

# Aquatic baseline report for a proposed Gas Networks Ireland Gas Pipeline, Edenderry, Co. Offaly



Prepared by Triturus Environmental Ltd. for Awn Consulting Ltd.

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## Table of contents

<b>1. Introduction</b>	<b>3</b>
1.1 Background	3
1.2 Development description	3
<b>2. Methodology</b>	<b>4</b>
2.1 Selection of watercourses for assessment	4
2.2 Aquatic site surveys	4
2.3 Fisheries assessment (electro-fishing)	7
2.4 White-clawed crayfish survey	7
2.5 Biological water quality (Q-sampling)	7
2.6 Canal macro-invertebrate communities	8
2.7 Macrophytes and aquatic bryophytes	8
2.8 Otter signs	8
2.9 Aquatic ecological evaluation	8
2.10 Biosecurity	9
<b>3. Desktop review</b>	<b>10</b>
3.1 Survey area	10
3.2 Fisheries	10
3.3 Protected and rare aquatic species	10
<b>4. Results of aquatic surveys</b>	<b>12</b>
4.2 White-clawed crayfish survey	49
4.3 Biological water quality (macro-invertebrates) & lacustrine macro-invertebrates	50
<b>5. Discussion</b>	<b>59</b>
5.1 Fisheries	59
5.2 White-clawed crayfish	60
5.3 Macro-invertebrates & biological water quality pressures	60
<b>6. References</b>	<b>62</b>
<b>7. Appendix A – fisheries report</b>	<b>65</b>
<b>8. Appendix B – Macro-invertebrates &amp; biological water quality</b>	<b>66</b>

## 1. Introduction

### 1.1 Background

Triturus Environmental Ltd. were commissioned by Awn Consulting Ltd. to conduct baseline aquatic surveys to inform EIA preparation for a proposed Gas Networks Ireland (GNI) Edenderry Gas Pipeline (to Bord na Móna) development near Edenderry, Co. Offaly (**Figure 2.1**).

Undertaken on a catchment-wide scale, this report provides a baseline assessment of the aquatic ecology including fisheries and biological water quality, as well as protected species and habitats in the vicinity of the proposed development. Aquatic surveys were undertaken in July and August 2025.

### 1.2 Development description

A full description of the proposed developments are provided in the Environmental Impact Assessment Report (EIA) used to support consenting applications.

## 2. Methodology

### 2.1 Selection of watercourses for assessment

All freshwater watercourses which could be affected directly or indirectly by the proposed development were considered as part of the current assessment. This included those crossed by the proposed pipeline in addition a low number of downstream control sites. Thus, a total of  $n=34$  sites were selected for detailed aquatic assessment (see **Table 2.1**, **Figure 2.1**). The courses and nomenclature for the riverine watercourses surveyed followed Environmental Protection Agency (EPA) mapping.

Riverine survey sites were present on the Kilwarden/Kinnegad River (EPA code: 07K01), Aghnahillagh River (07A05), Knockerasally or Colehill River (07K12), Park River (07P04), Ballynakill Stream (07B25), Castlejordan River (07C33), Rahin Stream (07R12), Roosk River (07R53), Mountwilson Stream (07M07), Kinnafad River (07K31), Ballyleakin River (14B52), Ballykilleen Stream (14B25) and a number of unnamed and unmapped channels (**Table 2.1**). The Grand Canal was also surveyed at a proposed pipeline crossing. The survey sites were located within the Boyne\_SC\_010 , Boyne\_SC\_030 and Figile\_SC\_010 river sub-catchments. None of the survey sites were located within a European site. The Grand Canal is designated as the Grand Canal pNHA (002104).

Please note that a proposed crossing of the Yellow River (07Y02) (site RVX02) was not accessible at the time of survey and thus no aquatic surveys were undertaken at this location.

Please note this aquatic report should be read in conjunction with the final Environmental Impact Assessment Report (EIAR) prepared for the proposed development(s).

### 2.2 Aquatic site surveys

Aquatic surveys were conducted on the 22<sup>nd</sup> and 23<sup>rd</sup> July and the 5<sup>th</sup> August 2025. Survey effort focused on both instream and riparian habitats at each aquatic sampling location and included a fisheries assessment (electro-fishing and or fisheries habitat appraisal), white-clawed crayfish survey, macrophyte and aquatic bryophyte survey and biological water quality sampling (Q-sampling). This holistic approach informed the overall aquatic ecological evaluation of each site/watercourse in context of the proposed development and ensured that any habitats and species of high conservation value would be detected to best inform mitigation.

In addition to the ecological characteristics of the site, a broad aquatic and riparian habitat assessment was conducted utilising elements of the methodology given in the Environment Agency's 'River Habitat Survey in Britain and Ireland Field Survey Guidance Manual 2003' (EA, 2003) and the Irish Heritage Council's 'A Guide to Habitats in Ireland' (Fossitt, 2000). This broad characterisation helped define the watercourses' conformity or departure from naturalness. All sites were assessed in terms of:

- Physical watercourse/waterbody characteristics (i.e. width, depth, channel form) including associated evidence of historical drainage
- Substrate type and relative condition, listing substrate fractions in order of dominance (i.e. bedrock, boulder, cobble, gravel, sand, silt etc.)

- Flow type by proportion of riffle, glide and pool in the sampling area
- An appraisal of the macrophyte and aquatic bryophyte community at each site
- Riparian vegetation composition and bordering land use practices

**Table 2.1** Location of 34 no. aquatic survey sites in vicinity of the proposed development

Site no.	Watercourse	EPA code	Location	X (ITM)	Y (ITM)
RVX01	Kilwarden/Kinnegad River	07K01	Kilwarden	662944	745904
RVX01b	Kilwarden/Kinnegad River	07K01	Clonard Bridge	665683	744913
WCX01	Unmapped channel	n/a	Ardnamullan	662692	745327
WCX02	Aghnahillagh River	07A05	Ardnamullan	662496	744077
WCX03	Unmapped channel	n/a	Park	662356	742512
WCX04	Knockerasally or Colehill River	07K12	Ballyboggan	662183	741037
WCX05	Park River	07P04	Ballyboggan	661931	740409
WCX06	Ballynakill Stream	07B25	Ballynakill	661911	740211
WCX07	Unmapped channel	n/a	Harristown	661852	739718
WCX08	Unmapped channel	n/a	Harristown	661435	739182
WCX09	Unmapped channel	n/a	Harristown	660994	739040
WCX10	Unmapped channel	n/a	Harristown	660782	738831
WCX11	CastleJordan River	07C33	Harristown	660784	738406
WCX12	Rahin Stream	07R12	Clongall	660820	738325
RVX02b	River Boyne	07B04	Ballyboggan Bridge	663829	740254
WCX13	Unmapped channel	n/a	Clonmore	660291	736027
WCX14	Unmapped stream	n/a	Clonmore	660345	735827
WCX15	Unmapped channel	n/a	Roosk	660392	735585
WCX16	Roosk River	07R53	Mountwilson	660014	734618
WCX17	Unmapped channel	n/a	Mountwilson	660054	733962
n/a	Mountwilson Stream	07M07	Mountwilson	660156	733679
WCX18	Unmapped channel	n/a	Thornwell	660109	733477
WCX19	Kinnafad River	07K31	Thornwell	660169	733178
WCX20	Unmapped stream	n/a	Monasteroris	660378	732910
WCX21	Unmapped channel	n/a	Monasteroris	660483	732769
WCX22	Unmapped channel	n/a	Monasteroris	660500	732461
WCX23	Grand Canal	n/a	Rathmore	660809	731699
WCX24	Ballyleakin River	14B42	Ballykilleen	661206	729650
WCX25	Unmapped channel	n/a	Ballykilleen	661121	729520
WCX26	Unmapped channel	n/a	Ballykilleen	660821	729332
WCX27	Unmapped channel	n/a	Ballykilleen	660906	728164
WCX28	Unmapped channel	n/a	Ballykilleen	661003	728040
WCX29	Ballykilleen Stream	14B25	Ballykilleen	661091	727953
WCX30	Ballykilleen Stream	14B25	Shean	661258	727643



Figure 2.1 Overview of the aquatic survey sites, July-August 2025

### 2.3 Fisheries assessment (electro-fishing)

To collate a more accurate baseline, a catchment-wide approach was adopted and the electro-fishing survey was undertaken across 33 no. riverine sites (see **Table 2.1, Figure 2.1**). A single anode Smith-Root LR24 backpack (12V DC input; 300V, 100W DC output) was used to electro-fish riverine sites on the 22<sup>nd</sup> and 23<sup>rd</sup> July and the 5<sup>th</sup> August 2025 following notification to Inland Fisheries Ireland and under the conditions of a Department of Climate, Energy and the Environment (DCEE) licence. The survey was undertaken in accordance with best practice (CFB, 2008; CEN, 2003) and Section 14 licencing requirements.

Furthermore, a fisheries habitat appraisal of all aquatic survey sites (**Table 2.1**), inclusive of the Grand Canal, was undertaken to establish their importance for salmonid, lamprey, European eel and other fish species. The baseline assessment also considered the quality of fisheries habitats within the vicinity of the survey sites. For detailed survey methodology, please refer to accompanying fisheries assessment report in **Appendix A**.

### 2.4 White-clawed crayfish survey

White-clawed crayfish (*Austropotamobius pallipes*) surveys were undertaken at the aquatic survey sites in July-August 2025 under a National Parks and Wildlife (NPWS) open national licence (C164/2025) as prescribed by Sections 9, 23 and 34 of the Wildlife Act (1976-2023), to capture and release crayfish to their site of capture. As per Inland Fisheries Ireland aquatic biosecurity recommendations, the crayfish sampling started at the uppermost site(s) of each catchment or sub-catchment in the survey area to minimise the risk of transfer invasive propagules (including crayfish plague) in an upstream direction.

Hand-searching of instream refugia and sweep netting was undertaken according to Reynolds et al. (2010). An appraisal of white-clawed crayfish habitat at each site was conducted based on physical habitat attributes (Gammell et al., 2021; Peay, 2003), water chemistry and incidental records in mustelid spraint. Additionally, a desktop review of crayfish records within the wider survey area was completed.

### 2.5 Biological water quality (Q-sampling)

The 33 no. riverine survey sites were assessed for biological water quality through Q-sampling in July 2025. All samples were taken with a standard kick sampling hand net (250mm width, 500µm mesh size) from areas of riffle/glide utilising a 2-minute kick sample, as per Environmental Protection Authority (EPA) methodology (Feeley et al., 2020). Large cobble was also washed at each site for 1-minute (where present) to collect attached macro-invertebrates (as per Feeley et al., 2020). Samples were elutriated and fixed in 70% ethanol for subsequent laboratory identification to species level. Samples were converted to Q-ratings as per Toner et al. (2005) and assigned to WFD status classes (**Table 2.2**). Any rare invertebrate species were identified from the NPWS Red List publications for beetles (Foster et al., 2009), mayflies (Kelly-Quinn & Regan, 2012), stoneflies (Feeley et al., 2020) and other relevant taxa (i.e. Byrne et al., 2009; Nelson et al., 2011).

**Table 2.2** Reference categories for EPA Q-ratings (Q1 to Q5) (Toner et al., 2005)

Q value	WFD status class	Pollution status	Condition
Q5 or Q4-5	High status	Unpolluted	Satisfactory
Q4	Good status	Unpolluted	Satisfactory
Q3-4	Moderate status	Slightly polluted	Unsatisfactory
Q3 or Q2-3	Poor status	Moderately polluted	Unsatisfactory
Q2, Q1-2 or Q1	Bad status	Seriously polluted	Unsatisfactory

## 2.6 Canal macro-invertebrate communities

The Grand Canal survey site (WCX23) was sampled for macro-invertebrates via sweep netting. A standard pond net (250mm width, mesh size 500µm) was used to sweep macrophytes to capture macro-invertebrates. The net was also moved along the canal bed to collect epibenthic and epiphytic invertebrates from the substratum (as per Cheal et al., 1993). A 3-minute sampling period was employed. To ensure appropriate habitat coverage, the sampling period was also divided amongst the range of meso-habitats present at the survey site to get a representative sample for sub-habitats.

## 2.7 Macrophytes and aquatic bryophytes

Surveys of the macrophyte and aquatic bryophyte community were conducted by instream wading at each of the survey sites, with specimens collected (by hand or via grapnel) for on-site identification. An assessment of the aquatic vegetation community helped to identify any rare macrophyte species listed under the Flora (Protection) Order, 2022, Irish Red list for vascular plants (Wyse-Jackson et al., 2016) and or aquatic bryophytes (Lockhart et al., 2012), or habitats corresponding to the Annex I habitats, e.g., ‘Water courses of plain to montane levels, with submerged or floating vegetation of the *Ranunculon fluitantis* and *Callitricho-Batrachion* (low water level during summer) or aquatic mosses [3260]’ (more commonly referred to as ‘floating river vegetation’).

## 2.8 Otter signs

The presence of otter (*Lutra lutra*) was determined through the recording of otter signs within 150m radius of each survey site. Notes on the age and location of signs (ITM coordinates) were made, in addition to the quantity and visible constituents of spraint (i.e. remains of fish, crustaceans, molluscs etc.).

## 2.9 Aquatic ecological evaluation

The evaluation of aquatic ecological receptors contained within this report uses the geographic scale and criteria defined in the ‘Guidelines for Assessment of Ecological Impacts of National Road Schemes’ (NRA, 2009).

## 2.10 Biosecurity

A strict biosecurity protocol following IFI (2010) and the Check-Clean-Dry approach was adhered to during surveys for all equipment and PPE used. Disinfection of all equipment and PPE before and after use with Virkon™ was conducted to prevent the transfer of pathogens or invasive propagules between survey sites. Surveys were undertaken at sites in a downstream order to minimise the risk of upstream propagule mobilisation. Particular cognisance was given towards preventing the spread or introduction of highly virulent crayfish plague (*Aphanomyces astaci*). Any aquatic invasive species or pathogens recorded within or adjoining the survey areas were geo-referenced. All Triturus staff are certified in 'Good fieldwork practice: slowing the spread of invasive non-native species' by the University of Leeds.

### 3. Desktop review

#### 3.1 Survey area

The watercourses and aquatic surveys sites in the vicinity of the proposed pipeline were typically heavily modified lowland depositing channels (FW2; Fossitt, 2000) and peat drainage ditches (FW4) within the within the Boyne\_SC\_010 , Boyne\_SC\_030 and Figile\_SC\_010 river sub-catchments. Land use practices in the wider survey area are dominated by peat bogs (CORINE 412) and pastures (231). Predominantly, the watercourses flow over areas of Carboniferous limestone and shale (Geological Survey of Ireland data).

#### 3.2 Fisheries

Fisheries data was only available for a low number of the survey watercourses (i.e. those crossed by the proposed pipeline). The Castlejordan River (aka. Mongagh River) supports brown trout (*Salmo trutta*), lamprey (*Lampetra* sp.), stone loach (*Barbatula barbatula*), perch (*Perca fluviatilis*), pike (*Esox lucius*) and three-spined stickleback (*Gasterosteus aculeatus*) (Triturus 2023 data; O'Connor, 2006).

The Kilwarden/Kinnegad River, another tributary of the Boyne, supports brown trout and three-spined stickleback (Triturus 2022 data). The Kinnegad and Castlejordan Rivers support a genetically distinct sub-population of trout within the Boyne catchment (Massa-Gallucci & Mariani, 2011).

The Grand Canal is known to support a range of coarse fish species, including perch (*Perca fluviatilis*), pike (*Esox lucius*), bream (*Abramis brama*), roach (*Rutilus rutilus*), rudd (*Scardinius erythrophthalmus*) and their respective hybrids, tench (*Tinca tinca*) and highly localised common carp (*Cyprinus carpio*) and brown trout, in addition to Red-listed European eel (IFI data; McLoone, 2011; Tierney et al., 1999; pers. obs.). Lamprey (*Lampetra* sp.) ammocoetes have also been recorded at a low number of locations, e.g. 5<sup>th</sup> lock, MKO, 2019; 11<sup>th</sup> lock, ROD, 2016; 7<sup>th</sup> lock, Caffrey et al., 2006).

#### 3.3 Protected and rare aquatic species

A comprehensive desktop review of available data from the National Parks and Wildlife Service (NPWS), National Biodiversity Data Centre (NBDC), Inland Fisheries Ireland (IFI), Botanical Society of Britain and Ireland (BSBI), National Crayfish Plague Surveillance Programme (NCPSP), Environmental Protection Agency (EPA) and Triturus databases for the 10km grid squares containing and adjoining the developments (i.e. N62, N63 & N64) identified a low number of records for rare and or protected aquatic species within the vicinity of the proposed development.

Contemporary Annex II otter (*Lutra lutra*) records were widespread throughout the respective grid squares, with records available for the River Boyne and Kinnegad River (**Figure 3.1**).

Contemporary records for Annex II white-clawed crayfish (*Austropotamobius pallipes*) were also widespread in the respective grid squares although most were concentrated in the Barrow catchment to the south of the proposed pipeline (**Figure 3.1**). A low number of crayfish records were also available for the Kinnegad River.

There were no NPWS records for macrophytes or aquatic bryophytes protected under the Flora (Protection) Order, 2022 available for the respective grid squares.

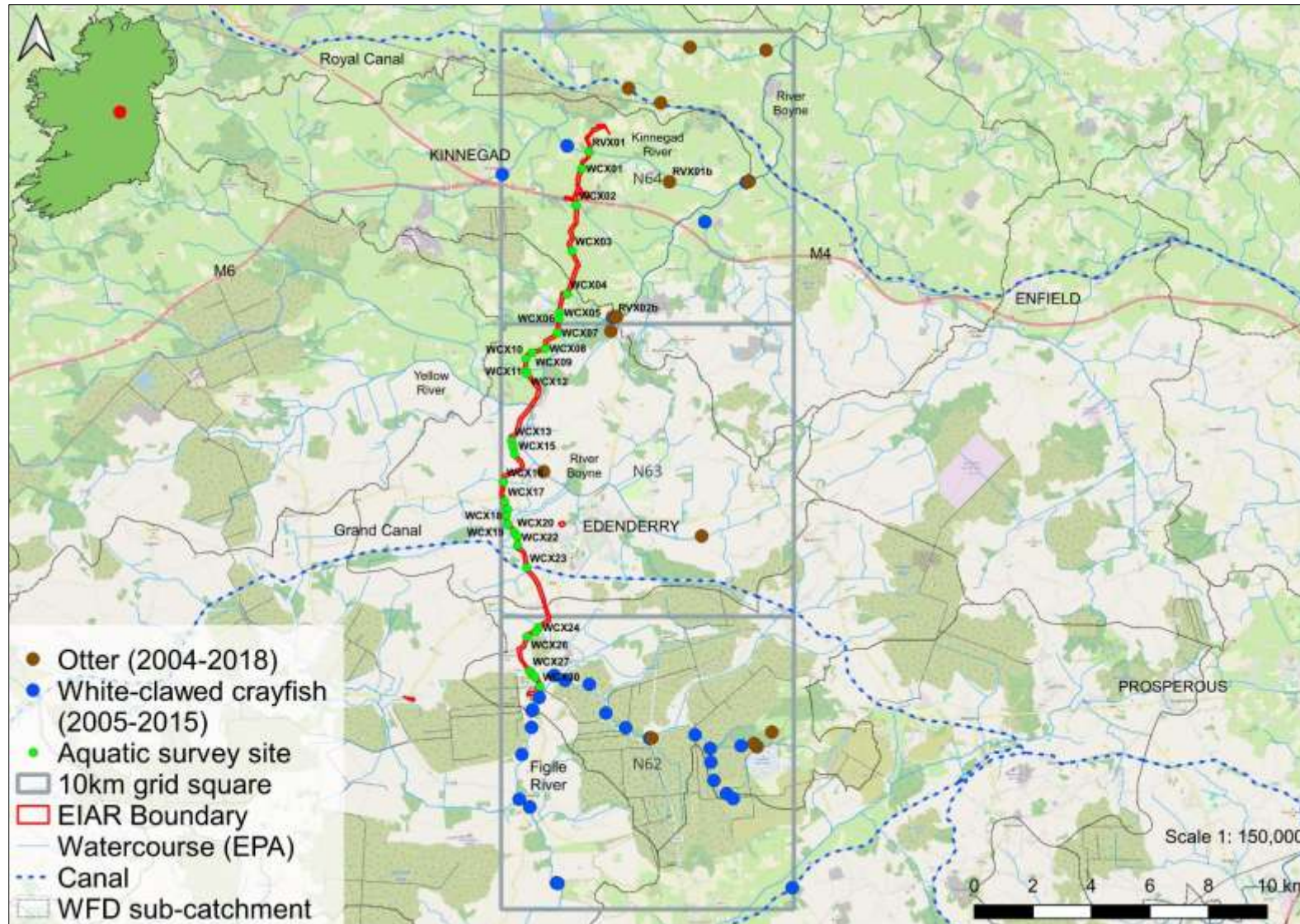


Figure 3.1 Selected rare/protected aquatic species records in vicinity of the proposed development (source: NPWS, EPA, NBDC & Triturus data)

## 4. Results of aquatic surveys

The following section summarises each of the 34 no. survey sites in terms of aquatic habitats, physical characteristics and overall value for fish and macrophyte/aquatic bryophyte communities. Biological water quality (Q-sample) results are summarised for each riverine sampling site and presented in full in **Appendix B**. A summary of the fish species recorded at each survey site is provided in **Table 4.1**. A summary of the aquatic species and habitats of high conservation concern recorded during the surveys is provided in **Table 4.3**. An evaluation of the aquatic ecological importance of each survey site based on these aquatic surveys is provided and summarised in **Table 4.3**. Habitat codes are according to Fossitt (2000). Scientific names are provided at first mention only. Sites were surveyed in July or August 2025.

### 4.1 Aquatic survey site results

#### 4.1.1 Site RVX01 – Kilwarden/Kinnegad River, Kilwarden

Site RVX01 was located on the Kilwarden/Kinnegad River (07K01) at a proposed pipeline crossing. The lowland depositing river (FW2) had been historically straightened and deepened resulting in a trapezoidal, often two-stage channel with steep banks. More recent bank clearance works had occurred near the proposed crossing but the river demonstrated some low level of instream recovery. The river was 4-5m wide and 0.3-0.5m deep with a profile of homogenous glide (no riffle or pool). The bed was dominated by argillaceous soft sediment deposits although small calcified boulder and mixed gravels were present but highly localised. These were often heavily silted. Sand was abundant throughout. Livestock poaching was evident along both banks, further contributing to siltation. Macrophyte growth was locally high with frequent broad-leaved pondweed (*Potamogeton natans*), curled pondweed (*Potamogeton crispus*) and unbranched bur-reed (*Sparganium emersum*). The scoured margins supported linear stands of fool's watercress (*Helosciadium nodiflorum*) and least duckweed (*Lemna minuta*) with rare water mint (*Mentha aquatica*), ivy-leaved duckweed (*Lemna trisulca*) and lesser water parsnip (*Berula erecta*). Given the paucity of hard substrata, aquatic bryophyte cover was low with some scattered *Leptodictyum riparium*. The steep banks were dominated by reed canary grass (*Phalaris arundinacea*) with abundant bramble (*Rubus fruticosus* agg.) scrub. The south bank had been cleared to the bank top but the north supported a continuous dense hedgerow of hawthorn (*Crataegus monogyna*), wych elm (*Ulmus glabra*) and grey willow (*Salix cinerea* subsp. *oleifolia*) and scattered downy birch (*Betula pubescens*). The site was bordered by heavily improved pasture (GA1).

Atlantic salmon (*Salmo salar*), brown trout (*Salmo trutta*), lamprey (*Lampetra* sp.), European eel (*Anguilla anguilla*), stone loach (*Barbatula barbatula*), minnow (*Phoxinus phoxinus*) and three-spined stickleback (*Gasterosteus aculeatus*) were recorded via electro-fishing at site RVX01 (**Appendix A**). Despite historical drainage the site was of surprising value for salmonids, with scattered areas of silted gravels providing some moderate quality spawning and nursery habitat - a rarity in the arterially drained river (pers. obs.). Holding areas for adult salmonids was sparse although undercut/scoured banks with overhanging vegetation were evidently utilised by adult trout. Areas of finer gravels also provided some moderate suitability for lamprey spawning. Abundant soft sediment accumulations were comprised largely of argillaceous particles (sub-optimal) but nevertheless supported a low

density of lamprey ammocoetes. The quality of eel habitat was moderate due to a paucity of instream refugia with a low density present. Despite some good suitability for white-clawed crayfish in terms of macrophyte refugia and soft clay banks, none were recorded. No otter signs were recorded in vicinity of the site.

Biological water quality, based on Q-sampling, was calculated as **Q3 (poor status) (Appendix B)**. However, this rating was tentative given the absence of suitable riffle areas for sampling (as per Toner et al., 2005). No macro-invertebrate species of conservation value greater than 'least concern', according to national red lists, were recorded via Q-sampling.

Given the presence of salmonids (including Atlantic salmon), lamprey (*Lampetra* sp.) and Red-listed European eel, the aquatic ecological evaluation of site RVX01 was of **local importance (higher value) (Table 4.3)**.



**Plate 4.1** Representative image of site RVX01 on the Kilwarden/Kinnegad River, August 2025

#### 4.1.2 Site RVX01b – Kilwarden/Kinnegad River, Clonard Bridge

Site RVX01b was located on the Kilwarden/Kinnegad River (07K01) at Clonard Bridge (a downstream control site not crossed by the proposed pipeline). The lowland depositing river (FW2) had been straightened and deepened historically although some instream recovery was evident. The trapezoidal, often 2-stage channel was 5-8m wide and 0.3-1m deep with a profile of deep slow flowing glide and pool (no riffle). The substrata comprised abundant calcified cobble and boulder with localised areas of mixed gravels and sands. Soft sediment accumulations were abundant along channel margins, with livestock poaching contributing to siltation. The site supported abundant macrophytes with frequent common clubrush (*Schoenoplectus lacustris*), fool's watercress, various-leaved water starwort (*Callitriche platycarpa*) and curled pondweed. Smaller stands of broad-leaved pondweed, water plantain (*Alisma plantago-aquatica*), lesser water parsnip and blue water speedwell (*Veronica*

*anagallis-aquatica*) were intertwined with fool's watercress mats. Ivy-leaved duckweed was abundant on instream substrata. The aquatic moss *Leptodictyum riparium* was locally frequent on hard instream substrata. The high cover of floc and filamentous algae was further indicative of significant eutrophication pressures. The typically steep banks supported a characteristic nitrophilous community dominated by great willowherb (*Epilobium hirsutum*), reed canary grass, hedge bindweed (*Calystegia sepium*), nettle (*Urtica dioica*) and some bittersweet (*Solanum dulcamara*). The banks had been historically cleared with only isolated hawthorn remaining. The site was bordered by improved pasture (GA1).

Atlantic salmon, brown trout, lamprey (*Lampetra* sp.), stone loach, gudgeon (*Gobio gobio*), minnow and three-spined stickleback were recorded via electro-fishing at site RVX01b (**Appendix A**). The deep water site was of good value for salmonids despite historical modifications. Deep pool and glide with overhanging vegetation was of high value as holding habitat for adult salmonids, in addition to European eel (albeit the latter was not recorded). Gravels were localised and heavily silted and thus the spawning value for salmonids and lamprey was much reduced (although still present). Nursery habitat for salmonids was also compromised due to siltation and eutrophication pressures. Many areas of soft sediment were shallow and of poor suitability for lamprey ammocetes although low densities were present in deeper accumulations. Despite some good suitability for white-clawed crayfish, none were recorded. Furthermore, 2 no. otter spraints on boulder revetment under the bridge did not contain crayfish remains (beetle and fish).

Biological water quality, based on Q-sampling, was calculated as **Q3 (poor status) (Appendix B)**. No macro-invertebrate species of conservation value greater than 'least concern', according to national red lists, were recorded via Q-sampling.

Given the presence of salmonids (including Atlantic salmon) and lamprey (*Lampetra* sp.) and utilisation by otter, the aquatic ecological evaluation of site RVX01b was of **local importance (higher value) (Table 4.3)**.



**Plate 4.2** Representative image of site RVX01b on the Killwarden/Kinnegad River at Clonard Bridge, August 2025

#### 4.1.3 Site WCX01 – Unmapped channel, Ardnamullan

Site WCX01 was located on an unmapped channel at a proposed pipeline crossing. The small lowland stream (FW1) had been extensively deepened and straightened historically along field boundaries resulting in a very steep trapezoidal channel with banks of up to 6m in height. The channel suffered from low summer water levels at the time of survey with an imperceptible flow in glide/pool habitat. The channel was 1.5-2m wide and 0.2-0.4m deep and had been excavated as far as the clay/gravel layer resulting in a bed comprised of deep soft sediment deposits (0.2m) over buried hard substrata (gravels with scattered boulder). The site was very heavily vegetated with near total cover of macrophytes. Fool's watercress and water mint were dominant with scattered small stands of branched bur-reed (*Sparganium erectum*). Common duckweed was also present in localised pockets of open water. Aquatic bryophytes were not recorded. Terrestrial encroachment of wet ground species such as great willowherb, marsh marigold (*Caltha palustris*) and marsh bedstraw (*Galium aparine*) was widespread. The riparian zones supported a dense hedgerow of hawthorn, blackthorn (*Prunus spinosa*) and bramble with guelder rose (*Viburnum opulus*), with the south bank cleared to the bank top and dominated by rank grasses and herbaceous vegetation. The site was bordered by improved pasture (GA1).

Three-spined stickleback was the only fish species recorded via electro-fishing at site WCX1 (**Appendix A**). With the exception of moderate densities of this species, the heavily modified and vegetated channel was of poor fisheries value given an absence of summer flows, siltation pressures, poor hydromorphology and poor connectivity with superior fisheries habitats. There was poor suitability for white-clawed crayfish and none were recorded. No otter signs were recorded in vicinity of the site.

Biological water quality, based on Q-sampling, was calculated as **Q2-3 (poor status) (Appendix B)**. No macro-invertebrate species of conservation value greater than 'least concern', according to national red lists, were recorded via Q-sampling.

Given the absence of aquatic species or habitats of high conservation value, the aquatic ecological evaluation of site WCX01 was of **local importance (lower value) (Table 4.3)**.



**Plate 4.3** Representative image of site WCX1 on an unmapped channel, July 2025

#### 4.1.4 Site WCX02 – Aghnahillagh River, Ardnamullan

Site WCX02 was located on the Aghnahillagh River (07A05) at a proposed pipeline crossing. The small river (FW1/FW2) had been extensively straightened and over-deepened along field boundaries resulting in a very steep trapezoidal channel with unstable banks of up to 8m in height. The river suffered from low summer water levels at the time of survey but retained a slight flow. The channel was a homogenous 2m wide and 0.1-0.2m deep with a profile of shallow glide and riffle (no pool). The substrata comprised abundant boulder and cobble with localised mixed gravels but these were heavily silted. Soft sediment accumulations were present along the margins. Livestock poaching (cattle) was widespread with numerous livestock access points also present. Instream woody debris was abundant and formed many debris dams. The channel was heavily shaded given the bank profile and mature treelines, precluding rooted macrophyte growth. Some common duckweed was present behind debris dams. Aquatic bryophytes were limited to rare *Pellia* sp. on stable instream substrata. The banks supported mature but narrow treelines of sycamore, elder (*Sambucus nigra*), hawthorn and beech (*Fagus sylvatica*). The site was bordered by heavily improved pasture (GA1).

Three-spined stickleback was the only fish species recorded via electro-fishing at site WCX02 (**Appendix A**). Despite some suitability for salmonids and European eel, low summer flows, historical modifications and siltation pressures were evidently too extensive to support these species. There

was poor suitability for white-clawed crayfish and none were recorded. No other signs were recorded in vicinity of the site with a paucity of marking opportunities and poor prey resources.

Biological water quality, based on Q-sampling, was calculated as **Q3 (poor status) (Appendix B)**. No macro-invertebrate species of conservation value greater than 'least concern', according to national red lists, were recorded via Q-sampling.

Given the absence of aquatic species or habitats of high conservation value, the aquatic ecological evaluation of site WCX02 was of **local importance (lower value) (Table 4.3)**.



**Plate 4.4** Representative image of site WCX02 on the Aghnahillagh River, July 2025

#### 4.1.5 Site WCX03 – Unmapped channel, Park

Site WCX03 was located on an unmapped channel at a proposed pipeline crossing. The drainage channel (FW4) was situated along field boundaries and had been historically and more recently deepened and straightened for land drainage purposes. The trapezoidal channel was 1.5-2m wide and largely dry at the time of survey with no flows and only isolated shallow pools of stagnant rainwater. The channel terminated at a farm access crossing (no culvert) within the pipeline boundary. The bed comprised deep argillaceous soft sediment deposits with abundant leaf litter. The wet base supported locally frequent narrow-fruited watercress (*Nasturtium microphyllum*) with occasional water mint, brooklime and marsh horsetail (*Equisetum palustris*). Aquatic bryophytes were absent. The south bank provided high degree of shading via a mature beech treeline with elder, ash, hawthorn, grey willow, privet (*Ligustrum vulgare*), holly (*Ilex aquifolium*), bramble and ivy (*Hedera helix*). The north bank had been cleared and fenced to the bank top. The site was bordered by improved pasture (GA1).

No fish were recorded via electro-fishing at site WCX03 (**Appendix A**). With the exception of some low suitability for stickleback species (not recorded), the site was not of fisheries value given historical

modifications and the stagnant, ephemeral nature of the channel. There was no suitability for white-clawed crayfish. No otter signs were recorded within vicinity of the site.

Biological water quality, based on Q-sampling, was calculated as **Q2-3 (poor status) (Appendix B)**. However, this rating was tentative given the absence of suitable riffle areas for sampling (as per Toner et al., 2005). No macro-invertebrate species of conservation value greater than 'least concern', according to national red lists, were recorded via Q-sampling.

Given the absence of aquatic species or habitats of high conservation value, the aquatic ecological evaluation of site WCX03 was of **local importance (lower value) (Table 4.3)**.



**Plate 4.5** Representative image of site WCX03 on an ephemeral drainage channel, July 2025

#### 4.1.6 Site WCX04 – Knockerasally or Colehill River, Ballyboggan

Site WCX04 was located on the Knockerasally or Colehill River (07K12) at the R401 road crossing adjacent to the proposed pipeline crossing. The lowland river (FW2) had been extensively straightened and deepened historically resulting in a trapezoidal channel with poor hydromorphology. The river was 2.5-3m wide and 0.3-0.7m deep with a profile comprised entirely of deep slow-flowing glide. The substrata were dominated by deep argillaceous soft sediment with only rare scattered boulder along littoral areas. No gravels were present. Erosion of the steep banks was evident throughout, with a retaining wall adjoining the road bridge. The site was heavily vegetated with frequent fool's watercress and water mint in addition to small stands of branched bur-reed and iris instream. Common duckweed and common water starwort (*Callitriche stagnalis*) were occasional. Downstream of the road crossing, the river was colonised by abundant common reed (*Phragmites australis*) resulting in obstructions to flow and impounded areas. Upstream, the river was lined by a mature cypress treeline (*Cupressus* sp.) with only scattered hawthorn and grey willow downstream. Reed canary grass dominated the steep banks with a low diversity of herbaceous vegetation present. The site was bordered by arable crops

(BC1) and improved pasture (GA1).

Brown trout, European eel, minnow and three-spined stickleback were recorded via electro-fishing at site WCX04 (**Appendix A**). Despite hydromorphological and gross siltation pressures, the site supported a moderate density of adult brown trout, with low densities of juveniles. The site was not of value for spawning salmonids (or lamprey) given the absence of suitable substrata. Slow flowing vegetated glide was of low value as a salmonid nursery but deeper glide with overhanging vegetation was of value for adult trout. Abundant silt accumulations were unsuitable for lamprey ammocoetes given their argillaceous nature and poor flows. European eel habitat was of poor quality with only a single eel captured. Despite some low suitability for white-clawed crayfish, none were recorded (paucity of suitable refugia). Recent otter prints were recorded on a muddy shelf under the road culvert (ITM 662181, 741031).

Biological water quality, based on Q-sampling, was calculated as **Q3 (poor status) (Appendix B)**. However, this rating was tentative given the absence of suitable riffle areas for sampling (as per Toner et al., 2005). The Red-listed, Near Threatened (Foster et al., 2009) whirligig beetle *Gyrinus urinator* was recorded (single specimen). No other macro-invertebrate species of conservation value greater than 'least concern', according to national red lists, were recorded via Q-sampling.

Given the presence of salmonids, Red-listed European eel and Red-listed *Gyrinus urinator*, in addition to utilisation by otter, the aquatic ecological evaluation of site WCX04 was of **local importance (higher value) (Table 4.3)**.



**Plate 4.6** Representative image of site WCX04 on the Knockersally or Colehill River, July 2025

#### 4.1.7 Site WCX05 – Park River, Ballyboggan

Site WCX05 was located on the Park River (07P04) at a proposed pipeline crossing adjacent to an

existing farm access bridge (box culvert). The lowland depositing river (FW2) had been extensively over-deepened and straightened resulting in a steep trapezoidal channel with 4-5m bank heights and very poor hydromorphology. The peat stained river was a homogenous 3m wide but suffered from low summer flows at the time of survey meaning the sloping margins of the channel were exposed. The substrata were dominated by very deep largely anoxic soft sediment accumulations with only scattered hard substrata along littoral areas (originating from bank erosion areas). Large woody debris and leaf litter were abundant and often created small debris dams. Given high shading and a mostly flocculent bed, macrophytes were limited to localised fool's watercress and common duckweed only. Exposed muddy bank sections supported the semi-aquatic *Pellia* sp. liverwort. The channel was heavily shaded from the banktop by mature hazel (*Corylus avellana*), hawthorn, elder, sycamore and ash with ivy and bramble. The site was bordered by improved pasture (GA1) grazed by horses.

Three-spined stickleback was the only fish species recorded via electro-fishing at site WCX05 (**Appendix A**). With the exception of low densities of these species, the site was not of fisheries value given extensive historical modifications, poor hydromorphology, poor flows and gross siltation pressures. The heavily modified channel was of very poor suitability for white-clawed crayfish and none were recorded. No otter signs were recorded in vicinity of the site.

Biological water quality, based on Q-sampling, was calculated as **Q2 (bad status) (Appendix B)**. However, this rating was tentative given the absence of suitable riffle areas for sampling (as per Toner et al., 2005). No macro-invertebrate species of conservation value greater than 'least concern', according to national red lists, were recorded via Q-sampling.

Given the absence of aquatic species or habitats of high conservation value, the aquatic ecological evaluation of site WCX05 was of **local importance (lower value) (Table 4.3)**.



**Plate 4.7** Representative image of site WCX05 on the Park River, July 2025

#### 4.1.8 Site WCX06 – Ballynakill Stream, Ballynakill

Site WCX06 was located on the mapped course of the Ballynakill Stream (07B25) along a field boundary at a proposed pipeline crossing adjoining the L4019 road. Contrary to EPA mapping, the stream was dry at the time of survey with only the remnants of an old shallow U-shaped channel. The stream had possibly been culverted historically. The dry channel was <2m wide and heavily overgrown by a mature and dense treeline/hedgerow mosaic of ash, hawthorn and blackthorn with bramble-dominated understories. No aquatic habitats or species were present and the dry nature of the channel indicated the infrequency (or even cessation) of water flows. The site was bordered by improved pasture (GA1).

Site WCX06 was not of fisheries or aquatic value given the dry nature of the channel. No otter signs were recorded within vicinity of the site. It was not possible to collect a biological water quality sample.

Given the absence of aquatic species or habitats of high conservation value, the aquatic ecological evaluation of site WCX06 was of **local importance (lower value) (Table 4.3)**.



**Plate 4.8** Representative image of site WCX06 on the Ballynakill Stream, July 2025 (dry channel)

#### 4.1.9 Site WCX07 – Unmapped channel, Harristown

Site WCX07 was located on an unmapped channel along a field boundary at a proposed pipeline crossing. The drainage channel (FW4) ran alongside a farm access track and had been deepened and straightened, resulting in a characteristic trapezoidal profile with steep banks and very poor hydromorphology. Although the channel contained some water at the time of survey (0.05m deep), no perceptible flows were evident (i.e. stagnant). The channel was <1.5m wide with banks of up 1-2m. The bed was composed entirely of deep and anoxic soft sediment, with soft banks featuring some

erosion locally. The narrow channel was heavily vegetated with abundant fool's watercress in more open areas. However, such areas were rare given very high shading (tunnelling) of the channel by dense hawthorn, elder and bramble-dominated scrub. The riparian areas also supported nettle and cleavers (*Galium aparine*) scrub with a mature treeline of Scot's pine (*Pinus sylvestris*) and larch (*Larix decidua*) on the east bank. The site was bordered by heavily improved pasture (GA1).

No fish were recorded via electro-fishing at site WCX07 (**Appendix A**). The channel was not of fisheries value at this location given its very shallow nature, siltation pressures and poor hydromorphology resulting from instream modifications. There was no suitability for white-clawed crayfish. No otter signs were recorded within vicinity of the site.

Biological water quality, based on Q-sampling, was calculated as **Q2 (bad status) (Appendix B)**. However, this rating was tentative given the absence of suitable riffle areas for sampling (as per Toner et al., 2005). No macro-invertebrate species of conservation value greater than 'least concern', according to national red lists, were recorded via Q-sampling.

Given the absence of aquatic species or habitats of high conservation value, the aquatic ecological evaluation of site WCX07 was of **local importance (lower value) (Table 4.3)**.



**Plate 4.9** Representative image of site WCX07 on an unmapped channel, July 2025

#### 4.1.10 Site WCX08 – Unmapped channel, Harristown

Site WCX08 was located on an unmapped tributary of the River Boyne at a proposed pipeline crossing. The drainage channel (FW4) fell over a slight gradient but did not support flowing water at the time of survey. The steep trapezoidal channel was a homogenous 1-1.5m wide with localised standing pools of water to 0.15m locally only. The bed was composed entirely of deep soft sediment accumulations with abundant woody debris and frequent debris dams. The site was heavily vegetated given historical

clearance along the eastern bank, reducing shading. Fool's watercress and watercress (*Nasturtium officinale*) were frequent with common duckweed also present. Aquatic bryophytes were absent. The narrow channel was heavily encroached by terrestrial vegetation such as great willowherb, nettle and bittersweet. The west bank was lined by a mature treeline of ash, hawthorn, elder and dense bramble. The site was bordered by extensive and heavily improved pasture (GA1).

Three-spined stickleback was the only fish species recorded via electro-fishing at site WCX08 (**Appendix A**). With the exception of low densities of these species, the site was not of fisheries value given extensive historical modifications, poor hydromorphology, poor flows, high vegetation cover and gross siltation pressures. The heavily modified channel was of poor suitability for white-clawed crayfish and none were recorded. No otter signs were recorded in vicinity of the site.

Biological water quality, based on Q-sampling, was calculated as **Q2-3 (poor status) (Appendix B)**. However, this rating was tentative given the absence of suitable riffle areas for sampling (as per Toner et al., 2005). No macro-invertebrate species of conservation value greater than 'least concern', according to national red lists, were recorded via Q-sampling.

Given the absence of aquatic species or habitats of high conservation value, the aquatic ecological evaluation of site WCX08 was of **local importance (lower value) (Table 4.3)**.



**Plate 4.10** Representative image of site WCX08 on an unmapped channel, July 2025

#### 4.1.11 Site WCX09 – Unmapped channel, Harristown

Site WCX09 was located on an unmapped tributary of the River Boyne at a proposed pipeline crossing. The channel (FW4) drained a farm yard (and silage storage area) and thus was likely reliant on rainfall (i.e. ephemeral channel). Indeed, a slight flow was observed following heavy downpours. However, the heavily modified channel showed evidence of an ephemeral habitat including a bed with abundant

leaf litter and high levels of terrestrial plant encroachment. The channel had been straightened but not deepened historically and was 2-2.5m wide and <0.02m deep at the time of survey. The bed was composed entirely of deep argillaceous and anoxic soft sediment of up to 0.2m in depth. Hard substrata were absent. The site was heavily vegetated with abundant fool's watercress and narrow-fruited watercress, in addition to more occasional water mint. Aquatic bryophytes were absent. The channel was shaded by an intermittent treelines of grey willow, ash and beech but became more open moving downstream (both banks cleared). Some livestock poaching was present along the north bank. The site was bordered by heavily improved pasture (GA1).

No fish were recorded via electro-fishing at site WCX09 (**Appendix A**). The site was not of fisheries value given historical modifications, gross siltation and the likely ephemeral nature of the channel at this location. There was no suitability for white-clawed crayfish. No otter signs were recorded within vicinity of the site.

Biological water quality, based on Q-sampling, was calculated as **Q2 (bad status) (Appendix B)**. However, this rating was tentative given the absence of suitable riffle areas for sampling (as per Toner et al., 2005). No macro-invertebrate species of conservation value greater than 'least concern', according to national red lists, were recorded via Q-sampling.

Given the absence of aquatic species or habitats of high conservation value, the aquatic ecological evaluation of site WCX09 was of **local importance (lower value) (Table 4.3)**.



**Plate 4.11** Representative image of site WCX09 on an unmapped channel, July 2025

#### 4.1.12 Site WCX10 – Unmapped channel, Harristown

Site WCX10 was located on an unmapped channel at a proposed pipeline crossing. The drainage channel (FW4) supported minimal water flows at the time of survey with stagnation/ponding in

several areas. The channel had been extensively straightened and deepened historically resulting in a deep trapezoidal channel with banks of up to 4m in height (often near vertical). The channel was 1.5-2m wide although livestock poaching within the pipeline footprint has caused over-widening to 4m locally. The shallow channel was 0.05-0.2m deep in a profile of very slow flowing glide and pool (no riffle). The substrata were dominated by soft sediment accumulations that were argillaceous in nature. Whilst scattered gravels and small boulder were present locally these were heavily silted. Macrophyte growth was high in more open areas of channel with branched bur-reed, water mint, common duckweed and fool's watercress. Watercress and brooklime (*Veronica beccabunga*) were rare. Aquatic bryophytes were limited to *Pellia* sp. on muddy littorals. The channel was heavily shaded by mature hedgerows of hawthorn, blackthorn and grey willow with scattered ash and beech. Abundant bramble scrub (WS1) lined the steep banks. The site was bordered by extensive areas of heavily improved pasture (GA1).

Three-spined and ten-spined stickleback (*Pungitius pungitius*) were the only fish species recorded via electro-fishing at site WCX10 (**Appendix A**). With the exception of low densities of these species, the site was of very poor fisheries value given extensive historical modifications, poor hydromorphology, poor flows, high vegetation cover and gross siltation pressures. The heavily modified channel was of poor suitability for white-clawed crayfish and none were recorded. No other signs were recorded in vicinity of the site.

Biological water quality, based on Q-sampling, was calculated as **Q2-3 (poor status) (Appendix B)**. However, this rating was tentative given the absence of suitable riffle areas for sampling (as per Toner et al., 2005). No macro-invertebrate species of conservation value greater than 'least concern', according to national red lists, were recorded via Q-sampling.

Given the absence of aquatic species or habitats of high conservation value, the aquatic ecological evaluation of site WCX10 was of **local importance (lower value) (Table 4.3)**.



**Plate 4.12** Representative image of site WCX10 on an unmapped channel, July 2025

#### 4.1.13 Site WCX11 – Castlejordan River, Harristown

Site WCX11 was located on the Castlejordan River (07K33) at a proposed pipeline crossing. The small tributary of the River Boyne (FW2) had been extensively over-deepened and straightened historically resulting in a very steep trapezoidal channel with very poor hydromorphology. The river was 2m wide and 0.1-0.2m deep with banks of up to 4m in height. The profile comprised glide and pool with an imperceptible flows and an absence of riffles. The substrata were dominated by deep argillaceous soft sediment accumulations with scattered and bedded small boulder and gravels originating from the modified banks. The channel was heavily vegetated (indicative of eutrophication) with abundant fool's watercress and common duckweed. Water mint, watercress and common water starwort were also present locally. Steep banks and littoral areas supported a nitrophilous community dominated by reed canary grass. Aquatic bryophytes were limited to the semi-aquatic *Pellia* sp. on steep sections of exposed banks. The north bank had been cleared locally with intermittent hawthorn and blackthorn hedgerows along the banks top. The south bank featured a continuous stockproof hedgerow of blackthorn, hawthorn, bramble, ivy, dog rose (*Rosa canina*) and holly with scattered ash and grey willow. The site was bordered by extensive areas of heavily improved pasture (GA1).

Three-spined and ten-spined stickleback were the only fish species recorded via electro-fishing at site WCX11 (**Appendix A**). With the exception of low densities of these species, the site was of very poor fisheries value given extensive historical modifications, poor hydromorphology, poor flows and high vegetation cover plus siltation and eutrophication pressures. The heavily modified channel was of poor suitability for white-clawed crayfish and none were recorded. No otter signs were recorded in vicinity of the site.

Biological water quality, based on Q-sampling, was calculated as **Q2 (bad status) (Appendix B)**. However, this rating was tentative given the absence of suitable riffle areas for sampling (as per Toner et al., 2005). No macro-invertebrate species of conservation value greater than 'least concern', according to national red lists, were recorded via Q-sampling.

Given the absence of aquatic species or habitats of high conservation value, the aquatic ecological evaluation of site WCX11 was of **local importance (lower value) (Table 4.3)**.



**Plate 4.13** Representative image of site WCX11 on the Castlejordan River, July 2025

#### 4.1.14 Site WCX12 – Rahin Stream, Clongall

Site WCX12 was located on an unmapped channel adjacent (south of) the Castlejordan River at site WCX11. The drainage channel (FW4) was semi-dry and supported only standing pools of water (0.05m) at the time of survey with no perceptible flows. The trapezoidal channel was 1.5-2m wide with banks of up to 2.5m in height. The damp bed was composed of soft sediment with only scattered hard substrata (small boulder & gravels) along the littorals at bank erosion areas. The site was heavily shaded/tunnelled, restricting macrophyte growth to rare open areas of channel. Here, fool's watercress, common duckweed, marsh horsetail and water mint were common. Aquatic bryophytes were not recorded. Terrestrial encroachment of herbaceous species such as meadowsweet (*Filipendula ulmaria*) and great willowherb was widespread. The channel was lined by intermittent hedgerows of grey willow and hawthorn with abundant bramble. The site was bordered by heavily improved pasture (GA1).

No fish were recorded via electro-fishing at site WCX12 (**Appendix A**). With the exception of some low suitability for stickleback species (not recorded), the site was not of fisheries value given historical modifications and the stagnant nature of the channel. There was no suitability for white-clawed crayfish. No otter signs were recorded within vicinity of the site.

Biological water quality, based on Q-sampling, was calculated as **Q2 (bad status) (Appendix B)**. However, this rating was tentative given the absence of suitable riffle areas for sampling (as per Toner et al., 2005). No macro-invertebrate species of conservation value greater than 'least concern', according to national red lists, were recorded via Q-sampling.

Given the absence of aquatic species or habitats of high conservation value, the aquatic ecological evaluation of site WCX12 was of **local importance (lower value) (Table 4.3)**.



**Plate 4.14** Representative image of site WCX12 on the Rahin Stream, July 2025

#### 4.1.15 Site RVX2b – River Boyne, Ballyboggan Bridge

Site RVX2b was located on the River Boyne (07B04) at Ballyboggan Bridge. The river at this location was not crossed by the proposed pipeline but served as a downstream control site. The lowland river (FW2) had been historically straightened and deepened as part of arterial drainage works resulting in a poorly recovered homogenous channel of 10-12m in width and 1.5-2.5m in depth. The profile comprised deep, slow-flowing glide and pool (no riffle). The site supported abundant macrophytes with frequent stands of branched bur reed and common clubrush with common duckweed entangled with floating fool's watercress rafts. Scattered small stands of arrowhead (*Sagittaria sagittifolia*), watercress, blue water speedwell and yellow lily (*Nuphar lutea*) were also present. Reed canary grass, reed sweet grass (*Glyceria maxima*) and floating sweet grass (*Glyceria fluitans*) grew along the steep margins. The narrow sloping riparian zones supported a nitrophilous plant community dominated by reed canary grass with scattered willow (including white willow, *Salix alba*) and poplar treelines upstream of the bridge. The site was bordered by improved pasture (GA1).

Electro-fishing was not undertaken at site RVX2b due to prohibitive depths and water volumes for backpack electro-fishing. The deep, slow-flowing lowland site was of high value for a range of coarse fish species, with abundant nursery and spawning habitat given the high cover of macrophytes. The quality of European eel habitat was also high. Although of some value as a holding habitat for adult salmonids, the site did not provide good nursery conditions and spawning habitat was absent. Likewise, lamprey spawning areas were not present with soft sediment accumulations offering sub-optimal nursery conditions. Whilst not recorded, the site was of some physical suitability for white-clawed crayfish. An old otter spraint site (with fox scat superimposition) was recorded on the ledge

under the bridge (ITM 663830, 740260).

Biological water quality, based on Q-sampling, was calculated as **Q3 (poor status) (Appendix B)**. However, this rating was tentative given the absence of suitable riffle areas for sampling (as per Toner et al., 2005). No macro-invertebrate species of conservation value greater than 'least concern', according to national red lists, were recorded via Q-sampling.

Given the high value of the River Boyne as an ecological corridor, the aquatic ecological evaluation of site RVX2b was of **county importance (Table 4.3)**.



**Plate 4.15** Representative image of site RVX2b on the River Boyne at Ballyboggan Bridge, July 2025

#### 4.1.16 Site WCX13 – Unmapped channel, Clonmore

Site WCX13 was located on an unmapped River Boyne tributary at a proposed pipeline crossing. The small drainage channel (FW4) supported slight water flows at the time of survey but had been historically deepened and straightened resulting in poor hydromorphology. Culverting for farm access also further impacted hydromorphology and created semi-impounded sections of channel. The channel was 2m wide and 0.2-0.5m deep with a bed dominated by deep soft sediment deposits. No hard exposed substrata were present. The site was heavily vegetated with frequent fool's watercress, water mint, reed canary grass and reed sweet grass instream. Aquatic bryophytes were not recorded. The channel was lined on the north bank by an intermittent treeline of ash, alder, grey willow and blackthorn, with dense scrub present upstream of the crossing. The south bank had been cleared and fenced to the banktop with low lying herbaceous and grass vegetation only. The site was bordered by lower intensity pasture (GA1).

Three-spined stickleback was the only fish species recorded via electro-fishing at site WCX13 (**Appendix A**). With the exception of low densities of this species, the site was of poor fisheries value

given high vegetation cover, siltation pressures and instream barriers reducing connectivity with downstream habitats. The heavily modified channel was of poor suitability for white-clawed crayfish and none were recorded. No otter signs were recorded in vicinity of the site.

Biological water quality, based on Q-sampling, was calculated as **Q3 (poor status) (Appendix B)**. However, this rating was tentative given the absence of suitable riffle areas for sampling (as per Toner et al., 2005). No macro-invertebrate species of conservation value greater than ‘least concern’, according to national red lists, were recorded via Q-sampling.

Given the absence of aquatic species or habitats of high conservation value, the aquatic ecological evaluation of site WCX13 was of **local importance (lower value) (Table 4.3)**.



**Plate 4.16** Representative image of site WCX13 on an unmapped channel, July 2025

#### 4.1.17 Site WCX14 – Unmapped stream, Clonmore

Site WCX14 was located on an unmapped stream at a proposed pipeline crossing. The swift flowing lowland tributary (FW2) of the River Boyne had been extensively straightened and over-deepened historically resulting in a steep trapezoidal channel with bank heights of up to 3m. The stream was 2-2.5m wide and 0.2-0.3m deep with a profile of glide and pool. Riffle areas were highly localised. As a result of historical excavations, the substrata were dominated by compacted mixed gravels and rounded cobble. There were heavily silted with peat staining (likely originating from upstream afforestation). Small boulders and large woody debris were present instream and contributed to hydromorphology. Macrophyte cover was locally high with lesser water parsnip and fool's watercress alongside common duckweed and rare watercress. Aquatic bryophytes were limited to occasional *Rhynchostegium riparioides* and *Pellia* sp. The presence of filamentous algae in open areas of channel (5% cover) was indicative of eutrophication pressures. The stream was lined on the south bank by an intermittent mature treeline of horse chestnut (*Aesculus hippocastanum*), ash and sycamore (*Acer*

*psuedoplatanus*) with bramble-dominated scrub. The north bank had been cleared historically to the bank top. The site was bordered by improved pasture (GA1) with a coniferous plantation (WD4) present upstream.

Brown trout and three-spined stickleback were the only fish species recorded via electro-fishing at site WCX14 (**Appendix A**). The small Boyne tributary was of moderate value for salmonids given the presence of exposed gravel and cobble substrata locally. These areas also provided some potential for lamprey spawning. Nursery and holding habitat was reduced in value given historical modifications but some was nonetheless present for a small salmonid population. Soft sediment accumulations were limited and sub-optimal for lamprey ammocoetes given their shallow and largely humic nature. Despite some low suitability for European eel and white-clawed crayfish, none were recorded. No otter signs were recorded in vicinity of the site.

Biological water quality, based on Q-sampling, was calculated as **Q3 (poor status)** (**Appendix B**). No macro-invertebrate species of conservation value greater than 'least concern', according to national red lists, were recorded via Q-sampling.

Given the presence of salmonids, the aquatic ecological evaluation of site WCX14 was of **local importance (higher value)** (**Table 4.3**).



**Plate 4.18** Representative image of site WCX14 on an unmapped stream, July 2025

#### 4.1.18 Site WCX15 – Unmapped channel, Roosk

Site WCX15 was located on an unmapped channel at a proposed pipeline crossing. The 2m wide straightened drainage channel (FW4) formed a field boundary and featured a characteristic trapezoidal profile with steep banks of up to 4m in height. The drain was 0.1-0.2m deep with stagnant water and no flows. The bed comprised deep anoxic soft sediment (up to 0.2m) with compacted

gravels and cobble underneath. There were no hard exposed substrata. The shallow stagnant channel was heavily vegetated with abundant narrow-fruited watercress in addition to more localised fool's watercress and common water starwort. Both common duckweed and fat duckweed (*Lemna gibba*) were frequent. Aquatic bryophytes were not present. The channel was lined on the south bank by a stockproof hedgerow of blackthorn, hawthorn, dog rose, bramble with scattered ash, wych elm (*Ulmus glabra*), elder and grey willow. The north bank was fenced and cleared to the bank top. The site was bordered by heavily improved pasture (GA1).

Three-spined stickleback was the only fish species recorded via electro-fishing at site WCX15 (**Appendix A**). With the exception of low densities of this species, the site was not of fisheries value given the artificial nature of the channel, significant siltation, very poor hydromorphology and poor connectivity with superior quality habitats. There was no suitability for white-clawed crayfish. No otter signs were recorded in vicinity of the site.

Biological water quality, based on Q-sampling, was calculated as **Q2-3 (poor status) (Appendix B)**. However, this rating was tentative given the absence of suitable riffle areas for sampling (as per Toner et al., 2005). No macro-invertebrate species of conservation value greater than 'least concern', according to national red lists, were recorded via Q-sampling.

Given the absence of aquatic species or habitats of high conservation value, the aquatic ecological evaluation of site WCX15 was of **local importance (lower value) (Table 4.3)**.



**Plate 4.18** Representative image of site WCX15 on an unmapped channel, July 2025

#### 4.1.19 Site WCX16 – Roosk River, Mountwilson

Site WCX16 was located on the Roosk River (07R53), a River Boyne tributary, at a proposed pipeline crossing. The lowland river (FW2) had been extensively over-deepened and straightened historically,

resulting in a very steep trapezoidal channel with very poor hydromorphology. The river suffered from low summer water levels at the time of survey with only a slight flow. The river was a homogenous 3-4m wide and 0.1-0.2m deep with banks of up to 6m. The bed was dominated by deep deposits of argillaceous silt (up to 0.4m) with compacted gravels and cobble underneath. Loose boulder and cobble were strewn along the margins which were often poached by livestock from the south bank. Due to very heavy shading (tunnelling), macrophyte growth was limited to fool's watercress, water mint, brooklime, fat duckweed and common duckweed in rare open areas. Reed canary grass grew along the littorals in these areas. Aquatic bryophytes were restricted to occasional semi-aquatic *Pellia* sp. The steep banks supported mature scrubby treelines comprising ash, alder, grey willow, yew (*Taxus baccata*), privet, bramble and scattered larch (*Larix* sp.). The site was bordered by improved and semi-improved pasture (GA1).

Three-spined stickleback was the only fish species recorded via electro-fishing at site WCX16 (**Appendix A**). With the exception of high densities of this species, the site was of very poor fisheries value given gross siltation and poor hydromorphology resulting from extensive historical modifications. There was an absence of spawning habitat for salmonids or lamprey and low flows would likely preclude these species from the wider survey area. Suitability for European eel and white-clawed crayfish was very low with neither recorded. No otter signs were recorded in vicinity of the site with holting opportunities low in the steep compacted banks.

Biological water quality, based on Q-sampling, was calculated as **Q2 (bad status) (Appendix B)**. However, this rating was tentative given the absence of suitable riffle areas for sampling (as per Toner et al., 2005). No macro-invertebrate species of conservation value greater than 'least concern', according to national red lists, were recorded via Q-sampling.

Given the absence of aquatic species or habitats of high conservation value, the aquatic ecological evaluation of site WCX16 was of **local importance (lower value) (Table 4.3)**.



**Plate 4.19** Representative image of site WCX16 on the Roosk River, July 2025

#### 4.1.20 Site WCX17 – Unmapped channel, Mountwilson

Site WCX17 was located on an unmapped channel at a proposed pipeline crossing. The field boundary drainage channel (FW4) had been historically deepened but not straightened, resulting in a homogenous U-shaped channel of 1.5-2m width. The channel supported only stagnant pools of water at the time of survey (no flows) with a bed comprised entirely of soft largely anoxic silt (>0.2m in depth). Clay was present underneath. Open areas were rare but supported abundant fool's watercress, watercress and common duckweed. Common water starwort and blue water speedwell was rare. Dense scrub vegetation overgrew and tunnelled the channel in many locations, resulting in an absence of macrophytes from much of the survey area. Aquatic bryophytes were not recorded. The narrow channel was heavily shaded by intermittent hedgerows of hawthorn, blackthorn, bramble with scattered ash, sycamore and isolated yew. The site was bordered by improved pasture (GA1).

No fish were recorded via electro-fishing at site WCX17 (**Appendix A**). With the exception of some low suitability for stickleback species (not recorded), the site was not of fisheries value given historical modifications and the stagnant nature of the channel. There was no suitability for white-clawed crayfish. No otter signs were recorded within vicinity of the site.

Biological water quality, based on Q-sampling, was calculated as **Q3 (poor status) (Appendix B)**. However, this rating was tentative given the absence of suitable riffle areas for sampling (as per Toner et al., 2005). No macro-invertebrate species of conservation value greater than 'least concern', according to national red lists, were recorded via Q-sampling.

Given the absence of aquatic species or habitats of high conservation value, the aquatic ecological evaluation of site WCX17 was of **local importance (lower value) (Table 4.3)**.



**Plate 4.20** Representative image of site WCX17 on an unmapped channel, July 2025

#### 4.1.21 Mountwilson Stream, Mountwilson

The survey site on the EPA-mapped course Mountwilson Stream (07M07) was not designated as a watercourse crossing (WCX) given the channel had evidently been dry for a considerable period (years), with a remnant channel that had been historically straightened and deepened. Embankments were evident along the south of the dry U-shaped channel. The stream had potentially been culverted underground with some adjacent ground disturbance indicative of an underground pipeline. Irrespectively, the stream was not accessible for survey. The dry channel was lined by mature beech and oak (*Quercus robur*) with scattered hawthorn and holly. The site was bordered by improved pasture (GA1).

The site was not of fisheries or aquatic value given the dry nature of the channel. No other signs were recorded within vicinity of the site. It was not possible to collect a biological water quality sample.

Given the absence of aquatic species or habitats of high conservation value, the aquatic ecological evaluation of the site was of **local importance (lower value) (Table 4.3)**.



**Plate 4.21** Representative image of the survey site on the Mountwilson Stream, July 2025 (dry channel)

#### 4.1.22 Site WCX18 – Unmapped channel, Thornwell

Site WCX18 was located on an unmapped drainage channel (FW4) at a proposed pipeline crossing. The channel ran along a field boundary north of the Kinnafad River. The straightened and deepened channel was dry at the time of the survey with a damp mud base. The ephemeral channel was a homogenous 1.5m wide with banks of 1.5m wide in a U-shaped channel. The site was heavily

vegetated with wetland vegetation indicating occasional water retention. Water mint and reed sweet grass were abundant with occasional fool's watercress and iris. Terrestrial plant encroachment of the channel was high with abundant nettle, cleavers and great willowherb in the channel. Aquatic bryophytes were absent. The south bank had been cleared and fenced historically with little shade. However, the north bank was lined by a mature stockproof hedgerow dominated by hawthorn, blackthorn and privet with mature alder and ash. The site was bordered by heavily improved pasture (GA1).

Site WCX18 was not of fisheries value given the dry ephemeral nature of the channel in addition to extensive historical modifications, siltation pressures and poor connectivity to downstream habitats. There was no suitability for white-clawed crayfish. No otter signs were recorded within vicinity of the site. It was not possible to collect a biological water quality sample.

Given the absence of aquatic species or habitats of high conservation value, the aquatic ecological evaluation of site WCX18 was of **local importance (lower value) (Table 4.3)**.



**Plate 4.22** Representative image of site WCX18 on an unmapped channel, July 2025 (dry channel)

#### 4.1.23 Site WCX19 – Kinnafad River, Thornwell

Site WCX19 was located on the Kinnafad River (07K31) at a proposed pipeline crossing. The small lowland river (FW2) had been extensively straightened and deepened historically resulting in a homogenous 3-4m wide, 0.2-0.5m deep U-shaped channel with very poor hydromorphology. The bed had been excavated locally in the recent past with other areas more mature. The profile comprised shallow, very slow flowing glide and pool with no riffle habitat. The site was exposed to gross siltation pressures with accumulations of over 0.5m depth on the bed. Hard substrata were absent. Large woody debris and leaf litter was abundant instream. Macrophyte growth was localised with common water starwort, fool's watercress, water mint and common duckweed. Small stands of branched bur-

reed and reed sweet grass were present. Aquatic bryophytes were limited to semi-aquatic *Pellia* sp. The river was well shaded from the south by a mature line of beech. However, the north bank had been cleared with widespread livestock poaching of the unfenced channel. The site was bordered by improved pasture (GA1).

Brown trout and three-spined stickleback were the only fish species recorded via electro-fishing at site WCX19 (**Appendix A**). Despite poor suitability for salmonids and an absence of spawning habitat, a low density of trout were recorded. Improved spawning and nursery habitat was present upstream nearer site WXC20 (but sub-optimal). Deeper holding areas were scarce given infilling by siltation and thus holding opportunities for adult salmonids were very poor. Likewise, European eel habitat was very poor with a paucity of suitable refugia. Despite an abundance of soft sediment accumulation, the quality of lamprey nursery habitat was poor due to low flows and no ammocoetes were recorded. No white-clawed crayfish were recorded, with suitability poor. No otter signs were recorded in vicinity of the site.

Biological water quality, based on Q-sampling, was calculated as **Q3-4 (moderate status) (Appendix B)**. However, this rating was tentative given the absence of suitable riffle areas for sampling (as per Toner et al., 2005). No macro-invertebrate species of conservation value greater than 'least concern', according to national red lists, were recorded via Q-sampling.

Given the presence of salmonids, the aquatic ecological evaluation of site WCX19 was of **local importance (higher value) (Table 4.3)**.



**Plate 4.23** Representative image of site WCX19 on the Kinnafad River, July 2025

#### 4.1.24 Site WCX20 – unmapped stream, Monasteroris

Site WCX20 was located on an unmapped stream at a proposed pipeline crossing. The Kinnafad River

tributary (FW2) had been extensively straightened and over-deepened historically resulting in a trapezoidal channel with banks of up to 4m in height. The homogenous swift flowing channel was 2.5-3m wide and 0.05-0.15m deep with a profile dominated by riffle and shallow glide at low water levels. Deeper pool areas were almost entirely absent. The substrata were dominated by mixed gravels and small cobble with scattered larger boulder. These were moderately silted. Sand accumulations were present locally. Given high shading, macrophytes were restricted to rare fool's watercress and water mint. The aquatic bryophyte community was poorly developed with some rare *Rhynchostegium riparioides* and *Pellia* sp. locally. Freshwater sponges were present on larger stable substrata. The river was lined by mature banktop treelines of beech, ash and hawthorn with abundant ivy in the understories. The site was bordered by improved pasture (GA1).

Lamprey (*Lampetra* sp.), minnow and three-spined stickleback were recorded via electro-fishing at site WCX20 (**Appendix A**). Despite some moderate suitability for salmonids in terms of spawning and lower quality nursery habitat, no salmonids were recorded. This likely reflected extensive instream modifications and possibly low summer flows which influenced fish distribution. Although a single lamprey ammocoete was recorded, habitat was very much sub-optimal with no suitable soft sediment nursery habitat identified (larger ammocoetes can survive without this; **Appendix A**). Some moderate to good quality lamprey spawning habitat by way of finer gravels was present although the value was reduced by siltation. Suitability for European eel and white-clawed crayfish was poor with a paucity of instream refugia - neither were recorded. No otter signs were recorded in vicinity of the site with the steep banks unsuitable for holting.

Biological water quality, based on Q-sampling, was calculated as **Q3 (poor status) (Appendix B)**. No macro-invertebrate species of conservation value greater than 'least concern', according to national red lists, were recorded via Q-sampling.

Given the presence of lamprey (*Lampetra* sp.), the aquatic ecological evaluation of site WCX20 was of **local importance (higher value) (Table 4.3)**.



**Plate 4.24** Representative image of site WCX20 on an unmapped channel, July 2025

#### 4.1.25 Site WCX21 – Unmapped channel, Monasteroris

Site WCX21 was located on an unmapped channel at a proposed pipeline crossing. The drainage channel (FW4) had been historically straightened and deepened along a field boundary resulting in a trapezoidal channel with steep banks (up to 3m) and poor hydromorphology. The drainage channel featured a slight flow of water at the time of survey (following heavy rain) and was 1-1.5m wide and 0.05m deep. The profile comprised riffle and very slow-flowing glide but was likely ephemeral at this location. The substrata were dominated by mixed gravels and scattered cobble with rare boulder. However, these were heavily silted with frequent silt accumulations throughout. Gravels (resulting from instream excavation) were more prominent near the unnamed stream confluence (which also featured frequent gravels). The very shallow channel supported abundant fool's watercress, water mint and watercress. Aquatic bryophytes were limited to occasional *Pellia* sp. and *Rhynchostegium riparioides*. Terrestrial encroachment of the likely ephemeral channel was high with great willowherb, reed canary grass, nettle, cleavers, meadowsweet and rank grasses along the steep banks. The fenced-off riparian zones were narrow with very few trees (grey willow). The site was bordered by improved pasture (GA1).

No fish were recorded via electro-fishing at site WCX21 (**Appendix A**). Despite some low suitability for salmonids in the lowermost reaches at the unnamed stream confluence, none were present and this likely reflected very low flows and the ephemeral nature of the stream. However, the downstream connecting stream (not crossed by the pipeline) had some moderate suitability for brown trout, albeit with siltation pressures. Suitability for white-clawed crayfish was low and none were recorded with the paucity of instream refugia and shallow depths likely precluding the species. No otter signs were recorded in vicinity of the site.

Biological water quality, based on Q-sampling, was calculated as **Q3 (poor status) (Appendix B)**. However, this rating was tentative given the absence of suitable riffle areas for sampling (as per Toner et al., 2005). No macro-invertebrate species of conservation value greater than 'least concern', according to national red lists, were recorded via Q-sampling.

Given the absence of aquatic species or habitats of high conservation value, the aquatic ecological evaluation of site WCX21 was of **local importance (lower value) (Table 4.3)**.



**Plate 4.25** Representative image of site WCX21 on an unmapped channel, July 2025

#### 4.1.26 Site WCX22 – Unmapped channel, Monasteroris

Site WCX22 was located on an unmapped channel at a proposed pipeline crossing. The drainage channel (FW4) ran along a field boundary. The straightened and deepened U-shaped channel (2.5m high banks) was dry at the time of survey with a damp mud base with abundant leaf litter and woody debris (following heavy rainfall). The 2m wide channel likely rarely conveyed water flows with an absence of aquatic vegetation or species. The channel was heavily shaded by dense scrub of bramble, ivy and dog rose with elder, ash, holly, hawthorn and blackthorn treelines. The channel was bordered by improved pasture (GA1).

Site WCX22 was not of fisheries or aquatic value given the dry nature of the channel. No otter signs were recorded within vicinity of the site. It was not possible to collect a biological water quality sample.

Given the absence of aquatic species or habitats of high conservation value, the aquatic ecological evaluation of site WCX22 was of **local importance (lower value) (Table 4.3)**.



**Plate 4.26** Representative image of site WCX22 on an unmapped channel, July 2025 (dry channel)

#### 4.1.27 Site WCX23 – Grand Canal, Rathmore

Site WCX23 was located on the Grand Canal at a proposed pipeline crossing just west of Rathmore Bridge. The alkaline canal was 12-14m wide and up to 1.6m deep with characteristic shallow sloping margins (from 0.05m to 0.5m). The substrata comprised argillaceous soft sediment with scattered calcified boulder, cobble and some gravels along the margins. The site and wider survey area was well vegetated with a typical macrophyte assemblage for the canal. This included abundant heterophyllus common clubrush (inclusive of linear fringes) with more localised water plantain (*Alisma plantago-aquatica*), yellow water lily, broad-leaved pondweed (*Potamogeton natans*) and bog bean (*Menyanthes trifoliata*). Shallow littoral areas supported locally abundant bristly stonewort (*Chara hispida*) and invasive New Zealand pigmyweed (*Crassula helmsii*). Slender spike rush (*Eleocharis acicularis*) was present locally. Aquatic bryophytes were not present. The mature narrow fringes supported calcicolous herbaceous vegetation including meadowsweet, marsh valerian (*Valeriana dioica*), common knapweed (*Centaurea nigra*), clover (*Trifolium* spp.), vetches (*Vicia* spp.), iris, purple loosestrife (*Lythrum salicaria*) and scattered grey willow. The canal was bordered by the Greenway and dry meadow habitat (GS2) along the banks with improved pasture (GA1) adjoining the site.

Electro-fishing was not undertaken at site WCX23 given prohibitive depths and water volumes. However, the site was of high value for a range of coarse fish including roach (*Rutilus rutilus*), perch (*Perca fluviatilis*), pike (*Esox lucius*) and tench (*Tinca tinca*), all of which were observed during the site visit. There was high suitability for both European eel and white-clawed crayfish. No otter signs were recorded in vicinity of the site despite high foraging suitability (but poor holting opportunities given high disturbance on both canal banks).

Red-listed duck mussel (*Anodonta anatina*), listed as vulnerable in Ireland (Byrne et al., 2009), were recorded in low densities via sweep sampling. No other macro-invertebrate species of conservation value greater than 'least concern', according to national red lists, were recorded (**Appendix B**).

Given the location of the site within the Grand Canal pNHA (002104), the aquatic ecological evaluation of site WCX23 was of **national importance (Table 4.3)**.



**Plate 4.27** Representative image of site WCX23 on the Grand Canal, July 2025

#### 4.1.28 Site WCX24 – Ballyleakin River, Ballykillen

Site WCX24 was located on the Ballyleakin River (14B22) at a proposed pipeline crossing. The river (FW2) ran along a field boundary and was dry at the time of survey with a damp muddy base following heavy rainfall. The historically modified channel was a homogenous 1.5-2m wide in a U-shaped channel with banks of up to 1.5m locally. The damp bed supported fool's watercress, watercress and localised brooklime in more open areas of channel. Tunnelling of riparian vegetation was heavy locally and often precluded macrophyte growth. No aquatic bryophytes were recorded. The channel was lined by a mature treeline of ash, hawthorn and elder with abundant dense bramble dominated scrub. Instream encroachment of herbaceous species such as great willowherb and marsh bedstraw (*Galium palustre*) was frequent. The site was bordered by heavily improved pasture (GA1).

Site WCX24 was not of fisheries or aquatic value given the dry, ephemeral nature of the channel. No otter signs were recorded within vicinity of the site. It was not possible to collect a biological water quality sample.

Given the absence of aquatic species or habitats of high conservation value, the aquatic ecological evaluation of site WCX24 was of **local importance (lower value) (Table 4.3)**.



**Plate 4.28** Representative image of site WCX24 on the Ballyleakin River, July 2025 (ephemeral channel)

#### 4.1.29 Site WCX25 – Unmapped channel, Ballykilleen

Site WCX25 was located on a small unmapped stream at a proposed pipeline crossing. The stream (FW2) had been extensively historically straightened and deepened resulting in a trapezoidal channel with very poor hydromorphology and steep often near vertical banks of up to 2m in height. The channel was semi-dry at the time and only conveyed rainwater following heavy downpours. The stream was a homogenous 1.5-2m wide and <0.02m deep at the time of survey with a near imperceptible flow in very shallow glide. The bed was dominated by soft sediment although some superficial calcified gravels (remaining from historical bed excavation) sat atop soft sediment locally. Given high riparian shading, macrophyte cover was highly localised with scattered fool's watercress, watercress and brooklime. Aquatic bryophytes were absent although some *Pellia* sp. liverwort grew on exposed muddy banks. Terrestrial plant encroachment was high with herbaceous vegetation instream in many areas (e.g. great willowherb). The fenced-off riparian areas supported intermittent hawthorn and blackthorn hedgerows with scattered ash trees. Dense bramble dominated scrub lined the channel. The site was bordered by drained and improved pasture (GA1).

No fish were recorded via electro-fishing at site WCX25 (**Appendix A**). The site was not of fisheries value given the semi-dry ephemeral nature of the channel in addition to extensive historical modifications, siltation pressures and poor connectivity with downstream habitats. There was no suitability for white-clawed crayfish. No otter signs were recorded within vicinity of the site.

Biological water quality, based on Q-sampling, was calculated as **Q3 (poor status) (Appendix B)**. However, this rating was tentative given the absence of suitable riffle areas for sampling (as per Toner

et al., 2005). No macro-invertebrate species of conservation value greater than 'least concern', according to national red lists, were recorded via Q-sampling.

Given the absence of aquatic species or habitats of high conservation value, the aquatic ecological evaluation of site WCX25 was of **local importance (lower value) (Table 4.3)**.



**Plate 4.29** Representative image of site WCX25 on an unmapped channel, July 2025 (semi-dry channel)

#### 4.1.30 Site WCX26 – Unmapped channel, Ballykilleen

Site WCX26 was located on an unmapped channel at a proposed pipeline crossing. The drainage channel (FW4) ran along a field boundary and was largely dry at the time of survey with only localised shallow pools of rainwater following heavy downpours (<0.02m). The channel had been excavated for land drainage historically resulting in a deep trapezoidal drain with banks of up to 3m in height. The channel was a homogenous 1.5m wide. The substrata (base) featured abundant soft sediment deposits (up to 0.1m depth) with scattered boulder and cobble from historical bank works. Given very high shading, macrophytes were limited to rare fool's watercress in localised open areas of channel. Aquatic bryophytes were absent. The channel was typically heavily tunnelled by dense scrub of elder, hawthorn, ivy and bramble with frequent ash. The site was located in drained and improved pasture (GA1).

Site WCX26 was not of fisheries value given the semi-dry, ephemeral nature of the channel in addition to extensive historical modifications, siltation pressures and poor connectivity with downstream habitats. There was no suitability for white-clawed crayfish. No otter signs were recorded within vicinity of the site.

Biological water quality, based on Q-sampling, was calculated as **Q3 (poor status) (Appendix B)**. However, this rating was tentative given the absence of suitable riffle areas for sampling (as per Toner et al., 2005). No macro-invertebrate species of conservation value greater than 'least concern', according to national red lists, were recorded via Q-sampling.

Given the absence of aquatic species or habitats of high conservation value, the aquatic ecological evaluation of site WCX26 was of **local importance (lower value) (Table 4.3)**.



**Plate 4.30** Representative image of site WCX26 on an unmapped channel, July 2025 (ephemeral channel)

#### 4.1.31 Site WCX27 – Unmapped channel, Ballykilleen

Site WCX27 was located on an unmapped channel at a proposed pipeline crossing. The drainage channel (FW4) bisected pasture and was largely dry at the time of survey with only localised shallow ponding of water following heavy downpours (<0.05m). The homogenous drainage channel was 2m wide and 0.05m deep with a base of deep peat. No hard substrata were present. The channel was open (historically cleared banks) and supported abundant common duckweed, frequent fool's watercress, branched bur-reed and water mint. Bulrush (*Typha latifolia*) was present locally. Aquatic bryophytes were not recorded. Terrestrial plant encroachment was high with abundant rushes (*Juncus* spp.) and grasses instream. The low lying banks were fenced off from livestock and supported a low diversity of herbaceous and scrub vegetation. The site was bordered by improved pasture (GA1) and adjoined an area of willow and downy birch (*Betula pubescens*) woodland on peat soils.

Ten-spined stickleback was the only fish species recorded via electro-fishing at site WCX27 (**Appendix A**). With the exception of low densities of this ubiquitous species, the site was not of fisheries value given its heavily modified nature, siltation pressures, lack of flows and poor connectivity with superior downstream habitats. There was no suitability for white-clawed crayfish. No otter signs were recorded

within vicinity of the site.

Biological water quality, based on Q-sampling, was calculated as **Q2-3 (poor status) (Appendix B)**. However, this rating was tentative given the absence of suitable riffle areas for sampling (as per Toner et al., 2005). No macro-invertebrate species of conservation value greater than 'least concern', according to national red lists, were recorded via Q-sampling.

Given the absence of aquatic species or habitats of high conservation value, the aquatic ecological evaluation of site WCX27 was of **local importance (lower value) (Table 4.3)**.



**Plate 4.31** Representative image of site WCX27 on an unmapped channel, July 2025

#### 4.1.32 Site WCX28 – Unmapped channel, Ballykilleen

Site WCX28 was located on an unmapped channel at a proposed pipeline crossing. The drainage channel (FW4) tributary of the Ballykilleen Stream had been straightened and deepened (but not in the recent past). The homogenous channel was 2-2.5m wide and 0.2-0.3m deep with a bed composed entirely of soft peat. The open channel was heavily vegetated with abundant common duckweed and fool's watercress. Bulrush, branched bur-reed and water mint were present locally. Encroachment from terrestrial sedges, rushes and herbs was widespread along the low lying banks. The fenced-off riparian areas supported abundant hedge bindweed, reed canary grass, thistles (*Cirsium* spp.), great willowherb, meadowsweet and wild angelica (*Angelica sylvestris*) with only very scattered downy birch saplings. The site was bordered by improved pasture (GA1) with coniferous block (WD4) present upstream of the pipeline corridor (south bank).

Three-spined stickleback was the only fish species recorded via electro-fishing at site WCX28 (**Appendix A**). With the exception of low densities of this ubiquitous species, the site was not of fisheries value given its heavily modified nature, siltation pressures and lack of flow. There was no

suitability for white-clawed crayfish. No otter signs were recorded within vicinity of the site.

Biological water quality, based on Q-sampling, was calculated as **Q2 (bad status) (Appendix B)**. However, this rating was tentative given the absence of suitable riffle areas for sampling (as per Toner et al., 2005). No macro-invertebrate species of conservation value greater than 'least concern', according to national red lists, were recorded via Q-sampling.

Given the absence of aquatic species or habitats of high conservation value, the aquatic ecological evaluation of site WCX28 was of **local importance (lower value) (Table 4.3)**.



**Plate 4.32** Representative image of site WCX28 on an unmapped channel, July 2025

#### 4.1.33 Site WCX29 – Ballykilleen Stream, Ballykilleen

Site WCX29 was located on the Ballykilleen Stream (14B25) immediately downstream of the R401 road crossing (box culvert). The lowland river (FW2) had been extensively straightened and deepened historically resulting in a typically uniform U-shaped channel with poor hydromorphology. However, some limited instream recovery had occurred. The stream was 2-3m wide and 0.1-0.2m but suffered from low summer water levels and poor flows at the time of survey. Up to a third of the channel width was exposed. Slow-flowing glide predominated with riffle confined to the culvert area. The substrata were dominated by peat with occasional scattered small boulder and gravels, particularly near the road crossing. Iron oxidising bacterial films were present on larger substrata. Large woody debris (including fallen trees) was locally abundant instream and created numerous debris dams. Macrophyte growth was sparse due to high riparian shading although localised open glide supported fool's watercress and iris. Aquatic bryophytes were limited to occasional *Pellia* sp. liverwort on larger substrata and exposed areas of bank. The channel was very heavily shaded by a mature stockproof hawthorn hedgerow to the north and an intermittent broadleaved treeline and nitrophilous scrub to the south (including invasive buddleja, *Buddleja davidii*). The site was bordered by improved pasture

(GA1) and scrub (WS1).

Three-spined stickleback was the only fish species recorded via electro-fishing at site WCX29 (**Appendix A**). With the exception of low densities of this species, the site was of poor fisheries value given its heavily modified nature, siltation pressures and poor seasonal flows. Although present, hard substrata (gravels) were of poor suitability for salmonid or lamprey spawning due to siltation. Soft sediment accumulations were humic in nature and thus unsuitable for lamprey ammocoetes. There was poor suitability for white-clawed crayfish and none were recorded. No other signs were recorded within vicinity of the site.

Biological water quality, based on Q-sampling, was calculated as **Q2-3 (poor status) (Appendix B)**. No macro-invertebrate species of conservation value greater than 'least concern', according to national red lists, were recorded via Q-sampling.

Given the absence of aquatic species or habitats of high conservation value, the aquatic ecological evaluation of site WCX29 was of **local importance (lower value) (Table 4.3)**.



**Plate 4.33** Representative image of site WCX29 on the Ballykilleen Stream, July 2025

#### 4.1.34 Site WCX30 – Ballykilleen Stream, Shean

Site WCX30 was located on the Ballykilleen Stream (14B25) c. 400m downstream of crossing WCX28. The lowland river (FW2) had been extensively straightened and deepened historically resulting in a homogenous steep U-shaped channel with poor hydromorphology and poor instream recovery. The stream was 3m wide and 0.2-0.5m deep following heavy rainfall although flows remained limited. The profile comprised slow-flowing glide and vegetated pool. The substrata were dominated by argillaceous silt with only rare scattered boulder. Large woody debris and fallen trees created instream

debris dams. Given an open (historically cleared) north bank, macrophyte cover was high with abundant fool's watercress in addition to water mint and common duckweed. Aquatic bryophytes were limited to occasional *Pellia* sp. on exposed muddy bank sections. The fenced-off banks were heavily scrubbed with abundant nitrophilous vegetation dominated by hedge bindweed, meadowsweet, cleavers, nettle, bramble and rank grasses. Grey willow was scattered along the banks with localised Scot's pine along the adjoining Bord na Móna track to the south. The site was bordered by improved pasture (GA1) with Edenderry Power Station to the south.

Three-spined stickleback and ten-spined stickleback were the only fish species recorded via electro-fishing at site WCX30 (**Appendix A**). With the exception of low densities of stickleback species, the site was of poor fisheries value given its heavily modified nature, siltation pressures, heavy vegetation cover and poor seasonal flows. Spawning habitat for salmonids and lamprey was absent. Abundant soft sediment accumulations were argillaceous in nature and unsuitable for lamprey ammocoetes. Despite some suitability for white-clawed crayfish in terms of macrophyte refugia and clay banks for burrowing, none were recorded. No other signs were recorded within vicinity of the site.

Biological water quality, based on Q-sampling, was calculated as **Q2-3 (poor status) (Appendix B)**. However, this rating was tentative given the absence of suitable riffle areas for sampling (as per Toner et al., 2005). No macro-invertebrate species of conservation value greater than 'least concern', according to national red lists, were recorded via Q-sampling.

Given the absence of aquatic species or habitats of high conservation value, the aquatic ecological evaluation of site WCX30 was of **local importance (lower value) (Table 4.3)**.



**Plate 4.34** Representative image of site WCX30 on the Ballykilleen Stream, July 2025

## 4.2 White-clawed crayfish survey

No white-clawed crayfish were recorded via hand-searching or sweep netting of instream refugia at any of the aquatic survey sites in July or August 2025. Furthermore, inspection of otter spraint at 2 no. sites on the Killwarden/Kinnegad River and River Boyne did not reveal the presence of crayfish remains.

### 4.3 Biological water quality (macro-invertebrates) & lacustrine macro-invertebrates

Duck mussel (*Anodonta anatina*), a species listed as Vulnerable in Ireland (Byrne et al., 2009), was recorded in low densities from the Grand Canal at site WCX23 (**Plate 4.35**). The Near Threatened (Foster et al., 2009) whirligig beetle *Gyrinus urinator* was recorded from site WCX4 on the Knockersally (or Colehill) River (**Plate 4.36**). No other rare or protected macro-invertebrate species (according to national red lists) were recorded in the biological water quality or sweep samples taken from the remaining sites in July or August 2025 (**Appendix B**).

None of the survey sites achieved  $\geq$ **Q4 (good status)** water quality and thus all failed to meet the target good status ( $\geq$ Q4) requirements of the European Union Environmental Objectives (Surface Waters) (Amendment) Regulations 2019 and the Water Framework Directive (2000/60/EC) (**Figure 4.1**).

Site WCX19 on the Kinnafad River achieved **Q3-4 (moderate status)** water quality (**Figure 4.1**). Despite the presence of the EPA group A stonefly *Nemoura cinerea*, the species were only recorded in low numbers (<5% of total sample) and thus did not meet the qualifying criteria for good status as set out by Toner et al. (2005).

A total of 19 no. sites (WCX01, WCX02, WCX03, WCX04, WCX08, WCX010, WCX13, WCX14, WCX15, WCX17, WCX20, WCX21, WCX25, WCX26, WCX27, WCX29, WCX30, RVX01 & RVX01b) achieved **Q2-3 or Q3 (poor status)** based on an absence of group A species, low numbers of group B species and a dominance of pollution tolerant group C, D and E species such as the mayfly *Baetis rhodani*, freshwater shrimp (*Gammarus duebeni*), blackfly larvae (Simuliidae), hoglouse (*Asellus aquaticus*) and non-biting midge larvae (*Chironomus* spp.) (**Appendix B**).

A total of 7 no. sites (WCX05, WCX07, WCX09, WCX11, WCX12, WCX16 & WCX28) achieved **Q2 (bad status)** given a dominance of highly pollution tolerant group D and E species, primarily hoglouse (*Asellus aquaticus*) and non-biting midge larvae (*Chironomus* spp.) (**Appendix B**).

The Grand Canal (site WCX23) supported a high macro-invertebrate diversity (taxon richness = 29). The sample was dominated by damselflies (Coenagrionidae), crustaceans such as great ramshorn (*Planorbis planorbis*) and non-native *Crangonyx* sp., and cased caddis such as *Mystacides longicornis* and *Agrypnia obsoleta* (**Appendix B**). Whilst not protected, the nationally uncommon water stick insect *Ranatra linearis*, a recent discovery in Ireland (Nelson, 2018), was recorded in the sample.



**Plate 4.35** Underwater image of Red-listed duck mussel (*Anodonta anatina*) recorded on the Grand Canal at site WCX23



**Plate 4.36** Stock image of the IUCN near-threatened whirligig beetle *Gyrinus urinator* recorded at site WCX04 on the Knockersally River in July 2025

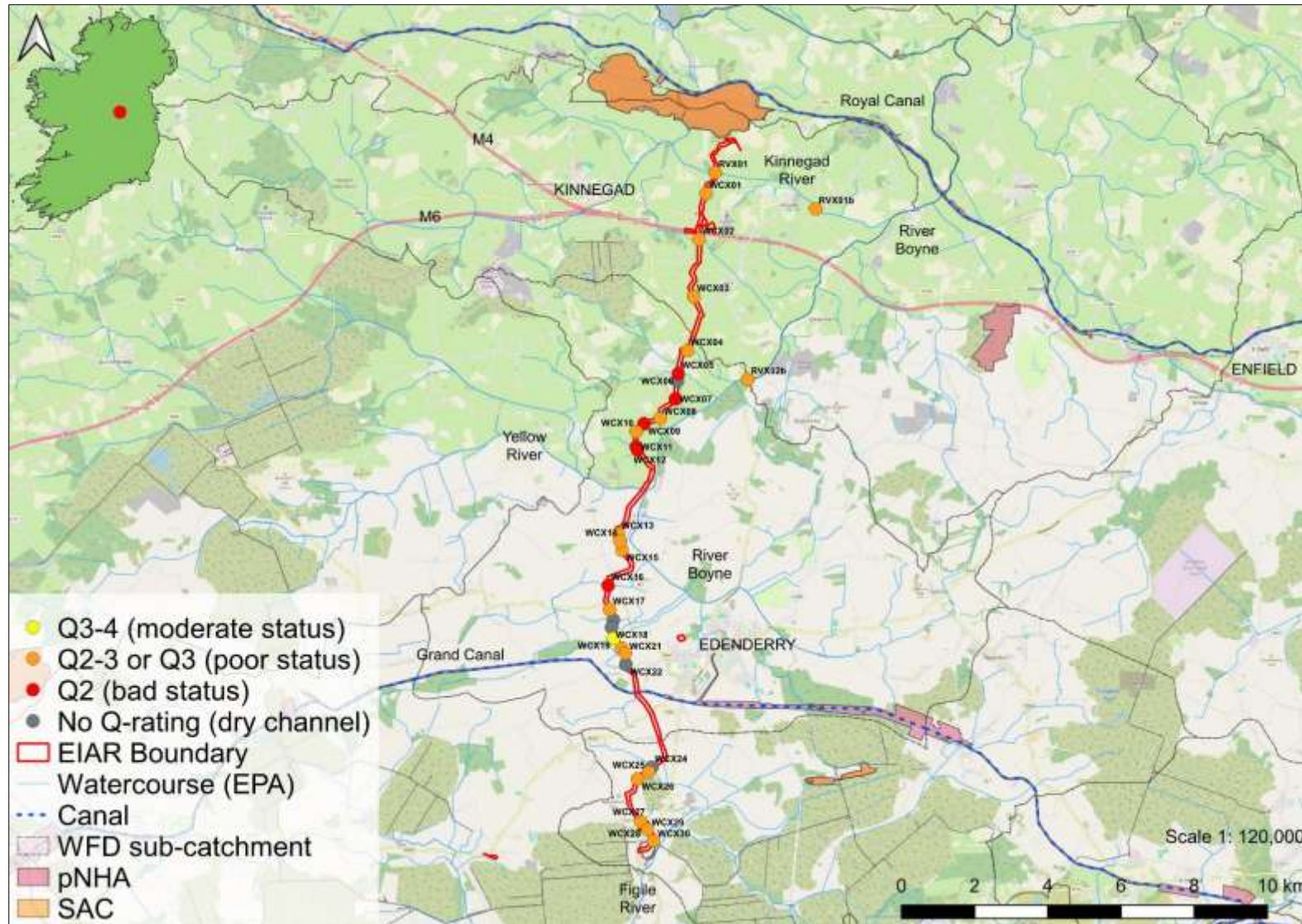


Figure 4.1 Overview of the biological water quality status in the vicinity of the proposed development, July-August 2025

**Table 4.1** Relative abundance of fish species of higher conservation value recorded via **electro-fishing** in the vicinity of the proposed development, July-August 2025

Site	Watercourse	Atlantic salmon	Brown trout	Lamprey ( <i>Lampetra</i> sp.)	European eel	Other species
RVX01	Kilwarden/Kinnegad River	Medium	Medium	Medium	Low	Minnow, stone loach, three-spined stickleback
RVX01b	Kilwarden/Kinnegad River	Low	Low	Medium		Minnow, gudgeon, stone loach, three-spined stickleback
WCX01	Unmapped channel					Three-spined stickleback
WCX02	Aghnahillagh River					Three-spined stickleback
WCX03	Unmapped channel	No fish recorded				
WCX04	Knockerasally or Colehill River		Medium		Low	Minnow, three-spined stickleback
WCX05	Park River					Three-spined stickleback
WCX06	Ballynakill Stream	No fish recorded				
WCX07	Unmapped channel	No fish recorded				
WCX08	Unmapped channel					Three-spined stickleback
WCX09	Unmapped channel	No fish recorded				
WCX10	Unmapped channel					Three-spined stickleback, ten-spined stickleback
WCX11	Castlejordan River					Three-spined stickleback, ten-spined stickleback
WCX12	Rahin Stream	No fish recorded				
RVX02b	River Boyne	Fisheries appraisal only				
WCX13	Unmapped channel					Three-spined stickleback
WCX14	Unmapped stream		Low			Three-spined stickleback
WCX15	Unmapped channel					Three-spined stickleback

Site	Watercourse	Atlantic salmon	Brown trout	Lamprey ( <i>Lampetra</i> sp.)	European eel	Other species
WCX16	Roosk River					Three-spined stickleback
WCX17	Unmapped channel	No fish recorded				
n/a	Mountwilson Stream	No fish recorded				
WCX18	Unmapped channel	No fish recorded				
WCX19	Kinnafad River		Low			Three-spined stickleback
WCX20	Unmapped stream			Low		Three-spined stickleback, minnow
WCX21	Unmapped channel	No fish recorded				
WCX22	Unmapped channel	No fish recorded				
WCX23	Grand Canal	Fisheries appraisal only				
WCX24	Ballyleakin River	No fish recorded				
WCX25	Unmapped channel	No fish recorded				
WCX26	Unmapped channel	No fish recorded				
WCX27	Unmapped channel					Ten-spined stickleback
WCX28	Unmapped channel					Three-spined stickleback
WCX29	Ballykilleen Stream					Three-spined stickleback
WCX30	Ballykilleen Stream					Three-spined stickleback, ten-spined stickleback

**Table 4.2** Summary of aquatic species and habitats of higher conservation value recorded in the vicinity of the proposed developments, July 2025

Site	Watercourse	White-clawed crayfish	Otter signs <sup>3</sup>	Annex I aquatic habitats	Rare or protected macrophytes/aquatic bryophytes	Rare or protected macro-invertebrates	Other aquatic species/habitats of high conservation value
RVX01	Kilwarden/Kinnegad River	None recorded	None recorded	Not present	None recorded	None recorded	<b>Atlantic salmon, <i>Lampetra</i> sp., European eel</b>
RVX01b	Kilwarden/Kinnegad River	None recorded	<b>2 no. spraint sites</b>	Not present	None recorded	None recorded	<b>Atlantic salmon, <i>Lampetra</i> sp.</b>
WCX01	Unmapped channel	None recorded	None recorded	Not present	None recorded	None recorded	None recorded
WCX02	Aghnahillagh River	None recorded	None recorded	Not present	None recorded	None recorded	None recorded
WCX03	Unmapped channel	None recorded	None recorded	Not present	None recorded	None recorded	None recorded
WCX04	Knockerasally or Colehill River	None recorded	None recorded	Not present	None recorded	<b><i>Gyrinus urinator</i> (Near Threatened; Foster et al., 2009)</b>	<b>European eel</b>
WCX05	Park River	None recorded	None recorded	Not present	None recorded	None recorded	None recorded
WCX06	Ballynakill Stream	None recorded	None recorded	Not present	None recorded	None recorded	None recorded
WCX07	Unmapped channel	None recorded	None recorded	Not present	None recorded	None recorded	None recorded
WCX08	Unmapped channel	None recorded	None recorded	Not present	None recorded	None recorded	None recorded
WCX09	Unmapped channel	None recorded	None recorded	Not present	None recorded	None recorded	None recorded
WCX10	Unmapped channel	None recorded	None recorded	Not present	None recorded	None recorded	None recorded
WCX11	Castlejordan River	None recorded	None recorded	Not present	None recorded	None recorded	None recorded
WCX12	Rahin Stream	None recorded	None recorded	Not present	None recorded	None recorded	None recorded
RVX02b	River Boyne	None recorded	<b>1 no. spraint site</b>	Not present	None recorded	None recorded	None recorded
WCX13	Unmapped channel	None recorded	None recorded	Not present	None recorded	None recorded	None recorded
WCX14	Unmapped stream	None recorded	None recorded	Not present	None recorded	None recorded	None recorded
WCX15	Unmapped channel	None recorded	None recorded	Not present	None recorded	None recorded	None recorded

Site	Watercourse	White-clawed crayfish	Otter signs <sup>3</sup>	Annex I aquatic habitats	Rare or protected macrophytes/aquatic bryophytes	Rare or protected macro-invertebrates	Other aquatic species/habitats of high conservation value
WCX16	Roosk River	None recorded	None recorded	Not present	None recorded	None recorded	None recorded
WCX17	Unmapped channel	None recorded	None recorded	Not present	None recorded	None recorded	None recorded
n/a	Mountwilson Stream	None recorded	None recorded	Not present	None recorded	None recorded	None recorded
WCX18	Unmapped channel	None recorded	None recorded	Not present	None recorded	None recorded	None recorded
WCX19	Kinnafad River	None recorded	None recorded	Not present	None recorded	None recorded	None recorded
WCX20	Unmapped stream	None recorded	None recorded	Not present	None recorded	None recorded	<b>Lampetra sp.</b>
WCX21	Unmapped channel	None recorded	None recorded	Not present	None recorded	None recorded	None recorded
WCX22	Unmapped channel	None recorded	None recorded	Not present	None recorded	None recorded	None recorded
WCX23	Grand Canal	None recorded	None recorded	Not present	None recorded	<b>Duck mussel (<i>Anodonta anatina</i>) (Vulnerable; Byrne et al., 2009)</b>	None recorded
WCX24	Ballyleakin River	None recorded	None recorded	Not present	None recorded	None recorded	None recorded
WCX25	Unmapped channel	None recorded	None recorded	Not present	None recorded	None recorded	None recorded
WCX26	Unmapped channel	None recorded	None recorded	Not present	None recorded	None recorded	None recorded
WCX27	Unmapped channel	None recorded	None recorded	Not present	None recorded	None recorded	None recorded
WCX28	Unmapped channel	None recorded	None recorded	Not present	None recorded	None recorded	None recorded
WCX29	Ballykilleen Stream	None recorded	None recorded	Not present	None recorded	None recorded	None recorded
WCX30	Ballykilleen Stream	None recorded	None recorded	Not present	None recorded	None recorded	None recorded

**Conservation value:** Eurasian otter (*Lutra lutra*), Atlantic salmon (*Salmo salar*) & lamprey (*Lampetra* spp.) are listed under Annex II and Annex V of the Directive on the Conservation of Natural Habitats of Wild Fauna and Flora (92/43/EEC) ('EU Habitats Directive'). Atlantic salmon & sea trout are also protected under the Wild Salmon and Sea Trout Tagging Scheme (Amendment) Regulations. European eel are 'critically endangered' according to most recent ICUN red list (Pike et al., 2020) and listed as 'critically endangered' in Ireland (King et al., 2011).

<sup>3</sup> Otter signs within 150m of the survey site

**Table 4.3** Aquatic ecological evaluation summary of the survey sites according to NRA (2009) criteria

Site no.	Watercourse	EPA code	Evaluation of importance	Rationale summary
RVX01	Kilwarden/Kinnegad River	07K01	<b>Local importance (higher value)</b>	Atlantic salmon, brown trout, lamprey ( <i>Lampetra</i> sp.) & European eel recorded
RVX01b	Kilwarden/Kinnegad River	07K01	<b>Local importance (higher value)</b>	Atlantic salmon, brown trout, lamprey ( <i>Lampetra</i> sp.) & otter recorded
WCX01	Unmapped channel	n/a	Local importance (lower value)	No aquatic species or habitats of high conservation value
WCX02	Aghnahillagh River	07A05	Local importance (lower value)	No aquatic species or habitats of high conservation value
WCX03	Unmapped channel	n/a	Local importance (lower value)	No aquatic species or habitats of high conservation value
WCX04	Knockerasally or Colehill River	07K12	<b>Local importance (higher value)</b>	Brown trout, European eel & <i>Gyrinus urinator</i> recorded
WCX05	Park River	07P04	Local importance (lower value)	No aquatic species or habitats of high conservation value
WCX06	Ballynakill Stream	07B25	Local importance (lower value)	No aquatic species or habitats of high conservation value (dry/ephemeral channel)
WCX07	Unmapped channel	n/a	Local importance (lower value)	No aquatic species or habitats of high conservation value
WCX08	Unmapped channel	n/a	Local importance (lower value)	No aquatic species or habitats of high conservation value
WCX09	Unmapped channel	n/a	Local importance (lower value)	No aquatic species or habitats of high conservation value
WCX10	Unmapped channel	n/a	Local importance (lower value)	No aquatic species or habitats of high conservation value
WCX11	Castlejordan River	07C33	Local importance (lower value)	No aquatic species or habitats of high conservation value
WCX12	Rahin Stream	07R12	Local importance (lower value)	No aquatic species or habitats of high conservation value
RVX02b	River Boyne	07B04	<b>County importance</b>	High value as an ecological corridor
WCX13	Unmapped channel	n/a	Local importance (lower value)	No aquatic species or habitats of high conservation value
WCX14	Unmapped stream	n/a	<b>Local importance (higher value)</b>	Brown trout recorded
WCX15	Unmapped channel	n/a	Local importance (lower value)	No aquatic species or habitats of high conservation value

Site no.	Watercourse	EPA code	Evaluation of importance	Rationale summary
WCX16	Roosk River	07R53	Local importance (lower value)	No aquatic species or habitats of high conservation value
WCX17	Unmapped channel	n/a	Local importance (lower value)	No aquatic species or habitats of high conservation value
n/a	Mountwilson Stream	07M07	Local importance (lower value)	No aquatic species or habitats of high conservation value (dry/ephemeral channel)
WCX18	Unmapped channel	n/a	Local importance (lower value)	No aquatic species or habitats of high conservation value (dry/ephemeral channel)
WCX19	Kinnafad River	07K31	<b>Local importance (higher value)</b>	Brown trout recorded
WCX20	Unmapped stream	n/a	<b>Local importance (higher value)</b>	Lamprey ( <i>Lampetra</i> sp.) recorded
WCX21	Unmapped channel	n/a	Local importance (lower value)	No aquatic species or habitats of high conservation value
WCX22	Unmapped channel	n/a	Local importance (lower value)	No aquatic species or habitats of high conservation value (dry/ephemeral channel)
WCX23	Grand Canal	n/a	<b>National importance</b>	Located within the Grand Canal pNHA
WCX24	Ballyleakin River	14B42	Local importance (lower value)	No aquatic species or habitats of high conservation value (dry/ephemeral channel)
WCX25	Unmapped channel	n/a	Local importance (lower value)	No aquatic species or habitats of high conservation value
WCX26	Unmapped channel	n/a	Local importance (lower value)	No aquatic species or habitats of high conservation value (dry/ephemeral channel)
WCX27	Unmapped channel	n/a	Local importance (lower value)	No aquatic species or habitats of high conservation value
WCX28	Unmapped channel	n/a	Local importance (lower value)	No aquatic species or habitats of high conservation value
WCX29	Ballykilleen Stream	14B25	Local importance (lower value)	No aquatic species or habitats of high conservation value
WCX30	Ballykilleen Stream	14B25	Local importance (lower value)	No aquatic species or habitats of high conservation value

**Conservation value:** Atlantic salmon, lamprey (*Lampetra* spp.) & otter are listed under Annex II and Annex V of the Directive on the Conservation of Natural Habitats of Wild Fauna and Flora (92/43/EEC) ('EU Habitats Directive'). Atlantic salmon & sea trout are also protected under the Wild Salmon and Sea Trout Tagging Scheme (Amendment) Regulations. Apart from the Inland Fisheries Acts 1959 to 2017, non-anadromous brown trout have no legal protection in Ireland although sites capable of supporting salmonid populations can be considered of at least higher local value. European eel are 'critically endangered' according to most recent ICUN red list (Pike et al., 2020) and listed as 'critically engendered' in Ireland (King et al., 2011). The whirligig beetle *Gyrinus urinator* is listed as Near Threatened (Foster et al., 2009). Duck mussel (*Anodonta anatina*) are listed as Vulnerable in Ireland (Byrne et al., 2009).

## 5. Discussion

The watercourses surveyed in the vicinity of the proposed Edenderry Gas Pipeline development were typically heavily modified lowland channels and drainage ditches of low aquatic value. Widespread historical straightening and deepening as part of land drainage works had resulted in watercourses with poor hydromorphology and often poor summer flows. A total of 6 no. sites on the Ballynakill Stream, Mountwilson Stream, Ballyleakin River and three unmapped channels were dry at the time of survey. Bordering and adjoining land uses had also exacerbated significant siltation and eutrophication impacts. Such pressures evidently influenced biological water quality with all sampling sites failing to achieve good status in July-August 2025.

However, a low number of high conservation value aquatic species were recorded during the surveys including Annex II Atlantic salmon (2 no. sites), lamprey (3 no. sites) and otter (2 no. sites) in addition to Red-listed European eel (2 no. sites) and the Red-listed whirligig beetle *Gyrinus urinator* (1 no. site). The presence of one or more of these species resulted in these sites being evaluated as **local importance (higher value)** in terms of their aquatic ecology, with the majority of sites being of **local importance (lower value)** (Table 4.3). Given its location within the Grand Canal pNHA (002104), watercourse crossing WCX23 on the Grand Canal was of **national importance**. This site also supported Red-listed duck mussel (*Anodonta anatina*). Whilst surveyed as a downstream control site (not a pipeline crossing), site RVX02b on the River Boyne was of **county importance** in terms of its aquatic ecology given its high value as an ecological corridor.

No examples of Annex I aquatic habitats, no rare or protected macrophytes/aquatic bryophytes and no white-clawed crayfish were recorded during the surveys. No breeding or resting places of otter, protected under the Wildlife Act 1976-2023, were recorded within 150m of the survey sites.

### 5.1 Fisheries

A typical diversity of fish for the survey catchments was recorded during the survey, with Atlantic salmon, brown trout, lamprey (*Lampetra* sp.), European eel, minnow, gudgeon, stone loach, three-spined stickleback and ten-spined stickleback captured via electro-fishing in July and August 2025 (Table 4.1). Fish were recorded from a total of 19 no. sites, with 13 no. of these supporting only stickleback species.

Salmonid populations were very restricted in the survey area, with brown trout recorded from 5 no. sites on the on the Kilwarden/Kinnegad River (RVX01 & RVX01b), Knockerasally River (WCX04), an unmapped Boyne tributary (WCX14) and the Kinnafad River (WCX19). Low numbers of Atlantic salmon were recorded from sites RVX01 and RVX01b on the Kinnegad River. This limited distribution reflected the widespread hydromorphological and water quality pressures in the survey area (Appendix A).

The distribution of lamprey was also highly limited with *Lampetra* sp. ammocoetes recorded from 2 no. sites on the Kilwarden/Kinnegad River (RVX01 & RVX01b) and an unmapped Kinnafad River tributary (WCX20). Lamprey habitat was generally poor across the survey area and the abundances and distribution of ammocoetes reflected the often low summer flows, the poor hydromorphology of most sites and paucity of suitable spawning and nursery areas (Appendix A).

Red-listed European eel were only recorded in low densities from sites RVX01 on the Kilwarden/Kinnegad River (a Figile tributary) and WCX04 on the Knockersally River, again signifying

the lower fisheries value of most survey areas due to historical modifications and water quality pressures (**Appendix A**).

## 5.2 White-clawed crayfish

Despite local habitat suitability and numerous available records in the wider survey area, including on the Kilwarden/Kinnegad River (**Figure 3.1**), no white-clawed crayfish were recorded via hand searching or sweep netting during the current survey. Their absence also included the inspection of otter spraint at 2 no. sites on the Kilwarden/Kinnegad River and River Boyne (for crayfish remains). Many survey watercourses were sub-optimal or unsuitable for crayfish, with poor summer flows, widespread instream modifications and water quality pressures.

The Boyne catchment suffered crayfish plague outbreaks in the late 1980s (Demers et al., 2005) and in more recent years, crayfish plague has been confirmed throughout the Barrow catchment, including sub-catchments adjoining the survey area (i.e. Slate\_SC\_010; NPWS data). Therefore, crayfish distribution in the survey area has also likely been impacted by this pathogen.

## 5.3 Macro-invertebrates & biological water quality pressures

Duck mussel (*Anodonta anatina*), a species listed as Vulnerable in Ireland (Byrne et al., 2009), was recorded in low densities from the Grand Canal at site WCX23 (**Plate 4.35**). This large bivalve mollusc is listed as 'vulnerable' in Ireland (Byrne et al., 2009) and the Grand Canal population (which is widespread, pers. obs.) can be considered of high conservation value. In contrast to freshwater pearl mussel (*Margaritifera margaritifera*) which require salmonids as obligate intermediate hosts to complete their life cycle, *Anodonta* sp. glochidia (swan and duck mussels) may develop in a wide range of fish species, including brown trout as well as cyprinids (Huber & Geist, 2019; Dias et al., 2020; Chowdhury et al., 2018). Duck mussels demonstrate a relatively high plasticity and tolerance to different abiotic conditions and can thus be found from fast-flowing streams to lentic habitats (Zieritz & Aldridge, 2011).

The Near Threatened (Foster et al., 2009) whirligig beetle *Gyrinus urinator* (referred to as 'The Artist') was recorded from site WCX04 on the Knockersally (or Colehill) River (**Plate 4.36**). This species is listed as IUCN near-threatened and has a limited distribution in Ireland, being largely restricted to lowland, base-rich rivers and streams (Foster et al., 2009). No other rare or protected macro-invertebrate species (according to national red lists) were recorded in the biological water quality or sweep samples taken from the remaining sites in July or August 2025 (**Appendix B**).

All biological water quality sampling sites sampled failed to meet the target good status ( $\geq Q4$ ) requirements of the European Union Environmental Objectives (Surface Waters) (Amendment) Regulations 2019 and the Water Framework Directive (2000/60/EC) (**Figure 4.1**). Site WCX19 on the Kinnafad River, a tributary of the River Boyne, achieved **Q3-4 (moderate status)** with all other sites achieving **Q2-3 or Q3 (poor status)** or **Q2 (bad status)** (**Appendix B**).

The unsatisfactory biological water quality of the survey area (i.e.  $< Q4$ ) reflected the widespread significant siltation, eutrophication and hydromorphological impacts which had evidently contributed to a reduction in water quality. Furthermore, many watercourse crossings were unsuitable for Q-sampling given poor flows and the absence of riffle areas for sampling (as per Toner et al., 2005). Thus,

20 no. Q-ratings are considered tentative. Hydromorphology (channelisation) and peat extraction are known to be the major water quality pressures within the wider survey area (EPA data) and this was supported by observations made during the aquatic surveys.

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## 7. Appendix A – fisheries report

Please see the accompanying fisheries assessment report

## 8. Appendix B – Macro-invertebrates & biological water quality

**Table 8.1** Macro-invertebrate Q-sampling results, July-August 2025 (\* tentative Q-rating given the absence of suitable riffle areas for sampling; Toner et al., 2005)

Group	Family	Species	RVX 01	RVX 01b	WCX 01	WCX 02	WCX 03	WCX 04	WCX 05	WCX 07	WCX 08	WCX 09	WCX 10	WCX 11	WCX 12	RVX 02b	EPA group
Ephemeroptera	Baetidae	<i>Alainites muticus</i>		8												1	B
Trichoptera	Cased caddis pupa	sp. indet.				5										6	B
Trichoptera	Glossosomatidae	<i>Agapetus fuscipes</i>				7											B
Trichoptera	Goeridae	<i>Silo pallipes</i>	14	11													B
Trichoptera	Limnephilidae	<i>Limnephilus lunatus</i>			14							4	10	12		14	B
Trichoptera	Limnephilidae	<i>Potamophylax cingulatus</i>	1														B
Trichoptera	Phryganeidae	<i>Agrypnia obsoleta</i>														2	B
Trichoptera	Sericostomatidae	<i>Sericostoma personatum</i>	12	8				4									B
Odonata	Aeshnidae	<i>Anax imperator</i>														1	B
Odonata	Calopterygidae	<i>Calopteryx splendens</i>	2	9												9	B
Ephemeroptera	Baetidae	<i>Baetis rhodani</i>	29	45		8										3	C
Ephemeroptera	Ephemerellidae	<i>Serratella ignita</i>	8	42													C
Trichoptera	Hydropsychidae	<i>Hydropsyche instabilis</i>	4	9													C
Trichoptera	Polycentropodidae	<i>Plectrocnemia conspersa</i>				2											C
Arachnida	Hydrachnidae	sp. indet.	1		11						6		8				C
Arachnida	Dictynidae	<i>Argyroneta aquatica</i>														1	C
Coleoptera	Dytiscidae	Dytiscidae larva												3		3	C
Coleoptera	Dytiscidae	<i>Dytiscus marginalis</i>														2	C
Coleoptera	Dytiscidae	<i>Hydroporus tessellatus</i>												3		1	C
Coleoptera	Dytiscidae	<i>Ilybius ater</i>											1				C
Coleoptera	Dytiscidae	<i>Ilybius fuliginosus</i>			1									2			C
Coleoptera	Dytiscidae	<i>Nebrioporus depressus</i>		7													C
Coleoptera	Dytiscidae	<i>Stictotarsus duodecimpustulatus</i>						5									C
Coleoptera	Elmidae	<i>Elmis aenea</i>	4	3													C
Coleoptera	Elmidae	<i>Limnius volckmari</i>															C

Group	Family	Species	RVX 01	RVX 01b	WCX 01	WCX 02	WCX 03	WCX 04	WCX 05	WCX 07	WCX 08	WCX 09	WCX 10	WCX 11	WCX 12	RVX 02b	EPA group
Coleoptera	Gyrinidae	<i>Gyrinus substriatus</i>			7			5						6	2		C
Coleoptera	Gyrinidae	<i>Gyrinus urinator</i>						1									C
Coleoptera	Halipliidae	<i>Brychius elevatus</i>	7	12													C
Coleoptera	Halipliidae	<i>Halipilus ruficollis</i> group														1	C
Coleoptera	Hydraenidae	<i>Hydraena gracilis</i>												3			C
Coleoptera	Hydrophilidae	<i>Helophorus brevipalpis</i>			2									4		1	C
Coleoptera	Hydrophilidae	<i>Helophorus grandis</i>						1					1				C
Coleoptera	Hydrophilidae	<i>Laccobius bipunctatus</i>						3					1				C
Coleoptera	Scirtidae	Scirtidae larva				2	3			1							C
Crustacea	Gammaridae	<i>Gammarus duebeni</i>	62	6		25		45		3	12					6	C
Diptera	Chironomidae	Non- <i>Chironomus</i> spp.	3		1		6							3	6	2	C
Diptera	Culicidae	sp. indet.					5										C
Diptera	Dixidae	sp. indet.			1												C
Diptera	Pediciidae	<i>Dicranota</i> sp.	1														C
Diptera	Ptychopteridae	sp. indet.												3			C
Diptera	Simuliidae	sp. indet.	13	31		12										6	C
Gastropoda	Bithyniidae	<i>Bithynia tentaculata</i>															C
Gastropoda	Lymnaeidae	<i>Lymnaea stagnalis</i>		2												4	C
Gastropoda	Planorbidae	<i>Ancylus fluviatilis</i>	3														C
Gastropoda	Planorbidae	<i>Bathyomphalus contortus</i>	4		6								2			9	C
Gastropoda	Planorbidae	<i>Planorbis planorbis</i>		13	16			6	15				12			5	C
Gastropoda	Tateidae	<i>Potamopyrgus antipodarum</i>	10	14				6								16	C
Gastropoda	Physidae	<i>Aplexa hypnorum</i>							3								C
Gastropoda	Succineidae	sp. indet.			5			2		1						1	C
Hemiptera	Corixidae	Corixidae nymph											2			3	C
Hemiptera	Corixidae	<i>Hesperocorixa sahlbergi</i>											1			1	C
Hemiptera	Gerridae	sp. indet.	1		10			2		2	8	6					C

Group	Family	Species	RVX 01	RVX 01b	WCX 01	WCX 02	WCX 03	WCX 04	WCX 05	WCX 07	WCX 08	WCX 09	WCX 10	WCX 11	WCX 12	RVX 02b	EPA group
Hemiptera	Hydrometridae	<i>Hydrometra stagnorum</i>			1			2						1		1	C
Hemiptera	Nepidae	<i>Nepa cinerea</i>												1		2	C
Hemiptera	Veliidae	<i>Velia caprai</i>						2					2	1		2	C
Platyhelminthes	Planariidae	sp. indet.												3	5		C
Hirudinidae	Piscicolidae	<i>Piscicola</i> sp.						2									C
Crustacea	Asellidae	<i>Asellus aquaticus</i>		5	53	10	16	13	41	58	33	12	104	85	44	28	D
Crustacea	Crangonyctidae	<i>Crangonyx</i> sp.	5	1										5		3	D
Hirudinidae	Erpobdellidae	sp. indet.										2					D
Hirudinidae	Glossiphoniidae	sp. indet.										1					D
Gastropoda	Lymnaeidae	<i>Ampullacaena balthica</i>	6	12	8			2					1	1		5	D
Gastropoda	Physidae	<i>Physa fontinalis</i>			5									18			D
Mollusca	Sphaeriidae	sp. indet.	7							3		2	6			4	D
Diptera	Chironomidae	<i>Chironomus</i> spp.	1	1	6	4	3	6	10	6	8	4	7	28		2	E
Annelidae	Oligochaeta	sp. indet.							4			3			5		n/a
<b>Abundance</b>			<b>198</b>	<b>239</b>	<b>147</b>	<b>75</b>	<b>33</b>	<b>107</b>	<b>73</b>	<b>74</b>	<b>67</b>	<b>34</b>	<b>158</b>	<b>182</b>	<b>62</b>	<b>145</b>	
<b>Q-rating</b>			Q3*	Q3	Q2-3	Q3	Q2-3*	Q3*	Q2*	Q2*	Q2-3*	Q2*	Q2-3*	Q2*	Q2*	Q3*	
<b>WFD class</b>			Poor	Poor	Poor	Poor	Poor	Poor	Bad	Bad	Poor	Bad	Poor	Bad	Bad	Poor	

**Table 8.2** Macro-invertebrate Q-sampling results, July-August 2025 (\* tentative Q-rating given the absence of suitable riffle areas for sampling; Toner et al., 2005)

Group	Family	Species	WCX 13	WCX 14	WCX 15	WCX 16	WCX 17	WCX 19	WCX 20	WCX 21	WCX 25	WCX 26	WCX 27	WCX 28	WCX 29	WCX 30	EPA group
Trichoptera	Polycentropodidae	<i>Plectrocnemia conspersa</i>	5	3													C
Arachnida	Dictynidae	<i>Argyroneta aquatica</i>											2	3			C
Coleoptera	Dytiscidae	<i>Agabus nebulosus</i>						3									C
Coleoptera	Dytiscidae	Dytiscidae larva	1			4							1	4			C
Coleoptera	Dytiscidae	<i>Dytiscus marginalis</i>					1	1									C
Coleoptera	Dytiscidae	<i>Hydroporus tessellatus</i>												4			C
Coleoptera	Dytiscidae	<i>Ilybius ater</i>											8	5			C
Coleoptera	Dytiscidae	<i>Ilybius fuliginosus</i>	8		3		6								1		C
Coleoptera	Elmidae	<i>Elmis aenea</i>	1	4					18								C
Coleoptera	Elmidae	<i>Limnius volckmari</i>		3													C
Coleoptera	Gyrinidae	<i>Gyrinus substriatus</i>						5								7	C
Coleoptera	Halpliidae	<i>Halplus ruficollis</i> group											9				C
Coleoptera	Hydraenidae	<i>Hydraena gracilis</i>						2									C
Coleoptera	Hydrophilidae	<i>Helophorus brevipalpis</i>				1		12		1							C
Coleoptera	Hydrophilidae	<i>Hydrobius fuscipes</i>				1											C
Coleoptera	Hydrophilidae	<i>Laccobius bipunctatus</i>								4			2				C
Coleoptera	Hydrophilidae	<i>Laccobius minutus</i>											1				C
Coleoptera	Scirtidae	Scirtidae larva				2				1							C
Crustacea	Gammaridae	<i>Gammarus duebeni</i>	35	84	5	5		13	33	57	32					22	C
Diptera	Chironomidae	Non- <i>Chironomus</i> spp.	2		9				1		1						C
Diptera	Culicidae	sp. indet.						5									C
Diptera	Dixidae	sp. indet.								2						1	C
Diptera	Pediciidae	<i>Dicranota</i> sp.	5						1		5	4					C
Diptera	Ptychopteridae	sp. indet.				1											C
Gastropoda	Bithyniidae	<i>Bithynia tentaculata</i>	7					18									C

Group	Family	Species	WCX 13	WCX 14	WCX 15	WCX 16	WCX 17	WCX 19	WCX 20	WCX 21	WCX 25	WCX 26	WCX 27	WCX 28	WCX 29	WCX 30	EPA group
Gastropoda	Lymnaeidae	<i>Lymnaea stagnalis</i>	2		2											2	C
Gastropoda	Planorbidae	<i>Ancylus fluviatilis</i>							5								C
Gastropoda	Planorbidae	<i>Bathymphalus contortus</i>			10	4							1	31			C
Gastropoda	Planorbidae	<i>Planorbarius corneus</i>							1								C
Gastropoda	Planorbidae	<i>Planorbis planorbis</i>						12									C
Gastropoda	Valvatidae	<i>Valvata cristata</i>				2	25										C
Gastropoda	Tateidae	<i>Potamopyrgus antipodarum</i>														53	C
Gastropoda	Physidae	<i>Aplexa hypnorum</i>												85		1	C
Gastropoda	Succineidae	sp. indet.				1				1			1	1			C
Hemiptera	Gerridae	sp. indet.		11										6			C
Hemiptera	Hydrometridae	<i>Hydrometra stagnorum</i>				2							3	1			C
Hemiptera	Nepidae	<i>Nepa cinerea</i>												2			C
Hemiptera	Notonectidae	<i>Notonecta viridis</i>												25	11		C
Hemiptera	Veliidae	<i>Velia caprai</i>	3	2	1	3		15	3						3	4	C
Platyhelminthes	Planariidae	sp. indet.					5					2					C
Crustacea	Asellidae	<i>Asellus aquaticus</i>	42	4	113	125	10	37		7	21	6	49	108	87	11	D
Crustacea	Crangonyctidae	<i>Crangonyx</i> sp.			4			1					41			8	D
Hirudinidae	Erpobdellidae	sp. indet.	1														D
Hirudinidae	Glossiphoniidae	sp. indet.		1	3		2							1		1	D
Gastropoda	Lymnaeidae	<i>Ampullacaena balthica</i>						4		2			2	103		4	D
Gastropoda	Physidae	<i>Physa fontinalis</i>	3														D
Mollusca	Sphaeriidae	sp. indet.		6	15	2											D
Diptera	Chironomidae	<i>Chironomus</i> spp.			11	6		11	1		7	5		4	1		E
<b>Abundance</b>			<b>142</b>	<b>187</b>	<b>176</b>	<b>160</b>	<b>51</b>	<b>142</b>	<b>122</b>	<b>89</b>	<b>79</b>	<b>20</b>	<b>120</b>	<b>387</b>	<b>134</b>	<b>128</b>	
<b>Q-rating</b>			<b>Q3</b>	<b>Q3</b>	<b>Q2-3*</b>	<b>Q2*</b>	<b>Q3*</b>	<b>Q3-4*</b>	<b>Q3*</b>	<b>Q3*</b>	<b>Q3*</b>	<b>Q3*</b>	<b>Q2-3*</b>	<b>Q2*</b>	<b>Q2-3</b>	<b>Q3*</b>	
<b>WFD class</b>			<b>Poor</b>	<b>Poor</b>	<b>Poor</b>	<b>Bad</b>	<b>Poor</b>	<b>Mod</b>	<b>Poor</b>	<b>Poor</b>	<b>Poor</b>	<b>Poor</b>	<b>Poor</b>	<b>Bad</b>	<b>Poor</b>	<b>Poor</b>	

**Table 8.3** Macro-invertebrate community recorded at Grand Canal site WCX23, July 2025

Group	Family	Species	WCX23
Odonata	Coenagrionidae	sp. indet.	29
Gastropoda	Planorbidae	<i>Planorbis planorbis</i>	24
Crustacea	Crangonyctidae	<i>Crangonyx</i> sp.	24
Arachnida	Hydrachnidae	sp. indet.	22
Ephemeroptera	Baetidae	<i>Cloeon dipterum</i>	15
Trichoptera	Leptoceridae	<i>Mystacides longicornis</i>	12
Trichoptera	Phryganeidae	<i>Agrypnia obsoleta</i>	11
Hemiptera	Nepidae	<i>Ranatra linearis</i>	10
Odonata	Aeshnidae	<i>Anax imperator</i>	7
Hemiptera	Hydrometridae	<i>Hydrometra stagnorum</i>	7
Trichoptera	Leptoceridae	<i>Triaenodes bicolor</i>	6
Coleoptera	Gyrinidae	<i>Gyrinus substriatus</i>	6
Diptera	Culicidae	sp. indet.	6
Hemiptera	Notonectidae	<i>Notonecta viridis</i>	6
Diptera	Chironomidae	<i>Chironomus</i> spp.	5
Annelidae	Oligochaeta	sp. indet.	5
Diptera	Chironomidae	Non- <i>Chironomus</i> spp.	4
Gastropoda	Bithyniidae	<i>Bithynia tentaculata</i>	4
Mollusca	Sphaeriidae	sp. indet.	4
Gastropoda	Lymnaeidae	<i>Lymnaea stagnalis</i>	3
Crustacea	Asellidae	<i>Asellus aquaticus</i>	3
Coleoptera	Scirtidae	Scirtidae larva	2
Hemiptera	Gerridae	sp. indet.	2
Coleoptera	Dytiscidae	<i>Hyphydrus ovatus</i>	1
Coleoptera	Haliplidae	sp. indet.	1
Coleoptera	Noteridae	<i>Noterus clavicornis</i>	1
Diptera	Dixidae	sp. indet.	1
Gastropoda	Succineidae	sp. indet.	1
Hemiptera	Corixidae	<i>Cymatia bonsdorfii</i>	1
<b>Abundance</b>			<b>223</b>
<b>Taxon richness</b>			<b>29</b>



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# Fisheries assessment for a proposed Gas Networks Ireland Gas Pipeline, Edenderry, Co. Offaly



Prepared by Triturus Environmental Ltd. for AWN Consulting Ltd.

**October 2025**

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## Table of contents

<b>1. Introduction</b>	<b>3</b>
1.1 Background	3
1.2 Fisheries (desktop review)	3
<b>2. Methodology</b>	<b>4</b>
2.1 Fisheries assessment (electro-fishing)	4
2.2 Fisheries habitat	5
2.3 Biosecurity	5
<b>3. Results</b>	<b>8</b>
3.1 Fisheries assessment & appraisal	8
<b>4. Discussion</b>	<b>44</b>
<b>5. References</b>	<b>46</b>

## 1. Introduction

### 1.1 Background

Triturus Environmental Ltd. were commissioned by AWN Consulting Ltd. to undertake a baseline fisheries assessment for a proposed Gas Networks Ireland (GNI) Edenderry Gas Pipeline (to Bord na Móna) development near Edenderry, Co. Offaly.

The survey was undertaken to establish baseline fisheries data used in the preparation of the EIAR for the proposed pipeline. In order to gain an accurate overview of the existing and potential fisheries value of the watercourses crossed by the proposed pipeline, a catchment-wide electro-fishing survey across 33 no. riverine sites was undertaken (**Table 2.1; Figure 2.1**). A fisheries appraisal of 1 no. site on the Grand Canal was also undertaken. Electro-fishing helped to identify the importance of the watercourses as nurseries and habitats for salmonids, lamprey (*Lampetra* sp.) and European eel (*Anguilla anguilla*). Other species of lower conservation value were also recorded. The presence and or absence of fish populations and or associated supporting habitat would help inform impact assessment and any subsequent mitigation for the development.

Triturus Environmental Ltd. made an application under Section 14 of the Fisheries (Consolidation) Act, 1959 as substituted by Section 4 of the Fisheries (Amendment) Act, 1962, to undertake a catchment-wide electro-fishing survey in the vicinity of the proposed pipeline. The surveys were undertaken in July and August 2025.

### 1.2 Fisheries (desktop review)

Fisheries data was only available for a low number of the survey watercourses (i.e. those crossed by the proposed pipeline).

The Castlejordan River (aka. Mongagh River) supports brown trout (*Salmo trutta*), lamprey (*Lampetra* sp.), stone loach (*Barbatula barbatula*), perch (*Perca fluviatilis*), pike (*Esox lucius*) and three-spined stickleback (*Gasterosteus aculeatus*) (Triturus 2023 data; O'Connor, 2006).

The Kilwarden/Kinnegad River, another tributary of the Boyne, supports brown trout and three-spined stickleback (Triturus 2022 data). The Kinnegad and Castlejordan Rivers support a genetically distinct sub-population of trout within the Boyne catchment (Massa-Gallucci & Mariani, 2011).

The Grand Canal is known to support a range of coarse fish species, including perch (*Perca fluviatilis*), pike (*Esox lucius*), bream (*Abramis brama*), roach (*Rutilus rutilus*), rudd (*Scardinius erythrophthalmus*) and their respective hybrids, tench (*Tinca tinca*) and highly localised common carp (*Cyprinus carpio*) and brown trout, in addition to Red-listed European eel (IFI data; McLoone, 2011; Tierney et al., 1999; pers. obs.). Lamprey (*Lampetra* sp.) ammocoetes have also been recorded at a low number of locations, e.g. 5<sup>th</sup> lock, MKO, 2019; 11<sup>th</sup> lock, ROD, 2016; 7<sup>th</sup> lock, Caffrey et al., 2006).

## 2. Methodology

### 2.1 Fisheries assessment (electro-fishing)

A single anode Smith-Root LR24 backpack (12V DC input; 300V, 100W DC output) was used to electro-fish riverine sites on the 22<sup>nd</sup> and 23<sup>rd</sup> July and the 5<sup>th</sup> August 2025 following notification to Inland Fisheries Ireland and under the conditions of a Department of Climate, Energy and the Environment (DCEE) licence. The electro-fishing survey was undertaken at 31 no. proposed watercourse crossings with 2 no. downstream control sites also surveyed (see **Table 2.1**, **Figure 2.1**).

Both river and holding tank water temperature was monitored continually throughout the survey to ensure temperatures of 20°C were not exceeded, thus minimising stress to the captured fish due to low dissolved oxygen levels. A portable battery-powered aerator was also used to further reduce stress to any captured fish contained in the holding tank. Salmonids, European eel and other captured fish species were transferred to a holding container with oxygenated fresh river water following capture. To reduce fish stress levels, anaesthesia was not applied to captured fish. All fish were measured to the nearest millimetre and released in-situ following a suitable recovery period.

As three primary species groups were targeted during the survey, i.e., salmonids, lamprey, and eel, the electro-fishing settings were tailored for each species. By undertaking electro-fishing using the rapid electro-fishing technique (see methodology below), the broad characterisation of the fish community at each sampling reach could be determined as a longer representative length of channel was surveyed. Electro-fishing methodology followed accepted European standards (CEN, 2003) and adhered to best practice (e.g., CFB, 2008).

#### 2.1.1 Salmonids and European eel

For salmonid species and European eel, as well as all other incidental species, electro-fishing was carried out in an upstream direction for a 10-minute CPUE, an increasingly common standard approach for wadable streams (Matson et al., 2018). A total of approximately 30-75m channel length was surveyed at each site, where feasible, in order to gain a better representation of fish stock assemblages.

Relative conductivity of the water at each site was checked in-situ with a conductivity meter and the electro-fishing backpack was energised with the appropriate voltage and frequency to provide enough draw to attract salmonids and European eel to the anode without harm. For the moderate to high conductivity waters of the sites a voltage of 220-275V, frequency of 35-40Hz and pulse duration of 3.5-4ms was utilised to draw fish to the anode without causing physical damage.

#### 2.1.2 Lamprey

Electro-fishing for lamprey ammocoetes was conducted using targeted quadrat-based electro-fishing (as per Harvey & Cowx, 2003) in objectively suitable areas of sand/silt, where encountered. As lamprey take longer to emerge from silts and require a more persistent approach, they were targeted at a lower frequency (30Hz) burst DC pulse setting which also allowed detection of European eel in sediment, if present. Settings for lamprey followed those recommended and used by Harvey & Cowx (2003), APEM (2004) and Niven & McAuley (2013). Using this approach, the anode was placed under

the water's surface, approximately 10-15cm 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 were collected by a second operator using a fine-mesh hand net as they emerged.

Lamprey species were identified to species level, where possible, with the assistance of a hand lens, through external pigmentation patterns and trunk myomere counts as described by Potter & Osborne (1975) and Gardiner (2003).

## 2.2 Fisheries habitat

A fisheries habitat appraisal of all 34 no. riverine and canal sites was undertaken to establish their importance for salmonid, lamprey, European eel and other fish species. The appraisals of salmonids and lamprey were cognisant of species-specific habitat requirements and preferences as outlined in O'Grady (2006), Hendry et al. (2003), Armstrong et al. (2003), Harvey & Cowx (2003), Maitland (2003) and Hendry & Cragg-Hine (1997). River habitat surveys and fisheries assessments were also carried out utilising elements of the approaches in the River Habitat Survey Methodology (EA, 2003) and Fishery Assessment Methodology (O'Grady, 2006) to broadly characterise the riverine sites (i.e. channel profile, substrata etc.).

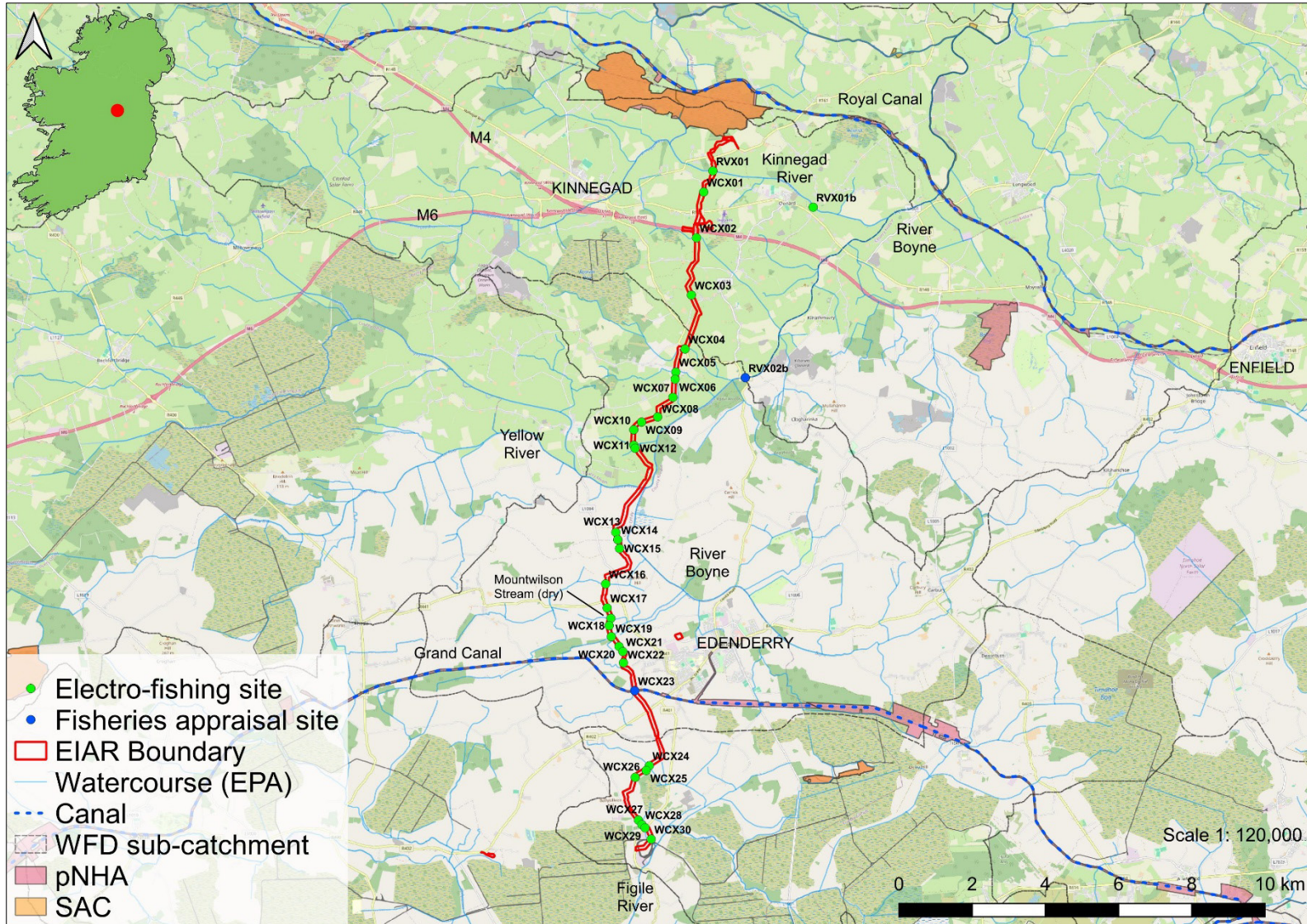
## 2.3 Biosecurity

A strict biosecurity protocol following IFI (2010) and the Check-Clean-Dry approach was adhered to during surveys for all equipment and PPE used. Disinfection of all equipment and PPE before and after use with Virkon™ was conducted to prevent the transfer of pathogens or invasive propagules between survey sites. Surveys were undertaken at sites in a downstream order to minimise the risk of upstream propagule mobilisation. Particular cognisance was given towards preventing the spread or introduction of highly virulent crayfish plague (*Aphanomyces astaci*). Any aquatic invasive species or pathogens recorded within or adjoining the survey areas were geo-referenced. All Triturus staff are certified in 'Good fieldwork practice: slowing the spread of invasive non-native species' by the University of Leeds.

**Table 2.1** Location of 34 no. electro-fishing & fisheries appraisal survey sites in the vicinity of the proposed pipeline

Site no.	Watercourse	EPA code	Location	X (ITM)	Y (ITM)
RVX01	Kilwarden/Kinnegad River	07K01	Kilwarden	662944	745904
RVX01b	Kilwarden/Kinnegad River	07K01	Clonard Bridge	665683	744913
WCX01	Unmapped channel	n/a	Ardnamullan	662692	745327
WCX02	Aghnahillagh River	07A05	Ardnamullan	662496	744077
WCX03	Unmapped channel	n/a	Park	662356	742512
WCX04	Knockerasally or Colehill River	07K12	Ballyboggan	662183	741037
WCX05	Park River	07P04	Ballyboggan	661931	740409
WCX06	Ballynakill Stream	07B25	Ballynakill	661911	740211
WCX07	Unmapped channel	n/a	Harristown	661852	739718
WCX08	Unmapped channel	n/a	Harristown	661435	739182
WCX09	Unmapped channel	n/a	Harristown	660994	739040
WCX10	Unmapped channel	n/a	Harristown	660782	738831
WCX11	Castlejordan River	07C33	Harristown	660784	738406
WCX12	Rahin Stream	07R12	Clongall	660820	738325
<b>RVX02b*</b>	River Boyne	07B04	Ballyboggan Bridge	663829	740254
WCX13	Unmapped channel	n/a	Clonmore	660291	736027
WCX14	Unmapped stream	n/a	Clonmore	660345	735827
WCX15	Unmapped channel	n/a	Roosk	660392	735585
WCX16	Roosk River	07R53	Mountwilson	660014	734618
WCX17	Unmapped channel	n/a	Mountwilson	660054	733962
n/a	Mountwilson Stream	07M07	Mountwilson	660156	733679
WCX18	Unmapped channel	n/a	Thornwell	660109	733477
WCX19	Kinnafad River	07K31	Thornwell	660169	733178
WCX20	Unmapped stream	n/a	Monasteroris	660378	732910
WCX21	Unmapped channel	n/a	Monasteroris	660483	732769
WCX22	Unmapped channel	n/a	Monasteroris	660500	732461
<b>WCX23*</b>	Grand Canal	n/a	Rathmore	660809	731699
WCX24	Ballyleakin River	14B42	Ballykilleen	661206	729650
WCX25	Unmapped channel	n/a	Ballykilleen	661121	729520
WCX26	Unmapped channel	n/a	Ballykilleen	660821	729332
WCX27	Unmapped channel	n/a	Ballykilleen	660906	728164
WCX28	Unmapped channel	n/a	Ballykilleen	661003	728040
WCX29	Ballykilleen Stream	14B25	Ballykilleen	661091	727953
WCX30	Ballykilleen Stream	14B25	Shean	661258	727643

\* fisheries appraisal only



**Figure 2.1** Overview of the electro-fishing & fisheries appraisal survey site locations

### 3. Results

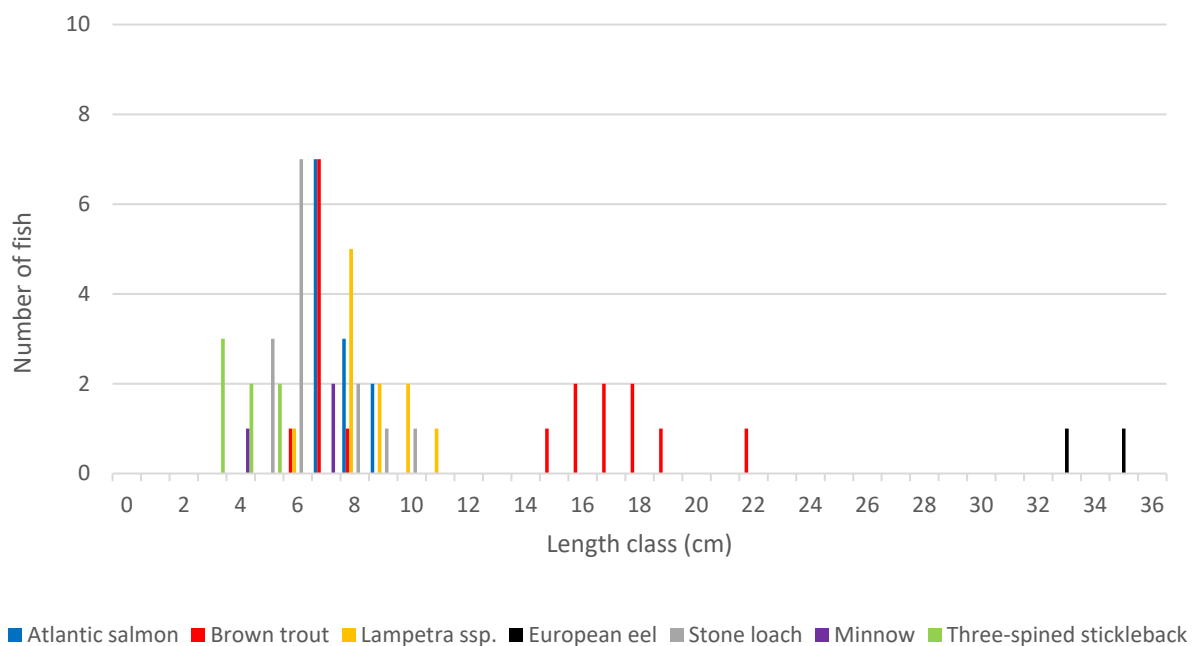
A catchment-wide fisheries survey of 33 no. riverine and 1 no. canal sites in the vicinity of the proposed pipeline was conducted on the 22<sup>nd</sup> and 23<sup>rd</sup> July and the 5<sup>th</sup> August 2025 following notification to Inland Fisheries Ireland. The results of the survey are discussed below in terms of fish population structure, population size and the suitability and value of the surveyed areas as nursery and spawning habitat for salmonids, European eel and lamprey species. Scientific names are provided at first mention only.

#### 3.1 Fisheries assessment & appraisal

##### 3.1.1 Site RVX01 – Kilwarden/Kinnegad River, Kilwarden

Brown trout (*Salmo trutta*) ( $n=18$ ), stone loach (*Barbatula barbatula*) ( $n=14$ ), Atlantic salmon (*Salmo salar*) ( $n=12$ ), lamprey (*Lampetra* sp.) ( $n=11$ ), minnow (*Phoxinus phoxinus*) ( $n=7$ ), European eel (*Anguilla anguilla*) ( $n=3$ ) and three-spined stickleback (*Gasterosteus aculeatus*) ( $n=3$ ) were recorded via electro-fishing at site RVX01 on the Kilwarden/Kinnegad River (07K01) at a proposed pipeline crossing (**Figure 4.1**).

Despite historical drainage the site was of surprising value for salmonids, with scattered areas of silted gravels providing some moderate quality spawning and nursery habitat - a rarity in the arterially drained river (pers. obs.). Holding areas for adult salmonids was sparse although undercut/scoured banks with overhanging vegetation were evidently utilised by adult trout. Areas of finer gravels also provided some moderate suitability for lamprey spawning. Abundant soft sediment accumulations were comprised largely of argillaceous particles (sub-optimal) but nevertheless supported a low density of lamprey ammocoetes (4.4 per m<sup>2</sup>). The quality of eel habitat was moderate due to a paucity of instream refugia with a low density present.



**Figure 3.1** Length frequency distribution recorded via electro-fishing at site RVX01, August 2025



**Plate 3.1** Minnow and Atlantic salmon parr recorded at site RVX01 on the Kilwarden/Kinnegad River, August 2025



**Plate 3.2** Adult brown trout recorded at site RVX01 on the Kilwarden/Kinnegad River, August 2025

### 3.1.2 Site RVX01b – Kilwarden/Kinnegad River, Clonard Bridge

Minnow ( $n=30$ ), lamprey (*Lampetra* sp.) ( $n=10$ ), three-spined stickleback ( $n=9$ ), brown trout ( $n=7$ ), stone loach ( $n=5$ ), Atlantic salmon ( $n=2$ ) and gudgeon (*Gobio gobio*) ( $n=1$ ) were recorded via electro-fishing at site RVX01b on the Kilwarden/Kinnegad River (07K01) at Clonard Bridge (a downstream control site not crossed by the proposed pipeline). (**Figure 3.2**).

The deep water site was of good value for salmonids despite historical modifications. Deep pool and glide with overhanging vegetation was of high value as holding habitat for adult salmonids, in addition to European eel (albeit the latter was not recorded). Gravels were localised and heavily silted and thus the spawning value for salmonids and lamprey was much reduced (although still present). Nursery habitat for salmonids was also compromised due to siltation and eutrophication pressures. Many areas of soft sediment were shallow and of poor suitability for lamprey ammocetes although low densities (2 per m<sup>2</sup>) were present in deeper accumulations.

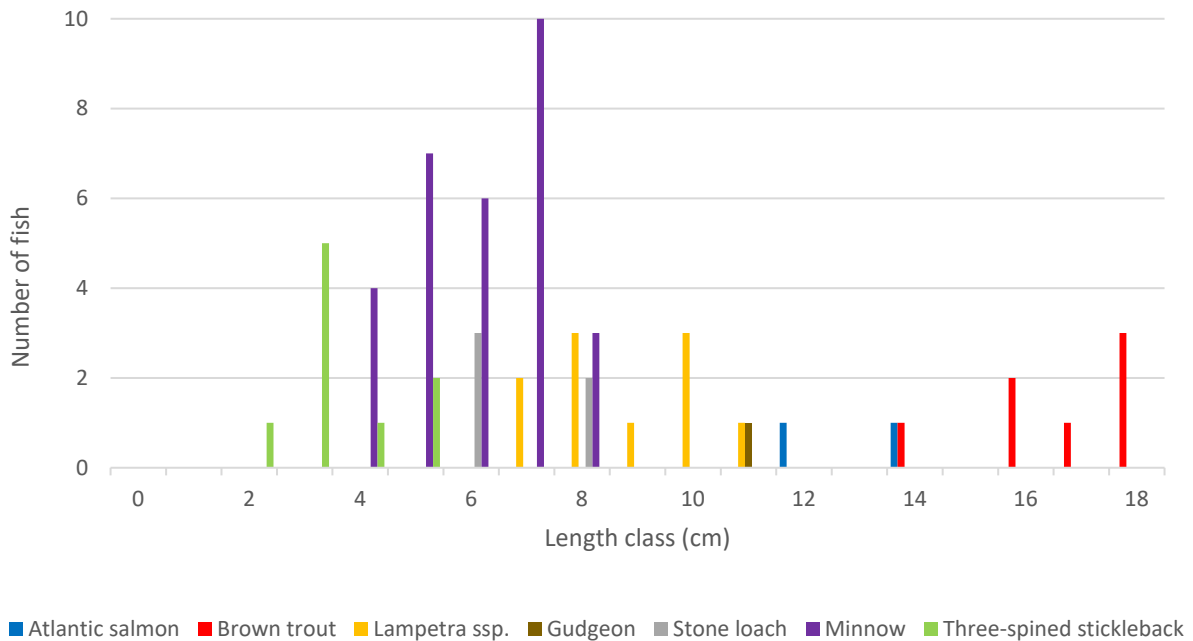


Figure 3.2 Length frequency distribution recorded via electro-fishing at site RVX01b, August 2025



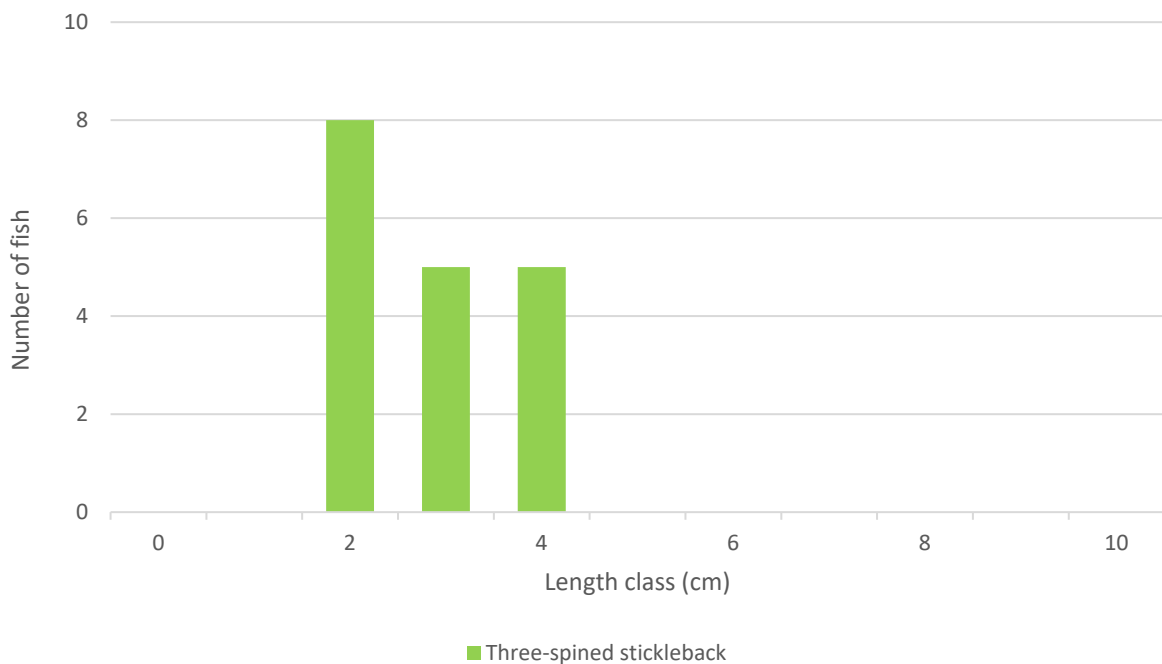
Plate 3.3 Brown trout (top) and Atlantic salmon parr recorded at site RVX01b, August 2025



**Plate 3.4** Gudgeon and minnow recorded at site RVX01b, August 2025

### 3.1.3 Site WCX01 – Unmapped channel, Ardnamullan

Three-spined stickleback ( $n=18$ ) was the only fish species recorded via electro-fishing at site WCX01 on an unmapped channel at a proposed pipeline crossing (**Figure 3.3**). With the exception of moderate densities of this species, the heavily modified and vegetated channel was of poor fisheries value given an absence of summer flows, siltation pressures, poor hydromorphology and poor connectivity with superior fisheries habitats.



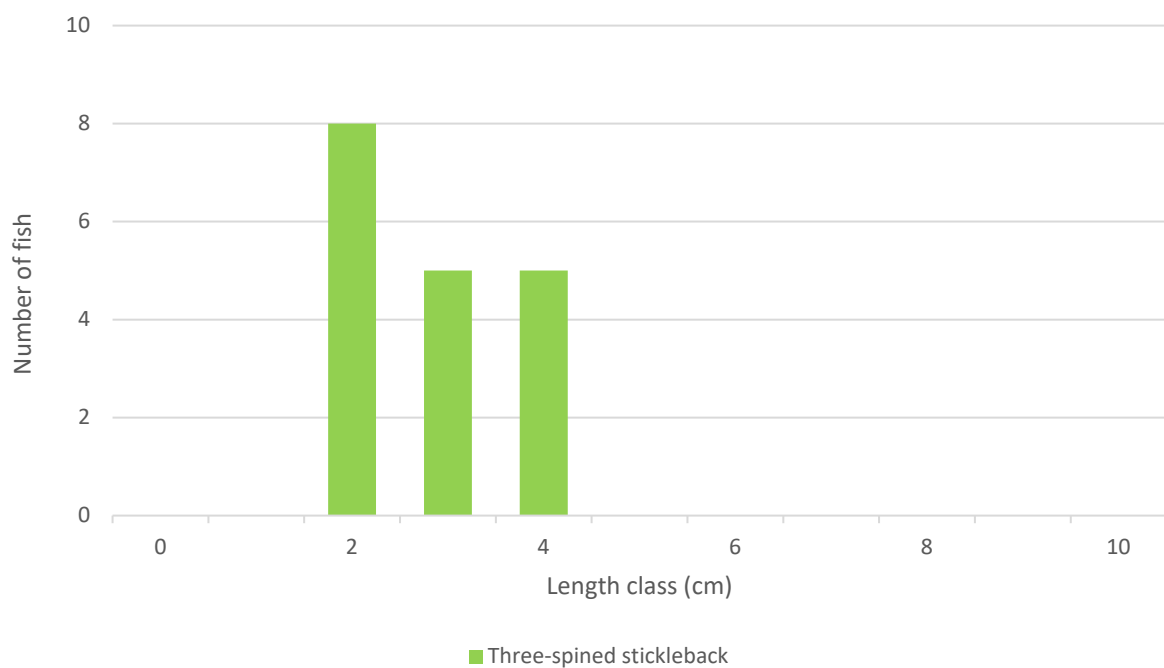
**Figure 3.3** Length frequency distribution recorded via electro-fishing at site WCX01, July 2025



**Plate 3.5** Representative image of site WCX01 on an unmapped channel, July 2025

### 3.1.4 Site WCX02 – Aghnahillagh River, Ardnamullan

Three-spined stickleback ( $n=4$ ) was the only fish species recorded via electro-fishing at site WCX02 on the Aghnahillagh River (07A05) at a proposed pipeline crossing (**Figure 3.4**). Despite some suitability for salmonids and European eel, low summer flows, historical modifications and siltation pressures were evidently too extensive to support these species.



**Figure 3.4** Length frequency distribution recorded via electro-fishing at site WXC02, July 2025



**Plate 3.6** Male three-spined stickleback recorded at site WCX02 on the Aghnahillagh River, July 2025

### 3.1.5 Site WCX03 – Unmapped channel, Park

No fish were recorded via electro-fishing at site WCX03 on an unmapped channel at a proposed pipeline crossing. With the exception of some low suitability for stickleback species (not recorded), the site was not of fisheries value given historical modifications and the stagnant, ephemeral nature of the channel.

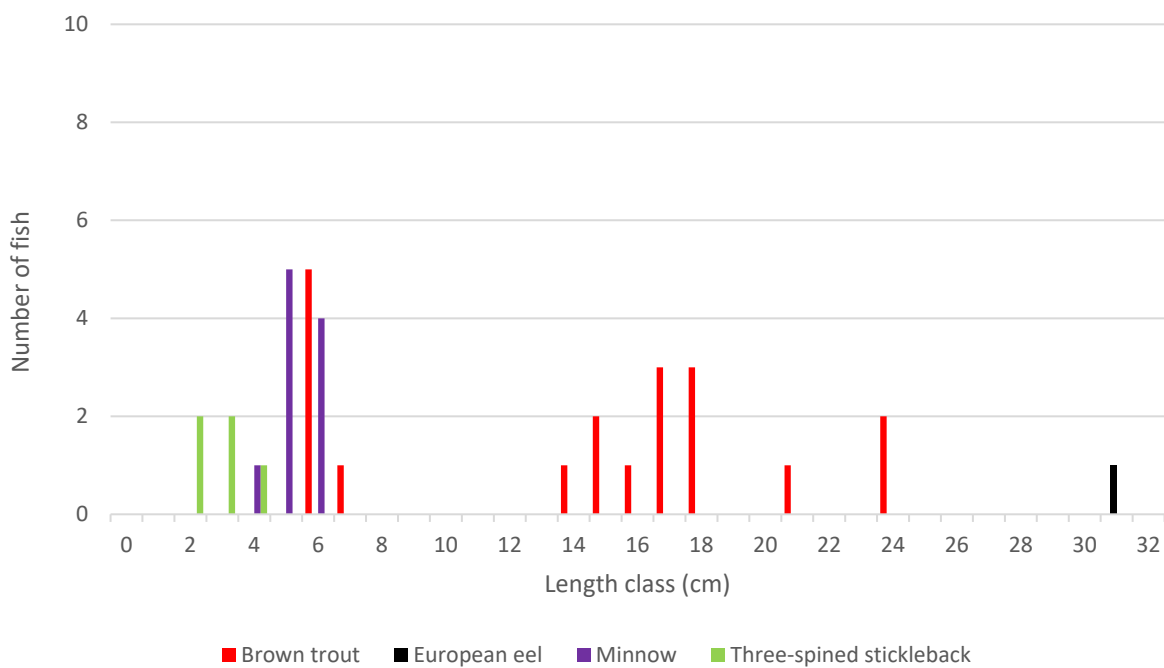


**Plate 3.7** Representative image of site WCX03 on an ephemeral drainage channel, July 2025

### 3.1.6 Site WCX04 – Knockerasally or Colehill River, Ballyboggan

Brown trout ( $n=19$ ), minnow ( $n=10$ ), three-spined stickleback ( $n=5$ ) and European eel ( $n=1$ ) were recorded via electro-fishing at site WCX04 on the Knockerasally or Colehill River (07K12) at the R401 road crossing adjacent to the proposed pipeline crossing (**Figure 3.5**).

Despite hydromorphological and gross siltation pressures, the site supported a moderate density of adult brown trout, with low densities of juveniles. The site was not of value for spawning salmonids (or lamprey) given the absence of suitable substrata. Slow flowing vegetated glide was of low value as a salmonid nursery but deeper glide with overhanging vegetation was of value for adult trout. Abundant silt accumulations were unsuitable for lamprey ammocoetes given their argillaceous nature and poor flows. European eel habitat was of poor quality with only a single eel captured.



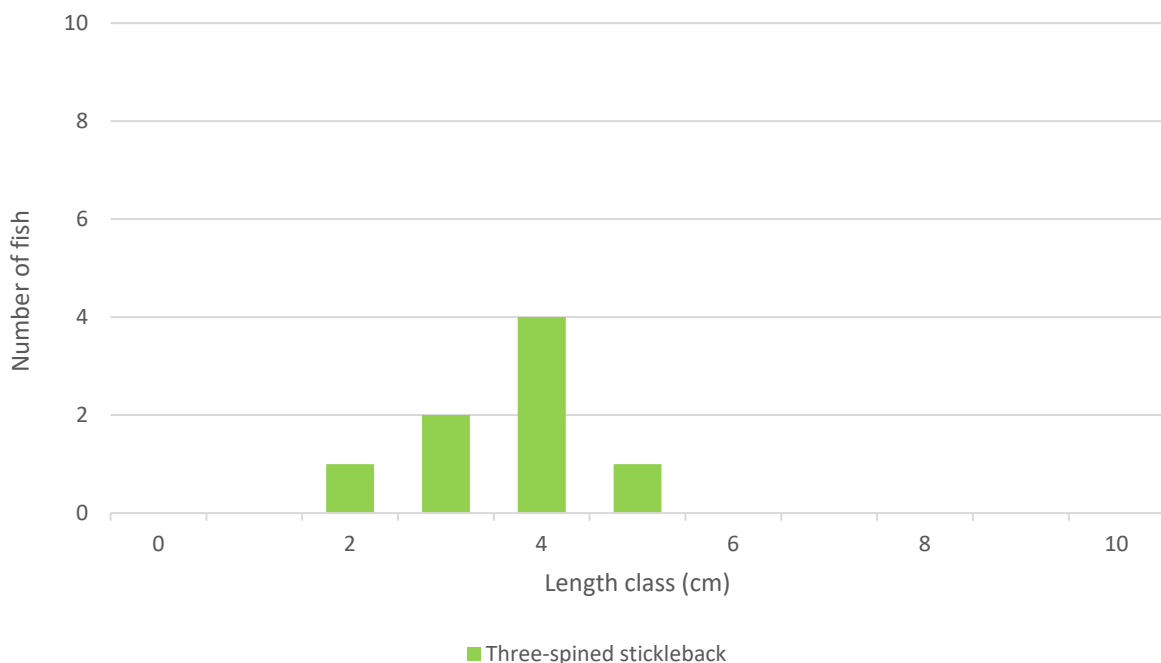
**Figure 3.5** Length frequency distribution recorded via electro-fishing at site WCX04, July 2025



**Plate 3.8** Representative image of site WCX04 on the Knockersally or Colehill River, July 2025

### 3.1.7 Site WCX05 – Park River, Ballyboggan

Three-spined stickleback ( $n=8$ ) was the only fish species recorded via electro-fishing at site WCX05 on the Park River (07P04) at a proposed pipeline crossing adjacent to an existing farm access bridge (box culvert) (**Figure 3.6**). With the exception of low densities of these species, the site was not of fisheries value given extensive historical modifications, poor hydromorphology, poor flows and gross siltation pressures.



**Figure 3.6** Length frequency distribution recorded via electro-fishing at site WXC05, July 2025



**Plate 3.9** Representative image of site WCX05 on the Park River, July 2025

### 3.1.8 Site WCX06 – Ballynakill Stream, Ballynakill

Site WCX06 was located on the mapped course of the Ballynakill Stream (07B25) along a field boundary at a proposed pipeline crossing adjoining the L4019 road. The stream had possibly been culverted historically. The site was not of fisheries value given the dry nature of the channel.



**Plate 3.10** Representative image of site WCX06 on the Ballynakill Stream, July 2025 (dry channel)

### 3.1.9 Site WCX07 – Unmapped channel, Harristown

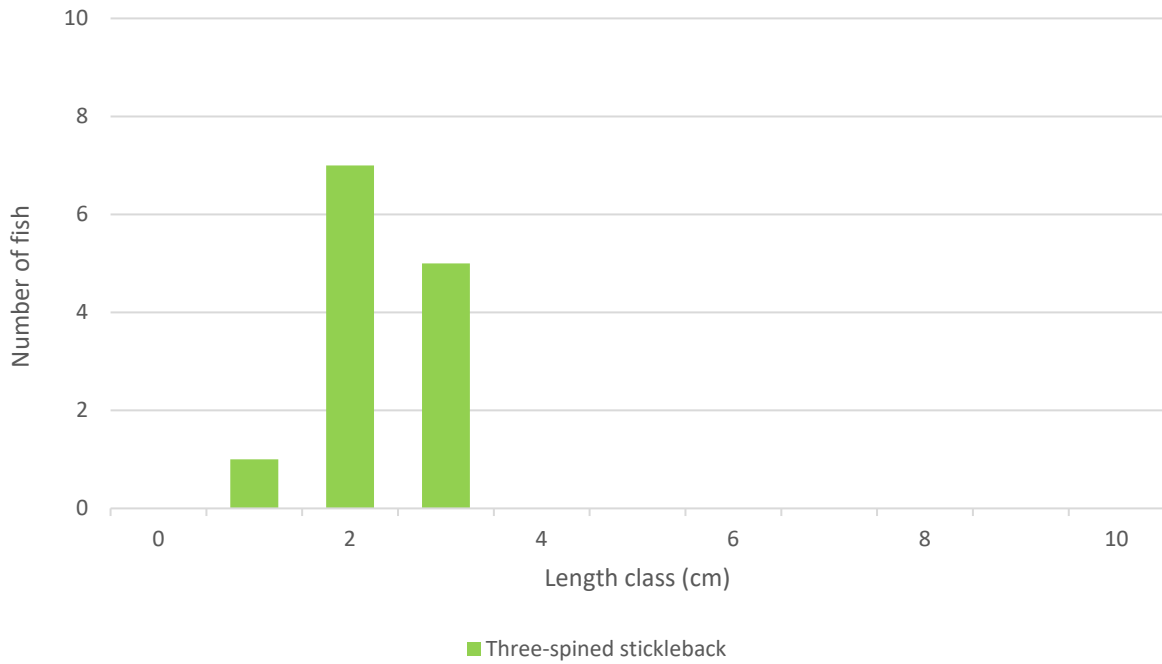
No fish were recorded via electro-fishing at site WCX07 on an unmapped channel along a field boundary at a proposed pipeline crossing. The channel was not of fisheries value at this location given its very shallow nature, siltation pressures and poor hydromorphology resulting from instream modifications.



**Plate 3.11** Representative image of site WCX07 on an unmapped channel, July 2025

### 3.1.10 Site WCX08 – Unmapped channel, Harristown

Three-spined stickleback ( $n=13$ ) was the only fish species recorded via electro-fishing at site WCX08 on an unmapped tributary of the River Boyne at a proposed pipeline crossing (**Appendix A**). With the exception of low densities of these species, the site was not of fisheries value given extensive historical modifications, poor hydromorphology, poor flows, high vegetation cover and gross siltation pressures.



**Figure 3.7** Length frequency distribution recorded via electro-fishing at site WXC08, July 2025



**Plate 3.12** Three-spined stickleback recorded at site WXC08, July 2025

### 3.1.11 Site WXC09 – Unmapped channel, Harristown

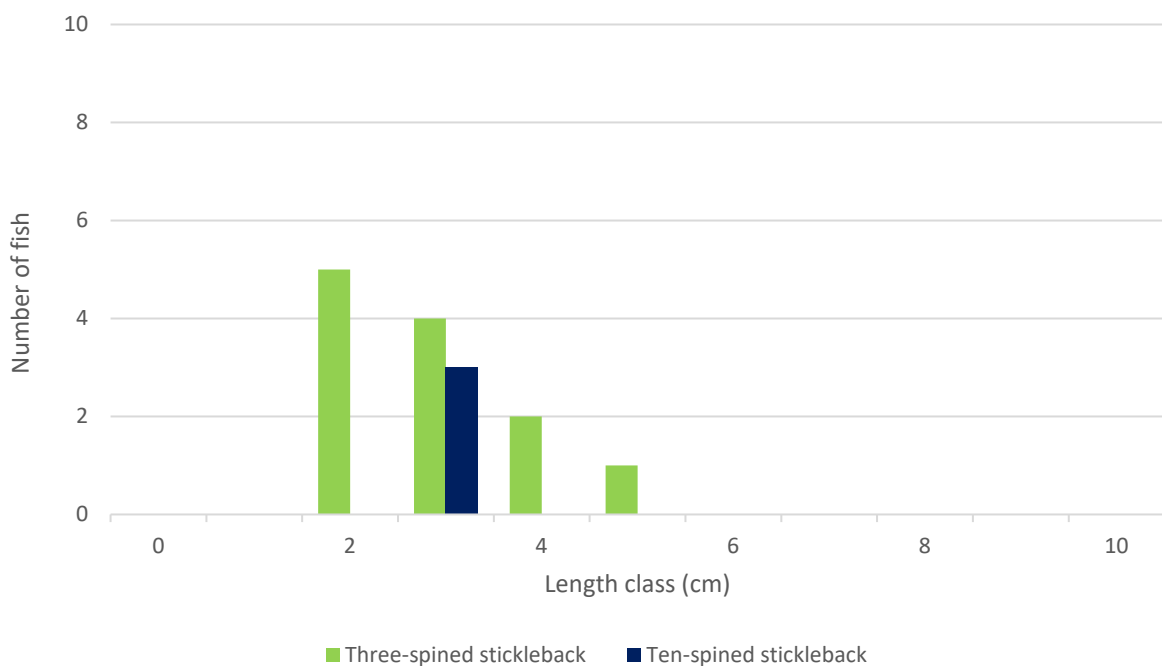
No fish were recorded via electro-fishing at site WXC09 on an unmapped tributary of the River Boyne at a proposed pipeline crossing. The site was not of fisheries value given historical modifications, gross siltation and the likely ephemeral nature of the channel at this location.



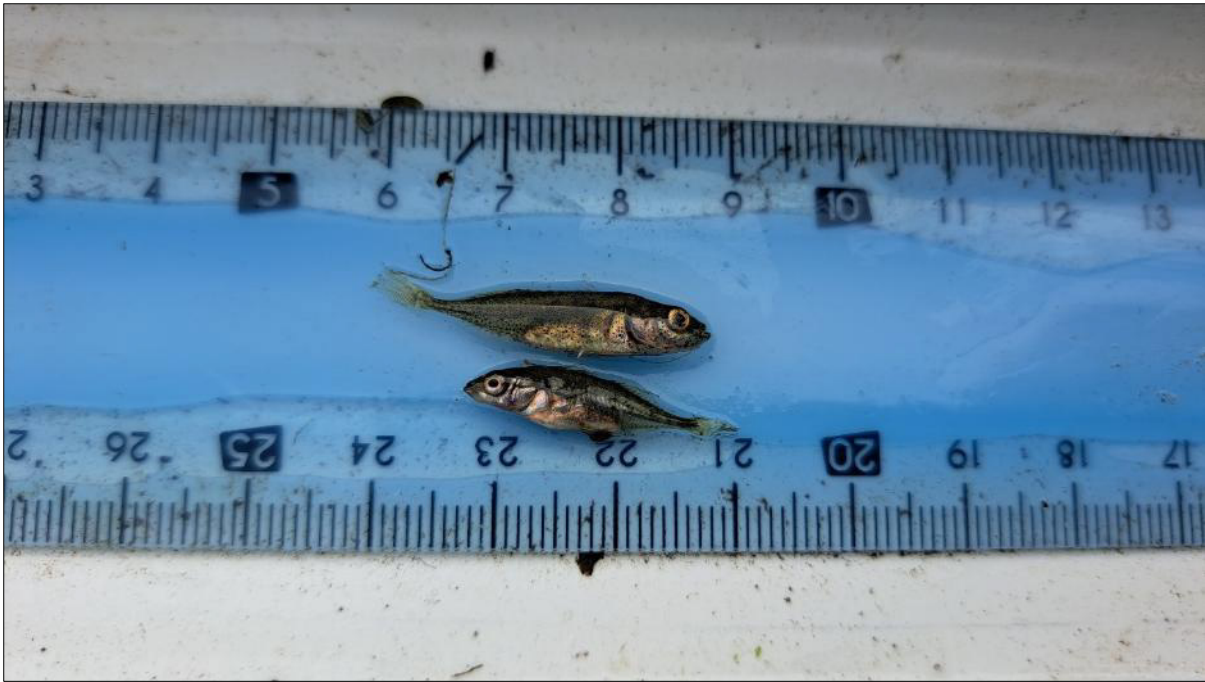
**Plate 3.13** Representative image of site WCX09 on an unmapped channel, July 2025

### 3.1.12 Site WCX10 – Unmapped channel, Harristown

Three-spined ( $n=12$ ) and ten-spined stickleback (*Pungitius pungitius*) ( $n=3$ ) were the only fish species recorded via electro-fishing at site WCX10 on an unmapped channel at a proposed pipeline crossing (**Figure 3.7**). With the exception of low densities of these species, the site was of very poor fisheries value given extensive historical modifications, poor hydromorphology, poor flows, high vegetation cover and gross siltation pressures.



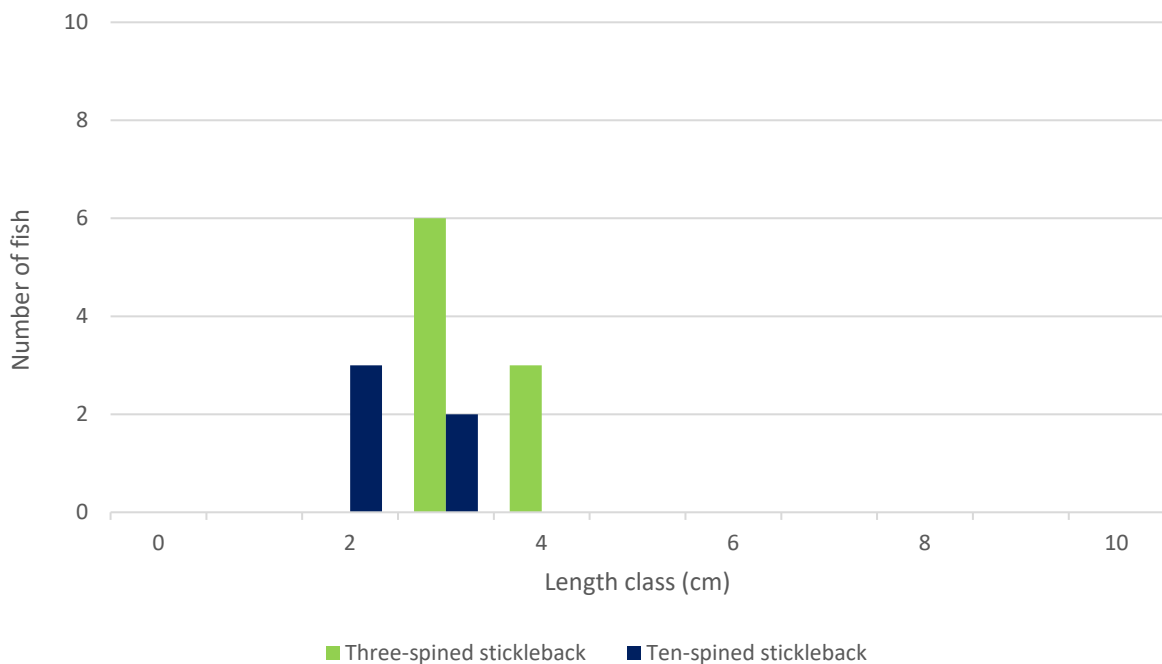
**Figure 3.8** Length frequency distribution recorded via electro-fishing at site WXC10, July 2025



**Plate 3.14** Ten-spined (top) and three-spined stickleback recorded at site WCX10 on an unmapped channel, July 2025

### 3.1.13 Site WCX11 – Castlejordan River, Harristown

Three-spined ( $n=9$ ) and ten-spined stickleback ( $n=5$ ) were the only fish species recorded via electro-fishing at site WCX11 on the Castlejordan River (07K33) at a proposed pipeline crossing (**Figure 3.9**). With the exception of low densities of these species, the site was of very poor fisheries value given extensive historical modifications, poor hydromorphology, poor flows and high vegetation cover plus siltation and eutrophication pressures.



**Figure 3.9** Length frequency distribution recorded via electro-fishing at site WXC11, July 2025



**Plate 3.15** Representative image of site WCX11 on the Castlejordan River, July 2025

#### 3.1.14 Site WCX12 – Rahin Stream, Clongall

No fish were recorded via electro-fishing at site WCX12 on an unmapped channel adjacent (south of) the Castlejordan River at site WCX11. With the exception of some low suitability for stickleback species (not recorded), the site was not of fisheries value given historical modifications and the stagnant nature of the channel.



**Plate 3.16** Representative image of site WCX12 on the Rahin Stream, July 2025

### 3.1.15 Site RVX02b – River Boyne, Ballyboggan Bridge

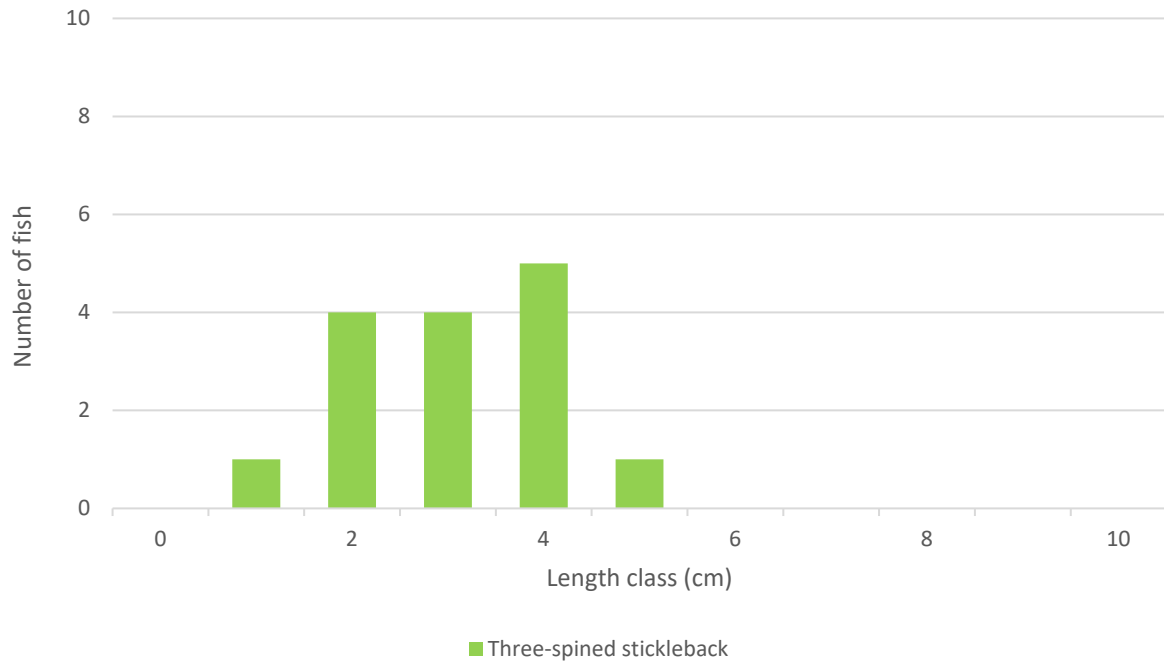
Electro-fishing was not undertaken at site RVX02b (downstream control site) located on the River Boyne (07B04) at Ballyboggan Bridge due to prohibitive depths and water volumes for backpack electro-fishing. The deep, slow-flowing lowland site is of high value for a range of coarse fish species, with abundant nursery and spawning habitat given the high cover of macrophytes. The quality of European eel habitat was also high. Although of some value as a holding habitat for adult salmonids, the site did not provide good nursery conditions and spawning habitat was absent. Likewise, lamprey spawning areas were not present with soft sediment accumulations offering sub-optimal nursery conditions.



**Plate 3.17** Representative image of site RVX02b on the River Boyne at Ballyboggan Bridge, July 2025

### 3.1.16 Site WCX13 – Unmapped channel, Clonmore

Three-spined stickleback ( $n=15$ ) was the only fish species recorded via electro-fishing at site WCX13 on an unmapped River Boyne tributary at a proposed pipeline crossing (**Figure 3.10**). With the exception of low densities of this species, the site was of poor fisheries value given high vegetation cover, siltation pressures and instream barriers reducing connectivity with downstream habitats.



**Figure 3.10** Length frequency distribution recorded via electro-fishing at site WXC13, July 2025



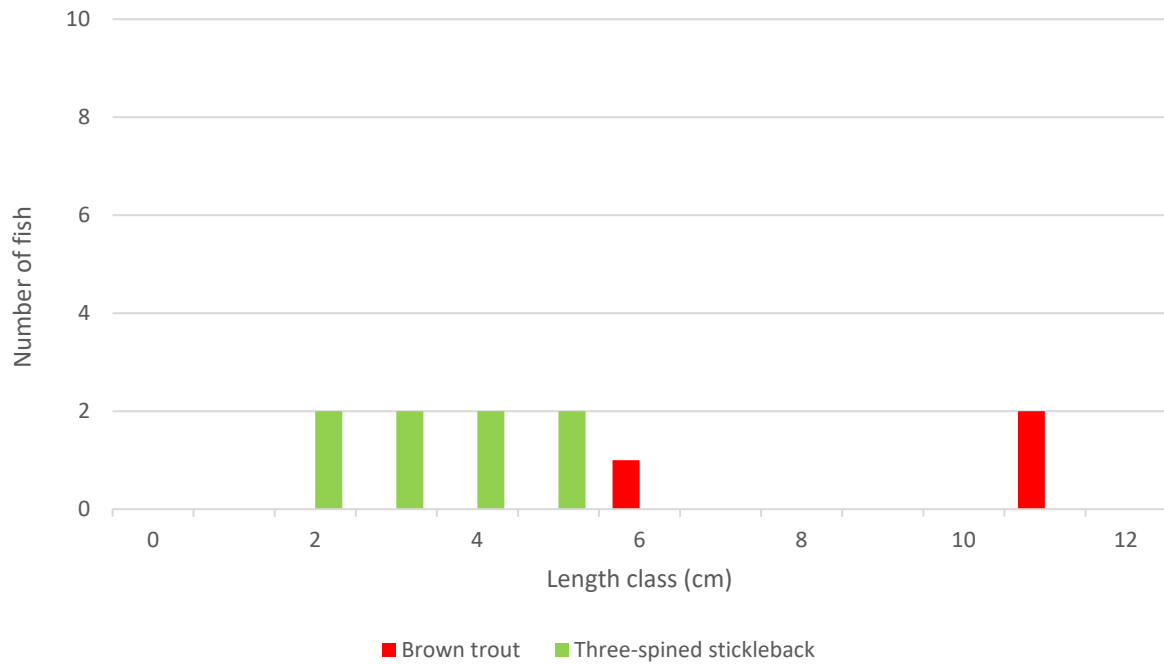
**Plate 3.18** Representative image of site WXC13 on an unmapped channel, July 2025

### 3.1.17 Site WXC14 – Unmapped stream, Clonmore

Three-spined stickleback ( $n=8$ ) and brown trout ( $n=3$ ) were the only fish species recorded via electro-fishing at site WXC14 on an unmapped stream at a proposed pipeline crossing (**Figure 3.11**).

The small Boyne tributary was of moderate value for salmonids given the presence of exposed gravel and cobble substrata locally. These areas also provided some potential for lamprey spawning. Nursery

and holding habitat was reduced in value given historical modifications but some was nonetheless present for a small salmonid population. Soft sediment accumulations were limited and sub-optimal for lamprey ammocoetes given their shallow and largely humic nature. Despite some low suitability for European eel, none were recorded.



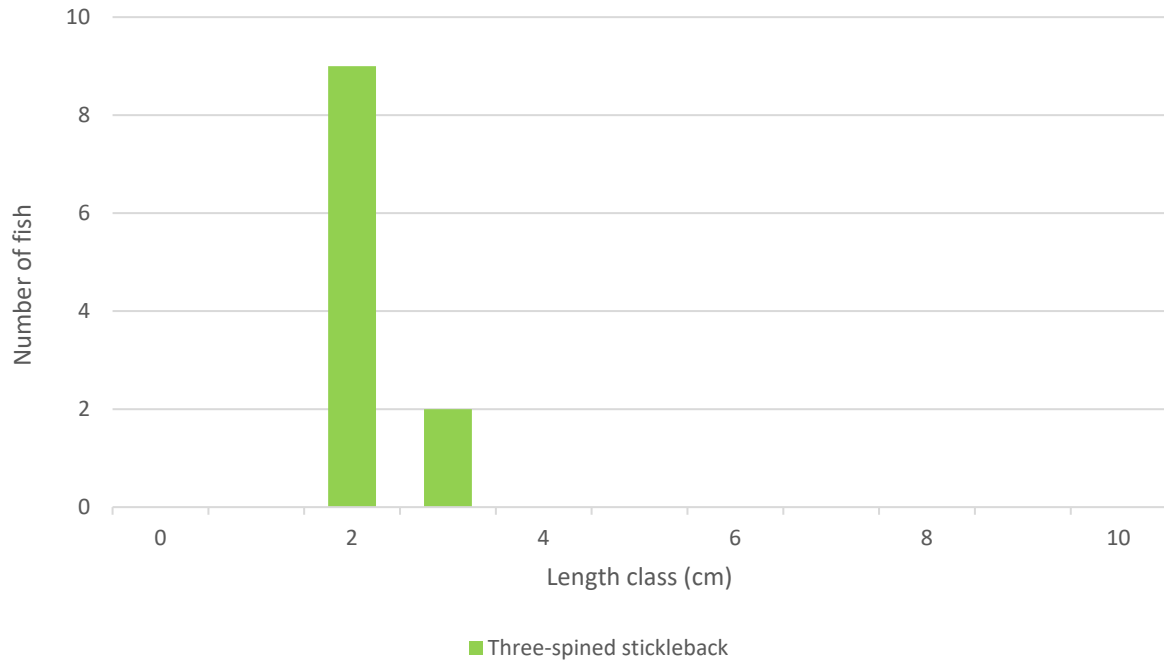
**Figure 3.11** Length frequency distribution recorded via electro-fishing at site WXC14, July 2025



**Plate 3.19** Juvenile brown trout recorded at site WCX14 on an unmapped stream, July 2025

### 3.1.18 Site WCX15 – Unmapped channel, Roosk

Three-spined stickleback ( $n=11$ ) was the only fish species recorded via electro-fishing at site WCX15 on an unmapped channel at a proposed pipeline crossing (**Figure 3.12**). With the exception of low densities of this species, the site was not of fisheries value given the artificial nature of the channel, significant siltation, very poor hydromorphology and poor connectivity with superior quality habitats.



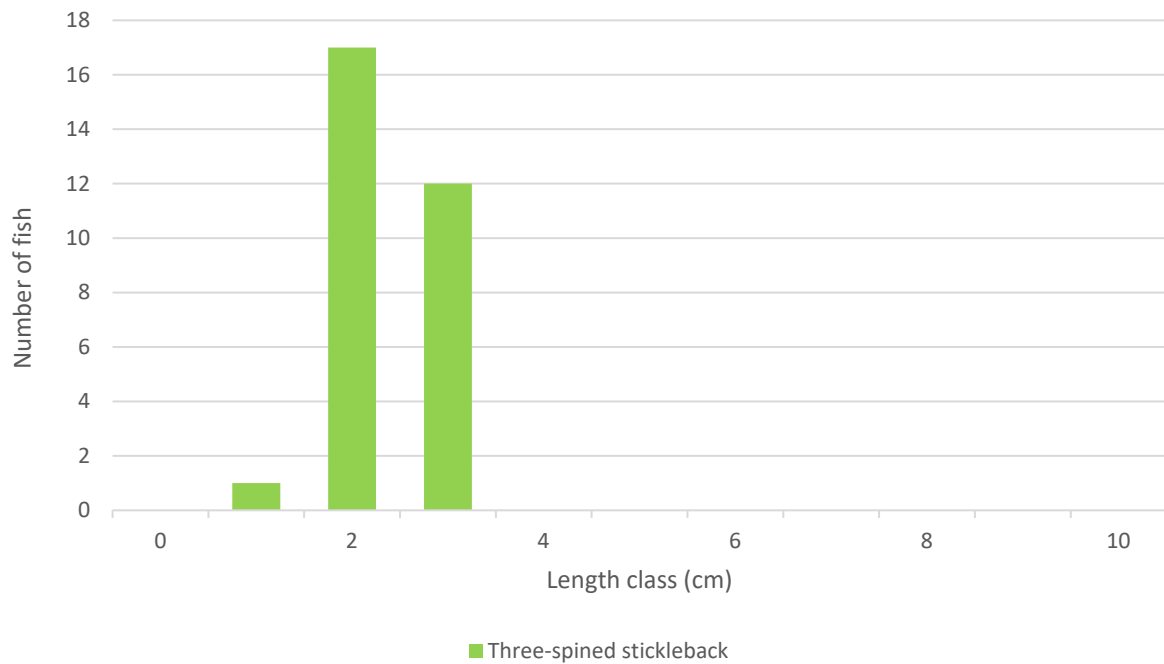
**Figure 3.12** Length frequency distribution recorded via electro-fishing at site WXC15, July 2025



**Plate 3.20** Representative image of site WCX15 on an unmapped channel, July 2025

### 3.1.19 Site WCX16 – Rook River, Mountwilson

Three-spined stickleback ( $n=39$ ) was the only fish species recorded via electro-fishing at site WCX16 on the Rook River (07R53), a River Boyne tributary, at a proposed pipeline crossing (**Figure 3.13**). With the exception of high densities of this species, the site was of very poor fisheries value given gross siltation and poor hydromorphology resulting from extensive historical modifications. There was an absence of spawning habitat for salmonids or lamprey and low flows would likely preclude these species from the wider survey area. Suitability for European eel was very low with none recorded.



**Figure 3.13** Length frequency distribution recorded via electro-fishing at site WXC16, July 2025



**Plate 3.21** Three-spined stickleback recorded at site WCX16 on the Rook River, July 2025

### 3.1.20 Site WCX17 – Unmapped channel, Mountwilson

No fish were recorded via electro-fishing at site WCX17 on an unmapped channel at a proposed pipeline crossing. With the exception of some low suitability for stickleback species (not recorded), the site was not of fisheries value given historical modifications and the stagnant nature of the channel.



**Plate 3.22** Representative image of site WCX17 on an unmapped channel, July 2025

### 3.1.21 Mountwilson Stream, Mountwilson

The survey site on the EPA-mapped course Mountwilson Stream (07M07) was not designated as a watercourse crossing (WCX) given the channel had evidently been dry for a considerable period (years), with a remnant channel that had been historically straightened and deepened. The site was not of fisheries value given the dry nature of the channel.



**Plate 3.23** Representative image of the survey site on the Mountwilson Stream, July 2025 (dry channel)

### 3.1.22 Site WCX18 – Unmapped channel, Thornwell

Site WCX18 was located on an unmapped drainage channel (FW4) at a proposed pipeline crossing. The straightened and deepened channel was not of fisheries value given the dry ephemeral nature of the channel in addition to extensive historical modifications, siltation pressures and poor connectivity to downstream habitats.

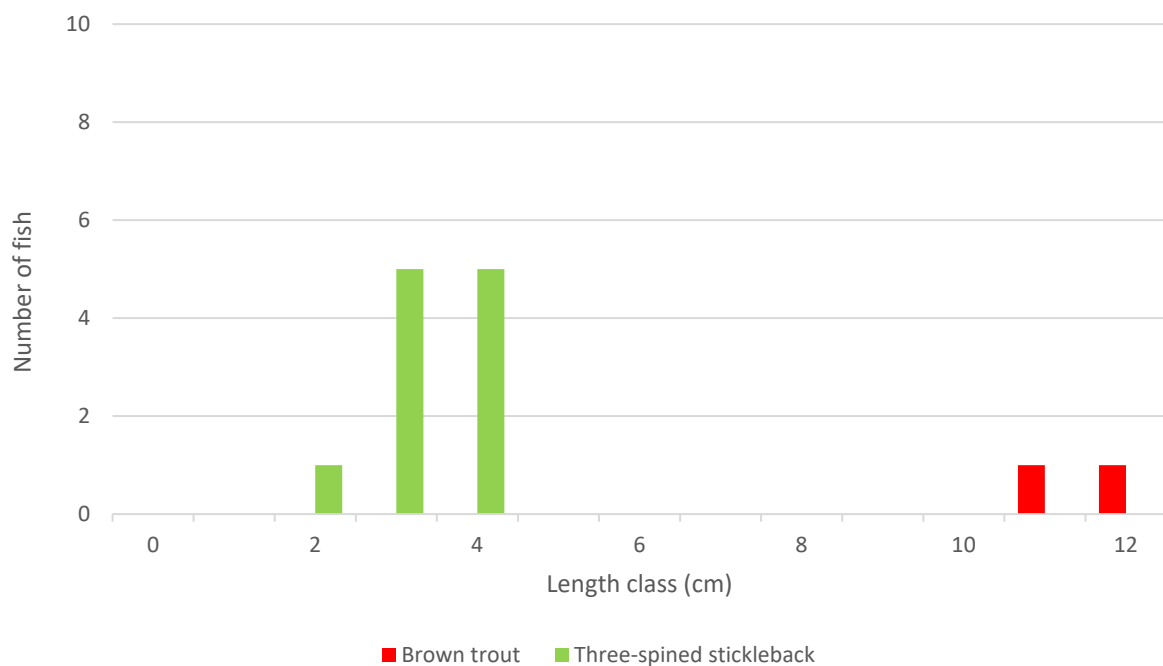


**Plate 3.24** Representative image of site WCX18 on an unmapped channel, July 2025 (dry channel)

### 3.1.23 Site WCX19 – Kinnafad River, Thornwell

Three-spined stickleback ( $n=11$ ) and brown trout ( $n=2$ ) were the only fish species recorded via electro-fishing at site WCX19 on the Kinnafad River (07K31) at a proposed pipeline crossing (**Figure 3.14**).

Despite poor suitability for salmonids and an absence of spawning habitat, a low density of trout were recorded. Improved spawning and nursery habitat was present upstream nearer site WXC20 (but sub-optimal). Deeper holding areas were scarce given infilling by siltation and thus holding opportunities for adult salmonids were very poor. Likewise, European eel habitat was very poor with a paucity of suitable refugia. Despite an abundance of soft sediment accumulation, the quality of lamprey nursery habitat was poor due to low flows and no ammocoetes were recorded.



**Figure 3.14** Length frequency distribution recorded via electro-fishing at site WXC19, July 2025

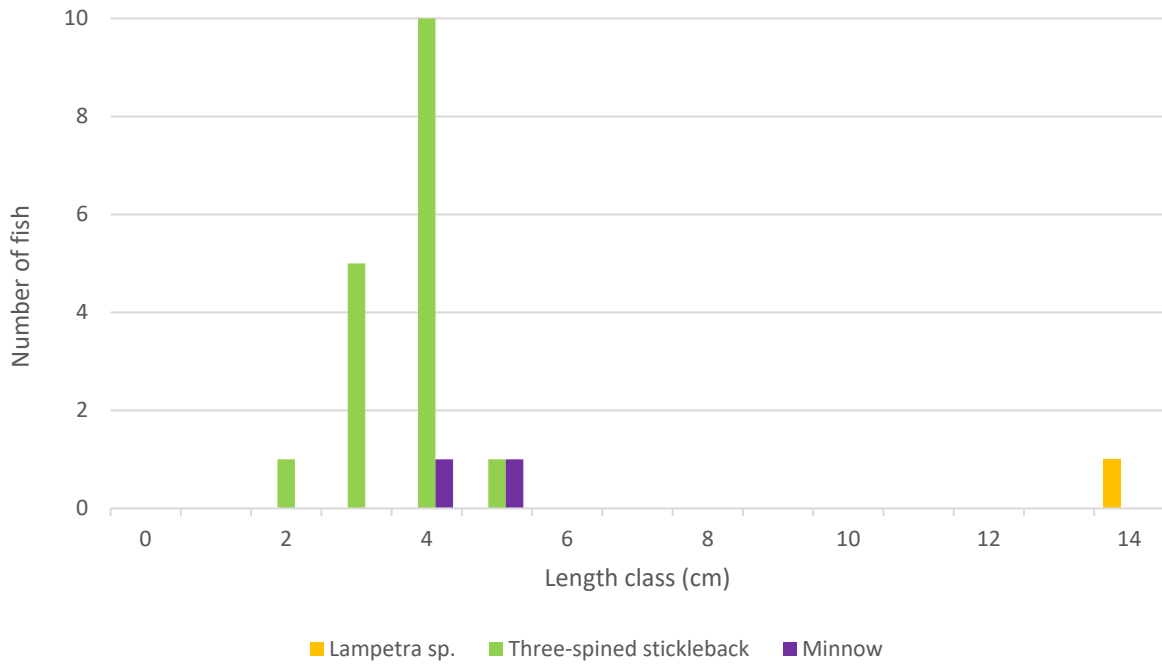


**Plate 3.25** Brown trout recorded at site WCX19 on the Kinnafad River, July 2025

#### 3.1.24 Site WCX20 – unmapped stream, Monasteroris

Minnow ( $n=17$ ), three-spined stickleback ( $n=2$ ) and lamprey (*Lampetra* sp.) ( $n=1$ ) were recorded via electro-fishing at site WCX20 on an unmapped stream at a proposed pipeline crossing (**Figure 3.15**).

Despite some moderate suitability for salmonids in terms of spawning and lower quality nursery habitat, no salmonids were recorded. This likely reflected extensive instream modifications and possibly low summer flows which influenced fish distribution. Although a single lamprey ammocoete was recorded, habitat was very much sub-optimal with no suitable soft sediment nursery habitat identified. Some moderate to good quality lamprey spawning habitat by way of finer gravels was present although the value was reduced by siltation. Suitability for European eel was poor with a paucity of instream refugia - none were recorded.



**Figure 3.15** Length frequency distribution recorded via electro-fishing at site WXC20, July 2025



**Plate 3.26** *Lampetra* sp. ammocoete recorded at site WXC20 on an unmapped channel, July 2025

### 3.1.25 Site WXC21 – Unmapped channel, Monasteroris

No fish were recorded via electro-fishing at site WXC21 on an unmapped channel at a proposed pipeline crossing. Despite some low suitability for salmonids in the lowermost reaches at the unnamed stream confluence, none were present and this likely reflected very low flows and the ephemeral nature of the stream. However, the downstream connecting stream (not crossed by the pipeline) had some moderate suitability for brown trout, albeit with siltation pressures.



**Plate 3.27** Representative image of site WCX21 on an unmapped channel, July 2025

### 3.1.26 Site WCX22 – Unmapped channel, Monasteroris

Site WCX22 was located on an unmapped channel at a proposed pipeline crossing. The drainage channel (FW4) ran along a field boundary. The straightened and deepened U-shaped channel (2.5m high banks) was dry at the time of survey with no fisheries value.



**Plate 3.28** Representative image of site WCX22 on an unmapped channel, July 2025 (dry channel)

### 3.1.27 Site WCX23 – Grand Canal, Rathmore

Site WCX23 was located on the Grand Canal at a proposed pipeline crossing just west of Rathmore Bridge. Electro-fishing was not undertaken at site WCX23 given prohibitive depths and water volumes. However, the site was of high value for a range of coarse fish including roach (*Rutilus rutilus*), perch (*Perca fluviatilis*), pike (*Esox lucius*) and tench (*Tinca tinca*), all of which were observed during the site visit. There was also high suitability for European eel.



**Plate 3.29** Representative image of site WCX23 on the Grand Canal, July 2025

### 3.1.28 Site WCX24 – Ballyleakin River, Ballykilleen

Site WCX24 was located on the Ballyleakin River (14B22) at a proposed pipeline crossing. The river was dry at the time of survey with a damp muddy base following heavy rainfall. The site was not of fisheries or aquatic value given the dry, ephemeral nature of the channel.



**Plate 3.30** Representative image of site WCX24 on the Ballyleakin River, July 2025 (ephemeral channel)

### 3.1.29 Site WCX25 – Unmapped channel, Ballykilleen

No fish were recorded via electro-fishing at site WCX25 on a small unmapped stream at a proposed pipeline crossing. The site was not of fisheries value given the semi-dry ephemeral nature of the channel in addition to extensive historical modifications, siltation pressures and poor connectivity with downstream habitats.



**Plate 3.31** Representative image of site WCX25 on an unmapped channel, July 2025 (semi-dry channel)

### 3.1.30 Site WCX26 – Unmapped channel, Ballykilleen

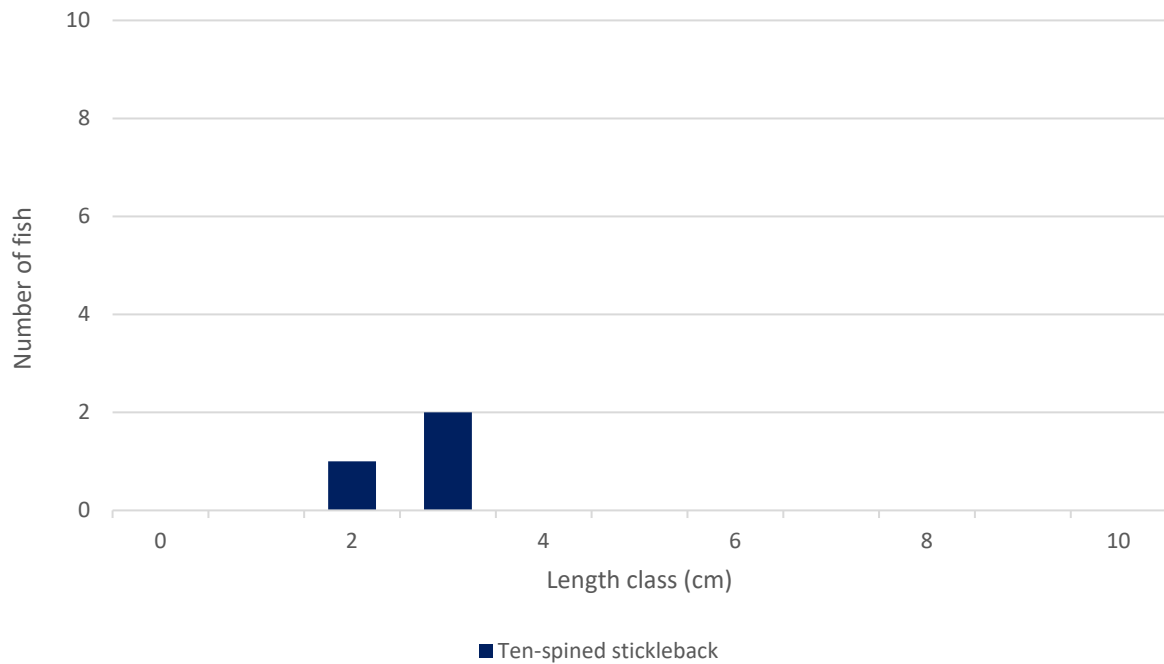
Site WCX26 was located on an unmapped channel at a proposed pipeline crossing. The drainage channel (FW4) ran along a field boundary and was largely dry at the time of survey with only localised shallow pools of rainwater following heavy downpours (<0.02m). The site was not of fisheries value given the semi-dry, ephemeral nature of the channel in addition to extensive historical modifications, siltation pressures and poor connectivity with downstream habitats.



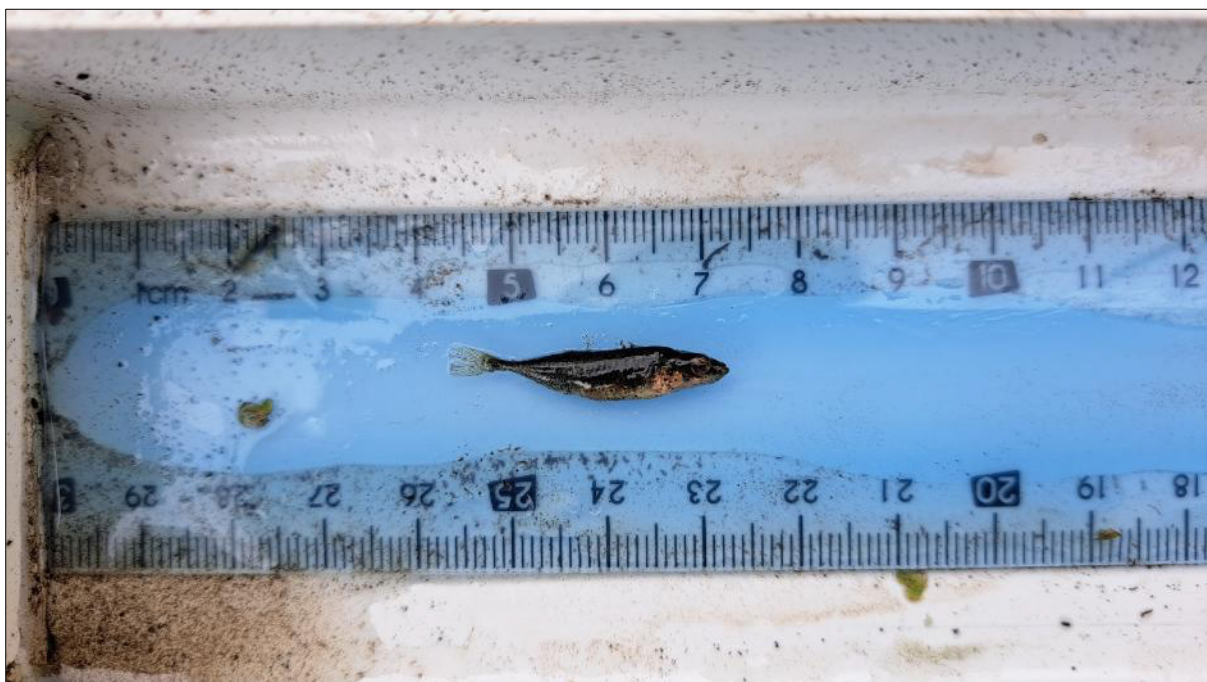
**Plate 3.32** Representative image of site WCX26 on an unmapped channel, July 2025 (ephemeral channel)

### 3.1.31 Site WCX27 – Unmapped channel, Ballykilleen

Ten-spined stickleback ( $n=3$ ) was the only fish species recorded via electro-fishing at site WCX27 on an unmapped channel at a proposed pipeline crossing (**Figure 3.16**). With the exception of low densities of this ubiquitous species, the site was not of fisheries value given its heavily modified nature, siltation pressures, lack of flows and poor connectivity with superior downstream habitats.



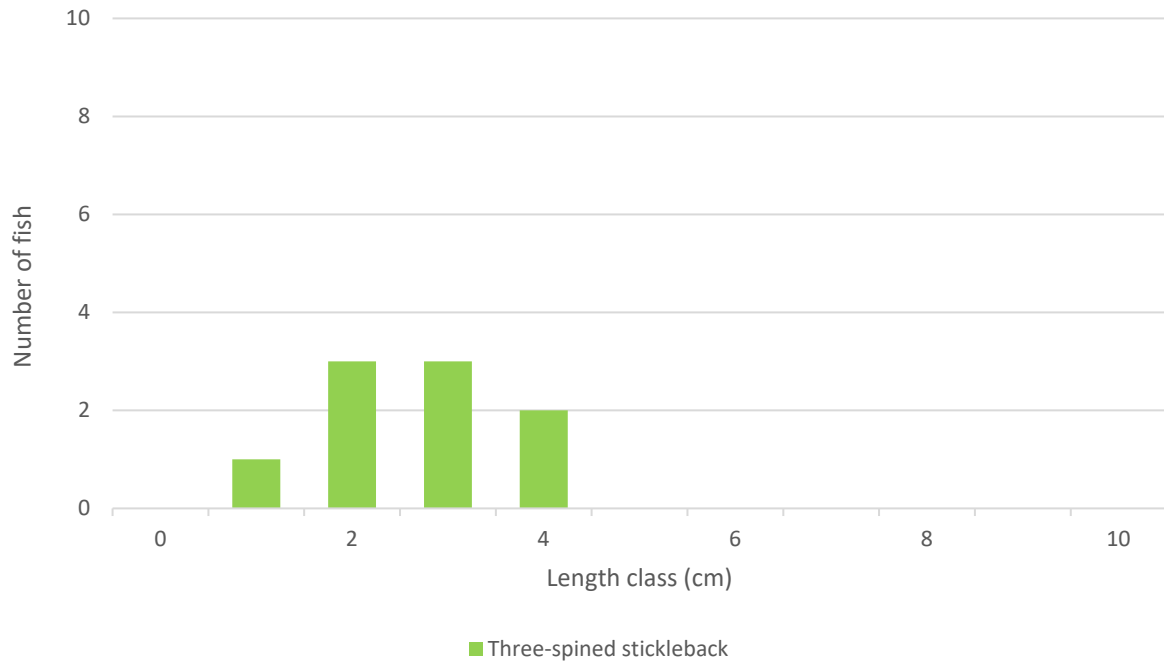
**Figure 3.16** Length frequency distribution recorded via electro-fishing at site WXC27, July 2025



**Plate 3.33** Ten-spined stickleback recorded at site WCX27 on an unmapped channel, July 2025

### 3.1.32 Site WCX28 – Unmapped channel, Ballykilleen

Three-spined stickleback ( $n=9$ ) was the only fish species recorded via electro-fishing at site WCX28 on an unmapped channel at a proposed pipeline crossing (**Figure 3.17**). With the exception of low densities of this ubiquitous species, the site was not of fisheries value given its heavily modified nature, siltation pressures and lack of flow.



**Figure 3.17** Length frequency distribution recorded via electro-fishing at site WXC28, July 2025



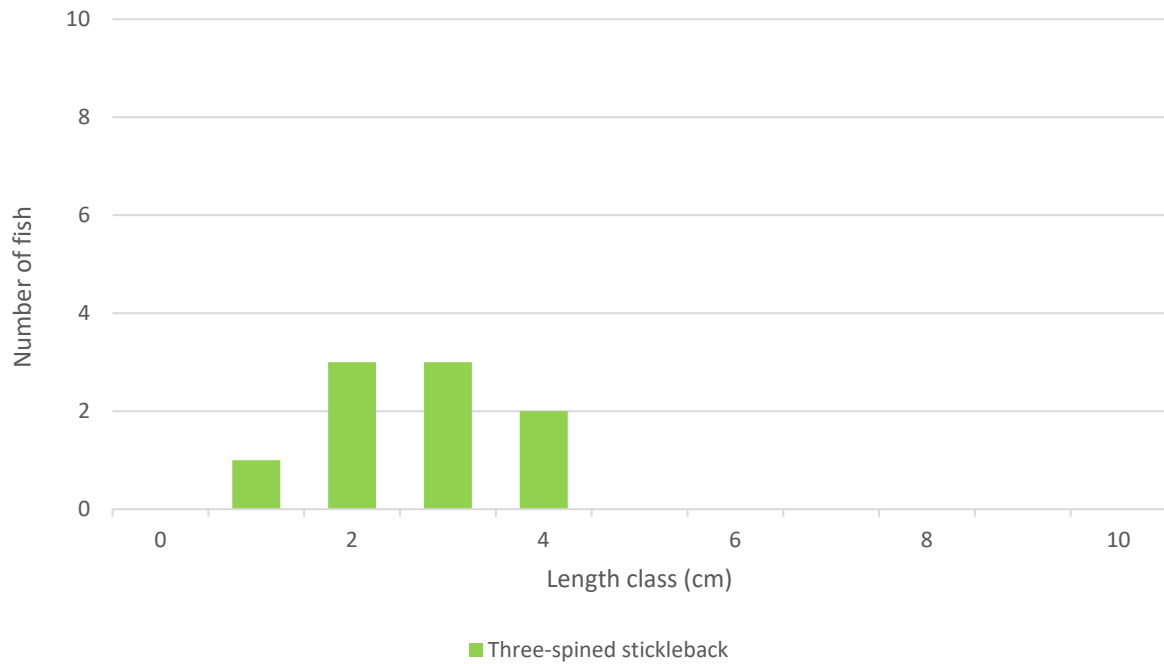
**Plate 3.34** Representative image of site WXC28 on an unmapped channel, July 2025

### 3.1.33 Site WXC29 – Ballykilleen Stream, Ballykilleen

Three-spined stickleback ( $n=8$ ) was the only fish species recorded via electro-fishing at site WXC29 in the Ballykilleen Stream (14B25) immediately downstream of the R401 road crossing (box culvert). (**Figure 3.18**).

With the exception of low densities of this species, the site was of poor fisheries value given its heavily

modified nature, siltation pressures and poor seasonal flows. Although present, hard substrata (gravels) were of poor suitability for salmonid or lamprey spawning due to siltation. Soft sediment accumulations were humic in nature and thus unsuitable for lamprey ammocoetes.



**Figure 3.18** Length frequency distribution recorded via electro-fishing at site WXC29, July 2025



**Plate 3.35** Representative image of site WXC29 on the Ballykilleen Stream, July 2025

### 3.1.34 Site WCX30 – Ballykilleen Stream, Shean

Three-spined stickleback ( $n=12$ ) and ten-spined stickleback ( $n=1$ ) were the only fish species recorded via electro-fishing at site WCX30 on the Ballykilleen Stream (14B25) c. 400m downstream of crossing WCX28. (Figure 3.19). With the exception of low densities of stickleback species, the site was of poor fisheries value given its heavily modified nature, siltation pressures, heavy vegetation cover and poor seasonal flows. Spawning habitat for salmonids and lamprey was absent. Abundant soft sediment accumulations were argillaceous in nature and unsuitable for lamprey ammocoetes.

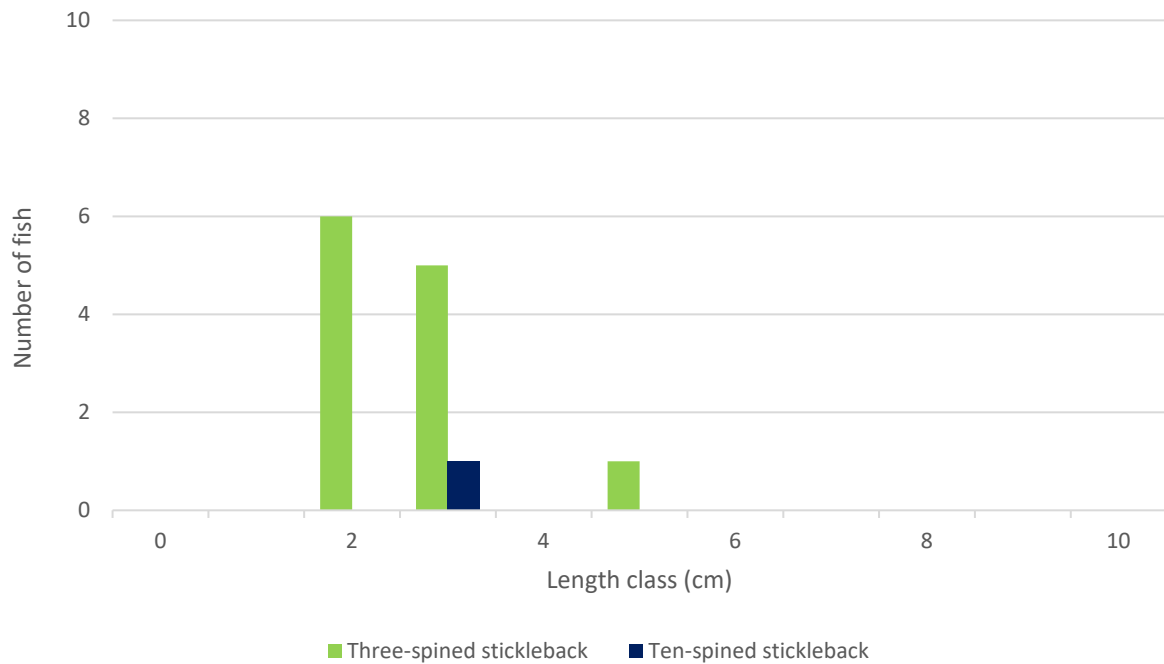


Figure 3.19 Length frequency distribution recorded via electro-fishing at site WXC30, July 2025



Plate 3.36 Three-spined stickleback recorded at site WCX30 on the Ballykilleen Stream, July 2025

**Table 3.1** Relative abundance of fish species of higher conservation value recorded via **electro-fishing** in the vicinity of the proposed development, July-August 2025

Site	Watercourse	Atlantic salmon	Brown trout	Lamprey ( <i>Lampetra</i> sp.)	European eel	Other species
RVX01	Kilwarden/ Kinnegad River	Medium	Medium	Medium	Low	Minnow, stone loach, three-spined stickleback
RVX01b	Kilwarden/ Kinnegad River	Low	Low	Medium		Minnow, gudgeon, stone loach, three-spined stickleback
WCX01	Unmapped channel					Three-spined stickleback
WCX02	Aghnahillagh River					Three-spined stickleback
WCX03	Unmapped channel	No fish recorded				
WCX04	Knockerasally or Colehill River		Medium		Low	Minnow, three-spined stickleback
WCX05	Park River					Three-spined stickleback
WCX06	Ballynakill Stream	No fish recorded				
WCX07	Unmapped channel	No fish recorded				
WCX08	Unmapped channel					Three-spined stickleback
WCX09	Unmapped channel	No fish recorded				
WCX10	Unmapped channel					Three-spined stickleback, ten-spined stickleback
WCX11	Castlejordan River					Three-spined stickleback, ten-spined stickleback
WCX12	Rahin Stream	No fish recorded				
RVX02b	River Boyne	Fisheries appraisal only				
WCX13	Unmapped channel					Three-spined stickleback
WCX14	Unmapped stream		Low			Three-spined stickleback
WCX15	Unmapped channel					Three-spined stickleback

Site	Watercourse	Atlantic salmon	Brown trout	Lamprey ( <i>Lampetra</i> sp.)	European eel	Other species
WCX16	Roosk River					Three-spined stickleback
WCX17	Unmapped channel				No fish recorded	
n/a	Mountwilson Stream				No fish recorded	
WCX18	Unmapped channel				No fish recorded	
WCX19	Kinnafad River		Low			Three-spined stickleback
WCX20	Unmapped stream			Low		Three-spined stickleback, minnow
WCX21	Unmapped channel				No fish recorded	
WCX22	Unmapped channel				No fish recorded	
WCX23	Grand Canal				Fisheries appraisal only	
WCX24	Ballyleakin River				No fish recorded	
WCX25	Unmapped channel				No fish recorded	
WCX26	Unmapped channel				No fish recorded	
WCX27	Unmapped channel					Ten-spined stickleback
WCX28	Unmapped channel					Three-spined stickleback
WCX29	Ballykilleen Stream					Three-spined stickleback
WCX30	Ballykilleen Stream					Three-spined stickleback, ten-spined stickleback

**Conservation value:** Atlantic salmon (*Salmo salar*) & lamprey (*Lampetra* spp.) are listed under Annex II and Annex V of the Directive on the Conservation of Natural Habitats of Wild Fauna and Flora (92/43/EEC) ('EU Habitats Directive'). Atlantic salmon are also protected under the Irish Wildlife Acts 1976-2023. Atlantic salmon & sea trout are protected under the Wild Salmon and Sea Trout Tagging Scheme (Amendment) Regulations. With the exception of the Inland Fisheries Acts 1959 to 2017, brown trout and coarse fish species have no legal protection in Ireland. European eel are 'critically endangered' according to most recent ICUN red list (Pike et al., 2020) and listed as 'critically endangered' in Ireland (King et al., 2011).

**Table 3.2** Fish species densities per m<sup>2</sup> recorded at sites in the vicinity of the proposed development via electro-fishing in July or August 2025 (values in **bold** represent the highest densities recorded for each species, respectively)

Site	Watercourse	CPUE (elapsed time)	Approx. area fished (m <sup>2</sup> )	Atlantic salmon	Brown trout	<i>Lampetra</i> sp.	European eel	Stone loach	Minnow	Gudgeon	Three-spined stickleback	Ten-spined stickleback
RVX01	Kilwarden/Kinnegad River	10	325	<b>0.037</b>	0.055	<b>4.4 / m<sup>2</sup></b>	0.009	<b>0.043</b>	0.009	0.000	0.022	0.000
RVX01b	Kilwarden/Kinnegad River	10	270	0.007	0.026	2 / m <sup>2</sup>	0.000	0.019	0.111	<b>0.004</b>	0.033	0.000
WCX01	Unmapped channel	10	90	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.200	0.000
WCX02	Aghnahillagh River	10	240	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.017	0.000
WCX03	Unmapped channel	5	80	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
WCX04	Knockerasally or Colehill River	5	80	0.000	<b>0.238</b>	0.000	<b>0.013</b>	0.000	<b>0.125</b>	0.000	0.063	0.000
WCX05	Park River	10	210	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.024	0.000
WCX06	Ballynakill Stream	n/a	n/a - dry channel	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
WCX07	Unmapped channel	5	40	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
WCX08	Unmapped channel	5	45	0.000	0.000	0.000	0.000	0.000	0.000	0.000	<b>0.289</b>	0.000
WCX09	Unmapped channel	5	50	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
WCX10	Unmapped channel	5	75	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.160	<b>0.040</b>
WCX11	Castlejordan River	5	80	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.113	<b>0.063</b>
WCX12	Rahin Stream	5	60	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
RVX02b	River Boyne	n/a	n/a - too deep	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
WCX13	Unmapped channel	10	120	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.125	0.000
WCX14	Unmapped channel	10	150	0.000	<b>0.020</b>	0.000	0.000	0.000	0.000	0.000	0.053	0.000

Site	Watercourse	CPUE (elapsed time)	Approx. area fished (m <sup>2</sup> )	Atlantic salmon	Brown trout	<i>Lampetra</i> sp.	European eel	Stone loach	Minnow	Gudgeon	Three-spined stickleback	Ten-spined stickleback
WCX15	Unmapped channel	5	50	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.220	0.000
WCX16	Roosk River	10	270	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.144	0.000
WCX17	Unmapped channel	5	100	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
n/a	Mountwilson Stream	n/a	n/a - dry channel	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
WCX18	Unmapped channel	n/a	n/a - dry channel	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
WCX19	Kinnafad River	10	210	0.000	0.010	0.000	0.000	0.000	0.000	0.000	0.052	0.000
WCX20	Unmapped channel	10	250	0.000	0.000	0.004	0.000	0.000	0.008	0.000	0.068	0.000
WCX21	Unmapped channel	5	80	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
WCX22	Unmapped channel	n/a	n/a - dry channel	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
WCX23	Grand Canal	n/a	n/a - fisheries appraisal only	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
WCX24	Ballyleakin River	n/a	n/a - dry channel	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
WCX25	Unmapped channel	5	100	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
WCX26	Unmapped channel	5	20	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
WCX27	Unmapped channel	10	100	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.030
WCX28	Unmapped channel	10	100	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.090	0.000
WCX29	Ballykilleen Stream	10	90	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.089	0.000
WCX30	Ballykilleen Stream	10	150	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.080	0.007

## 4. Discussion

The watercourses surveyed in the vicinity of the proposed Edenderry Gas Pipeline development were typically heavily modified lowland channels and drainage ditches with low fisheries value. This reflected widespread hydromorphological modifications in addition to significant siltation and eutrophication pressures. Straightening and over-deepening (as part of land drainage) damages instream habitats and hydromorphological heterogeneity, encourages sediment deposition and invariably results in an irreparable reduction in fisheries potential, particularly for salmonids and lamprey (O’Grady et al., 2017, O’Grady, 2006; Lynch & Murray, 1994) but also European eel. Many survey watercourses featured low or even absent summer flows, further restricting their fisheries value. A total of 6 no. sites on the Ballynakill Stream, Mountwilson Stream, Ballyleakin River and three unmapped channels were dry at the time of survey (i.e. an absence of fisheries habitats).

A typical diversity of fish for the survey catchments was recorded during the survey, with Atlantic salmon, brown trout, lamprey (*Lampetra* sp.), European eel, minnow, gudgeon, stone loach, three-spined stickleback and ten-spined stickleback captured in July and August 2025 (**Table 3.1**). Fish were recorded from a total of 19 no. sites, with 13 no. of these supporting only stickleback species. Larger watercourses with greater flow volumes, such as the Kilwarden/Kinnegad River and River Boyne, are more resilient to historical modifications and supported better quality fisheries habitats and more diverse fish populations. The Grand Canal was of very high value for a range of coarse fish species, as well as European eel.

Salmonid populations were heavily restricted in the survey area, with brown trout recorded from just 5 no. sites on the Kilwarden/Kinnegad River (RVX01 & RVX01b), Knockerasally River (WCX04), an unmapped Boyne tributary (WCX14) and the Kinnafad River (WCX19) (**Table 3.1, 3.2**). Low numbers of Atlantic salmon were recorded from sites RVX01 and RVX01b on the Kilwarden/Kinnegad River. These watercourses, whilst clearly impacted by historical straightening/deepening and water quality pressures, provided some localised salmonid nursery and or spawning habitat that was very sparse in the wider survey area. The Kilwarden/Kinnegad River supports a genetically distinct sub-population of trout within the Boyne catchment (Massa-Gallucci & Mariani, 2011) and is thus of particular conservation value. The majority of survey sites (watercourse crossings) were present on channels incapable of supporting salmonids in light of low/absent summer flows, an absence of spawning or nursery habitat and poor or no connectivity with downstream habitats.

Similar to salmonids, lamprey distribution was found to be highly restricted in the survey area with *Lampetra* sp. ammocoetes recorded from 2 no. sites on the Kilwarden/Kinnegad River (RVX01 & RVX01b) and an unmapped Kinnafad River tributary (WXC20). Sites RVX01 and RVX01b featured both sub-optimal spawning and nursery habitats, with low ammocoete densities recorded from shallow, organic-rich silt deposits (**Table 3.2**). Site WXC20 provided some limited spawning areas for lamprey but nursery habitat was absent. The single *Lampetra* sp. recorded at this site was present in mixed gravel refugia, a substrate that can be utilised by larger classes of ammocoetes (Melchior & Madsen, 2025; Aronsuu & Virkkala, 2014). Overall, lamprey habitat was poor across the survey area and the abundances and distribution of *Lampetra* sp. ammocoetes reflected the often low summer flows (impacting food supplies & oxygenation), the poor hydromorphology of most sites and the dominance of peat-dominated soft sediment. Owing to their relatively small morphologies, *Lampetra* species such as brook lamprey require clean, fine gravels in which to dig their redds (Lasne et al., 2010; Rooney et

al., 2013; Dawson et al., 2015) although areas may also include fractions of sand, larger gravels, and cobble (Nika & Virbickas, 2010). Spawning habitat in the vicinity of the proposed pipeline was sporadic and of poor quality due to significant siltation pressures (as outlined above). Furthermore, lamprey ammocoetes require the deposition of fine, organic-rich sediment  $\geq 5\text{cm}$  in depth in which to burrow and mature (Gardiner, 2003; Goodwin et al., 2008; Aronsuu & Virkkala, 2014). Peat-dominated substrata (i.e., humic deposits), such as those typically found in the vicinity of the proposed pipeline, do not provide suitable burial/burrowing habitat complexity or structure for ammocoetes given their invariably fine and flocculent nature (pers. obs.).

European eel are Red-listed in Ireland (King et al., 2011) and are classed as 'critically endangered' on a global scale (Pike et al., 2020). Despite some suitability across the survey area, eel were only recorded from sites RVX01 on the Kilwarden/Kinnegad River (a Figile tributary) and WCX04 on the Knockersally River (**Table 3.1, 3.2**). Suitability for eel was very high on the River Boyne (RVX02b) and the Grand Canal (WCX23) where electro-fishing was not possible. Indeed, eel are known from both watercourses. As per salmonids, European eel habitat is also degraded by arterial drainage by virtue of a reduction or removal of instream refugia preferred by the species (Laffaille et al., 2003) and more optimal areas of channel (e.g. boulder zones) were highly localised in vicinity of the proposed pipeline. As eel occurrence decreases significantly with increasing distance from the sea (Degerman et al., 2019), the paucity of eel observed can be further explained by the large distances between the survey area and marine habitats (Matondo et al., 2021; Chadwick et al., 2007).

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