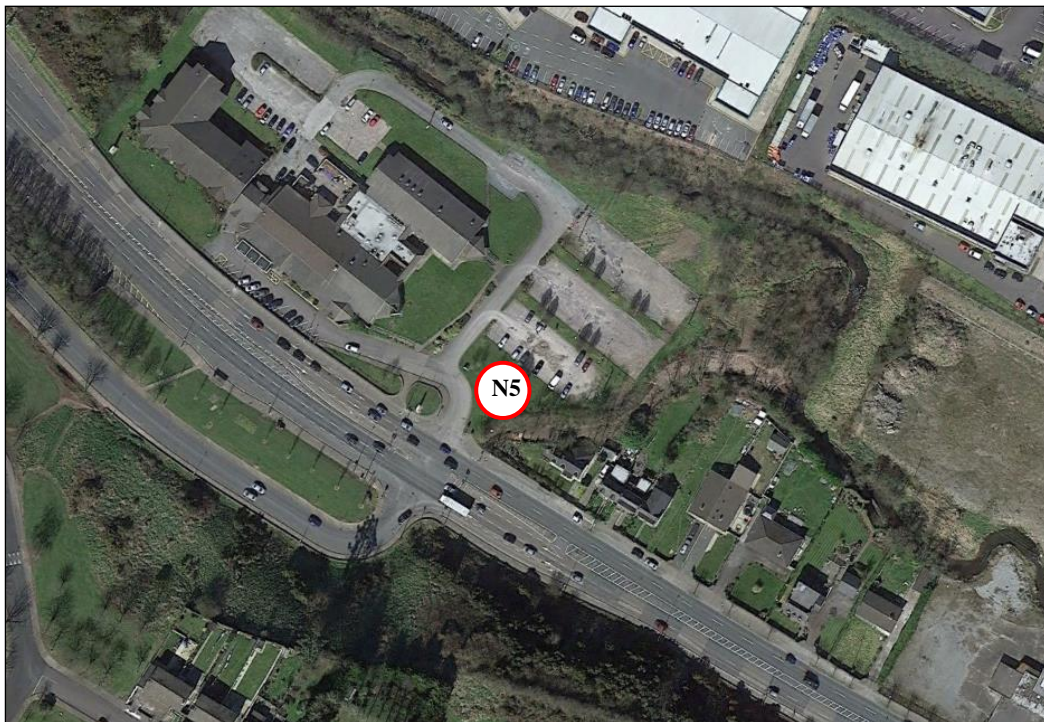


Figure 8.5: Station N5 location.

N5



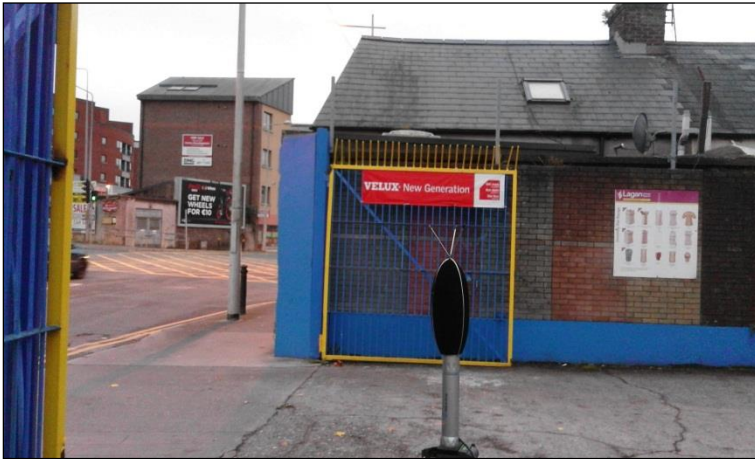
**Figure 8.6: Stations N3 & N4 locations**

**NO**



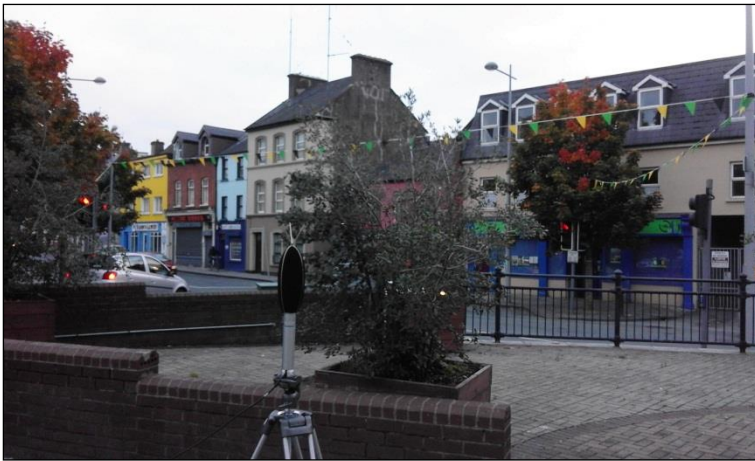
**Figure 8.7: Stations N1 & N2 locations.**

**NO**



**Photograph 8.1: N1**

T&A Builder's Providers carpark, with roof of nearest dwelling at Madden's Buildings visible, looking S.



**Photograph 8.2: N2**

Blackpool Church, looking NE towards Thomas Davis St.



**Photograph 8.3: N3**

Orchard Court (south), looking N.



**Photograph 8.4: N4**  
Orchard Court (north), looking SE.



**Photograph 8.5: N5**  
Commons Inn carpark, with rear of  
nearby dwelling visible through trees,  
looking SE.



**Photograph 8.6: N6**  
Dwelling at end of N20 Killeens off-  
ramp, looking SW.



**Photograph 8.7: N7**  
Front lawn of secluded dwelling, looking N.



**Photograph 8.8: N8**  
Front lawn of secluded dwelling, looking E.

### 8.2.3 Results

Noise data recorded are presented in Appendix 8C and summarised in Table 8.7 below. Frequency spectra and time history profiles are shown in Appendix 8D.

**Table 8.7: Ambient noise data summary.**

Station	Location	L <sub>Aeq</sub> 15 min dB	L <sub>AF90</sub> 15 min dB	Dominant noise sources
N1	Madden's Buildings, Watercourse Rd.	66	58-59	Watercourse Rd. traffic dominant continuously. N20 traffic also clearly audible.
N2	Blackpool Church	62-64	55-57	Traffic through local junction dominant.
N3	Orchard Court south	51-55	47-49	Road traffic on surrounding streets clearly audible and dominant, although screened by buildings and walls.
N4	Orchard Court north	56-58	52-53	N20 Blackpool bypass traffic continuously clearly audible and dominant.
N5	Commons Inn	55-56	52	N20 traffic continuously dominant.
N6	Killeens off-ramp	65	54-57	Intermittent traffic through adjacent junction dominant. N20 traffic continuously clearly audible.

N7	Dwelling below Kilnap railway br.	51-52	49-50	Water flow in nearby river clearly audible continuously, co-dominant with continuously audible N20 traffic noise.
N8	Dwelling at Glennamought Br.	48-56	47	Water flow in adjacent river. Dog barking temporarily raising LAeq 15 min.

Noise levels measured at each location were markedly consistent, showing relatively unchanged levels across all three measurement intervals. This is a typical feature of noise environments dominated by road traffic noise. Also a feature of such environments is the elevated noise levels prevailing throughout the day. The highest levels were measured at locations close to street and road verges (N1, N2 and N6), with LAeq 15 min levels of 62-66 dB recorded. Reductions of several decibels were measured at stations more removed from road noise (N3, N4 and N5), where LAeq 15 min levels fell to 51-58 dB. At N7, located in a sheltered position 330 m from the N20, LAeq 15 min levels decreased to 51-52 dB. Here, N20 traffic and local river flow maintained a steady noise environment. Levels fell further at N8, where the secluded position screened out more distant sources, and only water flow in the adjacent river remained dominant.

Regardless of location, measured levels at all stations except N8 were relatively elevated, and reflect the intrusion of both local and distant road traffic. The impact of traffic light sequences, which resulted in traffic waves, is readily apparent in most time history profiles shown in Appendix 8D. No tones were noted at any station.

#### 8.2.4 Likely Future Receiving Environment

In line with Guidelines on the information to be contained in environmental impact assessment reports (EPA, August 2017 Draft), a brief comment is warranted here on the likely future progression of the local noise environment in the absence of the proposed development i.e. should the development not proceed. Recorded noise data indicate that the local soundscape is entirely dominated by road traffic. Significant changes in traffic volumes are required before any changes in noise levels become perceptible. Such changes are unlikely in the short to medium term. In the longer term, it is possible that gradual expansion of the city urban area and/or construction of new roads may alter the noise environment. The long term soundscape may also be altered by the introduction of commercial and/or industrial activities. The proposed development, whether it proceeds or not, is unlikely to influence the evolution of the local soundscape.

### 8.3 ASSESSMENT CRITERIA

#### 8.3.1 Air Quality & Climate

In order to reduce the risk to health from poor air quality, national and European statutory bodies have set limit values in ambient air for a range of air pollutants. These limit values or “Air Quality Standards” are health or environmental-based levels for which additional factors may be considered. For example, natural background levels, environmental conditions and socio-economic factors may all play a part in the limit value which is set. Air quality significance criteria are assessed on the basis of compliance with the appropriate standards or limit values.

In 1996, the Air Quality Framework Directive (96/62/EC) was published. This Directive was transposed into Irish law by the Environmental Protection Agency Act 1992 (Ambient Air Quality Assessment and Management) Regulations 1999. The Directive was followed by four Daughter Directives, which set out limit values for specific pollutants:

- The first Daughter Directive (1999/30/EC) deals with sulphur dioxide, oxides of nitrogen, particulate matter and lead.
- The second Daughter Directive (2000/69/EC) addresses carbon monoxide and benzene. The first two Daughter Directives were transposed into Irish law by the Air Quality Standards Regulations 2002 (SI No. 271 of 2002).
- A third Daughter Directive, Council Directive (2002/3/EC) relating to ozone was published in 2002 and was transposed into Irish law by the Ozone in Ambient Air Regulations 2004 (SI No. 53 of 2004).
- The fourth Daughter Directive, published in 2007, deals with polyaromatic hydrocarbons (PAHs), arsenic, nickel, cadmium and mercury in ambient air.

The Air Quality Framework Directive and the first three Daughter Directives have been replaced by the Clean Air for Europe (CAFE) Directive (Directive 2008/50/EC on ambient air quality), which encompasses the following elements:

- The merging of most of the existing legislation into a single Directive (except for the Fourth Daughter Directive) with no change to existing air quality objectives.
- New air quality objectives for PM<sub>2.5</sub> (fine particles) including the limit value and exposure concentration reduction target.
- The possibility to discount natural sources of pollution when assessing compliance against limit values.
- The possibility for time extensions of three years (for particulate matter PM<sub>10</sub>) or up to five years (nitrogen dioxide, benzene) for complying with limit values, based on conditions and the assessment by the European Commission.

Table 8.8 below sets out the limit values of the CAFE Directive, as derived from the Air Quality Framework Daughter Directives. Limit values are presented in micrograms per cubic metre ( $\mu\text{g}/\text{m}^3$ ) and parts per billion (ppb). The notation PM<sub>10</sub> is used to describe particulate matter or particles of ten micrometres or less in aerodynamic diameter. PM<sub>2.5</sub> represents particles measuring less than 2.5 micrometres in aerodynamic diameter.

**Table 8.8 Limit values of Directive 2008/50/EC, 1999/30/EC and 2000/69/EC (Source: EPA)**

Pollutant	Limit Value Objective	Averaging Period	Limit Value ( $\mu\text{g}/\text{m}^3$ )	Limit Value (ppb)	Basis of Application of Limit Value	Attainment Date
Sulphur dioxide (SO <sub>2</sub> )	Protection of Human Health	1 hour	350	132	Not to be exceeded more than 24 times in a calendar year	1st Jan 2005
Sulphur dioxide (SO <sub>2</sub> )	Protection of human health	24 hours	125	47	Not to be exceeded more than 3 times in a calendar year	1st Jan 2005
Sulphur dioxide (SO <sub>2</sub> )	Protection of vegetation	Calendar year	20	7.5	Annual mean	19th Jul 2001

Pollutant	Limit Value Objective	Averaging Period	Limit Value ( $\mu\text{g}/\text{m}^3$ )	Limit Value (ppb)	Basis of Application of Limit Value	Attainment Date
Sulphur dioxide (SO <sub>2</sub> )	Protection of vegetation	1st Oct to 31st Mar	20	7.5	Winter mean	19th Jul 2001
Nitrogen dioxide (NO <sub>2</sub> )	Protection of human health	1 hour	200	105	Not to be exceeded more than 18 times in a calendar year	1st Jan 2010
Nitrogen dioxide (NO <sub>2</sub> )	Protection of human health	Calendar year	40	21	Annual mean	1st Jan 2010
Nitrogen monoxide (NO) and nitrogen dioxide (NO <sub>2</sub> )	Protection of ecosystems	Calendar year	30	16	Annual mean	19th Jul 2001
Particulate matter 10 (PM <sub>10</sub> )	Protection of human health	24 hours	50	-	Not to be exceeded more than 35 times in a calendar year	1st Jan 2005
Particulate matter 2.5 (PM <sub>2.5</sub> )	Protection of human health	Calendar year	40	-	Annual mean	1st Jan 2005
Particulate matter 2.5 (PM <sub>2.5</sub> ) Stage 1	Protection of human health	Calendar year	25	-	Annual mean	1st Jan 2015
Particulate matter 2.5 (PM <sub>2.5</sub> ) Stage 2	Protection of human health	Calendar year	20	-	Annual mean	1st Jan 2020
Lead (Pb)	Protection of human health	Calendar year	0.5	-	Annual mean	1st Jan 2005
Carbon Monoxide (CO)	Protection of human health	8 hours	10,000	8,620	-	1st Jan 2005
Benzene (C <sub>6</sub> H <sub>6</sub> )	Protection of human health	Calendar Year	5	1.5	-	1st Jan 2010

The Ozone Daughter Directive 2002/3/EC is different from the other Daughter Directives in that it sets target values and long-term objectives for ozone rather than limit values. Table 8.9 presents the limit and target values for ozone.

**Table 8.9 Target values for Ozone Defined in Directive 2008/50/EC**

Objective	Parameter	Target Value for 2010	Target Value for 2020
Protection of human health	Maximum daily 8 hour mean	120 mg/m <sup>3</sup> not to be exceeded more than 25 days per calendar year averaged over 3 years	120 mg/m <sup>3</sup>
Protection of vegetation	AOT40 calculated from 1 hour values from May to July	18,000 mg/m <sup>3</sup> .h averaged over 5 years	6,000 mg/m <sup>3</sup> .h
Information Threshold	1 hour average	180 mg/m <sup>3</sup>	-
Alert Threshold	1 hour average	240 mg/m <sup>3</sup>	-

There are no statutory guidelines regarding the maximum dust deposition levels that may be generated during the construction phase of a development in Ireland. Furthermore, no specific criteria have been set in respect of this development. However, guidelines from the Department of the Environment, Heritage and Local Government currently exist for dust emissions from quarrying and ancillary activities. These can be implemented with regard to dust emissions from the proposed construction sites.

With regard to dust deposition, the German TA-Luft standard for dust deposition (non-hazardous dust) sets a maximum permissible immission level for dust deposition of 350 mg/(m<sup>2</sup>\*day) averaged over a one year period at any receptors outside the site boundary. Recommendations outlined by the Department of the Environment, Health & Local Government, apply the Bergerhoff limit of 350 mg/(m<sup>2</sup>\*day) to the site boundary of quarries.

The concern from a health perspective is focused on particles of dust which are less than 10 microns. EU ambient air quality standards (Council Directive 2008/50/EC transposed into Irish law as S.I. 180 of 2011) centres on PM<sub>10</sub> (particles less than 10 microns) as it is these particles which have the potential to be inhaled into the lungs and cause some adverse health impact. The Directive also sets an ambient standard for PM<sub>2.5</sub> (particles less than 2.5 microns) which will come into force in 2015 (see Table 8.8).

### Climate Agreements

Ireland is a Party to the Kyoto Protocol, which is an international agreement that sets limitations and reduction targets for greenhouse gases for developed countries. It is a protocol to the United Nations Framework for the Convention on Climate Change. The Kyoto Protocol came into effect in 2005, as a result of which, emission reduction targets agreed by developed countries, including Ireland, are binding.

At Kyoto in 2007, the European Union committed to an average annual greenhouse gas (GHG) emission reduction of 8% below the 1990 levels, over the five year period 2008-2012, with the reductions to be shared between EU Member States. Ireland negotiated an increase of 13% above the 1990 level for the period 2008-2012. Other Member States committed to a reduction of more than 8% to facilitate Ireland's increase in emissions.

In Doha, Qatar, on 8th December 2012, the 'Doha Amendment to the Kyoto Protocol' was adopted. The amendment includes:

- New commitments for Annex I Parties (including Ireland) to the Kyoto Protocol who agreed to take on commitments in a second commitment period from 1 January 2013 to 31 December 2020;