# Appendix 5E Lower Lee Electro-Fishing Survey and Licence Return Report

# **OFFICE OF PUBLIC WORKS**

# Lower Lee (Cork City) Drainage Scheme



# ELECTRO-FISHING SURVEY & LICENSE RETURN REPORT

December 2016



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APPENDIX I: DCMNR AUTHORISATION

# 1. Introduction

Triturus Environmental Services was contracted by Ryan Hanley Consulting Engineers to conduct a number of fisheries surveys on the River Lee and several of its tributaries, Co. Cork. These surveys were commissioned as part of the overall Lower Lee Flood Relief Scheme, which aims to address the excessive flooding of the rivers in the vicinity of Cork City. A number of discrete proposed works areas are located along the River Lee and selected tributaries, where planned work activities include the installation of flood prevention walls. Survey sites were, where feasible, were selected relevant to these proposed works areas.

The purpose of the surveys was to assess the overall fisheries habitat value in the lower River Lee (from Iniscarra Hydroelectric Dam, downstream) and selected tributaries (i.e. Curragheen, Glasheen, Bride [North] and Glenamought Rivers), particularly in relation to Annex II lamprey and salmonid species.

Ryan Hanley Consulting Engineers obtained a Section 14 Authorisation on the 27<sup>th</sup> September 2014, under the Fisheries Consolidation Act 1959, as substituted by section 4 of the Fisheries (Amendment) Act 1952, to conduct an electro-fishing assessment of the River Lee and selected aforementioned tributaries, Co. Cork. As agreed with Inland Fisheries Ireland, Ross Macklin and Bill Brazier of Triturus Environmental Services were commissioned to undertake the surveys by electro-fishing as appointed by Ryan Hanley.

The baseline data and results of the surveys would help inform the detailed design and mitigation for the proposed flood relief works along the lower River Lee and selected tributaries, namely the Curragheen, Glasheen, Bride (North) and Glenamought Rivers.

# Background

The Rivers Lee (EPA code: IE\_SW\_19\_1663), Curragheen (IE\_SW\_19\_1744), Glasheen (IE\_SW\_19\_1744), Bride [North] (IE\_SW\_19\_1451) and Glenamought (IE\_SW\_19\_1520) are located in hydrometric area 19 and within the South Western river basin district (SWRBD).

The Lee, which drains an area of 1253km<sup>2</sup>, is underlain by a mixed geology of Devonian old red sandstones and Dination mudstones and sandstones, with occasional, highly localised strikes of Tournasion limestone (Geological Survey of Ireland). The Bride (North) and Glenamought tributaries also flow over these geologies. The underlying geologies of the Curragheen and Glasheen Rivers, however, are more dynamic, consisting of intermittent Visean limestone and shale, Waulsortian mudbank limestone with limited Tournasian argillaceous biolclastic limestone (Geological Survey of Ireland).

The Lee is a lowland depositing watercourse (FW2; Fossit, 2000). It may be considered a 'C type' channel in its lower reaches (Rosgen, 1996). C type channels are meandering in character, their banks low enough to provide regular flooding and are excellent nursery and spawning rivers.

The Bride (North), Curragheen and Glasheen can also be classed as lowland depositing watercourses (FW2). As these three tributaries flow through the urban environment of Cork City and surrounds, they have been largely altered and modified in terms of channel morphology and natural flow regimes. Overall, the Glenamought, with its steeper gradient and higher flow rate, represents a more typical eroding/upland river (FW1).

According to the EPA the biological water quality on the River Lee achieved Q4, 'good status' at Leemount Bridge (on the R618 road) during 2011, which indicates it is meeting the requirements of the Water Framework Directive (2000/60/EEC). Water quality data for the selected tributaries is largely lacking. The water quality of fifteen sites on the Curragheen River was assessed as ranging from Q3-4 according to Kelly et al. (2007). However, under the South West River Basin District Management Plan, the water quality of the Curragheen River is designated as poor and it is an objective to restore this water body to good status by 2015.

No other water quality data is available for the selected tributaries in the survey although the urban reaches of all these rivers are considered to be particularly under threat from pollution.

The River Lee is a designated salmonid watercourse under S.I. No. 293/1988 - European Communities (Quality of Salmonid Waters) Regulations, 1988. The River Lee contains 1.01% of the fluvial accessible habitat to Atlantic salmon (Salmo salar), ranking it 22nd nationally according to the Quantification of the Freshwater Salmon Habitat Asset in Ireland (McGinnity et al., 2003).

The Bride, and its Glenamought tributary, are both considered impassable to migratory Atlantic salmon due to urban modification (culverted from Blackpool to River Lee confluence). However, both rivers are known locally to support moderate stocks of wild brown trout (Salmo trutta). In contrast, due to more direct connectivity with the south channel of the River Lee (Cork City), the Curragheen is locally known to support stocks of Atlantic salmon.

# 2. Methods

### Study Site

Electro-fishing surveys of the existing fish stocks at selected sites on the Rivers Lee (n=2), Curragheen (n=3), Glasheen (n=1), Bride (North) (n=3) and Glenamought (n=1), Co. Cork, were conducted over the 27-30th September 2014. Where feasible, sites were selected in relation to proposed works areas along the respective river channels (Fig 2.1). Site selection on the River Lee was constrained largely by river depth, with the majority of the river in the vicinity of works areas deemed unsuitable (i.e. too deep) for safe and effective wadable/bank electro-fishing. Safe access rather than depth was a particular issue on the Curragheen and Bride (North) rivers, although sites were chosen to provide as broad a characterisation as possible along the length of channels relevant to the proposed works areas. With regards to the Glasheen and Glenamought, single sites were selected and surveyed to reflect the limited locations of the proposed works areas.

As two primary species groups were targeted during the electro-fishing surveys, i.e. lamprey and salmonids, two separate electrofishing methodologies were employed, incorporating different settings. For lamprey species, a 1m<sup>2</sup> box-quadrat was utilised, where two operator's electro-fished within the selected quadrat areas at each site (if present) in a discontinuous, upstream, manner. For salmonids, electro-fishing was conducted in an upstream direction at each pre-selected site for a standard 5 minute CPUE, after Kennedy (1984) and O' Connor & Kennedy (2002). Both approaches were conducted using a single anode Smith-Root LR24 backpack (12V DC input; 300V, 100W DC output).

Water with a low conductivity has a higher resistance to the passage of an electric current through it. This means that in high conductivity waters the current for a given voltage is higher than in low conductivity water and the threshold values for different fish responses are also lower (Zalewski and Cowx, 1990). Given this fact, conductivity (µs) was measured on-site prior to any electro-fishing activity to better inform the management of settings.

In order to minimise potential damage and undue stress to qualifying interest lamprey species and Atlantic salmon, electro-fishing settings were modified to target specific species at the site (see below). Larval

lamprey species, for example, were specifically targeted in areas of low/reduced flow and with a higher proportion of soft sediment.

Typically, salmonids require a higher frequency (and also voltage) than lamprey species in order to sufficiently stun them for capture. Unless amended, these settings can result in the inadvertent electro-narcosis of buried ammocoetes, resulting in failure to emerge and recording of absence, as well as damage to the fish (Thompson *et al.*, 2010).

Specific settings on the Smith-Root LR24 for each species utilised during the survey are outlined below.

# **Electrofishing settings**

### Lamprey species

As per Harvey & Cowx (2003), quadrat-based electro-fishing was conducted for lamprey ammocoetes. Settings for lamprey followed those recommended and used by APEM (2004) and Niven & McAuley (2013). Using this approach, the anode was placed under the water surface, approx. 10–15 cm above the sediment, to prevent immobilising lamprey ammocoetes within the sediment. The anode was energised with 100V of pulsed DC for 15-20 seconds and then turned off for approximately five seconds to allow ammocoetes to emerge from their burrows. The anode was switched on and off in this way for approximately two minutes. Immobilised ammocoetes are either carried downstream and collected in the cod end of the box quadrat, or are collected by a second operator using a fine-mesh hand net as they emerge. During this survey, a frequency of 20-25Hz was utilised, with a duty cycle of approx. 12% (pulse width 6ms).

#### Salmonids

As salmonids typically require a higher frequency than lamprey ammocoetes, the frequency was increased to 35-40Hz at a duty cycle of 18% when specifically targeting salmonids during these fisheries assessments (i.e. in faster glides, over gravels).

### Other fish species (i.e. eels, cyprinids, percids, pike)

In the deeper water following one site pass with lamprey settings (to ensure no lamprey would be missed), a pulse width of 30 hertz and 18% duty cycle was used. Eel, cyprinids, percids and pike typically require a lower frequency than salmonids and higher than lamprey. While perch and eel may be captured at lower frequencies, these settings would offer the best capabilities to catch a wide range of fish.

# Fish handling

Once immobilised, fish were quickly removed and placed in 20L oxygenated bankside water baths (batterypowered Jarvis Walker Deluxe Two-Speed Aerators) containing river water until all electrofishing passes had been completed. Fish were then anaesthetised in a 30mg/L clove oil solution and then identified to species level. Captured fish were subsequently measured to the nearest millimetre (standard length, SL for eel and lamprey; fork length, FL for all other species) and weighed to the nearest 0.1g. Lamprey ammocoetes were identified to species level, with the assistance of a hand lens, through external pigmentation patterns and trunk myomere counts as described by Potter & Osborne (1975) and Gardiner (2003). Handling of live fish was kept to a minimum when processing any captured individuals. Latex gloves were used when handling and processing all fish to minimise potential damage through slime removal and/or the spread of infection between fish. Following processing, all fish were allowed sufficient time to recover in well oxygenated water and returned to the river. All fish recovered quickly and no mortalities were observed.

## **Dive Survey**

A dive survey was undertaken in the deep areas of channel between the Lee Fields and the Kingsley Hotel downstream of the weir, where it was unfeasible to safely or effectively electro-fish. Three 50m transecsts were covered both upstream and downstream of the weir. Underwater photography equipment was used to broadly record the fish species encountered, general abundances and to evaluate the numbers of adult salmon observed. Nikon D7100 cameras with Nauticam Housing and Ikelite DS161 strobe lighting were used to capture pictures in the turbid water.

# Optimum Survey Period and seasonal sensitivities

Surveys should be conducted during the optimum survey period of the particular species of interest. This electro-fishing survey was undertaken before the end of September 2014. It is considered that by undertaking electro-fishing surveys for salmonids during or post-August that the juvenile fish (including young-of-the-year individuals) are of sufficient size to recover following a survey which was conducted according to Inland Fisheries Ireland best practice (IFI pers. comm. 2014). In addition, the metamorphosis of lamprey usually takes place between July and September. It is therefore recommended that surveys for ammocoetes are carried out in July at the earliest but preferably between August and October in order to detect the presence of transformed ammocoetes (Harvey & Cowx, 2003; National Roads Authority, 2009). As these surveys were undertaken before the end of September, brook, river (and sea) lamprey transformers were more likely to be detected, thus making the separation of river and brook species ammocoetes possible should transformers be present.

### Biosecurity

All equipment and PPE used was disinfected with Virkon® prior to and post-survey completion, and best practice precautions were employed to prevent the potential spread of invasive species and water-borne pathogens between sites, according to standard Inland Fisheries Ireland (IFI) biosecurity protocols.





Figure 2.1:- Location of Electro-fishing and dive survey sites for the Lower Lee Flood Relief Scheme



# 3. Results

Riparian zone characteristics

### River Lee

The River Leedownstream from Innishcarra Hydro-electric Dam is characterised by dense, often continuous riparian tree lines (WL1) on both banks, predominantly bordered by moderate quality agricultural grassland (GA1). In the vicinity of the dam some coniferous afforestation exits but downstream the treelines are largely dominated by species such as sally willow (Salix cinera), grey willow (Salix cinerea subsp. oleifolia) alder (Alnus glutinosa) and ash (Fraxinus excelsior). Common bankside herbs and grasses included reed canary grass (Phalaris arundinacea), nettle (Urtica dioica), bramble (Rubus fructicosus agg.), creeping buttercup (Ranunculus repens), American willowherb (Epilobium ciliatum), purple loosestrife (Lythrum salicaria), common figwort (Scrophularia nodosa) etc. water pepper (Persicaria hydropiper) was particularly common in the vicinity of gravel banks. From the Anglers Rest downstream the invasive but striking looking plant Himalayan balsam (Impatiens glandulifera) becomes increasingly common. This pattern continues as far downstream as the Cork City boundaries at the Lee Fields.

Beyond the county hall weir the river splits into the North and South channels, with the banks becoming more modified, maintained and urbanised in general, with a greater occurrence of non-native species such as (invasive) Japanese knotweed (Fallopia japonica), travellers joy (Clematis vitalba) and buddleja (Buddleja davidii). Through Cork City to Tivoli Docks (estuarine habitat) the Lee is constrained by flood prevention and quay walls, which harbour species such as Maidenhair spleenwort (Asplenium trichomanes), pellitory-of-the-wall (Parietaria judaica) and buddleja (Buddleja davidii).

### **Curragheen River**

The Curragheen River, features several distinct riparian zones. Downstream of Carrigrohane Bridge, its banks are relatively densely vegetated by mature crack willow (Salix fragilis), sally willow, sycamore (Acer *psuedoplanatus*). Alder is also present in addition to some beech (Fagus sylvatica). The understory species complex includes bramble, nettle, cocksfoot grass (Dactylis glomerata) and red-osier. Dogwood (Cornus sericea) is common in the middle reaches of the river downstream of the concrete works. Downstream of the playing fields at Carrigrohane the river becomes more urbanised and contained by retaining walls and a channel heavily choked by unbranched bur reed (Sparganium emersum) vegetation.

### **Glasheen River**

The Glasheen River is a highly modified, urban channel, whose water quality is considered as poor. The riparian cover was dense and mostly planted given the urban encroachment on the channel. Leylandi cypress (Cupressus x leylandii), ash, elm (Ulmus spp.), buddleja, bluebell (Hyacinthoides non-scripta), ivy (Hedera helix), herb robert (Geranium robertanium), harts tongue fern (Aspelnium scolopendrium), nettle and the non-native winter heliotrope (Petasites fragrans). A number of localised liverwort species are present on the man-made surfaces (walls) along the river such as great scented liverwort (Conocephalum conicum), Marchantia polymorpha, Pellia endiviifolia and Pellia epiphylla.

# River Bride (North)

Similar to the Curragheen, the River Bride can be considered by a number of distinct riparian zones, both semi-urban and urban. The less urbanised section of the river, at least in relation to survey efforts, is short and features a riparian zone containing sally willow, ash, sycamore, buddleja, bramble, montbretia, red bartsia (Odontites vernus), false oat grass (Arrhenatherum elatius), etc. where it flows through agricultural grassland (GA1). Downstream of the N20 culvert and adjacent to North Point Business Park, the river meanders naturally through an area of dry meadow and grassy verges (GS2) containing species such as

meadowsweet (*Filipendula ulmaria*), sally willow, nettle, purple loosestrife, water mint (*Mentha aquatica*), bramble, cocksfoot grass, etc. From the Commons Inn (site 2) onwards, the river flows through a series of operational and derelict industrial areas and is typically retained by flood walls. Riparian species here are more typical of wasteground, such as buddleja, catsear (*Hypochaeris radicata*), etc although small patches of reed canary grass, water dropwort (*Oenanthe crocata*) etc. are also present. The Bride also flows through an area of recreational parkland (GA2 and WD5) at Blackpool retail park, with many atypical, planted and ornamental species present including raspberry (*Rubus idaeus*). Downstream of this park, in Blackpool, the river is briefly lined by dense riparian cover from species such as sycamore, alder, birch and willow before it is culverted underground to its confluence with the River Lee at Popes Quay, Cork City. A number of non-native species are present along the Bride, including montbretia (*Crocosmia x crocosmiiflora*), snowberry (*Symphoricarpos albus*) and the highly invasive Japanese Knotweed.

#### **Glenamought River**

The Glenamought is the least modified river surveyed, flowing through rural areas for much of its length. The single selected site, located downstream of the viaduct on the Mallow Road was relatively heavily shaded (like much of the river) from species including beech (Fagus sylvatica), sycamore, hawthorn, horse chesnut (Aesculus hippocastanum), willow (Salix spp.), buddleja, Cherry laurel (Prunus laurocerasus) with herbaceous species such as butterbur, purple loosestrife and the invasive Japanese knotweed also present.

#### Physical site characteristics

Site-specific physical characteristics for each river surveyed as part of the fisheries assessment i.e. Lee, Curaheen, Glasheen, Bride & Glenamought, are summarised in Tables 3.1, 3.2 and 3.3 below.

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Characteristic	Lee Road (site L1)	Salmon Weir (u/s) (site L2)	Salmon Weir (d/s) (site L3)	d/s Kingsley Hotel (site L4)
Section Profile	% Riffle:- 0 % Glide:- 100 % Pool:- 0	% Riffle:- 0 % Glide:- 90 % Pool:- 10	% Riffle:- 20 % Glide:- 20 % Pool:- 60	% Riffle:- 0 % Glide:- 90 % Pool:- 10
Salmonid habitat quality	Nursery – Moderate Spawning – Good Holding – Moderate	Nursery – Poor Spawning – Poor Holding – Poor	Nursery – Moderate Spawning – Good Holding – Excellent	Nursery – Excellent Spawning – Good Holding –Moderate
Section Substrata	% Bedrock:- 0 % Boulder:- 0 % Cobble:- 60 % Coarse Gravel:- 30 % Sand:- 5 % Silt:- 5	% Bedrock:- 0 % Boulder:- 40 % Cobble:- 10 % Coarse Gravel:- 10 % Medium Gravel:- 10 % Sand:- 20 % Silt:- 10	<ul> <li>% Bedrock:- 0</li> <li>% Boulder:- 40</li> <li>% Cobble:- 15</li> <li>% Coarse Gravel:- 20</li> <li>% Medium Gravel:- 10</li> <li>% Sand:- 10</li> <li>% Silt:- 5</li> </ul>	<ul> <li>% Bedrock:- 0</li> <li>% Boulder:- 5</li> <li>% Cobble:- 40</li> <li>% Coarse Gravel:- 15</li> <li>% Medium Gravel:- 30</li> <li>% Sand:- 10</li> <li>% Silt:- 0</li> </ul>
Section Dimensions	Section Length (m):- approx. 50 Section width (m):- 15 Mean Depth (m):- 1- 1.4 Bank Height(m):- 1m % Shading:- <10	Section Length (m):- approx. 50 Section width (m):- 10 Mean Depth (m):- 0.5- 2 Bank Height(m):-4m % Shading:- <10	Section Length (m):- approx 60 Section width (m):- 10 Mean Depth (m):- 0.5- 2 Bank Height(m):-4m % Shading:- <5	Section Length (m):- 20 Section width (m):- 15 Mean Depth (m):-0.5- 1.2 Bank Height(m):- 1-2m % Shading:- <5
Flow Rate (m/s <sup>-1</sup> )	Imperceptible	0.22	0.22	0.22
Siltation Index	3 (moderate siltation)	3	3	3
Macrophyte % cover	Caldophora spp. – 50% Branched bur-reed - 5% Nuttall's pondweed - 5% <i>Ranunculus</i> spp. – 5% Fools Watercress – 1% Water Speedwell – 1% F Water Pepper – 1%	Caldophora spp. – 70% Broad Leave pondweed – 1% Branched bur-reed - 5% Nuttall's pondweed - 5% Ranunculus spp. – 5% Fools Watercress – 1% Water Speedwell – 1% Water Starwort – 1%	Cladophora spp. – 20% Branched bur-reed - 5% Nuttall's pondweed - 10% Ranunculus spp. – 5% Fools Watercress – 1% Water Speedwell – 1%	Cladophora spp. – 10% Ranunculus spp. – 40%
Mosses/liverworts/ bryophytes % cover	Fontinalis spp. – 1% O	Fontinalis antipyretica – 1%	Fontinalis antipyretica – <2%	Fontinalis antipyretica – <2% Porella cordaena – 1%

Table 3.1:- Habitat characteristics of the surveyed sites on the River Lee, September 2014

	Curragheen		Glasheen	
Characteristic	Carrigrohane Bridge (site C1)	Concrete Works (site C2)	GAA pitches (site C3)	Ashbrook (site G1)
Section Profile	% Riffle:- 10 % Glide:- 60 % Pool:- 30	% Riffle:- 10 % Glide:- 70 % Pool:- 20	% Riffle:- 0 % Glide:- 90 % Pool:- 10	% Riffle:- 40 % Glide:- 50 % Pool:- 10

	Curragheen		Glasheen	
Characteristic	Carrigrohane Bridge (site C1)	Concrete Works (site C2)	GAA pitches (site C3)	Ashbrook (site G1)
Salmonid habitat quality	Nursery – Moderate to poor Spawning – Good Holding - Excellent	Nursery – Moderate Spawning – Good Holding - Excellent	Nursery – Moderate Spawning – Poor Holding - Moderate	Nursery –Poor Spawning – Poor Holding - Poor
Section Substrata	% Bedrock:- 0 % Boulder:- 0 % Cobble:- 10 % Coarse gravel:- 30 % Medium gravel:- 30 % Fine gravel:- 10 % Sand:- 15 % Silt:- 5	%Bedrock:- 0 % Boulder:- 0 % Cobble:- 10 % Coarse Gravel:- 30 % Medium-fine Gravel:- 30 % Sand:- 10 % Silt:- 20	% Bedrock:- 0 % Boulder:- 0 % Cobble:- 0 % Coarse Gravel:- 20 % Medium-fine Gravel:- 30 % Sand:- 20 % Silt:- 30	% Bedrock:- 0 % Boulder:- 10 % Cobble:- 40 % Coarse gravel:- 30 % Medium-fine Gravel:- 10 % Sand:- 0 % Silt:- 10
Section Dimensions	Section Length (m):- 50 Section width (m):- 8 Mean Depth (m):- 0.7 Bank Height(m):- 1m % Shading:- <5	Section Length (m):- 50 Section width (m):- 4 Mean Depth (m):- 0.6 Bank Height(m):- 1.5m % Shading:- <20	Section Length (m):- 50 Section width (m):- 8 Mean Depth (m):- 0.9 Bank Height(m):-1.5m % Shading:- 10	Section Length (m):- 25 Section width (m):- 2 Mean Depth (m):- 0.3 Bank Height(m):- 3 % Shading:- 50
Flow Rate (m/s <sup>-1</sup> )	0.22	0.22	0.18	0.17
Siltation Index	3 (moderate)	3 (moderate)	4 (heavy)	4 (heavy)
Macrophyte % cover	Water Parsnip - <1% Common water Starwort - <1%	Ranunculus spp. – F Cladophora spp. – F Common water Starwort – O Canadian pondweed – O Fools Watercress – F Cladophora spp F	Unbranched bur-reed – 70% Common water Starwort – <5% Lesser Duckweed - <5%	None
Mosses/liverworts/ bryophytes % cover	Fontanalis antipyretica — 1%	Fontanalis antipyretica — 1%	Fontanalis antipyretica — 1%	None

Table 3.2:- Habitat characteristics of the surveyed sites on the Curragheen and Glasheen Rivers, September 2014

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	Bride			Glenamought
Characteristic	u/s N20 culvert (site B1)	Commons Inn (site B2)	Orchard Court, Blackpool (site B3)	d/s Viaduct (site B4)
Section Profile	% Riffle:- 0 % Glide:- 100 % Pool:- 0	% Riffle:- 40 % Glide:- 50 % Pool:- 10	% Riffle:- 40 % Glide:- 40 % Pool:- 20	% Riffle:- 50 % Glide:- 40 % Pool:- 10
Salmonid habitat quality	Nursery –Poor Spawning – Poor Holding - Poor	Nursery – Moderate Spawning – Moderate (would be good if not silted) Holding – Poor	Nursery –Moderate Spawning – Moderate Holding - Good	Nursery –Good Spawning – Moderate Holding - Good
Section Substrata	% Bedrock:- 0 % Boulder:- 0 % Cobble:- 0 % Coarse gravel:- 40 Fine gravel:- 20 % Sand:- 20 % Silt:- 40	% Bedrock:- 0 % Boulder:- 0 % Cobble:- 10 % Coarse gravel:- 60 % Sand:- 10 % Silt:- 20	% Bedrock:- 0 % Boulder:- 20 % Cobble:- 40 % Coarse gravel:- 20 % Sand:- 5 % Silt:- 15	% Bedrock:- 0 % Boulder:- 0 % Cobble:- 65 % Coarse gravel:- 20 % Medium gravel:- 5 % Sand:- 5 % Silt:- 5
Section Dimensions	Section Length (m):- 25 Section width (m):- 3 Mean Depth (m):- 0.3-0.4 Bank Height(m):- 1.5-2 % Shading:- <5	Section Length (m):- 25 Section width (m):- 3 Mean Depth (m):- 0.3- 0.6 Bank Height(m):- 1-1.5 % Shading:- 50	Section Length (m):- 25 Section width (m):- 2-3 Mean Depth (m):- 0.3- 0.4 Bank Height(m):- 1-2 % Shading:- 30	Section Length (m):- 25 Section width (m):- 2-3 Mean Depth (m):- 0.2- 0.4 Bank Height(m):- 1-2 % Shading:- 30
Flow Rate (m/s <sup>-1</sup> )	0.13	0.13	0.18	0.13
Siltation Index	3 (moderate)	3-4 ( mod to heavy)	3 (moderate)	3-4 (mod to heavy)
Macrophyte % cover	Fools Watercress – 90% Common Water starwort - <5%	Cladophora spp. – 10% Fools Watercress - <5% Ranunculus spp <1%	Fools Watercress - <5%	Fools Watercress - <5% <i>Cladophora</i> spp <10%
Mosses/liverworts/ bryophytes % cover		Fontinalis antipyretica - <1%	Fontinalis antipyretica - <2%	

Table 3.3:- Habitat characteristics of the surveyed sites on the Bride (North) and Glenamought Rivers, September 2014

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![](_page_14_Picture_1.jpeg)

Table 3.4:- Photographic representation of the electro-fishing and dive-surveyed sites as part of the Lower Lee Flood Relief Scheme, September 2014.

### **Electro-fishing results**

Electro-fishing surveys of the existing fish stocks in the Rivers Lee, Curragheen, Glasheen, Bride (North) and Glenamought were conducted over Saturday 27th to 30th September 2014, following notification to Inland Fisheries Ireland. The results of the surveys are discussed below in terms of fish population structure, and the suitability and value of each of the surveyed areas as nursery and spawning habitat for Annex II fish species.

# River Lee – Lee Road (site L1)

A total of eight fish species were recorded in the surveyed section along the Lee Road, west of Cork City. A length-frequency plot for each species recorded is presented in Figure 3.1. Minnow (*Phoxinus phoxinus*), followed by roach (*Rutilus rutilus*), Atlantic salmon and brown trout, were the most frequently recorded species at the time of surveying. Gudgeon (*Gobio gobio*), perch (*Perca fluviatilis*) and stone loach (*Barbatula barbatula*) were also captured, along with a single example of European eel (*Anguilla anguilla*). Incidentally, the flow rate in the section at the time of the survey was imperceptible (due to unseasonably low rainfall throughout the region), which greatly reduced the effectiveness of the electro-fishing equipment.

![](_page_15_Figure_1.jpeg)

Length (cm)

Fig 3.1:- Length-frequency distribution plot for all fish species recorded at River Lee – Lee Road (site L1) September 2014

#### River Lee – d/s Kingsley Hotel (site L4)

In contrast to the Lee Road site, the River Lee downstream of the County Hall Weir (at the Kingsley Hotel) features an increased flow regime even during periods of low rainfall given the drop in channel gradient from the nearby weir upstream. As such, the habitat is more suitable for salmonid species and was considered an excellent nursery for salmon. Very clean river gravels, in clear water adjoined beds of *Ranunculus* sp. vegetation providing excellent cover. In support of this, Atlantic salmon parr were the most abundant species recorded at this site (n=15). Low numbers of brown trout, eel, perch and stone loach were also present. As this site is located within the upper tidal reaches of the River Lee, several flounder (*Platichthys flesus*) were unsurprisingly recorded. A length-frequency plot for each species recorded is presented in Figure 3.2 below.

![](_page_15_Figure_6.jpeg)

Fig 3.2:- Length-frequency distribution plot for all fish species recorded at River Lee – d/s Kingsley Hotel, Cork City (site L4) September 2014

## Curragheen River – Carrigrohane Bridge (site C1)

A total of five fish species were recorded from the Curragheen River downstream of Carrigrohane Bridge. Brown trout were the most frequently recorded species (n=17). The average size was relatively large, owing to the good feeding and holding habitat present at this site. Annex II-listed river lamprey (*Lampetra fluviatilis*) transformers (n=5) were also identified at the site. Single examples of Atlantic salmon, flounder and eel were also captured. A length-frequency plot for each species recorded is presented in Figure 3.3 below.

![](_page_16_Figure_3.jpeg)

Fig 3.3:- Length-frequency distribution plot for all fish species recorded at Curragheen River – Carrigrohane Bridge (site C1) September 2014

# Curragheen River - Concrete Works (site C2)

The species diversity in the second Curragheen River site was relatively high (8 species). The channel was an excellent nursery habitat for lamprey and an excellent ault trout habitat, given the incised banks and weed beds bordering gravel and sand/ silt shoals. At the Concrete Works site, brook lamprey (*Lampetra planeri*) and brown trout were the most abundant species present, with just a single river lamprey transformer recorded. Low numbers of Atlantic salmon, flounder and stone loach were present, and a number of 'yellow' European eel (>35cm SL) were also captured. A length-frequency plot for each species recorded is presented in Figure 3.4.

![](_page_17_Figure_1.jpeg)

Fig 3.4:- Length-frequency distribution plot for all fish species recorded at Curragheen River – Concrete Works (site C2) September 2014

Curragheen River – GAA Pitch (site C3)

A total of five species were recorded from the Curragheen River near its confluence with the south channel of the River Lee, Cork City. Brown trout followed by Atlantic salmon were the most frequent species, despite a low flow, heavy siltation and a substantial cover of submerged macrophytes (i.e *Sparganium emersum*). Other species included stone loach along with single specimens of European eel and river lamprey (transformer). While the river was canalised and heavily silted it supported a healthy population of fish. A length-frequency plot for each species recorded is presented in Figure 3.5.

![](_page_17_Figure_5.jpeg)

![](_page_17_Figure_6.jpeg)

#### Glasheen River – Ashbrook (site G1)

The observed habitat and water quality at the single surveyed site on the Glasheen River was poor, with heavy siltation and heavy shading. This was reflected in the electro-fishing results, where European eel (n=4) was the only species captured. A length-frequency plot for the European eel recorded is presented in Figure 3.6. It is evident that salmonids have been extirpated from the habitat given the presence of point sources of pollution, riverbed siltation and visible historical channel alterations that have reduced the quality of the habitat.

![](_page_18_Figure_3.jpeg)

Length (cm)

Fig 3.6:- Length-frequency distribution plot for all fish species recorded at Glasheen River – Ashbrook (site G1) September 2014

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

A low diversity and abundance of fish species was recorded from the River Bride 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 3.7

![](_page_19_Figure_3.jpeg)

![](_page_19_Figure_4.jpeg)

Fig 3.7:- Length-frequency distribution plot for all fish species recorded at River Bride - u/s N20 culvert (site B1) September 2014

# River Bride - Commons Inn (site B2)

The River Bride on the Commons Road becomes increasingly encroached by industrial development. However it maintains a semi-natural channel and the better quality water from upstream likely helps in maintaining some salmonid habitat. The River Bride 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 3.8.

![](_page_19_Figure_8.jpeg)

Fig 3.8:- Length-frequency distribution plot for all fish species recorded at River Bride Commons Inn (site B2) September 2014

# River Bride – Orchard Court, Blackpool (site B3)

Similar to the other surveyed sites on the River Bride, the sampling site at Orchard Court, Blackpool contained a low fish diversity. In this area the Bride forms its last natural area of habitat before being heavily culverted in Blackpool. The river was bordered by domestic housing flats and was encroached heavily by Japanese Knotweed. 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 3.9

![](_page_20_Figure_3.jpeg)

![](_page_20_Figure_4.jpeg)

Fig 3.9:- Length-frequency distribution plot for all fish species recorded at River Bride – 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. The Glenamought is a very natural river channel and the wide river valley upstream with wet woodland and low intensities of housing has helped preserve the good quality habitat of the river. It may be considered the most pristine part of the River Bride catchment. 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 3.10.

![](_page_21_Figure_1.jpeg)

Fig 3.10:- Length-frequency distribution plot for all fish species recorded at Glenamought River - d/s Viaduct (site B4) September 2014

![](_page_22_Figure_1.jpeg)

# RYANHANLEY

![](_page_23_Picture_1.jpeg)

Table 3.5:- Photographic representation of the fish species captured during electro-fishing and dive-surveys as part of the Lower Lee Flood Relief Scheme, September 2014.

# **Dive Survey (River Lee)**

River Lee -u/s County Hall Weir (Site L2)

The dive formed three transects covering the north bank, south bank and channel centre (each 50m in length) at two locations upstream and downstream of the county hall weir. The survey facilitated an assessment of these two deep sections of channel that are not possible to survey with conventional electro-fishing equipment. The findings of the dive survey are summarised in Table 3.6 below. The River Lee upstream of the Weir was artificially deep following the construction of the weir. This caused the channel upstream of the weir structure to be slower moving as far as the Hollymount area. The slower water has resulted in exuberant Cladophora spp. growth, which covered up to 80% of the channel bed. Very high densities of Greater Pond snails (Lymnaea stagnalis) grazed on the large mats of vegetation creating an alien looking landscape below the surface. Fish appeared to be largely restricted to the margins of the river where cover existed. The centre of the channel only held small densities of brown trout holding in the current. However, on the north bank downstream of the water intake for the water treatment plant, large patches of Nuttall's Pondweed (Elodea nuttali) adjoined beds of broad leaved pondweed (Potamogeton natans) which supported good numbers of very large adult roach (circa 0.5-0.75kgs). Two small 'jack pike' (2-3kg) were also observed resting in the weeds in the river margins. Underneath the beds of Nuttall's Pondweed small shoals of Threespined stickleback were present along with juvenile roach. The south bank of the River Lee had small densities of minnow shoaling on the boulder revetments underneath the water adjoining the Lee Fields walkway. One adult eel was also seen resting in a crevice.

#### River Lee – d/s County Hall Weir (Site L3)

The River Lee downstream of the County Hall Weir was an area of deep fast-flowing water with good quality spawning gravels and adult salmonid holding habitat. The north bank had slower flowing water with beds of silt and sand colonised by Nuttall's Pondweed. The bed profile slopes in gradient from the shallower water of the north bank to the deeper water of the south bank. The south bank of the channel downstream of the weir had fast flowing very deep water (circa. 4m) that extended as far downstream as the Kingsley hotel where the water shallowed into glide habitat. The fast water adjoining the south bank retaining wall held two shoals of large adult Atlantic salmon (4-8kgs), resting prior to their migration upstream. Each shoal

# had between 10-15 salmon that moved in circles between the island and the weir shoots. No brown trout or other species were observed in this area.

Table 3.6: Summary data for fish composition and habitats encountered during the dive-surveys in the River Lee, September 2014.

Survey Area	Transect 1 (North Bank)	Transect 2 (Centre Channel)	Transect 3 (South Bank)
Site L2 (upstream County Hall Weir)	General Description: - Area of channel in backwater of the River Lee directly upstream of the weir on the north bank. Water depths in this slow area of the margin of the River Lee were between 1.5 and 3m deep with very thick vegetation growth (pondweeds, reeds and blanket weed). The substrate comprised sand, silt and patches of gravels. Fish: - Abundant adult roach were present in the reed beds with two small pike also observed. Shoals of small roach were present in beds of Nuttall's Pondweed with abundant three-spined stickleback also present within these mats of vegetation.	General Description:-The centre of the River Lee upstream of the weir had a water depth of 2.5m and was dominated by substrata of gravels and boulder. The substrate was also heavily colonised by Cladophora vegetation (circa. 90% cover) with large numbers of Greater Pond snails (circa 100 per m2). Fish: - Very small numbers of trout holding station in the current were present but the channel was largely barren and devoid of fish.	General Description: - Shallow area of channel circa 1.5-2m deep bordering the Lee fields on the south bank. A large stone revetment of boulder adjoins the channel from the River Lee walkway. It grades into a zone of thick Cladophora that covers the broad majority of the centre part of the channel of the River Lee. Fish: - Abundant minnow in small shoals along the rocky embankment. One adult eel observed in crevice. No brown trout or other species recorded.
Site L3 (downstream County Hall Weir)	General Description: Shallow area of water adjoining turbine on the south bank of the River Lee downstream of the weir (circa. 1.5m deep). Large banks of sand had accumulated which supported beds of Nuttall's Pondweed.	General Description: - Area of water between the weir centre pass (fish pass) and the river island downstream. The substrate was of medium and coarse gravels covered with patches of Cladophora vegetation.	General Description:- Area of deep fast moving water (circa. 4m deep) in front of large wall where salmon anglers fish. The substrate was composed of large boulders near the wall that graded into a deeper river pool with a gravel and sand bottom. The water velocities were fast.
	Fish: - Within the pondweed small numbers of Three- spined stickleback were present. Interestingly no salmon were observed under the weir falls in this area but the water was much shallower (circa 1.5m) than other areas and slower water velocities were present.	Fish: - Small numbers of adult salmon were observed swimming near the island but no fish were seen along the weir apron. The salmon appeared to be 4kgs plus in weight range.	Fish: - Two large shoals of adult salmon were seen present. Each shoal contained 10-15 fish. The fish appeared to be between 4kgs and 8kgs in size. No fish apart from salmon were observed.

# 4. Conclusions

# **Evaluation of Fisheries Habitat**

#### River Lee

The River Lee was surveyed in areas between the Lee Fields at Hollymount and the Kingsley Hotel area. It tributaries were surveyed as follows: Curragheen – between the Carrigrohane bridge and the Lee Fields GAA pitches; the Bride North – between the N20 culvert and Orchard Court; Glasheen – single site at Ashbrook; Glenamought – upstream of its confluence with the Bride North (refer to figure 2.1 for all sampling locations). Somewhat unsurprisingly, the River Lee yielded the greatest diversity of fish species during the surveys, with eleven recorded in total through electro-fishing. Notably, good stocks of Atlantic salmon parr (electro-fishing) and migrating adults (dive survey) were recorded. The River Lee is an important salmon fishery and the presence of good numbers of juvenile salmon and adults is indicative of a healthy fish population. The entire River Lee channel supports Atlantic salmon and the most important fishery exists at Innishcarra Dam, where smolts are released from the hatchery at Carrigadrohid to help sustain the ESB managed fishery. The Shournagh and west Bride River tributaries downstream of the dam still receive runs of wild adult salmon during the spring and late summer (per. obs.). Given that the river has a well preserved riparian corridor between the Carrigrohane Weir and Innishcarra Dam in addition to limited encroachment on the river, it retained a very natural and swift flowing profile. The dive survey did however reveal that nutrient enrichment was a problem on the River Lee. Large mats of Cladophora blanket weed formed in the slower moving stretches where nutrients settled out of suspension and facilitated algal growth. This was accompanied by large densities of grazing pond snails. None the less despite evident elevations in nutrient levels, good numbers of salmonids remained present.

No lamprey species were recorded from the two electro-fishing sites or during the dive survey. However, this is likely reflective of the lack of suitability of the sites surveyed (lack of soft sediment for ammocoetes) as opposed to their absence in the river. The construction of Innishcarra Dam in 1956 imposed a significant barrier to upstream migration of lamprey (and eel and salmonids, incidentally) in the Lee system (Igoe et al., 2004). However, both brook and river lamprey (Lampetra spp.) are known in the lower river below this barrier (Igoe et al., 2004; Kelly et al., 2008; 2010), as are sea lamprey which have been observed spawning below the Lee Fields Weir (R. Macklin, pers. obs). Indeed, lamprey ammocoetes (Lampetra spp.) were the most frequently recorded species (n=97) at the Lee Fields site during the most recent Water Framework Directive fisheries assessment (Kelly et al., 2010).

Roach (*Rutilus rutilus*) are a relatively recent introduction to the Lee system (c. 2008; Brazier & Macklin, unpublished data) and juveniles were recorded at the Lee Fields site. Roach are considered an invasive fish species under articles 49 & 50 of the EU habitats Directive and the spread of this non-native species in the River Lee is cause for concern with regards to inter-specific competition with brown trout and Atlantic salmon. Pike (*Esox lucius*) were not recorded during the surveys but are known to be present in the river downstream of Innishcarra Dam in low densities (B. Brazier, R. Macklin pers. obs.). Whether pike are present in adequate numbers to assist in control of the expanding roach population of the lower Lee remains to be seen.

Although the Lower Lee Flood Relief Scheme encompasses the river from Innishcarra Dam as far as Tivoli Docks, Cork City, it was not feasible to conduct electro-fishing or dive surveys in the estuarine habitat. The furthest downstream site was located in the vicinity of the Kingsley Hotel, where the Lee diverges into its North and South channels. However, numerous estuarine species are known from this point downstream to Tivoli Docks, including flounder, thick-lipped grey mullet (Chelon labrosus), plaice (Pleuronectes platessa), juvenile pollock (Pollachius pollachius), juvenile cod (Gadus morhua), common goby (Pomatoschistus microps), sand goby (Pomatoschistus minutus), five-bearded rockling (Ciliata mustela), fifteen-spined stickleback

(Spinachia spinachia), Nilsson's pipefish (Syngnathus rostellatus), scad (Trachurus trachurus) and sea trout (Salmo trutta trutta) (Kelly et al., 2010b). Atlantic salmon, European eel and lamprey move through the estuarine reaches on route to spawning grounds upstream and are likely to occur in the estuarine parts of the river at different times throughout the year.

# Curragheen River

As with the Lee, the overall species diversity was high in the Curragheen River sites surveyed. Atlantic salmon parr were recorded at all three sites, albeit in low numbers. Spawning potential for salmonids was good at the two uppermost sites, although siltation has degraded the river habitat overall in these terms. Despite this, recorded brown trout numbers were high, owing to the often excellent holding habitat of the sites (i.e. plenty of deeper pools).

The Curragheen offers good nursery habitat for Annex II lamprey species. Lamprey ammocoetes, regardless of species, require soft sediment (>5-10cm) in which to burrow, be it mud, sand, silt, clay or a matrix of all types (Maitland, 2003). Typically, this substrate would demonstrate a high organic content, such as that present at site C2 (Concrete Works area). This site was heavily silted and offered excellent larval lamprey habitat, with a high number of brook / river lamprey (*Lampetra spp.*) present. Brook lamprey typically spawn in areas of lesser depth and lower flow velocities than the larger river lamprey (Lasne et al., 2010), hence their particularly high occurrence at this site and not the others surveyed, which are more suited to river lamprey. River lamprey (*Lampetra fluviatilis*) transformers were present at all three sites, although densities were low.

No Sea lamprey (*Petromyzon marinus*) were recorded from the Curragheen River. Sea lamprey typically utilise similar (or even the same) spawning areas to Atlantic salmon, spawning in coarse gravel, pebbles and sand, where the diameter of the gravel can vary from 1-11 cm, where the overlying water column has a depth of 40–60cm (Igoe et al., 2004) and in relatively strong currents of up to 1-2ms–1 (APEM, 2004). Therefore, it stands to reason that if Atlantic salmon can spawn in the Curragheen (confirmed by the presence of parr) then sea lamprey may also be present at other (unsurveyed) sites along the watercourse.

# **Glasheen** River

The single site surveyed on the Glasheen River offered poor fisheries habitat and potential, featuring a low flow rate with heavy siltation and excessive macrophyte growth. The river is highly modified and urbanised and it is accepted locally that water quality is poor, largely due to urban run-off. These characteristics were reflected in the low diversity and abundance of fish recorded. In fact, only a low number (n=4) of European eel were captured. The siltation of gravel beds clearly inhibits the spawning of salmonid and lamprey species at this site, and the river in general. The heavy siltation and noxious densities of macrophyte vegetation, such as Unbranched Bur-reed (Sparganium emersum) present at this site, and throughout much of this short river, warrants remediation.

# River Bride (North)

The River Bride, flowing in a North-South direction into Cork City, has also been heavily modified and suffers from urban pollution. Despite this, brown trout nursery and holding habitat quality was generally moderate to good, although spawning substrata has been degraded due to siltation.

The diversion of the river underground from Blackpool to its confluence with the North channel of the River Lee (at Popes Quay), presents a significant barrier to upstream fish migration. No structure to assist in fish migration or passing has been installed on the Bride. Indicative of this was the lack of Atlantic salmon recorded at the surveyed sites. However, a pair of river lamprey transformers was captured from the uppermost site, which was heavily choked with Fools watercress (*Apium nodiflorum*). Despite this, the substrate at this site (and the un-fished section upstream, incidentally) consisted largely of fine gravels suitable for river lamprey spawning (Aronsuu & Virkkala, 2014; Rooney et al., 2013).

The occurrence of anadromous river lamprey in the River Bride is peculiar. It was suspected that, like Atlantic salmon, migrating lamprey species (i.e. river and sea) would also be unable to navigate up the Bride catchment (comprising the Bride, Glenamought and Glen rivers). However, as the Bride discharges at a single point to the River Lee, it can only be presumed that river lamprey (unlike Atlantic salmon) are able to bypass the Blackpool culvert, which, under normal flow conditions features a very shallow depth profile (mean 10-20cm; pers. obs.). This is well below the recommended depth within culverts for easy adult Atlantic salmon passage of  $\geq 150$ mm (National Roads Authority, 2005). However, there appears to be no visible structural barriers to migration in the channel albeit not an ideal scenario for migratory fish.

In Ireland, River lamprey spawn between March and May, having entered freshwater in the late summer/early winter period (Kelly & King, 2001). Although River lamprey swimming ability is far weaker than that of Atlantic salmon, lamprey can utilise alternative methods, such as oral disc attachment to substrata, to migrate upstream. Even so, the incline of the river/stream bed must be low for River lamprey passage, as their climbing ability is noted as poor (Russon & Kemp, 2011). Their inherent morphology also allows lamprey to navigate shallower water depths than larger species. It is hypothesised that the occurrence of low numbers of River lamprey transformers in the River Bride, as recorded in September 2014, is a result of favourable conditions such as suitable flow rates and water levels during a previous migration season.

#### **Glenamought River**

The status of the Brown trout population in the Glenamought appears healthy, with a range of size (and likely, year) classes recorded. The habitat of the surveyed site provided good nursery and holding conditions. Incidentally, much of the rest of the river, which flows through more rural areas, also provides a similar environment (pers. obs.). Generally speaking, the Glenamought tributary offers better spawning opportunities for Brown trout and it is likely that it acts as a source for much of the Bride's trout stocks.

As with the Bride, two river lamprey transformers were also recorded at the surveyed site. The hydrology of the Glenamought means that any lamprey must access the river through the Bride. Therefore, the occurrence of maturing lamprey here is presumably as a result of favourable flow conditions on the Bride during a previous migration season, as outlined above.

## **Evaluation of Fisheries Importance**

#### Salmonids

In summary, brown trout were the most frequent species recorded throughout the rivers Lee, Curragheen, Bride (north) and Glenamought, as surveyed for the Lower Lee Flood Relief Scheme. Although afforded no legal protection, the presence of brown trout even in small stream and river sites (such as the Curragheen, Bride and Glenamought) remains important in an overall biodiversity, conservation and management context, especially in terms of genetic value (Carlsson *et al.*, 1999; Carlsson & Nielsen, 2000). Wild Brown trout in Ireland are considered to be genetically diverse with numerous strains (Taggart *et al.* 1981; Ferguson, 2006; Massa-Galluci *et al.*, 2010) and thus are important for the wider conservation and management of the species in Europe. Additionally, any watercourses containing good salmonid habitat, where not located within a protected area (e.g. NHA) or Natura 2000 site, can be considered of at least higher value local ecological importance (National Roads Authority, 2009). Brown trout remain an important indicator of the ecological status of stream health. As such the removal of brown trout also has consequences for a stream meeting 'good status' under the Water Framework Directive (2000/60/EC).

Atlantic salmon parr were recorded from the Lee and Curragheen. High numbers of adults were also observed at Lee Fields Weir during the dive survey, awaiting suitable flow conditions to recommence their upstream migration. Both rivers provide suitable spawning and nursery habitat, even in the vicinity of Cork City. The Glasheen, an urban tributary of the Curragheen, is considered largely unsuitable for salmonids in general due to poor habitat and water quality. The Bride (North) and Glenamought (especially) are also considered suitable (though far from optimal) for Atlantic salmon but their presence here is precluded by the seemingly un-navigable underground Bride culvert for the species in Blackpool, Cork City.

# Lamprey species

Although not recorded during these surveys, suitable Annex II lamprey habitat is present in the lower Lee, downstream of Innishcarra Dam (Kelly et al., 2010). The Curragheen also provides good (yet localised) brook and river lamprey habitat. Somewhat surprisingly, river lamprey transformers were recorded from both the Bride and Glenamought. Whilst unrecorded in the Glasheen, the existence of *Lampetra* species cannot be discounted.

The greatest threats to brook lamprey are the potential impacts of pollution and dredging (NPWS, 2013). The same can be said for river lamprey, with the addition of migration barriers. As lamprey spend much of their life cycle in sediments (as ammocoetes), changes in siltation patterns can significantly impact on their habitat. Removal of sediments and allied river engineering works can lead to a loss or removal of sediment that may already contain juvenile lamprey (King *et al.*, 2008). In light of the proposed works for the Lower Lee Flood Relief Scheme, which suggests the installation of flood prevention walls to alter and refocus hydrological characteristics of the surveyed channels, lamprey may be at risk of losing channel features required for their lifecycle, i.e. fine sediment deposits. In order for lamprey ammocoete habitats to form or be maintained, a channel must have a capacity to deposit fine sediment along its margins or into 'alcove' niches, frequently in the lee of some obstructing feature that is disturbing the flow. This must be taken into account on all channels prior to any work commencement on the surveyed channels. Should disturbance of lamprey habitat remain likely, the population should be removed to suitable habitat outside the impact zone in order to prevent direct impacts. Should significant volumes of sediment be generated from works on the riparian zone they may travel downstream and impact on spawning redds for Atlantic salmon. As such carefully planned mitigation must be ensured to preserve the fishery assets.

# European eel

The critically endangered European eel (Freyhoff & Kottelat, 2010) are considered to be the most threatened fish species in Ireland in a recent red listed publication on Irish Fish (King *et al.*, 2011). The European eel has protective status under the European Eel Regulation EC No. 1100/2007 to facilitate the recovery of the eel stocks since the large decline in the 1980's.

The physical characteristics of the sites surveyed on the Lee and Curragheen, with ample marginal refugia such as macrophyte stands and submerged branches, make them well suited as Annex II European eel feeding/foraging habitat. Eel were also recorded on the Glasheen and Bride rivers, where suitable habitat is also present. The Glenamought, although representing more of an upland/eroding watercourse (FW1) for much of its length is also deemed as providing good eel habitat.

During the proposed works as part of the Lower Lee Flood Relief Scheme, mitigation must be employed to maintain as much refugia habitat (e.g. sunken branches, boulders) in the surveyed channels as possible. Overall the fisheries habitats, as surveyed for the Lower Lee Flood Relief Scheme, of the Rivers Lee, Curragheen, Bride (North) and Glenamought can all be considered of High Value Local Importance for trout species, eel and lamprey (Lampetra spp.), given the presence of all species and the presence of good spawning and nursery habitat, in addition to healthy mixed stock compositions. The River Lee may however be considered of National Importance for salmonids as it is a designated salmonid water on S.I. No. 293/1988 - European Communities (Quality of Salmonid Waters) Regulations, 1988. The Glasheen River can be considered of High Value Local Importance for European eel but not for other species.

![](_page_29_Picture_0.jpeg)

#### Other fish species

Notably, numbers of roach were officially recorded (via electro-fishing) in the Lower Lee for the first time during these surveys. This non-native species first appeared in the Innishcarra and Carrigadrohid reservoirs c. 2008 (Brazier & Macklin, unpublished data). The presence of juveniles confirms that suitable spawning conditions exist for roach in the Lower Lee. Although primarily a freshwater species, roach are able to tolerate moderate salinities (up to 15pmm for adults, Thiel *et al.*, 1995) and thus are, theoretically, able to traverse the Lee Fields Weir, into brackish water and navigate downstream (via the River Lee South channel) to the Curragheen and Glasheen rivers. Though no examples were recorded from these Lee tributaries during these surveys, there is a risk that the species will colonise these watercourses in the near future.

The spread of roach has both potential advantages and disadvantages for the existing ecology of the lower Lee system. The increase in potential prey resources may benefit indigenous predators such as Annex I kingfisher (*Alcedo atthis*) and Annex II otter (*Lutra lutra*) and European eel, whilst conversely the increased inter-specific competition may negatively impact native brown trout and Atlantic salmon populations. It is currently unclear if resident predators, including those above as well as pike and cormorant (*Phalacrocorax carbo*), will be effective in curbing the spread of roach in the lower Lee.

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# Appendix I

DCMNR License

# CERTIFICATE OF AUTHORISATION UNDER SECTION 14 OF THE FISHERIES (CONSOLIDATION) ACT, 1959 AS SUBSTITUTED BY SECTION 4 OF THE FISHERIES (AMENDMENT) ACT, 1962.

The Minister for Communications, Energy and Natural Resources in exercise of the powers conferred on him by Section 14 of the Fisheries (Consolidation) Act, 1959 as substituted by Section 4 of the Fisheries (Amendment) Act, 1962 hereby authorises:

Lisa Dolan, Ryan Hanley Environmental Consultants and or person(s) nominated by her to undertake an electro fishing survey for lamprey species on the River Shannon. Approximate locations of these sites (not to scale) are shown on attached map. The survey is to be included in an Environmental Impact Statement (EIS) an Appropriate Assessment (AA)/Natura Impact Statement (NIS) and hydrological impact assessment for the construction and ongoing impact of an instream hydro electricity facility

This authorisation is granted subject to the following conditions:

- This authorisation shall not confer on the holder thereof, independently of the conditions therein;
  - (a) any rights or title which the holder would not have had if this Authorisation had not been given, or;
  - (b) any authority in any way to interfere with or infringe the lawful rights of any other person.
- This authorisation is issued to and valid for use by Lisa Dolan and or person(s) nominated by her.
- 3. This authorisation is valid from 11 September 2014 to 30 September 2014

- 4. The electro-fishing must be carried out only by nominated personnel with training and experience in such operations. Ryan Hanley Consulting Engineers shall submit the names of all such personnel including details of their training and experience
- 5. The electric fishing operation must be carried out during suitable weather and flow conditions. IFI recommend that electric fishing should be carried out between early July and 30 September when juvenile fish are of a sufficiently large size to be caught by electic fishing, to minimize damage to the fish and to be distinguished from similar species (CEN, 2001 and CFB "Electric Fishing in Wadeable reaches "manual).
- Sampling should commence at the uppermost site on the river and finish at the lowermost site on the river to limit any possible upstream transfer of invasive species.
- The consent of the fishery owner, and informs local angling clubs of their plans for the surveys where relevant. The applicant must also seek permission from landowners to cross land where relevant.
- All electric fishing equipment must be available for inspection by an IFI officer during each survey.
- 9. IFI Limerick should be notified at least five working days in advance of the proposed commencement date of the electric fishing operation, by email to <u>Amanda.Mooney@Fisheriedireland.ie</u> / <u>Catherine.Kerins@Fisheriesireland.ie</u>
- 10. Any fish captured shall be carefully handled and returned alive to the water from which they are taken, following the gathering of data. The IFI is to be immediately informed of any fish mortalities. Details including the County, Site Number, River Name, Townland, Irish Grid Reference, species and numbers killed shall be communicated to the relevant IFI office by telephone to; IFI Limerick (061) 300238 for the attention of Catherine Kerins.

- 11. Any and all of the electro fishing gear/equipment, including the transformer, generator nets etc shall be disinfected prior to and after use at each electro fishing site to prevent the spread of pathogens, disease, parasites or exotic species and to avoid the transfer of species such as anguillicola, zebra mussels and various plants etc. The holder of this authorisation shall strictly comply with the submitted Biosecurity measures and as directed by an officer of IFI Limerick.
- 12. When doing anything pursuant to this authorisation, the holder shall, if requested by any person affected, produce this authorisation to that person.
- 13. The survey report including the survey quantitative data obtained in the appraisal shall be forwarded electronically in the standard IFI format to Sandra Doyle, Inland Fisheries Ireland, 3044 Lake Drive, Citywest Business Campus, Dublin 24, <u>Sandra.doyle@fisheriesireland.ie</u> within 30 days of completion of the survey. For ease of reference an electronic copy of IFI's standard template will be forwarded directly to the applicant.
- 14. The holder of this authorisation is competent in the use of electro-fishing gear. All equipment should be disinfected prior to and after use to prevent the spread of disease, parasites or invasive species and must strictly comply with IFI's Biosecurity measure (<u>http://www.fisheriesircland.ie/Invasive-Species/ biosecurity-protocol-forfield-survey-work.html</u>) and as directed by an officer of IFI Limerick.
- 15. Failure to comply with any of the conditions of this authorisation may result in revocation of this authorisation.
- 16. The holder of this authorisation should be mindful of the potential occurrence of invasive alien species, either in the wetted channels being surveyed or in the adjoining riparian zone. IFI would be grateful if the presence of such species could be recorded along with geo-reference and indication of the extent of occurrence and submitted in report form directly to IFI.

- 17. The holder of this authorisation shall indemnify and keep indemnified the State, the Minister for Communications, Energy and Natural Resources and the Minister for Finance against any claims, arising in any manner whatsoever in connection with the user of the fishing gear or in the exercise of the permission hereby granted.
- 18. Notwithstanding the foregoing, this authorisation may be revoked or amended by the Minister for Communications, Energy and Natural Resources without the payment of compensation to the holder on giving one weeks notice in writing to the holder if he considers it necessary in the public interest to do so.

Dated this 11 September 2014

For the Minister for Communications, Energy and Natural Resources.

Gerry Clerkin

An officer authorised on that behalf by the said Minister