

Aquatic baseline report for Tinakilly
Demesne Residential Development,
Rathnew, Co. Wicklow

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1. Introduction

1.1 Background

The following report provides a baseline assessment of the aquatic ecology and fisheries of watercourses in the vicinity of a proposed residential development at Tinakilly Demesne, Rathnew, Co. Wicklow. The site was bordered by the Rathnew Stream (EPA code: 10R02) and its tributary, the Rossana Lower Stream (10R19), which were the focus of the study.

The aquatic baseline surveys recorded the fisheries potential for species of high conservation value (i.e. salmonids, European eel and lamprey) based on habitat characteristics. The surveys also assessed the value of the watercourses in the vicinity of the proposed development for white-clawed crayfish (*Austropotamobius pallipes*) and evaluated the biological water quality by Q-sampling. The surveys also evaluated the importance of the watercourses for macrophytes, aquatic bryophytes and associated linkages with Annex I habitats. A survey of otter (*Lutra lutra*) on the Rathnew Stream and Rossanna Lower Stream was also undertaken to establish otter presence and utilisation of the streams bordering the study area. The presence of aquatic and riparian invasive species was also noted in the vicinity of the proposed site boundary. Aquatic surveys were undertaken on the 9th of April 2022 during base flow conditions.

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2. Methodology

2.1 Selection of watercourses for assessment

Watercourses adjoining the western and northern boundaries of the proposed development were surveyed as part of the current assessment. The $n=4$ total aquatic survey sites were surveyed on the bordering Rossanna Lower Stream and Rathnew Stream (**Table 2.1; Figure 2.1**). The nomenclature for the watercourses surveyed is as per the Environmental Protection Agency's (EPA) online map viewer.

Please note this aquatic report should be read in conjunction with the Ecological Impact Assessment Report (EclA) prepared for the proposed development by Scott Cawley Ltd. The aquatic survey methodology is outlined in the sections below.

2.2 Aquatic site surveys

Surveys of the Rathnew Stream and Rossanna Lower Stream were conducted on the 9th April 2022. Survey effort focused on both instream and riparian habitats in the vicinity of each survey site (**Figure 2.1**). The surveys were conducted during bright weather and base flow riverine conditions. The watercourses at each survey site were described in terms of the important aquatic habitats and species. This helped to evaluate species and habitats of ecological value in the vicinity of each site. The aquatic baseline prepared would inform mitigation for the project.

A broad aquatic 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). All sites were assessed in terms of:

- Physical watercourse/waterbody characteristics (i.e., width, depth etc.)
- Substrate type, listing substrate fractions in order of dominance (i.e., bedrock, boulder, cobble, gravel, sand, silt etc.)
- River profile in the sampling area
- An appraisal of the macrophyte and aquatic bryophyte community at each site
- Riparian vegetation composition

Table 2.1 Location of $n=4$ aquatic survey sites in the vicinity of Tinakilly Demesne Residential Development, Rathnew, Co, Wicklow

Site	Watercourse	EPA code	Location	X (ITM)	Y (ITM)
S1	Rossanna Lower Stream	10R19	Upstream of site boundary, Tinakilly Lane	729173	695516
S2	Rossanna Lower Stream	10R19	Upstream of confluence with Rathnew Stream	729070	695771
S3	Rathnew Stream	10R02	Upstream of confluence with Rossanna Lower Stream	729046	695780
S4	Rathnew Stream	10R02	Adjoining downstream extent of site boundary	729338	695912

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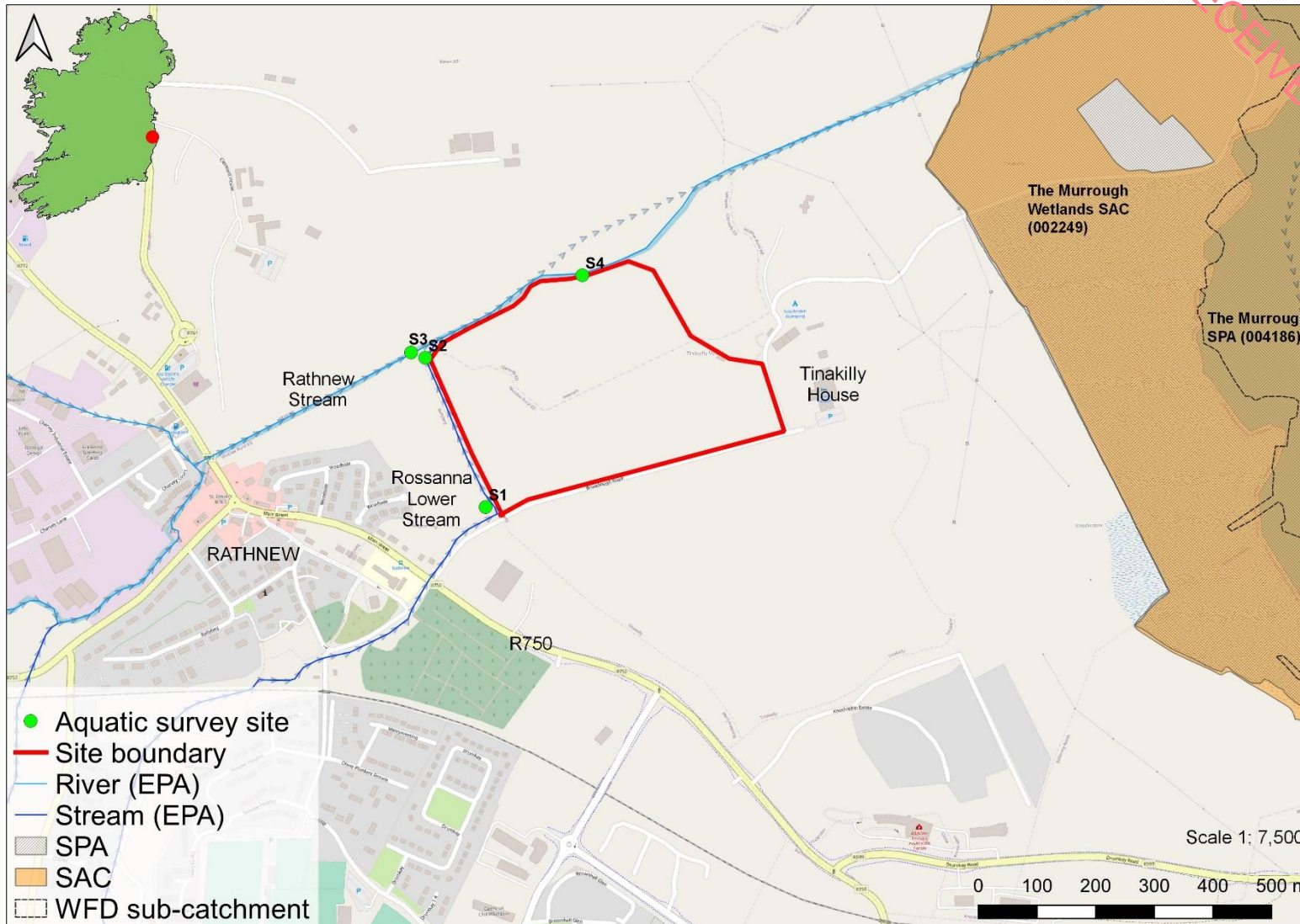


Figure 2.1 Overview of the aquatic survey site locations for the proposed Tinakilly Demesne Residential Development, Rathnew, Co. Wicklow

2.3 Otter signs

The presence of otter (*Lutra lutra*) at each aquatic survey site was determined through the recording of otter signs, if encountered incidentally during surveys. The survey broadly followed the best practice survey methodology for otter as recommended by Lenton et al. (1980), Chanin (2003) and Bailey & Rochford (2006). Notes on the age and location (ITM coordinates) were made for each otter sign recorded, in addition to the quantity and visible constituents of spraint (i.e. remains of fish, molluscs etc.).

2.4 Fisheries habitat

2.4.1 Salmonid habitat

Fisheries habitat quality for salmonids was assessed using the Life Cycle Unit method (Kennedy, 1984; O'Connor & Kennedy, 2002) to map the $n=4$ riverine sites as nursery, spawning and holding habitat, by assigning quality scores to each type of habitat. Those habitats with poor quality substrata, shallow depth and a poorly defined river profile receive a higher score. Higher scores in the Life Cycle Unit method of fisheries quantification are representative of poorer value, with lower scores being more optimal despite this appearing counter intuitive.

Table 2.1 Life Cycle Unit scoring system for salmonid nursery, spawning and holding habitat value (as per Kennedy, 1984 & O'Connor & Kennedy, 2002)

Habitat quality	Habitat score	Total score (three components)
Poor	4	12
Moderate	3	9-11
Good	2	6-8
Excellent	1	3-5

2.4.2 Lamprey habitat

Lamprey habitat evaluation for each survey site was undertaken using the Lamprey Habitat Quality Index (LHQI) scoring system, as devised by Macklin et al. (2018). The LHQI broadly follows a similar rationale as the Life Cycle Unit score for salmonids. Those habitats with a lack of soft, largely organic sediment areas for ammocoete burrowing, shallow sediment depth (<10cm) or compacted sediment nature receive a higher score. Higher scores in this index are thus of poorer value (in a similar fashion to the salmonid Life Cycle Unit Index), with lower scores being more optimal. Overall scores are calculated as a simple function of the sum of individual habitat scores.

Larval lamprey habitat quality as well as the suitability of adult spawning habitat is assessed based on the information provided in Maitland (2003) and other relevant literature (e.g. Gardiner, 2003). Unlike the salmonid Life Cycle Unit index, holding habitat for adult lamprey is not assessed owing to their

different migratory and life history strategies, and that electro-fishing surveys routinely only sample larval lamprey.

The LHQI scoring system provides additional information compared to the habitat classification based on the observations of Applegate (1950) and Slade et al. (2003), which deals specifically with larval (sea) lamprey settlement habitat. Under this scheme, habitat is classified into three different types: preferred (Type 1), acceptable (Type 2), and not acceptable for larvae (Type 3) (Slade et al., 2003). Type 1 habitat is characterized by soft substrate materials usually consisting of a mixture of sand and fine organic matter, often with some cover over the top such as detritus or twigs in areas of deposition. Type 2 habitat is characterized by substrates consisting of shifting sand with little if any organic matter and may also contain some gravel and cobble (lamprey may be present but at much lower densities than Type 1). Type 3 habitat consists of materials too hard for larvae to burrow including bedrock and highly compacted sediment. This classification can also be broadly applied to other lamprey species ammocoetes, including *Lampetra* species.

Table 2.2 Lamprey Habitat Quality Index (LHQI) scoring system for lamprey spawning and nursery habitat value (Macklin et al., 2018).

Habitat quality	Habitat score	Total score (two components)
Poor	4	8
Moderate	3	6-7
Good	2	3-5
Excellent	1	2

2.5 White-clawed crayfish survey

White-clawed crayfish (*Austropotamobius pallipes*) surveys were undertaken at the aquatic survey sites under a National Parks and Wildlife (NPWS) open licence (no. C31/2022), as prescribed by Sections 9, 23 and 34 of the Wildlife Act (1976-2021), to capture and release crayfish to their site of capture, under condition no. 6 of the licence. As per Inland Fisheries Ireland recommendations, the crayfish licence sampling started at the uppermost site of 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). Trapping of crayfish was not feasible given the small nature of the watercourses surveyed. An appraisal of white-clawed crayfish habitat at each site was conducted based on physical channel attributes, water chemistry and incidental records in mustelid spraint. Additionally, a desktop review of crayfish records within the wider survey area was undertaken.

2.6 Biological water quality (Q-sampling)

The $n=4$ aquatic survey sites were assessed for biological water quality through Q-sampling on the 9th April 2022, (**Table 2.1, Figures 2.1, 2.2**). All samples were taken with a standard kick sampling hand net (250mm width, 500 μ m mesh size) from areas of riffle/glide utilising a two-minute sample, with an additional one-minute hand search of instream substrata, as per EPA methodology (Feeley et al., 2020a). Samples were elutriated and fixed in 70% ethanol for subsequent laboratory identification. Macro-invertebrate samples were converted to Q-ratings as per Toner et al. (2005). 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., 2020b) 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)

Q Value	WFD Status	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

2.7 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).

2.8 Biosecurity

A strict biosecurity protocol including 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. Where feasible, equipment was also thoroughly dried (through UV exposure) between survey areas. Any aquatic invasive species or pathogens recorded within or adjoining the survey areas were geo-referenced.

3. Receiving environment

3.1 Rathnew Stream catchment and survey area description

The proposed Tinakilly Demesne residential development is located 0.5km east of Rathnew, Co. Wicklow. The proposed development is bordered to the west by the Rossanna Lower Stream and to the north by the Rathnew Stream within the Vartry_SC_010 sub-catchment. The watercourses in the vicinity of the proposed residential development are small to medium-sized lowland depositing watercourses (FW2; Fossitt, 2000).

Land use practices in the wider survey area are dominated by non-irrigated arable land (CORINE 211) and pastures (231), comprising improved agricultural grassland (GA1; Fossitt, 2000) and arable crops (BC1). Predominantly, the watercourses flowed over areas of Lower-Middle Ordovician slate, sandstone, greywacke and conglomerate (Geological Survey of Ireland data).

Fisheries data was not available for the Rathnew Stream or Rossanna Lower Stream. However, Atlantic salmon (*Salmo salar*), brown trout and sea trout (*Salmo trutta*), European eel and lamprey (*Lampetra* sp.) are known from the wider Varty_SC_010 sub-catchment (Kelly et al., 2015).

3.2 EPA water quality data (existing data)

The following outlines the available water quality data for the watercourses in context of the proposed project. Only recent water quality (i.e., since 2015) is summarised below.

The Rathnew Stream rises near Glenealy, Co, Wicklow and flows in an easterly direction for approx. 11km before joining the Broad Lough estuary, 1.2km downstream of the survey area. There is a single EPA biological monitoring station on the watercourse. This site (station RS10R020600 in Rathnew) achieved **Q4 (good status)** in 2020. There is no biological water quality monitoring station on the Rossanna Lower Stream.

The Rathnew Stream and Rossanna Stream (both part of the Rathnew Stream_010 river waterbody) was of poor WFD status and considered 'at risk' in the 2013-2018 period. This was primarily due to urban pressures and domestic wastewater, in addition to agricultural pressures (EPA, 2021).

4. Results

The following section summarises the data compiled from the aquatic surveys on the Rossanna Lower Stream and Rathnew Stream. The physical instream characteristics are summarised to support overall value for fish, white-clawed crayfish and macrophyte/aquatic bryophyte communities. The quality of fisheries habitat for both salmonids and lamprey at each survey site is summarised below with further detail provided in **Appendix A**. Biological water quality (Q-sample) results are also summarised for $n=4$ riverine sampling sites and in **Appendix B**. Habitat codes are according to Fossitt (2000). Scientific names are provided at first mention only. Sites were surveyed on the 9th April 2021 during base flow conditions and dry, bright weather. An evaluation of the aquatic ecological importance of each survey site based on these aquatic surveys is provided and summarised in **Table 4.1**.

4.1 Aquatic survey site results

4.1.1 Site S1 – Rossanna Lower Stream

Site S1 was situated on the Rossanna Lower Stream, a small 1m wide lowland depositing stream (FW2) situated upstream of the proposed site boundary. The channel was shallow, averaging between 0.1m and 0.2m deep. The stream had been historically straightened but not deepened with low bank heights of 0.3-0.5m high. The profile comprised a mixture of riffle, glide and very localised pool. The stream bed comprised mixed medium and fine gravels with localised cobble and abundant silt. The substrata were heavily bedded with moderate to heavy siltation. The gravels were visible, but the interstitial spaces were blocked with some areas fully covered with silt. The channel supported no macrophytes apart from localised fool's watercress (*Apium nodiflorum*). The riparian zone supported ash (*Fraxinus excelsior*) and hawthorn (*Crataegus monoygna*) with localised elder (*Sambucus nigra*). The understory supported abundant bramble (*Rubus fruticosus* agg.) and ivy (*Hedera hibernica*) with lesser celandine (*Ficaria verna*) and meadow buttercup (*Ranunculus acris*) near the stream margin in addition to localised iris (*Iris psuedacorus*). The channel was bordered by rough pasture. Some fly tipping of rubbish was evident in the stream.

The stream flow was low at the time of survey, and it was not suitable for salmonids. However, the site was considered of some value to brook lamprey (*Lampetra planeri*) albeit the habitat quality was reduced due to compaction of soft sediment areas, which had a high clay fraction. The stream at this site was considered of some low value to European eel which may occur locally in pools. The site was unsuitable for white-clawed crayfish due to an absence of suitable refugia and the shallow nature of the small watercourse. No otter signs were recorded in the vicinity of the survey site and suitability was low.

Biological water quality, based on Q-sampling, was calculated as **Q3-4 (moderate 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 good quality of salmonid habitat, the small size of channel and limited aquatic importance overall, the aquatic ecological evaluation of site S1 was of **local importance (lower value) (Table 4.1)**.



Plate 4.1 Representative image of site S1 on the Rossanna Lower Stream, April 2022

4.1.2 Site S2 – Rossanna Lower Stream

Site S2 was situated on the lower reaches of Rosanna Lower Stream upstream of its confluence with the Rathnew Stream, approx. 280m downstream of site S1. The lowland depositing watercourse (FW2) was narrow and shallow, being 0.5m to 1m wide and between 0.1m and 0.3m deep. The bank heights were 0.5m. The stream had been re-sectioned locally along the field boundary but followed a natural course near its confluence with the Rathnew Stream. The profile was glide dominated with localised riffle. Pool was also present but very localised. The substrata comprised mixed medium and fine gravels with abundant silt and sand. The substrata were heavily bedded with heavy siltation. Gravels were more bedded and more heavily silted than upstream (site S1) with a higher silt loading. The channel did not support macrophytes apart from very localised water parsnip (*Berula erecta*). The riparian zone was open on the western bank and adjoined open semi-improved pasture (GA1) while the eastern bank supported a stock-proof dense hedgerow (WL1) of grey willow (*Salix cinerea*), bramble, gorse (*Ulex europaeus*) and elder.

Although improved compared to upstream, the flows and stream size at site S2 were not considered suitable for salmonids. However, during winter flows some salmonids may enter the stream from the adjoining Rathnew Stream, that was considered a significant salmonid watercourse (see below sections). The site was considered to have good potential for brook lamprey with abundant ammocoete burial habitat present. It also some moderate quality spawning areas featuring medium and fine gravels. The stream at this site was considered of some low value to European eel which may occur locally in pools. The site was unsuitable for white-clawed crayfish due to an absence of suitable refugia and the shallow nature of the small watercourse. No otter signs were recorded in the vicinity of the survey site and suitability was low.

Biological water quality, based on Q-sampling, was calculated as **Q3-4 (moderate 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 good quality of salmonid habitat, small size of channel and limited aquatic importance overall, the aquatic ecological evaluation of site S2 was of **local importance (lower value) (Table 4.1)**.



Plate 4.2 Representative image of site S2 on the Rossanna Lower Stream, April 2022

4.1.3 Site S3 – Rathnew Stream

Site S3 on the Rathnew Stream was a medium sized lowland depositing watercourse (FW2) that was 3-4m wide and between 0.1m and 0.5m deep. The bank heights were 1-1.2m high. The stream had been historically straightened and deepened through agricultural lands but showed good recovery and retained a high degree of naturalness. The stream profile was dominated by deeper glide with localised riffle and pool habitat. Pool habitat was associated with overhanging willow limbs and root systems. The substrata comprised mixed small cobble, coarse and medium gravels with more localised fine gravels. Depositing littorals also supported beds of sand and silt. The substrata were partially bedded with moderate siltation (silt plumes underfoot and deposition in margins). The channel was too shaded to support macrophytes apart from very localised hemlock water dropwort (*Oenanthe crocata*). The riparian zone supported mature willow (*Salix* spp.) on the northern bank with ivy and bramble in the understories, while the southern bank supported semi-improved pasture with scattered gorse scrub (WS1).

The stream at this site was considered an excellent nursery for salmonids due to the presence of abundant well-oxygenated glide and riffle habitat (**Appendix A**). Spawning habitat was also of good

quality throughout, with mixed gravels adjoining deeper glide and pool being abundant. Holding habitat was of good quality locally but improved downstream where the frequency of deep pools increased. The site was also a very good brook lamprey nursery with both spawning areas and soft sediment ammocoete burial areas present. The stream at this location was also considered of good value for European eel given undercut banks with pool and high shading. While the Rathnew Stream had some suitability for white-clawed crayfish none were recorded present. The Rathnew Stream was considered a very good foraging area for otter with two spraint sites recorded in the vicinity of the site. These were recorded on a tyre in the channel (ITM 729084, 695802) and on grey willow limbs (ITM 729064, 695788). Salmonid remains were present in the spraint.

Biological water quality, based on Q-sampling, was calculated tentatively (due to deep glide habitat) as **Q4 (good 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 Rathnew Stream had very high fisheries value (i.e. high suitability for lamprey, salmonids and European eel) in addition to supporting an otter population and **Q4 (good status)** water quality, the site was considered of **local importance (higher value) (Table 4.1)**.



Plate 4.3 Representative image of site S3 on the Rathnew Stream, April 2022

4.1.4 Site S4 - Rathnew Stream

Site S4 on the Rathnew Stream was situated along the north-eastern boundary of the study area, approx. 0.35km downstream of site S3. The Rathnew Stream at this location was a lowland depositing watercourse (FW2) that had been historically deepened but retained a sinuous profile with a well-defined thalweg. The stream was 3.5m-4m wide and between 0.2m and 1.1m deep, being variable due to the mixed profile comprising equal proportions of riffle, pool and glide. The bank heights were between 2m and 2.5m high, exemplifying historical deepening relative to channel width. Pool habitat

was more frequent than upstream due to willow root systems and large woody debris that encouraged erosion on meanders and pool formation. The channel bed supported mixed small cobble, coarse, medium and fine gravels with localised boulder. Depositing littorals supported soft sand and silt (near pools). The substrata were predominantly loose with light to moderate siltation only. The channel supported no macrophytes apart from hemlock water dropwort that was present where light permitted growth in open shallow glide areas. The muddy loam banks supported the liverwort species *Conocephalum conicum* and *Pellia endiviifolia*. The riparian areas supported abundant mature willow (*Salix* spp.) with more occasional alder (*Alnus glutinosa*). The understories supported dense bramble with occasional gorse. The channel was bordered by improved grassland (GA1).

The Rathnew Stream at site S4 was considered a very good quality nursery for salmonids due to the presence of fast-moving glide and riffle with mixed cobbles and gravels (**Appendix A**). It was also a very good spawning area due to mixed gravels adjoining pool. A 0+ Atlantic salmon fry was recorded in a Q-sample confirming the presence of the species within the watercourse (**Plate 4.5**). Holding habitat was of excellent quality due to abundant deep pools with overhanging trees providing cover. The site was also a very good brook lamprey nursery with both spawning areas and ammocoete burial areas present. The channel was also considered of very good value for European eel given undercut banks with deep pool and high shading from overhanging trees. While the Rathnew Stream had some suitability for white-clawed crayfish none were recorded present. The Rathnew Stream was also considered a very good foraging area for otter with a spraint site recorded on a willow limb (ITM 729281, 695914) and a couch site recorded on a moss-covered willow limb (ITM 729278, 695902) in the vicinity of the site (**Plate 4.6**). Salmonid remains were present in the spraint.

Biological water quality, based on Q-sampling, was calculated tentatively (due to deep glide habitat) as **Q4 (good 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 Rathnew Stream had very high fisheries value (i.e. high suitability for lamprey, salmonids and European eel) in addition to supporting an otter population and **Q4 (good status)** water quality, the site was considered of **local importance (higher value)** (**Table 4.1**).



Plate 4.4 Representative image of site S4 on the Rathnew Stream, April 2022



Plate 4.5 0+ Atlantic salmon fry recorded in Q-sample, April 2022 (released back to the Rathnew Stream)



Plate 4.6 Otter couch on willow limb with very frequently used spraint site

4.2 Biological Water Quality

No rare or protected macro-invertebrate species (according to national red lists) were recorded in the biological water quality samples taken from $n=4$ survey sites sampled for macro-invertebrates on the Rossanna Lower Stream and Rathnew Stream.

Based on a combined assessment of stream condition and also on review of the taxonomic composition of the samples relative to the EPA groups (ranging from clean water indicators to pollution indicators) Q-ratings were determined (as per Toner et al., 2005). Following this approach, the samples collected from the Rossanna Lower Stream achieved **Q3-4 (moderate status)**. The bed of the Rossanna Lower Stream suffered from moderate to heavy siltation at the time of survey. The channel had also been historically realigned and bordered semi-improved grassland that contributed enrichment and siltation pressures (i.e. riparian areas were open along the field boundary with no buffer). Upstream of the study area, suburbanisation pressures (i.e. storm drainage) were evidently impacting the stream. These pressures were reflected in the macro-invertebrate composition that supported only small numbers of clean water indicator mayflies including *Rhithrogena semicolorata* (EPA group A) and *Alainites muticus* (EPA group B) with a dominance of more pollution tolerant group C taxa. The Rossanna Lower Stream also supported the pollution indicator species *Asellus aquaticus* in small numbers. The condition of the stream coupled with the macro-invertebrate composition indicated both sites on the Rossanna Lower Stream were not achieving target **Q4 (good status)** biological water quality and, therefore, did not meet the good status requirements (i.e., $\geq Q4$ or EQR equivalent of 0.8) of the Water Framework Directive (2000/60/EC) and the European Union Environmental Objectives (Surface Waters) (Amendment) Regulations 2019 (S.I. No. 77/2019) (**Appendix B**).

The Rathnew Stream, while suffering from some siltation and enrichment pressures, had a much-improved riverbed quality from that observed on the Rossanna Lower Stream. The river, despite being historically deepened, showed very good recovery. The overhanging trees and large woody debris present strongly benefited the river ecology by providing shading and improving local flow velocities and channel heterogeneity. This was reflected in the **Q4 (good status)** water quality recorded at the site. therefore, both sites on the Rathnew Stream met the good status requirements (i.e., $\geq Q4$ or EQR equivalent of 0.8) of the Water Framework Directive (2000/60/EC) and the European Union Environmental Objectives (Surface Waters) (Amendment) Regulations 2019 (S.I. No. 77/2019) (**Appendix B**). The invertebrate community supported high numbers of clean water indicator mayflies including *Rhithrogena semicolorata* (EPA group A) and *Alainites muticus* (EPA group B). The Rathnew Stream also supported the cased caddis species *Sericostoma personatum* and *Odontocerum albicorne* (both EPA group B clean water indicators).

4.3 Aquatic ecological evaluation

An aquatic ecological evaluation of $n=4$ survey sites was based on the results of the aquatic and fisheries appraisals and are summarised in **Table 4.1**.

No rare or protected macro-invertebrate species (according to national red lists) were recorded in the biological water quality samples collected from a total of $n=4$ sites.

No rare macrophytes or rare aquatic bryophytes were recorded during the survey. No examples of the Annex I habitats 'Water courses of plain to montane levels with the *Ranunculion fluitantis* and *Callitriche-Batrachion* vegetation and aquatic mosses [3260]' were recorded at the $n=4$ survey sites.

The Rossanna Lower Stream at sites S1 and S2 was evaluated as **local importance (lower value)** in terms of aquatic ecology, primarily due to the absence of aquatic species/habitats of high conservation value or Q4 (good status) water quality. The downstream-connecting Rathnew Stream was evaluated as **local importance (higher value)** at sites S3 and S4 primarily due to the high suitability and or confirmed presence fish of conservation value (salmonids, lamprey and European eel), in addition to utilisation by otter and **Q4 (good status)** biological water quality.

Table 4.1 Aquatic ecological evaluation summary of the aquatic survey sites according to NRA (2009) criteria

Site no.	Watercourse	EPA code	Evaluation of importance	Rationale summary
S1	Rossanna Lower Stream	10R19	Local importance (lower value)	Poor quality salmonid habitat, moderate lamprey & European eel habitat; no suitability for white-clawed crayfish, none recorded; poor suitability for otter, no signs recorded; Q3-4 (moderate status) water quality; no aquatic species or habitats of high conservation value
S2	Rossanna Lower Stream	10R19	Local importance (lower value)	Poor quality salmonid habitat, moderate lamprey & European eel habitat; no suitability for white-clawed crayfish, none recorded; poor suitability for otter, no signs recorded; Q3-4 (moderate status) water quality; no aquatic species or habitats of high conservation value
S3	Rathnew Stream	10R02	Local importance (higher value)	Excellent quality salmonid nursery habitat with good quality spawning and good holding habitat; good quality <i>Lampetra</i> sp. nursery & spawning habitat; good-quality European eel habitat; good suitability for white-clawed crayfish but none recorded; otter signs recorded at the site; Q4 (good status) water quality; no other recorded aquatic species or habitats of high conservation value
S4	Rathnew Stream	10R02	Local importance (higher value)	Good quality salmonid nursery & spawning habitat with good quality holding habitat (0+ Atlantic salmon fry recorded via kick sampling); good quality <i>Lampetra</i> sp. nursery & spawning habitat; good quality European eel habitat; good suitability for white-clawed crayfish but none recorded; otter signs recorded at the site; Q4 (good status) water quality; no other recorded aquatic species or habitats of high conservation value

* **Conservation value:** Atlantic salmon (*Salmo salar*), sea lamprey (*Petromyzon marinus*), brook lamprey (*Lampetra planeri*), river lamprey (*Lampetra fluviatilis*), white-clawed crayfish (*Austropotamobius pallipes*) and otter (*Lutra lutra*) are listed under Annex II of the Habitats Directive [92/42/EEC]. Atlantic salmon, river lamprey and white-clawed crayfish are also listed under Annex V of the Habitats Directive [92/42/EEC]. 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).

5. Discussion

The Rossanna Lower Stream at sites S1 and S2 was evaluated as **local importance (lower value)** in terms of aquatic ecology. This was primarily due to the absence of aquatic species/habitats of high conservation value but also failure of the sites to achieve target Q4 (good status) biological water quality (see **section 5.2** below). Whilst the sites were not considered suitable for salmonids due to low flows and evident siltation pressures, there was, however, some moderate to good suitability for lamprey (*Lampetra* sp.), particularly in terms of soft sediment larval (ammocoete) habitat (**Appendix A**). Overall historical straightening, siltation, enrichment pressures and the clearance of mature trees on the northern and western banks of the stream reduced its ecological value.

The downstream-connecting Rathnew Stream was evaluated as **local importance (higher value)** at sites S3 and S4 given the high suitability for fish of conservation value, namely salmonids (including Atlantic salmon; **Plate 4.5**), lamprey and European eel. The site was also utilised by Annex II otter and achieved Q4 (good status) biological water quality. Site 3 provided excellent quality salmonid nursery habitat with good quality spawning and good holding habitat, in addition to good quality *Lampetra* sp. nursery & spawning habitat (**Appendix A**). There was also good potential for Red-listed (King et al., 2011) European eel in localised deeper pool areas.

Whilst there was some physical suitability in the Rathnew Stream for Annex II white-clawed crayfish, none were recorded during targeted surveys and there are no records for the species in the wider Vartry River catchment (NPWS & NBDC data). The presence of a mature riparian zone with overhanging willow, woody debris and a recovering channel profile (despite historical deepening) on the Rathnew Stream were important features supporting the high ecological value of the river.

6. Recommendation

Considering the importance of the Rathnew Stream as a salmonid bearing watercourse with connectivity to Broad Lough an important sea trout estuarine habitat, it is vitally important to preserve the fisheries value of the watercourse. Several high-level recommendations are presented below but do not represent the full suite of measures that would need to be applied to protect watercourses. During the construction phase a CEMP should be formulated to ensure the protection of watercourses in consultation with IFI and the NPWS. This would include control of pollutants at source and monitoring discharges to the adjoining Rossanna and connecting Rathnew Streams. The riparian zone of both watercourses should be strictly protected with a minimum buffer of 15m from the development. This would also help protect identified otter foraging and or resting and breeding habitat. No storm water discharges should be made directly to the Rathnew Stream and rather only to the adjoining Rossanna Lower Stream given its lower ecological value. A drainage plan for the operational phase of the development should be developed with regular maintenance of the drainage system to prevent impacts from storm water pollution to the river system. Consideration of open swale systems and or natural wetland attenuation for storm drainage prior to discharge to the Rossanna Stream are extremely important to curb the threat of stormwater pollution which is one of the primary threats to catchments subject to suburbanisation pressures.

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8. Appendix A – fisheries habitat

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Table 8.1 Life Cycle Unit scores for salmonid habitat at the $n=4$ survey sites (lower scores = superior habitat)

Site	Watercourse	Spawning	Nursery	Holding	Total score	Salmonid habitat value	Salmonids recorded
S1	Rossanna Lower Stream	4	4	4	12	Poor	Not observed
S2	Rossanna Lower Stream	4	4	4	12	Poor	No observed
S3	Rathnew Stream	1	1	2	4	Excellent	Yes, seen present
S4	Rathnew Stream	2	2	1	5	Excellent	Yes, seen present; 0+ Atlantic salmon recorded via kick sampling

Table 8.2 Lamprey Habitat Quality Index (LHQI) scores for lamprey habitat at the $n=4$ survey sites (lower scores = superior habitat)

Site	Watercourse	Spawning	Nursery	Total score	Lamprey habitat value	Lamprey recorded
S1	Rossanna Lower Stream	3	3	6	Moderate	Not recorded but some low suitability
S2	Rossanna Lower Stream	3	2	5	Good	Good nursery habitat in soft sediment deposits
S3	Rathnew Stream	2	2	4	Good	Not observed but good suitability
S4	Rathnew Stream	2	2	4	Good	Not observed but good suitability

9. Appendix B – Q-sample results (biological water quality)

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Table 8.1 Macro-invertebrate Q-sampling results for aquatic survey sites S1, S2, S3 & S4

Group	Family	Species	Rossanna Lower Stream		Rathnew Stream		EPA group
			S1	S2	S3	S4	
Ephemeroptera	Heptageniidae	<i>Rhithrogena semicolorata</i>	3	4	39	44	A
Ephemeroptera	Baetidae	<i>Alainites muticus</i>	1	2	18	12	B
Trichoptera	Limnephilidae	<i>Potamophylax cingulatus</i>	2				B
Trichoptera	Limnephilidae	<i>Limnephilus</i> sp.		1		1	B
Trichoptera	Odontoceridae	<i>Odontocerum albicorne</i>			1		B
Trichoptera	Sericostomatidae	<i>Sericostoma personatum</i>	5	10	1	1	B
Ephemeroptera	Baetidae	<i>Baetis rhodani</i>	26	35	19	11	C
Ephemeroptera	Ephemerellidae	<i>Serratella ignita</i>	1	1	2	4	C
Trichoptera	Hydropsychidae	<i>Hydropsyche instabilis</i>	4	2	6	17	C
Trichoptera	Hydropsychidae	<i>Hydropsyche siltalai</i>	2	1		6	C
Trichoptera	Polycentropodidae	<i>Plectrocnemia conspersa</i>		1			C
Trichoptera	Psychomyiidae	<i>Metalype fragilis</i>			1		C
Trichoptera	Rhyacophilidae	<i>Rhyacophila dorsalis</i>				1	C
Mollusca	Lymnaeidae	<i>Radix baltica</i>	1				C
Coleoptera	Elmidae	<i>Limnius volckmari larva</i>			4	4	C
Coleoptera	Hydraenidae	<i>Hydraena gracilis</i>				1	C
Diptera	Chironomidae	Non- <i>Chironomus</i> spp.	34	7	3	5	C
Diptera	Pediciidae	<i>Dicranota</i> sp.	8		12	40	C
Diptera	Pediciidae	<i>Pedicia</i> sp.	3	2			C
Crustacea	Gammaridae	<i>Gammarus duebeni</i>	11	36	5	8	C
Arachnida	Hydrachnidiae	Unidentified species	3			1	C
Mollusca	Tateidae	<i>Potamopyrgus antipodarum</i>	36	48	13	5	D
Hirudinidae	Erpobdellidae	<i>Erpobdella</i> sp.	2				D
Crustacea	Asellidae	<i>Asellus aquaticus</i>	4	2			D

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Group	Family	Species	Rossanna Lower Stream		Rathnew Stream		EPA group
			S1	S2	S3	S4	
Diptera	Chironomidae	<i>Chironomus spp.</i>	3				E
Nematomorpha	Gordiidae	Unidentified species	1			1	n/a
Annelidae	Oligochaeta	Unidentified species	7	1			n/a
Abundance			157	153	124	162	
Q-rating			Q3-4	Q3-4	Q4	Q4	
WFD status			Mod	Mod	Good	Good	

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