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# Natura Impact Statement (NIS)

Fermoy Weir Remediation and Fish Bypass Channel,
Fermoy, Co, Cork.

On Behalf of
Cork County Council

May 2022

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environmental consultants

| Project | Natura Impact Statement (NIS) for Fermoy Weir Remediation and Fish Bypass Channel, Fermoy, Co, Cork. | |
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# 1. Introduction

## 1.1 Background

The information in this report has been compiled by DixonBrosnan Environmental Consultants, on behalf of the applicant. It provides information on and assesses the potential for the proposed development at Fermoy, Co. Cork to impact on any European sites within its zone of influence. DixonBrosnan have previously prepared a Report in Support of Appropriate Assessment (AA) Screening and this has been submitted with this planning application. This report determined that a Natura Impact Statement (NIS) was required for the proposed development.

The Habitats Directive (92/43/EEC) and the associated Birds Directive (2009/147/EC) are transposed into Irish legislation by Part XAB of the 2000 Act and the Birds and Natural Habitats Regulations 2011. Approval of the NIS is required from An Bord Pleanála (ABP) through the Part XAB planning procedure under section 177AE (relating to Appropriate Assessment) of the Planning and Development Act, 2000, as amended. Accordingly, this NIS for Appropriate Assessment comprises a compilation of the information relevant to the competent authority's assessments relating to the potential significant impacts of the proposed development on European sites within the surrounding area.

## 1.2 Report Contributors

This report was prepared by Carl Dixon MSc (Ecological Monitoring) and Dr. Sorcha Sheehy PhD (Ecology/ornithology). Fieldwork was conducted by Carl Dixon MSc (Ecological Monitoring), Mark Donnelly BSc (Forestry), Ross Macklin BSc (Applied Ecology), Pascal Sweeny BSc (Zoology), Cian Gill MSc (Ecological Monitoring).

Carl Dixon MSc (Ecology) is a senior ecologist who has over 20 years' experience in ecological and water quality assessments. Carl Dixon holds an Honours Degree (BSc) in Ecology and a Masters (MSc) in Ecological Monitoring from UCC. He is a senior ecologist who has over 25 years' experience in ecological assessment. Prior to setting up DixonBrosnan Environmental Consultants in 2000, Carl set up and ran Core Environmental Services which included Rural Environmental Protection Scheme (REPS) planning for landowners and ecological assessments. Carl has particular experience in freshwater ecology including electrofishing fish stock assessments and water quality assessments. He also has considerable experience in habitat mapping and mammal ecology including survey work and reporting in relation to badgers and bats. Other competencies include surveys for invasive species and bird surveys. Carl has extensive experience with regards to EIAR and NIS mitigation and impact assessment. He has particular experience in large-scale industrial developments with extensive experience in complex assessments as part of multi-disciplinary teams. Such projects include gas pipelines, incinerators, electrical cable routes, oil refineries and quarries.

Dr. Sorcha Sheehy PhD (ecology/ornithology) is an experienced ecological consultant specialising in bird behaviour. Sorcha received a BSc in Applied Ecology from UCC and subsequently went on to receive a PhD in behavioural ornithology at UCC. During her PhD research, Sorcha studied bird-aircraft collision with a particular focus on bird behaviour, included field-based behavioural observations at airports, bird cadaver examination and collision classification and the use of radar tracking to model collision risk. Sorcha has worked

for over 12 years in a professional ecology role and specialises in the coordination of ecology projects and assessments. She has coordinated and contributed to Habitats Directive Assessments (AA screenings and NIS) and Environmental Impact Assessment Reports (EIAR) for a range of small and large-scale projects with particular expertise in assessing impacts on birds. Notable projects include Arklow Bank Wind Park, Shannon Technology and Energy Park and Waste to Energy Facility Ringaskiddy.

Ross Macklin BSc (Hons) Applied Ecology HDip GIS Dip IPM MCIEEM IFM. Ross is an environmental scientist specialising in freshwater and fisheries ecology. He studied a BSc in Applied Ecology at UCC and later completed a higher diploma in Geographical Information Systems and Integrated Pest Management. He is currently completing his PhD in UCC. in the area of fisheries ecology. Ross has an in-depth knowledge of all freshwater ecosystems and riparian corridors. He has undertaken river habitat, lake habitat, wetland habitat and fisheries assessments in professional work for 16 years. His specialist freshwater experience lies in biological and physiochemical water quality analysis, fisheries ecology, riparian habitat assessments, habitat mapping, protected species, geographical information systems, ecological design and invasive species. Ross has expert experience in identifying and assessing macrophyte plant, aquatic bryophtes, fish and macro-invertebrates from a variety of aquatic habitats. He routinely undertakes Habitat Regulations Assessments, Fisheries Assessments, Protected Species Surveys, Invasive Species Surveys, Habitat & Surface Water Management Plans, CEMP, EcIA and EIAR reporting.

Pascal Sweeney of Sweeney Consultancy is a freshwater biologist, specialising in aquatic invertebrates. Following his B.Sc. degree in zoology, he was employed by UCD as a Research Assistant to monitor biological parameters in the Killarney Lakes. This led to a research MSc on nutrient enrichment impacts on lake invertebrates. He is currently the Honorary Secretary of the Irish Freshwater Sciences Association. His current work is focused mainly on biological water quality assessments (Q-value; SSRS) and protected species surveys. Every summer from 2012 to 2021, he has been engaged by EPA for the River Monitoring Programme. He has also carried out a large number of other water quality surveys for Irish Water, Inland Fisheries Ireland, Coillte, local authorities (Wexford, Kilkenny, Carlow, Kildare Waterford, Tipperary and Offaly Co. Cos.), and industries (e.g. Glanbia, Dairygold, Irish Sugar, Irish Distillers, Lisheen Mine, Carbury Mushrooms). Pascal has conducted Freshwater Pearl Mussel surveys in the catchments of the Slaney, Barrow, Nore, Suir, Munster Blackwater, Lee, Roury, Kerry Blackwater, Roughty, Flesk, Finnihy, Behy, Owennafeanna, Creagh, Colligan, Tay, Clady and Corrib. White-clawed Crayfish surveys conducted in the catchments of the Liffey, Barrow, Nore, Suir, Munster Blackwater, Lee and Shannon.

Mark Donnelly (Forestry) holds a BSc. Hons in Forestry from Bangor University, Wales, and is a member of the Institute of Chartered Foresters. He worked as an arboricultural consultant for the National Trust in Wales for 22 years and was a lecturer in Forest Ecology at Bangor University. In Ireland, he has completed landscape assessments for a range of projects including wind farms, quarries, local authorities, housing developments, roads and pipelines.

Cian Gill MSc (Ecology) is a qualified ecologist with ten years' experience working with wildlife and ecology-based NGOs and public bodies in Ireland, the UK and the US. Past projects include invasive species planning for the city of Rosemount, Minnesota, and the Under The Sea project for Essex Wildlife Trust. Recent projects include ecological reports for Cork-based housing and private developments.

# 2. Regulatory Context and Appropriate Assessment Procedure

## 2.1 Regulatory Context

The Habitats Directive (Council Directive 92/43/EEC on the *Conservation of Natural Habitats and of Wild Fauna and Flora*) aims to maintain or restore the favourable conservation status of habitats and species of community interest across Europe. The requirements of these directives are transposed into Irish law through the European Communities (Birds and Natural Habitats Regulations; S.I. No. 477 of 2011). The Habitats Directive (92/43/EEC) and the associated Birds Directive (2009/147/EC) are transposed into Irish legislation by Part XAB of the 2000 Act and the Birds and Natural Habitats Regulations 2011.

Under the Directive a network of sites of nature conservation importance have been identified by each Member State as containing specified habitats or species requiring to be maintained or returned to favourable conservation status. In Ireland the network consists of SACs and SPAs, and also candidate sites, which form the Natura 2000 network.

Article 6(3) of Council Directive 92/43/EEC of 21 May 1992 on the *Conservation of Natural Habitats and of Wild Fauna and Flora* (as amended) (hereafter 'the Habitats Directive') requires that, any plan or project not directly connected with or necessary to the management of a designated site, but likely to have a significant effect thereon, either individually or in combination with other plans or projects, shall be subject to appropriate assessment of its implications for the site in view of the site's conservation objectives. A competent authority (e.g. the EPA or Local Authority) can only agree to a plan or project after having determined that it will not adversely affect the integrity of the site concerned.

The possibility of a significant effect on a designated or "European" site has generated the need for an appropriate assessment to be carried out by the competent authority for the purposes of Article 6(3). The requirements arising out of Article 6(3) are transposed into Irish law by Part 5 of the Habitats Regulations and Part XAB of the Planning and Development Act, and the assessment is referred to as "Appropriate Assessment" (AA).

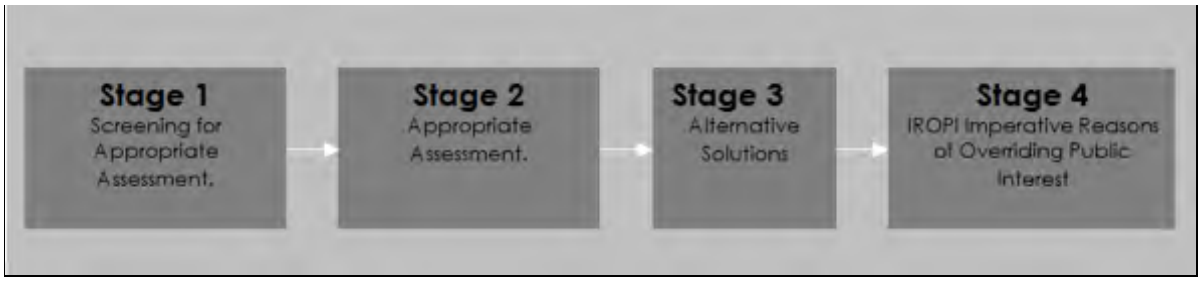
A Stage Two Appropriate Assessment is required if it cannot be excluded, on the basis of objective information, that the proposed development, individually or in combination with other plans or projects, will have a significant effect on a European site. The first (Screening) Stage for appropriate assessment operates merely to determine whether a (Stage Two) Appropriate Assessment must be undertaken on the implications of the plan or project for the conservation objectives of relevant European sites.

DixonBrosnan have previously prepared a Report in Support of Appropriate Assessment (AA) Screening and this has been submitted with this planning application. This report determined that a Natura Impact Statement (NIS) was required for the proposed development. In accordance with Section 177AE of the Act, it is therefore required for Cork County Council(CCC) to submit the proposed development, including the NIS, to An Bord Pleanála for approval.

## 2.2 Appropriate Assessment Procedure

The assessment requirements of Article 6(3) establish a stage-by-stage approach. This assessment follows the stages outlined in the 2001 European Commission publications

"*Assessment of plans and projects significantly affecting Natura 2000 sites: methodological guidance on the provisions of Articles 6(3) and 6(4) of the Habitats Directive 92/43/EEC*" (EC 2001), *Managing Natura 2000 Sites: the provisions of Article 6 of the 'Habitats' Directive 92/43/EEC (Draft)* Office for Official Publications of the European Communities, Luxembourg (EC, 2015) and *Assessment of plans and projects in relation to Natura 2000 sites - Methodological guidance on Article 6(3) and (4) of the Habitats Directive 92/43/EEC* (EC 2021).




The stages are as follows:

Stage One: Screening — the process which identifies any appreciable impacts upon a Natura 2000 site of a project or plan, either alone or in combination with other projects or plans, and considers whether these impacts are likely to be significant;

Stage Two: Appropriate assessment — the consideration of the impact on the integrity of the Natura 2000 site of the project or plan, either alone or in combination with other projects or plans, with respect to the site's structure and function and its conservation objectives. Additionally, where there are adverse impacts, an assessment of the potential mitigation of those impacts;

Stage Three: Assessment of alternative solutions: The process which examines alternative ways of achieving the objectives of the project or plan that avoid adverse impacts on the integrity of the Natura 2000 site. It is confirmed that no reliance is placed by the developer on Stage Three in the context of this application for development consent;

Stage Four: Assessment where no alternative solutions exist and where adverse impacts remain — an assessment of compensatory measures where, in the light of an assessment of imperative reasons of overriding public interest (IROPI), it is deemed that the project or plan should proceed (it is important to note that this guidance does not deal with the assessment of imperative reasons of overriding public interest). Again, for the avoidance of doubt, it is confirmed that no reliance is placed by the developer on Stage Four in the context of this application for development consent.

It is the responsibility of the competent authority, in this instance An Bord Pleanála, to make a decision on whether or not the proposed development should be approved, taking into consideration any potential impact upon any Natura 2000 site within its zone of influence.

This report has been prepared with regard to the following guidance documents, where relevant.

- *Managing Natura 2000 Sites: The Provision of Article 6 of the Habitats Directive 92/43/EEC* (European Commission (EC), 2018);

- *Assessment of Plans and Projects Significantly Affecting Natura 2000 sites: Methodical Guidance on the Provisions of Article 6(3) and (4) of the Habitats Directive 92/43/EEC* (European Commission (EC), 2001);
- *Assessment of plans and projects in relation to Natura 2000 sites - Methodological guidance on Article 6(3) and (4) of the Habitats Directive 92/43/EEC* (European Commission, (EC) 2021).
- *Guidance Document on Article 6(4) of the Habitats Directive 92/43/EEC* (European Commission, (EC) 2007);
- *Appropriate Assessment of Plans and Projects in Ireland – Guidance for Planning Authorities* (Department of Environment, Heritage and Local Government, 2010 revision);
- *Appropriate Assessment under Article 6 of the Habitats Directive; Guidance for Planning Authorities. Circular NPW 1/10 and PSSP 2/10* (Department of Environment, Heritage and Local Government, 2010);
- *Guidelines for Good Practice Appropriate Assessment of Plans under Article 6(3) Habitats Directive* (International Workshop on Assessment of Plans under the Habitats Directive, 2011
- Practice Note PN01 Appropriate Assessment Screening for Development Management Office of the Planning Regulator (2021) *Assessment of plans & projects in relation to N2K sites – Methodological Guidance* (EC 2021);
- *Guidance document on the strict protection of animal species of Community interest under the Habitats Directive* (EC 2021) and
- C*ommunication from the Commission on the precautionary principle. European Commission* (2000).

### 2.3 Screening of Proposed Development

In accordance with the Department of Environment Heritage and Local Government (DoEHLG) Guidelines screening is the process that addresses two tests of Article 6(3) of the Habitats Directive:

I. *whether a plan or project is directly connected to or necessary for the management of the site, and*

II. *whether a plan or project, alone or in combination with other plans and projects, is likely to have significant effects on a European site in view of its conservation objectives.*

If the effects are deemed to be significant, potentially significant, or uncertain, or if the screening process becomes overly complicated, then the process must proceed to Stage 2. The screening assessment for the operations follows the following steps in accordance with the DoEHLG guidelines:

1) Description of plan or project, and local site or plan area characteristics.

2) Identification of relevant European sites, and compilation of information on their qualifying interests and conservation objectives.

3) Assessment of likely effects – direct, indirect and cumulative – undertaken on the basis of available information as a desk study or field survey or primary research as necessary.

4) Screening statement with conclusions.

### 2.4 Conclusions of Screening Report

An Appropriate Assessment Screening Report was previously prepared by DixonBrosnan in respect of this project (*Report in Support of Appropriate Assessment Screening Fermoy Weir Remediation and Fish Bypass Channel, Fermoy, Co. Cork* DixonBrosnan, 2022). This report has also been submitted with this planning application.

In accordance with the European Commission Methodological Guidance (EC 2018), the AA screening carried out an assessment of Natura 2000 sites which could potentially be within the zone of influence of the proposed development. Two Natura sites were identified i.e. Blackwater River (Cork/Waterford) SAC (site code 002170) and Blackwater Callows SPA (site code 004094). A source-pathway-receptor link was identified between the proposed development and the Blackwater River (Cork/Waterford) SAC (in which the proposed development site is located) via several potential pathways i.e. habitat loss, direct and indirect injury or morality to qualifying species, impacts on water quality, disturbance or spread of invasive species and biosecurity risk barriers to movement during construction or operational phase, changes in hydrological regimes during operation. A source-pathway-receptor link was also identified between the proposed development and the Blackwater Callows SPA (located 1.4km northwest of the proposed development site) via several potential pathways i.e., disturbance of *ex situ* foraging habitat and impacts on water quality during construction.

Following a detailed assessment of the construction and operational impacts on the proposed development. The screening report concluded that the only European site for which potential significant impacts could not be ruled out was the Blackwater River (Cork/Waterford) SAC. Potential significant impacts which were screened in for further assessment in the NIS included habitat loss, deterioration in water quality (and sedimentation), direct injury/mortality, noise/disturbance impacts and the spread of invasive species during construction, changes in hydrological regime during operation and barriers to movement, increased predation and impacts on prey availability for Otter during construction and operation. The Qualifying Interests (QI) for the Blackwater River (Cork/Waterford) SAC for which the screening report determined potential significant effects may arise are detailed below in **Table 1**.

Significant impacts on the Blackwater Callows SPA were screened out. While the AA screening noted that Special Conservation Interest (SCI) waterbirds and wildfowl could occur within and in the vicinity of the proposed development site, the absence of high value habitat, the presence of large areas of similar habitat nearby and existing levels of disturbance at the site no impacts on SCI species are predicted to occur.

**Table 1. Identification of relevant Natura 2000 sites. All Natura 2000 sites and QI's screened in for AA are highlighted (in bold).**

| Natura 2000 site | Qualifying Interest/Special Conservation Interest*<br><br>(*Screened in QI's/SCI's In Bold) | Potential Impacts | Screened In/Out |
|---|---|---|---|
| **Blackwater River (Cork/Waterford) SAC** | Estuaries [1130]<br><br>Mudflats and sandflats not covered by seawater at low tide [1140]<br><br>Perennial vegetation of stony banks [1220]<br><br>Salicornia and other annuals colonising mud and sand [1310]<br><br>Atlantic salt meadows (*Glauco-Puccinellietalia maritimae*) [1330]<br><br>Mediterranean salt meadows (*Juncetalia maritimi*) [1410] | These habitats are located a significant distance from the proposed development site. Given that there are no significant aqueous discharges associated with the proposed development, the robust nature of these habitats and the dilution available within the River Blackwater, no impact on these qualifying habitats is predicted to occur. | Screened Out |
| | **Water courses of plain to montane levels with the *Ranunculion fluitantis* and *Callitricho-Batrachion* vegetation [3260]** | Part of the proposed development site is located within the Blackwater River (Cork/Waterford) SAC and this habitat type was recorded within the proposed development site boundary.<br><br>Habitat loss, deterioration in water quality, sedimentation and invasive species impacts during construction as well as changes in hydrological regime during operation have the potential to adversely affect the Conservation Objectives for this Qualifying Interest | Screened in |

| Natura 2000 site | Qualifying Interest/Special Conservation Interest*<br><br>(*Screened in QI's/SCI's In Bold) | Potential Impacts | Screened In/Out |
|---|---|---|---|
| | **Alluvial forests with *Alnus glutinosa* and *Fraxinus excelsior* (*Alno-Padion, Alnion incanae, Salicion albae*) [91E0]** | A small area of woodland which corresponds loosely to 91A0 habitat was identified through a desktop survey, 700m upstream of the proposed development site. Further assessment of this woodland is carried out in the NIS. Changes in hydrological regimes and flows during operation could potentially impact on this habitat. | Screened in |
| | Old sessile oak woods with Ilex and Blechnum in the British Isles [91A0]<br><br>**Taxus baccata* woods of the British Isles Under Review [91J0] | There are no Old sessile oak woods with Ilex and Blechnum in British Isles habitat, or *Taxa baccata* woods within or in proximity to the proposed development site. | Screened out |
| | ***Margaritifera margaritifera* (Freshwater Pearl Mussel) [1029]**<br><br>***Austropotamobius pallipes* (White-clawed Crayfish) [1092]**<br><br>***Petromyzon marinus* (Sea Lamprey) [1095]**<br><br>***Lampetra planeri* (Brook Lamprey) [1096]**<br><br>***Lampetra fluviatilis* (River Lamprey) [1099]**<br><br>***Salmo salar* (Salmon) [1106]**<br><br>***Alosa fallax fallax* (Twaite Shad) [1103]** | These species Inhabit and/or migrate through freshwater and thus could be affected by habitat loss, changes in water quality, direct/indirect injury and mortality during construction as well as barriers to movement during construction and operation.<br><br>Impacts on prey availability along with noise and disturbance could impact on Otter. Lighting disturbance and increased predation risk during passage through the fish bypass channel may impact on qualifying fish species. | Screened In |

| Natura 2000 site | Qualifying Interest/Special Conservation Interest*<br><br>(*Screened in QI's/SCI's In Bold) | Potential Impacts | Screened In/Out |
|---|---|---|---|
| | ***Lutra lutra* (Otter) [1355]** | | |
| | *Trichomanes speciosum* (Killarney Fern) [1421] | Killarney fern generally requires specific habitat requirements which are found in dripping caves, cliffs, crevices and gullies by waterfalls, crevices in woodland, and occasionally on the floor of damp woodland - all deeply shaded humid habitats. No habitat suitable for this species occurs within the proposed development area and no potential impact on this species has been identified. | Screened Out |

## 2.3 Consultation

Consultation has been carried out the National Parks and Wildlife Service (NPWS) and Inland Fisheries Ireland (IFI) at all stages of this project. A letter was received from the Development Applications Unit (DAU) of the Department of Culture, Heritage and the Gaeltacht regarding the proposed development. The following extracts from this letter are relevant to this NIS.

### NPWS letter received 28th February 2020 (Ref: G Pre00324/2019)

*Nature Conservation*

*The proposed works are within and immediately adjacent to the following European site: the Blackwater River (Cork/Waterford) candidate Special Area of Conservation (cSAC) (2170). Conservation objectives for this site is available at https://www.npws.ie/protected-sites/sac/002170 and apply amongst others to the habitat type alluvial woodland and to the freshwater species Salmon, Sea Lamprey, River Lamprey, Brook Lamprey, Twaite Shad, Otter and white-clawed crayfish.*

*It is a conservation objective for both Sea Lamprey and Twaite Shad to restore their favourable conservation condition in the Munster Blackwater River, by making more than 75% of the main channel length of the river accessible to these species from the Blackwater Estuary. [NPWS 2012]. This means that repair of the Fermoy weir can only be permitted where the fish pass will allow upstream access to both Twaite Shad and lamprey. The design requirements for shad will be more demanding in terms of design, because, unlike Salmonids, they are unable to swim against any plunging water, and they swim in shoals rather than individually. Also the flow velocities will need to avoid circumstances where shad will swim back down the fish-pass and they can abandon an unsuitable fish-pass after entry [Castro-Santos, (2012)]. Velocity barriers of 4.15 m/s for 6.1m or 4.5 m/s for 5m have been cited as passable by American shad [Haro and Castro-Santos 2012]. [Larnier and Travade (2002)] provide design recommendations for shad fish passways and large numbers of shad have successfully passed designs used in Bergerac (France) [Travade et. al (2008)] for instance, but it is recommended to obtain site-specific advice from IFI in relation to the efficacy of the proposed fish-pass for Twaite Shad and other fish species.*

*In order to fully assess alternatives, it is recommended that the impacts four other options on the above European site are also assessed in the NIS and ecological impact assessment, in addition to those proposed:*

- *'Do-nothing' option.*
- *Complete or partial permanent weir removal.*
- *Stabilization of current breach.*
- *Construction of the fish pass in the breached weir area of the river channel.*

*Predictions of the effectiveness of fish pass options for each species based on monitoring evidence from other weir fish passes should be included.*

*It is recommended that the following conservation issues and questions are addressed in the Natura Impact Statement (NIS):*

- *The predicted velocity of water flow in the fish pass during lamprey and shad upstream migration, based on seasonal data.*
- *The predicted efficacy of the fish-pass design to allow upstream access to Twaite Shad, lamprey species and eel (as an important prey of Otter).*
- *The exact restored height of the proposed weir compared to that of the original (damaged) weir.*
- *Any OPW amendments to the works.*
- *In-combination assessment with changes to Condulane and other weirs in the cSAC, upstream and downstream.*
- *The need for regular downstream gravel removal as part of weir maintenance.*
- *Sediment deposition upstream of the weir.*
- *Effects on invasive species, such as dace.*
- *Potential for increased heron, cormorant or mink predation at the fish-pass).*
- *Creation of nest sites and roosting ledges on any new or replacement structures.*
- *Waste management plan for construction and excavation wastes.*
- *Mitigation measures to avoid silt release.*
- *Biosecurity precautions, particularly in relation to crayfish plague.*
- *Effects of lighting on fish-pass effectiveness.*

*Depending on the predicted changes in flow and velocity as a result of the preferred works option, it is recommended that the following be considered as part of survey work for the NIS and ecological impact assessment:*

- *Occurrence of alluvial woodland (up to 3km upstream and 2km downstream of weir) – please contact NPWS (regional ecologist) if there are any issues with the interpretation of this habitat type.*
- *Occurrence of water crowfoot / starwort community (up to 1 km below the weir).*
- *Presence of Freshwater Pearl Mussel (up to 150m below the weir).*
- *Presence of White-clawed Crayfish (up to 150m below the weir).*
- *Presence of breeding Otter (up to 150m above and below the weir).*

- *Spawning and juvenile habitat of lamprey species (up to 150m below the weir) - the advice of IFI should be followed in relation to survey and impact assessment for these species.*
- *Salmon and Twaite Shad: The advice of IFI should be followed as to whether these species need to be surveyed.*
- *Presence of breeding river birds: kingfisher (Birds Directive Annex 1 species), grey wagtail (amber listed species) and dipper (up to 100m above and below the weir).*
- *Presence of invasive species (e.g., Japanese Knotweed, Himalayan balsam, giant hogweed) in works area.*

*It is recommended that proposals for the monitoring of the efficacy of the fish-pass, particularly in relation to Twaite Shad access, are included in the NIS. The use of eDNA could be considered, as primers for Twaite Shad have been developed by UCD* [Aktinson, S., *et al.* (2017)].

# 3. NIS Methodology

## 3.1 Study Area and Scope of Appraisal

European sites are only at risk from significant effects where a source-pathway-receptor link exists between a proposed development and a European site(s). This can take the form of a direct impact (e.g. where the proposed development and/or associated construction works are located within the boundary of the European site(s) or an indirect impact where impacts outside of the European site(s) affect ecological receptors within (e.g. impacts to water quality which can affect riparian habitats at a distance from the impact source).

Considering the European sites present in the region, their Qualifying Interests (QIs) and conservation objectives, and any potential impact pathways that could link those sites to the proposed development area, were assessed.

The zone of influence for the proposed development extends beyond the boundaries of the proposed development site primarily due to the proximity of River Blackwater. Thus, any appreciable direct, indirect or cumulative impacts which could arise from the proposed development in relation to the designated sites within this zone were considered.

The screening report concluded that the only European site for which potential impacts could occur was the Blackwater River (Cork/Waterford) SAC and this this is the only European site addressed by this NIS report.

## 3.2 Desktop Study

A desktop review facilitates the identification of the baseline ecological conditions and key ecological issues relating to European sites and facilitates an evaluation assessment of potential in-combination impacts. Sources of information used for this report include reports prepared for the Fermoy area and information from statutory and non-statutory bodies. The following sources of information and relevant documentation were utilised:

- National Parks & Wildlife Service (NPWS) - www.npws.ie

- Environmental Protection Agency (EPA) – www.epa.ie
- National Biodiversity Data Centre (NDBC)– www.biodiversityireland.ie
- *County Cork Biodiversity Action Plan 2009-2014*
- NPWS (2012) *Blackwater River (Cork/Waterford) SAC (site code 2170) Conservation objectives supporting document -coastal habitats*
- NPWS (2012) *River Blackwater (Cork/Waterford) SAC (site code 2170) Conservation objectives supporting document- woodland habitats*
- King J. J. and Linnane S. M. (2004) *The status and distribution of lamprey and shad in the Slaney and Munster Blackwater SACs. Irish Wildlife Manuals, No. 14.* National Parks and Wildlife Service, Department of Environment, Heritage and Local Government, Dublin, Ireland and
- NS 2 (2010) *Freshwater Pearl Mussel. Second Draft. Munster Blackwater Sub-basin management plan.*
- Sweeney, N. and Sweeney, P. (2017) *Expansion of the White-clawed Crayfish (Austropotamobius pallipes (Lereboullet)) population in the Munster Blackwater. Irish Naturalists'* Journal 35: 94-98.
- DixonBrosnan (2020). *Natura Impact Statement (NIS) Emergency Maintenance Works Fermoy, Co. Cork*
- Sweeney (2012). *Ecological Assessment of Likely Significant Impacts of Proposed Repairs to the Fermoy Weir Fish Pass*
- Sweeney (2014). *Likely Significant Impacts of a Proposed Fish Bypass Channel at Fermoy Weir – Screening Statement and NIS,*
- Sweeney (2017). *Ecological Assessment of Likely Significant Impacts of Proposed Rehabilitation Works to the Fermoy Weir.*
- *Fermoy flood relief scheme – additional bat and Otter surveys 2007* (DixonBrosnan 2007)
- *Flood Relief Scheme Fermoy, Co. Cork* (Punch & Partners, 2005)
- Bat Conservation Ireland – http://www.batconservationireland.org
- Birdwatch Ireland - http://www.birdwatchireland.ie/
- Amber Barrier Atlas - https://amber.international/european-barrier-atlas/
- Invasive Species Ireland - http://www.invasivespeciesireland.com/
- *Best Practice Guidance for Habitat Survey and Mapping* (Heritage Council, 2011)
- *Guidelines for Assessment of Ecological Impacts of National Road Schemes* (National Roads Authority, 2009)

- *Environmental Impact Assessment of Projects Guidance on the preparation of the Environmental Impact Assessment Report (Directive 2011/92/EU as amended by 2014/52/EU)* European Union, 2017
- *Assessment of plans & projects in relation to N2K sites – Methodological Guidance* (EC 2021).
- *Guidance document on the strict protection of animal species of Community interest under the Habitats Directive* (EC 2021) and
- *Guidelines for Planning Authorities and An Bord Pleanála on carrying out Environmental Impact Assessmen*t (DoHLGH 2018).

# 4. Options Considered

The River Blackwater weir and adjacent limestone quay wall at O'Neill Crowley Quay are included in the Fermoy Record of Protected Structures in the Fermoy Development Plan (2010-2016). Works that materially alter a protected structure require planning approval, irrespective of any applicable exemptions, if the works would affect the character of the structure or any element of the structure that contributes to its special interest. The weir is located in the River Blackwater which forms part of the Blackwater River (Cork/Waterford) SAC. Cork County Council identified the need to carry out remediation works to the existing Weir in Fermoy and to construct a new permanent Fish Bypass channel on the north bank. In September 2019, T.J. O'Connor & Associates (TJOC) were appointed by CCC to provide civil engineering consultancy services for the project and to develop a scheme for the works that complied with the relevant standards and statutory requirements. The objective of the project was to identify and assess potential options for the scheme in order to identify the preferred solution for the project following consultation with all relevant stakeholders. The preferred option was designed and developed into a viable, cost effective and sustainable scheme which will comply with the relevant standards and statutory requirements. The project requires CCC to fulfil its obligations to maintain and repair the weir at Fermoy, a Protected Structure under Section IV of the Planning & Development Act 2000, while complying with the conservation and fisheries obligations to provide for the free passage of fish along the river Blackwater arising under the Water Framework Directive, Habitats Directive and Inland Fisheries Act 2010 and related legislation. Further details on the conservation objectives for the Blackwater River (Cork/Waterford) SAC are included in **Section 6.1** of this report.

As part of this assessment of options, previous studies and reports in relation to the Fermoy Weir and Fish Bypass Channel were assessed including engineering, hydrology, archaeology, fisheries, ecology and topographic reports/surveys. Consultations were conducted with NPWS, Inland Fisheries Ireland, CCC Architectural Conservation Officer, CCC Ecologist and CCC Archaeologist. The Engineering Inspector of the Water and Marine Advisory Unit, Department of Housing, Planning, Community & Local Government was in attendance at the consultation with Inland Fisheries Ireland. The results of this assessment were included in the Fermoy Weir and Fish Bypass Channel Options Report (TJOC 2020).

The weir has deteriorated significantly in the past number of years since this was first highlighted by Inland Fisheries Ireland (IFI) in 2016. The Mill Race section of the weir in particular has deteriorated considerably. The damage to the weir is at its most severe at the

eastern end of the Mill Race Weir wall where significant erosion has occurred The effect of the ongoing breach in the weir is that normal flow in the River Blackwater does not spill over the weir. Instead, the flow in the river is directed through a narrow section of channel between the Mill Race Weir Wall and O'Neill Crowley Quay before passing through the breach in the weir. The current speed of the waters flowing through the breach in the weir is too fast to facilitate upstream movement of migratory fish and is unable to meet the requirements of IFI in terms of providing fish passage for fish of all species. This resultant turbulent flow has contributed to the progressive nature of the breach and to the ongoing erosion of the river bed alongside O'Neill Crowley Quay and of the river bank at Mill Island, threatening the stability of the flood defence infrastructure.

### 4.1 Weir Remediation

Fermoy weir, which dates back to the early 19th Century, was constructed originally of masonry and rubble and a concrete capping and apron was placed over it in the 1970's. The weir is a protected structure and, consequently, best conservation practices should be adopted for any remedial works. The Conservation Engineers report states that the main ethos of conservation is to retain as much of the existing fabric as possible and keep interventions to a minimum.

Options for remediating the weir were discussed with CCC's Architectural Conservation Officer to identify any constraints to the works and to determine acceptable/ preferred methods of remediation from a heritage perspective. A meeting to discuss the options was held on 30th January 2020 with CCC's Architectural Conservation Officer.

The options that were considered and discussed during the meeting were;

1. Mitigation by design, i.e. reconstruction using original materials.

2. Mitigation by record, i.e. record and replace with new.

The solution agreed at the meeting for remediating the weir was mitigation by design, where possible. It was agreed that the materials to be used for remediation are to consist of the existing masonry and rubble where possible. CCC's Architectural Conservation Officer acknowledged that the weir serves a design function and is not simply an aesthetic feature. In view of this, the Conservation Officer also agreed that new masonry, closely resembling the existing masonry, such as locally sourced limestone and sandstone, could also be used if necessary when rehabilitating the weir subject to the approval of the Architectural Conservation Officer.

#### 4.1.1 Conservation Engineers Report

TWCE, the conservation engineers advising T.J. O'Connor & Associates, carried out inspections of the existing weir on 30th of June 2020 and 20th of May 2020. Significant rainfall occurred in the days leading up to the first inspection which resulted in higher levels been observed in the river. During the first inspection, TWCE observed the following;

- The main breach on the eastern end of the weir appeared to have increased in size since the photos taken in December 2019.
- The main embankment (Crump) section of the weir, i.e., the section of weir which extends from the northern river bank on the western side of Fermoy Bridge to the Mill

Race section, has limited flow spilling over it due to the breach passing the majority of the flow which in turn is reducing water levels at the crump weir section.

- The only section where noticeable flow was observed over the crump weir section was close to the fish pass section on the southern side.

As a result of the high river levels, a further inspection was carried out at a time when the river levels were significantly lower in May 2020. The water levels were such that a closer inspection was possible for the majority of the weir apart from the immediate vicinity of the breach.

Two types of stonework were identified in the Mill Race weir section. The base layers are limestone surmounted by a section composed of sandstone, topped with limestone. Significant washout of fill material was evident. The breach in the weir was observed to have extended into the adjacent ground where flood relief works were undertaken.

The concrete capping on the crump weir was observed to have been a later intervention which in the opinion of the conservation engineer was a contributory factor to the undermining of the toe of the crump weir due to its relative smoothness compared to the randomly placed stonework.

The original fish pass walls, base and steps are formed from cut limestone blocks. A concrete cap and plug, with a pipe inserted, was visible at all of the steps in the fish pass. This is identified as a later intervention as are some repair works, undertaken following a collapse of a section of side wall of the fish pass, where steel sheet piling and timber infill panels have been inserted. The conservation engineer recommends that both these interventions should be removed as part of the remediation.

### 4.1.2 Remediation of Crump Weir Section

The conservation engineer's initial recommendations for remediating the crump section of the weir is to remove the concrete apron and reset the limestone setts with the addition of random rubble fill (similar to the existing) where required. The concrete apron which was placed in the 1970's has the effect of increasing velocities on the downstream face of the weir leading to scour at the toe of the weir. A high tensile geotextile is also proposed to be introduced to assist in reducing wash out of the fill. At both the upstream heel and downstream toe of the crump weir section, the undercut / missing stonework is proposed to be reset on concrete heel and toe footings along with the addition of rock armour on both the upstream and downstream sides to prevent undercurrents undermining the embankment, in particular on the downstream section in the future.

The crest of the crump weir is to be reinstated to a level corresponding to the historic level of the weir as evident from the historic photographs of the weir. A level of 21.45mOD is proposed for this section on the remediated weir.

### 4.1.3 Remediation of Mill Race Weir Section

TWCE's initial recommendations for remediating the Mill Race section of the weir involve reconstructing the breached sections with existing stonework or new stonework to closely resemble the existing masonry. Given the nature of this section of the weir, it is proposed to inject natural cement (also referred to as Prompt) into the fill sections and place mass concrete in the core of the new section of the weir. The stonework facing would then be pointed in

natural cement and the downstream face of the weir protected by adding rock armour. The capping of the Mill Race wall would be removed, the wall raised and the capping reset to a remediated level higher than the adjacent Crump weir, with a level of 21.55mOD proposed.

Prompt is also referred to as natural cement, in which the description “natural” indicates that the raw material, a type of limestone known as clayey marl, is simply mined and burnt with no further additions. Portland and other “artificial” cements are produced from a manmade mixture of pure limestone, silicates and clays in a controlled, reproducible manner. The bank and walls downstream of the weir at Mill Island have been severely eroded since the breach in the weir. It is not proposed to remove the rock armour placed in this area in the course of emergency stabilisation works undertaken by the OPW in late 2020.

### 4.1.4 Remediation of Existing Fish Pass

The initial recommendations for remediating the existing fish pass include removing the temporary remedial works previously carried out and reconstructing this section of the side wall with new limestone to match the existing masonry. The remaining sections of the fish pass side walls would then be pointed with natural cement. Other missing stonework would be replaced and any out of position stonework would also be reset.

Should the existing fish pass need to be decommissioned, it is proposed that this could be achieved by constructing stonework across the upstream entrance of the fish pass to the same height of the stonework on the rehabilitated side walls. The diversion of flows from the fish pass should extend to include the flow which runs down the south side of the fish pass resulting in considerable erosion of the weir face where the flow is funnelled by the diagonal orientation of the existing fish pass. The downstream end of the fish pass would also need to be blocked/infilled to prevent fish from trying to navigate the pass.

## 4.2 Fish Bypass Channel

Options for a proposed fish bypass channel were previously developed in 2014 and were discussed with IFI at the time. Four options were developed and considered over a number of years. These comprised options 3,5,7 and 9 in the list of options below. A meeting was held with the NPWS on 10th February 2020 and further options (1,2 4 and 6) were identified by the NPWS for consideration. Option 8 was suggested by the Dept of Housing. The final nine options put forward for consideration were:

1. Do-nothing;
2. Do-nothing except for stabilising the existing weir;
3. Remediate the existing fish pass;
4. Remove the weir in its entirety;
5. Construct an in-river rock ramp;
6. Construct a rock ramp in the existing breach;
7. Construct a near natural bypass channel.
8. Bypass the river around the weir

9. Construct a rough channel pool bypass.

The following sections set out the assessment of each option. The options have been assessed relative to the legal requirements to protect the SAC and its qualifying interests, as set out in the Habitats Directive, and relative to the potential of satisfying the primary project objectives of weir remediation and providing for fish passage in all circumstances.

### 4.2.1. Option 1 – Do-Nothing

The do-nothing option would involve leaving the current situation as it is at present. This will not facilitate free passage of fish species listed as qualifying interests for the Blackwater River (Cork/Waterford) SAC (See **Table 1**). Current speeds are too fast to facilitate upstream movement of qualifying interest fish species and is unable to meet the requirements of IFI in terms of providing fish passage for fish of all species. Similarly, the greater part of the flow range in the river would continue to be funnelled into the Mill Race Channel with resultant high velocities and turbulence acting as a barrier to fish passage.

This option would also not be acceptable from an architectural conservation perspective as the weir, which is a protected structure, would continue to deteriorate. CCC, as the owner of the protected structure, is legally required to make sure that the structure does not become endangered through neglect, decay, damage or harm. This option would, in effect, involve CCC ignoring its obligations under Part IV of the Planning and development Act, 2000. It is likely that the weir would further deteriorate rapidly where significant damage was sustained to the weir over a relatively short period of time.

This could impact on aquatic species listed as QIs for the Blackwater River (Cork/Waterford) SAC including Freshwater Pearl Mussel which are particularly susceptible to increased silt levels. Whilst it is noted that the complete removal (or collapse) of the weir would facilitate movement of fish listed as qualifying species for the Blackwater River (Cork/Waterford) SAC, such movement of fish can be facilitated by the engineered solutions discussed below. The release of silt which accumulated upstream of the weir could have effects on other aquatic qualifying species including White-clawed Crayfish, Brook Lamprey, Otter (via impacts on prey availability), Freshwater Pearl Mussel and Water courses of plain to montane levels with the *Ranunculion fluitantis* and Callitricho-Batrachion vegetation (floating river vegetation). As the weir degrades over time and the timeframe over which the weir would degrade is difficult to predict, water levels drop this could have a detrimental effect on the conservation objectives for Alluvial forests with *Alnus glutinosa* and *Fraxinus excelsior* (Alno-Padion, Alnion incanae, Salicion albae) (alluvial woodland) which is listed as a conservation interest for the Blackwater River (Cork/Waterford) SAC.

### 4.2.2 Option 2 - Stabilise Remaining Section of Existing Weir

Stabilising the remaining section of the existing weir would involve maintaining the existing breaches that have occurred in the weir. This option is similar to the do-nothing scenario described in Option 1 (**Section 4.2.1**), except that it would involve works to stabilise the existing weir to prevent further deterioration, while leaving the breach in the weir.

This option would potentially meet the conservation objectives of the SAC only if it is able to provide for free passage to fish species listed as qualifying interests for the Blackwater River (Cork/Waterford) SAC and is unable to meet the requirements of IFI in terms of providing fish

passage for fish of all species. Similar to Option 1, the greater part of the flow range in the river would continue to be funnelled into the Mill Race Channel with resultant high velocities and turbulence acting as a barrier to fish passage. This would give rise to continued erosion of the river bed and banks, with the potential risk to the stability of the flood defence infrastructure and build-up of gravel islands downstream of the weir.

It is also unlikely that this would meet the architectural conservation objectives for the protected weir.

### 4.2.3 Option 3 - Remediate Existing Fish Pass

This option consists of repairing the existing fish pass. The existing fish pass is a technical type fish pass, comprising a masonry stepped structure located within the weir structure close to the midpoint of the river. The fish pass crosses the weir on a diagonal to decrease the gradient and increase the number of steps in the structure. Damage to the lower part of the structure was repaired in 2013. Since then, further damage has occurred and part of the side wall of the pass, on the downstream facing side of the structure, has been breached.

It had been proposed to retain the upper section of the fish pass structure and demolish and replace the lower section with a new in-situ concrete structure. A new channel was proposed to be created in the riverbed to create an attraction flow in the river at the entrance to the fish pass. IFI have advised that the location of the existing fish pass is contrary to basic fish pass design guidance. Guidance advises that the entrance should be located where migrating fish naturally congregate which is generally as far upstream along a weir structure as possible. The existing fish pass entrance is halfway along the weir and is too far downstream to be found by all migrating fish. In addition to this, the entrance will not ensure the free run of all fish at all periods of the year.

Furthermore, the orientation of the fish pass is also unsuitable and does not conform to basic fish pass design guidance which states it should be perpendicular to the weir and parallel to the water flow on the weir.

IFI advised that the fish pass is required to provide passage for all fish species listed as Annex II QI species for the Blackwater River (Cork/Waterford) SAC i.e., Atlantic Salmon, Sea, River and Brook Lamprey and Twaite shad. IFI also advised that the fish pass is also required to provide passage at all times, to the above species, irrespective of flow conditions. This would not be achievable with an upgrade of the existing fish pass. In addition to this, remediating the existing fish pass would not satisfy the relevant requirements of the Fisheries Consolidation Act, the Water Framework Directive or the Habitats Directive.

The generation of silt and chemical contamination during construction could have effects on other aquatic qualifying species, including White-clawed Crayfish, Otter (via impacts on prey availability), Freshwater Pearl Mussel and the habitat Water courses of plain to montane levels with the Ranunculion fluitantis and Callitricho-Batrachion vegetation [3260]. Noise and disturbance could potentially have an adverse effect on Otter.

### 4.2.4 Option 4 - Complete Removal of Existing Weir

The last option identified by NPWS for inclusion in the analysis is the complete removal of the existing weir. While this option would satisfy the conservation objectives of the SAC, and would

also provide for the passage of all fish due to the elimination of the barrier, it would not be acceptable from an architectural conservation objective as the existing weir is a protected structure.

As previously stated, CCC, as the owner of the protected structure, is legally required to make sure that the structure does not become endangered through neglect, decay, damage or harm. This option would, in effect, involve CCC ignoring or reneging on its obligations under Part IV of the Planning and Development Act, 2000.

This option would result in a significant lowering of water levels in the reach of the river upstream of where the weir is situated. This impact would extend for several kilometres upstream and could reach as much as 1.0 to 1.5m at the location of the weir. This could have a detrimental impact on alluvial woodland which is listed as a conservation interest for the Blackwater River (Cork/Waterford) SAC.

Riverbank habitats could be permanently affected by the lowering of the water level if the weir was removed. Construction impacts could include the requirement for instream works to remove the rubble and masonry structure resulting in the risk of silt generation and disturbance of adjacent instream habitats. There is also a risk that silt, accumulated over many years at the upstream side of the weir, could be released downstream during the demolition and removal of the weir structure. This could impact on aquatic species listed as qualifying interests for the Blackwater River (Cork/Waterford) SAC including Freshwater Pearl Mussel which are particularly susceptible to increased silt levels. Whilst it is noted that the complete removal of weir would facilitate movement of fish listed as qualifying species for the Blackwater River (Cork/Waterford) SAC, such movement of fish can be facilitated by the engineered solutions discussed below.

### 4.2.5 Option 5 - Construct an In-River Rock Ramp

This proposal comprises constructing a rock ramp, approx. 62m long x 30m wide in the river Blackwater on the western side of Fermoy Bridge alongside the north bank of the river. This option also involves raising the weir crest level to form a height of 21.50mOD throughout. Dredging of an area of the riverbed of approximately 350m$^2$, downstream of the weir, would also be required as part of this option. The rock ramp would be integrated directly in the weir construction.

The bed of the ramp would comprise rockfill in which big boulders or boulder sills would be arranged to form cascades providing the water depths and flow velocities required to allow upstream migration of fish. These boulders and sills would also serve to create shelters, deep zones and resting pools along the length of the ramp. A bed slope of 1 in 30 approximately was proposed to satisfy these requirements. The ramp would have to be separated from the retained section of weir by a vertical dividing wall.

The proximity of Fermoy Bridge to the weir dictates that the rock ramp would have to be largely located upstream of the existing weir. If the ramp extended downstream it would interfere with the bridge pier. Typically for instream rock ramps, the total discharge available at low and mean flow would be directed through the ramp. This would have the potential to give rise to increased scour and risk of erosion to the piers at the northern end of Fermoy Bridge.

The development of a rock ramp may facilitate movement of migratory fish species listed as qualifying interests for the Blackwater River (Cork/Waterford) SAC (Sea Lamprey, River Lamprey, Twaite Shad and Atlantic Salmon and downstream movement of Brook Lamprey). However, the proposed location of the new rock ramp would require removal of a significant section of the weir which is a Protected Structure.

The generation of silt and chemical contamination during construction could have adverse effects on other aquatic qualifying species including White-clawed Crayfish, brook lamprey, Otter (via impacts on prey availability), Freshwater Pearl Mussel and the habitat floating river vegetation. Noise and disturbance could potentially have an adverse effect on Otter.

### 4.2.6 Option 6 – Construct Fish Ramp (Rock Ramp) in Existing Breach

This option proposed by NPWS consists of constructing the new fish ramp in the existing breach in the weir. However, it would not be ideally situated for fish passage because the breach is located at the downstream end of the weir. Ideally, fish passage should be provided for at the furthest upstream point on the obstruction. In the case of Fermoy weir, the furthest upstream point is located alongside the north bank. The breach in the weir is located alongside the south bank at the furthest downstream point. Therefore, migratory fish listed as qualifying interests for the Blackwater River (Cork/Waterford) SAC arriving at the weir may miss the entrance to the fish ramp.

The generation of silt and chemical contamination during construction could have effects on other aquatic qualifying species including White-clawed Crayfish, brook lamprey, Otter (via impacts on prey availability), Freshwater Pearl Mussel and the habitat floating river vegetation. Noise and disturbance could potentially have an adverse effect on Otter.

### 4.2.7 Option 7 – Construct a Near Natural Bypass Channel

This option consists of constructing a meandering, near natural, bypass channel which would be situated in the northern bank of the River Blackwater, west of Fermoy Bridge. This option would have the added benefit of being able to construct the bypass predominantly from land which would significantly reduce the extent of instream works and the subsequent impact on the SAC.

The term ‘bypass channel’ is used for fish passes that bypass an obstacle and that are in the form of a natural-looking channel that mimics a natural river. This proposal would require no structural alterations to the weir structure itself other than those required for the remediation of the weir. Only a portion of the flow would be diverted through the bypass channel. An adequate area of land is available alongside the weir on the north bank of the river.

A near natural bypass channel as proposed for Fermoy would receive approximately 15% of the upstream flow and would have an average longitudinal gradient of 1:30 approximately and a channel width varying between 8 and 12 metres. Resting pools are incorporated for fish at two locations in this option.

IFI expressed concern that a near natural fish bypass channel would not satisfy the requirement for passage of migratory fish species listed as qualifying interests for the Blackwater River (Cork/Waterford) SAC. The use of a natural channel could also lead to increased poaching and/or increased predation risk for these species.

IFI noted that the resting pools are too small to provide the energy dissipation required to allow for fish passage. In addition to this, IFI considered that the flows would be too low to be attractive and to allow downstream fish to locate the fish pass without being delayed. IFI advised that this option would not provide for satisfactory fish passage and would not be acceptable to them. Given satisfactory fish passage would not be provided by this option, there could be adverse effects on the migratory fish species listed as qualifying interests for the Blackwater River (Cork/Waterford) SAC. Therefore, this option would not be compatible with legal obligations to prevent adverse effects on the integrity of the Blackwater River (Cork/Waterford) SAC in regard to the conservation objectives for these species.

This option would lower the risk of siltation and chemical contamination during construction. The generation of silt and chemical contamination during construction could have limited effects on other aquatic qualifying species including White-clawed Crayfish, brook lamprey, Otter (via impacts on prey availability), Freshwater Pearl Mussel and the habitat floating river vegetation. Noise and disturbance could potentially have an adverse effect on Otter. However, with this option the risk is lower than for instream options.

### 4.2.7 Option 8 – Bypass River Around Weir

A variation of Option 7 (**Section 4.2.7**) was also considered, which consists of utilising the proposed bypass channel to divert all of the flow around the existing weir. This alternative option would eliminate the need for a rock ramp. Although this option would be substantially cheaper, it would still require significant land acquisition, bank protection measures on the new channel and would not avoid the costs associated with the remediation of the weir. However, the water level in the reach of the river upstream of the weir would be reduced if this option was implemented.

When the weir was intact there was a 2.2m difference in water levels either side of the weir. Allowing all flow to bypass the weir structure without controls would result in a drop in water level on the upstream side of the weir in the range 1 to 1.5m. The impact of this drop in water level would continue to be experienced several kilometres upstream. This could have a detrimental effect on the conservation objectives for alluvial woodland which is listed as a conservation interest for the Blackwater River (Cork/Waterford) SAC. This also may not be acceptable from an architectural conservation point of view.

In order to provide for the free passage of all fish, velocities in this diversion channel would have to be maintained below 2m/s. This may prove difficult given the size of the catchment area of the Blackwater at Fermoy (in excess of 1750km$^2$). There is also a wide variation in flows which would add to the difficulty of maintaining the desired velocity. Therefore, this option may not facilitate free movement of migratory fish species listed as qualifying interests for the Blackwater River (Cork/Waterford) SAC (Sea Lamprey, River Lamprey, Twaite Shad and Atlantic Salmon and movement of Brook Lamprey). The generation of silt and chemical contamination during construction could have effects on other aquatic qualifying species including White-clawed Crayfish, Otter (via impacts on prey availability), Freshwater Pearl Mussel and the habitat floating river vegetation. Noise and disturbance could potentially have an adverse effect on Otter. However, with this option the risk is lower than for instream options.

### 4.2.9 Option 9 – Construct a Rough Channel Pool Bypass

Option 9 consists of constructing a curved rock (rough channel pool) ramp type of bypass in the northern bank of the river Blackwater, west of Fermoy Bridge. The rock ramp would provide a ladder for fish migrating upstream and resting pools would be created by the varying levels of rock weir walls.

The *Fish Passes Design, Dimensions, Monitoring Guideline* published by the FAO and DVWK (2002) describes a rough-channel pool pass as a combination of a technical fish pass and a fish ramp, in which the pool cross-walls are substituted by columnar rocks set on edge. This arrangement allows appreciably greater water depths to be obtained and a steeper slope (up to maximum 1:10, although 1:60 is proposed for Fermoy) to be used than with conventional fish ramps. A decisive feature in this case is that the differences in water level between the pools must not exceed h = 0.2m, to maintain the maximum permissible flow velocities of $v_{max}$ = 2.0m/s.

Large, slender boulders (quarry-stones), embedded in the bottom rockfill layer of the pass, will be used to build the transverse bars as shown in **Figure 1**. The boulders will be embedded in approximately 0.4m in the rockfill bottom. The boulders must be embedded in such a way that water only flows around them, and not over them. The clear width of the opening between the boulders should not be less than 0.20m, to enable larger fish to ascend and to reduce the risk of clogging with debris.

The boulders must be offset in both the longitudinal and the transverse directions to allow the discharge to better fan-out and for better dissipation of energy in the pools. The discharge jets should always impinge on a boulder of the next transverse bar downstream and should not shoot through the next bar in order not to form a short-circuit current.

The principal disadvantages with this option are:

- Sensitivity to fluctuating headwater levels.
- The large discharges necessary for its operation.
- The large amount of space occupied

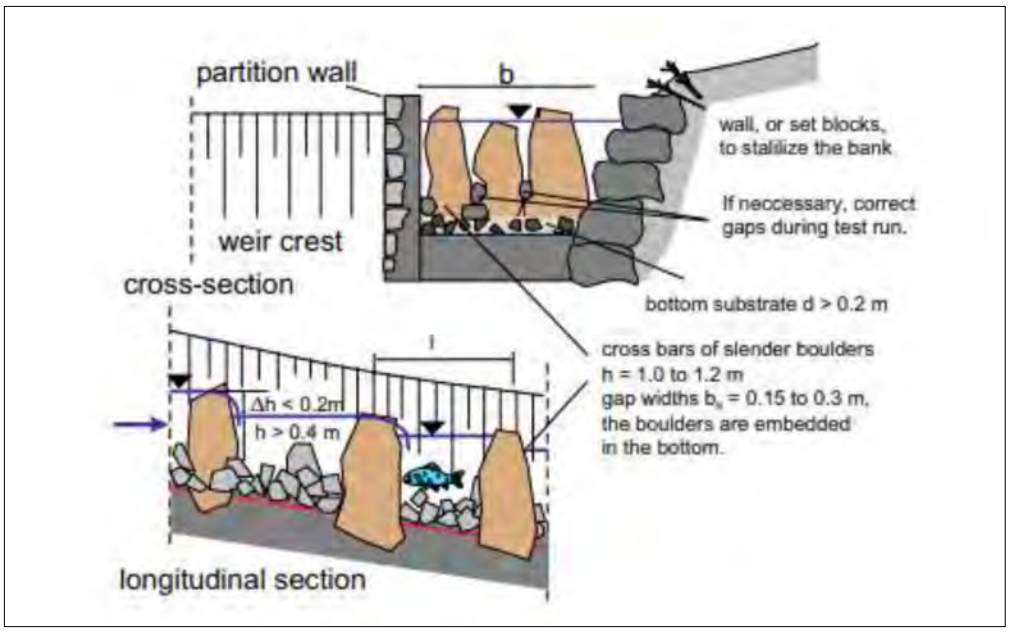



**Figure 1. Rough Channel Pool Pass Details**

This option also has the following advantages;

- It can provide passage for small fish and fry and by the benthic invertebrates.
- It is also suitable for downstream migration of fish.
- It can be designed to be natural-looking and visually attractive
- It requires little maintenance in comparison with other constructions.
- It is not easily clogged; deposits of flotsam and flood debris do not immediately affect the efficiency of the installation.
- The guide currents are satisfactory and easily located by fish.
- It can provide a habitat for species of fish which prefer flowing water (rheophilic).

This option will facilitate free movement of migratory fish species listed as qualifying interests for the Blackwater River (Cork/Waterford) SAC (Sea Lamprey, River Lamprey, Twaite Shad and Atlantic Salmon and movement of Brook Lamprey).

The generation of silt and chemical contamination during construction could have effects on other aquatic qualifying species including White-clawed Crayfish, brook lamprey, Otter (via impacts on prey availability), Freshwater Pearl Mussel and the habitat floating river vegetation. Noise and disturbance could potentially have an adverse effect on Otter. However, with this option the risk is lower than for instream options.

### 4.2.10 Preferred Option

The above describe the fish pass options that have been considered and illustrates the difficulty in identifying a solution that can satisfy both the main project objectives as well as a range of other factors and stakeholders. Viable options are ones that can meet the legal

requirements of the Habitats Directive while also allowing the remediation of the protected structure. Those options which achieve this while also facilitating leisure and amenity users of the river are considered the most viable options.

Some options do not satisfy the legal requirements of the Habitats Directive and are not considered viable for that reason. Options in this category include Option 1 (Do Nothing), Option 2 (Do-nothing except for stabilising the existing weir) and Option 3 (Remediate the existing fish pass). Other options do not respect the protected structure status of the weir and would result in CCC failing to fulfil its obligations to prevent further deterioration of the weir. Option 4 (Remove the weir in its entirety), Option 5 ( Construct an in-river rock ramp) and Option 6 (Construct a rock ramp in the existing breach) could be considered to fall into this category.

Option 7 (Construct a near natural bypass channel), Option 8 (Bypass the river around the weir) and Option 9 (Construct a rough channel pool bypass) provide for the full reinstatement of the weir. Although in the case of Option 8, the weir would normally have no flow over it. Option 7 is not likely to satisfy the requirement for passage for all fish and does not meet Fisheries Ireland's requirements for fish pass design. Option 8 may not be acceptable from an architectural conservation point of view and maintaining suitable velocities in this diversion channel is likely to prove difficult given the size of the catchment area of the Blackwater at Fermoy.

Of all of the options, Option 9 is likely to best satisfy the legal requirements of the Habitats Directive while allowing for the remediation of the weir structure in its entirety.

The construction of Option 9 would satisfy the requirements of IFI in terms of providing for the passage of all Annex II species listed in the Habitats Directive. The fish pass can also accommodate passage by European Eel. This is not an Annexed species or a qualifying interest for the Blackwater River (Cork/Waterford) SAC but is a critically endangered red listed species.

### 4.3 Final Design

The final decision for remediating the weir was mitigation by design (See **Section 4.1**). The materials to be used for the remediation works will consist of the existing masonry and rubble where possible. In addition, new masonry closely resembling that of the existing masonry, will also be used where necessary should there be a shortfall of masonry.

The final decision for the fish bypass channel was to construct the rough channel pool bypass (Option 9 See **Section 4.2.9**). The proposed scheme does not increase flood risk to properties outside the site and does not require any raising of the levels of the demountable barrier element of the flood defence scheme. A 3D model of the proposed fish bypass channel was developed in conjunction with the detailed design of the works (See **Section 7.5 and Section 7.6**). This model enabled the project proposals to be clearly visualised.

The details of the proposed development for which planning permission is being sought are included in **Section 5** of this report.

# 5. Description of Proposed Development

## 5.1 Existing site and project background

The proposed development is located in the vicinity of Fermoy Bridge on the River Blackwater in the town of Fermoy, Co Cork (**Figure 2**). Fermoy weir extends from the northern bank of the river on the west side of the bridge, through the second arch from the south bank and continues east of the bridge towards a tie in with the apex of Mill Island. Due to the age and the poor condition of the Mill Race Weir wall, an initial breach of the weir which occurred around 2016 has led to progressive unravelling of the masonry Mill Race weir wall and erosion of the western end of Mill Island. The OPW undertook emergency riverbed stabilisation works in the autumn of 2020 to mitigate against the excessive scour that was occurring as a result of the high velocities through the breach. The current speed of the waters flowing through the breach in the weir is too fast to facilitate upstream movement of migratory fish and is unable to meet the requirements of IFI in terms of providing fish passage for fish of all species.

Cork County Council (CCC) is obliged to protect the weir against further deterioration. Despite the presence of a fish ladder in the weir, and the existing breach, the weir acts as a barrier to the passage of certain fish species. The breach in the weir means that there is no flow through the existing fish ladder in most flow conditions. The project requires a solution that will enable CCC to fulfil their obligations to maintain and repair the weir (as its owner) at Fermoy, a Protected Structure under Section IV of the Planning & Development Act 2000 and comply with the conservation and fisheries obligations to provide for the free passage of fish within the River Blackwater arising under the Water Framework Directive, Habitats Directive and Inland Fisheries Act 2010 and related legislation.

In order to comply with the above legislative requirements, it is proposed to construct a new fish bypass channel on the northern bank of the river on the western side of Fermoy Bridge.

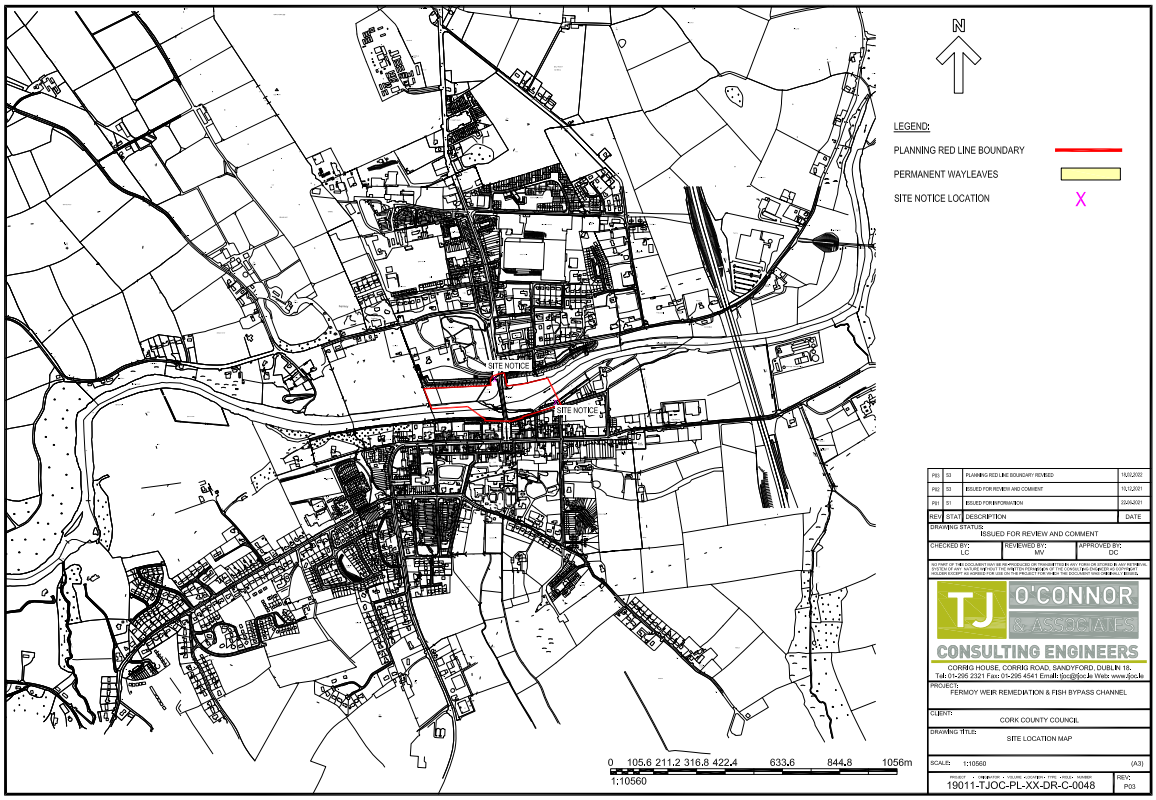



**Figure 2. Site location | Source TJ O'Connor**

## 5.2 Proposed Development

### 5.2.1 Works Proposal

The proposed project comprises the remediation of the existing weir, including reconstruction of breached sections of the weir, and the construction of a rough channel pool bypass to provide for fish passage around the weir. Further detail on the channel design and construction works are included in **Appendix 2 Drawings**.

The weir remediation works can be divided into two different elements which comprise the remediation of the section of the weir, upstream of Fermoy Bridge, including the existing fish ladder incorporated in the weir, and the section of the weir downstream of the bridge. The weir is categorised as a rubble embankment (or Crump) type weir upstream of the bridge and extending for a distance of 37m east of Fermoy Bridge. The remaining section of the weir, extending eastwards, is a gravity wall type weir (referred to as the Mill Race weir wall section). It is this section of the weir that has been breached in the approx. locations as shown on the Existing Site Layout Plan drawing 19011-TJOC-PL-XX-DR-C-0051 included in the planning drawings and reproduced at **Appendix 2**.

The locations of the different sections of the weir are indicated on Drawing No. 19011-TJOC-PL-XX-DR-C-0058 in **Appendix 2.** A section of the gravity wall type weir has collapsed resulting in a breach in the weir.

The locations of cross-section through the existing weir, as well as proposed remedial works to each of these sections, are shown on drawings 19011-TJOC-PL-XX-DR-C-0059 and 19011-TJOC-PL-XX-DR-C-0060 (**Appendix 2**) and are described below. Proposed remedial details to the existing fish pass are included on Drawing No. 19011-TJOC-PL-XX-DR-C-0081 (See **Appendix 2**).

### 5.2.2 Weir remediation - Embankment Section

The remediation of the embankment (crump) section of the weir will involve the removal of the existing concrete apron and resetting of the limestone setts with the addition of random rubble fill (similar to the existing) where required. A high tensile geotextile will be incorporated to assist in reducing wash out of the fill in the embankment. At both the upstream heel and downstream toe of the crump weir section, the undercut / missing stonework will be reset on concrete heel and toe footings along with the addition of rock armour on both the upstream and downstream sides to prevent undercurrents undermining the embankment, in particular on the downstream section in the future.

The crest of the crump weir will be reinstated to a level corresponding to the historic level of the weir as evident from the historic photographs of the weir. A level of 21.45mOD is proposed for this section on the remediated weir.

Cross-sections through the embankment section of the weir, showing the proposed remediation works, are shown at Drawing No.'s 19011-TJOC-PL-XX-DR-C-0061 and 19011-TJOC-PL-XX-DR-C-0062 included in the planning drawings and reproduced at **Appendix 2**.

### 5.2.3 Weir Remediation – Mill Race Weir Wall

The remediation of the Mill Race section of the weir, east of the Bridge, will involve reconstructing the breached sections with existing and new stonework to closely resemble Fermoy Weir Remediation and Fish Bypass Channel Outline Construction Management Plan the existing masonry. Given the nature of this section of the weir, it is proposed to inject natural cement (also referred to as Prompt) into the fill sections and place mass concrete in the core of the new section of the weir. The stonework facing will then be pointed in natural cement and the downstream face of the weir protected by adding rock armour. The capping of the Mill Race wall will be removed, the wall raised and the capping reset to a remediated level of 21.55mOD.

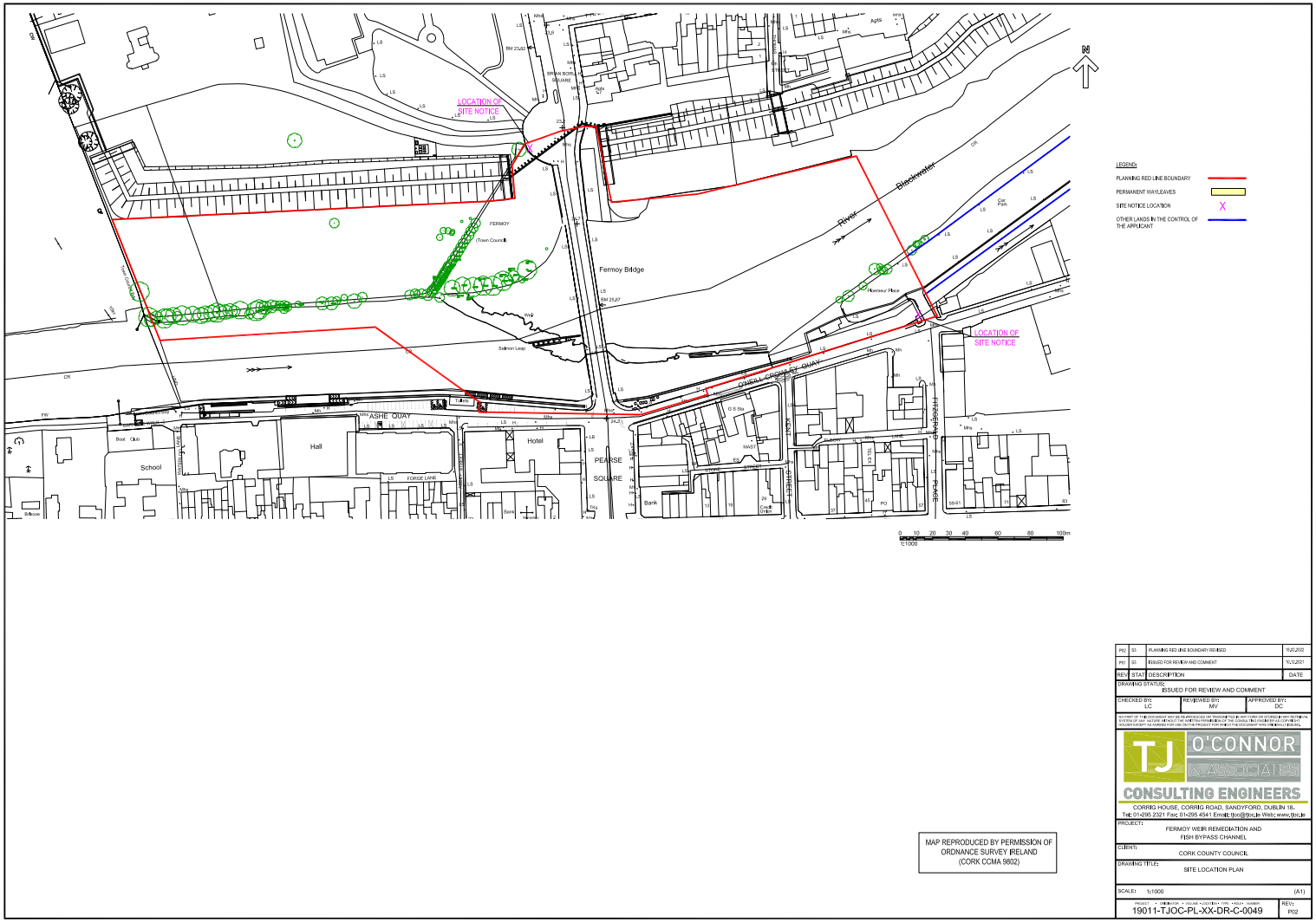



**Figure 3. Proposed development site boundary | Source TJ O'Connor**

### 5.2.4 Proposed Fish Bypass

The proposed bypass consists of constructing a curved rock (rough channel pool) ramp type of bypass in the northern bank of the river Blackwater, west of Fermoy Bridge. The rock ramp will provide a ladder for fish migrating upstream and resting pools would be created by the varying levels of rock weir walls.

The Bypass Channel will have sheet piled masonry faced side walls, The bed of the channel will comprise a gravel bed on rockfill. Armourstone pitched vertically will create the intermediate pools (12 No in total) and steps in the bypass channel.

The construction of the Bypass channel will require the removal of a number of riverbank trees. Planting of willow into the embankment of the fish pass will screen views of the development. A riparian enhancement planting scheme and wildflower meadow is proposed for the riverbank area to the north of the fish pass site (See Doyle O'Troithigh Landscape Plan LP-01-PP which is included in **Appendix 2**).

A drawing of the proposed fish bypass channel is presented on Drawing No. 19011-TJOC-PL-XX-DR-C-0053.

### 5.2.5 Principal Characteristics

The principal characteristics of the proposed development are as follows:

***Bypass Channel***

- Felling of approximately 30 No trees for Bypass channel and demolition (by lowering) of approximately 110m of existing masonry river wall (detail on tree species is included in **Section 6.3.8**);
- Excavation of ~14,500m$^3$ of spoil for construction of Bypass;
- Installation of ~2,050m$^2$ of sheet piles and ~250m length of concrete capping beams for side walls of Bypass Channel;
- Construction of ~250m$^2$ of masonry facing to bypass channel walls;
- Placement of ~3,750m$^3$ of Gravel and rockfill for base of bypass channel;
- Placement of ~95m$^3$ of Armourstone pitched vertically to create steps/ intermediate weirs in the Bypass channel;
- Installation of ~70m$^3$ of concrete and ~500m$^2$ of sheet piles for inlet weir wall to bypass channel;
- Profiling and landscaping ~175m$^2$ of banks with 1:2 to 1:4 side slopes with landscaping as per Landscape Architect's proposals;
- Restoration of existing Salmon leap including replacement of damaged and missing limestone from side walls and base;

- Riverbed profiling between outlet from Fish Bypass Channel and Fermoy Bridge ~425m$^3$.

***Weir Remediation***

- Demolition of ~176m$^3$ of concrete apron on face of embankment;
- Placement of ~2,800m$^2$ of geotextile fabric and resetting of 2,800m$^2$ of limestone sets;
- Excavation of ~315m length of trenches in river bed for toe and heel protection to embankment;
- Placement of ~395m$^3$ of concrete in toe and heel trenches;
- Placement of ~833m$^3$ of rock armour to toe and heel of embankment;
- Construction of ~95m$^3$ of concrete core for reconstructed Mill Race wall where the wall has been breached
- Removal of capping stone from existing Mill Race Wall
- Natural cement injection to both faces existing masonry weir wall (91.2m$^2$);
- Grout injection of ~92m$^2$ of masonry in existing Mill Race Weir wall;
- Pointing of ~260m$^2$ of Masonry in existing Mill Race Weir wall
- Raising of ~15m of existing weir wall with masonry and *in situ* concrete.
- Reinstatement of capping stones to Weir wall at adjusted level.

All ancillary works including tree felling, temporary diversion and control of flows, tie into existing structures and riverbanks, provision of access causeways and haul routes, disposal of surplus material, ecological monitoring, silt fences and curtains.

## 5.3 Construction Methodology

The construction of the project will involve conventional construction methodologies and so will require the use of typical construction plant and vehicles. The anticipated phasing of construction will generally be as follows.

### 5.3.1 Site setup

- Establish site hoarding, signage on north bank of river:
- Establish site offices, welfare facilities and construction deliveries set-down area adjacent the site as shown at Drawing 19011-TJOC- PL-XX-DR-C-0085 (see **Figure 4** below)
- The main compound will be located on the north bank of the Blackwater and a satellite compound will be located in the council carpark at Mill Island.

- All site accommodation and welfare facilities at the main compound will be located above the 1% AEP flood level at this location, based on the OPW's flood maps of the area.

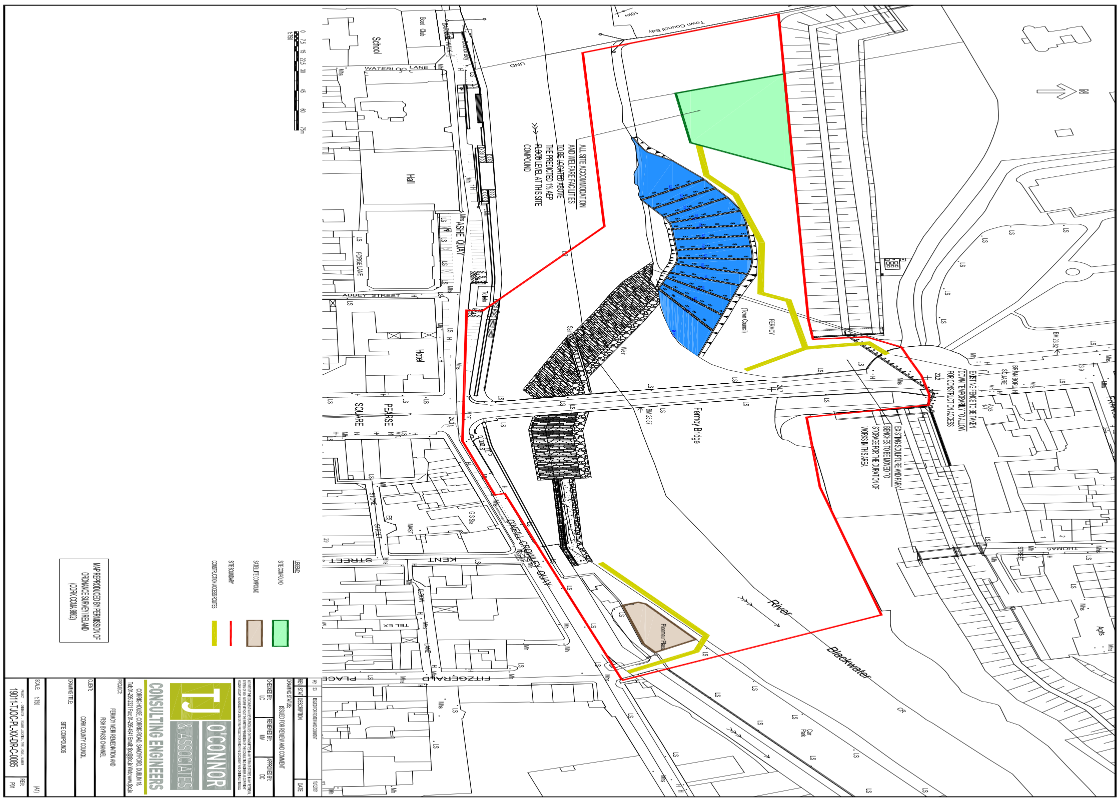


**Figure 4. *S*ite setup identifying site compound and satellite compound | Source TJOC**

### 5.3.2 Construction Work Sequence

Construction Works Sequence

The anticipated sequence of construction works will entail:

1. The remediation of the weir upstream (west) of Fermoy Bridge initially;

2. Followed by (or possibly concurrent with) the construction of the fish bypass channel on the north bank of the river.

3. On completion of the bypass channel works, flow from the river will be directed through the bypass channel, at which stage the flow to the Mill Race will be dammed at the southernmost pair of arches of Fermoy Bridge facilitating the remediation and reinstatement of the weir downstream (east) of the bridge.

These stages are shown at Drawing 19011-TJOC- PL-XX-DR-C-0086 (**Figure 5**). Construction works during Stages 1 and 2 will be accessed and serviced from the compound at the north side of the river. Works for Stage 3 will be accessed and serviced from a satellite compound at the Mill Island carpark.

**Figure 5. Phasing of instream works | Source TJOC**

### *Stage 1*

There are constraints in respect of when in stream works can be carried out within the river Blackwater in accordance with the “Guidelines on the Protection of Fisheries during Construction Works in or Adjacent to Waters”, IFI,2016.

The construction methods used within the River Blackwater will take into account the preservation of stream flows for movement of fish by ensuring a minimum depth of water shall be maintained within the river.

A temporary sheet piled dam will be erected upstream of the works to facilitate the weir remediation works, comprising removal of the existing concrete apron, the excavation of the trench for placement of the new toe protection material and to allow the placement of geotextile fabric and resetting of limestone setts to the embankment section of the weir.

Downstream of the embankment section of the weir, a trench will be excavated for the placement of heel protection materials and, in order to undertake this excavation, a bund will be placed in the river bed to divert the flow away from the area of works. The location of the upstream sheet piled dam and the downstream bund, on either side of the weir, will be located so as to accommodate access routes alongside the embankment.

Bed levels between the end of the bypass channel and the northernmost arches of Fermoy Bridge will be excavated to the levels proposed for the project.

The existing salmon leap will be reinstated and infilled as per the drawings.

### *Stage 2*

Depending on the contractor's programme, in parallel with or following on from Stage 1 activities, the contractor will undertake the following activities for the construction of the Fish Bypass channel.

The bypass channel will be constructed offline without the excavated channel being extended into the river channel until the majority of the bypass works are completed. Therefore, the upstream and down steam ends of the bypass channel will be closed off with temporary sheet piles which will be cut back or extracted when the flow is to be directed into the bypass channel.

The activities required for this stage will include:

- Tree felling;
- Topsoil stripping, stockpiling and disposal of excess;
- Sheet piling for side walls and temporary end walls;
- Bulk excavation, stockpiling of gravels for re use and off-site disposal of excess materials associated;
- Concrete placement for walls and capping beams;
- Construction of masonry faced walls
- Placement of rock fill to bed of channel
- Placement of armourstone and perturbation stones
- Placement of gravels
- Profiling of banks, topsoiling and landscaping;
- Removal of temporary end walls and diversion of flow into channel

### *Stage 3*

Stage 3 construction activities cannot commence until the fish bypass channel is completed in Stage 2 and flows are diverted from the river Blackwater to the Bypass channel. The activities required for this stage will include:

- Erection of temporary dam across southernmost arches of Fermoy Bridge to stop flow to Mill Race Channel;
- Provision of construction access from Mill Island carpark;
- Erection of temporary bund downstream of Mill Race weir wall;
- Excavation and filling of toe and heel protection trenches alongside embankment section weir;

- Placement of geotextile layer and limestone setts for surface of embankment section of weir;
- Removal of capping stone from Weir wall:
- Recovery of stonework from collapsed sections of weir wall:
- Natural cement and grout injection to both faces existing masonry weir:
- Construction of concrete core for replacement section of weir wall:
- Masonry facing to replacement sections of weir wall and pointing of masonry to remaining sections of weir wall
- Raising of sections of weir wall to uniform level and placement/replacement of capping stones to Mill Race weir wall
- Dressing of rock armour at Mill Island to reinstated weir wall and associated profiling of river bed;
- Removal of access and associated bund;
- Removal of temporary dam upstream of bridge;
- Removal of site compounds and demobilisation.

The listed sequence of works is indicative only. In practice, the actual approach taken by the Contractor will be subject to a range of factors, including the following;

Conditions of planning;

- Contractors proposed works methodology;
- Weather;
- Seasonal constraints;
- Ecological constraints (crayfish relocation, fish relocation, turbidity monitoring, etc.;
- Resources;
- Subcontractors;
- Lead in times.

Options for methods of construction will be further explored with the contractor appointed to undertake the work prior to commencement on site.

### 5.4 Landscape Plan

A proposed landscape plan has been included with this planning application. This includes areas grass meadow and hard wearing ryegrass areas, locally sourced willow and an areas of native species riparian enhancements along the boundary of the fish bypass channel including the following:

- 15% Alder - 8-10 cms Trees / 80-100cms Transplants
- 15% Salix 8-10 cms Trees / 80-100cms Transplants
- 10% Wild Cherry 8-10cms Trees / 80-100cms Transplants
- 10% Bird Cherry 8.10cms Trees / 80-100cms Transplants
- 10% Native Black Poplar 80-100cms Transplants.
- 15% Holly 40-60Cms Transplants
- 15% Blackthorn 90-120 Cms Transplants
- 2.5% Bramble - 40-60cms Transplants
- 2.5% Hazel - 60-90Cms Transplants
- 2.5% Dog Rose - 60-90Cms Transplants
- 2.5% Spindle - 90-120 Cms Transplants

Tree planting will also include a mixture of native species are proposed including Alder, Willow, Scots Pine, Birch & Rowan - 12-14cms. See Doyle O'Troithigh Landscape Plan LP-01-PP which is included in **Appendix 2.**

# 6. Baseline Information

## 6.1. Blackwater River (Cork/Waterford) SAC

### 6.1.1 Overview

The proposed works will be located within a European site therefore, a source-pathway-receptor link does exist between the source (proposed development) and the receptor (River Blackwater (Cork/Waterford) SAC (site code 002170)). Overall, the River Blackwater is of considerable conservation significance for the occurrence of good examples of habitats and of populations of plant and animal species that are listed on Annexes I and II of the E.U. Habitats Directive. An overview of the proposed project in relation to the Blackwater River (Cork/Waterford) SAC is provided below in Figure 6**.** Detailed drawings are provided in **Appendix 2**.

The Blackwater River (Cork/Waterford) SAC is a very large site which drains a major part of County Cork and five mountain ranges. The site supports a high diversity of Annex I habitats and Annex II species of the E.U. Habitats Directive, including Atlantic Salmon and Otter. The site designated as the Blackwater River (Cork/Waterford) SAC consists of the freshwater stretches of the River Blackwater as far upstream as Ballydesmond and as far downstream as the tidal stretches into Youghal Harbour as well as the many tributaries along the way, the larger of which include the Licky, Bride, Flesk, Chimneyfield, Finisk, Araglin, Awbeg (Buttevant), Clyda, Glen, Allow, Dalua, Brogeen, Rathcool, Finnow, Owentaraglin and Awnaskirtaun. The extent of the Blackwater and its tributaries in this site flows through the counties of Kerry, Cork, Limerick, Tipperary and Waterford. The designated site covers a total area of 15,048 ha.

The main threats to the site and current damaging activities include high inputs of nutrients into the river system from agricultural run-off and several sewage plants, dredging of the upper reaches of the Awbeg, over-grazing within the woodland areas, and invasion by non-native species, for example Rhododendron *Rhododendron ponticum* and Cherry Laurel *Prunus laurocerasus*.

Overall, the River Blackwater is of considerable conservation significance for the occurrence of good examples of habitats and populations of plant and animal species that are listed on Annexes I and II of the E.U. Habitats Directive respectively. Furthermore, it is of high conservation value for the populations of bird species that use it. Two Special Protection Areas, designated under the E.U. Birds Directive, are also located within the site - Blackwater Callows and Blackwater Estuary. Additionally, the importance of the site is enhanced by the presence of a suite of uncommon plant species.

A full site synopsis for the River Blackwater (Cork/Waterford) SAC is included as **Appendix 1** of this report.

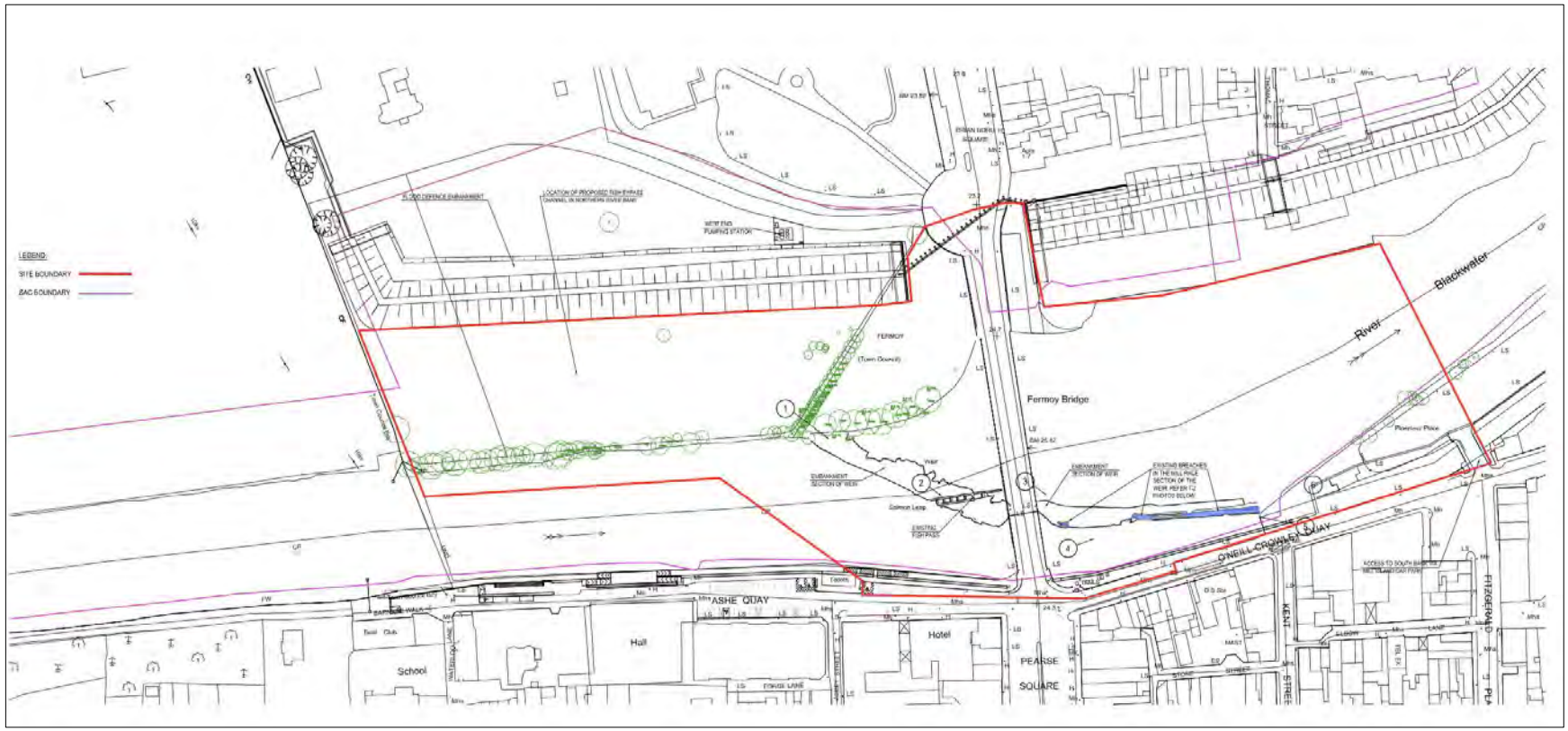



**Figure 6. Proposed Development site boundary (red line) and Blackwater River (Cork/Waterford) SAC (pink line)**

### 6.1.2 Qualifying interests and conservation objectives.

The EU Habitats Directive contains a list of habitats (Annex I) and species (Annex II) for which SACs must be established by Member States. Similarly, the EU Birds Directive contains lists of important bird species (Annex I) and other migratory bird species for which SPAs must be established. Those that are known to occur at a site are referred to as 'qualifying interests' and are listed in the European forms which are lodged with the EU Commission by each Member State. A 'qualifying interest' is one of the factors (such as the species or habitat that is present) for which the site merits designation. The National Parks and Wildlife Service (NPWS) are responsible for the designation of SACs and SPAs in Ireland.

The detailed conservation objectives for the site are detailed in: NPWS (2012) *Conservation Objectives: Blackwater River (Cork/Waterford) SAC 002170, Version 1. NPWS, Department of Arts, Heritage & the Gaeltacht*). The overall aim of the Habitats Directive is to maintain or restore the favourable conservation status of habitats and species of community interest. These habitats and species are listed in the Habitats and Birds Directives and Special Areas of Conservation and Special Protection Areas are designated to afford protection to the most vulnerable of them. These two designations are collectively known as the Natura 2000 network. European and national legislation places a collective obligation on Ireland and its citizens to maintain at favourable conservation status sites designated as Special Areas of Conservation and Special Protection Areas. The Government and its agencies are responsible for the implementation and enforcement of regulations that will ensure the ecological integrity of these sites.

The maintenance of habitats and species within European sites at favourable conservation condition will contribute to the overall maintenance of favourable conservation status of those habitats and species at a national level. Favourable conservation status of a habitat is achieved when its natural range, and area it covers within that range, is stable or increasing, and the ecological factors that are necessary for its long-term maintenance exist and are likely to continue to exist for the foreseeable future, and the conservation status of its typical species is favourable.

The favourable conservation status of a species is achieved when population data on the species concerned indicate that it is maintaining itself, and the natural range of the species is neither being reduced or likely to be reduced for the foreseeable future, and there is, and will probably continue to be, a sufficiently large habitat to maintain its populations on a long-term basis. The species and habitats listed as qualifying interests for the Blackwater River (Cork/Waterford) SAC and specific conservation objectives are included in **Table 2 and Table 3**.

**Table 2. Qualifying Species for the Blackwater River (Cork/Waterford) SAC**

| Species code | Species | | *Conservation objective* | *Screened in for NIS* |
|---|---|---|---|---|
| 1029 | Freshwater Pearl Mussel | *Margaritifera margaritifera* | Restore | Yes |
| 1092 | White-clawed crayfish | *Austropotamobius pallipes* | Maintain | Yes |
| 1095 | Sea Lamprey | *Petromyzon marinus* | Restore | Yes |
| 1096 | Brook Lamprey | *Lampetra planeri* | Maintain | Yes |
| 1099 | River Lamprey | *Lampetra fluviatilis* | Maintain | Yes |
| 1103 | Twaite Shad | *Alosa fallax* | Restore | Yes |
| 1106 | Atlantic Salmon | *Salmo salar* | Maintain | Yes |
| 1355 | Otter | *Lutra lutra* | Restore | Yes |
| 1421 | Killarney Fern | *Trichomanes speciosum* | Maintain | No |

**Table 3. Qualifying Habitats for the Blackwater River (Cork/Waterford) SAC**

| Habitat Code | Habitat | Conservation objective | Screened in for NIS |
|---|---|---|---|
| 1130 | Estuaries | Maintain | No |
| 1220 | Perennial vegetation of stony banks | Maintain | No |
| 1140 | Mudflats and sandflats not covered by seawater at low tide | Maintain | No |
| 1310 | Salicornia and other annuals colonizing mud and sand | Maintain | No |
| 1330 | Atlantic salt meadows (*Glauco-Puccinellietalia maritimae*) | Restore | No |
| 1410 | Mediterranean salt meadows (*Juncetalia maritimi*) | Maintain | No |
| 3260 | Water courses of plain to montane levels with the *Ranunculion fluitantis* and Callitricho-Batrachion vegetation | Maintain | Yes |
| 91E0 | Alluvial forests with *Alnus glutinosa* and *Fraxinus excelsior* (*Alno-Padion, Alnion incanae, Salicion albae*) | Restore | Yes |
| 91J0 | *Taxus baccata woods of the British Isles | Under Review | No |
| 91A0 | Old sessile oak woods with Ilex and Blechnum in British Isles | Restore | No |

Restore = Restore favourable conservation condition, Maintain = Maintain favourable conservation condition

### 6.1.3 Qualifying SAC habitats and species potentially affected-specific targets

The NPWS conservation objectives for the Blackwater River (Cork/Waterford) SAC (NPWS 2012) details the following targets for species and habitats which were screened into this NIS for further assessment **(Table 4** and **Table 5).**

### Table 4. QI species for which a potential impact has been identified – specific targets

| Species | Attribute | Measure | Target |
|---|---|---|---|
| White-clawed Crayfish | Distribution | Occurrence | No reduction from baseline. |
| | Population structure: recruitment | Percentage occurrence of juveniles and females with eggs | Juveniles and/or females with eggs in at least 50% of positive samples |
| | Negative indicator species | Occurrence | No alien crayfish species |
| | Disease | Occurrence | No instances of disease |
| | Water quality | EPA Q value | At least Q3-4 at all sites sampled by EPA |
| | Habitat quality: heterogeneity | Occurrence of positive habitat features | No decline in heterogeneity or habitat quality |
| Sea Lamprey | Distribution: extent of anadromy | % of river accessible | Greater than 75% of main stem length of rivers accessible from estuary. |
| | Population structure of juveniles | Number of age/size groups | At least three age/size groups present |
| | Juvenile density in fine sediment | Juveniles/m² | Juvenile density at least 1/m² |
| | Extent and distribution of spawning habitat | m² and occurrence | No decline in extent and distribution of spawning beds |
| | Availability of juvenile habitat | Number of positive sites in 3rd order channels (and greater), downstream of spawning areas | More than 50% of sample sites positive. |
| Brook Lamprey | Distribution | % of river accessible | Access to all water courses down to first order streams |
| | Population structure of juveniles | Number of age/size groups | At least three age/size groups of brook/River Lamprey present |

| Species | Attribute | Measure | Target |
|---|---|---|---|
| | Juvenile density in fine sediment | Juveniles/m² | Mean catchment juvenile density of brook/River Lamprey at least 2/m² |
| | Extent and distribution of spawning habitat | m² and occurrence | No decline in extent and distribution of spawning beds |
| | Availability of juvenile habitat | Number of positive sites in 2nd order channels (and greater), downstream of spawning areas | More than 50% of sample sites positive. |
| River Lamprey | Distribution | % of river accessible | Access to all water courses down to first order streams |
| | Population structure of juveniles | Number of age/size groups | At least three age/size groups of river/Brook Lamprey present |
| | Juvenile density in fine sediment | Juveniles/m² | Mean catchment juvenile density of brook/River Lamprey at least 2/m² |
| | Extent and distribution of spawning habitat | m² and occurrence | No decline in extent and distribution of spawning beds |
| | Availability of juvenile habitat | Number of positive sites in 2nd order channels (and greater), downstream of spawning areas | More than 50% of sample sites positive. |
| Atlantic Salmon | Distribution: extent of anadromy | % of river accessible | 100% of river channels down to second order accessible from estuary |
| | Adult spawning fish Number | Number | Conservation Limit (CL) for each system consistently exceeded |
| | Salmon fry | Number of fry/5 | Maintain or exceed 0+ fry mean catchment-wide abundance |

| Species | Attribute | Measure | Target |
|---|---|---|---|
| | abundance | minutes electrofishing | threshold value. Currently set at 17 Salmon fry/5 min sampling |
| | Out-migrating smolt abundance | Number | No significant decline |
| | Number and distribution of redds | Number and occurrence | No decline in number and distribution of spawning redds due to anthropogenic causes |
| | Water quality | EPA Q value | At least Q4 at all sites sampled by EPA |
| Otter | Distribution | Percentage positive survey sites | No significant decline |
| | Extent of terrestrial habitat | Hectares | No significant decline. Area mapped and calculated as 103ha above high water mark (HWM); 1165.7ha along river banks/ around ponds |
| | Extent of marine habitat | Hectares | No significant decline. Area mapped and calculated as 647.2ha |
| | Extent of freshwater (river) habitat | Kilometres | No significant decline. Length mapped and calculated as 599.54km |
| | Extent of freshwater (lake) habitat | Hectares | No significant decline. Area mapped and calculated as 25.06ha |
| | Couching sites and holts | Number | No significant decline |
| | Fish biomass available | Kilograms | No significant decline |
| | Barriers to | Number | No significant increase |

| Species | Attribute | Measure | Target |
|---|---|---|---|
| | connectivity | | |
| Freshwater Pearl Mussel | Distribution | Kilometres | Maintain at 161km. |
| | Population size | Number of adult mussels | Restore to 35,000 adult Mussels Information on the size of the population in the Blackwater and its tributaries is poor but estimated at less than 10,000 for the Blackwater main channel, for which the target is set at 10,000. |
| | Population structure: recruitment | Percentage per size class | Restore to at least 20% of population no more than 65mm in length; and at least 5% of population no more than 30mm in length Mussels of no more than 65mm are considered 'young mussels' and may be found buried in the substratum and/or beneath adult mussels. Mussels of no more than 30mm are 'juvenile mussels' and are always buried in the substratum. |
| | Population structure: adult mortality | Percentage | No more than 5% decline from previous number of live adults counted; dead shells less than 1% of the adult population and scattered in distribution. The Blackwater failed both targets in 2009. |
| | Habitat extent | Kilometres | Restore suitable habitat in more than 35km and any additional stretches necessary for Salmonid spawning. The species' habitat is a combination of 1) the area of habitat adult and juvenile mussels can occupy and 2) the area of spawning and nursery habitats the host fish can occupy. Fish nursery habitat typically overlaps with mussel habitat. Fish spawning habitat is generally adjacent to mussel habitat but may lie upstream of the generalised mussel distribution. Only those Salmonid spawning areas that could regularly contribute juvenile fish to the areas occupied by adult mussels |

| Species | Attribute | Measure | Target |
|---|---|---|---|
| | | | should be considered. The availability of mussel habitat and fish spawning and nursery habitats are determined by flow and substratum conditions. The habitat for the species is currently unsuitable for the survival of adult mussels or the recruitment of juveniles. The target is based on the stretches of river identified, from a combination of dedicated survey and incidental records, as having suitable habitat for the species. As there has been no full baseline survey, the quality of the data from the Blackwater and its tributaries is poor. |
| | Water quality: macroinvertebrate and phytobenthos (diatoms) | Ecological Quality Ratio (EQR) | Restore water quality-macroinvertebrates: EQR greater than 0.90; phytobenthos: EQR greater than 0.93. These EQRs correspond to high ecological status for these two Water Framework Directive biological quality elements. They represent high water quality with very low nutrient concentrations (oligotrophic conditions). The habitat in the Blackwater failed both standards during 2009 sampling for the Sub-basin Management Plans. |
| | Substratum quality: filamentous algae (macroalgae), macrophytes (rooted higher plants) | Percentage | Restore substratum quality-filamentous algae: absent or trace (<5%); macrophytes: absent or trace (<5%). Significant growth of macrophytes was found at some sites in all three populations sampled during 2009 for the Sub-basin Management Plans. Recruitment of juvenile mussels is being prevented by the poor quality of the river substrate. |
| | Substratum quality: sediment | Occurrence | Restore substratum quality-stable cobble and gravel substrate with very little fine material; no artificially elevated levels of fine sediment. The habitat for the species is |

| Species | Attribute | Measure | Target |
|---|---|---|---|
| | | | currently unsuitable for the recruitment of juveniles owing to sedimentation of the substratum. In some locations, it is also unsuitable for the survival of adult mussels. |
| | Substratum quality: oxygen availability | Redox potential | Restore to no more than 20% decline from water column to 5cm depth in substrate. Juvenile mussels require full oxygenation while buried in gravel. In suitable habitat, there should be very little loss of redox potential between the water column and underlying gravels. Data is not available for the main Blackwater River. |
| | Hydrological regime: flow variability | Metres per second | Restore appropriate hydrological regimes. The availability of suitable Freshwater Pearl Mussel habitat is largely determined by flow (catchment geology being the other important factor). In order to restore the habitat for the species, flow variability over the annual cycle must be such that: 1) high flows can wash fine sediments from the substratum, 2) low flows do not exacerbate the deposition of fines and 3) low flows do not cause stress to mussels in terms of exposure, water temperatures, food availability or aspects of the reproductive cycle. |
| | Host fish | Number | Maintain sufficient juvenile Salmonids to host glochidial larvae. Salmonid fish are host to the larval form of the Freshwater Pearl Mussel and, thus, they are essential to the completion of the life cycle. 0+ and 1+ fish are typically used, both because of the habitat overlaps and the development of immunity with age in the fish. Fish presence is considered sufficient, as higher densities and biomass of fish are indicative of enriched conditions in mussel rivers. Geist *et al.* (2006) found that higher |

| Species | Attribute | Measure | Target |
|---|---|---|---|
| | | | densities of host fish coincided with eutrophication, poor substrate quality for pearl mussels and a lack of pearl mussel recruitment, while significantly lower densities and biomass of host fish were associated with high numbers of juvenile mussels. Fish movement patterns must be such that 0+ fish in the vicinity of the mussel habitat remain in the mussel habitat until their 1+ summer. No fish stocking should occur within the mussel habitat, nor any works that may change the Salmonid balance or residency time.<br><br>No data on fish preferences are available for the Blackwater. |
| Twaite Shad | Distribution: extent of anadromy | % of river accessible | Greater than 75% of main stem length of rivers accessible from estuary |
| | Population structure: age classes | Number of age classes | More than one age class Present |
| | Extent and distribution of spawning habitat | m² and occurrence | No decline in extent and distribution of spawning habitats |
| | Water quality: oxygen levels | Milligrammes per litre | No lower than 5mg/l |
| | Spawning habitat quality: Filamentous algae; | Occurrence | Maintain stable gravel substrate with very little fine |

| Species | Attribute | Measure | Target |
|---|---|---|---|
| | macrophytes; sediment | | material, free of filamentous algal (macroalgae) growth and macrophyte (rooted higher plant) growth |

### Table 5. QI habitats for which a potential impact has been identified – specific targets

| Habitats | Attribute | Measure | Target |
|---|---|---|---|
| Water courses of plain to montane levels with the *Ranunculion fluitantis* and *Callitricho-Batrachion* vegetation | Habitat distribution | Occurrence | No decline, subject to natural processes |
| | Hydrological regime: river flow | Metres per second | Maintain appropriate hydrological regimes |
| | Hydrological regime: tidal influence | Daily water level fluctuations- metres | Maintain natural tidal regime |
| | Substratum composition: particle size range | Millimetres | The substratum should be dominated by the particle size ranges, appropriate to the habitat sub-type (typically sands, gravels and cobbles) |
| | Water quality: nutrients | Milligrammes per litre | The concentration of nutrients in the water column should be sufficiently low to prevent changes in species composition or habitat condition |
| | Vegetation composition: typical species | Occurrence | Typical species of the relevant habitat sub-type should be present and in good condition |
| | Floodplain connectivity: area | Hectares | The area of active floodplain at and upstream of the habitat should be maintained |
| Alluvial forests with Alnus glutinosa and Fraxinus excelsior (Alno-Padion, | Habitat area | Hectares | Area stable or increasing, subject to natural processes, at least 19.2ha for sites surveyed. S |

| Habitats | Attribute | Measure | Target |
|---|---|---|---|
| Alnion incanae, Salicion albae) | Habitat distribution | Occurrence | No decline. |
| | Woodland size | Hectares | Area stable or increasing. Where topographically possible, "large" woods at least 25ha in size and “small” woods at least 3ha in size |
| | Woodland structure: cover and height | Percentage and metres | Diverse structure with a relatively closed canopy containing mature trees; subcanopy layer with semi- mature trees and shrubs; and well-developed herb layer |
| | Woodland structure: community diversity and extent | Hectares | Maintain diversity and extent of community types |
| | Woodland structure: natural regeneration | Seedling: sapling: pole ratio | Seedlings, saplings and pole age-classes occur in adequate proportions to ensure survival of woodland canopy |
| | Hydrological regime: flooding depth/height of water table | Metres | Appropriate hydrological regime necessary for maintenance of alluvial vegetation |
| | Woodland structure: dead wood | $m^3$ per hectare; number per hectare | At least 30$m^3$/ha of fallen timber greater than 10cm diameter; 30 snags/ha; both categories should include stems greater than 40cm diameter (greater than 20cm diameter in the case of alder) |

## 6.2 Ecological Surveys

The ecological baseline for the proposed development site was based on a desktop review and direct surveys of the relevant works area and areas proximate to same. This focused on habitats and species that are listed as Qualifying Interests (QI) (in the case of SACs) and Special Conservation Interests (SCI) (in the case of SPAs) in the designations for the European sites. Surveys for habitats, mammals, birds and invasive species were undertaken within the study area.

Site surveys were carried out on the 26th May 2020, 29th May 2020, 8th June 2020, 9th July 2020, 26th July 2020, 28th May 2021, 30th May 2021, 19th of July 2021 and 31st July 2021. Additional detail on survey methodologies, dates and results are included in **Appendix 3,** *Aquatic baseline report for Fermoy Weir, Fermoy, Co. Cork*, **Appendix 4.** *A Survey of Freshwater Pearl Mussel (Margaritifera margaritifera) at Fermoy Bridge on the Munster Blackwater River, Co. Cork and* **Appendix 5.** *Tree survey and Arboricultural Impact Assessment*.

The following surveys were carried out as part of this assessment.

- Terrestrial habitat assessment was carried out by DixonBrosnan Environmental Consultants on the 28th May 2021, 30th May 2021, 19th of July 2021 and 31st July 2021. Habitats were classified according to the classification scheme outlined in the Heritage Council publication *A Guide to Habitats in Ireland* (Fossitt, 2000) and following the guidelines contained in *Best Practice Guidance for Habitat Survey and Mapping* (Heritage Council, 2011). Surveys for birds and mammals were carried out in conjunction with habitat surveys.

- Aquatic habitat assessment was conducted by Triturus Environmental Ltd in May, June and July 2020 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 Heritage Council's *A Guide to Habitats in Ireland* (Fossitt, 2000);

- Aerial fixed-wing drone survey was undertaken of the wider Fermoy Weir site by Triturus Environmental Ltd in June 2020 to further inform the walkover surveys and ensure the most contemporary mapping data was available for aquatic baseline surveys;

- Macrophyte survey was undertaken by Triturus Environmental Ltd in May, June and July 2020 to establish the presence of the Annex I habitats at the proposed development site;

- Biological water quality (Q-sampling) was undertaken by Triturus Environmental Ltd at n=4 sites (two upstream and two downstream of Fermoy Weir) as per Toner *et al.* (2005) in May, June and July 2020;

- SONAR survey was undertaken by Triturus Environmental Ltd in July 2020 to determine the bathymetry and substrata-type (i.e., bottom hardness and rugosity) within the survey sections of channel;

- Tree survey and arboricultural impact assessment was carried out by Mark Donnelly BSc in July 2021 within the proposed development site following the standards in BS 5837 (2012);

- Alluvial woodland assessment was carried out Mark Donnelly BSc on 15th September 2021;

- Otter *Lutra lutra* survey was undertaken by Triturus Environmental Ltd extending 250m upstream and 250m downstream of Fermoy Weir in May, June and July 2020 as per methodology developed by Macklin *et al.* (2019);

- Bat surveys were carried out by DixonBrosnan Environmental Consultants on the 30th May 2021 and 23rd of September 2021 utilising guidelines set out in '*Bat Surveys for Professional Ecologists: Good Practice Guidelines (3rd ed)'* (Collins, 2016).;

- Electro-fishing survey was carried out (under permission from Inland Fisheries Ireland (IFI)) in July 2020. Electro-fishing methodology followed accepted European standards (CEN, 2003) and adhered to best practice (e.g. CFB, 2008);

- Environmental DNA (eDNA) analysis was undertaken on water samples (collected May 2020) by Triturus Environmental Ltd to assess the distribution of Twaite Shad *Alosa fallax* within the Blackwater River (Cork/Waterford) SAC (002170);

- White-clawed Crayfish *Austropotamobius pallipes* surveys were undertaken in May 2020 by Triturus Environmental Ltd under a National Parks and Wildlife (NPWS) open licence (no. C79/2020), in accordance with Reynolds *et al.* (2010);

- Freshwater Pearl Mussel *Margaritifera margaritifera* survey of the River Blackwater was carried out by Sweeny Consultancy in May 2020 100m upstream and 100m downstream of Fermoy Bridge (Kent Bridge) in accordance with the Stage 1 & 2 guidelines given in Irish Wildlife Manual No. 12, NPWS (Anon., 2004) and

- Invasive species surveys were carried out by DixonBrosnan Environmental Consultants on the 28th May 2021, 30th May 2021, 19th of July 2021 and 31st July 2021.

### 6.3 Habitat surveys

Habitat surveys were carried out on the 27th of September 2020, 10th of May 2021, 13th of May 2021, 17th of May 2021, 28th May 2021, 19th of July 2021 and 31st July 2021. Habitat mapping was carried out in line with the methodology outlined in the Heritage Council Publication, *Best Practice Guidance for Habitat Survey and Mapping* (Heritage Council, 2011). The terrestrial and aquatic habitats within the proposed development site were classified using the classification scheme outlined in the Heritage council publication *A Guide to Habitats in Ireland* (Fossitt, 2000) and the Environment Agency's *'River Habitat Survey in Britain and Ireland Field Survey Guidance Manual 2003'* (EA, 2003) and cross referenced with Annex I Habitats where required.

The survey area, both upstream and downstream of Fermoy Bridge and the existing weir, is located in the Blackwater River (Cork/Waterford) SAC (**Figure 7**) and also within the River Blackwater *Margaritifera* sensitive area.

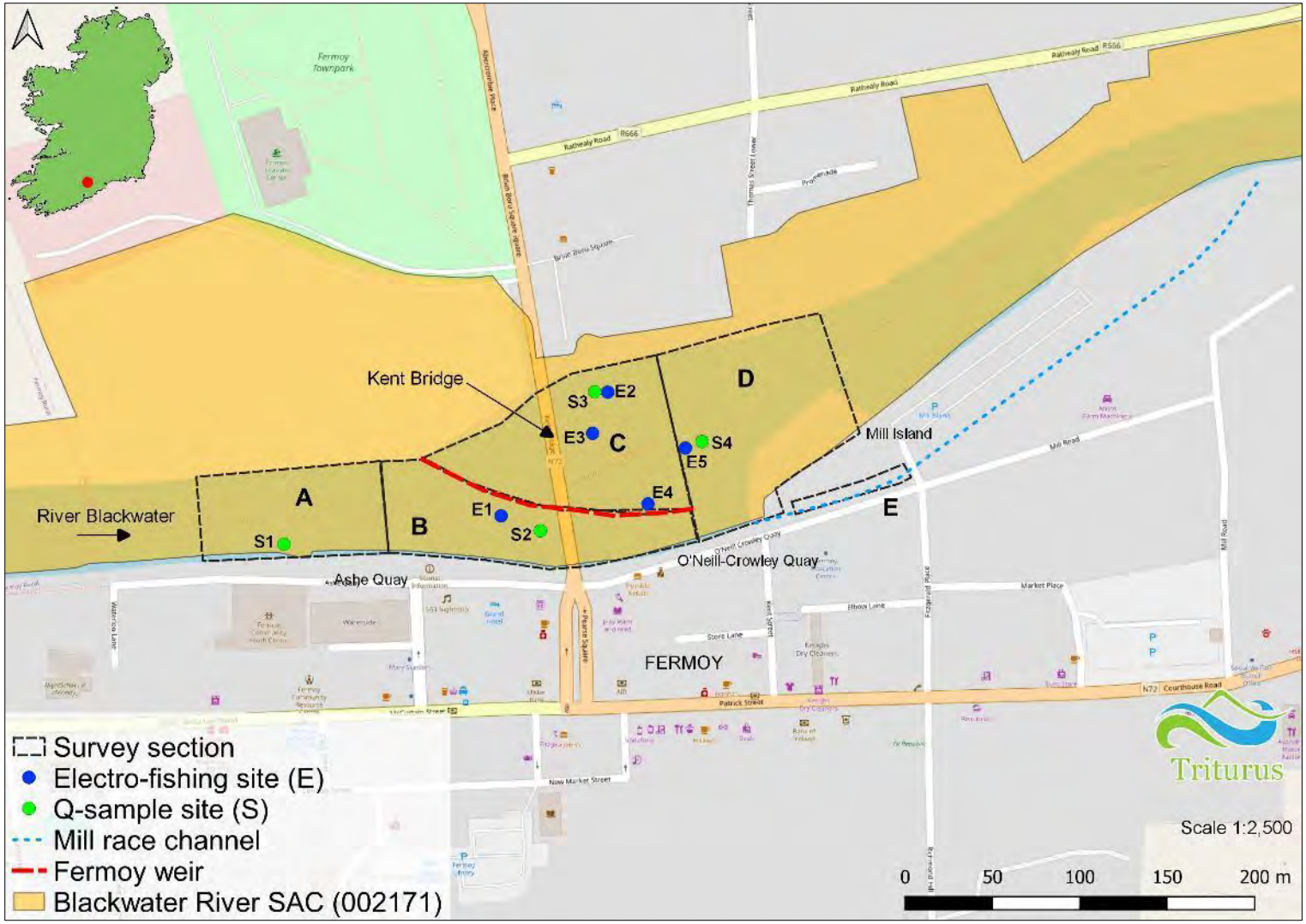



**Figure 7. Location of aquatic survey sections in the vicinity of the proposed Fermoy Weir works, Fermoy, Co. Cork**

### 6.3.1 Aquatic habitats

#### *Section A – >100-200m upstream Fermoy Weir*

Section A was located >100-200m upstream of the existing Fermoy Weir structure (**Plate 1**). This section was dominated by homogenous deep glide habitat, with the River Blackwater (Lowland Depositing River, FW2)) averaging 40-50m wide and 2-3m in depth. The river flowed through a deep U-shaped channel, with steep marginal sloping areas. The river channel was highly modified along the south bank, being bound by built land (Buildings and artificial surfaces BL3) and retaining walls approximately 2m above the surface of the river at the time of survey (note: extremely low water levels at the time of survey, May-June 2020). The substrata were dominated by boulder and cobble (60% overall), with patches of coarse gravels. Some sand and silt accumulations were present along the littoral zone of steep river margins. Generally, the substrata were relatively highly bedded with moderate siltation. Instream macrophytes were limited given the mean depth, with sparse marginal growth of Spiked Water Milfoil (*Myriophyllum spicatum*) and Hemlock Water Dropwort (*Oenanthe aquatica*). Instream bryophytes were limited to occasional *Fontinalis antipyretica* on larger boulders. Filamentous algal cover was particularly high at the time of survey, especially in marginal slope areas. Given the paucity of macrophytes upstream of the weir, no good examples of the Annex I habitat 'Water courses of plain to montane levels, with submerged or floating vegetation of *Ranunculion fluitantis* and *Callitricho-Batrachion* or aquatic mosses [3260]' was recorded. No vegetation representative of 'Hydrophilous tall herb fringe communities of plains and of the montane to alpine levels [6430]' was recorded.

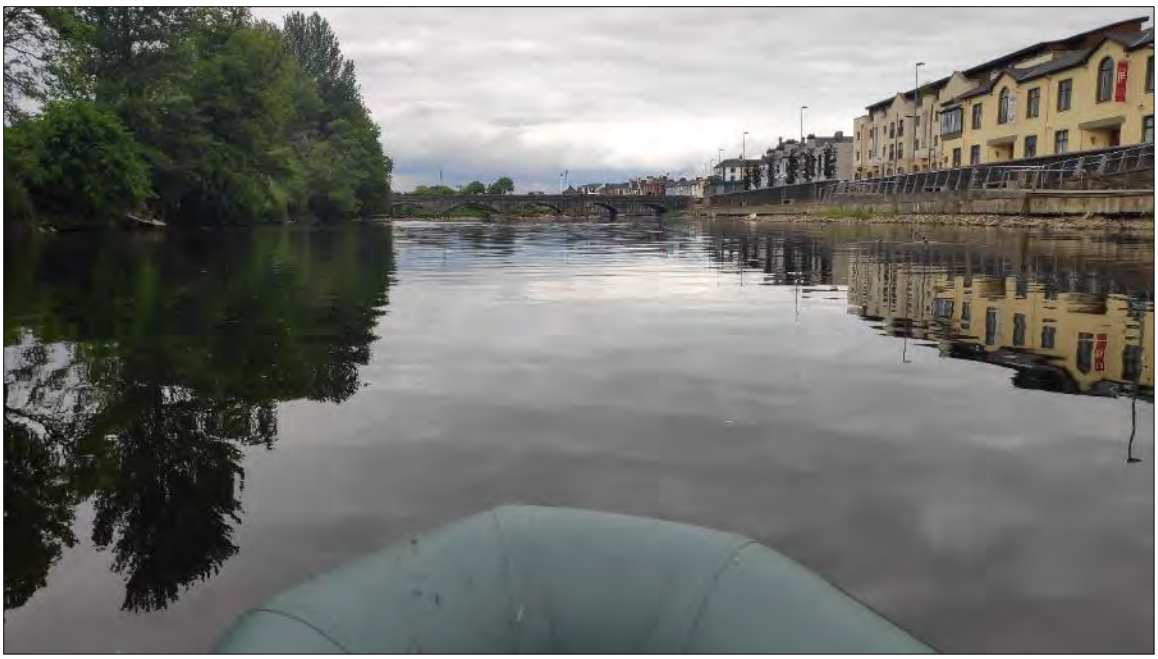


**Plate 1. Representative image of Section A >100m upstream of Fermoy Weir, July 2020 (facing downstream towards bridge)**

#### *Section B – 0-100m upstream of Fermoy Weir*

As per Section A, Section B (located <100m upstream of the existing weir face) was dominated by homogenous deep glide habitat, with the River Blackwater averaging 40-50m wide and 2-2.5m in depth (**Plate 2**). The existing Fermoy Weir structure bisected the section immediately

upstream of Fermoy Bridge. The structure was approximately 150m in length and ran from a NW to SE direction. Significant structural damage was evident along the weir face. The river in Section B flowed through a deep U-shaped channel, with steep marginal sloping areas. The channel was highly modified along the south bank, being bound by built land (BL3) and retaining walls approximately 2m above the surface of the river at the time of survey (note: very low water levels at the time of survey, May-June 2020). The substrata were dominated by boulder and cobble (70% overall), with frequent patches of coarse gravels. Some sand and silt accumulations were present along the littoral zone of steep river margins. Generally, the substrata were bedded with moderate siltation. Instream macrophytes were limited given the deeper water and predominance of hard substrata, with sparse marginal growth of Spiked Water Milfoil and Yellow Water Llily (*Nuphar lutea*) and occasional small stands of Hemlock Water Dropwort on exposed gravel shoals (often inundated at higher water levels). The weir structure supported sparse growth of Hemlock Water Dropwort in addition to the aquatic mosses *Cinclidotus fontinaloides* and *Fontinalis antipyretica* on the wetted faces. Filamentous algal cover was particularly high at the time of survey, especially in marginal slope areas. Given the paucity of macrophytes upstream of the weir, no good examples of the Annex I habitat 'Water courses of plain to montane levels, with submerged or floating vegetation of *Ranunculion fluitantis* and *Callitricho-Batrachion* or aquatic mosses [3260]' was recorded.

**Plate 2. Representative image of Section B (0-100m upstream of Fermoy Weir), June 2020 showing old fish pass, facing downstream towards bridge.**

### *Section C – 0-100m downstream Fermoy Weir*

Section C, located downstream of the existing weir structure, featured faster and more heterogeneous flows than upstream. Structural damage to the weir in recent years had resulted in accelerated deep (>1.5m) fast glide habitat along the south bank (main flow), feeding a large, deep pool approximately 30m downstream of Fermoy Bridge, along O'Neill-Crowley Quay (**Plates 3-5).** The river along the south bank was considerably shallower (<1m, often <0.5m) and dominated by riffle and shallow glide habitat, with pool-like/eddy habitat pool located in the vicinity of the bridge (i.e. between weir face and islands). Overall, the substrata

were dominated by well-mixed gravels and small cobble in most areas. Fine sediment (silt and clay) accumulations were associated with instream macrophyte beds and had caused some local bedding of substrata. However, overall, the substrata were generally mobile and free from sedimentation. At low water levels, numerous small islands of exposed gravel and cobble were present immediately downstream of the bridge. The lee of these islands supported fine sediment accumulations ranging from 1-10cm in depth and offered good lamprey potential.

In contrast to upstream, macrophyte cover was high with growth dominated by Water Crowfoot (*Ranunculus* subspecies *Batrachion* agg.) vegetation, which formed large stands along the shallow fast glide of the north bank, downstream of the bridge (30% cover overall). Spiked Water Milfoil was also locally frequent with occasional *Callitriche* sp. between islands/gravel shoals and along muddy river margins. Small, localised stands of Unbranched Bur-reed (*Sparganium emersum*) were also present. *Fontinalis antipyretica* was recorded very locally on large cobble. The moss species *Cinclidotus fontinaloides* was very abundant along the dry weir faces. Given the presence of ≥3 indicator species (see EC, 2013), the macrophyte community recorded was considered representative of the Annex I habitat 'Water courses of plain to montane levels, with submerged or floating vegetation of *Ranunculion fluitantis* and *Callitricho-Batrachion* or aquatic mosses [3260]'.

**Plate 3. Representative image of the downstream extent of Section C (0-100m downstream of Fermoy Weir), June 2020.**

**Plate 4. Representative image of Section C (0-100m downstream of Fermoy Weir), July 2020 showing existing wall (right) and mid-channel islands (left).**

**Plate 5. Representative image of Section C (0-100m downstream of Fermoy Weir), July 2020 facing upstream towards Fermoy Bridge from the O'Neill Crowley Quay retaining wall (large weir pool located in the right foreground was located within Section D).**

### *Section D - >100-200m downstream Fermoy Weir*

Section D, located ≥100m downstream of the existing weir structure, was dominated by very fast glide and pool habitat, invariably <1m in depth. Deeper glide and pool was present >200m downstream (i.e. towards the downstream extent of Mill Island). The large pool associated with the existing weir, along O'Neill-Crowley Quay (**Plate 6 and 7**), ranged from 2-2.5m in depth at the time of survey (i.e. low water levels). Standing water/ponding (<0.3m max. depth) was present on and to the south of the large, exposed gravel island (usually mostly inundated at normal water levels). In the river channel the substrata were dominated by cobble and coarse gravel. Large cobble and limited large boulders were present in the weir pool. Given high flow rates, the substrata were generally mobile and free from sedimentation although some shallow silt/sand accumulations were present in marginal slacks and in association with macrophyte beds.

In terms of macrophytes, *Ranunculus* subspecies *Batrachion* agg. vegetation was present but was localised in the main channel downstream of the pool and island (10% cover). Some limited Spiked Water Milfoil and *Callitriche* sp. were present at the Section C-D interface. *Fontinalis antipyretica* was recorded very locally on larger cobble and boulder. Given the presence of ≥3 indicator species (EC, 2013), the macrophyte community recorded was considered representative of the Annex I habitat 'Water courses of plain to montane levels, with submerged or floating vegetation of *Ranunculion fluitantis* and *Callitricho-Batrachion* or aquatic mosses [3260]'.

**Plate 6. Representative image of Section D (>100-200m downstream of Fermoy Weir), June 2020, facing downstream from the largest mid-channel island near Fermoy Bridge.**

**Plate 7. Representative image of Section D, July 2020, facing upstream towards Fermoy Bridge.**

### *Section E – Mill-race channel*

Site E represented the uppermost 100m of a disused Mill Race channel, that averaged 7-8m and 0.3-0.5m in depth at the time of survey. The channel was not located within the Blackwater River (Cork/Waterford) SAC site (**Figure 7**). Held between 2-3m-high retaining walls, the channel diverged from the River Blackwater through a flood wall (formerly sluice gates) near the weir pool along O'Neill-Crowley Quay/Mill Road. The channel rejoined the main river approximately 400m downstream. The channel supported standing water only at the time of survey (100% pool habitat), although it was known to convey significantly higher water volumes, seasonally. The channel substrata were dominated by deep silt, often >0.5m in depth. Otter prints (recently made) were recorded in the muddy paludal under the road bridge to the Mill Island car park (ITM 581346,598612).

The site was heavily-vegetated and supported a diverse macrophyte and riparian plant community. Instream, Unbranched Bur-reed was abundant, with frequent Canadian Pondweed (*Elodea canadensis*), Broad-leaved Pondweed (*Potamogeton natans*) and Common Duckweed (*Lemna minor*). *Callitriche* sp. and Water Plantain were occasional. Given the presence of only two indicator species (*Potamogeton* sp. and *Callitriche* sp.; EC, 2013), the macrophyte community did not correspond to the Annex I habitat 'Water courses of plain to montane levels, with submerged or floating vegetation of *Ranunculion fluitantis* and *Callitricho-Batrachion* or aquatic mosses [3260]'.

The margins of the channel, exposed to occasional inundation, supported abundant Reed Canary Grass with Flowering Rush, Fool's Watercress (*Apium nodiflorum*), Water Mint, Blue Water Speedwell (*Veronica anagallis-aquatica*), Bittersweet (*Solanum dulcamara*) and Redshank (*Persicaria maculosa*). Given the good species diversity, the plant community of the upper reaches of the mill-race channel was considered representative of the Annex I habitat 'Hydrophilous tall herb fringe communities of plains and of the montane to alpine levels [6430]'.

**Plate 8. Representative image of site E, the heavily vegetated mill-race channel downstream of the proposed works area, July 2020.**

**Plate 9. Representative image of marginal vegetation including flowering rush representative of the Annex I habitat 'Hydrophilous tall herb [6430]', July 2020.**

### 6.3.2 Sonar Survey

As anticipated, the boat-based SONAR survey revealed a clear differential in the bathymetric profile upstream and downstream of the weir (Refer to **Appendix 3 Figure 3.2**). Upstream of the existing weir (i.e. survey Section A and most of Section B) featured deeper glide habitat averaging 1.5-2.5m, while downstream the average depth of the areas dominated by faster-

flowing glide habitat averaged 0.5-<1.5m. Although some locally deeper pool areas were present, the majority of survey sections C and D (downstream of the weir) were ≤1m in depth.

The plots of river hardness (**Appendix 3 Figure 3.3**) and riverbed rugosity (**Appendix 3 Figure 3.4**) illustrated the dominance of softer substrata in the shallower areas, such as those in the vicinity of mid-channel islands downstream of Fermoy Bridge. These areas are indicated by higher relative scores in both the river hardness and rugosity maps (**Appendix 3 Figures 3.3 & 3.4**). In this respect silt dominated areas are softer and smoother as reflected in the scores and concentrated in the northern half of the River Blackwater channel downstream of the weir. The deeper glide and pool areas (e.g., sections A and D) supported harder substrata with higher rugosities (greater substrata complexity/ roughness) with very localised lamprey ammocoete habitat (as illustrated by the dark red banding on **Appendix 3 Figures 3.3 & 3.4**).

### 6.3.3 Floating river vegetation

Macrophyte communities representative of the Annex I habitat ''Water courses of plain to montane levels, with submerged or floating vegetation of *Ranunculion fluitantis* and *Callitricho-Batrachion* or aquatic mosses [3260]' ('floating river vegetation', FRV) were present within the River Blackwater survey area. Sections C and D, downstream of Fermoy Weir, supported frequent *Ranunculus* subspecies *Batrachion* agg. in addition to other indicator species (EC, 2013) including Callitriche sp., *Myriophyllum spicatum* and the moss *Fontinalis antipyretica*. The better-quality areas of FRV habitat could be considered as those featuring an overall higher percentage cover, i.e. survey Section C downstream of Fermoy Bridge, along the north bank. Given the paucity of macrophytes, no good examples of this Annex I habitat were present upstream of the weir (survey sections A and most of B).

### 6.3.4 Hydrophilous tall herb habitat (non-qualifying interest)

Of note, are several vegetated gravel islands located in the River Blackwater downstream of Fermoy Weir supported the non-qualifying interest Annex I habitat 'Hydrophilous tall herb fringe communities of plains and of the montane to alpine levels [6430]'. A number of positive indicator species (EC, 2013; Devaney *et al*., 2013) were recorded on exposed gravel shoals and their margins including *Epilobium hirsutum*, *Lythrum salicaria*, *Mentha aquatica*, *Myosotis scorpioides, Stachys palustris* and *Alisma plantago-aquatica*. River gravel islands (bars) are classified as vulnerable in the European Red List of Habitats, based on the criterion of a large reduction in the habitat area over the last 50 years (about 35%; Janssen *et al*., 2016). Such islands are ephemerally inundated at higher flows and subject to wetting and drying processes with changing water levels, thereby alternately offering terrestrial, wet and aquatic habitats (Zeng *et al.,* 2015). Gravel bars and partially vegetated islands, such as those found downstream of Fermoy Weir, are key components of gravel-bed rivers (Edwards *et al*., 1999; Tockner *et al.,* 2006) and are naturally highly dynamic and morphologically complex systems. Therefore, gravel islands represent important instream habitat at the aquatic-terrestrial interface. In having an ecotonal position between aquatic and terrestrial environments, bars have the potential to support a varied and rich biota (Kalníková *et al*., 2020; Gilvear *et al.,* 2007).

Good examples of the Annex I hydrophilous tall herb habitat was also present in the Mill Race channel (survey Section E), located outside of the Blackwater River (Cork/Waterford) SAC

boundary, as well as along the northern river margins of survey Section C (downstream of the bridge) and to the south of the large gravel island near Mill Island (Section D).

### 6.3.5 Aquatic habitat evaluation

An ecological evaluation of the survey area was based on the results of the aquatic surveys. All aquatic survey areas on the River Blackwater (i.e. sections A-D) were considered of International importance as they form part of the Blackwater River (Cork/Waterford) SAC (002170). These survey sections were also considered of high value given the presence of qualifying interest *Lampetra* sp. ammocoetes, Atlantic Salmon, White-clawed Crayfish and Otter in addition to the Annex I habitats 'Water courses of plain to montane levels, with submerged or floating vegetation of Ranunculion fluitantis and Callitricho-Batrachion or aquatic mosses [3260]' (sections C and D) 'Hydrophilous tall herb fringe communities of plains and of the montane to alpine levels [6430]' (sections C and D).

The Mill Race channel (survey Section E) was located outside of the Blackwater River (Cork/Waterford) SAC boundary. However, given that the channel supported Otter and herbaceous vegetation representative of the Annex I habitat 'Hydrophilous tall herb fringe communities of plains and of the montane to alpine levels [6430]', survey Section E was considered of local importance (higher value).

### 6.3.6 Terrestrial habitat

#### *Section A – >100-200m upstream Fermoy Weir*

In Section A the north bank featured a scattered mature riparian treeline (WL2) comprised of Sycamore (*Acer psuedoplatanus),* Elder (*Sambucus nigra*), Ash (*Fraxinus excelsior*), Aspen (*Populus tremula*), Hawthorn (*Crataegus monogyna*), Hazel (*Corylus avellana*), occasional Alder (*Alnus glutinosa*) and Wych elm (*Ulmus glabra*). The scrubby understorey was dominated by Bramble (*Rubus fruticosus* agg.) and nettle (*Urtica dioica*). Reed Canary Grass (*Phalaris arundinacea*) was common along channel margins, more so on the north bank.

#### *Section B – 0-100m upstream of Fermoy Weir*

In Section B the north bank featured a scattered mature riparian treeline (WL2) comprised of Sycamore, Elder, Ash, Aspen, Hawthorn, Hazel and occasional Alder and Wych Elm. The scrubby understorey was dominated by Bramble and Nettle. The river was bordered by improved agricultural grassland (GA1) to the north. No vegetation representative of 'Hydrophilous tall herb fringe communities of plains and of the montane to alpine levels [6430]' was recorded.

The weir and bridge in this area have been classified as Buildings and artificial surfaces (BL3) This habitat type includes the entirety of the Fermoy Bridge, as well as a section of paved park entrance and adjacent paths, and a small carpark north of the bridge. It also includes sections of footpath south of the bridge and a large carpark to the southeast of the bridge, as well as two smaller bridges connecting this carpark to O'Neill-Crowley Quay. While the weir structure supports limited vegetation (See **Section 5.1**), as noted in **Section 7.1** below, the weir is frequently used by Otter.

### *Section C – 0-100m downstream Fermoy Weir*

Along Section C, the river channel was bordered to the north by a mature treeline (WL2) comprising Alder, Ash and Sycamore with Elder, Willow and Hawthorn adjoining improved agricultural grassland (pasture). The south (town) bank along O'Neill-Crowley Quay was bound by retaining walls (Stonewalls and other stonework BL1). The north bank of the river immediately downstream of the bridge featured muddy paludal areas supporting localised Great Yellow-cress (*Rorippa amphibia*), Hemlock Water Dropwort, Pink Water Speedwell (*Veronica catenata*) and Water-forget-me-not (*Myosotis scorpioides*) (Tall-herb swamp FS2). These littoral species graded into more extensive swards of Reed Canary Grass on drier ground (including islands). Muddy areas below the water line supported occasional stands of Flowering Rush (*Butomus umbellatus*) (one large 10m$^2$ stand) and infrequent Branched Bur-reed (*Sparganium erectum*). The upper drier gravel areas of instream islands supported Great Willowherb (*Epilobium hirsutum*), Marsh Willowherb (*Epilobium palustre*), Ribwort Plantain (*Plantago lanceolata*), Common Figwort (*Scrophularia nodosa*), Charlock (*Sinapis arvensis*), Vetch (*Vicia* sp.), Creeping Yellowcress (*Rorippa sylvestris*), Bittercress (*Cardamine* sp.) and Marsh Woundwort (*Stachys palustris*). Exposed gravel and cobble littorals of such instream islands also supported frequent Redshank (*Persicaria maculosa*), Water Pepper (*Persicaria hydropiper*) and Fat Hen (*Chenopodium album*) with less frequent patches of Hemlock Water Dropwort. Curled Dock (*Rumex crispus*) and Creeping Yellowcress were more localised. The muddy margins of these islands supported Water Plantain (*Alisma plantago-aquatica*) and Water Mint (*Mentha aquatica*). Himalayan Balsam (*Impatiens glandulifera*) was occasional. Given the presence of ≥3 indicator species (see Devaney *et al.* 2013), the Annex I habitat 'Hydrophilous tall herb fringe communities of plains and of the montane to alpine levels [6430]' was also recorded in association with mid-channel islands and along the north bank of the river (downstream of Fermoy Bridge).

### *Section D - >100-200m downstream Fermoy Weir*

The river channel around Section D was bordered to the north and south by a mature treeline comprising alder, ash and sycamore with elder, willow and hawthorn. Reed canary grass formed large stands on island centers with inundation zones colonised by annuals of exposed gravel. The upper drier gravel areas of instream islands supported great willowherb, marsh Willowherb, Ribwort Plantain, Common Figwort, Charlock, Vetch (*Vicia* sp.), Creeping Yellowcress, Bittercress (*Cardamine* sp.) and Marsh Woundwort. Exposed gravel and cobble littorals of such instream islands also supported frequent Redshank, Water Pepper and Fat Hen with less frequent patches of hemlock water dropwort. Curled Dock and Creeping Yellowcress were more localised. The muddy margins of these islands supported water plantain and Water Mint. Himalayan Balsam was occasional. Given the presence of ≥3 indicator species (see Devaney *et al*. 2013), the river islands supported good examples of the Annex I habitat 'Hydrophilous tall herb fringe communities of plains and of the montane to alpine levels [6430]'.

### *Section E – Mill-race channel*

Good examples of the Annex I habitat 'Hydrophilous tall herb fringe communities of plains and of the montane to alpine levels [6430]' was also present in the Mill Race channel (survey Section E), located outside of the Blackwater River (Cork/Waterford) SAC boundary, as well as along the northern river margins of survey Section C (downstream of the bridge) and to the south of the large gravel island near Mill Island (Section D)

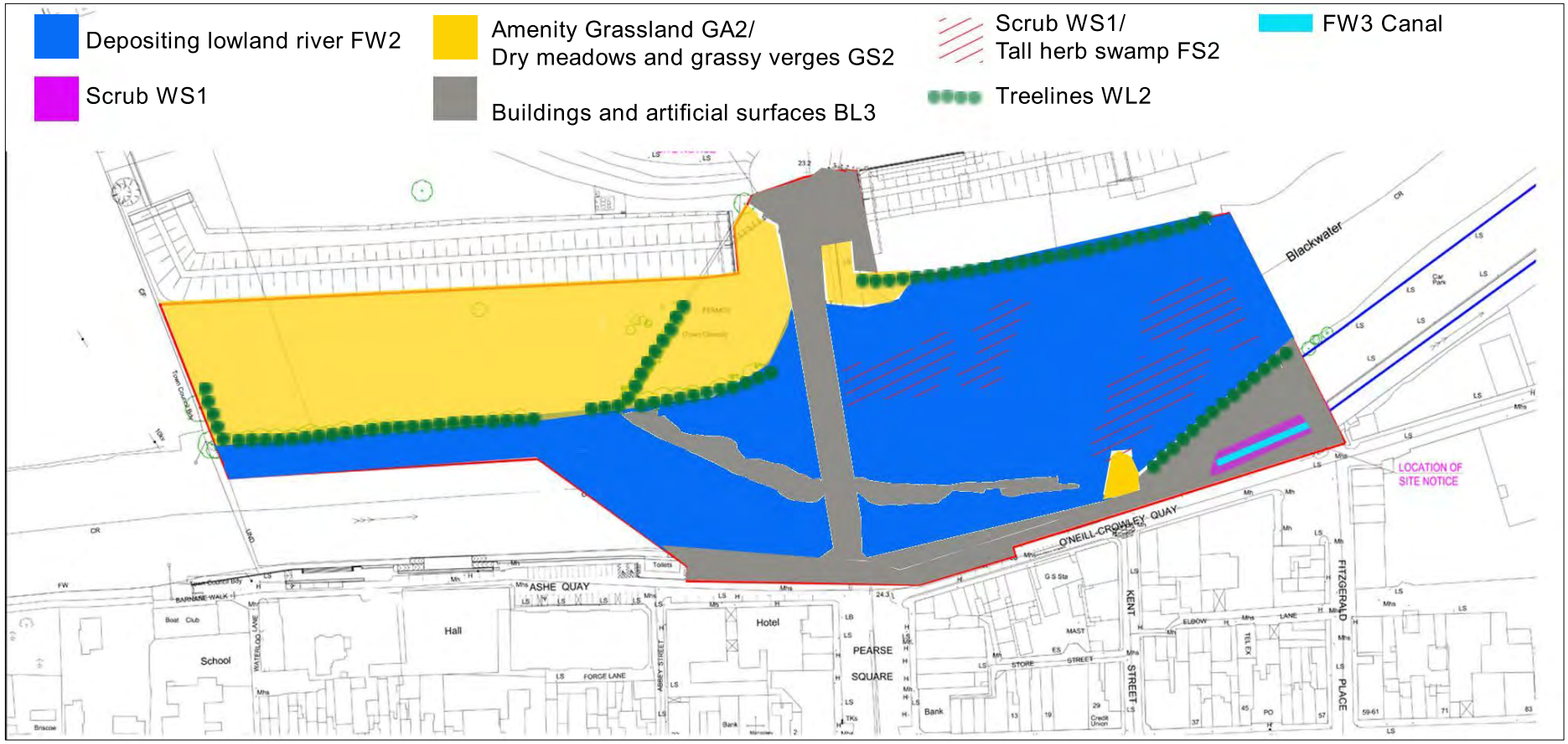



**Figure 8. Habitats within proposed development site boundary (Fossitt 2000)**

### *Other terrestrial habitats*

### *Other terrestrial habitats*

### *Treelines WL2*

Treelines border the River Blackwater on the northern and southern banks of the proposed development site (**Figure 8)**. These include the site's western border, along the north bank of the river on either side of the bridge, and along the south bank of the river east of the bridge, bordering the larger carpark. These treelines are dominated by mature trees (See **Appendix 5** for further detail). The exact composition of species in each location differs. The western-most treeline and the treeline along the north bank of the river are composed primarily of Ash *Fraxinus excelsior*, Willow, Sycamore *Acer pseudoplatanus* and Small-Leaved Lime *Tilia cordata*. The understory is dominated by Nettle *Urtica dioica*, Bindweed *Calystegia sepium* and Winter Heliotrope *Petasites pyrenaicus*. West of the bridge, the treeline splits. Its northern section is composed almost solely of planted Lawson's Cypress *Chamaecyparis lawsoniana*. The southern section is dominated by Wych Elm *Ulmus glabra*, Beech and Small-Leaved Lime. East of the bridge, a treeline runs along the north bank of the river. It is dominated by Sycamore, Willow, Ash and Cherry Laurel *Prunus laurocerasus*. This treeline is wider (2-3m) than any other within the development area with mature trees.

The treeline running along the southern bank, east of the bridge, has Horse Chestnut *Aesculus hippocastanum*, Alder, Willow, Sycamore and Ash as its dominant trees, and Bramble *Rubus fruticosu*s and Ivy *Hedera helix* as part of its understory.

### *Amenity Grassland GA2/Dry meadows and grassy verges GS2*

An area of Amenity Grassland GA2/Dry meadows and grassy verges GS2 is located on the northern banks of the River Blackwater Figure **8**). This grassland is bounded to the south by a treeline which borders the River Blackwater as well as line of Poplar which runs through this grassland area. A grassy embankment, part of the Fermoy Flood Relief scheme borders the north of this grassland habitat. A section of non-fertilized, infrequently-mown grassland is present west of the bridge. Parts of it are signposted to show that it has been seeded with wildflowers and allowed to grow. The grass was tall (50-80cm) at the time of surveying. Clumps of False Oatgrass *Arrhenatherum elatius* and Purple Moorgrass *Molinia Caerulia* are common. The broadleaved herb component includs Creeping Cinquefoil *Potentilla reptans* and Red Clovers *Trifolium pratense*. Curled Dock *Rumex crispus*, Nettle *Urtica dioica* and Common Knapweed *Centauria nigra* are dominant. Meadowsweet *Filipendula ulmaria* is also common. Smaller areas of this habitat are also present in two places east of the bridge.

### *Scrub WS2/Tall herb swamp FS2*

Within the river channel are various deposits of sediment, gravel banks, and small islands that are covered by scrub. These are likely to be partially or wholly inundated during flood events and as such the vegetation found here is stunted and they are not stable over time. At low water levels exposed gravel and cobble were present immediately downstream of the bridge. The Annex I habitat '*Hydrophilous tall herb fringe communities of plains and of the montane to alpine levels [6430]'* (FS2) was also recorded in association with mid-channel islands and along the north bank of the river (downstream of Fermoy Bridge). Stunted Willow trees and Bramble are dominant here. As these patches of land are small, the influence of the

surrounding river means that wetland grasses are also common, including Purple Moorgrass and Creeping Bent *Agrostis stolonifera*. This habitat is located within the SAC and therefore has been classified as internationally important.

Scrub habitat was also recorded on the margins of the Mill Race, which is located outside the SAC boundary.

#### *Canal FW3*

Site E represented the uppermost 100m of a disused Mill Race channel, that averaged 7-8m and 0.3-0.5m in depth at the time of survey. The channel was not located within the Blackwater River (Cork/Waterford) SAC site. Held between 2-3m-high retaining walls, the channel diverged from the River Blackwater through a flood wall (formerly sluice gates) near the weir pool along O'Neill-Crowley Quay/Mill Road. The channel rejoined the main river approx. 400m downstream. The channel supported standing water only at the time of survey (100% pool habitat), although it was known to convey significantly higher water volumes, seasonally. The channel substrata were dominated by deep silt, often >0.5m in depth.

### 6.3.7 Alluvial Woodland

The Annex I habitat 91E0 corresponds to four vegetation types described in Perrin *et al.* (2008). Three are in the *Alnus glutinosa – Filipendula ulmaria* group: *Fraxinus excelsior – Carex remota* type; *Alnus glutinosa – Rubus fruticosus* type; and *Salix cinerea – Equisetum fluviatile* type. The fourth type is in the *Fraxinus excelsior – Hedera helix* group: the *Salix-triandra – Urtica dioica* type.

91E0 is a priority Annex I habitat. A number of variants of this woodland habitat exist, of which riparian forests of *Fraxinus excelsior* and *Alnus glutinosa* of temperate and Boreal Europe lowland and hill watercourses (habitat 44.3 Alno-Padion of the Palaearctic habitat classification of Devillers & Devillers-Terschuren (1993), cited in European Commission (2007)) are the most common type to be found in Ireland. European Commission (2007) states that all types occur on heavy soils that are periodically inundated by the annual rise of river levels, but that are otherwise well drained and aerated during low water. The herbaceous layer includes many large species such as *Filipendula ulmaria, Angelica sylvestris* and *Carex acutiformis,* vernal species such as *Ranunculus ficaria* and *Anemone nemorosa*, and other indicative species such as *Carex remota, Lycopus europaeus, Urtica dioica* and *Geum rivale*.

A functioning alluvial forest with a good structure is, in common with sessile oak woods, a multi-layered system, although the individual layers may be less distinct than in oak woods. Non-native species should be no more than occasional, with a cover not exceeding 10%, and preferably absent, although an exception is made for gallery woodlands in which non-native species of *Salix*, such as *S. fragilis* or *S. alba,* may be frequent. Typical canopy species include *Salix* spp., *Fraxinus excelsior* and *Alnus glutinosa*, one or more of which should make up the greater proportion of the canopy. *Betula* spp. and *Crataegus monogyna* are frequently found, with other tree species such as *Quercus robur* and *Ulmus glabra* occurring in drier examples of the habitat.

The habitat *Alluvial forests with Alnus glutinosa and Fraxinus excelsior (Alno-Padion, Alnion incanae, Salicion albae) 91E0* does not occur in proximity to the proposed development site. The terrestrial habitats located adjacent to the proposed development site includes an area of

trees on the northern shores of the River Blackwater, upstream of the existing weir. This area of trees is a dry site with course loamy drift soil and siliceous stones. This site is liable to flooding as it is lower than the towns flood defences and part of a recreational area, open to the public. Although these trees are located within the Blackwater River (Cork/Waterford) SAC, they have been classified as Treelines WL2 habitat which is not an Annex I habitat or a qualifying habitat for the SAC.

According to NPWS (2012), the area of alluvial woodland within the SAC should be stable or increasing, subject to natural processes i.e., at least 19.2ha for sites surveyed. This is a minimum area based on six sites surveyed by Perrin *et al.* (2008). However, the publication notes that further un-surveyed areas are almost certainly present within the SAC. There are no mapped areas of 91E0 habitat in the vicinity of the proposed development site and the closest mapped area is located approximately 20km upstream (i.e., NSNW 1464).

Based on desktop review and field surveys, a small, wooded island within the River Blackwater channel located 700m upstream of Fermoy Bridge was identified as containing potential Alluvial woodland habitat and this site was the focus of a detailed survey to determine if the woodland here could be classified as this Annex I habitat (**Figure 9**). Species recorded within the survey area are listed in **Table 6**.

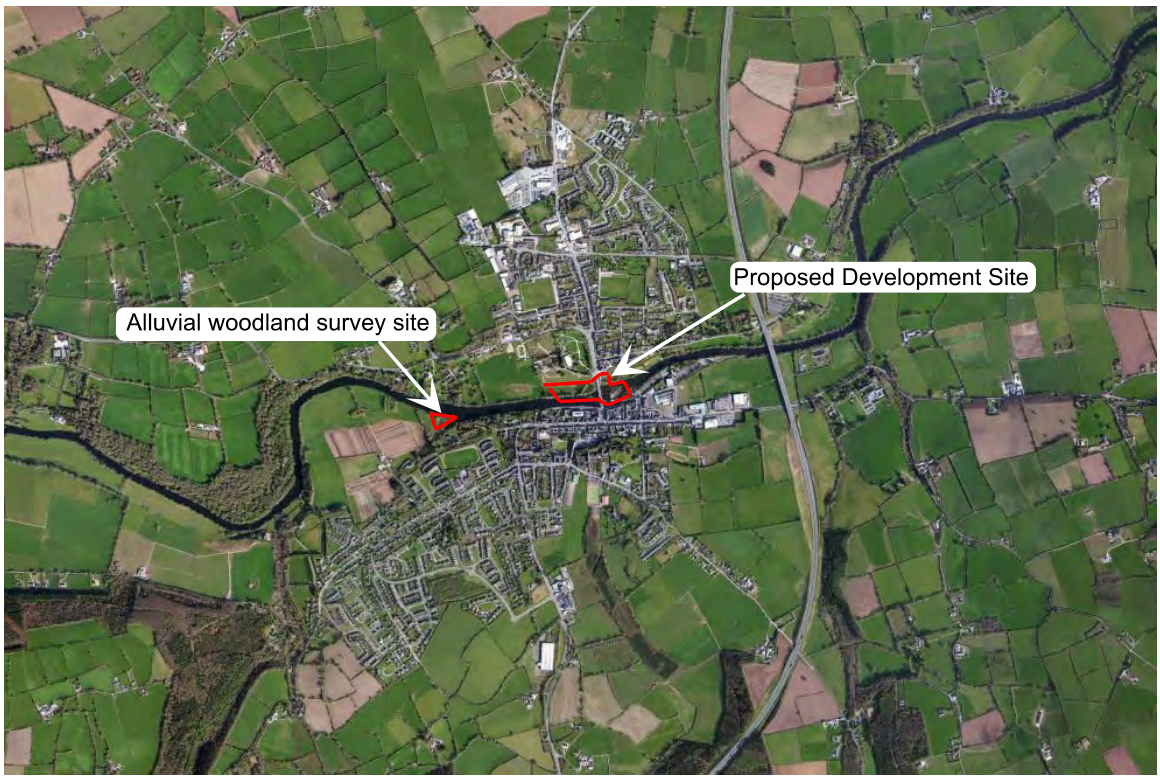



**Figure 9. Alluvial woodland survey site**

**Table 6. Species recorded within Alluvial woodland survey area**

| Alluvial woodland survey area |
|---|
| **Dominant ground flora:**<br>Scaly male fern *Dryopteris affinis*<br>Pendulum sedge Carex pundula<br>Wood melick *Melica uniflora*<br>Reed Canary-Grass *Phalaris arundinacea*<br><br>**Other ground flora:**<br>Ivy *Hedera helix*<br>Woundwort *Stachys* spp<br>Galium aparine*Angelica sylvestris*<br>Meadowsweet *Filipendula ulmaria*<br>Cow Parsley *Anthriscus sylvestris*<br>Himalayan Balsam *Impatiens glandulifera*<br>Ground Ivy *Glechoma hederacea*<br>Enchanter's Nightshade *Circaea lutetiana*<br>Bindweed *Calystegia sepium*<br>Wood Dock *Rumex sanguineus*<br>Creeping Buttercup *Ranunculus repens*<br>Nettle *Urtica dioica* |
| **Tree Species:**<br><br>Grey Poplar *Populus x canescens*<br>Crack willow *Salix fragilis*<br>Grey willow *Salix cinerea*<br>Ash *Fraxinus excelsior*<br>Sycamore *Acer pseudoplatanus*<br>Pedunculate Oak *Quercus robur*<br>Beech *Fagus sylvatica*<br>Holly *Ilex aquifolium*<br>Alder *Alnus glutinosa*<br>Bay Tree *Laurus nobilis*<br>Dogwood *Cornus* spp<br>Hawthorn *Crataegus monogyna*<br>Yew *Taxus baccata* |
| **Tree canopy:**<br><br>10% grey poplar *Populus x canescens*<br>30% sycamore *Acer pseudoplatanus*<br>10% beech *Fagus sylvatica*<br>20% ash *Fraxinus excelsior*<br>10% Willow Salix spp<br>10% alder *Alnus glutinosa*<br>10% other/open space |

The survey area appears to have been planted in the 18th century with both non-native and native willow species present. This area is no longer a distinct island but the channel between the island and the riverbank is regularly flooded. Ash, Alder and Willow *Salix spp*. account for approximately 40% of the total woodland at the site (20%, 10% and 10% respectively). However non-native species e.g., Sycamore *Acer pseudoplatanus* account for a significant amount of tree cover i.e., >10%.

Notwithstanding that ground flora is typical of riparian woodland, this is not a significant example of the Annex I habitat Alluvial woodland.

### 6.3.8 Tree Survey

The proposed works will encroach on amenity/recreation land and necessitate the removal of riverside trees and a parkland tree line. These trees were surveyed on 31st July 2021 following the standards in BS 5837 (2012). The trees are on the north bank upstream of Fermoy Bridge close to the existing weir and fish bypass channel. It is a dry site with coarse loamy drift soil and siliceous stones but it is liable to flooding as it is below the town's flood defences and part of a recreational area which is open to the public. The survey area is within the Blackwater River (Cork/Waterford) SAC. Full details of this tree survey are included in **Appendix 5** of this report.

The aim of the tree survey was to:

- To establish a baseline tree survey and description of the trees on the site with particular regard to safety management recommendations and an Arboricultural Method Statement,
- To provide an assessment of arboricultural impacts for the proposed development and
- To identify trees to be retained and provide recommendations for their management.

The surveyed trees can be broadly divided into three phases of establishment:

1. Parkland planting, early 1800's.
2. Amenity planting 1980's.
3. Naturally regenerated trees, post 1900.

#### *Parkland Planting*

This parkland planting forms part of the Fermoy House landscaping and dates from the early 1800's. Nine trees along the riverbank, all non-native Lime *Tilia* sp., date from this period. Six are within the proposed fish bypass channel footprint- 51,52,56,57,60 and 74 and will need to be removed. Trees 51,52,56 and 60 are very large prominent trees and two – 57 and 74 consist of low regrowth from the cut stumps of original trees. These trees will be removed as they are within the fish bypass channel footprint.

Outside the proposed fish bypass channel footprint three Lime trees will be retained (69,70 and 71). However, 60 which is regrowth from a cut stump and 70 is leaning over the river, will be removed as they are within the footprint of the fish bypass channel.

#### *Amenity planting*

This includes amenity planting from the 1980's along the riverbank and on internal boundaries. the species planted are Black Poplar *Populus nigra*, Lombardy Poplar *Populus nigra 'Italica',* Norway Maple *Acer platanoides*, Lime *Citrus × aurantiifolia* and Lawson's Cypress *Chamaecyparis lawsoniana.*

The Black Poplar are tall trees and are prominent in the landscape, There are six individual trees (27,28,29,30,49 and 84) and one group (61) which will be retained. The tree report recommends that the individual trees would need to be reduced in height by 50% to ensure

their stability when neighbouring trees are felled. Two planted Black Poplar along the riverbank (72 and 73) will be removed. The remaining Black Poplar will be retained.

There are three Lombardy Poplars, (63,65 and 66) outside the proposed footprint. While these will not be removed for the proposed works, their height and form make them unsuitable for retention in the longer term.

A total of eight Norway Maple are within the proposed footprint and will be removed during construction works– (53,55,59,77,79,80,82 and 83). Only two of these trees are in good condition, the remaining six would not be suitable for long term retention anyway due to their poor branching structure and tendency for crown branches to collapse.

There are two semi-mature Lime (54 and 58) within the proposed footprint, both would be suitable for long term retention. However, these trees will be removed during the construction works.

The six Lawson's Cypresses are growing amongst the Black Poplar and are suppressed (38 40, 42, 44, 46, 48). There are two dead trees. All are of low value and will be felled during construction works.

### *Naturally regenerated trees post 1900's*

Naturally regenerated trees have become established along the riverbank since the 1900's. They include Alder, Ash and Sycamore all of which regenerate freely in damp, fertile conditions.

Of particular value within the riparian zone are the Alder trees (50, 64,67 and 68) which are multi-stemmed, and several are decaying. They are outside the fish bypass channel footprint, are important for biodiversity. These trees will be retained.

Elm is present in the understorey, probably regrowth from mature trees lost to the endemic elm disease in the 1980's. However this species will succumb to Dutch Elm disease as the trees mature.

### *Summary and Conclusions*

The loss of the 1980's planted trees, Poplar, Norway Maple, lime and Lawson's Cypress will impact negatively on the landscape, but they are easily replaced by replanting with similar species, in the medium term. It is noted that these trees are not-native and their ecological value is limited.

Trees within the riparian zone, particularly the four mature Alder will be retained.

The mature Limes planted in the 1800s are a prominent landscape feature and have cultural interest. Six of the nine trees would need to be removed. These trees are not native and their ecological value is limited. It is noted that the Landscape and Visual Impact Assessment (Doyle & O'Troithigh 2022) which has been submitted with this application concluded that in the removal of these trees will have a negative, moderate, short-term effect on the landscape. However, following the implementation of the landscape plan, the impact in the long-term will be imperceptible.

## 6.4 Otter

Otter is a qualifying interest for the Blackwater River (Cork/Waterford)) SAC which is one of the most important sites in Ireland for this species. Otter records were widespread throughout W79 and W89, on the River Blackwater and several tributaries (NBCD & NPWS data). Although no records overlapped the survey area, Otter were known locally in the vicinity of Fermoy Weir (pers. obs. Ross Macklin).

An Otter survey was undertaken for the River Blackwater in the vicinity of the proposed works area (i.e. 250m upstream and 250m downstream of Fermoy Weir). Survey methodology followed the novel total channel Otter survey (TCOS) methodology as developed by Macklin *et al.* (2019). Otter signs (including spraints, prints, slides and latrines) in addition to the breeding and resting places of Otters (i.e., holts and couches) were searched for. This was undertaken along all bankside areas on foot and by boat, in addition to mid-channel gravel shoals and islands located downstream of Fermoy Bridge. 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, crayfish, molluscs, etc.) (**Plate 10**).

A total of *n*=11 Otter signs were recorded from the survey area in the vicinity of Fermoy Weir during June-July 2020 (**Figure 10**). The majority of signs were spraints although three couch sites and a holt were also recorded. The existing weir structure was evidently an important resting/feeding area for Otter, with very regular spraint sites present in addition to couch areas. The holt was located along the heavily-vegetated south bank of the River Blackwater, approx. 180m downstream of the weir face.

**Plate 10. Very regular Otter sprainting site (showing abundant, White-clawed Crayfish remains) recorded on the weir face downstream of Fermoy Bridge, July 2020**

**Figure 10. Otter sign distribution recorded in the vicinity of the proposed works area at Fermoy Weir, July 2020.**

## 6.5 Fish

### 6.5.1 Electro-fishing Survey

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 an electro-fishing survey (n=5 sites; see **Table 7, Figure 7)** in the footprint of the proposed development site. Further details on the survey are included in **Appendix 3** of this report.

A single anode Smith-Root LR24 backpack (12V DC input; 300V, 100W DC output) was used to electro-fish sites on the River Blackwater in the footprint of the proposed development site on 9th July 2020. 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. Electro-fishing methodology followed accepted European standards (CEN, 2003) and adhered to best practice (e.g., CFB, 2008).

**Table 7. .n=5 electro-fishing survey site locations on the River Blackwater in the vicinity of Fermoy Weir, Co. Cork.**

| Site no. | Watercourse | EPA code | Location | X (ITM) | Y (ITM) |
|---|---|---|---|---|---|
| E1 | River Blackwater | 18B02 | Upstream of Fermoy Weir – along weir face | 581079 | 598606 |
| E2 | River Blackwater | 18B02 | Upstream of Fermoy Weir – along weir face | 581118 | 598589 |
| E3 | River Blackwater | 18B02 | Downstream of Fermoy Weir – north bank channel | 581189 | 598657 |
| E4 | River Blackwater | 18B02 | Downstream of Fermoy Weir – centre arch | 581167 | 598609 |
| E5 | River Blackwater | 18B02 | Downstream of Fermoy Weir – downstream of weir pool | 581248 | 598632 |

Section A was too deep to electro-fishing utilising backpack equipment (mostly >2m) and, therefore, no results were available. However, in terms of fisheries habitat, the deep glide habitat of Section A offered good Salmonid holding habitat, with nursery and spawning habitat much improved downstream of the weir. The river upstream of the weir offered very good European eel (*Anguilla anguilla*) habitat given the presence of deep water and frequent boulder/cobble refugia. This section also supported a large population of non-native Dace (*Leuciscus leuciscus*), non-native Roach (*Rutilus rutilus*) and other species such as Minnow (*Phoxinus phoxinus*). Lamprey habitat was poor given the high average depth, slower flow and bedded substrata, resulting in a general lack of suitable sediment accumulations for ammocoetes and poor spawning habitat.

Electro-fishing was undertaken at one site within survey Section B i.e. E1 (**Figure 7)**. A total of *n*=4 fish species were recorded. Atlantic Salmon (*Salmo salar*) and Brown Trout (*Salmo trutta*) dominated, with low numbers of European Eel and Dace captured.

Electro-fishing was undertaken at three sites (E2, E3 and E4) within survey Section C (**Figure 7)**). A total of *n*=10 fish species were recorded across the three sites (i.e. Atlantic Salmon, Brown Trout, Minnow, Roach, Dace, European eel, Three-Spined Stickleback (*Gasterosteus*

*aculeatus*), Gudgeon (*Gobio gobio*), Stone Loach (*Barbatula barbatula*) and *Lampetra* sp. (see section 3.3). Three discrete 2m$^2$ areas (i.e. A, B & C) in the vicinity of mid-channel islands were targeted for lamprey ammocoetes (i.e. site E5, **Figure 7**). All of these areas supported *Lampetra* sp. ammocoetes, with equivalent densities of 10.5, 12 and 15 ammocoetes per m$^2$ recorded, respectively. Section C offered some excellent salmonid nursery habitat, with some locally excellent spawning substrata and holding habitat present also. European Eel habitat was good overall.

Electro-fishing was undertaken at one site (E5) within survey Section D (**Figure 7)**. A total of *n*=3 fish species were recorded, with low numbers of Dace, Stone Loach and Three-Spined Stickleback present. Section D offered excellent salmonid habitat overall, with high-quality spawning, nursery and holding habitat present. Lamprey spawning habitat was also present (including for Sea Lamprey) with some good European Eel habitat associated with deeper pool areas.

Electro-fishing was not undertaken in Section E. Due to poor connectivity with the main river, the survey reaches of the channel were of little fisheries value apart from for European Eel. However, fisheries value improved considerably in the downstream reaches, where some good value as a coarse fish nursery was present.

### 6.5.2 DNA Analysis

Given the limited knowledge in the known distribution and range of the qualifying interest Twaite Shad (*Alosa fallax fallax*) within the Blackwater River (Cork/Waterford) SAC (002170), environmental DNA (eDNA) analysis was undertaken on water samples collected on the 21$^{st}$ May 2020 (**Appendix 3 Table 2.2**). Sample collection overlapped with the seasonal migration of anadromous Twaite Shad into Irish rivers and coincided with the known peak spawning period of the species (King & Linnane, 2004; Doherty *et al.*, 2004). Analysis sought to elucidate the longitudinal distribution of shad species (*Alosa* spp.) within the River Blackwater, clarifying whether or not shad species could access and utilise the Fermoy Weir area. As Twaite and the closely-related Allis Shad (*Alosa alosa*) readily hybridise, it is not feasible to use eDNA assays (which are based on mitochondrial DNA) to speciate Shad. Thus, analysis could only determine the presence or absence of *Alosa* species (i.e., Twaite Shad and Allis Shad). The presence of Shad species DNA in a given sample specified their presence at that location during the sampling period. A negative result indicated the species was present at undetectable densities or not present at the time of sampling. Sampling locations are shown in **Figure 12** and further details on survey methodology is included in **Appendix 3**.

Shad (*Alosa* spp.) eDNA was detected from water samples collected from the 'Kitchen Hole' site on the River Blackwater at Cappoquin. However, no detectable concentrations of shad eDNA were recorded in water samples taken on the same day upstream of Fermoy Weir (samples 1A, 1B, 1C), downstream of Fermoy Weir (2A, 2B, 2C) or downstream of Clondulane Weir (3A, 3B, 3C) on the River Blackwater. This indicated the absence of *Alosa* spp. from these locations during the peak spawning migration sampling period (**Figure 12**). The positive control samples from St. Mullin's on the River Barrow (sites 5A, 5B & 5C) all contained *Alosa spp*. DNA (Figure **11**). All samples from all sampling locations yielded detectable Brown Trout (*Salmo trutta*) eDNA qPCR reactions (data not shown), demonstrating that all samples contained DNA that could be amplified successfully.

The concentrations of eDNA ranged from the lowest of 0.054ng/L in sample 5A at St. Mullin's to the highest of 1.442ng/L in the 4C sample from Kitchen Hole, Cappoquin. Average eDNA concentrations (across biological replicates) ranged from the lowest at in St. Mullin's (0.233 ng/L ±SD 0.152) to the highest at Kitchen Hole, Cappoquin (1.351, ±SD 0.079) ng/L). There was a significantly higher concentration of Alosa spp. eDNA in the Munster Blackwater (Kitchen Hole, Cappoquin) than in the samples from River Barrow (St. Mullin's) (**Figure 11**).

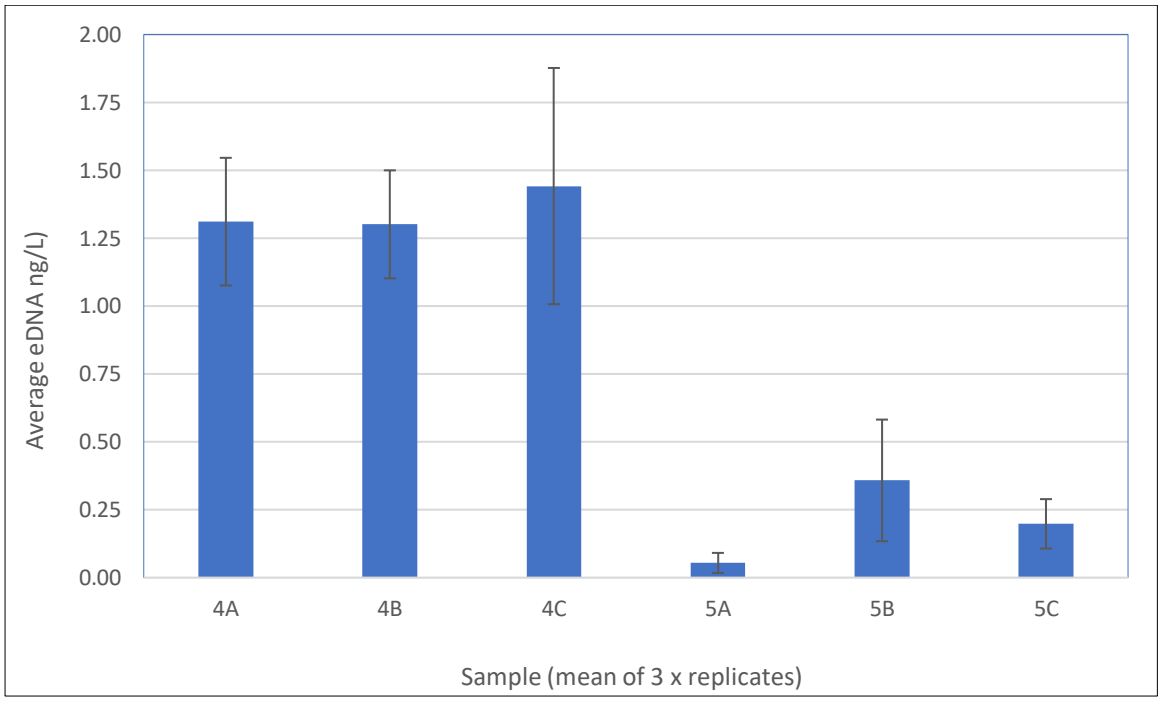



**Figure 11. Average eDNA concentrations (ng/l) ±SD of Alosa spp. eDNA recorded in water samples from 'Kitchen Hole', River Blackwater and control site at St. Mullin's, River Barrow, May 2020**

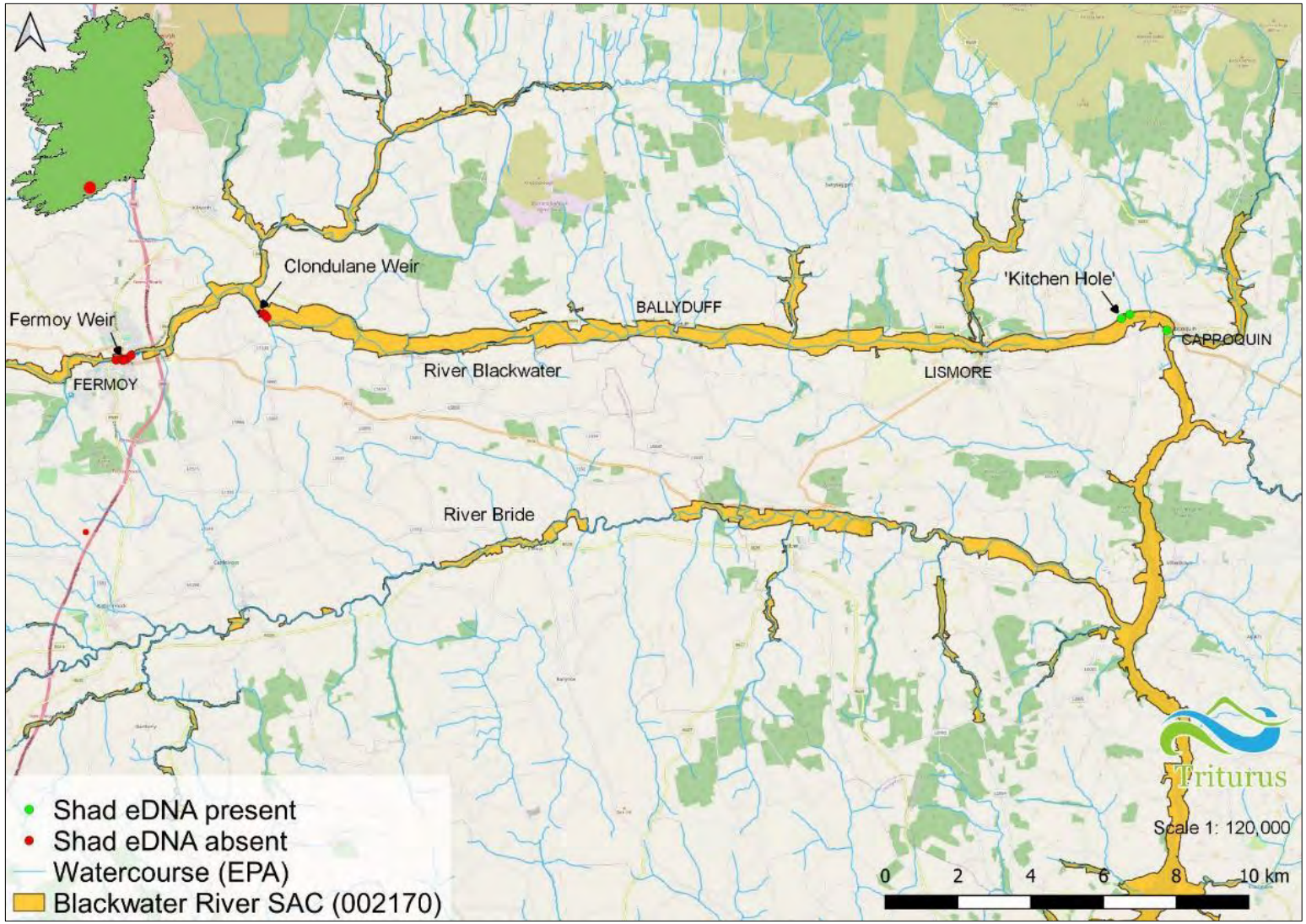



**Figure 12. Shad species (Alosa spp.) eDNA presence/absence in the River Blackwater samples, May 2020 (River Barrow positive control site not shown**

### 6.5.3 Atlantic Salmon

Although Atlantic Salmon was recorded upstream (site E1) and downstream (E2, E4) of Fermoy Weir, the best-quality Salmonid habitat was present downstream (i.e. survey Sections C and D). The northern extent of these sections (along the north bank of the river) was a particularly good nursery for salmonids (*Ranunculus*/macrophyte zone) and also offered some good-quality spawning substrata. Likewise, spawning habitat was good throughout much of the main channel in both Sections C and D. Some excellent quality adult salmonid holding habitat was present in the large weir pool in addition to the deeper glide habitat downstream of the pool. Upstream of the weir (slower-flowing deep glide) also provided good holding habitat for migrating adults although this area was more suited to a range of coarse fish species such as Dace, Roach and Minnow. The quality of salmonid habitat was very good overall although three of the four biological water quality samples were not meeting 'good status' WFD targets (i.e. Q3-4, moderate status, slightly polluted).

### 6.5.4 Lamprey Species

Survey Sections C and D (downstream of Fermoy Weir) were of high value for *Lampetra sp*. lamprey, with both suitable spawning and ammocoete habitat present. The margins and littoral area of river islands downstream of Fermoy Bridge were provided the most suitable ammocoete habitat within the study area. Here, accumulations of fine, organic-rich soft sediment required by both larval River/Brook and Sea Lamprey (Goodwin *et al.*, 2008; Aronsuu & Virkkala, 2014) were present, varying in sediment depths of 5-15cm.

Three such areas targeted for lamprey ammocoetes in close proximity to these islands (site E3), supported densities of 10.5, 12 and 15 *Lampetra* sp. ammocoetes per $m^2$, respectively. These densities compared favourably with the conservation objective of "Mean catchment juvenile density of Brook/River Lamprey at least 2/m²" for *Lampetra* sp. in the Blackwater River (Cork/Waterford) SAC (NPWS, 2012). Some suitable (though sub-optimal) ammocoete habitat was also present in association with macrophyte beds in these survey sections, although this was more limited in extent than the aforementioned island margins. Suitable lamprey spawning areas (ranging from finer gravels to larger cobbles) were present throughout survey Sections C and D, with the slow, deeper glide upstream of the weir less suitable. A known historical Sea Lamprey and River Lamprey spawning site was present in survey Section D (tailing of large weir pool; NPWS data).

### 6.5.5 Twaite Shad

Analysis of water samples for *Alosa* spp. eDNA during the species' known peak spawning migration (21st May 2020) supported the absence of shad from the River Blackwater upstream and downstream of Fermoy Weir and downstream of Clondulane Weir (Figure **12**). However, *Alosa* spp. eDNA was detected from water samples collected from the 'Kitchen Hole' site on the lower (tidal) River Blackwater at Cappoquin. Our genetic results support the suspected distribution of shad species (majority considered to be Twaite Shad, *Alosa fallax*) within the River Blackwater, i.e. present to the tidal limit (King & Linnane, 2004; King & Roche, 2008).

Two records exist for Allis Shad (incidental rod and line captures) on the River Blackwater at Careysville (below Clondulane Weir) in 2003 and 2005, some 25km upstream of the tidal limit (King & Linnane, 2004; NPWS data) - the furthest upstream record for shad species in the Blackwater River (Cork/Waterford) SAC. Whilst Allis Shad are known to penetrate further up river catchments compared to Twaite Shad (Maitland & Hattin-Ellis, 2003; Jolly et al., 2012), the Clondulane Weir would appear to be an impassable barrier to both shad species in the River Blackwater, based on eDNA analysis. Unlike Salmonids, weaker-swimming shad species are unable to traverse many instream barriers (Larinier & Travade, 2002). However, given their propensity for spawning in the lower (tidal) reaches of rivers, irrespective of upstream passage issues, Twaite Shad populations are often less impacted by barriers than other anadromous species (van Puijenbroek et al., 2018).

### 6.6 White-clawed Crayfish

A desktop review of the known distribution of crayfish within the wider River Blackwater catchment was also completed. A low number of records for White-clawed Crayfish were available for the River Blackwater near Ballyhooly (W79) but none overlapped with the survey area (NBDC & NPWS data).

White-clawed Crayfish surveys were undertaken at the aquatic survey sites in May 2020 under a National Parks and Wildlife (NPWS) open licence (no. C79/2020), as prescribed by Sections 9, 23 and 34 of the Wildlife Act (1976-2012), to capture and release crayfish to their site of capture, under condition no. 5 of the licence. As per Inland Fisheries Ireland recommendations, the crayfish licence sampling moved in a downstream direction to minimise the risk of transfer invasive propagules (including crayfish plague, *Aphanomyces astaci*) upstream.

Hand-searching of instream refugia and sweep netting was undertaken according to Reynolds *et al.* (2010). A broad appraisal of White-clawed Crayfish habitat in each survey section (A-E) was also carried out. Further details on this survey methodology and results are included in **Appendix 4.**

A total of *n*=32 White-clawed Crayfish were recorded from the survey area in May 2020 via sweep netting and hand searching (**Figure 13**). Furthermore, abundant crayfish remains were identified in numerous Otter spraints in the vicinity of the weir. The majority of captured crayfish were adults although the presence of a low number of juveniles indicated a local breeding population.

The best quality crayfish habitat within the survey area was present in Section C in the vicinity of Fermoy Bridge (particularly in the vicinity of the northernmost arches), where frequent cobble/boulder substrata and crevices offered good quality refugia. The areas downstream of the weir face and underneath Fermoy Bridge supported the greatest numbers of crayfish, as recorded by sweep netting/hand-searching and snorkelling (*n*=21). Low numbers of crayfish were recorded from survey Sections A (*n*=2) and B (*n*=4), respectively, where boulder, large woody debris and the weir face provided suitable refugia (upstream of the weir). Low numbers of crayfish (*n*=5) were also captured from

the downstream extent of the weir face in survey Section D, with low densities also observed via snorkelling the deep weir pool.

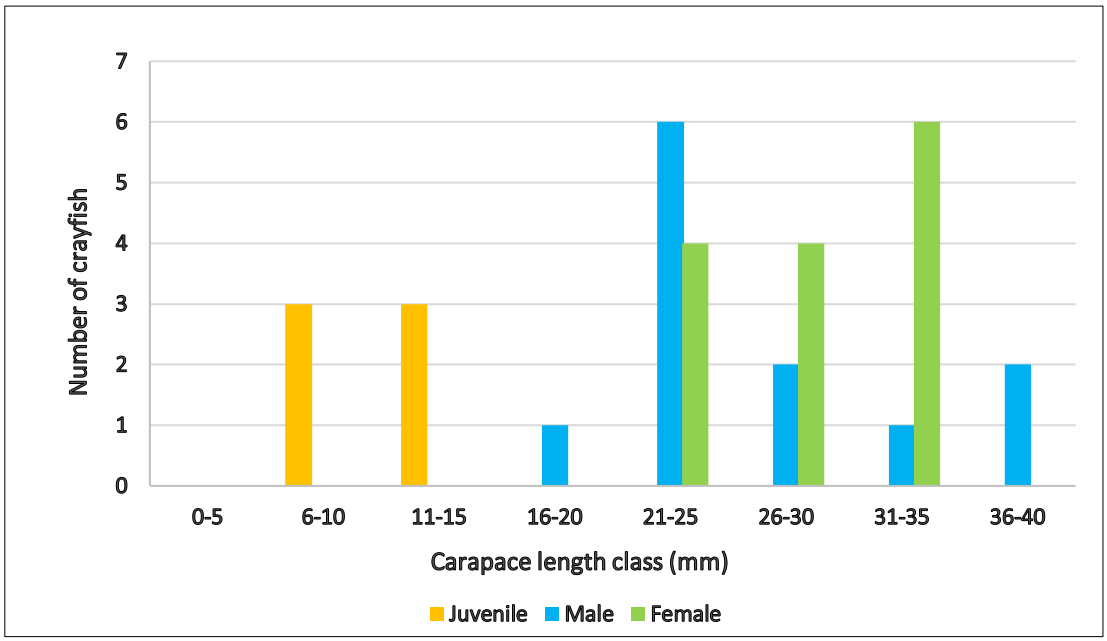



**Figure 13. Carapace length class and sex distribution of n=32 White-clawed Crayfish recorded in the vicinity of Fermoy Weir, 2020**

**Plate 11. White-clawed Crayfish recorded via hand searching from survey Section C, downstream of Fermoy Weir in the vicinity of Fermoy Bridge, May 2020**

**Plate 12. Dead Freshwater Pearl Mussel shell recorded on mid-channel island, downstream of Fermoy Bridge in May 2020**

## 6.7 Freshwater Pearl Mussel

A Freshwater Pearl Mussel survey of the River Blackwater in the vicinity of Fermoy Weir (100m upstream and 100m downstream of Fermoy Bridge) was completed by Pascal Sweeny of Sweeny Consultancy on Friday May 29th 2020 (**Appendix 4**). Conditions were suitable, with bright, sunny weather and good water visibility under base flow conditions. This helped to maximise visibility of Pearl Mussel against dark substrata and also improved chances of detection when mussels were filter feeding in brighter conditions. Pearl Mussel surveys were carried out under a national open licence (licence no. C15/2020), issued by the National Parks and Wildlife Service (NPWS). The survey methodology used was in accordance with the Stage 1 & 2 guidelines given in Irish Wildlife Manual No. 12, NPWS (Anon., 2004). Further details on this survey methodology and results are included in **Appendix 4**.

No live Freshwater Pearl Mussels were found in the section of the River Blackwater within 100m upstream and downstream of Fermoy Bridge. The only habitat within 100m of the bridge that could be considered suitable for Freshwater Pearl Mussels was located in survey Section D, downstream of the large weir pool along the north bank of the river (i.e., fast glide with clean, cobble-dominated substrata) (**Appendix 4**). Several empty shells, likely washed from upstream areas, were found in gravel/cobble deposits.

Four live individuals recorded in 2011 were not present given changes in substrata and local hydrology (i.e., partial weir collapse). A reproducing population at this location was not considered possible given water quality issues (i.e., ≤Q4). The changing morphology of the channel due to breaching of the weir and significant movement of gravels may also have impacted the small residual historical population.

## 6.8 Water Quality

### 6.8.1 EPA Water Quality Data

Water quality is a key supporting feature for aquatic qualifying interests for the Blackwater River (Cork/Waterford) SAC and therefore any impacts on water quality have the potential to negatively impact on these species and habitats.

The Environmental Protection Agency carries out a biological assessment of most river channels in the country on a regular basis. The assessments are used to derive Q values, indicators of the biological quality of the water. The biological health of a watercourse provides an indication of long-term water quality. The EPA Q value scheme is summarised in **Table 8**. The relationship between the Q-rating system and the Water Framework Directive classification as defined by the Surface Waters Regulations 2009 (S.I. 272 of 2009) is shown in **Table 9.**

The Q Value system which is used by the Environmental Protection Agency describes the relationship between water quality and the macro-invertebrate community in numerical terms. The presence of pollution causes changes in flora and fauna of rivers. Well documented changes occur in the macro-invertebrate community in the presence of organic pollution: sensitive species are progressively replaced by more tolerant forms as pollution increases. Q5 waters have a high diversity of macro-invertebrates and good water quality, while Q1 have little or no macro-invertebrate diversity and unsatisfactory water quality.

The intermediate ratings Q1-2, Q2-3, Q3-4 and Q4-5 are used to denote transitional conditions, while ratings within parenthesis indicate borderline values. Great importance is attached to the EPA biotic indices, and consequently it is these data that are generally used to form the basis of water quality management plans for river catchments. EPA biological monitoring data for the closest sites, for which up to date data is available, on the River Blackwater is shown in **Table 10** and **Figure 14.**

**Table 8. EPA biotic index scheme.**

| Q value | Water quality | Pollution | Condition |
|---|---|---|---|
| 5 | Good | Unpolluted | Satisfactory |
| 4 | Fair | Unpolluted | Satisfactory |
| 3 | Doubtful | Moderately polluted | Unsatisfactory |
| 2 | Poor | Seriously polluted | Unsatisfactory |
| 1 | Bad | Seriously polluted | Unsatisfactory |

Source: EPA

**Table 9. Correlation between the WFD classification and Q values**

| Ecological status WFD | Q Values |
|---|---|
| High | Q5, Q4-5 |
| Good | Q4 |
| Moderate | Q3-4 |
| Poor | Q3, Q2-3 |
| Bad | Q2, Q1 |

**Figure 14. Location of EPA Q values.**

**Table 10. Q-values and survey locations.**

| Q-Value location | Distance from development (as the crow flies) | Q-Value (Most recent) |
|---|---|---|
| **MUNSTER BLACKWATER** | | |
| **Ballyhooley Br** | 9.2 km upstream | Q4(Fair Status – 2020) |
| **Fermoy Bridge LHS** | Adjacent | Q4(Fair Status – 2015) |
| **Fermoy Bridge RHS** | Adjacent | Q4(Fair Status – 2020) |
| **W of Kilmurry Ho** | 7.8km downstream | Q4 (Fair Status – 2018) |

Source: EPA Envision map system

### 6.8.2 River Basin Management Plan for Ireland 2018 – 2021 (2nd Cycle)

The Water Framework Directive (WFD) sets out the environmental objectives which are required to be met through the process of river basin planning and implementation of those plans. Specific objectives are set out for surface water, groundwater and protected areas. The challenges that must be overcome in order to achieve those objectives are significant. Therefore, a key purpose of the River Basin Management Plan (RBMP) is to set out priorities and ensure that implementation is guided by these priorities.

The second cycle RBMP aims to build on the progress made during the first cycle. Key measures during the first cycle included the licensing of urban waste-water discharges (with an associated investment in urban waste-water treatment) and the implementation of the Nitrates Action Programme (Good Agricultural Practice Regulations). The former measure has resulted in significant progress in terms both of compliance levels and of the impact of urban wastewater on water quality. The latter provides a considerable

environmental baseline which all Irish farmers must achieve and has resulted in improving trends in the level of nitrates and phosphates in rivers and groundwater. It is acknowledged, however, that sufficient progress has not been made in developing and implementing supporting measures during the first cycle.

The third cycle River Basin Management Plan (draft) (2022-2027) was out for public consultation until March 31st 2022. In advance of drafting the third RBMP, the Department of Housing, Planning and Local Government ran a public consultation to identify key pressures or 'significant water management issues' (SWMIs) currently impacting water bodies in Ireland. The EPA's consultation closed on the 30th April 2022. The results discussed below refer to the RMBP 2nd Cycle as the full set of 3rd Cycle data have yet to be published.

Overall, RBMP assesses the quality of water in Ireland and presents detailed scientific characterisation of our water bodies. The characterisation process also takes into account wider water quality considerations, such as the special water-quality requirements of protected areas. The characterisation process identifies those water bodies that are At Risk of not meeting the objectives of the WFD, and the process also identifies the significant pressures causing this risk. Based on an assessment of risk and pressures, a programme of measures has been developed to address the identified pressures and work towards achieving the required objectives for water quality and protected areas. Data relating to the watercourses within the study area is provided in **Table 11** and shown in **Figure 15**. Limited data on the 3rd cycle of the RBMP have been released through the EPA envision mapping website and these are also reported below where relevant.

**Table 11. Water Framework Directive Data – Relevant data**

| **Catchment: Blackwater (Munster) (Code 18) – 2nd Cycle** |
|---|
| This catchment includes the area drained by the River Blackwater and all streams entering tidal water between East Point and Knockaverry, Youghal, Co. Cork, draining a total area of 3,310km². The largest urban centre in the catchment is Mallow. The other main urban centres in this catchment are Fermoy, Mitchelstown, Youghal, Kanturk and Millstreet. The total population of the catchment is approximately 109,030 with a population density of 33 people per km².<br><br>The Blackwater rises on the southern side of Knockanefune in the Mullaghareirk Mountains and flows south to Rathmore where it is joined by the Cullavaw River and the Owentaraglin River. The Blackwater continues eastwards to Banteer where it is joined by the Allow River from the north and the Glen River from the south. On its route east, the Blackwater is joined by the Awbeg, and the Cyldagh River before flowing through Mallow and eastwards to Fermoy. Downstream of Fermoy, the river is joined by its tributaries, the Rivers Funsion, Ariglin and Owennashad. The Blackwater becomes tidal, before turning abruptly south at Cappoquin where the Glennafilla River joins from the northeast. The tidal Blackwater is joined by the Finisk River and the Bride River from the west downstream of Villerstown. The Goish, Licky, Glendine and Tourig Rivers drain the lands adjacent to the estuarine part of the catchment, and the Blackwater then flows past Youghal and out to sea through Youghal Harbour.<br><br>The Munster Blackwater catchment comprises 28 subcatchments with 158 river water bodies, no lakes, three transitional and one coastal water body, and 18 groundwater bodies. There are no heavily modified or artificial water bodies in the Munster Blackwater Catchment.<br>There are three designated Nutrient Sensitive Areas (NSAs) (Blackwater (River), Blackwater Estuary Upper and Blackwater Estuary Lower) associated with three waste water treatment plants (Mallow, Fermoy and Youghal). |

| Catchment: Blackwater (Munster) (Code 18) – 2nd Cycle |
|---|
| Two of the three urban wastewater treatment plants (Mallow and Fermoy) have tertiary treatment and, therefore, were compliant with the environmental objectives for NSAs.<br><br>Youghal urban wastewater treatment was not compliant with the environmental objective for NSAs in 2015. Works are currently underway to provide secondary treatment at the plant.<br><br><u>Waterbodies At Risk</u><br><br>Fifty-two river water bodies in the catchment are At Risk of not meeting their water quality objectives. There are 15 river water bodies in Review (this means that either more information is required, or Good ecological status was recorded in 2010-2015, but nutrient concentrations are elevated).<br><br>Alteration of hydro-morphological (or physical) conditions is one of the most significant issues in rivers in the Munster Blackwater Catchment. This includes inputs of excess fine sediment and alteration of the morphology of the river channel, which in turn alter habitat conditions. This can occur because of, for example, implementing river and field drainage schemes, forestry activities, animal access, and discharge from quarries.<br><br>Excess phosphate leading to eutrophication is also a significant issue of concern in several water Bodies.<br><br>Urban Wastewater Treatment Plants (WWTPs) and agglomeration networks have been identified as a significant pressure in 13 At Risk water bodies within the catchment. None of these is relevant to the proposed development being assessed.<br><br><u>Sub catchment data</u><br><br>The proposed development falls close to the eastern boundary of Sub catchment Blackwater [Munster]_SC_110. The issues on the main channel occur in the westerly part of the sub catchment and range from elevated nutrients due to a combination of point (Section 4 and licenced facility) and urban diffuse sources on Blackwater (Munster)_130 to unknown pressures driving moderate fish status on Blackwater (Munster)_160. On a tributary to the Blackwater, Ross Killavulleen_010, ecological status declined to Moderate and the significant pressures are a combination of hydromorphology, forestry and nutrients from an urban wastewater treatment plant.<br><br><u>Waterbodies prioritised for Action</u><br><br>Following the publication of the draft river basin management plan in early 2017, the EPA and the Local Authority Waters and Communities Office (LAWCO) jointly led a collaborative regional workshop process to determine where, from a technical and scientific perspective, actions should be prioritised in the second cycle. The prioritisation process was based on the priorities in the draft river basin management plan, the evidence from the characterisation process, and the expertise, data and knowledge of public body staff with responsibilities for water and the different pressure types. The recommended areas for action selected during the workshops were then agreed by the Water and Environmental Regional Committees. The recommended areas for action are an initial list of areas where action will be carried out in the second cycle. All water bodies that are At Risk still however, need to be addressed. The initial list of areas for action is not therefore considered as a closed or finite list; it simply represents the initial areas where work will be carried out during the second WFD planning cycle from 2018 to 2021.<br><br>In the Munster Blackwater Catchment, thirteen river water bodies within have been prioritised for action as the water conservation objectives for their species and/or habitats are not being supported by ecological status. This includes seven water bodies with designated Freshwater Pearl Mussel populations and the reasons for selection included failing to meet protected area objectives for Freshwater Pearl Mussel. None of these have relevance to the proposed development being assessed. The Funshion _080 ( A tributary >4km east of Fermoy) has been identified as At Risk but it is not a High ecological status objective water body.<br><br>(A remaining fifty-eight At Risk and Review surface water bodies were not included in the recommended areas for action for the second cycle. |

**Catchment: Blackwater (Munster) (Code 18) – 2nd Cycle**

The proposed development site is located within the Blackwater (Munster) SC_110 and SC_120 sub catchments. Within the Blackwater (Munster SC_110) the issues on the main channel range from elevated nutrients due to a combination of point (Section 4 and licenced facility) and urban diffuse sources on Blackwater (Munster)_130 to unknown pressures driving moderate fish status on Blackwater (Munster)_160. On a tributary to the Blackwater, Ross Killavulleen_010, ecological status declined to Moderate and the significant pressures are a combination of hydromorphology, forestry and nutrients from an urban wastewater treatment plant.

In the Blackwater (Munster_SC_120) two out of six river waterbodies within this sub catchment are AT RISK, Funshion_060 and Funshion_080 due to Moderate biological status. Diffuse agriculture on land underlain by karst limestone is the main significant pressure within both water bodies in addition to point sources from piggeries and road activities within Funshion_080.

Relevant sub-basins are listed below. The proposed development site is located in the Blackwater (Munster)_190 sub-basin. The Blackwater (Munster)_200 sub-basin is located approximately 2km downstream.

**Blackwater [Munster] – River Waterbodies relevant to the proposed project**

| Waterbody | Status 2007-09 | Status 10-12 | Status 10-15 | Status 2013-2018 | Protected area (SAC) | Significant Pressures identified | WFD Risk (2nd cycle) | WFD Risk (3rd cycle) |
|---|---|---|---|---|---|---|---|---|
| Blackwater (Munster)_190 | Poor | Good | Good | Good | Within protected area | None | Not at risk | At risk |
| Blackwater (Munster)_200 | Good | Good | Good | Good | Within protected area | None | Not at risk | Not at risk |

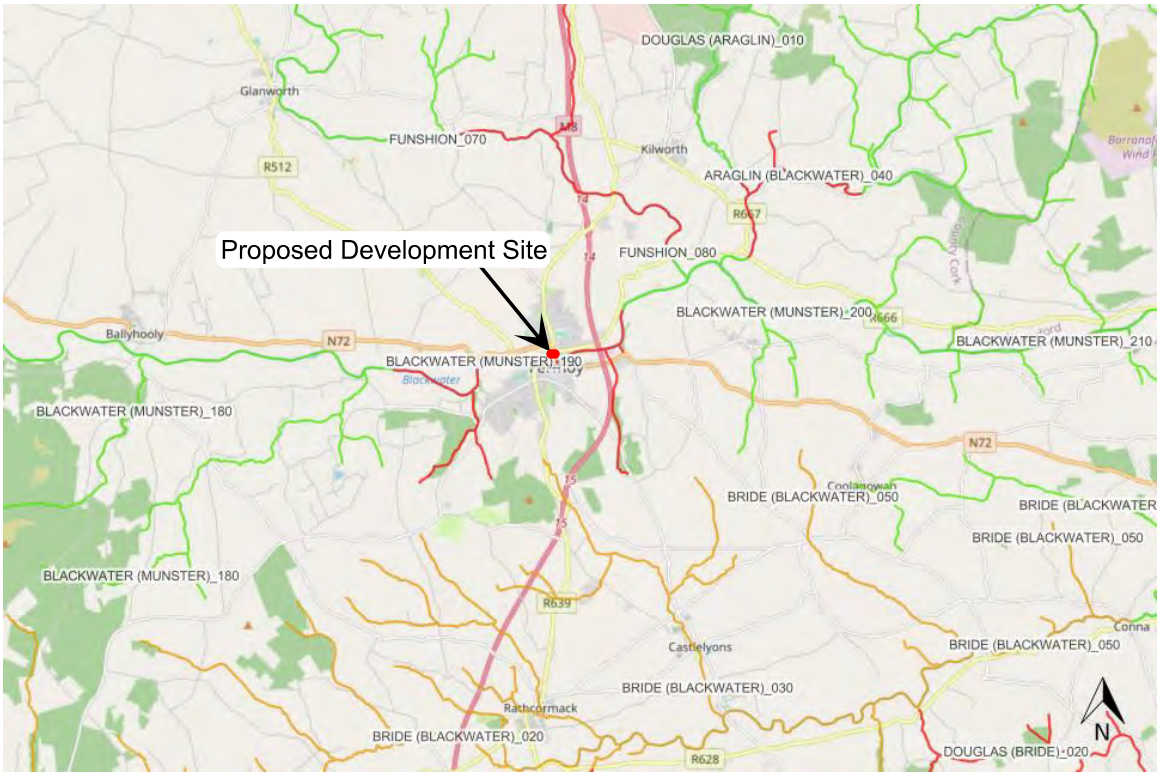



**Figure 15. Blackwater [Munster] – River Waterbodies (3rd cycle) relevant to the proposed works (outlined in red) | Source: EPA Envision mapping (https://gis.epa.ie/EPAMaps/) | Not to scale**

### 6.8.3 Biological Monitoring

To evaluate biological water quality within the survey area, Q-sampling was carried out at n=4 sites in the vicinity of Fermoy Weir (S1-S4; **Figure 7**). Macro-invertebrate samples were converted to Q-ratings as per Toner *et al*. (2005). All samples were taken with a standard kick sampling hand net (250mm width, 500µm mesh size) from areas of riffle/glide utilising a two-minute sample, as per ISO standards for water quality sampling (ISO 10870:2012). Large cobble was also washed at each site, where present, and samples were elutriated and fixed in 70% ethanol for subsequent laboratory identification. Any rare invertebrate species were identified from the NPWS Red List publications for beetles (Foster *et a*l., 2009), stoneflies (Feeley *et al.,* 2020), mayflies (Kelly-Quinn & Regan, 2012) and other relevant taxa (i.e. Byrne *et al*., 2009; Nelson *et al*., 2011).

A total of n=31 species across n=28 families were recorded in the n=4 Q-samples collected in July 2020. The samples S1 and S2 were collected upstream of the weir and S3 and S4 downstream of the weir. A summary of results is presented in **Table 12** and **Figure 16** below.

Following the methodology of Toner *et al.* (2005), the EPA group invertebrates into classes whereby pollution intolerant species are denoted class A, and species with greater pollution tolerance fall into successive classes (B through E, respectively). As such, the presence or absence of these groups and their relative abundance facilitates an assessment of biological river health. Good status (Q4) unpolluted water quality is achieved according to the EPA if at least one Group A taxon is present in, at least, fair

numbers (5-10% total sample composition). Group B taxa may be common or absent and *Baetis rhodani* (large dark olive mayfly) is often dominant. Other Group C taxa are never excessive and group D / E taxa are present in small numbers or absent (Toner et. al., 2005). Our results are discussed in this context in order to interpret potential changes in the macroinvertebrate community composition.

The invertebrate samples (S1 & S2) collected upstream of the weir, in addition to S4 downstream, had moderate status (Q3-4) biological water quality. The recorded water quality was assigned due to small numbers of clean water indicator group A, Heptageniidae mayfly species and a dominance of EPA Group B and C invertebrates (moderate water quality indicators). These included the group B mayfly species *Centroptilum luteolum*, and group C mayfly species, *Seratella ignita* and *Caenis rivulorum*.

A single sample (S3) had Q4 (good status), unpolluted water quality. The sample was well represented by EPA group A clean water indicator species with the stonefly species, *Isoperla grammatica* and two mayfly species present from the group (i.e. *Ecdyonurus insignis* and *Ephemera danica*).

No invertebrate species of higher conservation value than 'least concern' were recorded in the invertebrate assemblage when compared to national red lists (Feely *et al.* 2020; Kelly-Quinn & Regan, 2012; Byrne *et al*. 2009; Foster *et al*. 2009).

**Table 12. Macro-invertebrate species composition and Q-ratings recorded on the River Blackwater in the vicinity of Fermoy Weir, July 2020**

| Family | Species | S1 | S2 | S3 | S4 | EPA group |
|---|---|---|---|---|---|---|
| Perlodidae | *Isoperla grammatica* | | | 1 | | **A** |
| Heptageniidae | *Heptagenia sulphurea* | 1 | | | | **A** |
| Heptageniidae | *Ecdyonurus insignis* | | 2 | 2 | | **A** |
| Ephemeridae | *Ephemera danica* | | | 3 | 2 | **A** |
| Baetidae | *Centroptilum luteolum* | 5 | 6 | | 3 | **B** |
| Baetidae | *Baetis rhodani* | | | 1 | | **C** |
| Ephemerellidae | *Serratella ignita* | 9 | 8 | 10 | 2 | **C** |
| Caenidae | *Caenis rivulorum* | 14 | 4 | 16 | 3 | **C** |
| Leptoceridae | *Athripsodes cinereus* | 2 | | 2 | 5 | **B** |
| Limnephilidae | Not speciated - early instar | 1 | | | | **B** |
| Hydropsychidae | *Hydropsyche siltalai* | 4 | | 2 | 14 | **C** |
| Hydropsychidae | *Cheumatopsyche lepida* | | | | 4 | **C** |
| Polycentropodidae | *Polycentropus flavomaculatus* | 2 | 1 | 2 | | **C** |
| Dytiscidae | *Nebrioporus depressus* | | 1 | | | **C** |
| Elmidae | *Limnius volckmari* larva | | | 2 | 1 | **C** |
| Elmidae | *Elmis aenea* larva | 2 | | | | **C** |
| Neritidae | *Theodoxus fluviatilis* | 5 | | | | **C** |
| Bithyniidae | *Bithynia tentaculata* | 2 | 7 | 1 | | **C** |
| Planorbidae | *Planorbis planorbis* | | 2 | | | **C** |
| Valvatidae | *Valvata piscinalis* | 3 | 3 | | | **C** |

| Family | Species | S1 | S2 | S3 | S4 | EPA group |
|---|---|---|---|---|---|---|
| Physidae | *Physa fontinalis* | | 2 | | | **D** |
| Sphaeriidae | *Pisidium* sp. | 1 | | | | **D** |
| Lymnaeidae | *Radix balthica* | 6 | 1 | 3 | 1 | **D** |
| Sphaeriidae | *Sphaerium corneum* | | 2 | | | **D** |
| Hirudinidae | *Pisciola geometra* | | | 2 | | **C** |
| Gammaridae | *Gammarus duebeni* | 2 | 8 | 4 | 8 | **C** |
| Assellidae | *Asellus aquaticus* | 5 | 1 | 4 | 9 | **D** |
| Simulidae | Not speciated | | | | 2 | **C** |
| Chironomidae excl. *Chrionomus* sp. | Not speciated | 5 | 6 | | 6 | **C** |
| Hydrachnidiae | Not speciated | 1 | | 1 | | **C** |
| Oligochaeta | Not speciated | | | 2 | 2 | **n/a** |
| **Taxon richness** | | **18** | **15** | **17** | **14** | |
| **Total abundance** | | **70** | **54** | **58** | **62** | |
| **Q Rating** | | **Q3-4** | **Q3-4** | **Q4** | **Q3-4** | |
| **WFD Status** | | **Mod** | **Mod** | **Good** | **Mod** | |

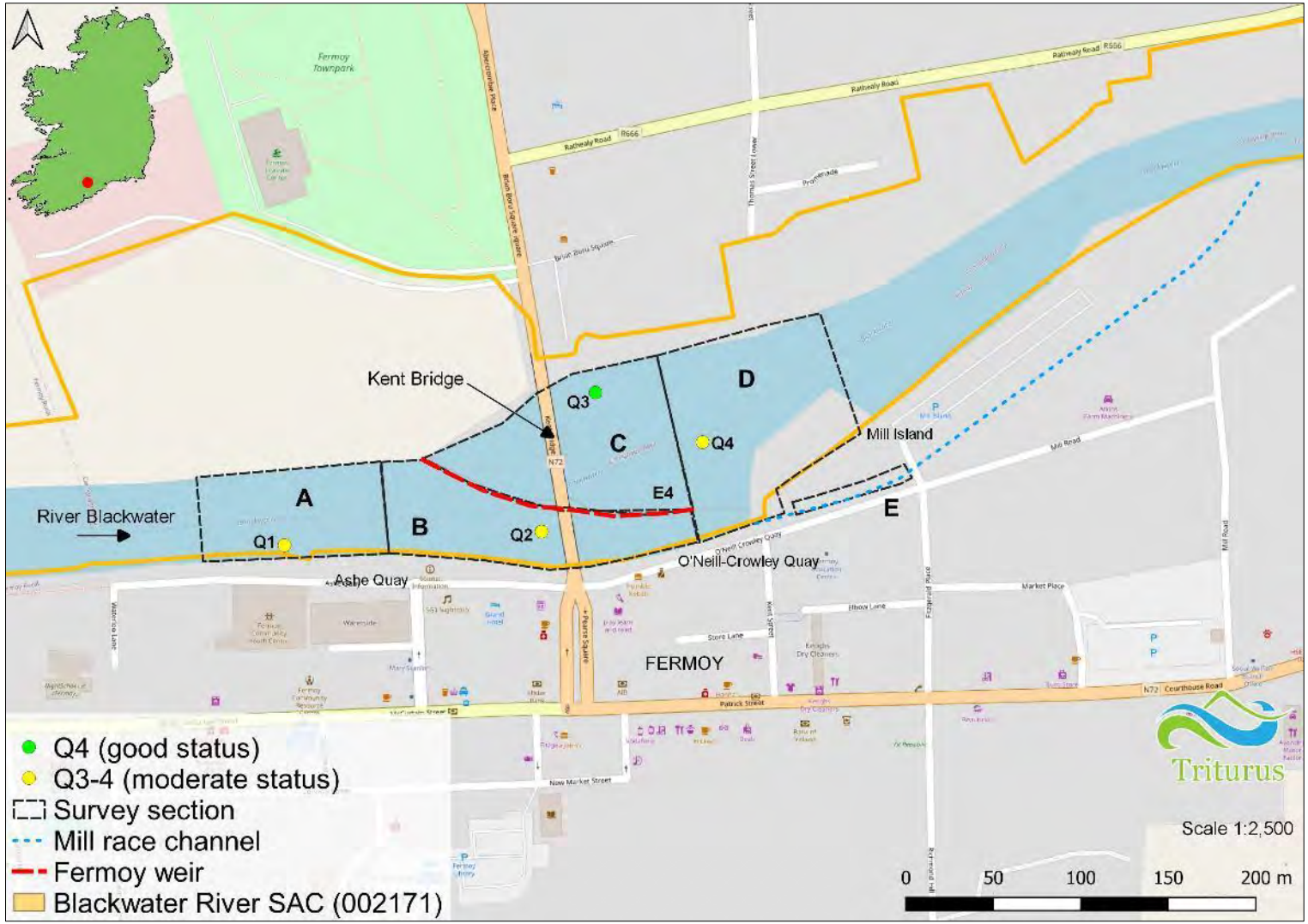



**Figure 16. Biological water quality (Q-ratings) recorded in the vicinity of Fermoy Weir, July 2020.**

## 6.9 Invasive Species

Non-native plants are defined as those plants which have been introduced outside of their native range by humans and their activities, either purposefully or accidentally. Invasive non-native species are so-called as they typically display one or more of the following characteristics or features: (1) prolific reproduction through seed dispersal and/or re-growth from plant fragments; (2) rapid growth patterns; and, (3) resistance to standard weed control methods.

Where a non-native species displays invasive qualities and is not managed it can potentially: (1) out compete native vegetation, affecting plant community structure and habitat for wildlife; (2) cause damage to infrastructure including road carriageways, footpaths, walls and foundations; and, (3) have an adverse effect on landscape quality. The NBDC lists a number of both aquatic and terrestrial high impact invasive species which have been recorded within grid square W89 (**Table 13**).

**Table 13. High impact invasive species recorded in W89**

| Species group | Species name |
|---|---|
| flowering plant | Canadian Waterweed (*Elodea canadensis*) |
| flowering plant | Cherry Laurel (*Prunus laurocerasus*) |
| flowering plant | Giant Hogweed (*Heracleum mantegazzianum*) |
| flowering plant | Indian Balsam (*Impatiens glandulifera*) |
| flowering plant | Japanese Knotweed (*Fallopia japonica*) |
| flowering plant | *Rhododendron ponticum* |
| terrestrial mammal | American Mink (*Mustela vison*) |
| terrestrial mammal | Brown Rat (*Rattus norvegicus)* |
| terrestrial mammal | Eastern Grey Squirrel (*Sciurus carolinensis*) |
| terrestrial mammal | Fallow Deer (*Dama dama*) |
| terrestrial mammal | Feral Ferret (*Mustela furo*) |

Source NBDC: 28/10/21

The control of invasive species in Ireland comes under the Wildlife (Amendment) Act 2000, where it states that

*'Any person who— [...] plants or otherwise causes to grow in a wild state in any place in the State any species of flora, or the flowers, roots, seeds or spores of flora, ['refers only to exotic species thereof'][...] otherwise than under and in accordance with a licence granted in that behalf by the Minister shall be guilty of an offence.'*

The Birds and Natural Habitats Regulations 2011 (SI 477 of 2011), Section 49(2) prohibits the introduction and dispersal of species listed in the Third Schedule, which includes Japanese Knotweed *Fallopia japonica* and Himalayan Balsam *Impatiens glandulifera*, as follows: "any person who plants, disperses, allows or causes to disperse, spreads or otherwise causes to grow [….] shall be guilty of an offence."

Himalayan Balsam both juvenile and adult plants, is widely scattered throughout the riparian zone. One area of Japanese Knotweed was recorded on the southern banks of the proposed development site (**Figure 17**).

Japanese Knotweed is a highly invasive, non-native species which was originally introduced as an ornamental plant but has since spread along transport routes and rivers to become a serious problem. From an ecological viewpoint it out-competes native species by forming dense stands which suppresses growth of other species. It grows extremely vigorously and can penetrate through small faults in tarmac and concrete and thus can damage footpaths, roads and flood defence structures. As it can survive in poor quality soils, including spoil, it often thrives in brownfield sites and in urban areas.

Himalayan balsam is an invasive terrestrial plant species that was first introduced in the UK in 1839 as an ornamental garden plant. Since it was introduced, it has spread to most parts of Ireland. Due to the nutrient poor soil and cold temperatures in its home range, the Himalayas, it has adapted to develop thousands of seeds, which are dispersed widely as the ripe seedpods shoot their seeds up to 7m (22ft) away. Due to our warmer climate and nutrient rich soils, it has thrived here and became highly invasive. Once established in the catchment of a river the seeds, which can remain viable for two years, are transported further afield by water.

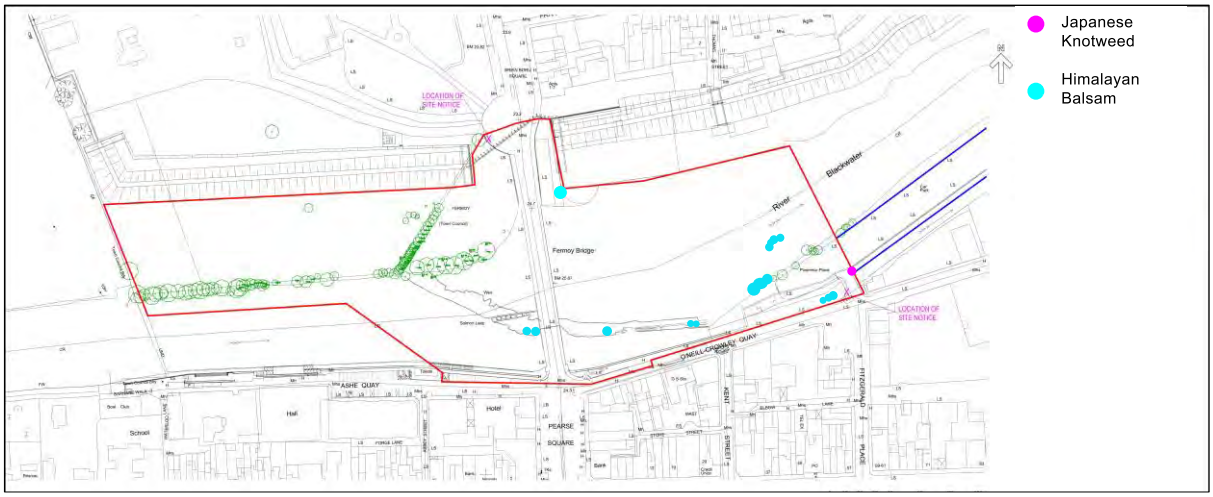



**Figure 17. Location of invasive species proposed development site**

It is noted the invasive fish species Dace (*Leuciscus leuciscus*) was recorded during electrofishing surveys within the proposed development site both upstream and downstream of the existing weir (See **Section 6.5.1** for detail). Dace is a relatively small cyprinid fish with a dorso-ventrally flattened symmetry, which makes it suited to fast flowing water. The flanks are silver, darkening to a bluish green along the back. Dace were intentionally released in the River Blackwater by anglers as live bait in 1889.

The most pressing of the threats posed by Dace is the impact on native salmonids. Dace, trout and salmon have similar habitat preferences and all spawn over gravels in fast flowing water. Dace competes with salmon for breeding grounds (O'Grady in Caffrey *et al.,* 2007), as well as potentially impacting on populations through predation (King *et al.* 2009). Efforts to create and improve breeding grounds for salmonids in the River Blackwater have been hampered by Dace moving onto the newly introduced gravels at spawning times.

# 7. Assessment of Potential Impacts

All potential impacts relate to habitat loss, surface water runoff, the spread of invasive species and biosecurity risk, barriers to movement, changes in hydrological regimes and disturbance effects during the construction and operational phase. Based on the *Managing Natura 2000 Sites: The Provision of Article 6 of the Habitats Directive 92/43/EEC* (European Commission (EC), 2018 and CIEEM guidelines '*Guidelines for Ecological Impact Assessment'* (CIEEM, 2019) impacts are listed as significant using a combination of professional judgement and criteria or standards where available, if impacts have the potential to have a significant impact on the ecological integrity on the habitats and species for which the site is designated.

The potential impacts associated with the proposed development are discussed in the following section with respect to their likelihood to have significant impacts on European sites.

As part of the assessment direct, indirect and in-combination impacts were considered. Direct impacts refer to habitat loss or fragmentation arising from land-take requirements for development. Indirect and secondary impacts do not have a straight-line route between cause and effect, and it is potentially more challenging to ensure that all the possible indirect impacts of the project/plan - in combination with other plans and projects have been established.

Potential impacts were identified as follows:

- Impacts from habitat loss during construction
- Impacts on water quality during construction
- Impacts from noise and disturbance during construction
- Impacts from direct injury and/mortality during construction
- Impacts from barriers to movement during construction and operation
- Impacts on the hydrological regime during operation
- Impacts from increased predation risk
- Impacts from lighting during construction and operation
- Impacts from the spread of invasive species and biosecurity risks during construction
- In-combination Impacts

## 7.1 Loss of Habitat

### 7.1.1 Loss of Terrestrial Habitat

The project has been designed to ensure that there will be no permanent habitat loss of qualifying habitats within the SAC boundary as a result of the proposed development. The fish bypass channel design option which has been chosen i.e., Rough Channel Pool Bypass will be built outside the main channel of the river. While the proposed bypass channel is located within the SAC boundary and there will be habitat loss, these habitats are common habitats i.e., Amenity grassland GA2/Dry meadows and grassy verges GS2 and Treelines WL2 and are not qualifying habitats for the Blackwater River (Cork/Waterford) SAC.

While the treelines along the River Blackwater at the proposed development are not a qualifying habitat for the SAC, these marginal habitats with overhanging vegetation and reduced flows are important for wildlife including qualifying species of the SAC as they provide areas of cover for fish and invertebrates as well as Otter. These marginal areas also provide protection from predators and direct sunlight and consequently fish may remain in these areas for extensive periods of time. It is noted that tree removal has been minimised at the design stage (see below) and only trees within the footprint of the fish bypass channel will be removed. A landscaping plan with native tree species has also been included with this application (**Appendix 2** Drawing 21-053 LP01-01-PP). This plan includes a riparian enhancement area to the north and south of the fish bypass channel which will provide cover for fish passing through the channel as well as providing cover for Otter.

Approximately 24 trees will be removed along the riverbank. Only two native trees will be removed, namely one Ash and one Alder. The remaining trees are non-native and include, Lime, Norway Maple, Lombardy Poplar and planted Black Poplar. It is noted that native trees are of higher ecological value as they support more invertebrate species which may provide a food source for fish species. However, all riparian trees can provide shade and cover for fish, perching opportunities for piscivorous bird species and can be used as holts or couches by Otter. In this instance a relatively small number of non-native trees will be removed and the loss of cover and shade for fish species, including QI species, is not considered significant. Given the limited loss of vegetation, no impact on qualifying interests (Brook Lamprey, Sea Lamprey, River Lamprey, Atlantic Salmon, White-clawed Crayfish, Freshwater Peal Mussel,) or their conservation objectives is predicted to occur. Furthermore, no potential holts or couches for Otter were recorded in this area and therefore, the loss of trees will not have a significant impact on Otters using the river.

Significant changes in flow patterns could impact on the distribution of *Alluvial forests with Alnus glutinosa and Fraxinus excelsior (Alno-Padion, Alnion incanae, Salicion albae)*. Investigation of the treelines and woodland habitat in the vicinity of the proposed development site indicates that the trees earmarked for removal do not correspond to a qualifying habitat for Blackwater River (Cork/Waterford) SAC. A small area of woodland habitat approximately 700m upstream of Fermoy Bridge was surveyed and has some characteristics of Alluvial woodland. Notwithstanding that ground flora is typical of riparian woodland, this is not a significant example of the Annex I habitat Alluvial woodland.

It is noted that the existing breach of the weir is relatively recent. This has altered upstream flow dynamics within the River Blackwater, which may be having adverse effects on the poor

quality alluvial woodland upstream due to lower water levels. The proposed weir remediation works may result is a slight rise in water levels upstream of the weir. This would allow conditions upstream to revert to the baseline conditions that existed when this riparian woodland was developing. Therefore, the works are likely to have a neutral to slightly positive impact on riparian woodland upstream of the works area, by restoring water levels to the previous baseline. This will facilitate the gradual ongoing transition of this largely artificial woodland to a more natural woodland. Downstream of the works there are no areas of alluvial woodland in proximity to the proposed works and no significant impact on water levels or flow patterns is predicted to occur. Therefore, no effect on this habitat downstream of the works area will occur.

The terrestrial habitats which will be directly impacted by the proposed development i.e., WL2 Treelines, BL3 Buildings, artificial surfaces and GA2 Amenity grassland/GS2 Dry meadows are not qualifying habitats for the Blackwater River (Cork/Waterford) SAC. Direct impacts on these habitats are discussed further in the Ecological Impact Assessment (EcIA) report which has been submitted within this application. The river islands support examples of the Annex I habitat '*Hydrophilous tall herb fringe communities of plains and of the montane to alpine levels [6430]*'. However, instream construction works will be confined to the area around the existing weir and largely avoid this Annex I habitat (See **Figure 5**).

Terrestrial habitat loss within the SAC will be confined to modified habitats such as amenity grassland and treelines. No qualifying terrestrial habitat will be removed as part of the proposed development. The changes to relatively common terrestrial habitats within the proposed development site will not adversely affect the conservation objectives for the QI habitats or the integrity of the Blackwater River (Cork/Waterford) SAC.

### 7.1.2 Loss of Aquatic Habitat

The proposed works will take place within the main channel of the River Blackwater, within the Blackwater River (Cork/Waterford) SAC. Potential impacts on aquatic habitats will be generally restricted to physical alterations of riverbed habitat/morphology and smothering of habitats due to resuspension of sediments.

The NPWS conservation objectives for the Blackwater River (Cork/Waterford) SAC (NPWS 2012) notes that no high conservation value subtypes of the qualifying habitat *Water courses of plain to montane levels with the Ranunculion fluitantis and Callitricho-Batrachion* vegetation are known to occur in the SAC. The high-water velocities upstream of the existing weir make it unsuitable for *Water courses of plain to montane levels with the Ranunculion fluitantis and Callitricho-Batrachion vegetation [3260]* habitat. However, macrophyte communities representative of this Annex I habitat are present downstream of Fermoy Weir (See **Figure 7** within Sections C and D) i.e. water crowfoot (*Ranunculus subspecies Batrachion agg.*), Spiked water milfoil (*Myriophyllum* spp.), *Callitriche* sp. Unbranched bur-reed (*Sparganium emersum*) , *Fontinalis antipyretica and Cinclidotus fontinaloides*.

As detailed in **Table 5**, NPWS conservation objectives for the Blackwater River (Cork/Waterford) SAC (NPWS 2012) lists specific targets with respect to this habitat. The main objectives for this habitat type are to maintain and if possible enhance the extent and composition of community, improve water quality and improve channel substrate quality by reducing siltation. Specific targets for this habitat include no decline in habitat distribution and

maintenance of the hydrological regime and substratum composition and vegetational composition.

Temporary damming of the river for the weir reinstatement works will lead to temporary impacts on river habitat, including small areas of the Annex I habitat *Water courses of plain to montane levels with the Ranunculion fluitantis and Callitricho-Batrachion* vegetation. The current hydrological regime downstream of the site is unstable due to the ongoing erosion of the weir. The reinstatement works will stabilise the hydrological conditions immediately downstream of the weir. While vegetation is likely to recolonize this area following the weir restoration works, weirs can modify flow in complex ways, and this may lead to the loss of species which are sensitive to ponding or slow flows (e.g. *Ranunculus fluitans*). Predicting the loss of habitat due to changes in flow downstream and upstream of the of the weir is difficult. However, it is noted that the macrophytes recorded within the proposed development site and/or survey area represent a common sub-type of this Annex I habitat and no rare subtypes were recorded during site surveys. This habitat can occur over a wide range of physical conditions, from acid, oligotrophic, flashy upland streams dominated by bryophytes to more eutrophic, slow flowing streams dominated by Ranunculus and Callitriche species. While there will be impacts on the river substrate, the restored structures and substrate will be comparable to what was present prior to the breach of the weir and the subsequent increased erosion downstream of the breach. No significant changes in nutrient levels which can impact on plant species composition or habitat condition will occur.

Changes in hydrological regimes could impact on *Water courses of plain to montane levels with the Ranunculion fluitantis and Callitricho-Batrachion vegetation [3260]* habitat downstream and upstream of the proposed works area. However, it is noted that rivers are dynamic systems which are not necessarily stable overtime and in this instance the breach of the weir has significantly altered flow patterns within the river. The provision of a fish pass will also alter flow dynamics within the river, which may result in changes in distribution pattern for this habitat. However, these changes will not necessarily be either negative or positive. The new flow pattern will be relatively stable overtime once the weir remediation works are complete. This will favour the development of this habitat in certain areas and may have a slight detrimental impact in others. It is noted that velocities downstream of the fish bypass channel will be lower than the velocities currently generated through the weir breach and this may encourage colonization by Ranunculus and Callitriche species. Overall, however, there is not likely to be any significant changes in the amount of this habitat and more controlled flow conditions will lead to a more stable hydrological regime which makes it less likely that this habitat will be negatively affected by extreme fluctuations in flow pattern in the future due to the continued deterioration of the weir.

Overall based on the short-term nature of the works, the establishment of more stable long-term flow dynamics, the seasonal restrictions pertaining to the project, the implementation of detailed and site specific mitigation measures and the reinstatement of instream habitat post construction no significant loss of aquatic habitat is predicted to occur and the proposed development will not result in significant impacts on the conservation objectives of aquatic habitats, habitat quality or loss of habitat within the Blackwater River (Cork/Waterford) SAC.

### 7.1.3 Loss of Habitat for Aquatic Qualifying Species

The loss of aquatic habitat during construction or operation could also potentially impact on aquatic qualifying species for the Blackwater River (Cork/Waterford) SAC and reduce the area of foraging and breeding habitat within the SAC boundary. Assuming a worst-case scenario there is the potential for a direct, short-term impact on a mix of potential adult, spawning and nursery habitat for Atlantic Salmon within the weir reinstatement works area. Similarly taking a worst-case scenario it is assumed that this area is also suitable for lamprey spawning and White-clawed Crayfish. No live Freshwater Pearl Mussels were found in the section of the River Blackwater within 100m upstream and downstream of Fermoy Bridge and there will be no direct impact on Freshwater Pearl Mussel habitats as a result of the proposed works.

As outlined in **Section 8**, riverbed material removed by the works within the River Blackwater will be used for backfill in order to maintain natural riverbed material in the reinstated bed area. Construction works will take place between July and September inclusive to prevent damage to spawning and early juvenile salmonids. Flows will be diverted away from the works area and detailed mitigation, including silt curtains, will be utilised to minimise any deposition of resuspending sediments on aquatic habitats. Riverbed material removed by the works within the River Blackwater will be used for backfill in order to maintain natural riverbed material in the reinstated bed area. Fish will be removed from the area of river within the barriers and dams and within any silt curtain envelope. White-clawed Crayfish will be trapped and relocated outside the works area. It is noted that cavities within the proposed rock armour will provide suitable habitat for White-clawed Crayfish. It is noted that the surface of the remediated weir will be cobbled, without pointing of joints, creating some opportunity for crevices for crayfish. Post construction White-clawed Crayfish and fish species are expected to rapidly colonise suitable areas and no significant effect on long-term population dynamics for this species will occur.

Overall based on the short-term nature of the works, the establishment of more stable long-term flow dynamics, the seasonal restrictions pertaining to the project, the implementation of detailed and site specific mitigation measures and the reinstatement of instream habitat post construction, no significant loss of aquatic habitat for QI species is predicted to occur and the proposed development will not result in any significant deterioration in habitat quality or loss of habitat within the Blackwater River (Cork/Waterford) SAC. Therefore there will be no impact on the integrity of the Blackwater River (Cork/Waterford) SAC due to loss of aquatic habitat.

## 7.2 Impacts on Water Quality

Instream works and surface water emissions associated with the proposed works could impact on aquatic habitats via increased silt levels in surface water run-off, resuspension of riverbed sediments and inadvertent spillages of hydrocarbons from fuel and hydraulic fluid.

### 7.2.1 Hydrocarbons

Inadvertent spillages of hydrocarbon and/or other chemical substances during construction could introduce toxic chemicals into the aquatic environment via direct means, surface water run-off or groundwater contamination. Some hydrocarbons exhibit an affinity for sediments and thus become entrapped in deposits from which they are only released by vigorous erosion or turbulence. Oil products may contain various highly toxic substances, such as benzene, toluene, naphthenic acids and xylene which are to some extent soluble in water; these

penetrate into the fish and can have a direct toxic effect. The lighter oil fractions (including kerosene, petrol, benzene, toluene and xylene) are much more toxic to fish than the heavy fractions (heavy paraffins and tars). In the case of turbulent waters, the oil becomes dispersed as droplets into the water. In such cases, the gills of fish can become mechanically contaminated and their respiratory capacity reduced. However, any such spills, in the unlikely event of their occurrence, would be minor in the context of the available dilution in the River Blackwater.

Hydrocarbon contamination, if severe, could potentially impact on water quality and thus could impact on aquatic qualifying species for the Blackwater River (Cork/Waterford) SAC namely Freshwater Pearl Mussel, Sea Lamprey, Brook Lamprey, River Lamprey, White-clawed Crayfish, Twaite Shad and Atlantic Salmon. There could also be impacts on Brown Trout which are an important component of the Freshwater Pearl Mussel lifecycle. Significant impacts on White-clawed Crayfish and on fish stocks, if they were to occur, could impact on Otter due to a reduction in prey availability.

It is noted that the genetic results discussed in **Section 6.5.5** of this report support the suspected distribution of shad species (majority considered to be Twaite Shad, *Alosa fallax*) within the River Blackwater, i.e., present to the tidal limit (King and Linnane, 2004; King and Roche, 2008). Given the distance for Twaite Shad populations downstream of the works area and the dilution provided in the lower reaches of the River Blackwater, no effect on Twaite Shad will occur given the minor nature of any hydrocarbon spills.

A range of mitigation measures have been specified in **Section 8** of this report to minimise the risk of such spills occurring and measures have also been specified to effectively deal with such spills were they to occur. It is also noted that any spills would be minor in the context of the dilution provided within the River Blackwater. It is concluded therefore that no significant impact on water quality from hydrocarbons or other chemical spills during construction will occur. Thus, no significant impacts on the conservation objectives of the aquatic qualifying interests will occur or on the integrity of Blackwater River (Cork/Waterford) SAC due to hydrocarbon spillage during construction works.

### 7.2.2 Silt

The proposed works have the potential to generate silt during the construction phase. Instream works and surface water emissions associated with both the aquatic and terrestrial construction phase of the proposed development could impact on aquatic habitats via increased silt levels in surface water run-off and resuspension of riverbed sediments. This has the potential to have a significant deleterious effect on aquatic QI species for the Blackwater River (Cork/Waterford) SAC.

High levels of silt can impact on fish species, in particular spawning salmonids. Suspended sediment can settle on spawning areas, infill the intragravel voids and smother the eggs and alevins (newly hatched fish) in the gravel. If of sufficient severity, adult fish could be affected by increased silt levels as gills may become damaged by exposure to elevated suspended solids levels. If of sufficient severity, aquatic invertebrates may be smothered by excessive deposits of silt from suspended solids. In areas of stony substrate, silt deposits may result in a change in the macro-invertebrate species composition, favouring less diverse assemblages and impacting on sensitive species. Suspended sediment can reduce water clarity and

visibility in the stream, impairing the ability of fish to find food items Cement can also affect fish, plant life and macroinvertebrates by altering pH levels of the water.

Aquatic plant communities may also be affected by increased siltation. Submerged plants may be stunted and photosynthesis may be reduced. Qualifying habitats which are estuarine or terrestrial in nature will not be affected; however, there could be an impact on the river habitat water courses of plain to montane levels with the *Ranunculion fluitantis* and Callitricho-Batrachion vegetation downstream of the proposed works area.

Silt can be extremely harmful to Freshwater Pearl Mussel. Silt deposition on the riverbed results in formerly clean gravels become clogged with fine sediment. This prevents oxygen movement into the waters in the riverbed (interstitial) that feed the juvenile mussels, and they quickly die. Each time siltation of gravels occurs, all juvenile mussels below five years of age are killed, and in rivers with chronic siltation problems, juvenile recruitment is rare and unsustainable, and existing adult populations face extinction. Fine sediment, once introduced to a pearl mussel river, can continue to cause very serious effects on a long-term basis (Ellis 1936, Marking and Bills 1979, Naden *et al*. 2003, Araujo and Ramos 2001, Killeen *et al.* 1998. All referenced in DEHLG, 2010).

Direct ingestion of silt by adult mussels can lead to rapid death. Turbidity, particularly from fine peat entering the water, causes adult mussels to clam up (they close their shells tightly and do not filter water through their siphons), a response that provides a protection against ingesting damaging fine particles. If the river water remains strongly turbid for a number of days, mussels can die from oxygen starvation, either from remaining clammed, or from ingesting contaminated water while stressed. The fine sediment subsequently provides a medium for macrophyte growth, which makes the riverbed habitat unsuitable for pearl mussels

It is noted that the Fourth Schedule of the Environmental Objectives (Freshwater Pearl Mussel) Regulations 2009 (S.I. No. 296 of 2009) cites five ecological quality objectives for Freshwater Pearl Mussel habitat (See **Table 4**). The Blackwater catchment fails to meet all five Environmental Quality Objectives (EQOs) listed.

Juvenile Freshwater Pearl Mussels require an extremely low concentration of Phosphate in the interstitial water in which they live. According to the Freshwater Pearl Mussel Sub Basin Management Plans Literature Review (May 2010, Subsection 3.1.13), ''*...the normal background ortho-phosphate level of 0.005 mg/l is considered to be essential to the maintenance of oligotrophic waters for reproducing pearl mussel rivers (Moorkens, 2006)*.'' In the ecological quality objectives (**Table 4)** sustainable pearl mussel habitat attributes, an EQR ≥0.90 for biological water quality (macroinvertebrates) equates to WFD high status or an EPA Q value rating of 4-5 or 5. Results between 1971 and 2018 are consistent, with a Q value of 4 recorded.

Based on the above and as confirmed by surveys in the lower catchment to date, the conditions do not exist at present within the lower catchment to support functioning populations of Freshwater Pearl Mussel and only adults are likely to be present, nor are such conditions likely to occur in the short-term. In the context the generation of silt as a result of works, particularly when compared to the amount of silt that will be generated by ongoing erosion, given the absence of juvenile populations which are most susceptible to elevated silt levels

and given that silt is likely to be rapidly moved downstream by winter storms rather than consolidate on the riverbed, no significant adverse effect on this species is predicted to occur.

Based on the above, increased silt levels, if severe, could potentially impact on water quality and thus could impact on aquatic qualifying species for the Blackwater River (Cork/Waterford) SAC namely Sea Lamprey, Brook Lamprey, Freshwater Pearl Mussel, White-clawed Crayfish, River Lamprey, Twaite Shad and Atlantic Salmon. Significant impacts on fish stocks could impact on Otter due to a reduction in prey availability. A range of standard and site-specific mitigation procedures will be employed during construction to minimise the potential for impacts on water quality. A temporary sheet piled dam will be erected upstream of the works to facilitate the weir remediation works, allowing works to be carried out in the dry. Bypass channel works will be carried out within terrestrial habitats and standard mitigation measures will ensure that there is no impact on local water quality. Where possible the use of natural cement (prompt) in place of traditional cement will further reduce potential impacts. These mitigation methods will effectively minimise impacts from silt.

Following the implementation of mitigation measures and the mitigation by design which has been built into this project, it has been concluded that silt runoff during the works will not have a significant effect on water quality and thus on the aquatic qualifying interests and conservation objectives or integrity of Blackwater River (Cork/Waterford) SAC.

### 7.3 Impacts from Noise and Disturbance

The proposed development site is located within Blackwater River (Cork/Waterford) SAC. Potentially increased noise and disturbance associated with the site works could cause disturbance/displacement of qualifying species. Otter is listed on Annex II of the Habitats Directive and is a conservation objective for the SAC. Potential impacts could arise due to disturbance of Otter as a result of increased noise and activity during site works. This could potentially lead to changes in feeding behaviour which if of sufficient severity could impact on reproductive success. Disturbance of breeding Otter could also have an impact on overall populations within the SAC.

Otter is generally considered to be a nocturnal or crepuscular species, i.e., individuals are predominantly active at night, with peaks in activity shortly after dusk at just before dawn (Chanin 2003; OPW 2006). Therefore, apart from their breeding and resting sites, Otters are not considered to be sensitive to noise and light impacts during daylight hours. Furthermore, the occurrence of Otters in Irish towns and cities suggests that this species is able to habituate to human activities. Noise/vibration and light arising from construction activities have the potential to cause disturbance to Otters, leading to reduced connectivity between areas upstream and downstream of the proposed development for the duration of the construction phase. Given the nocturnal or crepuscular nature of this species, the significance of any effects resulting from noise and lighting impacts depends on the daily programming and total duration of the construction activities of the construction area. Although no Otter breeding holts were recorded within the proposed development site, two couches were recorded along the existing weir and the results of site surveys indicate that this this area is of high value for Otter.

Sheet piling will be used to install the fish bypass channel along the northern banks of the River Blackwater and upstream of the bridge (See **Figure 5**). This will result in a significant increase in noise and disturbance during construction works. While this will not be significant

in the context of Otter's ability to move away from and/or adapt to short-term disturbance, a derogation licence will be sought for construction works as they will potentially disturb two Otter couches on the existing weir. Construction works will take place during normal working hours which will avoid the largely nocturnal foraging habits of Otter. Mitigation measures will ensure that noise levels during construction will be kept to a minimum (Refer to **Section 8.8**).

Lighting for the proposed development will be confined to the construction phase, which will be confined to normal working hours. No operational lighting will be required. During construction, mitigation measures will ensure that where lighting is required it will be directed away from the treelines and the areas of the River Blackwater outside the immediate working area. This will ensure that there is no light spillage and/or lighting disturbance for Otters outside the works area. Any disruption of Otter foraging behaviour will be temporary and slight. Noise will return to previous levels following construction. The existing weir face is regularly used as a feeding and resting area (i.e., couches). It is expected that Otters will continue to use the site in the operational phase.

Given the temporary nature of the works and the likely success of mitigation measures, no significant impact on qualifying species due to noise and disturbance is predicted to occur during the construction phase. Therefore, no significant impact from the proposed development on the qualifying interests or conservation objectives for the Blackwater River (Cork/Waterford) SAC as a result of noise/disturbance is predicted to occur.

## 7.4 Impacts from Direct Injury and/or Mortality During Construction

### 7.4.1 Atlantic Salmon, River Lamprey, Brook Lamprey, Sea Lamprey, Twaite Shad

Construction activities will be undertaken during normal working hours only and will ensure that there is potential for undisturbed passage at night, when the main surges of migratory fish are more likely to occur.

There is the potential for direct mortality impacts fish species including QI species such as Atlantic Salmon and Brook Lamprey to become trapped within silt curtain envelopes. The area to be affected is small and an electrofishing salvage operation will be carried out prior to construction works to remove any fish that become enclosed within the works area. The installation of sheet piling and bunds will ensure that the river flow is diverted away from the works area. Direct impacts during construction works will be prevented by removing fish including juvenile lamprey in sediments from the area of river within barriers and dams.

Further details on mitigation measures are included in **Section 8** of this report. These measures will ensure that there will be no significant direct effects on species listed as QIs for the Blackwater River (Cork/Waterford) SAC such as Atlantic Salmon and Brook Lamprey. This will also ensure there are no indirect effects on prey species for Otter e.g., Brown Trout and European Eel. While there will be temporary loss of a small area of potential spawning habitat for Atlantic Salmon and Brook Lamprey, this will not be significant given the small working area and the large areas of alternative habitat available. No significant impact on these species will occur due to direct injury or mortality during construction.

### 7.4.2 White-clawed Crayfish

NPWS conservation objectives for the Blackwater River (Cork/Waterford) SAC (NPWS 2012) lists specific targets with respect to White-clawed Crayfish. Relevant targets relate to distribution, population structure: recruitment, negative indicator species, disease, water quality, habitat quality: heterogeneity.

The works will impact on the existing river substrate and existing weir and potentially on crayfish habitat. The use of geotextile and rock amour will alter the habitat within the works area and may result in the loss of refuges for White-clawed Crayfish. It is noted that White-clawed Crayfish are gradually colonising the River Blackwater and there is likely to be large areas of habitat which is available to this species. A trapping programme will be implemented to ensure that any Crayfish within this area are removed prior to the commencement of works. Where possible suitable crevices will be created within the rock amour structure to provide refuges for this species.

While there will be temporary loss of a small area of habitat for White-clawed Crayfish during construction works, this will not be significant given the small working area and the large areas of alternative habitat available. There will be no permanent loss of habitat loss for crayfish, and no significant impact on this species will occur. No significant impact on this species will occur due to direct injury or mortality during construction.

### 7.4.3 Freshwater Pearl Mussel

The habitats within the works area were disturbed by the previous works for the construction of the Fermoy Flood Relief Walls at this location. In absence of any active juvenile recruitment in the interim period the presence of Freshwater Pearl Mussel within this area is highly improbable and no Freshwater Pearl Mussel were recorded in this area during Freshwater Pearl Mussel surveys for the Fermoy Weir Remediation Project in 2020. There is known areas of active recruitment downstream of the works and the works will prevent significant deposition of fine material into the Blackwater River (Cork/Waterford) SAC. No significant impact on this species will occur due to direct injury or mortality during construction.

### 7.4.4 Otter

Otter activity in this general area is high and works will impact directly on two Otter couches. The existing weir face is a regularly used as a feeding and resting area for Otter. A holt was recorded within a heavily vegetated area on the southern banks of the River Blackwater **(Figure 10**). However, this is located approximately 300m from the works area, outside the proposed development site boundary, and will not be directly impacted by the proposed development. A derogation licence will be sought for weir remediation works as these will impact on two couching areas. A buffer zone of 150m will be maintained between the Otter holt and construction works (See **Figure 10**). It is noted that no piling works are proposed downstream of the bridge or in the vicinity of the Otter holt and therefore no vibration impacts are predicted to occur. While there will be a temporary loss of foraging habitat during weir remediation works, there will be no long-term loss of terrestrial or freshwater habitat and no permanent loss of couching sites or holts as result of the proposed development.

While there will be some disruption of Otter activity during the works period, given the regular use of the existing weir, Otter are likely to continue to use this area of the River Blackwater

and the reinstated weir. Therefore, the primary concern is disturbance from noise, light and disturbance during weir remediation works. It is noted Otter would have undergone disturbance and possible displacement during the Fermoy Flood Relief Scheme works but they readily used this area once works were complete. Otters and in particular Otters in urban areas, as evidenced by their presence in Irish cities, can habituate to increased noise and disturbance and are largely nocturnal. Most of the work will be carried out during daylight hours and there will be no significant barriers to Otter movement during site works. No significant impact on this species will occur due to direct injury or mortality during construction.

## 7.5 Impacts of Fish Migration and Spawning

### 7.5.1 Impacts of Fish Migration and Spawning during Construction

In-stream works can act as barriers to migration and can also lead to other impacts, such as increases in suspended solids, removal of pools and disturbance to individuals in the intra-gravel life stage. Anthropogenic barriers to migration are one of the most significant threats to the long-term viability of Atlantic Salmon populations in many river catchments (Hendry and Cragg-Hine, 2003) and, consequently, the function of the European network with regard to the conservation of this species. Such barriers can be either physical, e.g., weirs or bridge aprons, or chemical, e.g., pollution. The magnitude of effects can be highly dependent on timing.

Migration of fish species such as Sea and River Lamprey and Atlantic Salmon could potentially be impacted if the construction works created a barrier to migration. Delays to migration can make these species more susceptible to predation or poaching. The construction methods used within the River Blackwater will take into account the preservation of stream flows for movement of fish by ensuring a minimum depth of water will be maintained within the river. In order to maintain flows in the river throughout the remediation of the weir it is proposed to undertake these works in two sections, with majority of the work completed in the dry. This shall be carried out in the period July to mid-September, when river levels are at their lowest in accordance with the "*Guidelines on the Protection of Fisheries during Construction Works in or Adjacent to Waters"*, IFI,2016. The works will not prevent Atlantic Salmon from migrating upstream. Movement of Sea Lamprey and River Lamprey will not be affected as works will take place outside the migration period for these species

In addition, construction activities will be undertaken primarily during daylight hours only and will ensure that there is generally the potential for undisturbed passage at night, when main surges of migratory fish are more likely to occur. Given the limited nature of the works no increased risk of predation or poaching has been identified.

Given the distance to Twaite Shad populations which only occur downstream and given the estuarine conditions in which these species commonly occur, no impact on Shad migration patterns will occur during construction.

Overall based on the short-term nature of the works, the seasonal restrictions pertaining to the project and the implementation of detailed and site-specific mitigation measures, no significant barrier to fish migration or spawning is predicted to occur during construction works. Therefore, the proposed development will not result in significant impacts on migration or spawning for QI species within the Blackwater River (Cork/Waterford) SAC during the construction phase.

### 7.5.2 Impacts of Fish Migration and Spawning during Operation

The proposed fish bypass channel has been designed to provide passage for all fish species including Atlantic Salmon, lamprey species, Twaite Shad and White-clawed Crayfish. Royal HaskoningDHV (RHDHV) were commissioned to assist in confirmation of the proposed hydraulic design of a fish bypass channel around the weir. The scope of this assessment comprised a hydraulic design review of the bypass channel and remediated existing weir at Fermoy Bridge. To inform the hydraulic design review, a Computational Fluid Dynamics (CFD) model was required to determine if velocities within the fish bypass channel comply with the maximum speed requirements for a variety of fish species. Further details on the CFD modelling exercise and fish bypass channel assessment are included in the planning application (See Engineering Technical Report 19011-TJOC-PL-XX-PD-C-3709 Appendix D)).

**Table 14** and **Table 15** provide approximate values of swim speeds and minimum depths for key fish species which the fish bypass channel should accommodate for a range of flows. It should be noted, if information on fish migration and flow is not available for the site, then it is suggested that the facility for upstream migration should be designed to operate across a flow range from Q90 to Q10 for Salmon; Q95 to Q10 for Sea Trout and Brown Trout; Q50 to Q20 for coarse fish and shad; and Q99 to Q70 for eel. It should be noted, on the condition that the flow velocity remains significantly less than the maximum speed, fish can swim more or less at their cruising speed through a fish bypass channel.

**Table 14. Generic Swim Speeds of Key Fish Species and Migration Windows**

| Species | Mean Burst (Swim) Speed | Median Sustained Swim Speed | Maximum Swim Speed | Upstream Migration Window |
|---|---|---|---|---|
| Salmon | > 1.2 m/s | - | 4.5 - 6.5 m/s | October to May (Key Spawning Season, although peak months are October to November for Salmonids) |
| Sea / Brown Trout | 1 35 m/s | 1.17 m/s | 1.8 - 5 m/s | |
| European Eel | 1.14 m/s | 0.25 m/s | Young eel < 0.5 m/s | |
| | | | Adult eel <1.5 m/s | |
| Coarse Fish (based on Chub) | 1.3 m/s | 0.93 m/s | 4 m/s | April – July |
| Sea Lamprey | - | - | 5 m/s | |
| River Lamprey | - | - | 3.5 m/s | |
| Allis shad | - | - | 4.1 - 6.1 m/s | |
| Twaite Shad | 1.52 - 2.06 m/s | 0.44 – 0.59 m/s | 2.7 - 5.4 m/s | |
| | | | | |

Source: IFM/Environment Agency Fish Pass Manual (2015); The ICE Protocol for Ecological Continuity-Assessing the Passage of Concepts, Design and Application (2014); CSAS Fish Swimming Performance Database and Analyses (2016)

**Table 15. Generic Swim Depths of Key Fish Species**

| Species | Minimum Depths (m) |
|---|---|
| Salmon | 0.2 m |
| Sea / Brown Trout | 0.05 m – 0.1 m |
| European Eel | 0.2 m |
| Coarse Fish (based on Chub) | 0.05 m – 0.1 m |
| Sea Lamprey | 0.15 m |
| River Lamprey | |
| Allis shad | 0.2 m – 0.3 m |
| Twaite Shad | |

Source: The ICE Protocol for Ecological Continuity-Assessing the Passage of Concepts, Design and Application (2014)

To inform the hydraulic design review, a CFD model was used to determine if flow conditions within the fish bypass channel complied with the requirements for a variety of fish species.

An initial design option was tested in the CFD model, however results showed that the required velocity threshold was exceeded within most of the gaps/slots in the first (most upstream) fish bypass channel. To reduce velocities, a revised option was modelled which incorporated increasing the width of three of the gaps/slots and incorporating a flat "sill" in the bed immediately upstream of the first weir.

The revised option of the design was tested for the three flow conditions (Q95, 0.7AADF and 1.0AADF). Results showed that the velocities remain relatively high i.e., above the 2ms-1 threshold stated in DVWK guidance, within two of the five gaps at the first fish bypass channel. However, velocities in the other three gaps were tolerable for different fish species. The higher velocities in the two gaps can be reduced by introducing perturbation boulders upstream of the inlets of these gaps. The exact configuration and orientation of the boulders is best established *in-situ* when the channel has been constructed.

The design review completed by RHDHV includes the following comment in respect of energy dissipation.

*Volumetric power dissipations calculated for the 12 pools within the fish bypass channel are comfortably within the limits for all modelled flows. The IFM Fish Pass Manual recommends that as the number of pools increases, maximum values should be at the lower end of the acceptable range. Larinier (2002) notes that 200 W/m$^3$ is generally taken as the upper limit for volumetric dissipated power in salmon and Sea Trout fish passes. Higher Pv figures may be accepted if the fishway consists of a few pools only, or for very large fish facilities with discharge flows of more than several m$^3$/s. This publication also noted that lower levels are advisable (less than 150 W/m$^3$) for small fishways, and for fishways designed for shad and riverine species. The levels predicted at the proposed fish bypass channel in* ***[Table 16]*** *are*

*below the 150 W/m$^3$ which are advisable for even the slowest fish species i.e. Twaite Shad (Larinier 2002).*

**Table 16. Volumetric power dissipation calculations**

| Event | Max power dissipation W/m3 | Min power dissipation W/m3 |
|---|---|---|
| Q95 | 80 | 30 |
| 0.7AADF | 120 | 50 |
| 1.0AADF | 130 | 60 |

The CFD model results also show that there is no issue with exceeding the flow velocities threshold throughout the rest of the fish bypass channel, where velocities are well below 1ms-1 and therefore compliant with the fish swim speeds **(**Error! Reference source not found.) and volumetric dissipated power **(Table 16)**.

As noted above the design of the fish bypass channel ensures that flow velocities and turbulence around the weir are in compliance with all relevant guidelines. The design of the fish bypass channel mirrors natural river flow patterns and velocities and there are no areas in which fish may be slowed or trapped within the channel or at the entrance or exit. There will be no lighting of the fish bypass channel during operation. While some predation is likely to occur within the fish bypass channel, this will not be significantly higher than other sections of the main river channel. No impact from increased predation within or around the fish bypass channel is predicted to occur.

Based on a review of the information provided and a CFD modelling exercise, the proposed fish bypass channel design at Fermoy will provide suitable hydraulic conditions for passage for all qualifying fish and invertebrate species. Therefore, the impact on fish passage during the operational stage will be positive, significant and long-term.

### *Operational Monitoring of Fish Passage*

The *Fermoy Fish Pass Hydraulic Design Revie*w (RHDHV 2021) noted the following:

*It should be noted that the DVWK guidance suggests that the characteristics of irregular rough-channel pool passes cannot be calculated accurately and that a degree of testing and modification should be allowed for during the construction phase. Post construction monitoring of the efficacy of the fish pass for the various target species is also recommended, particularly for shad.*

Following these recommendations, Trex Ecology were commissioned to carry out the following:

1. A high-level review of the provided documentation describing passage conditions for all relevant receptors within the Blackwater River (Cork/Waterford) SAC site designation.

2. Identification of suitable post operational monitoring approaches to determine the efficacy of the bypass channel for fish migration, focused on the relevant receptors from the Blackwater River (Cork/Waterford) SAC.

3. A technical note detailing the findings and conclusions from the above tasks.

Full details of this report have been included with the planning application (See Engineering Technical Report 19011-TJOC-PL-XX-PD-C-3709 Appendix C). The conclusions of the Trex report are outlined below and the report is attached as (See **Appendix 7).**

### *Overall*

- Due to factors such as river size, range of target species, cost and effectiveness, no monitoring approach can be proposed to fully quantify fish passage.
- Monitoring approaches are proposed therefore to verify hydraulic performance of the pass, and to monitor the relative abundance and distribution of fish communities within the River Blackwater following fish pass construction.

### *Fish pass design*

- The fish pass is a large structure with an associated high volume of total flow; however, it does not meet the 50% requirement proposed by IFI at 1 AADF. Nonetheless concentration of 43% of flow (at that flow level) within a much smaller relative area is likely to allow fish to easily find the entrance.
- Flow velocity at the exit breaches the 2m/s velocity at certain points, although does not seem to breach the burst swimming capabilities of many fish. These points should be monitored post construction at safe flows.
- Some post construction adjustment may be necessary.

### *Monitoring*

- On the grounds of cost and effectiveness direct monitoring (i.e., electrofishing surveys) and counters have been ruled out.
- eDNA methods have been proposed as the most effective solution give catchment location of the fish pass, the range of target fish with distinct life history traits and behaviours, and catchment size.
- A metabarcode all-species approach is proposed, although at a minimum shad and lamprey spp. should be included.
- A baseline should be established, with post operational monitoring to extend to ten years.
- An opportunity to include Freshwater Pearl Mussel (FPM) within the eDNA monitoring programme exists.

Based on the results of the CFD model, it is concluded that the proposed design does perform hydraulicly as intended, although compliance with fish regulations needs to be considered in greater detail to address the velocities within some sections of the bypass channel exceeding threshold set by the DVWK guidance. It is noted that this relates to two/three inlet slots at the uppermost weir and can be resolved by introducing perturbation boulder upstream of these slots. Some additional measure could be implemented to improve the design, e.g. perturbance

boulders could be added to disrupt the flow and slow velocities in the upper pools in front of gaps at the fish pass weir where the velocities are the highest. Further comments on the design review and recommendations are discussed in the main Fermoy Fish Pass – Hydraulic Design Review Technical Note (**Appendix 6**). It is noted monitoring of the efficiency of the fish bypass channel will be carried out during operation, through flow monitoring and operational monitoring of fish passage (See **Section 8.16**).

Therefore, operation of the proposed development will not impact the integrity of the Blackwater River (Cork/Waterford) SAC.

### 7.5.3 Spawning

Suspended sediment can settle on spawning areas, infill the intragravel voids and smother the eggs and alevins (newly hatched fish) in the gravel. There is suitable Salmon spawning and nursery habitat and lamprey spawning habitat within the study area. The egg and juvenile stages of the Salmon and lamprey life cycles are very vulnerable to deteriorations in water quality. It is noted that works will be complete before Salmon and lamprey spawning occurs.

Salmon spawn from November to January. River Lamprey spawn from April to May, Brook Lamprey spawn March to May and Sea Lamprey from June to mid-July. Sea Lamprey are known to spawn in this area (*Habitats Directive Assessment Report Removal of Gravel Islands from Blackwater River at Fermoy,* Sweeney Consultancy 2010 - Alan Cullagh, Inland Fisheries Ireland, *pers comm.*). The works will not take place during the spawning season for Salmon, River Lamprey and Brook Lamprey but will overlap slightly with the Sea Lamprey spawning season. There are historical records of Sea Lamprey spawning downstream of Fermoy Weir (Area D) and there is the potential for temporary impact on Sea Lamprey spawning in the absence of mitigation. However, no Sea Lamprey spawning areas were recorded during site surveys. Shad spawn between early April and the end of June and given the distance to Twaite Shad populations which only occur downstream and given the estuarine conditions in which these species commonly occur, no impact on Shad spawning will occur in the vicinity of the proposed development site.

## 7.6 Impacts on the hydrological regime during operation

CFD modelling was undertaken to validate hydraulic performance of the proposed design of the fish bypass channel at Fermoy, including remedial works to the existing Fermoy weir structure across the River Blackwater. The modelling was undertaken for three different flow conditions to assess velocities through the fish pass against maximum tolerable velocity for various fish species set out in the DVWK guidance for '*Fish Passes, Design, Dimensions and Monitoring'*. Full details on this CFD modelling and fish pass assessment are included in **Appendix 6**.

Design of the fish pass comprised a bypass channel with a series of 13 weirs, each with 5 staggered gaps to enable fish to swim up the channel. The weirs were spaced by set distance and each consecutive weir dropped in crest level. Such cascading design is favourable as it allows fish to swim up through the gaps and then rest within the pools in between the weirs.

The initial design option was tested in the CFD model, however results showed that the velocity threshold was exceeded within most of the gaps at the first (most upstream) fish pass weir. As such some amendments to the design were introduced to help alleviate the high

velocities. For that purpose, three out the five gaps in the first weir were widened and also a flat 'sill' immediately upstream of the first weir added to dissipate some of the velocity before entering the first fish pass weir.

The revised option of the design was tested for the three flow conditions. Results showed that the velocities remain relatively high, i.e., above the 2m/s threshold within two of the five gaps at the first fish pass weir. However, that is limited to the two gaps only giving 3 other gaps with tolerable velocities for different fish species. Furthermore, the results show that there is no issue with exceeding the flow velocities threshold throughout the rest of the fish pass, where velocities are well below 1m/s. It is noted that the higher velocities in the two gaps can be reduced by introducing perturbation boulders upstream of the inlets of these gaps. The exact configuration and orientation of the boulders is best established in-situ when the channel has been constructed.

The CFD model also shows that velocities around the Fermoy Bridge piers are well below 0.5m/s with small sections with velocities up to 0.9m/s. However, such velocities are not caused by the flow through the fish pass but rather over the Fermoy weir. Velocities within the fish pass at the downstream end are relatively low, i.e. less than 1m/s. The presence of the weir does not show any adverse effect on scour around the bridge piers and therefore the re-constructed structure would also not impact the safety of the bridge. The results of the flood risk assessment have concluded that there will be no increase in flood risk or increase in water levels alongside the flood defences (See 19011-TJOC-PL-XX-PD-C-3708_Flood_Risk_Assessment).

Based on the results of the CFD model, it is concluded that the proposed design does perform hydraulicly as intended, although compliance with fish regulations needs to be considered in greater detail to address the velocities within some sections of the bypass channel exceeding threshold set by the DVWK guidance. Additional measure will be implemented to enhance operational reliability, e.g., perturbance boulders will be added to disrupt the flow and slow velocities in the upper pools in front of the gaps at the fish pass inlet weir where the velocities are the highest. Further comments on the design review and recommendations are discussed in the Fermoy Fish Pass – Hydraulic Design Review Technical Note (Doc Ref. BI1645-RHD-ZZ-XX-NT-Z-0002) included in **Appendix 6** of this NIS.

It is noted monitoring of the efficiency of the fish bypass channel will be carried out during operation, through flow monitoring and operational monitoring of fish passage (See **Section 8.16**).

### 7.7 Impacts from increased risk of predation

Delayed passage through this section of the River Blackwater could cause an accumulation of fish immediately upstream and/or downstream the fish bypass channel. This delay could result in elevated predation pressure, increased susceptibility to disease, increase energy expenditure and reduce reproduction capacity (Scruton *et al.* 2008, Osbourne 1961, Geen 1975). Fish bypass channels are a strategy for conserving biodiversity, as they can provide connectivity between fragmented habitats and reduce predation on shoals that accumulate immediately below dams. However, changes in water velocity and flow immediately upstream and downstream of the proposed fish bypass channel could slow fish passage and leave them susceptible to predation from predators such as Grey Heron *Ardea cinerea*, Otter, Mink

*Neovison vison* or Cormorant *Phalacrocorax carbo*. Agostinho *et al.* (2012) found that fish passes attract multiple predator groups with differing predation strategies.

As noted in **Section 7.5** and **Section 7.6** the design of the fish pass ensures that flow velocities and turbulence around the weir are in compliance with all relevant guidelines. The design of the fish bypass channel mirrors natural river flow patterns and velocities and there are no areas in which fish may be slowed or trapped within the channel or at the entrance or exit. This design will also ensure there are no significant changes to water temperature within the fish bypass channel. While some predation is likely to occur within the fish bypass channel, this will not be significantly higher than other sections of the main river channel. No impact from increased predation within or around the fish bypass channel is predicted to occur. Therefore, operation of the proposed development will not impact the integrity of the Blackwater River (Cork/Waterford) SAC due to an increased predation risk on QI species.

### 7.8 Impacts from increased lighting of fish pass

During the construction phase, instream works could potentially create a barrier for migrating fish, including QI species. Other effective barriers to fish migration may arise from acoustic impacts or artificial lighting/shade. Artificial lighting at night has the potential to disrupt and disorientate fish and increase exposures to predation.

Construction works will be confined to normal working hours. However where lighting is required, this will avoid direct illumination of the river where possible and lights will be cowled where necessary to minimise light spill onto associated aquatic habitats outside the works area. As part of the landscape plan, a riparian enhancement area has been included along the northern and southern banks of the fish bypass channel. This will prevent light spillage from existing public lighting onto the bypass channel.

Existing lighting on Fermoy Bridge will not be altered/changed. The fish bypass channel will be located further from the bridge and associated lighting than the existing fish ladder and the recent breach in the weir. No significant impact from construction and operational lighting is predicted to occur.

### 7.9 Spread of Invasive Species and Biosecurity Risks

There is potential during the construction phase of the proposed works for invasive species to be spread within the Blackwater River (Cork/Waterford) SAC, thus impacting negatively on terrestrial habitats.

Himalayan Balsam were recorded growing within and in close proximity to the proposed development site. Under the right ecological conditions this may have an impact native species or habitats. Theoretically, the spread of invasive species could impact on the conservation objectives of the Blackwater River (Cork/Waterford) SAC. A range of standard mitigation measures have been outlined in **Section 8.12** of this report to prevent the spread of invasive species during construction works. These measures include all relevant provisions for site hygiene and appropriate disposal of contaminated soil and subsoil. Overall, no impact on the qualifying interests and conservation objectives for the Blackwater River (Cork/Waterford) SAC from the spread of invasive species is predicted to occur.

Crayfish plague is listed as one of Ireland's most invasive species by Invasive Species Ireland. This species is listed by DAISIE as among 100 of the worst invasive species in Europe. All non-native crayfish, which may be carriers of the crayfish plague, are listed on the Third Schedule Part 2 of the European Communities (Birds and Natural Habitats) Regulations 2011 in Ireland. Crayfish occur within the Blackwater system and establishment of the disease crayfish plague can have highly detrimental impacts on this species. Throughout its European range, this species has been decimated by the impact of Crayfish plague disease which spread to Europe with the introduction of the plague carrier North American species of crayfish. Biosecurity protocols, as outlined in **Section 8.15** will be strictly enforced. Construction plant used for instream works could potentially spread Crayfish Plague within the River Blackwater. A Biosecurity Management Plan which will be prepared by the contractor and approved by the supervising ecologist prior to the commencement of site works. The Biosecurity Management Plan will take into account up do date information with respect to biosecurity risks. Biosecurity protocols will be strictly enforced as the risks associated with non-compliance are high. Protocols will follow Irish Waters Standard Operation Procedures and guidance. These measures will ensure that construction works do not spread Crayfish plague within the River Blackwater.

Overall, the implementation of standard mitigation measures will ensure there is no effect on the qualifying interests and conservation objectives and integrity of the Blackwater River (Cork/Waterford) SAC from biosecurity or the spread of invasive plant species.

## 7.8 In-combination Impacts

In-combination effects refer to a series of individually impacts that may, in combination, produce a significant impact. The underlying intention of this in combination provision is to take account of cumulative impacts from existing or proposed plans and projects and these will often only occur over time. The proposed works could theoretically create a cumulative impact. Other developments relevant to the proposed development and potential cumulative effects are listed in **Table 17**.

**Table 17. Other developments near site and potential cumulative impacts**

| Plans and Projects | Key Policies/Issues/Objectives Directly Related to the Conservation of the European Network | |
|---|---|---|
| River Basin Management Plan 2018-2021<br><br>(Noted that the Draft River Basin Management Plan for Ireland 2022-2027 is currently at public consultation stage) | The project should comply with the environmental objectives of the Irish RBMP which are to be achieved generally by 2021.<br><br>Ensure full compliance with relevant EU legislation<br><br>Prevent deterioration<br><br>Meeting the objectives for designated protected areas<br><br>Protect high status waters<br><br>Implement targeted actions and pilot schemes in focus sub-catchments aimed at: targeting water bodies close to meeting their objective and | The implementation and compliance with key environmental policies, issues and objectives of this management plan will result in positive in-combination effects to European sites. The implementation of this plan will have a positive impact for the biodiversity. It will not contribute to in-combination or cumulative impacts with the proposed development. |

| Plans and Projects | Key Policies/Issues/Objectives Directly Related to the Conservation of the European Network | |
|---|---|---|
| | addressing more complex issues which will build knowledge for the third cycle. | |
| Inland Fisheries Ireland Corporate Plan 2021-2025<br><br>The Inland Fisheries Act 2010. | To ensure that Ireland's fish populations are managed and protected to ensure their conservation status remains favourable. That they provide a basis for a sustainable world class recreational angling product, and those pristine aquatic habitats are also enjoyed for other recreational uses.<br><br>To develop and improve fish habitats and ensure that the conditions required for fish populations to thrive are sustained and protected.<br><br>To grow the number of anglers and ensure the needs of IFI's other key stakeholders are being met in a sustainable conservation focused manner.<br><br>EU (Quality of Salmonid Waters) Regulations 1988. All works during development and operation of the project must aim to conserve fish and other species of fauna and flora habitat; biodiversity of inland fisheries and ecosystems and protect spawning Salmon and trout. | The implementation and compliance with key environmental issues and objectives of this corporate plan will result in positive on-combination effects to European sites. The implementation of this corporate plan will have a positive impact for biodiversity of inland fisheries and ecosystems. It will not contribute to in-combination or cumulative impacts with the proposed works. |
| Irish Water Capital Investment Plan 2020-2024 | Proposals to upgrade and secure water services and water treatment services countrywide. | Likely net positive impact due to water conservation and more effective treatment of water. |
| Water Services Strategic Plan (WSSP, 2015) | Irish Water has prepared a Water Services Strategic Plan (WSSP, 2015), under Section 33 of the Water Service No. 2 Act of 2013 to address the delivery of strategic objectives which will contribute towards improved water quality and biodiversity requirements through reducing:<br><br>Habitat loss and disturbance from new / upgraded infrastructure;<br><br>Species disturbance;<br><br>Changes to water quality or quantity; and<br><br>Nutrient enrichment /eutrophication. | The WSSP forms the highest tier of asset management plans (Tier 1) which Irish Water prepare and it sets the overarching framework for subsequent detailed implementation plans (Tier 2) and water services projects (Tier 3). The WSSP sets out the challenges we face as a country in relation to the provision of water services and identifies strategic national priorities. It includes Irish Water's short, medium and long-term objectives and identifies strategies to achieve these objectives. As such, the plan provides the context for subsequent detailed implementation plans (Tier 2) which will document the approach to be used for key water service areas such as water resource management, wastewater compliance and sludge |

| Plans and Projects | Key Policies/Issues/Objectives Directly Related to the Conservation of the European Network | |
|---|---|---|
| | | management. The WSSP also sets out the strategic objectives against which the Irish Water Capital Investment Programme is developed. The current version of the CAP outlines the proposals for capital expenditure in terms of upgrades and new builds within the Irish Water owned assets.<br><br>The overarching strategy was subject to AA and highlighted the need for additional plan/project environmental assessments to be carried out at the tier 2 and tier 3 level. Therefore, no likely significant in-combination effects are envisaged. |
| WWTP discharges | Ballyclough, Ballydesmond, Ballyduff WWTP, Ballyhooley, Banteer WWTP, Boherbue WWTP, Bweeng, Castlemagner, Cecilstown, Clondulane, Cullen, Dromahane WWTP, Fermoy WWTP, Freemount, Kanturk WWTP, Kilbrin, Killavullen WWTP, Kilworth, Kiskeam, Knocknagree, Lismore WWTP, Lombardstown, Mallow WWTP, Meelin, Millstreet WWTP, Nad, Newmarket, Rathcool, Rathmore WWTP | Discharges from municipal WWTPs are required to meet water quality standards. Irish Water Capital Investment Plan 2014-2016 and 2017 – 2021 proposes to upgrade water treatment services countrywide. The long-term cumulative impact is predicted to be negligible. |
| IPPC Programme | There are six IPPC Licence holders discharging directly to the Blackwater River (Cork/Waterford) SAC i.e. Dairygold, Micam, Road Binders, ALPS Electric Ireland, Newmarket Creameries Co-op, Micro-Bio Limited. | Discharges from these facilities are governed by strict limits to to ensure compliance with quality standards. The long-term cumulative impact is predicted to be negligible. |
| Quarries | Twelve registered quarries occur on the River Blackwater (NS2, 2010). | Extractive site that discharges process water into a watercourse requires a discharge licence under Section 4 of the Local Government (Water Pollution) Act 1977. Uncontrolled discharges of polluting matter to such media are an offence under the Act's Section 3. The long-term cumulative impact is predicted to be negligible |
| Applications under consideration | The Fermoy Local Area Plan had outlined that within the Fermoy Municipal District the County Development Plan provides for growth in population of 4,678 persons. The number of households is expected to grow by 4,381 leading to a net requirement for 4,874 new houses within | Future developments will only be granted permission where discharges from same meet with relevant water quality standards. The long-term cumulative impact is predicted to be negligible. |

| Plans and Projects | Key Policies/Issues/Objectives Directly Related to the Conservation of the European Network | |
|---|---|---|
| | the Municipal District. The County Development Plan indicates that 149ha of land are required to meet this level of housing provision in the main towns, in addition to housing opportunities in the villages and rural areas. Therefore, there is likely to be significant housing development in the area is the short to medium term.<br><br>Fermoy's location on the M8 corridor means it is well positioned to attract employment investment and is well suited to distribution type uses. This plan makes provision of a strong supply of employment land, with good access to the M8, within the town, zoning approximately 61 hectares of land for employment uses. Land has been zoned for business use to the north of the town, while to the south of the town lands are available for industrial use. Land is also zoned to the east of the M8 to facilitate expansion of an existing enterprise. | |
| Barriers to migration along River Blackwater | Clondulane Weir is located approximately 5km downstream of Fermoy Weir.<br><br>An application for the removal of a 50m section of Clondulane Weir was submitted to CCC(Ref 194958). Assessment reports are currently being prepared for a new application to decommission part of the weir. | Both Fermoy Weir and Clondulane Weir have been identified as barriers to movement for QI species within the Blackwater River (Cork/Waterford) SAC.<br><br>During operation the proposed development will allow free passage of fish through this area of the River Blackwater. Both Fermoy Weir and Clondulane Weir (located approximately 5km downstream of Fermoy Weir), have been identified as barriers to fish passage along the River Blackwater (AMBER barrier database, accessed 10/04/22). Clondulane Weir is a significant barrier to free movement of fish through the River Blackwater and its removal will improve fish passage. An application for the removal of a 50m section of Clondulane Weir was submitted to Cork County Council (Ref 194958). It is an assumption that this barrier will be removed in the near future and there is currently a High Court removal order on Clondulane Weir.<br><br>The removal of the Clondulane Weir is likely to have net positive impact on the conservation interests of the |

| Plans and Projects | Key Policies/Issues/Objectives Directly Related to the Conservation of the European Network | |
|---|---|---|
| | | Blackwater River (Cork/Waterford) SAC |

The proposed development could theoretically have in-combination impacts on water quality during construction. Impacts from noise and disturbance during construction and operation could also arise. A range of mitigation measures will be implemented during construction to effectively prevent impacts on water quality during construction. These include detailed methodologies for all works. Seasonal restrictions in line with IFI recommendations will ensure that works will not occur during key spawning or fish migration periods. These measures are standard and no impediments to their effective implementation has been identified. The measures to be implemented will effectively prevent any significant discharges of hydrocarbons or excess levels of silt from the individual elements of the project thus ensuring that no cumulative impacts will occur.

The works will be located in proximity to the town of Fermoy and thus background levels of noise and disturbance will be relatively high. Whilst works could potentially disrupt feeding patterns, given the short-term nature of the disturbance, the often-nocturnal habits of Otter and the ability of Otter to move away from disturbance, no significant impact on Otter is predicted to occur and thus no cumulative impact on this species from disturbance has been identified.

In the absence of any significant potential impacts on the on the qualifying interests and conservation interests for the Blackwater River (Cork/Waterford) SAC and in the absence of significant impacts on its overall integrity, no potential cumulative impact from the proposed works has been identified.

# 8. Mitigation Measures

There are a number of measures that have been built into the project at the design stage to ensure that the impacts of the proposed development on internationally, nationally and locally important habitats and wildlife are minimised during construction and operation.

These measures include:

- Fish bypass channel has been designed to allow free passage of all fish species through Fermoy Weir. This design was independently reviewed
- Fish bypass channel has been designed to maintain natural hydrological flows within the main channel of the River Blackwater
- Risk of predation for fish using the channel has been minimised through maintenance of natural hydrological conditions, absence of lighting during operational phase and landscaping plan to prevent light spillage onto the channel (from existing lights)
- Weir remediations works have been designed to avoid direct removal and/or damage to aquatic habitats

- The sequence of construction works has been designed to allow the preservation of stream flows for movement of fish by ensuring a minimum depth of water shall be maintained within the River Blackwater throughout the construction works (See **Section 5.3**). Stage 1 works on the north bank of the river will proceed as an offline construction. The tie ins from the fish bypass channel to the river will be completed after the Stage 2 works (remediation the weir upstream of Fermoy Bridge) are complete. Stage 3 works (remediation of the weir downstream of the bridge) shall not commence prior to the completion of Stage 2 (weir remediation works upstream of the bridge) and the completion of the fish bypass channel tie ins to the River Blackwater. The sequence of works will be agreed with IFI and in compliance with the CEMP.

- Fish bypass channel location will avoid any direct impacts on terrestrial qualifying habitats for the Blackwater River (Cork/Waterford) SAC

- Planting of native trees has specified used in the landscape plan

- Regrading of soil around the fish bypass channel works areas will blend into existing grass open space.

## 8.1 Construction phase mitigation measures

The mitigation measures have been drawn up in line with current best practice and include an avoidance of sensitive habitats at the design stage. It is clear that the mitigation measures are designed to achieve a lowering or reducing of the risk of impact to acceptable levels. The likely success of the proposed mitigation measures is high. The risk that the mitigation measures will not function effectively in preventing significant ecological impacts is low.

The mitigation measures to be implemented are based on proven technology and techniques which have been agreed with the relevant experts (IFI). Works will be monitored by an Ecological Clerk of Works (ECoW) to ensure they are effectively implemented. The ECoW will have at least 10 years' experience as a senior ecologist and will have expertise in freshwater ecology and Otter ecology.

A detailed Construction Stage Environmental Management Plan (CSEMP) will be developed by the appointed Contractors. A draft outline Construction Management Plan (OCMP) and parent Construction Environmental Management Plan (CEMP) has been prepared which respectively details the construction sequence and all of the construction mitigation measures, which are set out in this NIS report. The principal mitigation measures are detailed below and are set out in the CEMP.

The CSEMP, OCMP and parent CEMP take account of CIRIA Guidelines *C532 Control of Pollution from Construction Sites* in its preparation and the execution plan shall be prepared in full compliance with these guidelines. These documents also takes account of CIRIA 2010 (Third Edition C692) *Environmental Good Practice on Sites CIRIA UK.*

The works contractor(s) will be required to designate an Environmental Manager for the project whose duty it will be to identify and monitor all potential environmental impacts. They will be required to monitor and maintain registers for noise and dust impacts and shall be responsible for the integrity of the surrounding lands and their protection from potential impacts of the construction operations. Their responsibilities will include adherence to CIRIA Guide 532.

All individual elements of work shall be covered by full method statements which shall be submitted to IFI and NPWS well in advance of any works proceeding and approved prior to execution.

Construction best practice measures (of relevance in respect of any potential ecological impacts) will be implemented throughout the project, including the preparation and implementation of detailed method statements. The works will incorporate the relevant elements of the guidelines outlined below:

- NRA (2010) *Guidelines for the Management of Noxious Weeds and Non- Native Invasive Plant Species on National Roads. National Roads Authority, Dublin*.
- *IW-AMP-SOP-009 Information and Guidance Document on Japanese Knotweed*
- *Asset Strategy and Sustainability and Invasive Species Ireland Best Practice Management Guidelines for Himalayan Balsam*
- IFI (2016) *Guidelines on protection of fisheries during construction Works in and adjacent to waters (IFI, 2016)*
- H. Masters-Williams *et al.* (2001) *Control of water pollution from construction sites. Guidance for consultants and contractors (C532). CIRIA.*
- E. Murnane, A. Heap and A. Swain. (2006) *Control of water pollution from linear construction projects. Technical guidance (C648). CIRIA.*
- E. Murnane et al., (2006) *Control of water pollution from linear construction projects. Site guide (C649). CIRIA.*

The site shall be fully secured at all times and a full health and Safety Management Plan shall be put in place in accordance with current HSA Health and Safety (Construction) Regulations. A site traffic management plan will be submitted for approval prior to commencement.

All personnel involved with the project will receive an on-site induction relating to operations and the environmentally sensitive nature of the Blackwater River (Cork/Waterford) SAC and to re-emphasize the precautions that are required as well as the precautionary measures to be implemented. All staff and subcontractors have the responsibility to:

- Work to agreed plans, methods and procedures to eliminate and minimise environmental impacts,
- Understand the importance of avoiding pollution on-site, including noise and dust, and how to respond in the event of an incident to avoid or limit environmental impact;
- Respond in the event of an incident to avoid or limit environmental impact;
- Report all incidents immediately to their line manager;
- Monitor the workplace for potential environmental risks and alert the immediate line manager if any are observed; and
- Co-operate as required, with site inspections.

## 8.2 Protection of Water Quality

The employment of good construction management practices will minimise the risk of pollution of soil, storm water run-off, seawater or groundwater. The Construction Industry Research and Information Association (CIRIA) in the UK has issued a guidance note on the control and management of water pollution from construction sites, *Control of Water Pollution from Construction Sites, guidance for consultants and contractors* (Masters-Williams et al 2001).

### 8.2.1 Hydrocarbons and Waste Management

- A construction and demolition waste management plan will be developed by the main contractor prior to construction works commencing on site. The Plan will meet the requirements of the DoEHLG *Best Practice Guidelines on the Preparation of Waste Management Plans for Construction & Demolition Projects*.
- Oil, petrol and other fuel containers will be double-skinned and bunded to be able to contain 110% volume to guard against potential accidental spills or leakages entering local watercourses linked to the European sites. Bund specification will conform to the current best practice for oil storage such as Enterprise Irelands Best Practice Guidelines. Construction materials will be stored in a secure compound to prevent the potential for vandalism and theft of material.
- Dedicated fuel storage areas will be introduced on-site which shall be a minimum of 50m from watercourses or drains or, alternatively, fuelling will take place offsite (Drawing 19011-TJOC- PL-XX-DR-C-0085 (see **Figure 4)**.
- All vehicles and plant will be regularly inspected for fuel, oil and hydraulic fluid leaks. Suitable equipment, including spill kits, will be maintained on site to deal with spills.
- It will be ensured that all staff are trained and follow vehicle cleaning procedures. Details of the procedures in the work area will be displayed for easy reference. Use of cleaning chemicals will be minimised.
- Machinery including hand-tools will never be washed in watercourses or drainage ditches or within 50m of same. The location for any washing of machinery will be agreed with the ECoW prior to the commencement of works.
- It will be ensured that all areas where liquids are stored or cleaning is carried out are in a designated impermeable area that is isolated from the surrounding area, e.g., by a roll-over bund, raised kerb, ramps or stepped access.
- Concrete will be poured for the toe and heel protection to the embankment section of the weir and for the core and apron at the mill race weir wall. These activities will be carried out behind sheet piles barriers/ with river flows diverted away.
- It is proposed to inject natural cement (also referred to as Prompt) into the fill sections and place mass concrete in the core of the new section of the weir.
- Concrete pouring will not take place during heavy rain when run off is likely due to excess water. Shuttering will be designed to accommodate small increases in the volume of material contained within the shuttered area due to rainfall. Pre-cast

concrete will be used if possible. Otherwise all cast-in-place concrete shall be isolated from flowing water for a minimum of 48 hours to allow pH to reach neutral levels.

- Wash down and washout of concrete transporting vehicles will not be permitted at the location of construction. Such wash down and washout activities will take place at an appropriate facility offsite or at the location where concrete was sourced.

- A detailed spillage procedure will be put in place and all site personnel will be trained with respect to the relevant procedures to be undertaken in the event of the release of any sediment, hydrocarbons into a watercourse. Spill kits will be maintained on site and relevant staff will be trained in their effective usage. All site personnel will be trained and aware of the appropriate action in the event of an emergency, such as the spillage of potentially polluting substances. In the event of spillage of any polluting substance and/or pollution of a watercourse, CCC, IFI Ireland and the NPWS shall be notified.

- All wastes generated as part of the construction process will be controlled and managed to ensure environmental protection. All site wastes (hazardous and non-hazardous) will be stored in designated areas and taken off-site regularly to prevent large quantities accumulating. Careful ordering of materials will be undertaken to minimise quantities present on-site.

- Wastes which cannot be recycled will be removed from site by a licensed waste contractor to an appropriate licensed landfill facility ensuring adherence to the Environmental Protection (Duty of Care) Regulations 1991.

- Segregated waste for recycling will be removed from site to an appropriate Materials Recycling Facility for reprocessing.

- Where feasible, soil excavation will be completed during dry periods and undertaken with excavators and dump trucks. Topsoil and subsoil will not be mixed together. Topsoil will be stripped in advance of the works but the duration that the works area is left without topsoil cover will be minimised. Silt fences shall be erected where necessary.

- Stockpiles will be graded to a <1:4 profile. Topsoil and subsoils will be stored separately. Stockpiles of mineral soils and peat will be <2m and <1m respectively. Stockpiles will be covered with plastic sheeting during wet weather to prevent run-off of silt and will be located on flat ground where possible. Excavated material will be used for backfill where possible. Surplus material will be removed from site.

- Stockpiles will be a minimum of 10m from the main Blackwater Channel and will be separated from sensitive aquatic receptors by silt fences (Drawing 19011-TJOC- PL-XX-DR-C-0085 (see **Figure 4**)).

- A dedicated holding tank for storage of construction foul effluent will be constructed prior to commencement of the main construction activities. The effluent will be regularly disposed of off-site by tanker by a licensed contractor to an approved licensed facility.

### 8.2.2 Silt Control

Any pumping from the works area will discharge to a green vegetated area set back from the riverbank to allow for settlement and capture of suspended solids or via silt mitigation measures as specified in the Inland Fisheries Ireland "*Guidelines on Protection of Fisheries During Construction Works In and Adjacent to Water*" (IFI, 2016). Such settlements include lagoon systems and silt tanks discharging through silt socks. These systems will be incorporated into a detailed Water Management System (WMS) which will be prepared by the contractor. This will incorporate the mitigation measures specified by this and other planning documentation and any conditions of planning. The WMS will be drawn up in consultation with the ECoW and will be take into account any changes in river flows or ground conditions which may have occurred subsequent to the submission of this application. The WMS will provide detailed designs for each stage of development and will detail how surface water management will be carried out. The WMS will include the following provisions:

- The design of the WMS will take due consideration of the requirements given in the document "*Control of water pollution from Construction Sites – Guidance for consultants and contractors (Ciria C532*)".
- The WMS shall be contained within the development's site redline boundary.
- Detailed methodologies for the construction of silt management systems (e.g. settlement lagoon, greenfield areas, silt traps, cofferdams, settlement tanks and detailed procedures for pumping water from excavations and from within dammed areas to the relevant silt management systems) will be specified in the WMS.
- Dewatering pumps within excavations will have appropriate capacity to pump out the residual seepage from excavations to maintain the works area excavation dry. The pumps shall be integrated sumps or shall sit on an appropriately sized drip tray which is monitored and emptied regularly. Where required, submersible pumps shall be deployed.
- Pumped flows may contain high levels of silt and there may be possible contamination by hydrocarbons and cement. Thus, these pumped flows must be adequately treated by the WMS prior to discharge to the River Blackwater or other receiving water.
- Detailed contingency plans will be specified to deal with flood events and to manage or remove elements of the development and WMS (i.e., silt fences etc.) which could impact on water quality within the River Blackwater in the event of a severe flood event.
- A detailed water quality monitoring programme will be implemented (See **Section 8.5**).
- All elements of the WMS will be managed and maintained in line with the provisions of a detailed maintenance programme.
- Silt fences will be provided where required between site works and sensitive aquatic receptors. The function of silt fences is to intercept and capture sediment and reduce run-off velocity and erosive. Fences may be single, double or staggered depending on ground conditions. The silt fence layout will allow for vehicles or other equipment to pass and to facilitate maintenance. Silt fences will be in place for each section of works

prior to the commencement and must be securely supported with wooden posts. The silt fences will be examined and certified as fit for purpose by the ECoW prior to the commencement of works.

- The WMS will detail emergency procedures to be put in place in the event of fuel spillages.
- Identification of greenfield areas within the redline boundary to which surface water can be discharged. The WMS will ensure that there is sufficient greenfield area available for each section of works and/or will specify alternative means of surface water management.
- To minimise the potential for elevated silt levels in surface water run-off, the working area used during construction will be clearly outlined prior to the commencement of works and will be kept to the minimum area necessary to effectively complete the works.
- Works will be suspended during severe flood events or when such events are forecast. This makes all activities and measures easier to implement and manage and limits the potential for generation of sediment and mobilisation of both sediment and pollutants downstream.
- Works will be carried out in the dry. Temporary measures, including wheel washing facilities and road sweeping, will be provided for the duration of the works in this site to ensure that silt contaminated material is not carried onto the site access tracks or carried into the surface water drainage system. Construction runoff from the works area will be directed through a settlement system prior to discharge.

A site compound will be required for the duration of the works for the storage of materials, plant and equipment, and for a site office(s). It is envisaged that the location of the site compound will be to the west of the proposed Bypass channel (Drawing 19011-TJOC- PL-XX-DR-C-0085 (see **Figure 4**)). Access to the works on the north bank of the river will require the temporary removal of a section of the railing at the entrance to the triangle (Circus) field. The compound area is identified as being adjacent to the Stage 1 and Stage 2 works areas. A satellite compound/ storage area for the site may be provided for the stage 3 works in the Mill Island carpark with a construction access from there leading to the Stage 3 works area which is located alongside O'Neill Crowley Quay. The Mill Island carpark is in the ownership of the applicant, CCC.

The works will be undertaken within flood defence walls and embankments which comprise the Munster Blackwater Fermoy Drainage Scheme. Therefore, site offices located on a compound within the site on the north bank of the river could be at risk of flooding and would be inaccessible when the flood defence demountable barriers are erected. Therefore, site offices and welfare facilities will be located above the 1% AEP flood level at this location, based on the OPW's flood maps of the area.

### 8.3 Fish pass works mitigation (within flood plain)

The fish bypass channel is located adjacent to the River Blackwater and within the flood plain.

Because the catchment area of the River Backwater upstream of Fermoy Bridge is approx. 1750km$^2$ with an average flow of 22.284m$^3$/s, the risk of flooding of the works must be considered. Therefore, the Contractor undertaking the works shall register to receive early warning notification of flood events on the River Blackwater. An early warning system is in place based on river levels at Millstreet. Mobile plant will be removed from potential flood affected areas in the event of a flood warning. Operatives will also be evacuated from that portion of the site and any static plant or temporary works components will be made safe.

### 8.4 Weir Remediation Works

Weir remediation works will be overseen by the ECoW who will liaise with the contractor prior to the commencement of site works and will evaluate the effectiveness of mitigation measures. In the unlikely event that the mitigation measures do not function as planned during construction, it will be role of the ECoW to supplement the mitigation measures to ensure that they function as planned. Ultimately, the ECoW may decide to halt works until mitigation functions effectively.

- Works will comply with *IFI's Guidelines on protection of fisheries during construction Works in and adjacent to waters* (IFI, 2016).

- In order to maintain flows in the river throughout the weir remediation works, instream construction works will be carried out in two stages i.e., upstream of bridge and downstream of bridge. This will be carried out in the period July to Mid Sept, when river levels are at their lowest in accordance with the "Guidelines on the Protection of Fisheries during Construction Works in or Adjacent to Waters", IFI,2016 (See 19011-TJOC-PL-XX-DR-C-0086 (See **Figure 5**).

- The construction methods used within the River Blackwater will take into account the preservation of stream flows for movement of fish by ensuring that the sequencing for works allows fish movement for the duration of works.

- The works shall entail the construction of a temporary dam (sheetpiles and sandbags) upstream of the weir on the west side of the bridge, extending from the bridge to the north bank of the river, followed by the creation of a bund and silt fence or proprietary barrier fence extending above the water level in the river, downstream of the weir which would extend across the width of the weir that is located upstream of the bridge.

- Silt movement within the working area will be managed through the use of silt fences which will be disposed of off-site as part of a site clean-up operation prior to the completion of the relevant phase of the works. Sandbags may be required locally to close off any gaps between the elements of the proposed system and at the river banks.

- Sandbagging (damming) must be carefully planned and executed as this carries a risk of negative impacts through generation or introduction of silt and sediment to the river system (if bags burst, for example). Sand-bags (small or 1-tonne) must be clean and of good integrity, preferably fully sealed (i.e., composed of high-grade polythene, not webbing or hessian). Sand-bags must be filled with very clean, coarse grade sand with no fines at all. They need to be carefully handled and placed so they don't burst and no other additional material (like clay or soil etc.) should be introduced to seal gaps.

Small (1/4 filled) sandbags should be on hand to seal gaps/leaks in dams as they arise – this will discourage the use of clay or soil to seal gaps.

- A silt curtain will be installed on the river downstream of the section of works to trap any silt generated by the placing or removal of the embankment and downstream of outfalls. The silt curtains will remain until the dam system have been removed and potentially contaminated water enclosed within the dam system has been pumped out to the water management system as approved by the ECoW.

- The requirement for additional silt curtains will be determined by the ECoW based on the contractor's detailed methodology and flow conditions in the river prior to commencement of works.

- Silt curtains shall consist of a continuous filament nonwoven, needle punched, 100% polypropylene, UV stabilised geotextile with the following minimum properties:

    - Characteristic short term tensile strength = 31kN/m;
    - Elongation at characteristic short term strength (md/cd) = 80/50 %
    - CBR puncture strength = 5200N
    - Effective opening size (O90 ) = 0.08mm
    - Vertical water flow (50mm head) = 42 l/m²/s
    - Mass per unit area = 500g/m²

- Each individual silt fence or curtain panel shall be joined together by the use of high strength nylon rope. An overlap of 500mm shall be provided between each adjacent panel and threaded continuously together along the whole length with nylon rope to prevent piping of pollutant. The silt curtain shall be attached to a HDPE float for buoyancy and a steel chain weight fixed along the bottom of the silt curtain, with the size and weight of these determined by the silt curtain supplier. Appropriately sized and spaced concrete blocks shall also be used to anchor the HDPE float in position.

- The silt curtain shall initially be installed as close as possible to the proposed works and then moved from here into its required position to prevent fish being trapped behind it. The Contractor shall carefully choose the type and depth of silt curtain to ensure it is not damaged / swept away during flood conditions. Maintenance will be carried out daily.

- Fish will be removed from the area of river within the barriers and dams and within any silt curtain or sandbag envelope. This activity will be undertaken by personnel authorised by IFI and the EcOW.

- The optimum time for undertaking the works is from July to mid-September when river levels should be at their lowest and the risk of fluvial flooding would be low. In the event of a significant flood warning, the contractor will be obliged to breach the temporary barriers/dams in order to reduce the risk of the embankment contributing to increased flood risk.

## 8.5 Monitoring

The following measures are to be adopted with regards to silt monitoring:

- Sampling of the River Blackwater to establish a suitable baseline for Suspended Solids and Turbidity
- Determining a relationship between Suspended solids and Turbidity. This is to allow monitoring of Suspended Solids levels by monitoring Turbidity levels
- Specification of suitable trigger levels for Suspended Solids and equivalent Turbidity levels, for a traffic light system (green/continue, amber/caution, red/stop), in response to monitoring of Turbidity levels during the works.
- Monitoring of Suspended solids or turbidity during the works, including monitoring of Natural Turbidity levels prior to start of works each day, so that comparison each day can be related to Naturally occurring levels on the day, rather than a possibly exceptionally low baseline.
- Ensure temporary suspension of the works, if silt levels are excessive (above the predetermined thresholds), or if the silt curtains rupture or otherwise fail.
- Provision for further measures that may be implemented, as appropriate, if silt levels become increase above threshold level, such as, changing the work that is ongoing at the time, implementing additional silt control measures such as straw bales, suspending the work for a period to allow the river run clear.
- Modification of silt curtain location as the works vary, to suit the works
- Employ a specialist for guidance on the advice with regard to the use of silt curtains.
- Provide for ongoing engagement with IFI on the issue of construction methodologies, silt control and threshold levels.

## 8.6 Lighting

Potentially, construction lighting associated with the site works could cause disturbance/displacement of Otter (and bat) species. Artificial lighting at night has the potential to disrupt and disorientate fish and increase exposures to predation. If of sufficient severity and duration, there could be impacts on reproductive success.

Site lighting will typically be provided by tower mounted temporary portable construction floodlights. The floodlights will be cowled and angled downwards to minimise spillage to surrounding habitats. The following measures will be applied in relation to site lighting:

- Lighting will be provided with the minimum luminosity sufficient for safety and security purposes. Where practicable, precautions will be taken to avoid shadows cast by the site hoarding on surrounding footpaths, roads and amenity areas;
- Lights will be switched off when not in use; and

- Lighting will be positioned and directed so that it does not to unnecessarily intrude on adjacent ecological receptors and structures used by protected species. The primary area of concern is the potential impact on the treelines/riparian vegetation and the River Blackwater along the southern boundary of the site. There will be no directional lighting focused outside the working area within the River Blackwater or boundary habitats respectively and cowling and focusing lights downwards will minimise light spillage.

- Works will primarily take place during hours of daylight to minimise disturbance to any nocturnal mammal species.

### 8.7 Hours of Work

The hours of construction work and site deliveries, unless otherwise amended by the Planning Authority, will be restricted to the following:

• Monday to Friday 0700hrs to 1900hrs

• Saturday 0700hrs to 1400hrs

• Sunday and Bank Holidays Works prohibited

• Deliveries (of materials, plant or machinery) 0800hrs to 1900hrs

There may be occasions where it is necessary to make certain deliveries outside these times, for example, where large loads are limited to road usage outside peak times.

### 8.8 Noise

The development site is located in an urban setting. Background noise levels are expected to be elevated during daytime hours. The principle sources of noise emissions from the site will be: -

- During the site clearance phase

- During excavation works.

- General construction activity, including deliveries to / from the site, use of power tools etc.

- Sheet piling for weir remediation works and fish bypass channel

To minimise nuisance caused by noise from the construction, excavation and demolition (C&D) works, the contractor will be required to implement noise control measures in accordance with the requirements of British Standard BS5228 '*Noise Control on Construction on Open Sites, Part 1 – Code of Practice for basic information and procedures for noise control*'. In this regard, the contractor will be required to ensure that noise levels from the C&D activities on site are within acceptable limits.

The potential for any item of plant to generate noise will be assessed prior to the item being brought onto the site. The least noisy item should be selected.

If replacing a noisy item of plant is not a viable or practical option, consideration will be given to noise control “at source”. This refers to the modification of an item of plant or the application of improved sound reduction methods in consultation with the supplier. For example, resonance effects in panel work or cover plates can be reduced through stiffening or application of damping compounds; rattling and grinding noises can often be controlled by fixing resilient materials in between the surfaces in contact.

Mobile plant will be switched off when not in use and will not be left idling.

All items of plant will be subject to regular maintenance. Such maintenance can prevent unnecessary increases in plant noise and can serve to prolong the effectiveness of noise control measures.

### 8.9 Habitats

All personnel involved with the project will receive an on-site induction relating to operations and the environmentally sensitive nature of the Blackwater River (Cork/Waterford) SAC and the proximity of aquatic habitats.

The Wildlife Amendment Act 2000 (S.46.1) provides that it is an offence to cut, grub, burn or destroy any vegetation on uncultivated land or such growing in any hedge or ditch from the first of March to the 31st of August. Exemptions include the clearance of vegetation in the course of road or other construction works or in the development or preparation of sites on which any building or other structure is intended to be provided. None the less it is recommended that vegetation be removed outside of the breeding season where possible. In particular, removal during the peak-breeding season (April-June inclusive) will be avoided. Such a timeframe would also minimise the potential disturbance of breeding birds outside of the proposed development site boundary. If works are carried out during the breeding season, a preconstruction survey will be carried out by the EcOW who will specify appropriate mitigation.

The works will be identified and will be securely fenced and sign posted early in the construction phase. These will be clearly visible to machine operators.

All trees/hedgerows to be retained to be protected in accordance with BS 5837:2012, Trees in relation to design, demolition & construction. Prior to the commencement of any work, or any materials being brought on site, existing trees to be retained are to be protected with temporary fencing. This shall be maintained in good and effective condition until the work is completed. Allow for stabiliser struts to secure fence for duration of construction. Fully remove when construction is complete/site demobilised.

Significant crown reduction is likely to be required for retained Black Poplar to ensure their stability and survival once the other trees have been removed. The extent of crown reduction will be specified by the arboricultural consultant following removal of adjoining trees.

The protective fencing is to coincide, as far as is practical, with the root protection area (rpa), unless otherwise agreed. all weather notices shall be securely fixed to the fence words such as 'construction exclusion zone - no access.

The following measures are particularly important:

- Materials are never to be stacked within the root spread of the tree;
- No oil, tar, bitumen, cement or other material is to be allowed to contaminate the ground;
- No fires shall be lit beneath or in close proximity to the tree canopy;
- Trees to be retained should not be used as anchorages for equipment or for removing stumps
- Root Protection Area (RPA) Outside tree canopy dripline roots or other trees, or for other purposes;
- No notices, telephone cables or other services should be attached to any part of the tree;
- Cement mixing should not be carried out within the canopy/protected area of the tree;
- Rails clamped securely to posts
- Soil levels are to be maintained as existing within the root spread of the tree. Any alteration to soil levels in an area up to one and a half times the diameter of the tree canopy must be agreed with the ER/Architect.

Grassland area that are damaged and disturbed will be left to regenerate naturally or will be rehabilitated and landscaped with standard seed mixtures. The ECoW will specify suitable new grassland mixes, including native species mixes which are available from specialist suppliers, depending on the ground conditions post construction. A detailed landscape plan has been included with this application which outlines replacement tree planting within the footprint of the fish bypass channel (See **Section 5.4**).

To protect stream side vegetation from damage, where access is required to the river, the supervising ECoW will identify areas where construction activity is not necessary and will ensure these areas are securely fenced.

Standard mitigation will be implemented as part of a dust minimisation plan to minimise potential impact on terrestrial and aquatic habitats.

### 8.10 Otter

An Otter holt was recorded approximately 300m east of the weir during June and July 2020. A pre-construction Otter survey, including the use of camera traps, will be carried out prior to the commencement of works to ascertain if this holt is still being used and to determine if new holts, couches or resting areas have become established in the intervening period. A derogation licence will be sought for the instream works in relation to Otter couches based on the results if the up-to-date Otter surveys. It is noted that the Otter holt recorded during site surveys is located a considerable distance from site works and therefore a licence in relation to this holt is not considered necessary.

Any holts found to be present by up-to-date surveys prior to construction will be subject to monitoring and mitigation as set out in the NRA *Guidelines for the Treatment of Otter prior to the Construction of National Road Schemes* (2006). If found to be inactive, exclusion of holts

may be carried out during any season. No wheeled or tracked vehicles (of any kind) will be used within 20m of active, but non-breeding, Otter holts. Light work, such as digging by hand or scrub clearance will also not take place within 15m of such holts, except under license. The prohibited working area associated with Otter holts will be fenced and appropriate signage erected. Where breeding females and cubs are present no evacuation procedures of any kind will be undertaken until after the Otters have left the holt, as determined by an ecologist. Breeding may take place at any season, so activity at a holt must be adjudged on a case-by-case basis.

The ECoW will ensure that there are no impediments to prevent free movement of Otters, for example, between different feeding areas or between holts and a feeding area. The provisions required, which may include leaving gaps in fencing will be specified by the ECoW based on a preconstruction survey.

### 8.11 Invasive species

A survey for invasive species will be carried out prior to the commencement of works. This is to confirm the extent of infestations as identified by invasive species surveys to date, and to determine whether any new infestations have established in the intervening period. An Invasive species management plan (ISMP) is attached as **Appendix 8**. This will be updated by an invasive species specialist based on up-to-date survey data prior to the commencement of site works,

- To prevent Japanese Knotweed or other invasive species from outside the site being inadvertently being brought into the site, the contractor will be required to inspect, clean and wash down vehicles within a specific area within the site compound before using them on site.
- Prior notification will be given to all contractors that parts of the site are contaminated with Japanese Knotweed and that they must adhere to this protocol to avoid the spread of the plant within and more importantly, outside of the works area. This includes any site investigation works in advance of commencement of excavation works.
- All stands of Japanese Knotweed will be clearly delineated with hazard tape in a manner visible to machine operators prior to the commencement of works.
- Appropriate signage will be put in place to deter any entrance by people or machinery into the areas within which the Japanese Knotweed is growing.
- A buffer zone of at least seven metres should be put in place in respect to the stand of Japanese Knotweed. This zone should be clearly marked/fence and no works should proceed within these buffer zones.
- Where direct disturbance within 7m of a stand of Japanese Knotweed is unavoidable then an invasive species management plan will be drawn up to ensure that risks are minimised. This includes any site investigation works which may proceed the commencement of site works. This management plan should include all provisions for site hygiene and appropriate disposal of contaminated soil and subsoil.

- Only vehicles required for the works within the contaminated works area should be brought on site and the number of visits minimised as much as practicable. Vehicle movements within this area should be kept a minimum. A specialised wash down area will be created for machinery and footwear. All machinery and equipment (including footwear) should be power washed prior to leaving the contaminated works area within this wash down area. They should also be visually checked for clods of soil, bits of vegetation etc. and particular care is required with tracked machinery. This wash down area will be located in close proximity to existing stands and the wash down area will be included in the post-works treatment programme for Japanese Knotweed.

- Any excavation within the contaminated area should be carried out under the supervision of a qualified ecologist who can identify rhizomes and ensure they are removed if present.

- If Japanese Knotweed contaminated material is to be removed off site it will require a licence from the National Parks and Wildlife Service in advance of any removal, in accordance with the European Communities (Birds and Natural Habitats) Regulations 2011 (SI 477).

- Any Himalayan Balsam within the works will be hand-pulled and bagged prior to the commencement or site works. It will be then placed in a designated area of the site to decay. The seeds are not particularly robust but may survive for 18 months so a two-year programme of control, which will extend beyond the construction period, will be required. All machinery leaving the site will be washed down in a designated wash down area in proximity to the site exit to prevent seeds from being spread outside the site boundary.

- If and where contaminated soil or heaps of high-risk invasive species (i.e. Himalayan Balsam) are to be stockpiled, the area will be clearly marked out on site. These areas will preferably not be within 20m of any watercourse or flood zone.

- Post development any Amber Listed invasive species remaining on the site will be treated via a standard herbicide programme. Herbicides must be used according the manufacturers recommendations and must be suitable for use near watercourses.

Full details on invasive species control measures are outlined in the ISMP (**Appendix 8**).

### 8.12 Crayfish

A survey for this species will be carried out within the proposed works area prior to the commencement of works and any individuals recorded will be relocated outside the works area under a derogation licence from NPWS.

Prior to construction delimiting areas where construction activity is not necessary and which is to remain off-limits and undisturbed will be outlined by the supervising ECoW and securely marked up on contractor maps and where possible marked out or fenced on site. This species was recently recorded in crevices in proximity to Fermoy Weir and may occur within the works area in eroded crevices.

A trapping programme will be implemented to ensure that any crayfish within this area are removed prior to the commencement of works. Up to twenty 'Trappy Funnel Crayfish Traps' ballasted with extra rock will be positioned in the footprint of instream works areas during each trapping episode.

If flows are too high to remove crayfish prior to commencement of site works then it may be necessary to remove crayfish once the temporary dam is in place. The ECoW will check for crayfish on an ongoing basis during site works and translocated as necessary. A second translocation area will be located adjacent to Fermoy Slipway as agreed with NPWS. The Section 23 and 24 license to capture and translocate White-clawed Crayfish has been received from NPWS.

It is noted that rock armour is likely to provide suitable refuges for White-clawed Crayfish and this species is likely to recolonise this area after works are complete.

### 8.13 Fish

Construction activities will be limited to daylight hours where possible and will minimise night working when main surges of migratory fish are more likely to occur.

There is the potential for direct impacts on fish species including species such as AtlanticSalmon and Brook Lamprey to become trapped within silt curtain envelopes. Other species such as European Eel, Brown Trout and Dace may also be affected. Where necessary an electrofishing salvage operation will be carried out (by IFI or by EcOW ) to remove any fish that become enclosed within the works area. This will ensure that there will be no significant direct effects on fish species.

### 8.14 Biosecurity

Crayfish Plague is caused by a fungus-like organism *Aphanomyces astaci* which is of North American origin but now occurs throughout Europe. The Crayfish Plague organism (technically an Oomycete and often called water moulds) normally grows on the outer shell of crayfish and North American crayfish are generally immune to it, as they can prevent any infection reaching their body tissues. However, when the water mould infects White-clawed and other European crayfish, it rapidly, and fatally, spreads into the body tissues. Infected animals become distressed and behave abnormally and may survive several weeks before dying.

Crayfish occur within the Blackwater system and establishment of the disease crayfish plague can have highly detrimental impacts on this species. Throughout its European range, this species has been decimated by the impact of Crayfish plague disease which spread to Europe with the introduction of the plague carrier North American species of crayfish. Therefore, as recommended by the Inland Fisheries Ireland a Check, Clean and Dry protocol should be utilised.

- All wet gear or machinery which has previously come into contact with watercourses should be checked for any silt or mud, plant material or animals. It then should be cleaned and finally dried. Disinfectant or hot water (over 65ºC) should be used to clean all equipment followed by a 24hr drying period. This should be adopted as standard practice in all freshwaters. This will be incorporated into a detailed Biosecurity

Management Plan which will be prepared by the contractor and approved by the ECoW prior to the commencement of site works. The Biosecurity Management Plan will take into account up do date information with respect to biosecurity risks.

- Stringent biosecurity measures will be implemented throughout the works following the OPW's Invasive Species Procedures. The best practice principles of Check-Clean-Dry guidance of the Non-Native Species Secretariat (NNSS, 2017), IFI biosecurity protocols (IFI,2010) and Waterways Ireland Marine Notice No. 39/2017 shall be followed during these works, to ensure that crayfish plague and invasive non-native species are not introduced into the proposed working area.

### 8.15 Fish bypass channel monitoring

The DVWK guidance suggests that the characteristics of irregular rough-channel pool passes cannot be calculated accurately and that a degree of testing and modification should be allowed for during the construction phase. Therefore, testing and modification will be carried out during the construction phase in agreement with IFI. If it is determined that slight modifications are required e.g. perturbance boulders these will be agreed with IFI prior to implementation.

Flows within the fish bypass channel and at the entrance and exit points will be monitored during the operational phase to ensure that the bypass channel is operating as designed and meets the velocity requirements for various fish species, including all QI species for the Blackwater River (Cork/Waterford) SAC.

Where significant accumulations of debris occur during operation of the fish bypass channel, these will be removed on an ongoing basis.

Post construction monitoring of the efficacy of the fish bypass channel for the various target species was recommended (particularly for Twaite Shad) by the independent review RKDVH. The following operational monitoring will be carried out.

- eDNA methods have been proposed as the most effective solution given the catchment location of the fish pass, the range of target fish with distinct life history traits and behaviours, and catchment size.
- A meta-barcode all-species approach is proposed, although at a minimum shad and lamprey species should be included.
- A baseline will be established, with post operational monitoring to extend to ten years.
- An opportunity to include Freshwater Pearl Mussel (FPM) within the eDNA monitoring programme exists.

## 9. Conclusions

The AA screening concluded, on the basis of objective information and in view of best scientific knowledge, the possibility of significant effects from the proposed project on European sites could not be ruled out and therefore an Appropriate Assessment was required. The AA screening concluded that there was potential for the proposed development to significantly

impact the Blackwater River (Cork/Waterford) SAC, via habitat loss, surface water runoff, direct injury, disturbance and the spread of invasive species.

The NIS has been prepared to inform and assist to assess, in view of best scientific knowledge, if the proposed development, individually or in combination with another plan or project is likely to have a significant effect on the Blackwater River (Cork/Waterford) SAC or any other European sites.

This NIS has examined and analysed, in light of the best scientific knowledge, with respect to Blackwater River (Cork/Waterford) SAC within the potential zone of influence of the proposed development, the potential effect pathways, how these could impact on qualifying species or habitats and whether the predicted effects would adversely affect the integrity of the Blackwater River (Cork/Waterford) SAC.

Mitigation measures are set out in **Section 8** of the NIS and they ensure that any effects on the conservation objectives of the Blackwater River (Cork/Waterford) SAC will be avoided during the proposed development such that there will be no risk of adverse effects on the integrity of these European sites.

It has been objectively concluded following an examination, analysis and evaluation of the relevant information, including in particular the nature of the predicted effects from the proposed development and with the implementation of the mitigation measures proposed, that the construction, operation and decommissioning of the proposed development will not adversely affect (either directly or indirectly) the integrity of any European site, either alone or in combination with other plans or projects. There is no reasonable scientific doubt in relation to this conclusion. The competent authority will make the final determination in this regard.

## References

Agostinho, Angelo & Agostinho, Carlos & Pelicice, Fernando & Marques, Elineide. (2012). Fish ladders: Safe fish passage or hotspot for predation?. Neotropical Ichthyology. 10. 687-696

Aktinson, S., et al. (2017) Assessment of the extent and impact of obstacles on freshwater hydromorphology and connectivity in Ireland. http://www.ucd.ie/reconnect/t4media/National_Water_Event_2017_S_Atkinson_FINAL.pdf

Andréanne Demers, John Lucey, Martin L. McGarrigle and Julian D. Reynolds (2005) The Distribution of the White-Clawed Crayfish, Austropotamobius pallipes, in Ireland

Anon (2004). Margaritifera margaritifera. Stage 1 and Stage 2 survey guidelines. Irish Wildlife Manuals, No. 12. National Parks and Wildlife Service, Department of Environment, Heritage and Local Government, Dublin, Ireland.

APEM (2004). Assessment of Sea Lamprey distribution and abundance in the River Spey: Phase II. Scottish Natural Heritage Commissioned Report No. 027 (ROAME No. F01AC608).

Applications for approval for Local Authority Developments made to An Bord Pleanála under 177AE of the Planning and Development Act, 2000, as amended (Appropriate Assessment): Guidelines for Local Authorities. An Bord Pleanála, Dublin (ABP, 2013).

Appropriate Assessment of Plans and Projects in Ireland. Guidance for Planning Authorities. Department of the Environment, Heritage and Local Government, Dublin (DEHLG, 2010a);

Appropriate Assessment Screening Report. Proposed Amalgamation of 8 No. Combined Storm Overflows and Upgrade of the Combined Sewer Network at Mallow WWTP (DixonBrosnan, 2016).

Aronsuu, K. & Virkkala, P. (2014). Substrate selection by subyearling European River Lampreys (Lampetra fluviatilis) and older larvae (Lampetra spp.). Ecology of Freshwater Fish, 23: 644–655

Brasington, J., Vericat, D., & Rychkov, I. (2012). Modelling river bed morphology, roughness, and surface sedimentology using high resolution terrestrial laser scanning. Water Resources Research, 48(11).

Breathnach, S., & Fairley, J. S. (1993). The diet of Otters Lutra lutra (L.) in the Clare river system. In Biology and Environment: Proceedings of the Royal Irish Academy (pp. 151-158). Royal Irish Academy.

Byrne, A. W., Moorkens, E. A., Anderson, R., Killeen, I. J., & Regan, E. (2009). Ireland Red List no. 2: Non-marine molluscs. National Parks and Wildlife Service, Department of the Environment, Heritage and Local Government.

CEN (2003). Water Quality - Sampling of Fish with Electricity. Document CEN EN 14011:2000.

CFB (2008). Methods for the Water Framework Directive. Electric Fishing in Wadeable Reaches. Central Fisheries Board. Unpublished report.

CJEU Case C 164/17 Edel Grace Peter Sweetman v An Bord Pleanála

Control of water pollution from Construction Sites – Guidance for consultants and contractors (Ciria C532)".

Control of Water Pollution from Linear Construction Projects Site Guide" (CIRIA C649, 2006).

Control of Water Pollution from Linear Construction Projects Technical Guidance" (CIRIA C648,2006)

County Cork Biodiversity Action Plan 2009-2014

Department of Environment Heritage and Local Government Circular NPW 1/10 and PSSP 2/10 on Appropriate Assessment under Article 6 of the Habitats Directive – Guidance for Planning Authorities (DEHLG, 2010b);

Devaney, F. M., Martin, J. R., O'Neill, F. H., & Delaney, A. (2013). Irish semi-natural grasslands survey (No. 4). Annual Report.

DixonBrosnan (2020). Natura Impact Statement (NIS) Emergency Maintenance Works Fermoy, Co. Cork. Report prepared by DixonBrosnan Environmental Consultants on behalf of the Office of Public Works (OPW). September 2020.

Doherty, D., O'Maoiléidigh, N., & McCarthy, T. K. (2004). The biology, ecology and future conservation of Twaite Shad (Alosa fallax Lacépède), allis shad (Alosa alosa L.) and Killarney

shad (Alosa fallax killarnensis Tate Regan) in Ireland. In Biology and Environment: Proceedings of the Royal Irish Academy (pp. 93-102). Royal Irish Academy.

EA (2003). River Habitat Survey in Britain and Ireland: Field Survey Guidance Manual: 2003 Version. Forest Research. Environment Agency, UK.

EC (2013). Interpretation Manual of European Union Habitats, version EUR 28. European Commission. Available at: http://ec.europa.eu/environment/nature/legislation/habitatsdirective/docs/Int_Manual_EU28.pdf

European Commission (2007) Interpretation manual of European Union habitats – EUR27. http://ec.europa.eu/environment/nature/legislation/habitatsdirective/docs/2007_07_im. pdf.

Ecofact, 2018 Freshwater Pearl Mussel Survey Blackwater [Munster] River – Mallow

Edwards, P. J., Kollmann, J., Gurnell, A. M., Petts, G. E., Tockner, K., & Ward, J. V. (1999). A conceptual model of vegetation dynamics on gravel bars of a large Alpine river. Wetlands Ecology and Management, 7(3), 141-153.

Electrofishing survey for lamprey in two minor watercourses as part of the Munster Blackwater River (Mallow South and West) Drainage Scheme, DixonBrosnan, 2011

Environmental Protection Agency Ireland (http://www.epa.ie/) . Accessed 27/10/21

European Commission, 2000. Communication from the Commission on the Precautionary Principle., Office for Official Publications of the European Communities, Luxembourg (EC, 2000a);

European Commission, 2001. Assessment of plans and projects significantly affecting Natura 2000 sites: Methodological guidance on the provisions of Articles 6(3) and (4) of the Habitats Directive 92/43/EEC. Office for Official Publications of the European Communities, Brussels (EC, 2001);

Feeley, H.B., Baars, J-R., Kelly-Quinn, M. & Nelson, B. (2020). Ireland Red List No. 13: Stoneflies (Plecoptera). National Parks and Wildlife Service, Department of Culture, Heritage and the Gaeltacht, Dublin, Ireland.

Fossitt, J. A. (2000). A Guide to Habitats in Ireland. The Heritage Council of Ireland Series

Foster, G. N., Nelson, B. H. & O Connor, Á. (2009). Ireland Red List No. 1 – Water beetles. National

Gardiner, R. (2003). Identifying lamprey. A field key for sea, river and Brook Lamprey. Conserving Natura 2000 Rivers, Conservation techniques No. 4. Peterborough. English Nature.

Gilvear, D., Francis, R., Willby, N., & Gurnell, A. (2007). Gravel bars: a key habitat of gravel-bed rivers for vegetation. Developments in Earth Surface Processes, 677–700. doi:10.1016/s0928-2025(07)11154-8

Goodwin, C.E., Dick, J.T.A. & Elwood, R.W. (2008). A preliminary assessment of the distribution of the Sea Lamprey (Petromyzon marinus L), River Lamprey (Lampetra fluviatilis (L.)) and Brook Lamprey (Lampetra planeri (Bloch)) in Northern Ireland. Biology and Environment: Proceedings of the Royal Irish Academy 109B, 47-52.

Guidance document on Article 6(4) of the 'Habitats Directive' 92/43/EEC – Clarification of the concepts of: alternative solutions, imperative reasons of overriding public interest, compensatory measures, overall coherence, opinion of the commission; (EC, 2007);

Guidelines on Protection of Fisheries During Construction Works In and Adjacent to Water" (IFI, 2016).

Haro, A. and Castro-Santos, T. (2012) Passage of American shad: Paradigms and realities. Marine and coastal fisheries: Dynamics, management and ecosystem science 4: 252-261.

Harvey, J. & Cowx, I. (2003). Monitoring the River, Sea and Brook Lamprey, Lampetra fluviatilis, L. planeri and Petromyzon marinus. Conserving Natura 2000 Rivers Monitoring Series No. 5, English Nature, Peterborough.

Hendry,D Cragg-Hine,M O'Grady,H Sambrook,A Stephe (2003) Management of habitat for rehabilitation and enhancement of Salmonid stocks

Information on the status of EU protected habitats in Ireland (National Parks & Wildlife Service, 2013a & 2013b)

Interpretation Manual of European Union Habitats. Version EUR 28. European Commission (EC, 2013);

Invasivespecies Ireland (http://invasivespeciesireland.com/) Accessed 27/10/21

Janssen, J. A. M., Rodwell, J. S., Criado, M. G., Arts, G. H. P., Bijlsma, R. J., & Schaminee, J. H. J. (2016). European red list of habitats: Part 2. Terrestrial and freshwater habitats. European Union.

Jolly, M. T., Aprahamian, M. W., Hawkins, S. J., Henderson, P. A., Hillman, R., O'Maoiléidigh, N., … Genner, M. J. (2012). Population genetic structure of protected allis shad (Alosa alosa) and Twaite Shad (Alosa fallax). Marine Biology, 159, 675–687.

Kalníková, V., Chytrý, K., Biţa-Nicolae, C., Bracco, F., Font, X., Iakushenko, D.,Chytrý, M. (2020). Vegetation of the European mountain river gravel bars: a formalized classification. Applied Vegetation Science.

Kelly-Quinn, M. & Regan, E.C. (2012). Ireland Red List No. 7: Mayflies (Ephemeroptera). National Parks and Wildlife Service, Department of Arts, Heritage and the Gaeltacht, Dublin, Ireland.

King J. J. & Linnane S. M. (2004). The status and distribution of lamprey and shad in the Slaney and Munster Blackwater SACs. Irish Wildlife Manuals, No. 14. National Parks and Wildlife Service, Department of Environment, Heritage and Local Government, Dublin, Ireland.

King, J. J., & Roche, W. K. (2008). Aspects of anadromous allis shad (Alosa alosa Linnaeus) and Twaite Shad (Alosa fallax Lacépède) biology in four Irish Special Areas of Conservation (SACs): Status, spawning indications and implications for conservation designation. Hydrobiologia, 602, 145–154.

King, J. L., Marnell, F., Kingston, N., Rosell, R., Boylan, P., Caffrey, J. M., ... & Poole, R. (2011). Ireland red list no. 5: amphibians, reptiles & freshwater fish. National Parks and Wildlife Service, Department of Arts, Heritage and the Gaeltacht, Dublin, Ireland, 1-77.

King, J.J. and Linnane, S.M. (2004) The status and distribution of lamprey and shad in the Slaney and Munster Blackwater SACs. Irish Wildlife Manuals, No 14. National Parks and Wildlife Service, Department of Environment, Heritage and Local Government, Dublin, Ireland

Kyne, M., Smal, C., & Fairley, J. (1989). The Food of Otters Lutra lutra in the Irish Midlands and a Comparison with That of Mink Mustela vison in the Same Region. Proceedings of the Royal Irish Academy. Section B: Biological, Geological, and Chemical Science, 89B, 33-46.

Larinier, M., & Travade, F. (2002). The design of fishways for shad. Bulletin Francais de la Peche et de la Pisciculture, (364), 135-146.

Larnier, M. and Travade, F. (2002) The design of fishways for shad. Bulletin Français de la Pêche et de la Pisciculture 364 (Supplement): 135-146.

Macklin, R., Brazier, B. & Sleeman, P. (2019). Dublin City Otter survey. Report prepared by Triturus Environmental Ltd. for Dublin City Council as an action of the Dublin City Biodiversity Action Plan 2015-2020.

Maitland, P.S. (2003). Ecology of the River, Brook and Sea Lamprey. Conserving Natura 2000 Rivers Ecology Series No. 5. English Nature, Peterborough.

Maitland, P.S. and R.N. Campbell, 1992. Freshwater fishes of the British Isles. HarperCollins Publishers, London.368 p.

Managing Natura 2000 Sites: the provisions of Article 6 of the 'Habitats' Directive 92/43/EEC (EC, 2000)

Managing Natura 2000 Sites: the provisions of Article 6 of the 'Habitats' Directive 92/43/EEC Office for Official Publications of the European Communities, Luxembourg (EC, 2018);

Matson, R., Delanty, K., Shephard, S., Coghlan, B., & Kelly, F. (2018). Moving from multiple pass depletion to single pass timed electrofishing for fish community assessment in wadeable streams. Fisheries Research, 198, 99-108.

National Biodiversity Data Centre (http://www.biodiversityireland.ie/). Accessed 27/10/21

National Parks and Wildlife Service website (www.npws.ie). Accessed 27/10/21

Nelson, B., Ronayne, C. & Thompson, R. (2011). Ireland Red List No.6: Damselflies & Dragonflies

Niven, A.J. & McCauley, M. (2013). Lamprey Baseline Survey No2: River Faughan and Tributaries SAC. Loughs Agency, 22, Victoria Road, Derry.

NPWS (2007) Allis Shad (Alosa alosa) (1102) & Twaite Shad (Alosa fallax) (1103) Conservation Status Assessment Report. National Parks & Wildlife Service.

NPWS (2012). Conservation Objectives: Blackwater River (Cork/Waterford) SAC 002170. Version 1.0. National Parks and Wildlife Service, Department of Arts, Heritage and the Gaeltacht.

NRA (2009). Guidelines for Assessment of Ecological Impacts of National Road Schemes. National Roads Authority, Dublin.

NRA Guidelines on the Management of Noxious Weeds and Non-native Species on National Roads (NRA, 2010

NS 2 (2010) Freshwater Pearl Mussel. Second Draft. Munster Blackwater Sub-basin management plan. Funded by DEHLG. March 2010.

Ottino, P., & Giller, P. (2004). Distribution, density, diet and habitat use of the Otter in relation to land use in the Araglin valley, Southern Ireland. In Biology and Environment: Proceedings of the Royal Irish Academy (pp. 1-17). Royal Irish Academy.

Perrin, P.; Martin, J.; Barron, S.; O'Neill, F.; McNutt, K.; Delaney, A. (2008). National Survey of Native Woodlands 2003-2008 Unpublished Report to NPWS

POtter, I. C., & Osborne, T.S. (1975). The systematics of British larval lampreys. Journal of Zoology, 176(3), 311-329.

Reid, N., Thompson, D., Hayden, B., Marnell, F., & Montgomery, W. I. (2013). Review and quantitative meta-analysis of diet suggests the Eurasian Otter (Lutra lutra) is likely to be a poor bioindicator. Ecological indicators, 26, 5-13.

Reynolds, J.D., Lynn, D., O' Keeffe, C., Lucey, J., Clabbey, K., McGarrigle, M. & King, J. (2010). Conservation assessment and current status of protected white-clawed crayfish, Austropotamobius pallipes (Lereboullet), in Ireland. Freshwater Crayfish 17: 123-127.

Rooney, S.M., O'Gorman, N.M., King, J.J. (2013). National Programme: Habitats Directive and Red Data Book Species Executive Report 2012. Inland Fisheries Ireland, Swords Business Campus, Swords, Co. Dublin, Ireland.

Smiddy, P., & Saich, C. (2015). Using Otter (Lutra lutra) diet to indicate presence of White-clawed Crayfish (Austropotamobius pallipes) populations. The Irish Naturalists' Journal, 34(1), 45-50.

Svobodova et al (1993) Water Quality and Fish Health. EIFAC Technical Paper 54. European Inland Fisheries Advisory Commission

Sweeney, N. and Sweeney, P. (2017) Expansion of the White-clawed Crayfish (Austropotamobius pallipes (Lereboullet)) population in the Munster Blackwater. Irish Naturalists' Journal 35: 94-98.

Tockner, K., Paetzold, A, Karaus, U., Claret, C. and Zettel, J. (2006). Ecology of braided rivers. In: Smith G.H.S., Best J.L., Bristow C.S. and Petts, G.E. (Eds), Braided Rivers: Process, Deposits, Ecology and Management. Oxford: Blackwell, pp. 339–359.

Toner P. F. & O'Connell C. (1971) Water Quality Investigations in the River Blackwater and River Martin, Co. Cork 1966-69. Irish Fisheries Investigations, A, No. 8.

Toner, P., Bowman, J., Clabby, K., Lucey, J., McGarrigle, M., Concannon, C., ... & MacGarthaigh, M. (2005). Water quality in Ireland. Environmental Protection Agency, Co. Wexford, Ireland.

Travade, F. et al. (1998) Feedback on four fishpass instalations recently built on two rivers in southwest France. Pp. 146-170. ICES Annual Science Conference 1996.

Zeng, Q., Shi, L., Wen, L., Chen, J., Duo, H., & Lei, G. (2015). Gravel bars can be critical for biodiversity conservation: A case study on Scaly-sided Merganser in South China. PloS one, 10(5).

# Appendices

## Appendix 1 – Natura 2000 site synopses

### Blackwater River (Cork/Waterford) SAC (Site Code 2170) Site Synopsis

The River Blackwater is one of the largest rivers in Ireland, draining a major part of Co. Cork and five ranges of mountains. In times of heavy rainfall the levels can fluctuate widely by more than 12 feet on the gauge at Careysville. The peaty nature of the terrain in the upper reaches and of some of the tributaries gives the water a pronounced dark colour. The site consists of the freshwater stretches of the River Blackwater as far upstream as Ballydesmond, the tidal stretches as far as Youghal Harbour and many tributaries, the larger of which include the Licky, Bride, Flesk, Chimneyfield, Finisk, Araglin, Awbeg (Buttevant), Clyda, Glen, Allow, Dalua, Brogeen, Rathcool, Finnow, Owentaraglin and Awnaskirtaun. The portions of the Blackwater and its tributaries that fall within this SAC flow through the counties of Kerry, Cork, Limerick, Tipperary and Waterford. Nearby towns include Rathmore, Millstreet, Kanturk, Banteer, Mallow, Buttevant, Doneraile, Castletownroche, Fermoy, Ballyduff, Rathcormac, Tallow, Lismore, Cappoquin and Youghal.

The site is a Special Area of Conservation (SAC) selected for the following habitats and/or species listed on Annex I / II of the E.U. Habitats Directive (* = priority; numbers in brackets are Natura 2000 codes):

- [1130] Estuaries
- [1140] Tidal Mudflats and Sandflats
- [1220] Perennial Vegetation of Stony Banks
- [1310] Salicornia Mud
- [1330] Atlantic Salt Meadows
- [1410] Mediterranean Salt Meadows
- [3260] Floating River Vegetation
- [91A0] Old Oak Woodlands
- [91E0] Alluvial Forests*
- [1029] Freshwater Pearl Mussel (Margaritifera margaritifera)
- [1092] White-clawed Crayfish (Austropotamobius pallipes)
- [1095] Sea Lamprey (Petromyzon marinus)
- [1096] Brook Lamprey (Lampetra planeri)
- [1099] River Lamprey (Lampetra fluviatilis)
- [1103] Twaite Shad (Alosa fallax)
- [1106] Atlantic Salmon (Salmo salar)
- [1355] Otter (Lutra lutra)
- [1421] Killarney Fern (Trichomanes speciosum)

The conservation objectives for the site are detailed in: NPWS (2012) Conservation Objectives: Blackwater River (Cork/Waterford) SAC 002170, Version 1. NPWS, Department of Arts, Heritage & the Gaeltacht (dated 31 July 2012). The overall aim of the Habitats Directive is to maintain or restore the favourable conservation status of habitats and species of community interest.

The Blackwater rises in boggy land in east Kerry, where Namurian grits and shales build the low heather-covered plateaux. Near Kanturk the plateaux enclose a basin of productive Coal Measures. On leaving the Namurian rocks the Blackwater turns eastwards along the northern slopes of the Boggeragh Mountains before entering the narrow limestone strike vale at Mallow. The valley deepens as first the Nagles Mountains and then the Knockmealdowns impinge upon it. Interesting geological features along this stretch of the Blackwater Valley include limestone cliffs and caves near the villages and small towns of Killavullen and Ballyhooly; the Killavullen caves contain fossil material from the end of the glacial period. The associated basic soils in this area support the growth of plant communities which are rare in Cork because in general the county's rocks are acidic. At Cappoquin the river suddenly turns south and cuts through high ridges of Old Red Sandstone. The Araglin valley is predominantly underlain by sandstone, with limestone occurring in the lower reaches near Fermoy.

Wet woodlands are found where river embankments have broken down and channel edges are subject to daily inundation. This is particularly evident in the steep-sided valley of the River Bride, between Cappoquin and Youghal. The river side of the embankments was often used for willow growing in the past (most recently at Cappoquin) so that the channel is lined by narrow woods of White and Almondleaved Willow (Salix alba and S. triandra), with isolated Crack Willow (S. fragilis) and Osier (S. viminalis). Rusty Willow (S. cinerea subsp. oleifolia) spreads naturally into the sites and occasionally, as at Villierstown on the Blackwater and Sapperton on the Bride, forms woods with a distinctive mix of woodland and marsh plants, including Gypsywort (Lycopus europaeus), Guelder-rose (Viburnum opulus), Bittersweet (Solanum dulcamara) and various mosses and algae. These wet woodlands form one of the most extensive tracts of the wet woodland habitat in the country.

A small stand of Yew (Taxus baccata) woodland occurs within the site. This is on a limestone ridge at Dromana, near Villierstown. While there are some patches of the wood with a canopy of Yew and some very old trees, the quality is generally poor due to the dominance of non-native and invasive species such as Sycamore (Acer pseudoplatanus), Beech (Fagus sylvatica) and Douglas Fir (Pseudotsuga menzsisii). However, it does have the potential to develop into a Yew dominated stand in the long term and the site should continue to be monitored.

Marshes and reedbeds cover most of the flat areas beside the rivers and often occur in mosaic with the wet woodland. Common Reed (Phragmites australis) is ubiquitous and is harvested for thatching. There is also much Marsh-marigold (Caltha palustris) and, at the edges of the reeds, the Greater and Lesser Pond-sedge (Carex riparia and C. acutiformis). Hemlock Water-dropwort (Oenanthe crocata), Wild Angelica (Angelica sylvestris), Reed Canary-grass (Phalaris arundinacea), Meadowsweet (Filipendula ulmaria), Common Nettle (Urtica dioica), Purple Loosestrife (Lythrum salicaria), Common Valerian (Valeriana officinalis), Water Mint (Mentha aquatica) and Water Forget-me-not (Myosotis scorpioides) are all also found.

At Banteer there are a number of hollows in the sediments of the floodplain where subsidence and subterranean drainage have created isolated wetlands, sunk below the level of the surrounding fields. The water rises and falls in these holes depending on the water table and several different communities have developed on the acidic or neutral sediments. Many of the ponds are ringed with Rusty Willow, rooted in the mineral soils but sometimes collapsed into the water. Beneath the densest stands are woodland herbs like Yellow Pimpernel (Lysimachia nemorum), with locally abundant Common Water-starwort (Callitriche stagnalis) and Marsh Ragwort (Senecio aquaticus). One of the depressions has Silver Birch (Betula pendula), Ash (Fraxinus excelsior), Crab Apple (Malus sylvestris) and a little Pedunculate Oak (Quercus robur) in addition to the willows.

Floating river vegetation is found along much of the freshwater stretches within the site. The species list is quite extensive, with species such as water-crowfoots, including Pond Water-crowfoot (Ranunculus peltatus), Canadian Pondweed (Elodea canadensis), pondweed species, including Broad-leaved Pondweed (Potamogeton natans), water-milfoil species (Myriophyllum spp.), Common Club-rush (Scirpus lacustris), water-starwort species (Callitriche spp.), Lesser Water-parsnip (Berula erecta) particularly on the Awbeg, Water-cress (Nasturtium officinale), Hemlock Waterdropwort, Fine-leaved Water-dropwort (O. aquatica), Common Duckweed (Lemna minor), Yellow Water-lily (Nuphar lutea), Unbranched Bur-reed (Sparganium emersum) and the moss Fontinalis antipyretica all occurring.

The grasslands adjacent to the rivers of the site are generally heavily improved, although liable to flooding in many places. However, fields of more species-rich wet grassland with species such as Yellow Iris (Iris pseudacorus), Meadowsweet, Meadow Buttercup (Ranunculus acris) and rushes (Juncus spp.) occur occasionally. Extensive fields of wet grassland also occur at Annagh Bog on the Awbeg. These fields are dominated by Tufted Hair-grass (Deschampsia cespitosa) and rushes.

The Blackwater Valley has a number of dry woodlands; these have mostly been managed by the estates in which they occur, frequently with the introduction of Beech and a few conifers, and sometimes of the invasive species Rhododendron (Rhododendron ponticum) and Cherry Laurel (Prunus laurocerasus). Oak woodland is well developed on sandstone about Ballinatray, with the acid oak woodland community of Holly (Ilex aquifolium),

Bilberry (Vaccinium myrtillus), Great Wood-rush (Luzula sylvatica) and the ferns Dryopteris affinis and D. aemula occurring in one place. Irish Spurge (Euphorbia hyberna) continues eastwards on acid rocks from its headquarters to the west, but there are also many plants of richer soils, for example Wood Violet (Viola reichenbachiana), Goldilocks Buttercup (Ranunculus auricomus), Broad-leaved Helleborine (Epipactis helleborine) and Red Campion (Silene dioica). Oak woodland is also found in Rincrew, Carrigane, Glendine, Newport and Dromana. The spread of Rhododendron is locally a problem, as is over-grazing. A few limestone rocks stand over the river in places showing traces of a less acidic woodland type with Ash, False Brome (Brachypodium sylvaticum) and Early-purple Orchid (Orchis mascula).

In the vicinity of Lismore, two deep valleys cut in Old Red Sandstone join to form the Owenashad River before flowing into the Blackwater at Lismore. These valleys retain something close to their original cover of oak with Downy Birch (Betula pubescens), Holly and Hazel (Corylus avellana) also occurring. There has been much planting of Beech (as well as some of coniferous species) among the oak on the shallower slopes and here both Rhododendron and Cherry Laurel have invaded the woodland.

The oak wood community in the Lismore and Glenmore valleys is of the classic upland type, in which some Rowan (Sorbus aucuparia) and Downy Birch occur. Honeysuckle (Lonicera periclymenum) and Ivy (Hedera helix) cover many of the trees while Great Wood-rush, Bluebell (Hyacinthoides non-scripta), Wood-sorrel (Oxalis acetosella) and, locally, Bilberry dominate the ground flora. Ferns present on the site include Hard Fern (Blechnum spicant), Male Fern (Dryopteris filix-mas), the bucklerferns D. dilatata and D. aemula, and Lady Fern (Athyrium felix-femina). There are many mosses present and large species such as Rhytidiadelphus spp., Polytrichum formosum, Mnium hornum and Dicranum spp. are noticeable. The lichen flora is important and includes 'old forest' species which imply a continuity of woodland here since ancient times. Tree Lungwort (Lobaria spp.) is the most conspicuous and is widespread.

The Araglin valley consists predominantly of broadleaved woodland. Oak and Beech are joined by Hazel, Wild Cherry (Prunus avium) and Goat Willow (Salix caprea). The ground flora is relatively rich, with Pignut (Conopodium majus), Ramsons (Allium ursinum), Garlic Mustard (Alliaria petiolata) and Wild Strawberry (Fragaria vesca). The presence of Ivy Broomrape (Orobanche hederae), a local species within Ireland, suggests that the woodland, along with its attendant Ivy, is long established.

Along the lower reaches of the Awbeg River, the valley sides are generally cloaked with mixed deciduous woodland of estate origin. The dominant species is Beech, although a range of other species are also present, e.g. Sycamore, Ash and Horsechestnut (Aesculus hippocastanum).

In places the alien invasive species Cherry Laurel dominates the understorey. Parts of the woodlands are more semi-natural in composition, being dominated by Ash, with Hawthorn (Crataegus monogyna) and Spindle (Euonymus europaea) also present. However, the most natural areas of woodland appear to be the wet areas dominated by Alder and willows (Salix spp.). The ground flora of the dry woodland areas features species such as Pignut, Wood Avens (Geum urbanum), Ivy and Soft Shield-fern (Polystichum setiferum), while the ground flora of the wet woodland areas contains characteristic species such as Remote Sedge (Carex remota) and Opposite-leaved Golden-saxifrage (Chrysosplenium oppositifolium). In places along the upper Bride, scrubby, semi-natural deciduous woodland of willow, oak and Rowan occurs, with abundant Great Wood-rush in the ground flora.

The Bunaglanna River passes down a very steep valley, flowing in a north-south direction to meet the Bride River. It flows through blanket bog to heath and then scattered woodland. The higher levels of moisture here enable a vigorous moss and fern community to flourish, along with a well-developed epiphyte community on the tree trunks and branches.

At Banteer a type of wetland occurs near the railway line which offers a complete contrast to the others. Old turf banks are colonised by Royal Fern (Osmunda regalis) and Eared Willow (Salix aurita), and between them there is

a sheet of Bottle Sedge (Carex rostrata), Marsh Cinquefoil (Potentilla palustris), Bogbean (Menyanthes trifoliata), Marsh St. John's-wort (Hypericum elodes) and the mosses Sphagnum auriculatum and Aulacomnium palustre. The cover is a scraw (i.e. floating vegetation) with characteristic species like Marsh Willowherb (Epilobium palustre) and Early Marshorchid (Dactylorhiza incarnata).

The soil high up the Lismore valleys and in rocky places is poor in nutrients but it becomes richer where streams enter and also along the valley bottoms. In such sites Wood Speedwell (Veronica montana), Wood Anemone (Anemone nemorosa), Enchanter's-nightshade (Circaea lutetiana), Barren Strawberry (Potentilla sterilis) and shield-fern (Polystichum sp.) occur. There is some Ramsons, Three-nerved Sandwort (Moehringia trinervia) and Early-purple Orchid (Orchis mascula) locally, with Opposite-leaved Golden-saxifrage, Meadowsweet and Bugle (Ajuga reptans) in wet places. A stand of Hazel woodland at the base of the Glenakeeffe valley shows this community well.

The area has been subject to much tree felling in the recent past and re-sprouting stumps have given rise to areas of bushy Hazel, Holly, Rusty Willow and Downy Birch. The ground in the clearings is heathy with Heather (Calluna vulgaris), Slender St John's-wort (Hypericum pulchrum) and the occasional Broom (Cytisus scoparius) occurring.

The estuary and the habitats within and associated with it form a large component of the site. Very extensive areas of intertidal flats, comprised of substrates ranging from fine, silty mud to coarse sand with pebbles/stones are present. The main expanses occur at the southern end of the site, with the best examples at Kinsalebeg in Co. Waterford, and between Youghal and the main bridge north of it across the river in Co. Cork. Other areas occur along the tributaries of the Licky in east Co. Waterford, and Glendine, Newport, Bride and Killahaly Rivers in Waterford west of the Blackwater. There are also large tracts along the Tourig River in Co. Cork. There are narrow bands of intertidal flats along the main river as far north as Camphire Island. Patches of green filamentous algae (Ulva sp. and Enteromorpha sp.) occur in places, while fucoid algae are common on the more stony flats, even as high upstream as Glenassy or Coneen.

The area of saltmarsh within the site is small. The best examples occur at the mouths of the tributaries and in the townlands of Foxhole and Blackbog. Those found are generally characteristic of Atlantic salt meadows. The species list at Foxhole consists of Common Saltmarsh-grass (Puccinellia maritima), small amounts of Greater Seaspurrey (Spergularia media), glasswort (Salicornia sp.), Sea Arrowgrass (Triglochin maritima), Annual Sea-blite (Suaeda maritima) and Sea Purslane (Halimione portulacoides) - the latter a very recent coloniser. Some Sea Aster (Aster tripolium) occurs, generally with Creeping Bent (Agrostis stolonifera). Sea Couch (Elymus pycnanthus) and small isolated clumps of Sea Club-rush (Scirpus maritimus) are also seen. On the Tourig River additional saltmarsh species found include sea-lavenders (Limoniun spp.), Thrift (Armeria maritima), Red Fescue (Festuca rubra), Common Scurvygrass (Cochlearia officinalis) and Sea Plantain (Plantago maritima). Oraches (Atriplex spp.) are found on channel edges. Species such as Saltmarsh Rush (Juncus gerardi) and Sea Rush (J. maritimus) are found in places in this site also, and are indicative of Mediterranean salt meadows. Areas of Salicornia mud are found at the eastern side of the townland of Foxbole above Youghal, at Blackbog, along the Tourig and Kinsalebeg esturaies.

The shingle spit at Ferrypoint supports a good example of perennial vegetation of stony banks. The spit is composed of small stones and cobbles and has a well-developed and diverse flora. At the lowest part, Sea Beet (Beta vulgaris subsp. maritima), Curled Dock (Rumex crispus) and Yellow Horned-poppy (Glaucium flavum) occur, while at a slightly higher level Sea Mayweed (Matricaria maritima), Cleavers (Galium aparine), Rock Samphire (Crithmum maritimum), Sea Sandwort (Honkenya peploides), Spear-leaved Orache (Atriplex prostrata) and Babington’s Orache (A. glabriuscula). Other species present include Sea Rocket (Cakile maritima), Herb-Robert (Geranium robertianum), Red Fescue and Kidney Vetch (Anthyllis vulneraria). The top of the spit is more vegetated and supports lichens and bryophytes, including Tortula ruraliformis and Rhytidiadelphus squarrosus.

The site supports several Red Data Book plant species, i.e. Starved Wood-sedge (Carex depauperata), Killarney Fern (Trichomanes speciosum), Pennyroyal (Mentha pulegium), Bird’s-nest Orchid (Neottia nidus-avis), Golden

Dock (Rumex maritimus) and Bird Cherry (Prunus padus). The first three of these are also protected under the Flora (Protection) Order, 2015, while the Killarney Fern is also listed on Annex II of the E.U. Habitats Directive. The following plants, relatively rare nationally, are also found within the site: Toothwort (Lathraea squamaria) - associated with woodlands on the Awbeg and Blackwater; Summer Snowflake (Leucojum aestivum) and Flowering Rush (Butomus umbellatus) on the Blackwater; Common Calamint (Calamintha ascendens), Red Campion, Sand Leek (Allium scorodoprasum) and Wood Club-rush (Scirpus sylvaticus) on the Awbeg.

The site is also important for the presence of several E.U. Habitats Directive Annex II animal species, including Sea Lamprey (Petromyzon marinus), Brook Lamprey (Lampetra planeri), River Lamprey (L. fluviatilis), Twaite Shad (Alosa fallax fallax), Freshwater Pearl Mussel (Margaritifera margaritifera), Otter (Lutra lutra) and Salmon (Salmo salar). The Awbeg supports a population of White-clawed Crayfish (Austropotamobius pallipes). This threatened species has been recorded from a number of locations and its remains are also frequently found in Otter spraints, particularly in the lower reaches of the river. The freshwater stretches of the Blackwater and Bride Rivers are designated Salmonid rivers. The Blackwater is noted for its enormous run of Salmon over the years. The river is characterised by significant pools, streams, glides, and generally, a good push of water coming through except in very low water. Spring Salmon fishing can be carried out as far upstream as Fermoy and is highly regarded especially at Careysville. The Bride, main Blackwater upstream of Fermoy, and some of the tributaries are more associated with grilse fishing.

The site supports many of the mammal species occurring in Ireland. Those which are listed in the Irish Red Data Book include Pine Marten, Badger and Irish Hare. The bat species Natterer's Bat, Daubenton's Bat, Whiskered Bat, Brown Long-eared Bat and Pipistrelle, can be seen feeding along the river, roosting under the old bridges and in old buildings.

Common Frog, a Red Data Book species that is also legally protected (Wildlife Act, 1976), occurs throughout the site. The rare bush cricket Metrioptera roselii (Order Orthoptera) has been recorded in the reed/willow vegetation of the river embankment on the Lower Blackwater River. The Swan Mussel (Anodonta cygnea), a scarce species nationally, occurs at a few sites along the freshwater stretches of the Blackwater.

Several bird species listed on Annex I of the E.U. Birds Directive are found on the site. Some use it as a staging area, others are vagrants, while others use it more regularly. Internationally important numbers of Whooper Swan (average peak 174, 1994/95-95/96) and nationally important numbers Bewick's Swan (average peak 5, 1996/97-2000/01) use the Blackwater Callows. Golden Plover occur in regionally important numbers on the Blackwater estuary (average peak 885, 1984/85-86/87) and on the River Bride (absolute maximum 2,141, 1994/95). Staging Terns visit the site annually, with >300 Sandwich Tern and >200 Arctic/Common Tern (average peak 1974-1994). The site also supports populations of the following: Red Throated Diver, Great Northern Diver, Barnacle Goose, Ruff, Wood Sandpiper and Greenland Whitefronted Goose. Three breeding territories for Peregrine Falcon are known along the Blackwater Valley. This, the Awbeg and the Bride River are also thought to support at least 30 pairs of Kingfisher. Little Egret breed at the site (12 pairs in 1997, 19 pairs in 1998).

The site holds important numbers of wintering waterfowl. Both the Blackwater Callows and the Blackwater Estuary Special Protection Areas (SPAs) hold internationally important numbers of Black-tailed Godwit (average peak 847, 1994/95-95/96 on the callows, average peak 845, 1974/75-93/94 in the estuary). The Blackwater Callows also hold Wigeon (average peak 2,752), Teal (average peak 1,316), Mallard (average peak 427), Shoveler (average peak 28), Lapwing (average peak 880), Curlew (average peak 416) and Black-headed Gull (average peak 396) (counts from 1994/95-95/96). Numbers of birds using the Blackwater Estuary, given as the mean of the highest monthly maxima over 20 years (1974-94), are Shelduck (137 +10 breeding pairs), Wigeon (780), Teal (280), Mallard (320 + 10 breeding pairs), Goldeneye (11-97), Oystercatcher (340), Ringed Plover (50 + 4 breeding pairs), Grey Plover (36), Lapwing (1,680), Knot (150), Dunlin (2,293), Snipe (272), Black-tailed Godwit (845), Bar-tailed Godwit (130), Curlew (920), Redshank (340), Turnstone (130), Black-headed Gull (4,000) and Lesser Black-backed Gull (172). The greatest numbers (75%) of the wintering waterfowl of the estuary are located in the Kinsalebeg area on the east of the estuary in Co. Waterford. The remainder are concentrated along the Tourig estuary on the Co. Cork side.

The river and river margins also support many Heron, non-breeding Cormorant and Mute Swan (average peak 53, 1994/95-95/96 in the Blackwater Callows). Heron occurs all along the Bride and Blackwater Rivers: 2 or 3 pairs at Dromana Rock; approximately 25 pairs in the woodland opposite; 8 pairs at Ardsallagh Wood and around 20 pairs at Rincrew Wood have been recorded. Some of these are quite large and significant heronries. Significant numbers of Cormorant are found north of the bridge at Youghal and there are some important roosts present at Ardsallagh Wood, downstream of Strancally Castle and at the mouth of the Newport River. Of note are the high numbers of wintering Pochard (e.g. 275 individuals in 1997) found at Ballyhay quarry on the Awbeg, the best site for Pochard in Co. Cork.

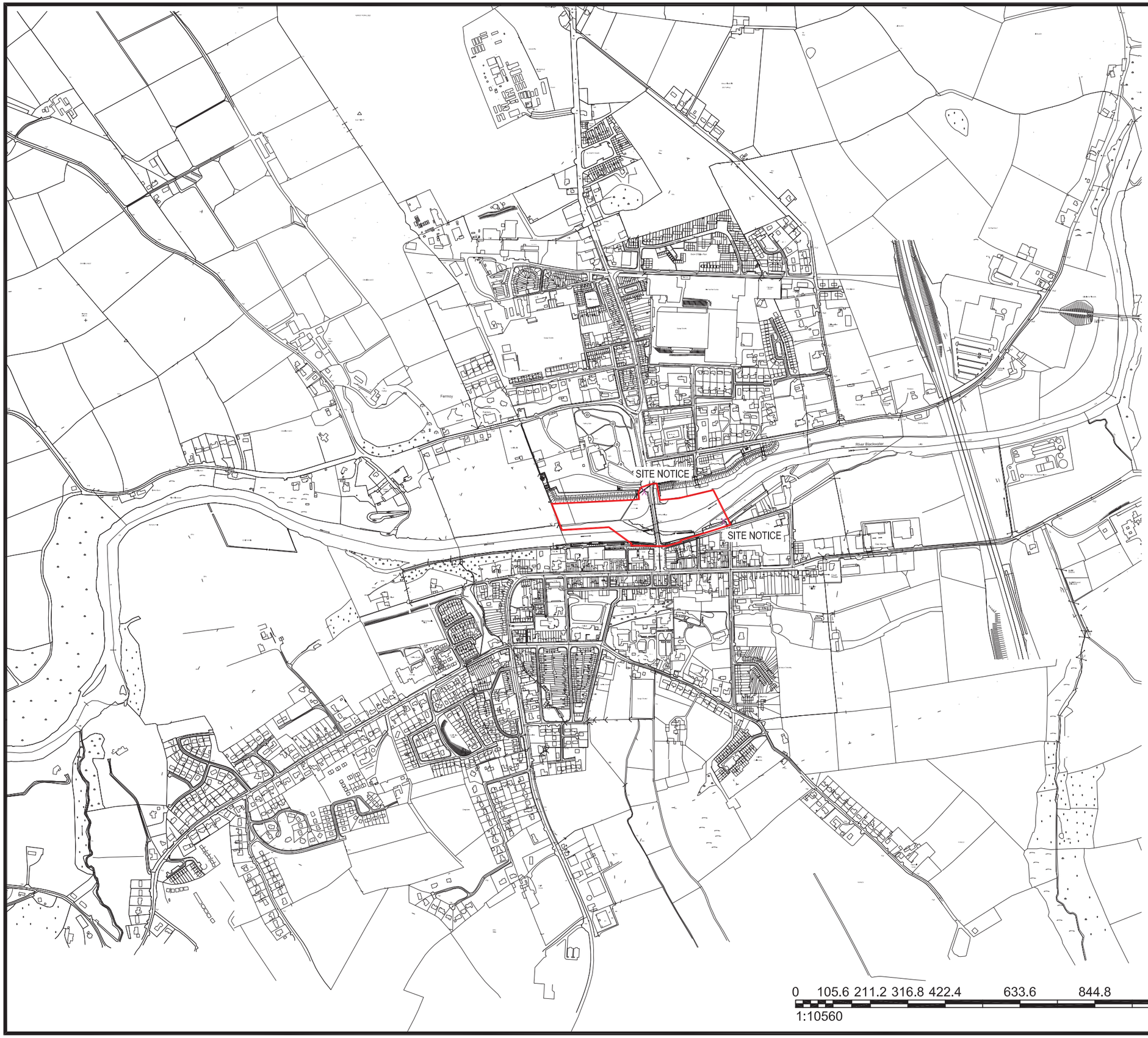
Other important species found within the site include Long-eared Owl, which occurs all along the Blackwater River, and Barn Owl, a Red Data Book species, which is found in some old buildings and in Castlehyde, west of Fermoy. Reed Warbler, a scarce breeding species in Ireland, was found for the first time in the site in 1998 at two locations. It is not known whether or not this species breeds on the site, although it breeds nearby to the south of Youghal. Dipper occurs on the rivers.

Land use at the site is mainly centred on agricultural activities. The banks of much of the site and the callows, which extend almost from Fermoy to Cappoquin, are dominated by improved grasslands which are drained and heavily fertilised. These areas are grazed and used for silage production. Slurry is spread over much of this area. Arable crops are also grown. The spreading of slurry and fertiliser poses a threat to the water quality of this Salmonid river and to the populations of E.U. Habitats Directive Annex II animal species within it. Many of the woodlands along the rivers belong to old estates and support many non-native species. Little active woodland management occurs. Fishing is a main tourist attraction along stretches of the Blackwater and its tributaries, and there are a number of angler associations, some with a number of beats. Fishing stands and styles have been erected in places. Both commercial and leisure fishing takes place on the rivers. Other recreational activities such as boating, golfing and walking are also popular. Water skiing is carried out at Villierstown. Parts of Doneraile Park and Anne's Grove are included in the site: both areas are primarily managed for amenity purposes. There is some hunting of game birds and Mink within the site. Ballyhay quarry is still actively quarried for sand and gravel. Several industrial developments, which discharge into the river, border the site.

The main threats to the site and current damaging activities include high inputs of nutrients into the river system from agricultural run-off and several sewage plants, dredging of the upper reaches of the Awbeg, over-grazing within the woodland areas, and invasion by non-native species, for example Rhododendron and Cherry Laurel.

Overall, the River Blackwater is of considerable conservation significance for the occurrence of good examples of habitats and populations of plant and animal species that are listed on Annexes I and II of the E.U. Habitats Directive respectively. Furthermore, it is of high conservation value for the populations of bird species that use it. Two Special Protection Areas, designated under the E.U. Birds Directive, are also located within the site - Blackwater Callows and Blackwater Estuary. Additionally, the importance of the site is enhanced by the presence of a suite of uncommon plant species.

## Appendix 2. Site Drawings




N

LEGEND:

PLANNING RED LINE BOUNDARY

PERMANENT WAYLEAVES

SITE NOTICE LOCATION X

| REV | STAT | DESCRIPTION | DATE |
|---|---|---|---|
| C01 | AP | ISSUED FOR PLANNING | 02.06.2022 |

DRAWING STATUS: ISSUED FOR PLANNING

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Tel: 01-295 2321 Fax: 01-295 4541 Email: tjoc@tjoc.ie Web: www.tjoc.ie

PROJECT: FERMOY WEIR REMEDIATION & FISH BYPASS CHANNEL

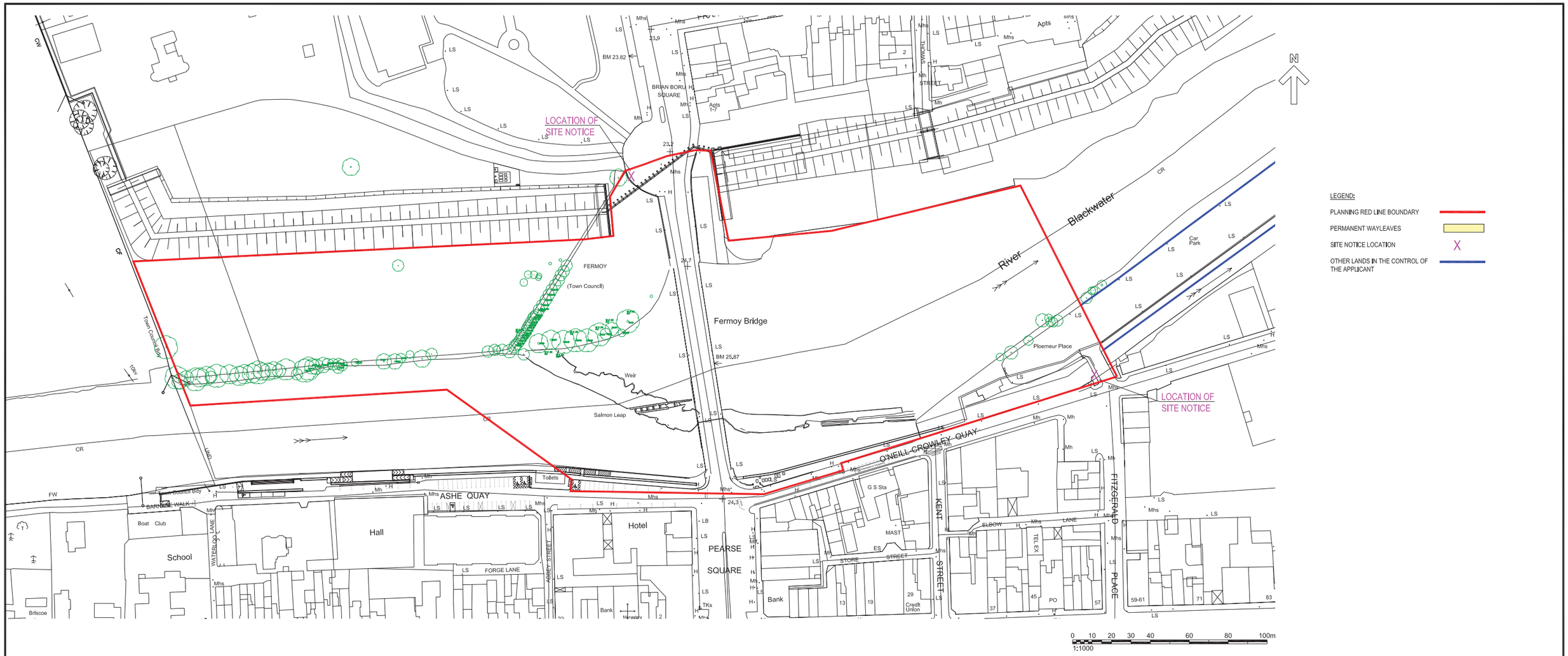
CLIENT: CORK COUNTY COUNCIL

DRAWING TITLE: SITE LOCATION MAP

SCALE: 1:10560 (A3)

PROJECT - ORIGINATOR - VOLUME - LOCATION - TYPE - ROLE - NUMBER
19011-TJOC-PL-XX-DR-C-0048

REV: C01




LEGEND:

- PLANNING RED LINE BOUNDARY
- PERMANENT WAYLEAVES
- SITE NOTICE LOCATION X
- OTHER LANDS IN THE CONTROL OF THE APPLICANT

MAP REPRODUCED BY PERMISSION OF ORDNANCE SURVEY IRELAND (CORK CCMA 9802)

| REV | STAT | DESCRIPTION | DATE |
|---|---|---|---|
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PROJECT: FERMOY WEIR REMEDIATION AND FISH BYPASS CHANNEL

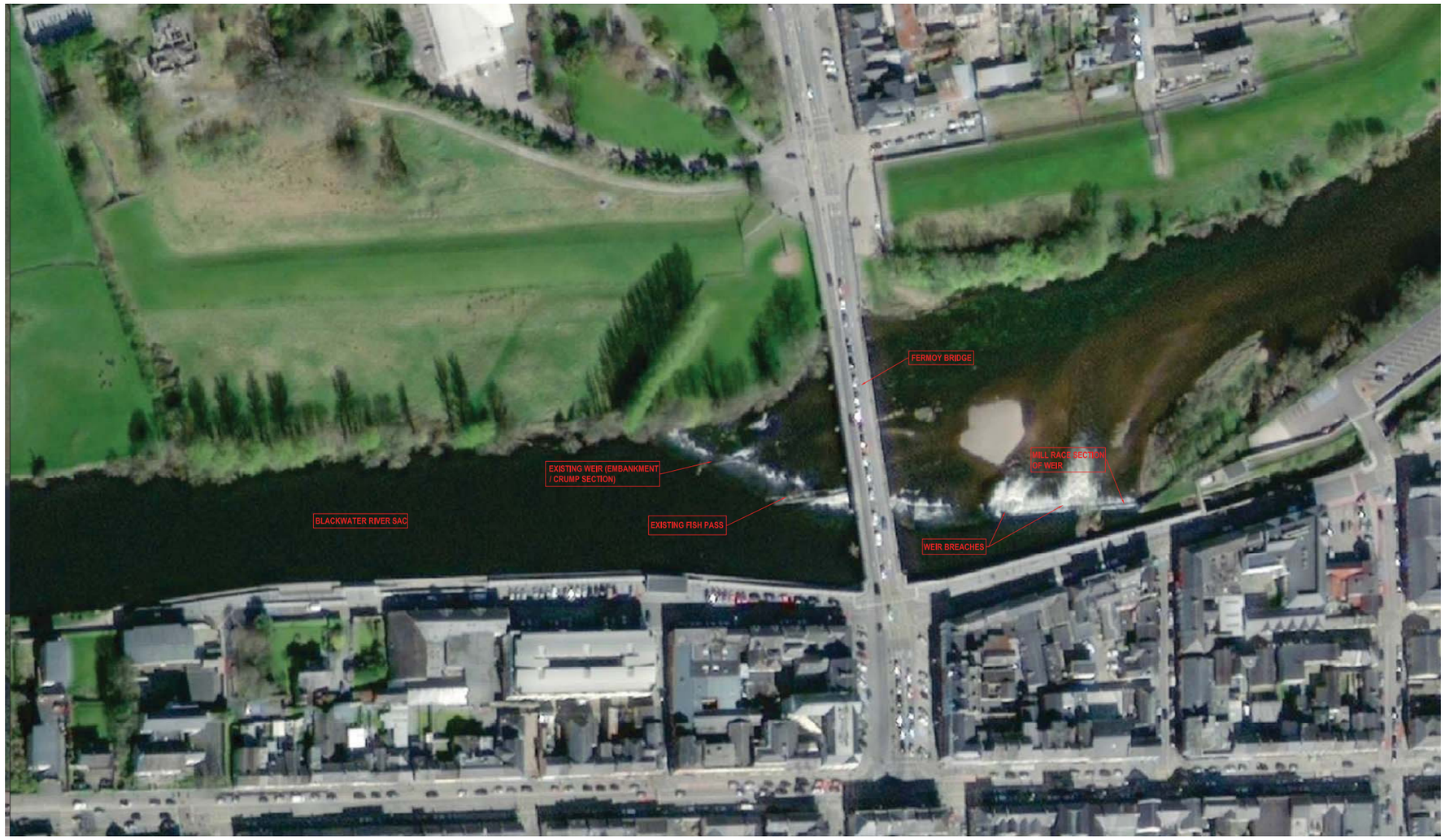
CLIENT: CORK COUNTY COUNCIL

DRAWING TITLE: SITE LOCATION PLAN

SCALE: 1:1000 (A1)

PROJECT - ORIGINATOR - VOLUME - LOCATION - TYPE - ROLE - NUMBER: 19011-TJOC-PL-XX-DR-C-0049

REV: C01




N

0 10 20 30 40 60 80 100m
1:1000

Lidar Survey supplied by
Cork County Council
26th June 2018

| REV | STAT | DESCRIPTION | DATE |
|---|---|---|---|
| C01 | AP | ISSUED FOR PLANNING | 02.06.2022 |

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PROJECT: FERMOY WEIR REMEDIATION AND FISH BYPASS CHANNEL

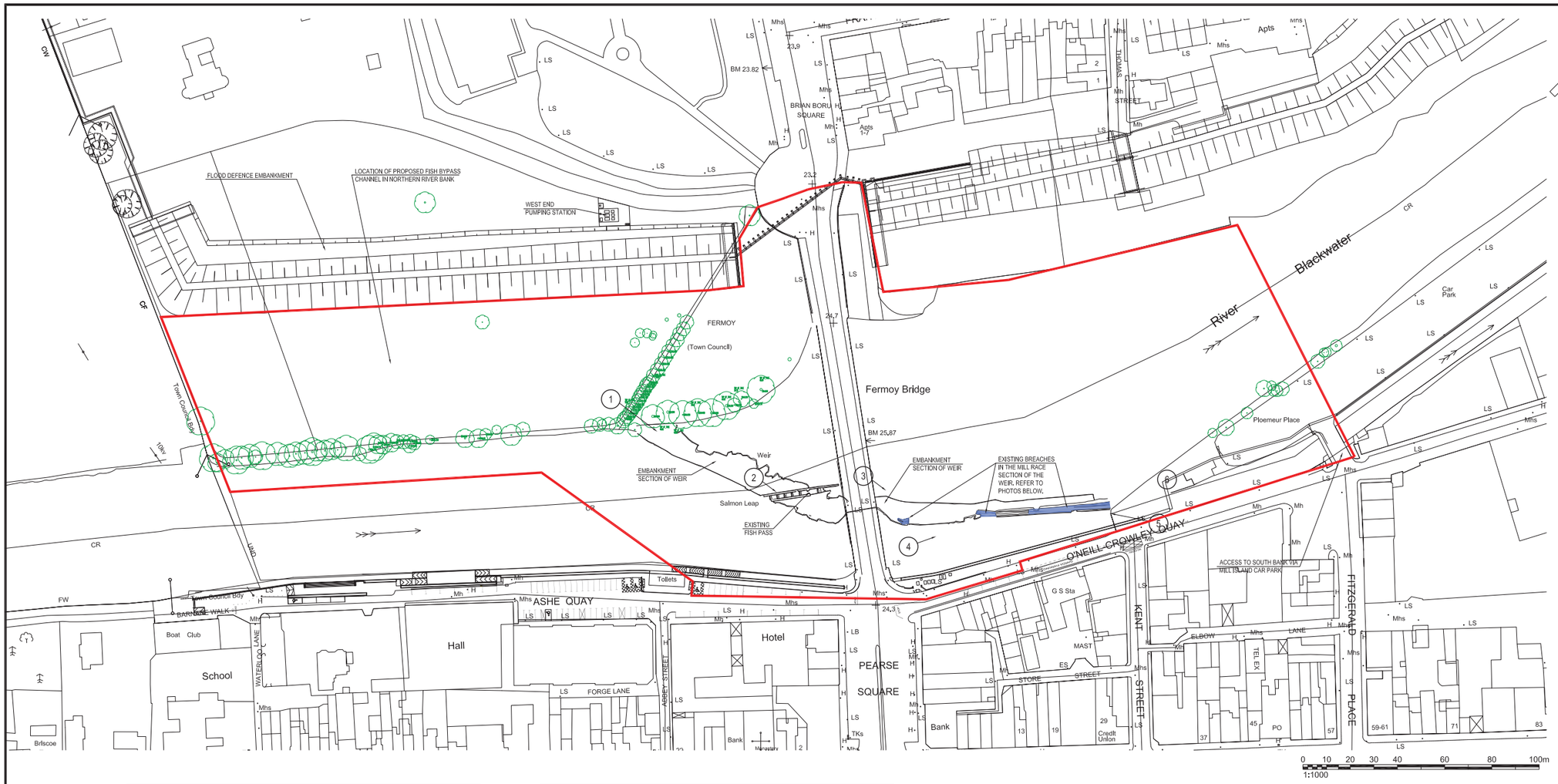
CLIENT: CORK COUNTY COUNCIL

DRAWING TITLE: FERMOY WEIR AERIAL VIEW OF EXISTING SITE

SCALE: 1:1000 (A1)

PROJECT - ORIGINATOR - VOLUME - LOCATION - TYPE - ROLE - NUMBER
19011-TJOC-PL-XX-DR-C-0050

REV: C01




NOTES:

1. TREE INFORMATION SHOWN ON THIS DRAWING IS TAKEN FROM GEODATA SURVEYING LTD. TOPOGRAPHICAL SURVEY OF JUNE 2020.
2. EXISTING WEIR INFORMATION SHOWN ON THIS DRAWING IS TAKEN FROM WEIR SURVEY CARRIED OUT BY MURPHY GEOSPACIAL IN AUGUST 2018. EXTENT OF BREACHES SHOWN ARE AS SURVEYED IN 2018 AND MAY HAVE INCREASED IN THE TIME SINCE THE SURVEY HAD BEEN CARRIED OUT.
3. PHOTOS TAKEN IN MARCH 2021.

LEGEND:

SITE BOUNDARY

EXISTING TREES

PHOTO LOCATION AND DIRECTION (1)

EXISTING BREACHES IN WEIR

PHOTO 1 - EMBANKMENT WEIR

PHOTO 3 - INTERFACE BETWEEN EMBANKMENT AND MILL RACE WEIR

PHOTO 5 -EXISTING BREACHES IN MILL RACE SECTION OF WEIR

PHOTO 2 - EXISTING FISH LADDER

PHOTO 4 - EXISTING BREACHES IN MILL RACE SECTION OF WEIR
(LOOKING DOWNSTREAM)

PHOTO 6 -EXISTING BREACHES IN MILL RACE SECTION OF WEIR
(LOOKING UPSTREAM)

MAP REPRODUCED BY PERMISSION OF ORDNANCE SURVEY IRELAND (CORK CCMA 9802)

| REV | STAT | DESCRIPTION | DATE |
|---|---|---|---|
| C01 | AP | ISSUED FOR PLANNING | 02.06.2022 |

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PROJECT: FERMOY WEIR REMEDIATION AND FISH BYPASS CHANNEL

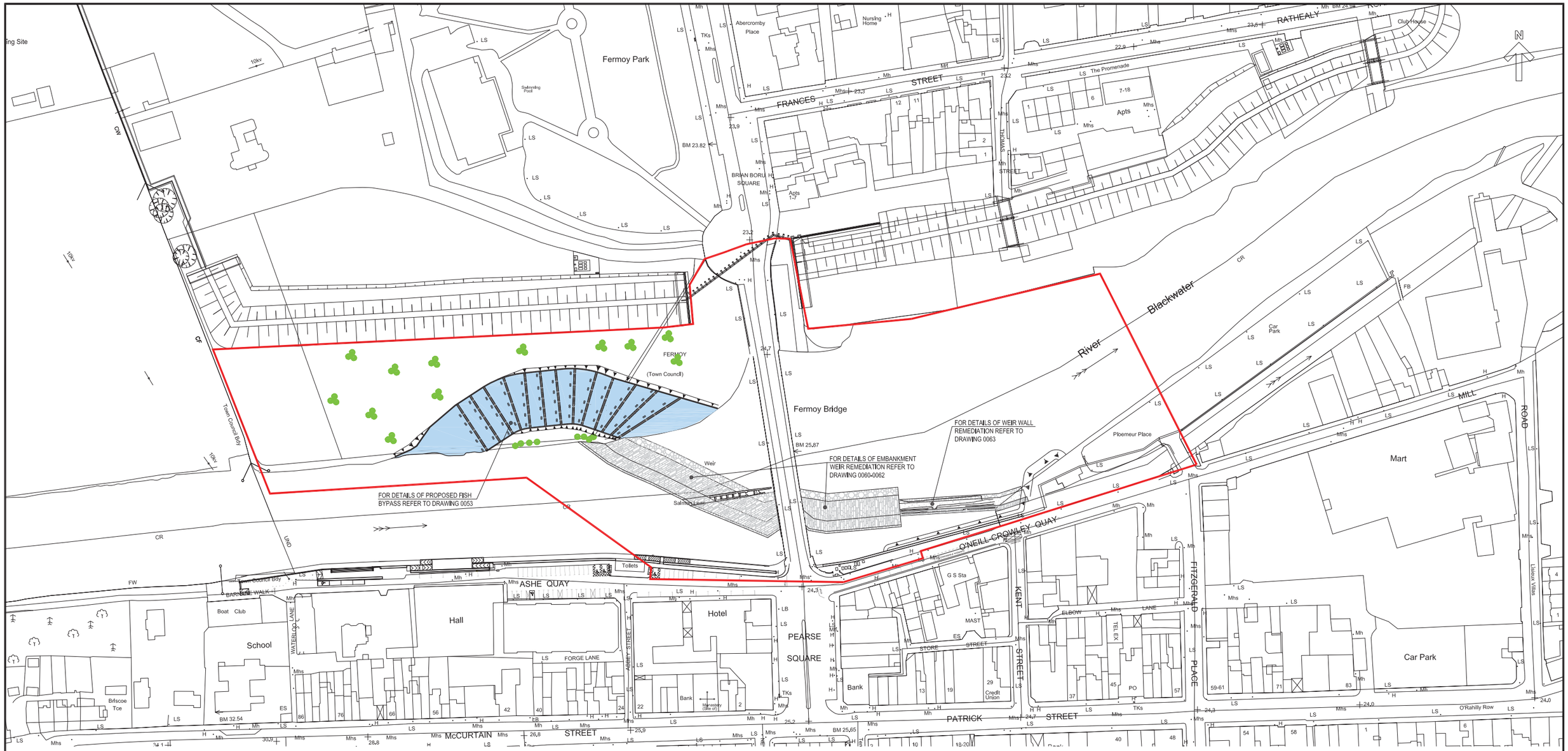
CLIENT: CORK COUNTY COUNCIL

DRAWING TITLE: EXISTING SITE LAYOUT PLAN

SCALE: 1:1000 (A1)

PROJECT - ORIGINATOR - VOLUME - LOCATION - TYPE - ROLE - NUMBER: 19011-TJOC-PL-XX-DR-C-0051

REV: C01




0 10 20 30 40 60 80 100m
1:1000

NOTES:

1. FOR DETAILS OF FISH BYPASS REFER TO DRAWING 0053.
2. FOR DETAILS OF REMEDIATION OF EMBANKMENT SECTION OF WEIR REFER TO DRAWINGS 0060-0062.
3. FOR DETAILS OF REMEDIATION TO MILL RACE SECTION OF WEIR REFER TO DRAWINGS 0060 AND 0063.

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| REV | STAT | DESCRIPTION | DATE |
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| C01 | AP | ISSUED FOR PLANNING | 02.06.2022 |

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PROJECT: FERMOY WEIR REMEDIATION AND FISH BYPASS CHANNEL

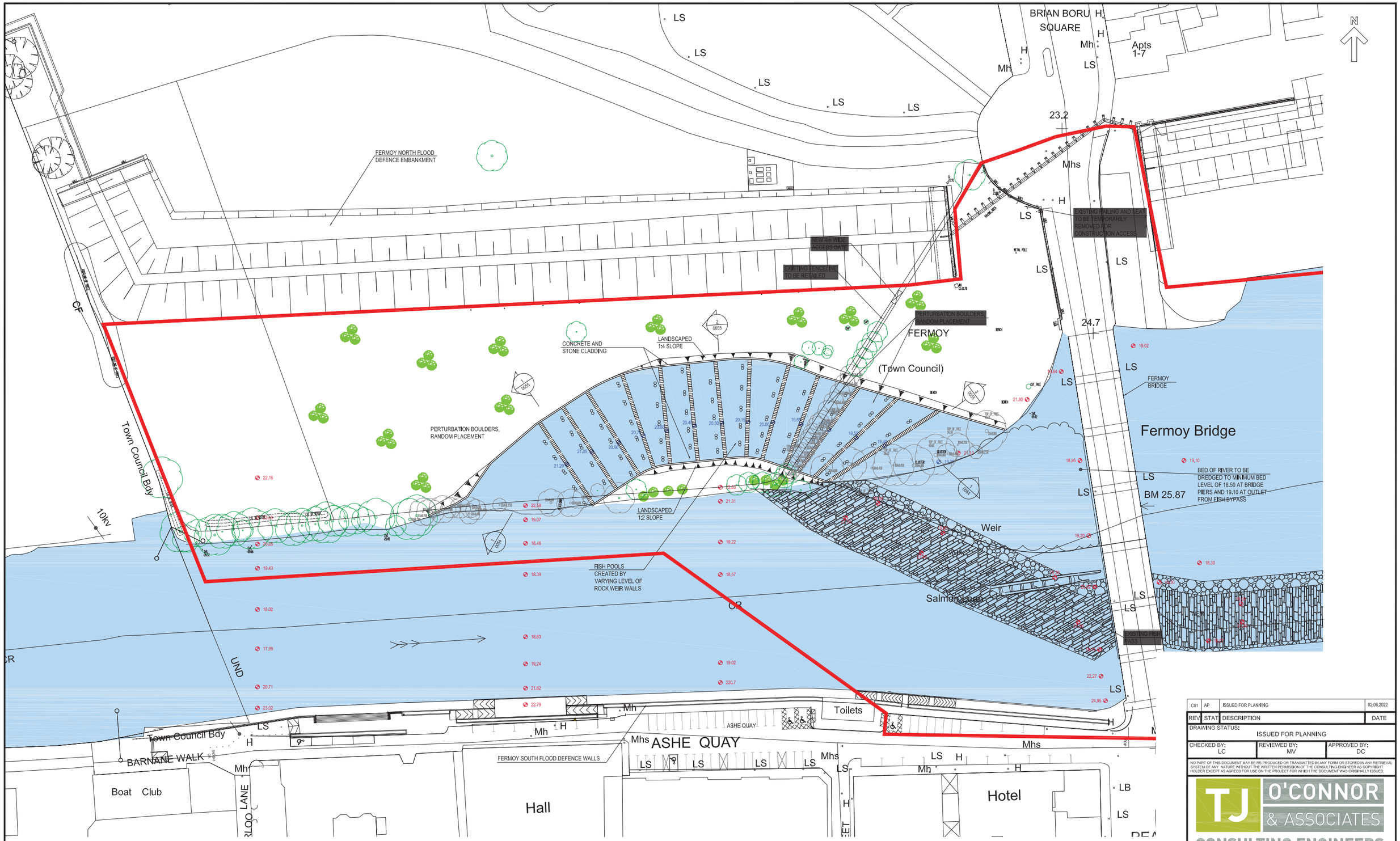
CLIENT: CORK COUNTY COUNCIL

DRAWING TITLE: KEY PLAN
PROPOSED FISH BYPASS, WEIR AND MILL ISLAND PLAN

SCALE: 1:1000 (A1)

PROJECT - ORIGINATOR - VOLUME - LOCATION - TYPE - ROLE - NUMBER
19011-TJOC-PL-XX-DR-C-0052

REV: C01




0 5 10 15 20 30 40 50m
1:500

LEGEND:

- EXISTING RIVER BED LEVELS 19.02
- PROPOSED LEVELS 19.02
- EXISTING TREES
- EXISTING TREES TO BE REMOVED
- PROPOSED PLANTING

NOTES:

1. REFER TO DRAWINGS 0054 AND 0055 FOR SECTION DETAILS OF PROPOSED FISH BYPASS CHANNEL.
2. ALL LEVELS SHOWN RELATE TO ORDNANCE DATUM MALIN HEAD.

| REV | STAT | DESCRIPTION | DATE |
|---|---|---|---|
| C01 | AP | ISSUED FOR PLANNING | 02.06.2022 |

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PROJECT: FERMOY WEIR REMEDIATION AND FISH BYPASS CHANNEL

CLIENT: CORK COUNTY COUNCIL

DRAWING TITLE: PROPOSED FISH BYPASS PLAN

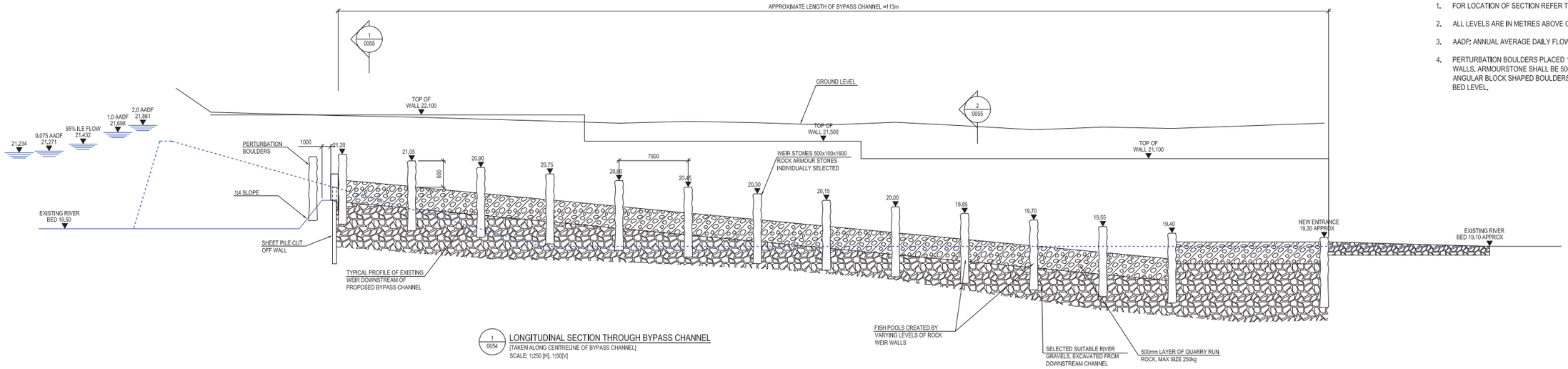
SCALE: 1:500 (A1)

PROJECT - ORIGINATOR - VOLUME - LOCATION - TYPE - ROLE - NUMBER
19011-TJOC-XX-XX-DR-C-0053

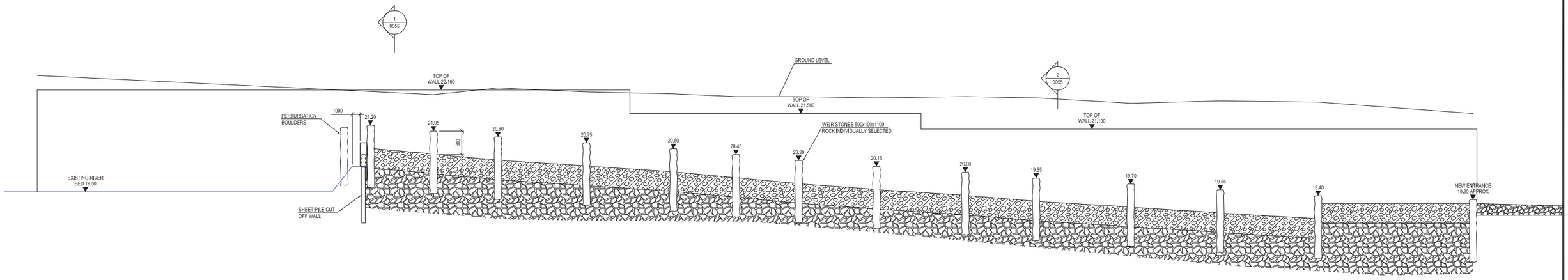
REV: C01

NOTES:

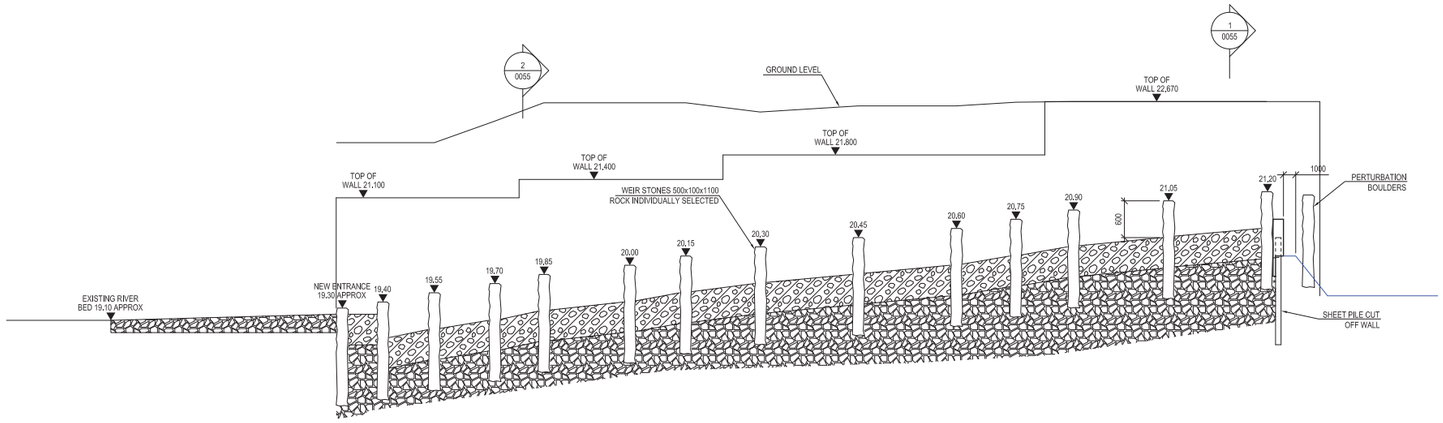
1. FOR LOCATION OF SECTION REFER TO DRAWING 0053.
2. ALL LEVELS ARE IN METRES ABOVE ORDNANCE DATUM MALIN HEAD.
3. AADF: ANNUAL AVERAGE DAILY FLOW
4. PERTURBATION BOULDERS PLACED 1m UPSTREAM OF GAPS IN THE WEIR WALLS. ARMOURSTONE SHALL BE 500x1000x1600 HIGH MIN. DIMENSIONS ANGULAR BLOCK SHAPED BOULDERS PROJECTION 500mm ABOVE THE RAMP BED LEVEL.




1 / 0054 LONGITUDINAL SECTION THROUGH BYPASS CHANNEL
[TAKEN ALONG CENTRELINE OF BYPASS CHANNEL]
SCALE: 1:250 [H], 1:50[V]




2 / 0054 ELEVATION OF NORTHERN WALL OF BYPASS CHANNEL
SCALE: 1:250 [H], 1:50[V]




3 / 0054 ELEVATION OF SOUTHERN WALL OF BYPASS CHANNEL
SCALE: 1:250 [H], 1:50[V]

| REV | STAT | DESCRIPTION | DATE |
|---|---|---|---|
| C01 | AP | ISSUED FOR PLANNING | 02.06.2022 |

DRAWING STATUS: ISSUED FOR PLANNING

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PROJECT: FERMOY WEIR REMEDIATION AND FISH BYPASS CHANNEL

CLIENT: CORK COUNTY COUNCIL

DRAWING TITLE: PROPOSED FISH BYPASS LONGITUDINAL SECTION

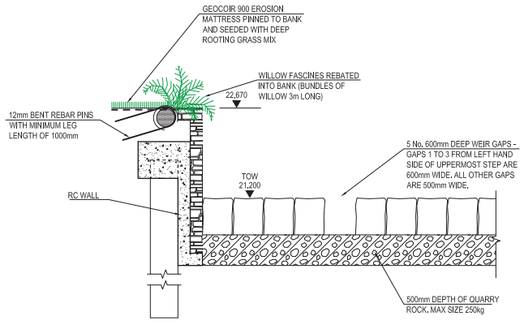
SCALE: 1:250 [H], 1:50 [V] (A1)

PROJECT - ORIGINATOR - VOLUME - LOCATION - TYPE - ROLE - NUMBER
19011-TJOC-XX-XX-DR-C-0054

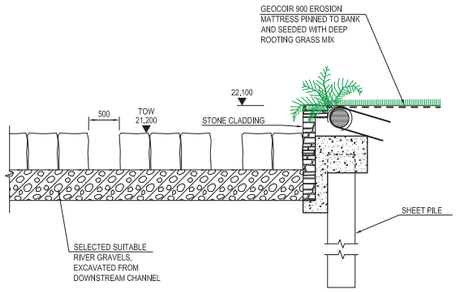
REV: C01

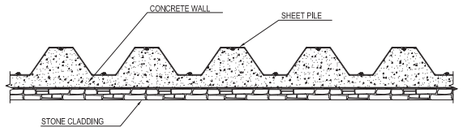
NOTES:

1. FOR LOCATION OF SECTIONS REFER TO DRAWING 0053.
2. ALL LEVELS ARE IN METERS ABOVE ORDNANCE DATUM MALIN HEAD

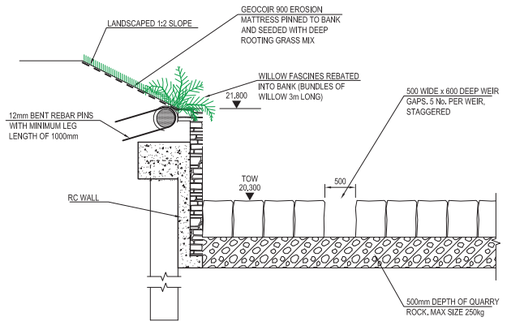



1 / 0055 SECTION
SCALE: 1:50

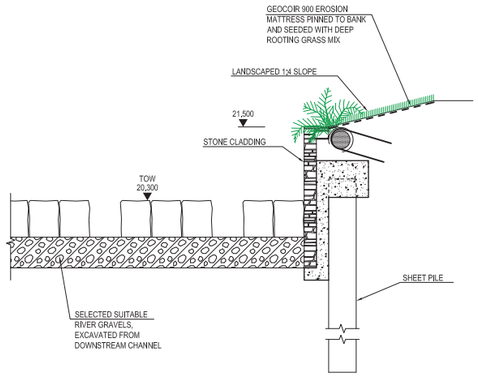


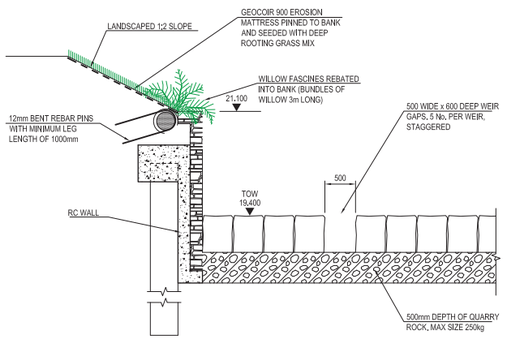




4 / 0055 DETAIL PART PLAN OF SHEET PILE WALL
SCALE: 1:50

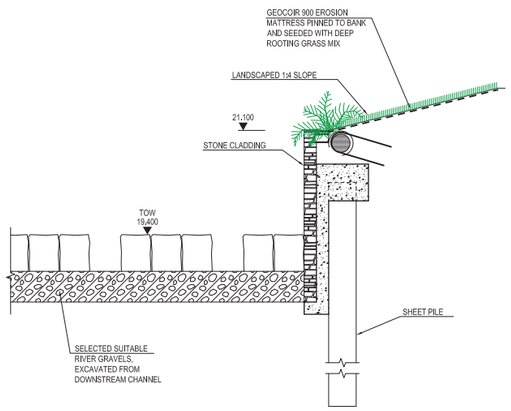



2 / 0055 SECTION
SCALE: 1:50




3 / 0055 SECTION
SCALE: 1:50

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| C01 | AP | ISSUED FOR PLANNING | 02.06.2022 |

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Tel: 01-295 2321 Fax: 01-295 4541 Email: tjoc@tjoc.ie Web: www.tjoc.ie

PROJECT: FERMOY WEIR REMEDIATION AND FISH BYPASS CHANNEL

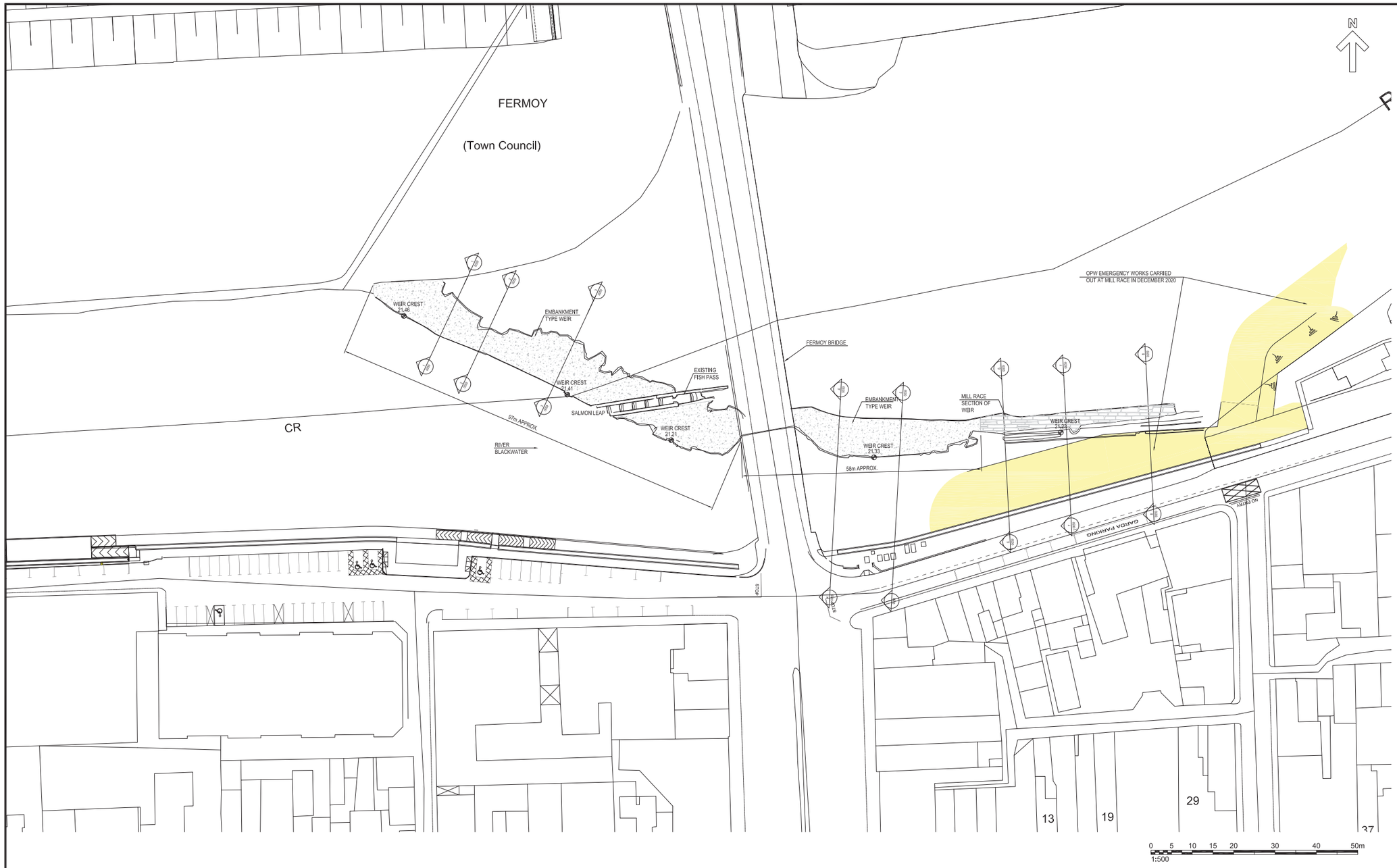
CLIENT: CORK COUNTY COUNCIL

DRAWING TITLE: FISH BYPASS SECTIONS

SCALE: 1:50 (A1)

PROJECT - ORIGINATOR - VOLUME -LOCATION- TYPE -ROLE- NUMBER
19011-TJOC-XX-XX-DR-C-0055

REV: C01




NOTES:

1. EXTENT OF EXISTING WEIR BASE ON TOPOGRAPHICAL SURVEY UNDERTAKEN BY MURPHY GEOSPACIAL IN AUGUST 2018.
2. FOR SECTIONS THROUGH EXISTING WEIR REFER TO DRAWING 0059.

APPROXIMATE EXTENT OF BED STABILISATION WORKS UNDERTAKEN BY THE OPW IN 2020

MAP REPRODUCED BY PERMISSION OF ORDNANCE SURVEY IRELAND (CORK CCMA 9802)

| REV | SUIT | DESCRIPTION | DATE |
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Tel: 01-295 2321 Fax: 01-295 4541 Email: tjoc@tjoc.ie Web: www.tjoc.ie

PROJECT: FERMOY EMBANKMENT WEIR REMEDIATION AND FISH BYPASS CHANNEL

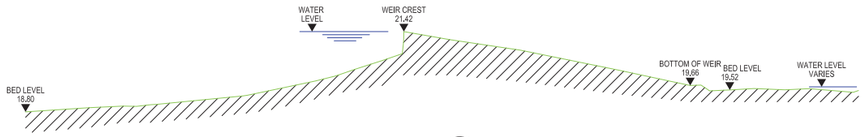
CLIENT: CORK COUNTY COUNCIL

DRAWING TITLE: WEIR REMEDIATION PLAN OF EXISTING WEIR

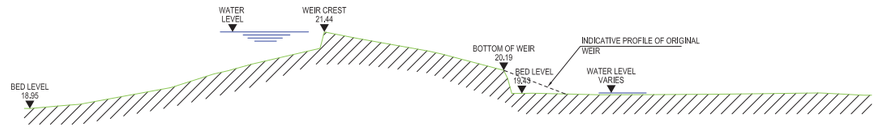
SCALE: 1:500 (A1)

PROJECT - ORIGINATOR - VOLUME - LOCATION - TYPE - ROLE - NUMBER
19011-TJOC-PL-XX-DR-C-0058

REV: C01




1 / 0059 EXISTING EMBANKMENT WEIR SECTION
SCALE: 1:100




2 / 0059 EXISTING EMBANKMENT WEIR SECTION
SCALE: 1:100

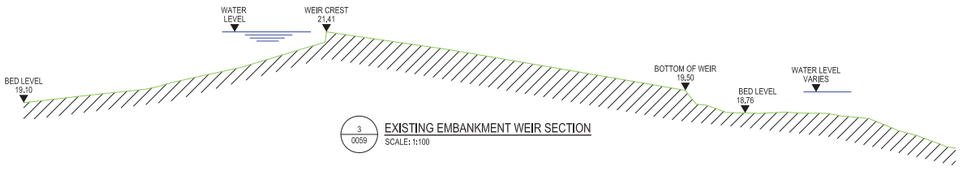
NOTES:

1. FOR LOCATION OF SECTIONS REFER TO DRAWING 0058.
2. ALL LEVELS SHOWN ARE IN METERS ABOVE ORDNANCE DATUM, MALIN HEAD.
3. AUGUST 2018 AND AUGUST 2020 SURVEYS OF THE RIVER BED AND WEIR UNDERTAKEN BY MURPHY GEOSPATIAL AND CARRIED OUT TO ITM.
4. AUG 2018 SURVEY DRAWING REFERENCE 27232 18024_Fermoy_Weir
5. AUG 2020 SURVEY DRAWING REFERENCE MSL37760_01
6. SECTIONS SHOW APPROXIMATE BED PROFILE FOLLOWING WORKS COMPLETED BY OPW IN AUTUMN 2020.

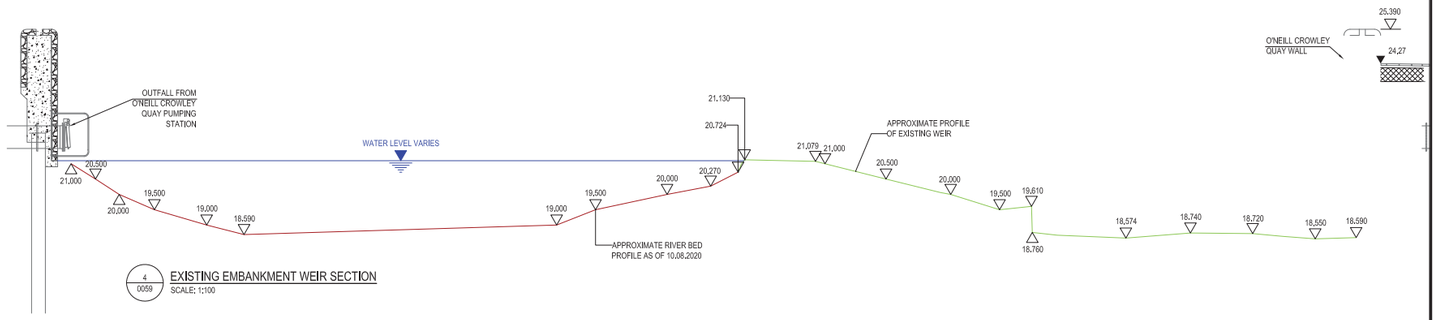
LEGEND:

AUGUST 2018 SURVEY PROFILE

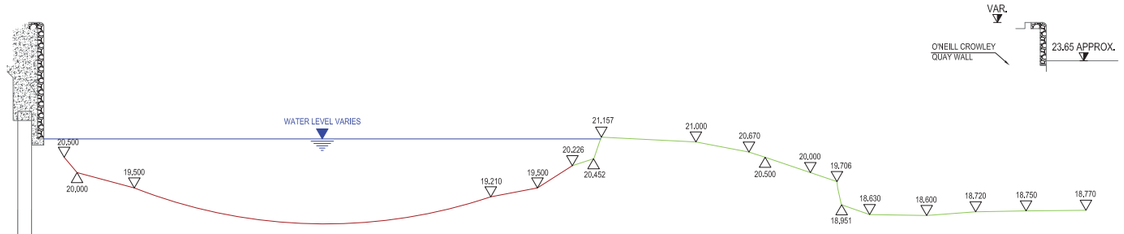
AUGUST 2020 SURVEY BED PROFILE



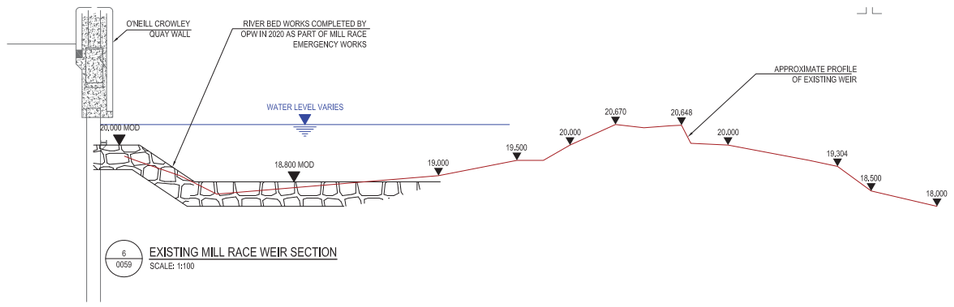

3 / 0059 EXISTING EMBANKMENT WEIR SECTION
SCALE: 1:100



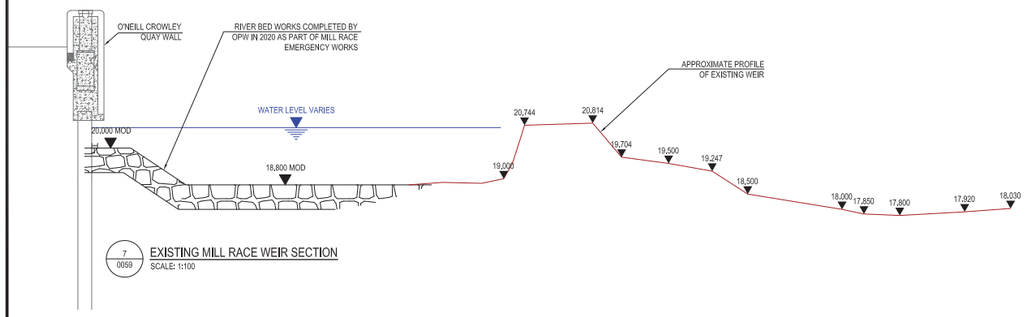

4 / 0059 EXISTING EMBANKMENT WEIR SECTION
SCALE: 1:100



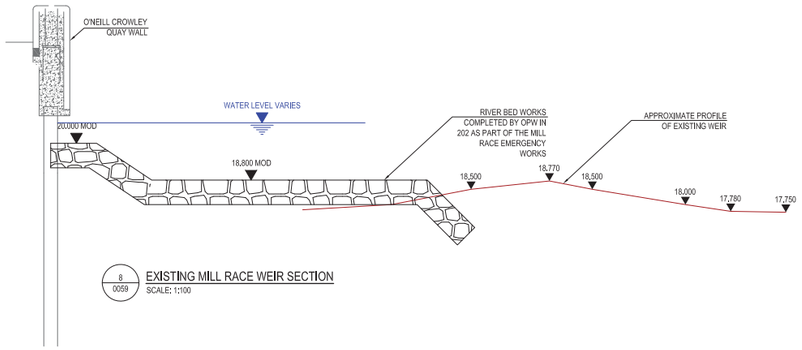

5 / 0059 EXISTING EMBANKMENT WEIR SECTION
SCALE: 1:100




6 / 0059 EXISTING MILL RACE WEIR SECTION
SCALE: 1:100




7 / 0059 EXISTING MILL RACE WEIR SECTION
SCALE: 1:100




8 / 0059 EXISTING MILL RACE WEIR SECTION
SCALE: 1:100

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Tel: 01-295 2321 Fax: 01-295 4541 Email: tjoc@tjoc.ie Web: www.tjoc.ie

PROJECT: FERMOY WEIR REMEDIATION AND FISH BYPASS CHANNEL

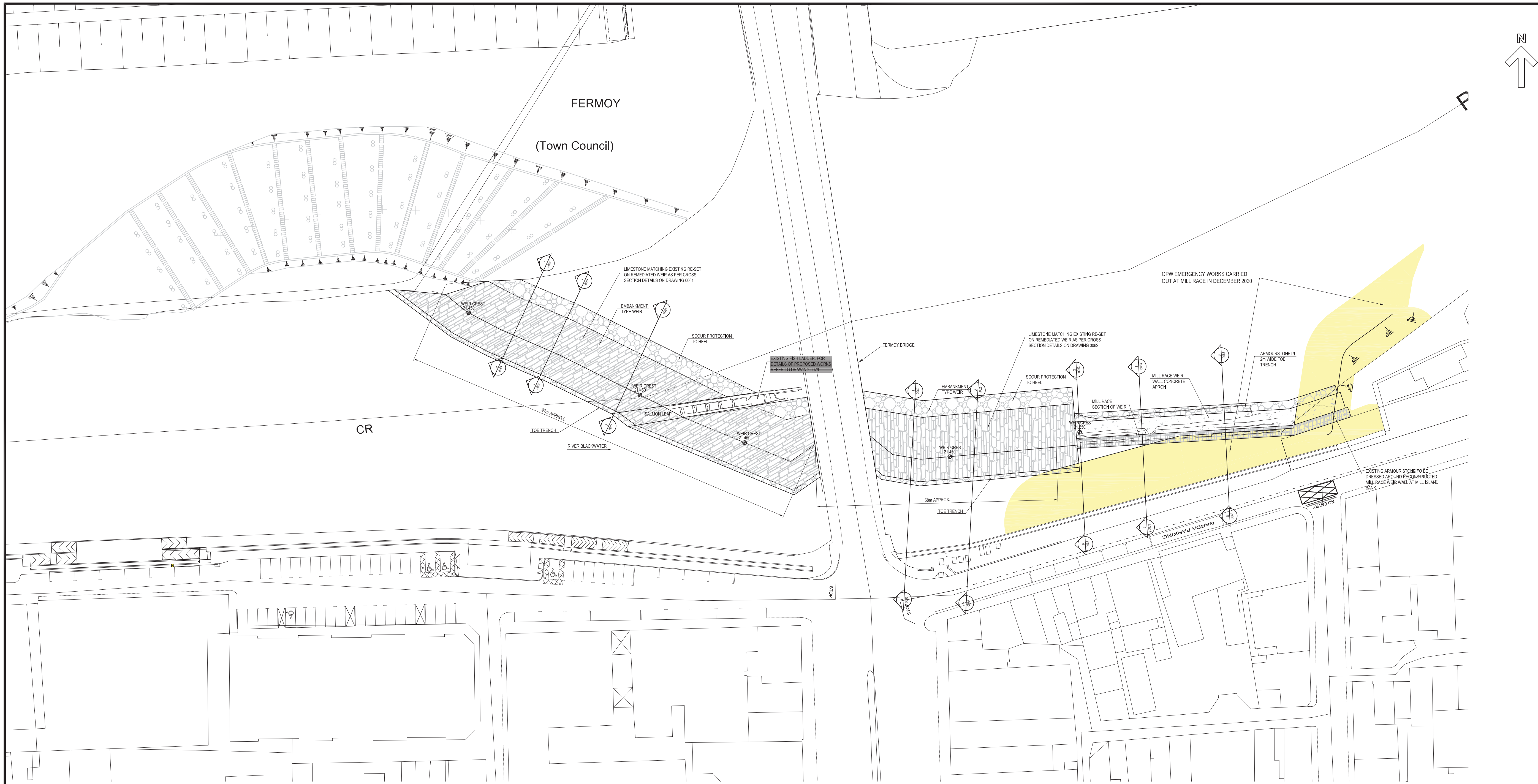
CLIENT: CORK COUNTY COUNCIL

DRAWING TITLE: PROPOSED WEIR REMEDIATION EXISTING SECTIONS

SCALE: AS SHOWN (A1)

PROJECT - ORIGINATOR - VOLUME -LOCATION- TYPE -ROLE- NUMBER
19011-TJOC-PL-XX-DR-C-0059

REV: C01




0 5 10 15 20 30 40 50m
1:500

NOTES:

1. FOR SECTIONS THROUGH PROPOSED EMBANKMENT WEIR REFER TO DRAWINGS 0061 AND 0062.
2. FOR SECTIONS THROUGH PROPOSED MILL RACE WEIR REFER TO DRAWING 0063.
3. ALL LEVELS ARE IN METRES ABOVE ORDNANCE DATUM MALIN HEAD.
4. WEIR REMEDIATION SHALL BE UNDERTAKEN IN ACCORDANCE WITH THE CONSERVATION ENGINEER'S RECOMMENDATIONS.

APPROXIMATE EXTENT OF BED STABILISATION WORKS UNDERTAKEN BY THE OPW IN 2020

MAP REPRODUCED BY PERMISSION OF ORDNANCE SURVEY IRELAND (CORK CCMA 9802)

| REV | SUIT | DESCRIPTION | DATE |
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Tel: 01-295 2321 Fax: 01-295 4541 Email: tjoc@tjoc.ie Web: www.tjoc.ie

PROJECT: FERMOY EMBANKMENT WEIR REMEDIATION AND FISH BYPASS CHANNEL

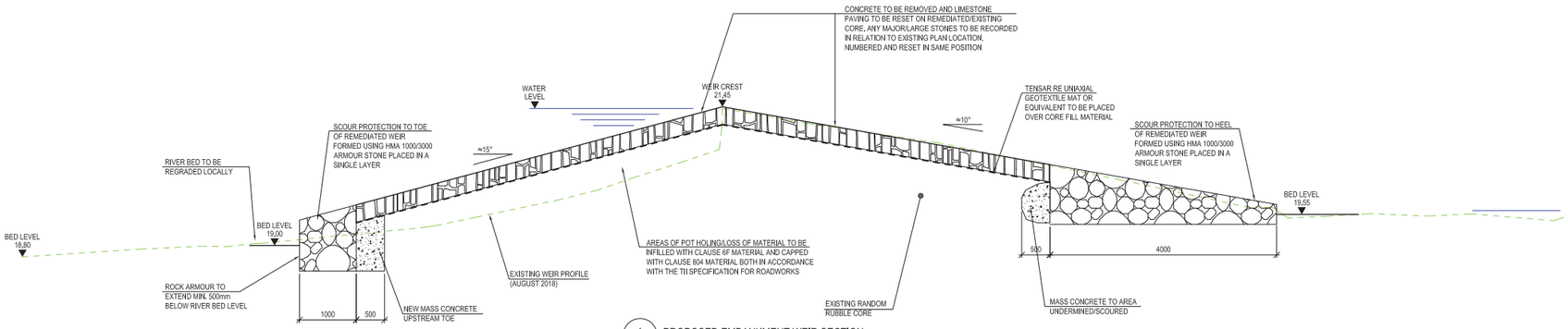
CLIENT: CORK COUNTY COUNCIL

DRAWING TITLE: WEIR REMEDIATION PLAN OF PROPOSED WEIR

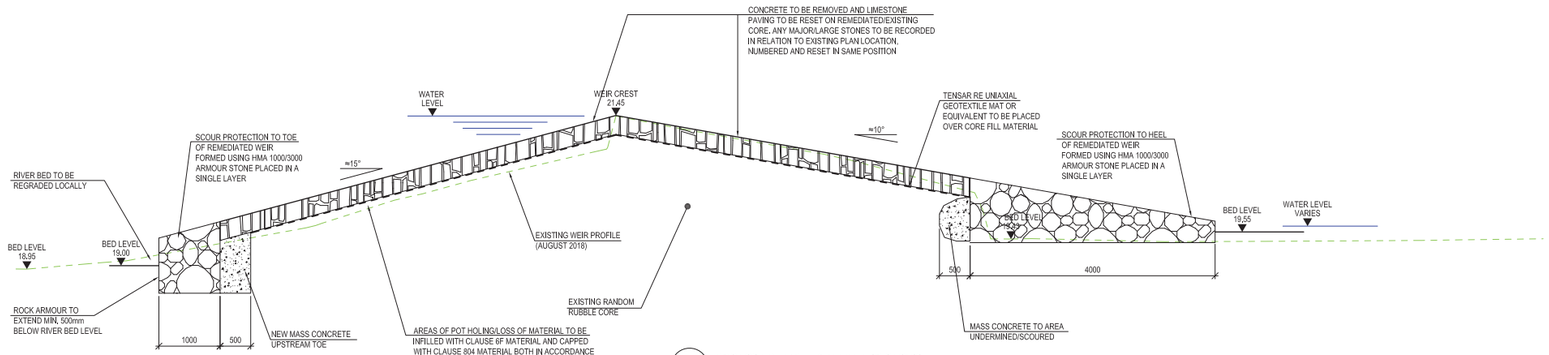
SCALE: 1:500 (A1)

PROJECT - ORIGINATOR - VOLUME - LOCATION - TYPE - ROLE - NUMBER
19011-TJOC-PL-XX-DR-C-0060

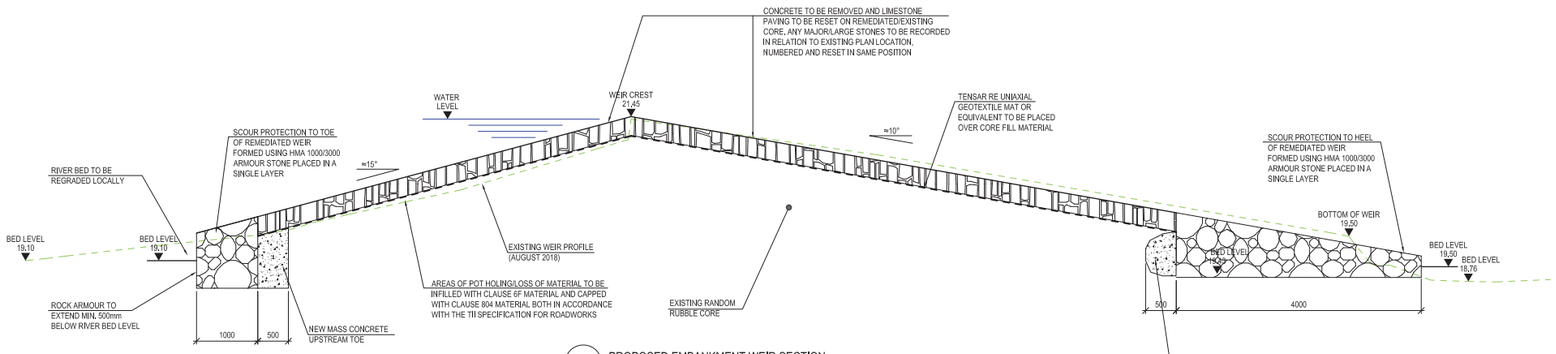
REV: C01




1 / 0061 PROPOSED EMBANKMENT WEIR SECTION
SCALE: 1:50




2 / 0061 PROPOSED EMBANKMENT WEIR SECTION
SCALE: 1:50




3 / 0061 PROPOSED EMBANKMENT WEIR SECTION
SCALE: 1:50

NOTES:

1. ALL LEVELS SHOWN ARE IN METERS ABOVE ORDNANCE DATUM, MALIN HEAD.
2. FOR LOCATIONS OF SECTIONS REFER TO DRAWING 0060.
3. THIS DRAWING SHALL BE READ IN CONJUNCTION WITH SURVEY DRAWINGS OF EXISTING WEIR STRUCTURE AND WITH SECTION DRAWINGS 0062 AND 0063.
4. WEIR REMEDIATION SHALL BE UNDERTAKEN IN ACCORDANCE WITH THE CONSERVATION ENGINEER'S RECOMMENDATIONS.

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Tel: 01-295 2321 Fax: 01-295 4541 Email: tjoc@tjoc.ie Web: www.tjoc.ie

PROJECT: FERMOY WEIR REMEDIATION AND FISH BYPASS CHANNEL

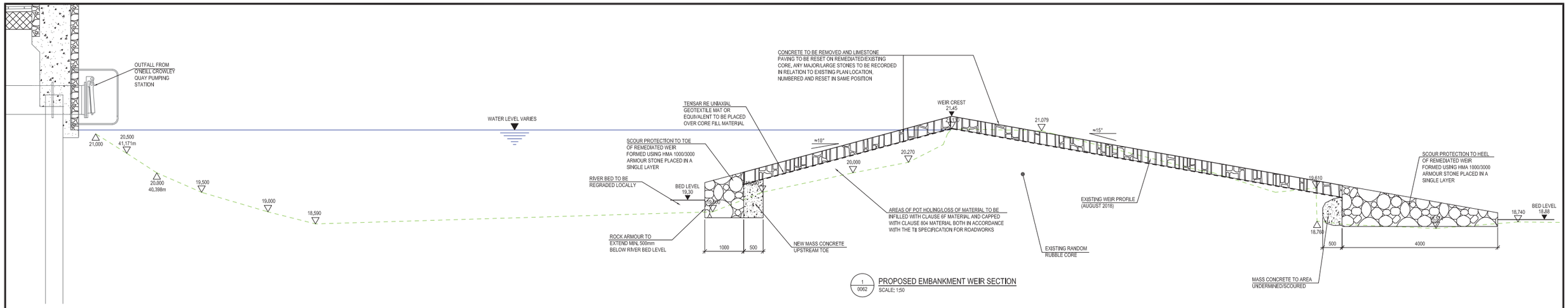
CLIENT: CORK COUNTY COUNCIL

DRAWING TITLE: WEIR REMEDIATION PROPOSED SECTIONS

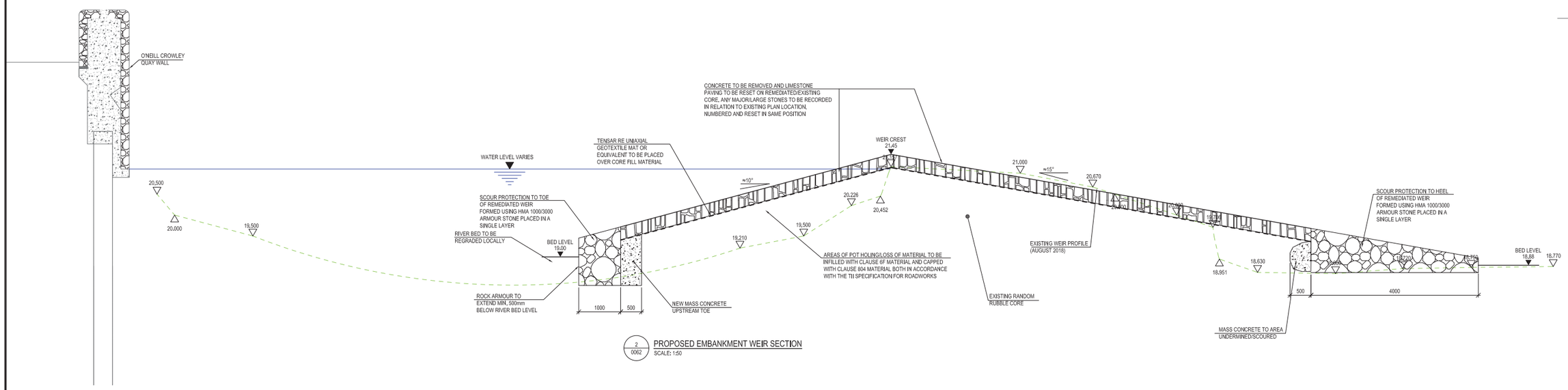
SCALE: AS SHOWN (A1)

PROJECT - ORIGINATOR - VOLUME - LOCATION - TYPE - ROLE - NUMBER
19011-TJOC-PL-XX-DR-C-0061

REV: C01




1 / 0062 PROPOSED EMBANKMENT WEIR SECTION
SCALE: 1:50




2 / 0062 PROPOSED EMBANKMENT WEIR SECTION
SCALE: 1:50

NOTES:

1. ALL LEVELS SHOWN ARE IN METERS ABOVE ORDNANCE DATUM, MALIN HEAD.
2. FOR LOCATIONS OF SECTIONS REFER TO DRAWING 0060.
3. THIS DRAWING SHALL BE READ IN CONJUNCTION WITH SURVEY DRAWINGS OF EXISTING WEIR STRUCTURE AND WITH SECTION DRAWINGS 0061 AND 0063.
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PROJECT: FERMOY WEIR REMEDIATION AND FISH BYPASS CHANNEL

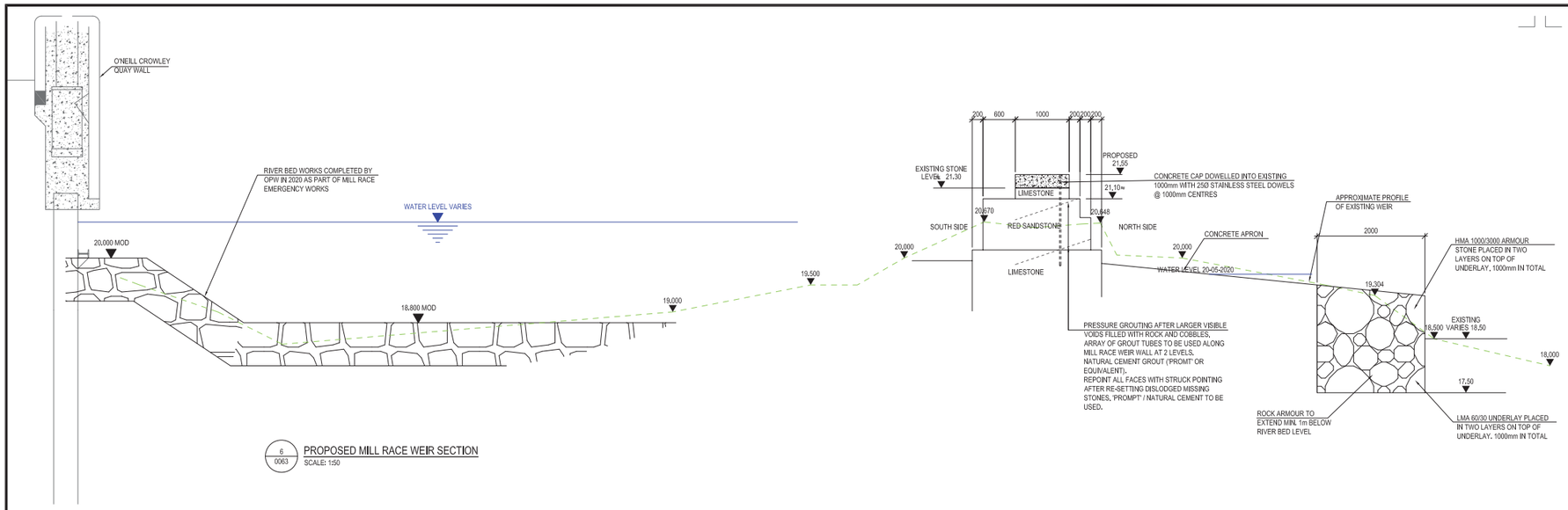
CLIENT: CORK COUNTY COUNCIL

DRAWING TITLE: WEIR REMEDIATION PROPOSED SECTIONS

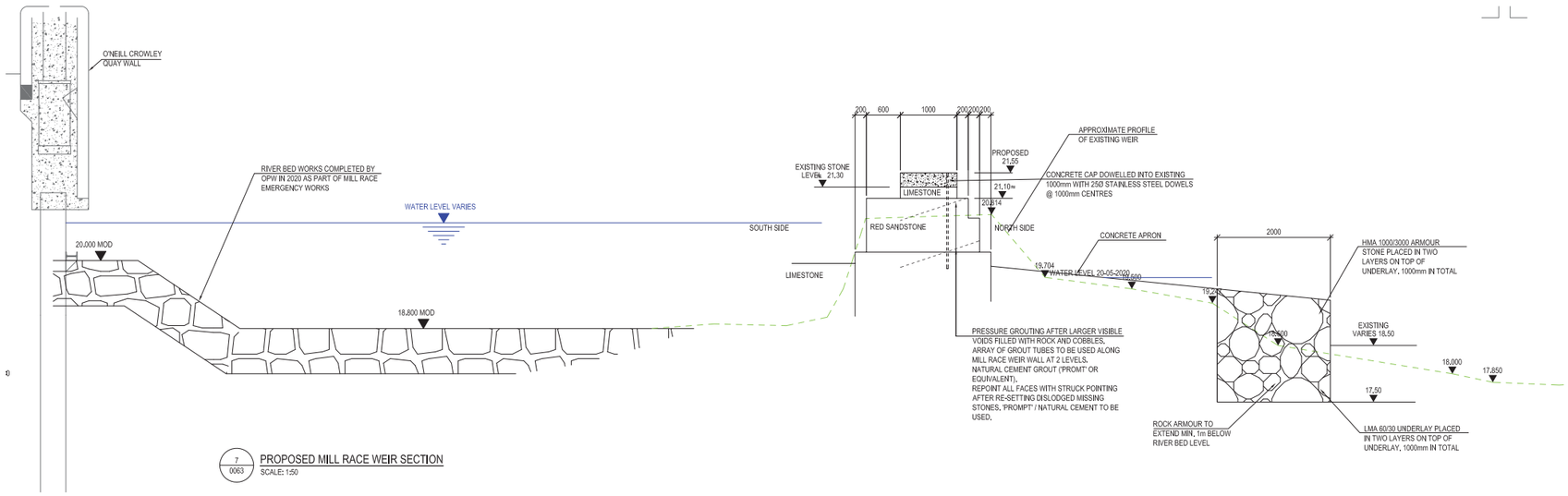
SCALE: AS SHOWN (A1)

PROJECT - ORIGINATOR - VOLUME - LOCATION - TYPE - ROLE - NUMBER
19011-TJOC-PL-XX-DR-C-0062

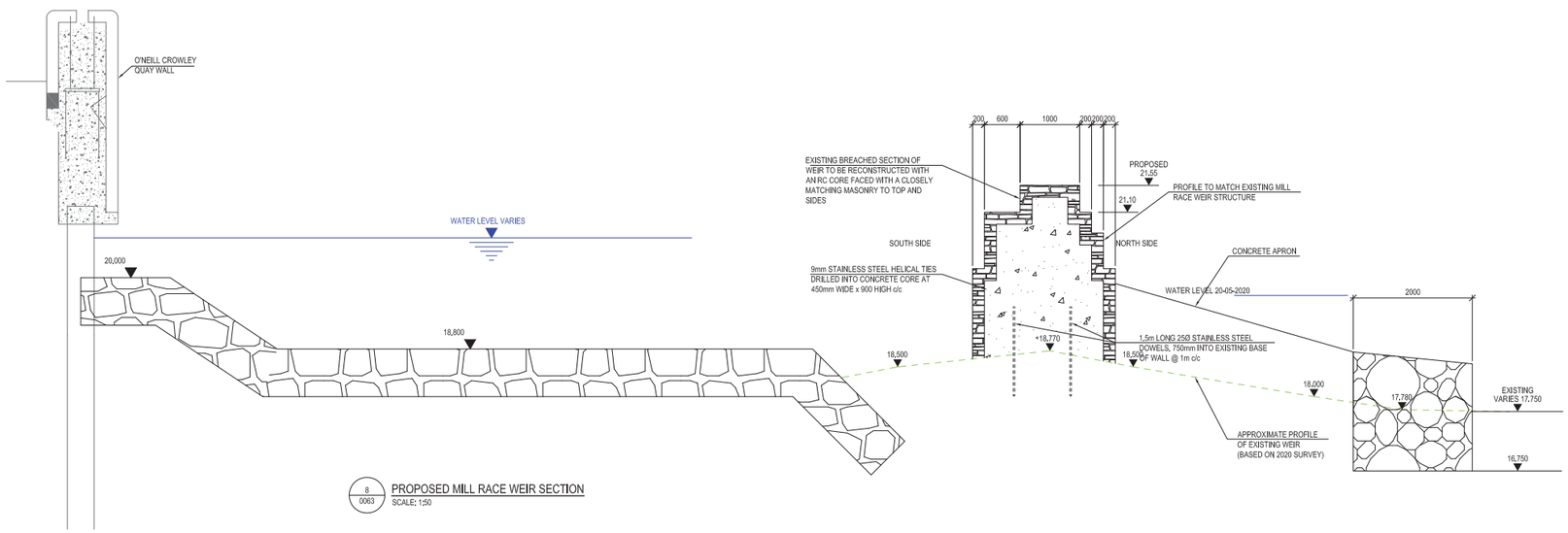
REV: C01




6 / 0063 PROPOSED MILL RACE WEIR SECTION
SCALE: 1:50




7 / 0063 PROPOSED MILL RACE WEIR SECTION
SCALE: 1:50




8 / 0063 PROPOSED MILL RACE WEIR SECTION
SCALE: 1:50

NOTES:

1. ALL LEVELS SHOWN ARE IN METERS ABOVE ORDNANCE DATUM, MALIN HEAD.
2. FOR LOCATIONS OF SECTIONS REFER TO DRAWING 0060.
3. THIS DRAWING SHALL BE READ IN CONJUNCTION WITH SURVEY DRAWINGS OF EXISTING WEIR STRUCTURE AND WITH SECTION DRAWINGS 0061 AND 0062.
4. WEIR REMEDIATION SHALL BE UNDERTAKEN IN ACCORDANCE WITH THE CONSERVATION ENGINEER'S RECOMMENDATIONS.

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PROJECT: FERMOY WEIR REMEDIATION AND FISH BYPASS CHANNEL

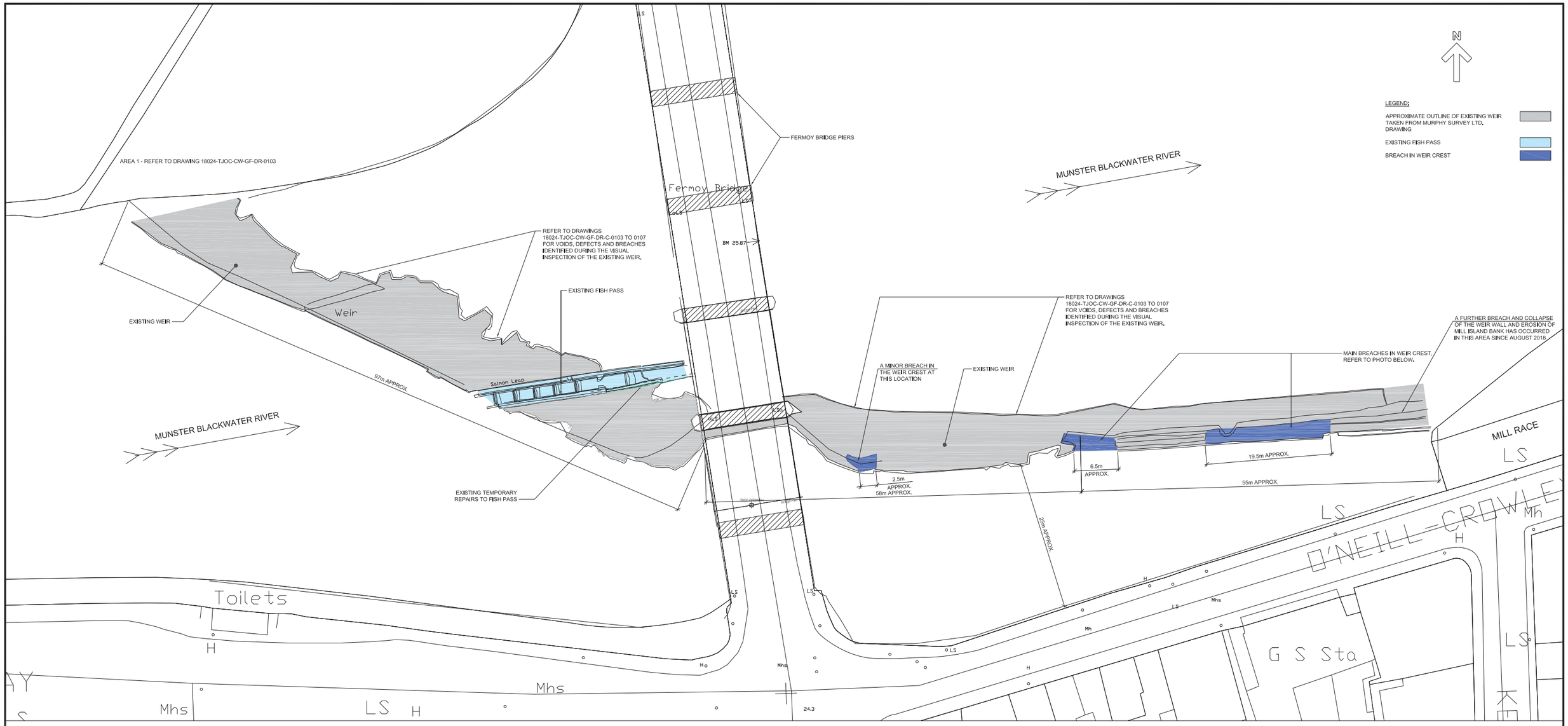
CLIENT: CORK COUNTY COUNCIL

DRAWING TITLE: WEIR REMEDIATION PROPOSED SECTIONS

SCALE: AS SHOWN (A1)

PROJECT - ORIGINATOR - VOLUME - LOCATION - TYPE - ROLE - NUMBER
19011-TJOC-PL-XX-DR-C-0063

REV: C01




1 / 0073 EXISTING WEIR LAYOUT
SCALE: 1:300

0 3 6 9 12 18 24 30m
1:300

2 / 0073 PHOTO OF EXISTING WEIR ON EAST SIDE OF FERMOY BRIDGE

3 / 0073 AERIAL PHOTO OF FERMOY WEIR

NOTES:

1. REFER TO DRAWINGS 19011-TJOC-PL-XX-DR-C-0074 TO 0078 FOR FURTHER NOTES AND PHOTOGRAPHS.
2. DIMENSIONS SHOWN ON DRAWING ARE APPROXIMATE ONLY AND ARE BASED ON THE SURVEY UNDERTAKEN BY MURPHY SURVEYS LTD ON 23rd AUGUST 2018.
3. COMMENTS AND PHOTOGRAPHS ON THE CONDITION OF THE WEIR ARE BASED ON A VISUAL INSPECTION OF THE WEIR ON 15th AUGUST 2018. NO OPENING UP WORKS OF ANY KIND WERE UNDERTAKEN DURING THE VISUAL INSPECTION.

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CORRIG HOUSE, CORRIG ROAD, SANDYFORD, DUBLIN 18.
Tel: 01-295 2321 Fax: 01-295 4541 Email: tjoc@tjoc.ie Web: www.tjoc.ie

PROJECT: FERMOY WEIR REMEDIATION

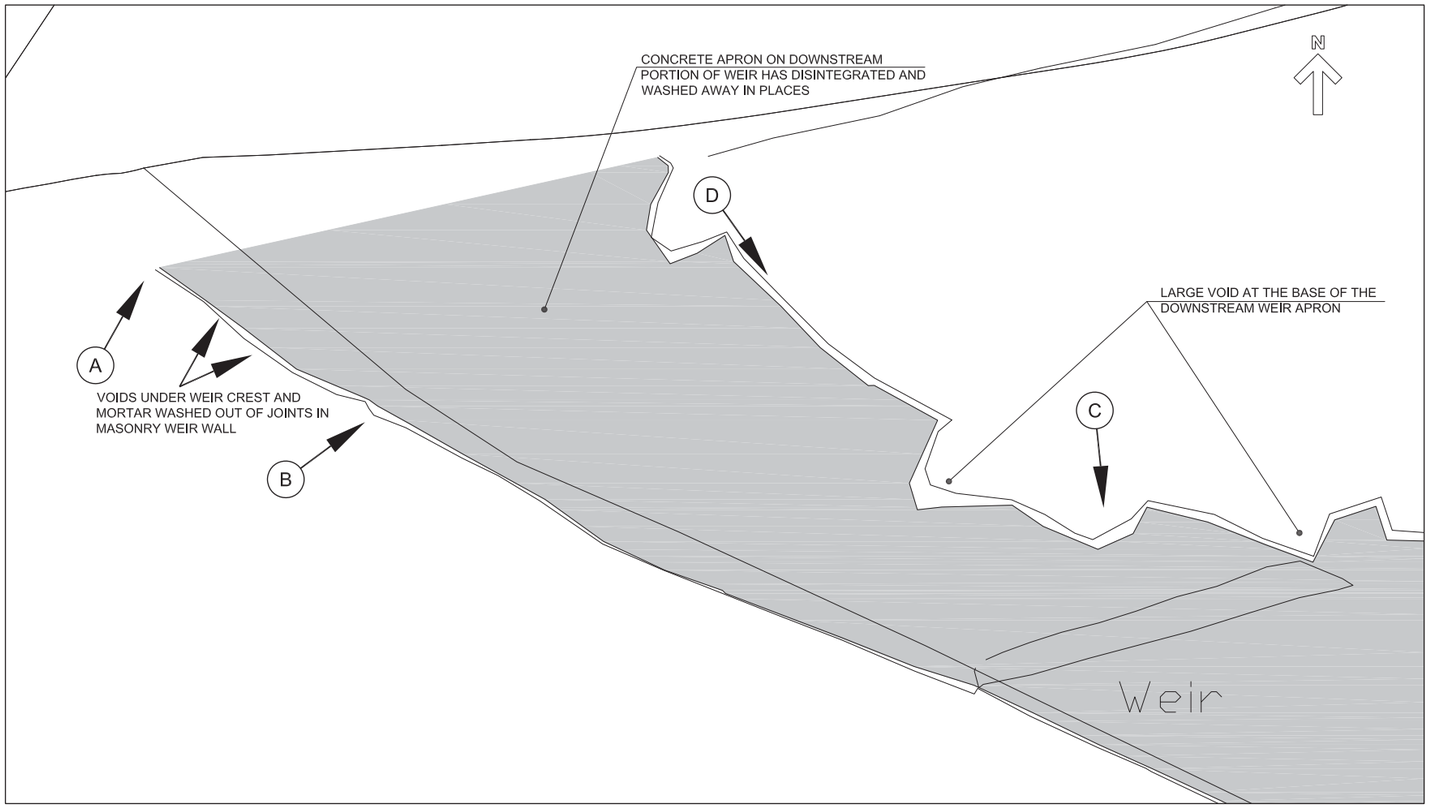
CLIENT: CORK COUNTY COUNCIL

DRAWING TITLE: SUMMARY OF EXISTING WEIR CONDITION IN 2018

SCALE: 1:300 (A1)

PROJECT - ORIGINATOR - VOLUME -LOCATION- TYPE - ROLE - NUMBER
19011-TJOC-PL-XX-DR-C-0073

REV: C01



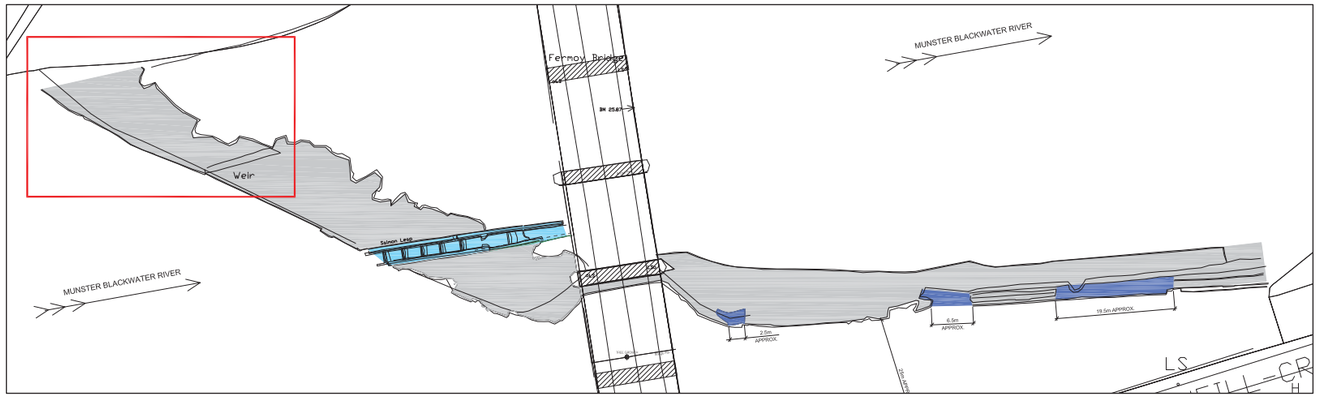

1 / 0074 EXISTING WEIR LAYOUT - AREA 1
SCALE: 1:100

A / 0074 VOIDS UNDER WEIR CREST

B / 0074 MORTAR AND FINES WASHED OUT OF JOINTS IN MASONRY WEIR WALLS

C / 0074 LARGE VOID AT THE BASE OF THE DOWNSTREAM WEIR APRON

D / 0074 CONCRETE APRON OF WEIR HAS DISINTEGRATED AND WASHED AWAY IN PLACES




2 / 0074 KEYPLAN - AREA 1
SCALE: 1:500

NOTES:

1. COMMENTS AND PHOTOGRAPHS ON THE CONDITION OF THE WEIR ARE BASED ON A VISUAL INSPECTION OF THE WEIR ON 15th AUGUST 2018. NO OPENING UP WORKS OF ANY KIND WERE UNDERTAKEN DURING THE VISUAL INSPECTION.

| REV | SUIT | DESCRIPTION | DATE |
|---|---|---|---|
| C01 | AP | ISSUED FOR PLANNING | 02.06.2022 |

DRAWING STATUS: ISSUED FOR PLANNING

CHECKED BY: LC | REVIEWED BY: MV | APPROVED BY: DC

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Tel: 01-295 2321 Fax: 01-295 4541 Email: tjoc@tjoc.ie Web: www.tjoc.ie

PROJECT: FERMOY WEIR REMEDIATION

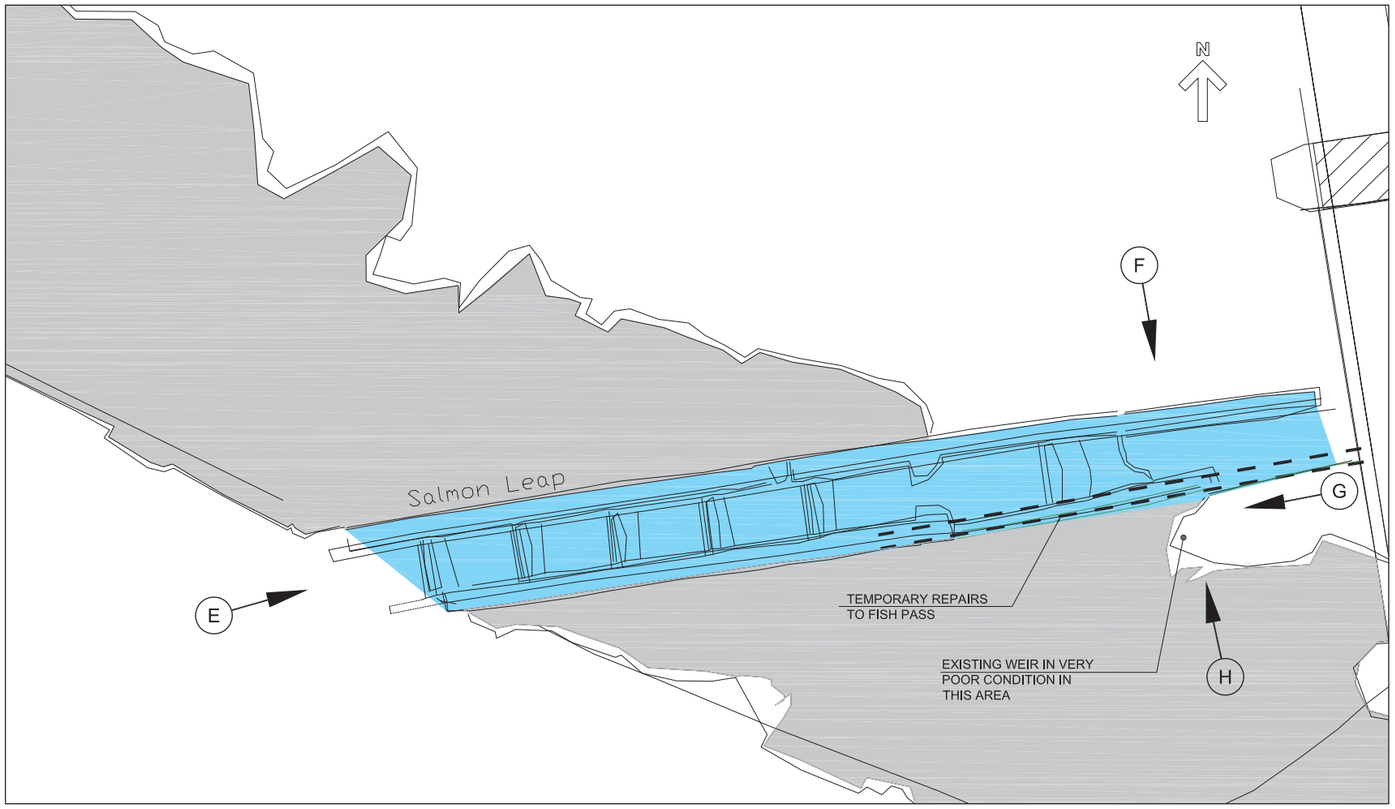
CLIENT: CORK COUNTY COUNCIL

DRAWING TITLE: EXISTING WEIR CONDITION AREA 1

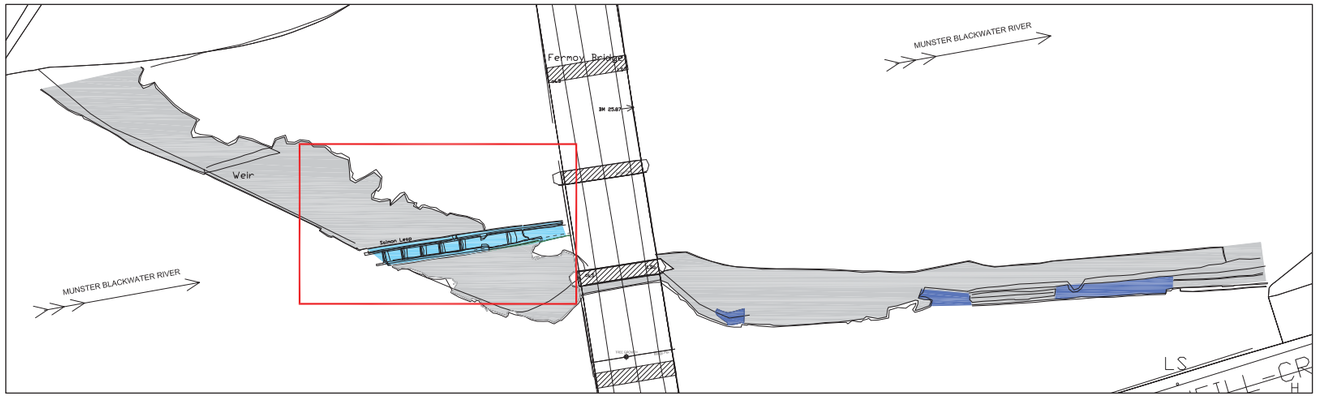
SCALE: 1:100 (A1)

PROJECT - ORIGINATOR - VOLUME - LOCATION - TYPE - ROLE - NUMBER
19011-TJOC-PL-XX-DR-C-0074

REV: C01




1 / 0075 EXISTING WEIR LAYOUT - AREA 2
SCALE: 1:100




2 / 0075 KEYPLAN - AREA 2
SCALE: 1:500

E / 0075 VIEW OF UPSTREAM END OF FISH PASS

F / 0075 VIEW OF DAMAGE TO FISH PASS WALL

G / 0075 WEIR APRON HAS DISINTEGRATED AND WASHED AWAY

H / 0075 VIEW OF TEMPORARY REPAIRS TO FISH PASS AND DISLODGED MATERIAL FROM WEIR

NOTES:

1. COMMENTS AND PHOTOGRAPHS ON THE CONDITION OF THE WEIR ARE BASED ON A VISUAL INSPECTION OF THE WEIR ON 15th AUGUST 2018. NO OPENING UP WORKS OF ANY KIND WERE UNDERTAKEN DURING THE VISUAL INSPECTION.

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PROJECT: FERMOY WEIR REMEDIATION

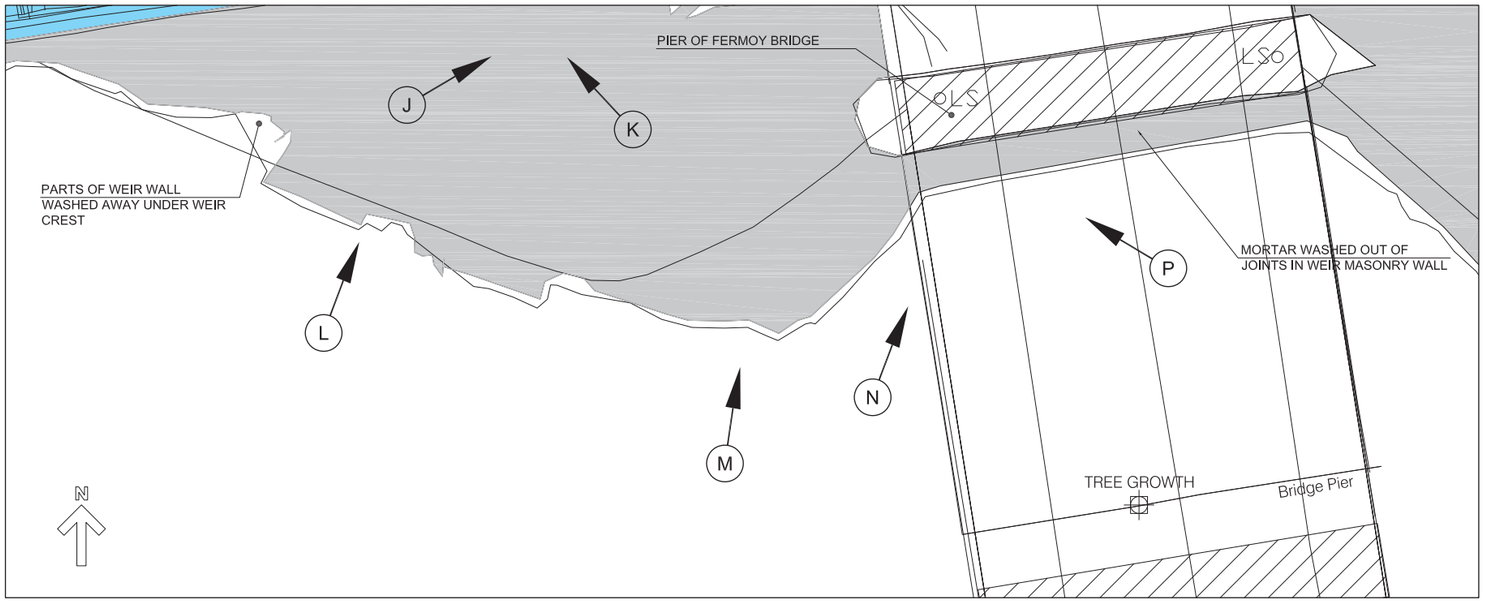
CLIENT: CORK COUNTY COUNCIL

DRAWING TITLE: EXISTING WEIR CONDITION AREA 2

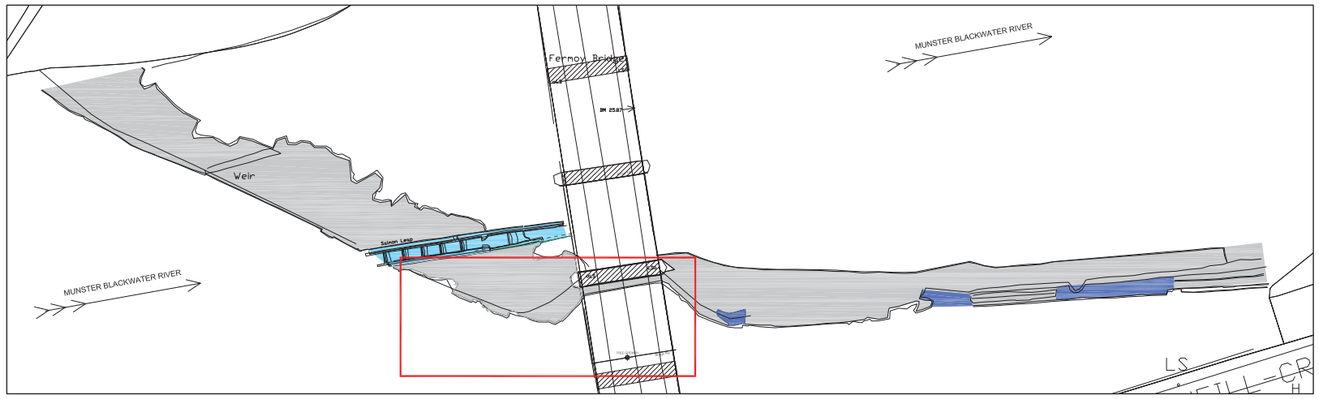
SCALE: 1:100 (A1)

PROJECT - ORIGINATOR - VOLUME - LOCATION - TYPE - ROLE - NUMBER
19011-TJOC-PL-XX-DR-C-0075

REV: C01




1 / 0076 EXISTING WEIR LAYOUT - AREA 3
SCALE: 1:100




2 / 0076 KEYPLAN - AREA 3
SCALE: 1:500

M / 0076 PART OF WEIR WALL WASHED AWAY UNDER WEIR CREST

N / 0076 MORTAR AND FINES WASHED OUT OF MASONRY WEIR WALL ADJACENT TO FERMOY BRIDGE

P / 0076 MORTAR AND FINES WASHED OUT OF MASONRY WEIR WALL ADJACENT TO FERMOY BRIDGE

J / 0076 WEIR APRON DISINTEGRATED AND WASHED AWAY AT JUNCTION WITH FISH PASS

K / 0076 WEIR APRON DISINTEGRATED AND WASHED AWAY AT JUNCTION WITH FISH PASS

L / 0076 PART OF WEIR WALL WASHED AWAY UNDER WEIR CREST

NOTES:

1. COMMENTS AND PHOTOGRAPHS ON THE CONDITION OF THE WEIR ARE BASED ON A VISUAL INSPECTION OF THE WEIR ON 15th AUGUST 2018. NO OPENING UP WORKS OF ANY KIND WERE UNDERTAKEN DURING THE VISUAL INSPECTION.

| REV | SUIT | DESCRIPTION | DATE |
|---|---|---|---|
| C01 | AP | ISSUED FOR PLANNING | 02.06.2022 |

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PROJECT: FERMOY WEIR REMEDIATION

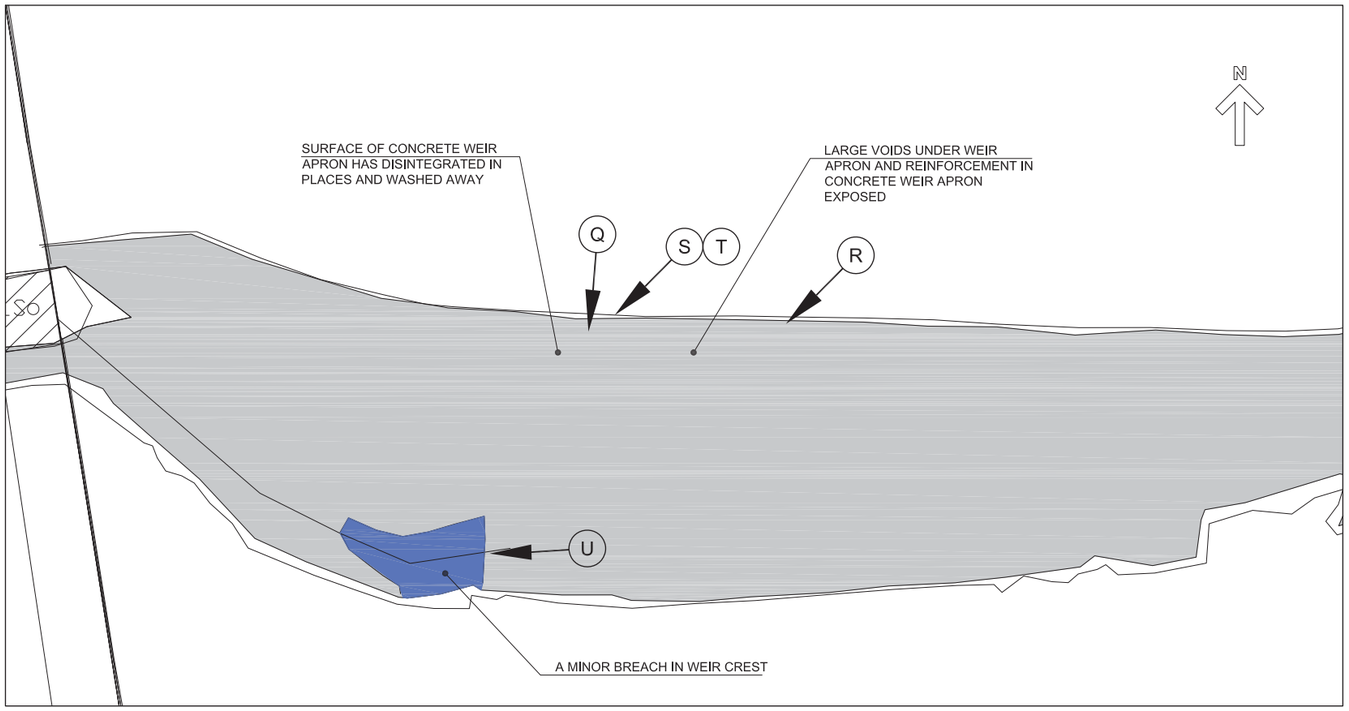
CLIENT: CORK COUNTY COUNCIL

DRAWING TITLE: EXISTING WEIR CONDITION AREA 3

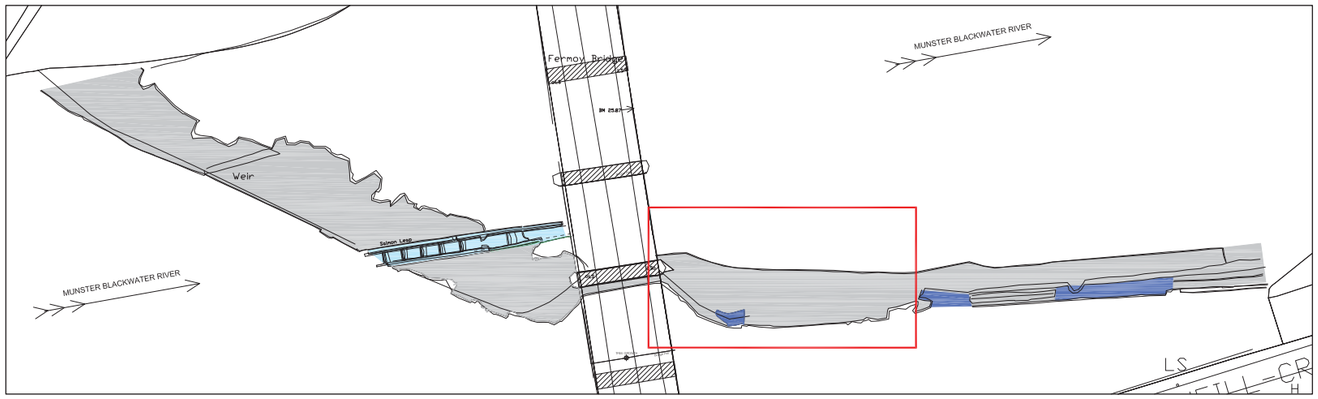
SCALE: 1:100 (A1)

PROJECT - ORIGINATOR - VOLUME - LOCATION - TYPE - ROLE - NUMBER
19011-TJOC-PL-XX-DR-C-0076

REV: C01

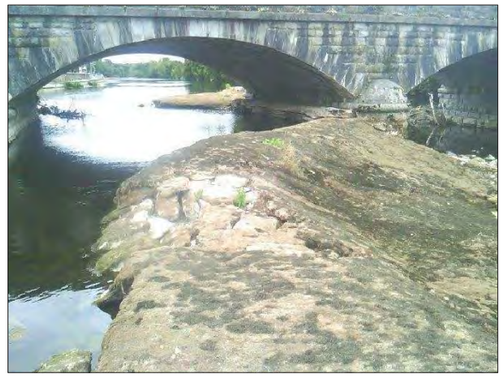



1 / 0077 EXISTING WEIR LAYOUT - AREA 4
SCALE: 1:100




2 / 0077 KEYPLAN - AREA 4
SCALE: 1:500

T / 0077 LARGE VOIDS UNDER CONCRETE WEIR APRON, REINFORCEMENT EXPOSED AND CORRODED



U / 0077 MINOR BREACH IN WEIR CREST

Q / 0077 SURFACE OF CONCRETE WEIR APRON HAS DISINTEGRATED IN PLACES

R / 0077 LARGE VOIDS UNDER CONCRETE WEIR APRON

S / 0077 REINFORCEMENT EXPOSED AND CORRODED UNDER WEIR APRON

NOTES:

1. COMMENTS AND PHOTOGRAPHS ON THE CONDITION OF THE WEIR ARE BASED ON A VISUAL INSPECTION OF THE WEIR ON 15th AUGUST 2018. NO OPENING UP WORKS OF ANY KIND WERE UNDERTAKEN DURING THE VISUAL INSPECTION.

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Tel: 01-295 2321 Fax: 01-295 4541 Email: tjoc@tjoc.ie Web: www.tjoc.ie

PROJECT: FERMOY WEIR REMEDIATION

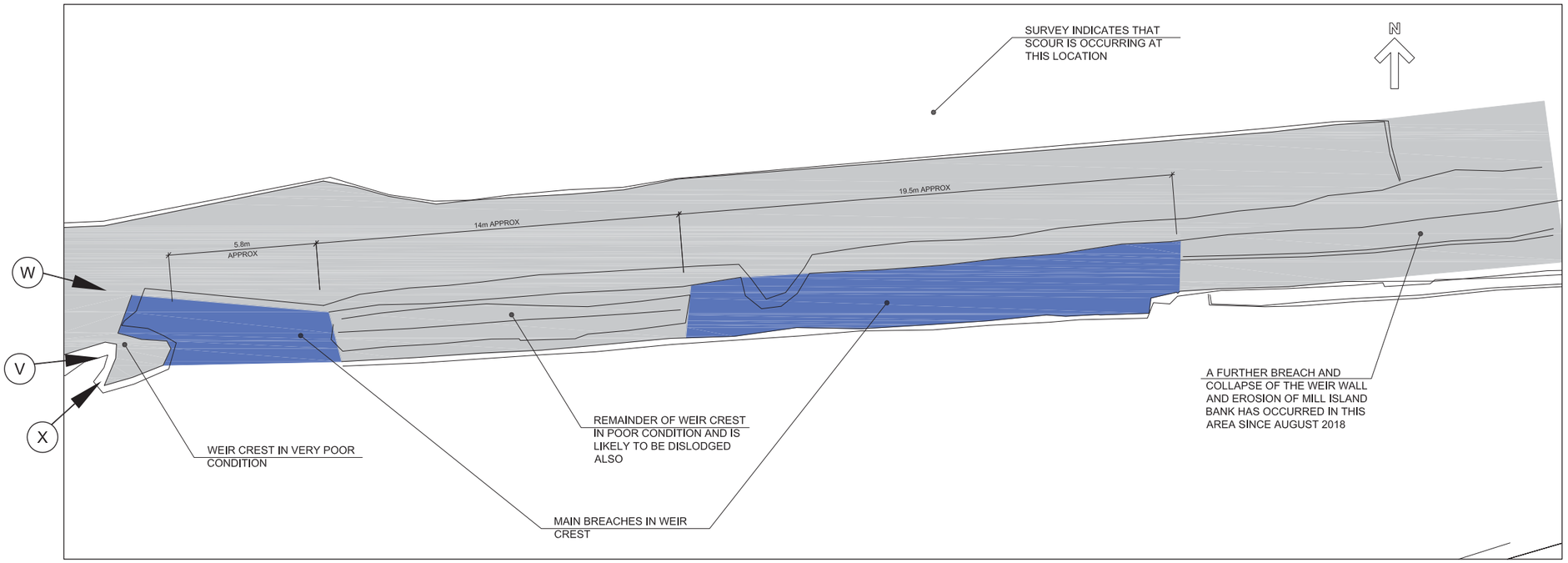
CLIENT: CORK COUNTY COUNCIL

DRAWING TITLE: EXISTING WEIR CONDITION AREA 4

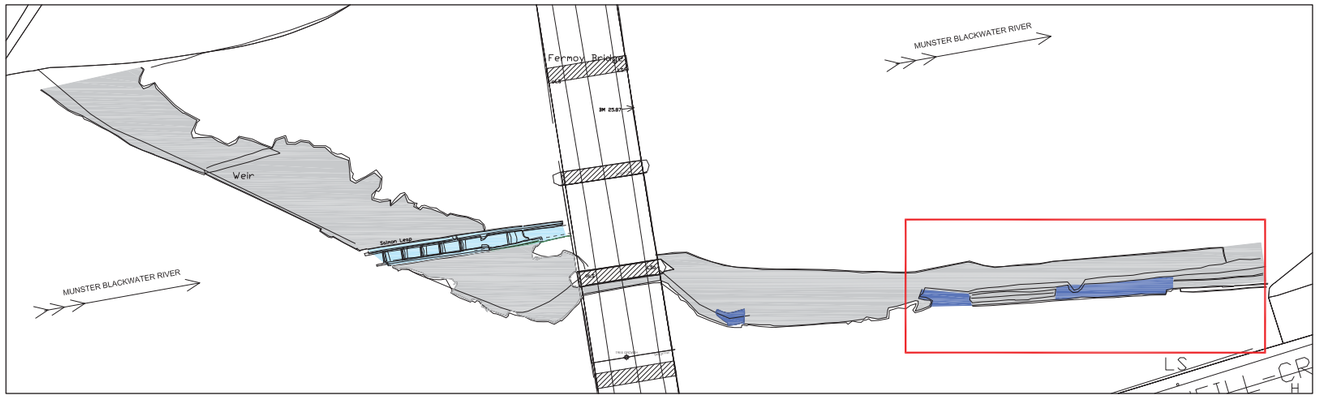
SCALE: 1:100 (A1)

PROJECT - ORIGINATOR - VOLUME - LOCATION - TYPE - ROLE - NUMBER
19011-TJOC-PL-XX-DR-C-0077

REV: C01

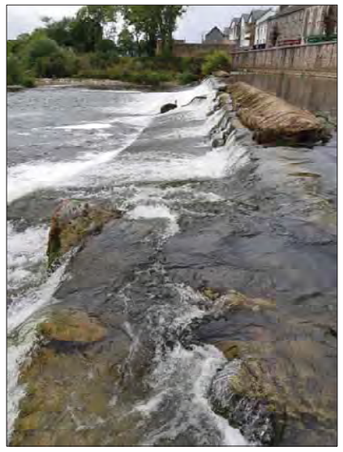



1 / 0078 EXISTING WEIR LAYOUT - AREA 5
SCALE: 1:100




2 / 0078 KEYPLAN - AREA 5
SCALE: 1:500

V / 0078 VIEW OF WEIR CREST



W / 0078 VIEW OF WEIR CREST AND DOWNSTREAM APRON

X / 0078 VIEW OF WEIR CREST CONDITION

NOTES:

1. COMMENTS AND PHOTOGRAPHS ON THE CONDITION OF THE WEIR ARE BASED ON A VISUAL INSPECTION OF THE WEIR ON 15th AUGUST 2018. NO OPENING UP WORKS OF ANY KIND WERE UNDERTAKEN DURING THE VISUAL INSPECTION.

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| C01 | AP | ISSUED FOR PLANNING | 02.06.2022 |

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Tel: 01-295 2321 Fax: 01-295 4541 Email: tjoc@tjoc.ie Web: www.tjoc.ie

PROJECT: FERMOY WEIR REMEDIATION

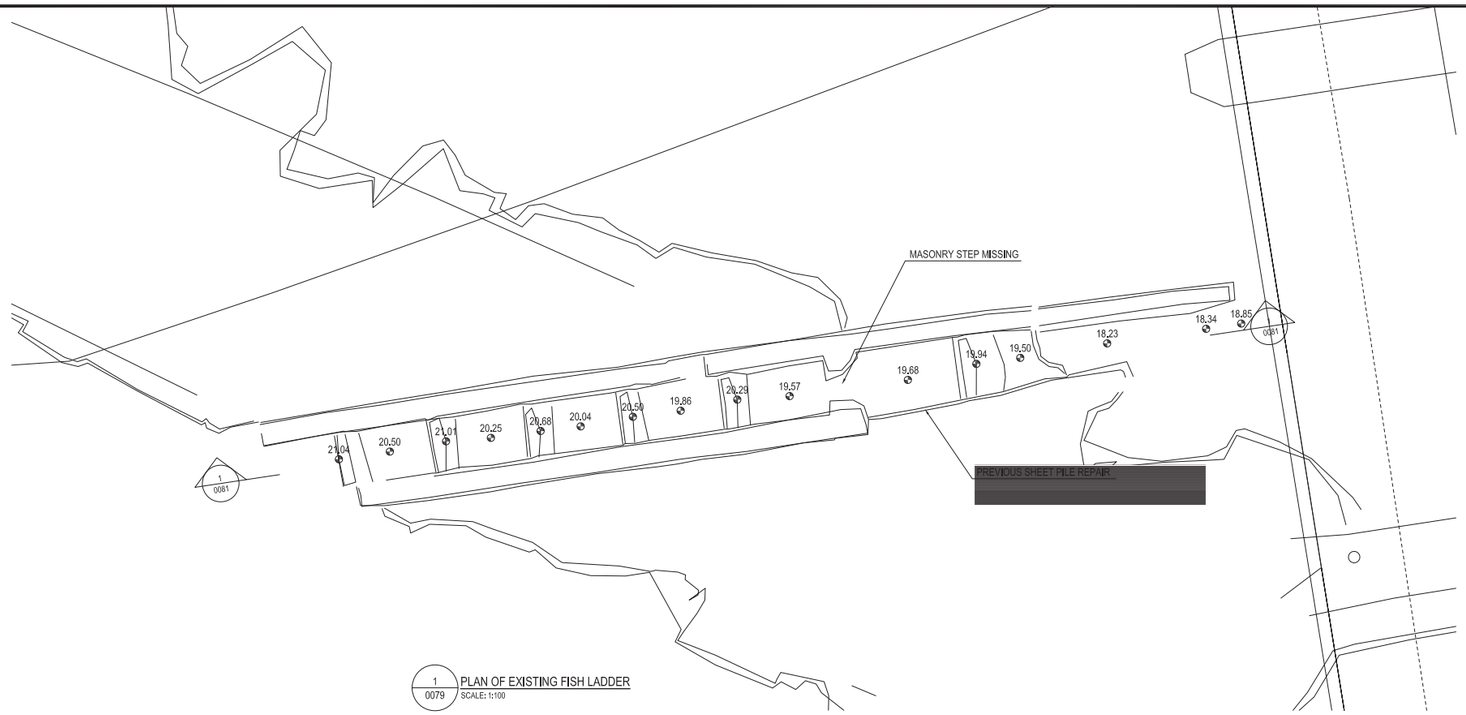
CLIENT: CORK COUNTY COUNCIL

DRAWING TITLE: EXISTING WEIR CONDITION AREA 5

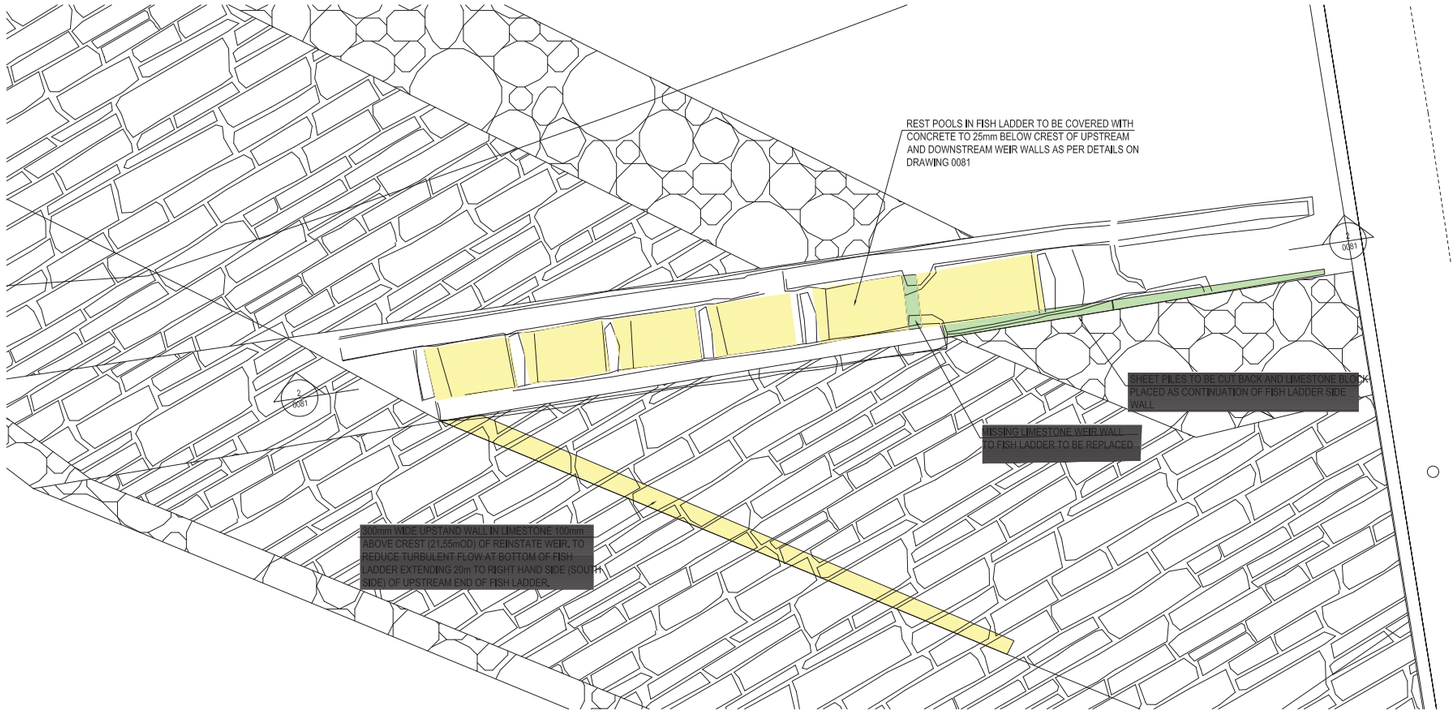
SCALE: 1:100 (A1)

PROJECT - ORIGINATOR - VOLUME - LOCATION - TYPE - ROLE - NUMBER
19011-TJOC-PL-XX-DR-C-0078

REV: C01




1 / 0079 PLAN OF EXISTING FISH LADDER
SCALE: 1:100




2 / 0079 PLAN OF PROPOSED WORKS TO EXISTING FISH LADDER
SCALE: 1:100

NOTES:

1. 1. FISH PASS REMEDIATION WORKS SHALL BE CARRIED OUT IN ACCORDANCE WITH CONSERVATION ENGINEER'S RECOMMENDATIONS AND DETAILS SHOWN ON DRAWING 0081.
2. LAYOUT OF EXISTING FISH LADDER BASED ON MURPHY SURVEYS TOPOGRAPHICAL SURVEY COMPLETED AUGUST 2018.

NOTE:
DETAILS AND DIMENSIONS OF PROPOSED WORKS TO FISH PASS ARE TAKEN FROM INFORMATION SUPPLIED BY OTHERS AND ARE SUBJECT TO APPROVAL FROM INLAND FISHERIES IRELAND

MAP REPRODUCED BY PERMISSION OF ORDNANCE SURVEY IRELAND (CORK CCMA 9802)

| REV | STAT | DESCRIPTION | DATE |
|---|---|---|---|
| C01 | AP | ISSUED FOR PLANNING | 02.06.2022 |

DRAWING STATUS: ISSUED FOR PLANNING

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Tel: 01-295 2321 Fax: 01-295 4541 Email: tjoc@tjoc.ie Web: www.tjoc.ie

PROJECT: FERMOY WEIR REMEDIATION AND FISH BYPASS CHANNEL

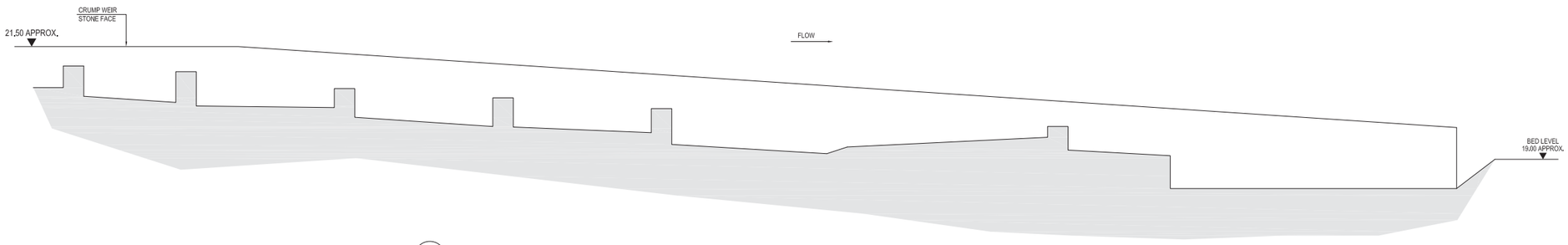
CLIENT: CORK COUNTY COUNCIL

DRAWING TITLE: EXISTING FISH LADDER REMEDIATION PLAN

SCALE: 1:100 (A1)

PROJECT - ORIGINATOR - VOLUME -LOCATION- TYPE - ROLE - NUMBER
19011-TJOC-PL-XX-DR-C-0079

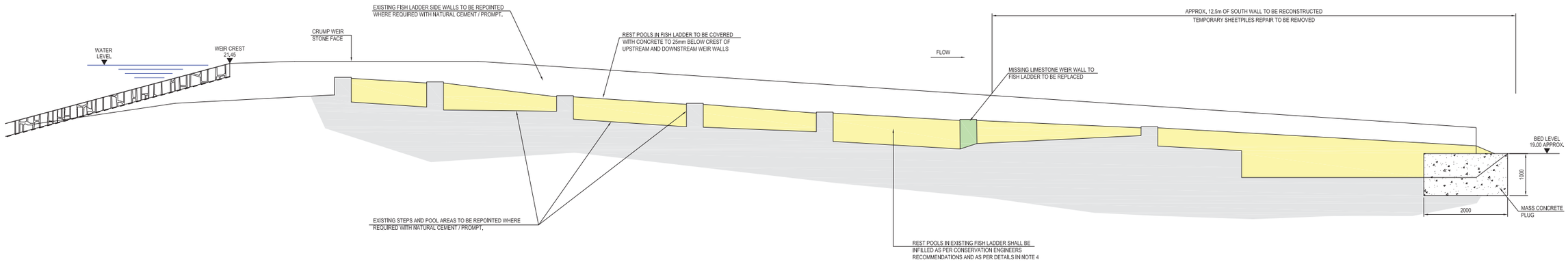
REV: C01




1 / 0081 EXISTING FISH LADDER SECTION
SCALE: 1:50

NOTES:

1. ALL WORKS CARRIED OUT IN THE RIVER AND TO THE FISH PASS TO BE AGREED WITH INLAND FISHERIES IRELAND PRIOR TO COMMENCEMENT OF THE WORKS.
2. WORKS IN THE RIVER WILL ONLY BE PERMITTED BETWEEN THE BEGINNING OF AUGUST TO MID SEPTEMBER IN ACCORDANCE WITH INLAND FISHERIES IRELAND GUIDELINES.
3. PROPOSED REMEDIAL WORK DETAILS AS PER CONSERVATION ENGINEER, TREVOR WOODS CONSULTING ENGINEERS, DETAILS.
4. COVERING
   DPM 1500 GAUGE TO BE LAID UP PASS INSIDE WALLS OVER BASE AND LAPPED MINIMUM 1m BETWEEN SHEETS / JOINTS.
   TYPE 6F FILL WITHIN 300mm EXISTING CAPPING.
   150mm CLAUSE 804 BLINDED WITH LEAN MIX CONCRETE.
   150mm CONCRETE SLAB (FIBRE MESH POLYPROPYLENE FIBRES)
   SURFACE TO BE STAMPED WITH RANDOM STONE PATTERN.
5. ALL LEVELS AS PER MURPHY SURVEYS 2018 SURVEY OF WEIR STRUCTURE.
6. EXISTING FISH LADDER SHALL BE INFILLED IN ORDER TO AVOID WHITE WATER CREATED BY THE STEPS IN THE LADDER ATTRACTING FISH FROM DOWNSTREAM OF THE WEIR.




2 / 0081 PROPOSED FISH LADDER SECTION
SCALE: 1:50

| REV | STAT | DESCRIPTION | DATE |
|---|---|---|---|
| C01 | AP | ISSUED FOR PLANNING | 02.06.2022 |

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Tel: 01-295 2321 Fax: 01-295 4541 Email: tjoc@tjoc.ie Web: www.tjoc.ie

PROJECT: FERMOY WEIR REMEDIATION AND FISH BYPASS CHANNEL

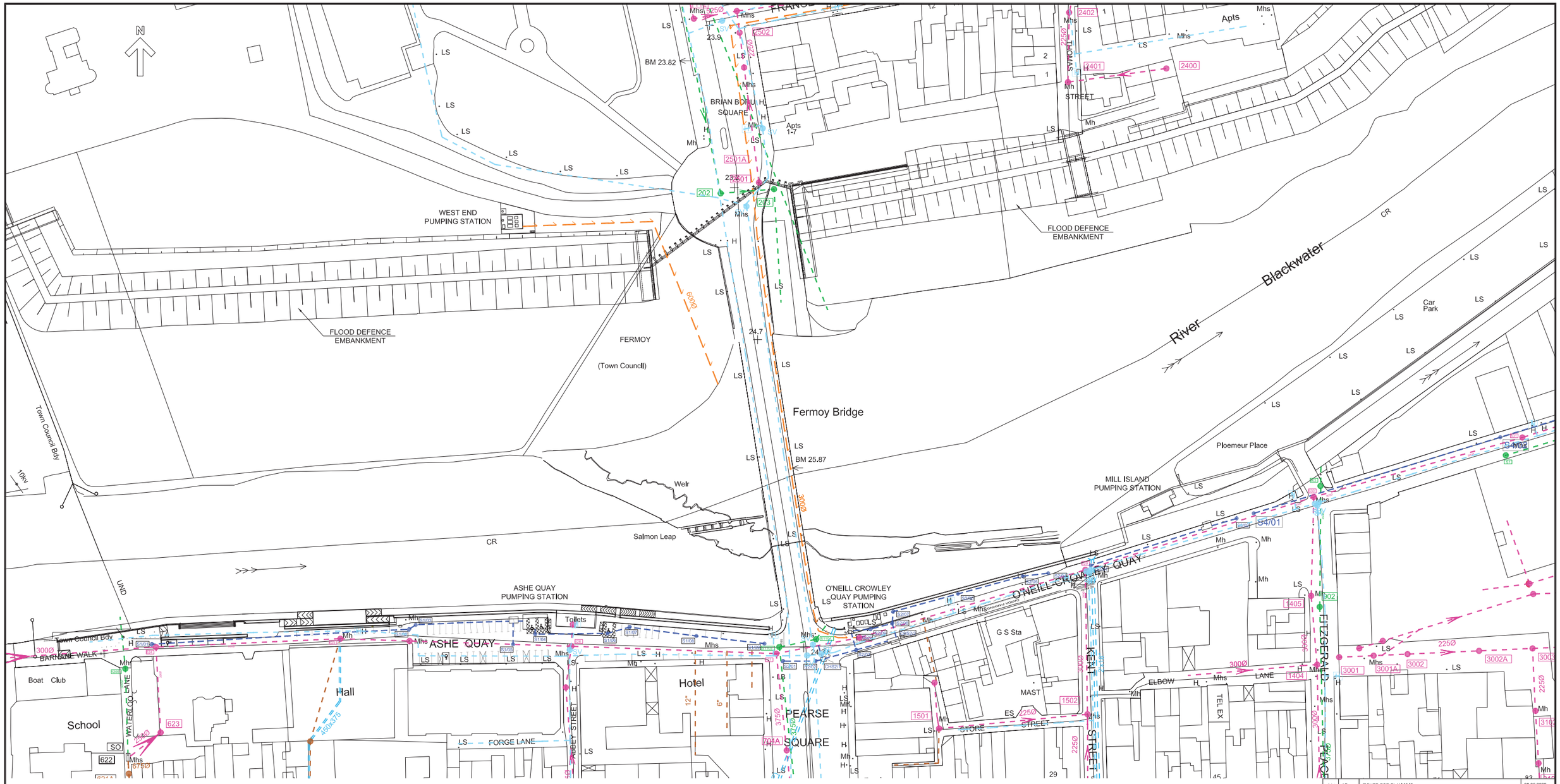
CLIENT: CORK COUNTY COUNCIL

DRAWING TITLE: EXISTING FISH LADDER REMEDIATION DETAILS - SHEET 2

SCALE: AS SHOWN (A1)

PROJECT - ORIGINATOR - VOLUME - LOCATION - TYPE - ROLE - NUMBER
190080-TJOC-PL-XX-DR-C-0081

REV: C01




0 7.5 15 22.5 30 45 60 75m
1:750

LEGEND

- FOUL SEWER
- SURFACE WATER SEWER
- COMBINED SEWER
- CULVERT SEWER
- RISING MAIN
- WATERMAIN

MAP REPRODUCED BY PERMISSION OF ORDNANCE SURVEY IRELAND (CORK CCMA 9802)

| REV | STAT | DESCRIPTION | DATE |
|---|---|---|---|
| C01 | AP | ISSUED FOR PLANNING | 02.06.2022 |

DRAWING STATUS: ISSUED FOR REVIEW AND COMMENT

| CHECKED BY: | REVIEWED BY: | APPROVED BY: |
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Tel: 01-295 2321 Fax: 01-295 4541 Email: tjoc@tjoc.ie Web: www.tjoc.ie

PROJECT: FERMOY WEIR REMEDIATION AND FISH BYPASS CHANNEL

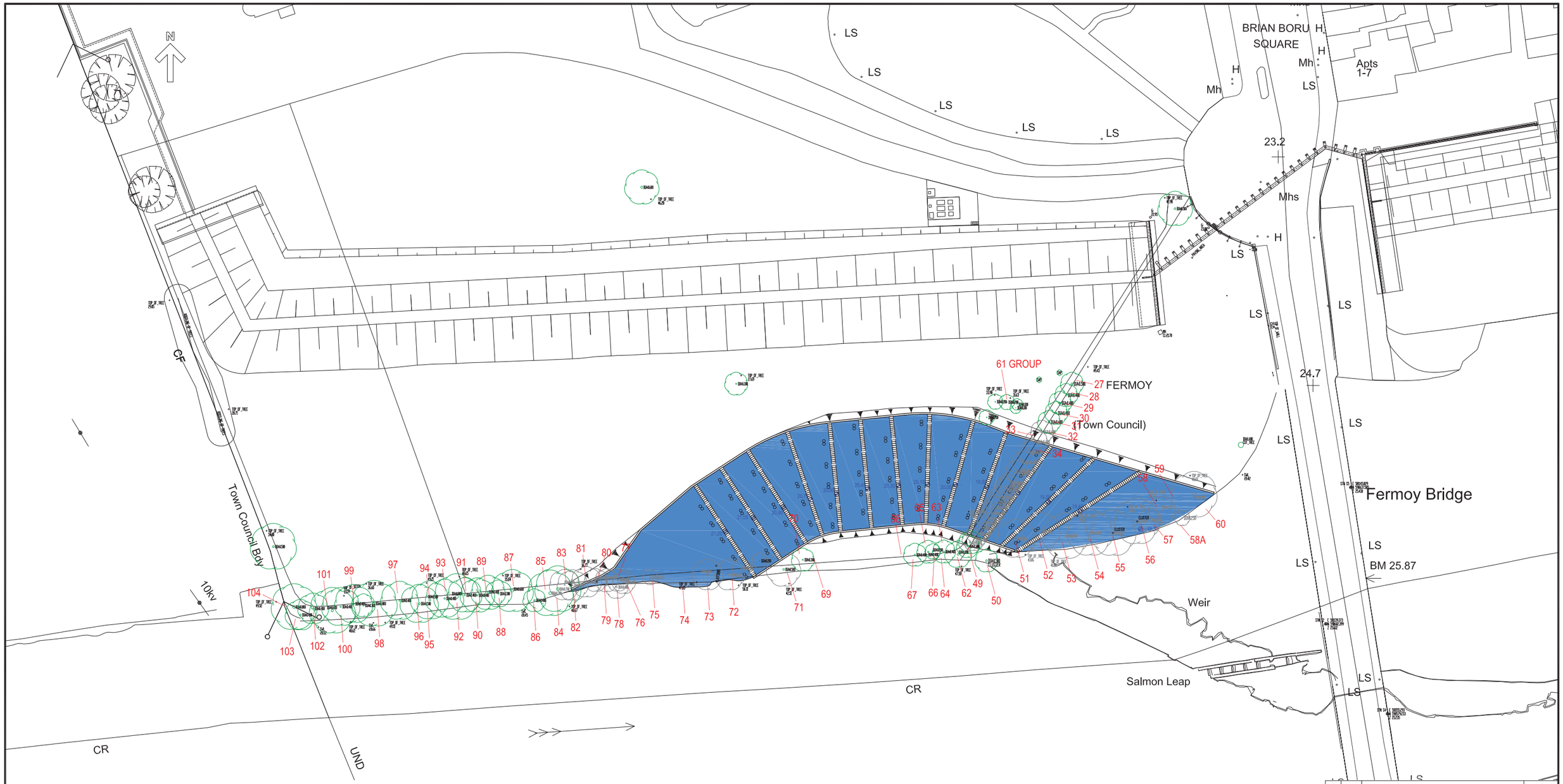
CLIENT: CORK COUNTY COUNCIL

DRAWING TITLE: EXISTING SERVICES

SCALE: 1:750 (A1)

PROJECT - ORIGINATOR - VOLUME -LOCATION- TYPE - ROLE - NUMBER
19011-TJOC-PL-XX-DR-C-0082

REV: P01




LEGEND:

EXISTING TREES

EXISTING TREES TO BE REMOVED

ROOT PROTECTION AREA

NOTES:

1. TREES LOCATIONS ARE BASED ON GEODATA 2020 TOPOGRAPHICAL SURVEY
2. DRAWING RECORDS TREES AND GROUPS OF TREES IDENTIFIED IN THE TREE SURVEY UNDERTAKEN BY MARK DONNELLY BSC ARBORIST IN 2021
3. TREE SURVEY DRAWING SHALL BE READ IN CONJUNCITON WITH THE ECOLOGISTS ECOLOGICAL IMPACT ASSESSMENT FOR THE PROJECT.

MAP REPRODUCED BY PERMISSION OF ORDNANCE SURVEY IRELAND (CORK CCMA 9802)

| REV | STAT | DESCRIPTION | DATE |
|---|---|---|---|
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PROJECT: FERMOY WEIR REMEDIATION AND FISH BYPASS CHANNEL

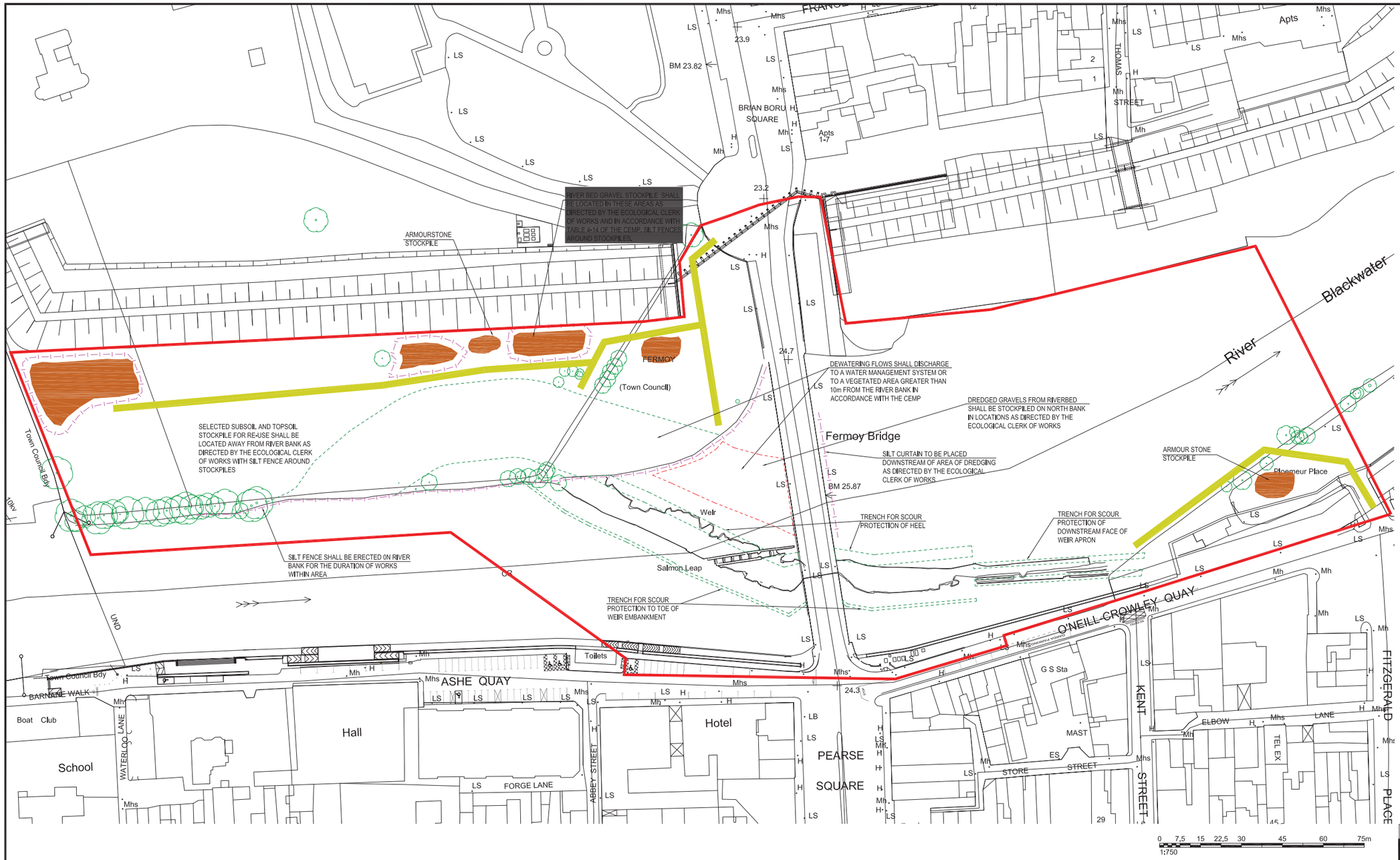
CLIENT: CORK COUNTY COUNCIL

DRAWING TITLE: TREE PROTECTION PLAN

SCALE: 1:500 (A1)

PROJECT - ORIGINATOR - VOLUME - LOCATION - TYPE - ROLE - NUMBER
19011-TJOC-PL-XX-DR-C-0083

REV: C01




NOTES:

1. WHERE FEASIBLE SOIL EXCAVATION SHALL TAKE PLACE DURING DRY PERIODS AND UNDERTAKEN WITH EXCAVATORS AND DUMP TRUCKS.
2. TOP SOIL AND SUBSOIL SHALL NOT BE MIXED TOGETHER.
3. STOCKPILES SHALL BE GRADED TO <1:4 PROFILE. TOPSOIL AND SUBSOIL SHALL BE STOCKPILED SEPARATELY.
4. SURFACE WATER MANAGEMENT SHALL COMPLY WITH MITIGATION MEASURES IDENTIFIED IN TABLE 4-5 OF THE CEMP.
5. SILT FENCES SHALL BE ERECTED AROUND EACH STOCKPILE.
6. RIVERBED GRAVELS SELECTED FOR RE-USE IN THE WORKS SHALL BE STOCKPILED IN A BUNDED AREA AS DIRECTED BY THE ECOLOGICAL CLERK OF WORKS.
7. STOCKPILES SHALL NOT ENCROACH ON ROOT PROTECTION AREAS OF ANY TREES.
8. THE LOCATIONS OF STOCKPILES SHOWN HERE ARE INDICATIVE. THE CONTRACTOR SHALL DEVELOP MATERIALS STORAGE PROPOSALS IN ACCORDANCE WITH THE CEMP AND TO THE SATISFACTION OF THE ECOLOGICAL CLERK OF WORKS.
9. STOCKPILING OF MATERIALS SHALL NOT BE PERMITTED WITHIN THE MAIN CHANNEL OF THE BLACKWATER APART FROM LOCAL STOCKPILES OF MATERIAL REQUIRED FOR THE REMEDIATION OF THE WEIR.

LEGEND:

- PROPOSED SITE BOUNDARY
- OUTLINE OF PROPOSED EXCAVATION
- AREA OF DREDGING
- SILT FENCE
- EXISTING TREES TO BE RETAINED
- CONSTRUCTION ACCESS ROUTES

MAP REPRODUCED BY PERMISSION OF ORDNANCE SURVEY IRELAND (CORK CCMA 9802)

| REV | STAT | DESCRIPTION | DATE |
|---|---|---|---|
| C01 | AP | ISSUED FOR PLANNING | 02.06.2022 |

DRAWING STATUS: ISSUED FOR PLANNING

| CHECKED BY: | REVIEWED BY: | APPROVED BY: |
|---|---|---|
| LC | MV | DC |

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TJ O'CONNOR & ASSOCIATES
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CORRIG HOUSE, CORRIG ROAD, SANDYFORD, DUBLIN 18.
Tel: 01-295 2321 Fax: 01-295 4541 Email: tjoc@tjoc.ie Web: www.tjoc.ie

PROJECT: FERMOY WEIR REMEDIATION AND FISH BYPASS CHANNEL

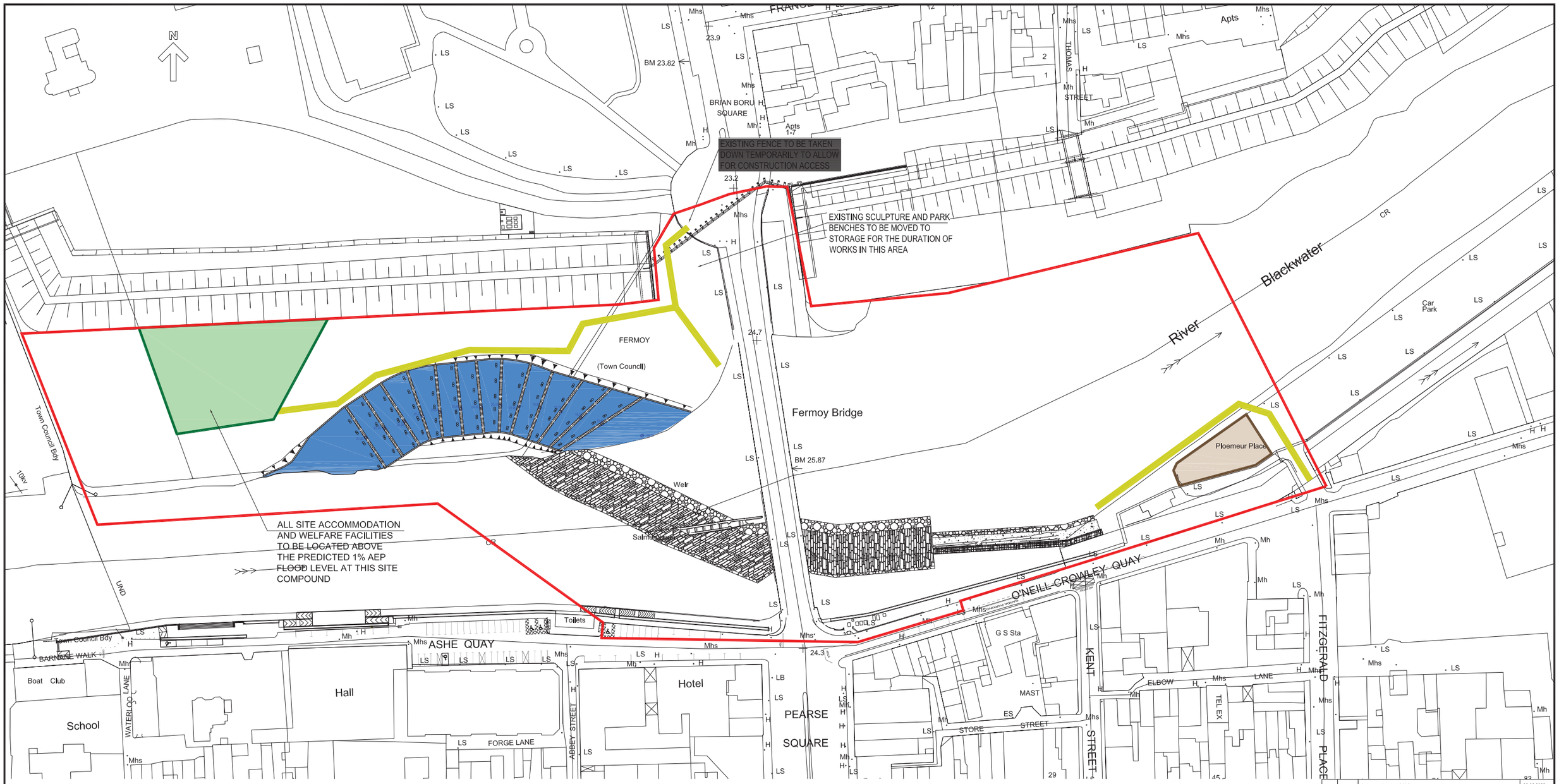
CLIENT: CORK COUNTY COUNCIL

DRAWING TITLE: CONSTRUCTION SPOIL MANAGEMENT

SCALE: 1:750 (A1)

PROJECT - ORIGINATOR - VOLUME - LOCATION - TYPE - ROLE - NUMBER
19011-TJOC-PL-XX-DR-C-0084

REV: C01




LEGEND:

SITE COMPOUND

SATELLITE COMPOUND

SITE BOUNDARY

CONSTRUCTION ACCESS ROUTES

MAP REPRODUCED BY PERMISSION OF ORDNANCE SURVEY IRELAND (CORK CCMA 9802)

| REV | STAT | DESCRIPTION | DATE |
|---|---|---|---|
| C01 | AP | ISSUED FOR PLANNING | 02.06.2022 |

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Tel: 01-295 2321 Fax: 01-295 4541 Email: tjoc@tjoc.ie Web: www.tjoc.ie

PROJECT: FERMOY WEIR REMEDIATION AND FISH BYPASS CHANNEL

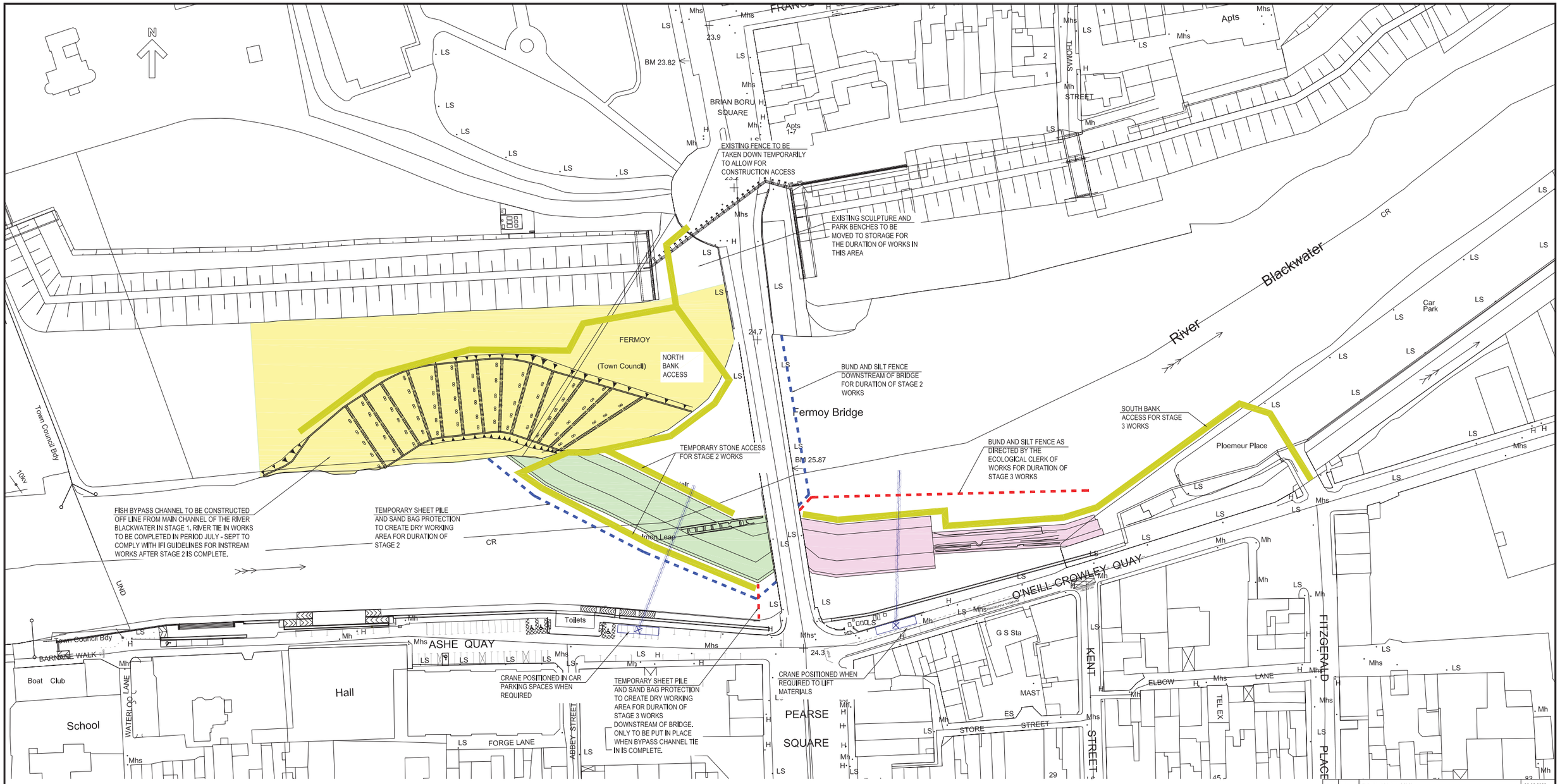
CLIENT: CORK COUNTY COUNCIL

DRAWING TITLE: SITE COMPOUNDS

SCALE: 1:750 (A1)

PROJECT • ORIGINATOR • VOLUME • LOCATION • TYPE • ROLE • NUMBER: 19011-TJOC-PL-XX-DR-C-0085

REV: C01




0 7.5 15 22.5 30 45 60 75m
1:750

NOTES

1. SEQUENCE OF CONSTRUCTION OPERATIONS SHALL BE AS AGREED WITH IFI AND SHALL BE IN COMPLIANCE WITH THE CEMP
2. INSTREAM WORKS SHALL BE UNDERTAKEN IN ACCORDANCE WITH FISHERIES IRELAND GUIDELINES FOR INSTREAM WORKS
3. STAGE 1 WORKS ON THE NORTH BANK OF THE RIVER TO CONSTRUCT THE FISH BYPASS CHANNEL SHALL PROCEED AS AN OFF LINE CONSTRUCTION. THE TIES INS OF THE FISH BYPASS CHANNEL TO THE RIVER SHALL BE COMPLETED AFTER THE STAGE 2 WORKS, TO REMEDIATE THE WEIR UPSTREAM OF FERMOY BRIDGE, ARE COMPLETE.
4. 4. STAGE 3 WORKS TO REMEDIATE THE WEIR DOWNSTREAM OF THE BRIDGE SHALL NOT COMMENCE PRIOR TO COMPLETION OF STAGE 2, WEIR REMEDIATION WORKS UPSTREAM OF THE BRIDGE, AND COMPLETION OF FISH BYPASS CHANNEL TIE INS TO RIVER BLACKWATER

LEGEND:

STAGE 1 - WORKS ON NORTH BANK OF RIVER FOR BYPASS CHANNEL

STAGE 2 - IN STREAM WORKS UPSTREAM OF BRIDGE

STAGE 3 - IN STREAM WORKS DOWNSTREAM OF BRIDGE

MAP REPRODUCED BY PERMISSION OF ORDNANCE SURVEY IRELAND (CORK CCMA 9802)

| REV | STAT | DESCRIPTION | DATE |
|---|---|---|---|
| C01 | AP | ISSUED FOR PLANNING | 02.06.2022 |

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Tel: 01-295 2321 Fax: 01-295 4541 Email: tjoc@tjoc.ie Web: www.tjoc.ie

PROJECT: FERMOY WEIR REMEDIATION AND FISH BYPASS CHANNEL

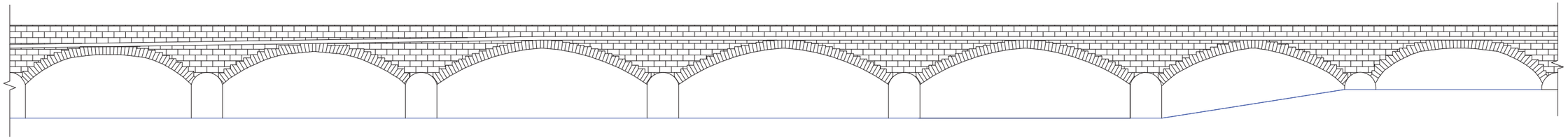
CLIENT: CORK COUNTY COUNCIL

DRAWING TITLE: INSTREAM WORKS PHASING

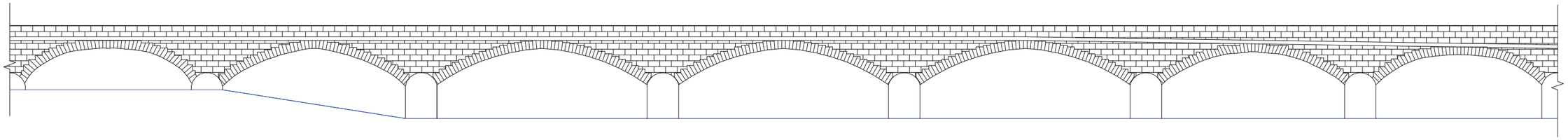
SCALE: 1:750 (A1)

PROJECT - ORIGINATOR - VOLUME - LOCATION - TYPE - ROLE - NUMBER: 19011-TJOC-PL-XX-DR-C-0086

REV: C01



1 / 0087 EAST ELEVATION
SCALE: 1:150



2 / 0087 WEST ELEVATION
SCALE: 1:150

| | | | |
|---|---|---|---|
| C01 | AP | ISSUED FOR PLANNING | 02.06.2022 |
| REV | SUIT | DESCRIPTION | DATE |

DRAWING STATUS: ISSUED FOR PLANNING

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Tel: 01-295 2321 Fax: 01-295 4541 Email: tjoc@tjoc.ie Web: www.tjoc.ie

PROJECT: FERMOY WEIR REMEDIATION

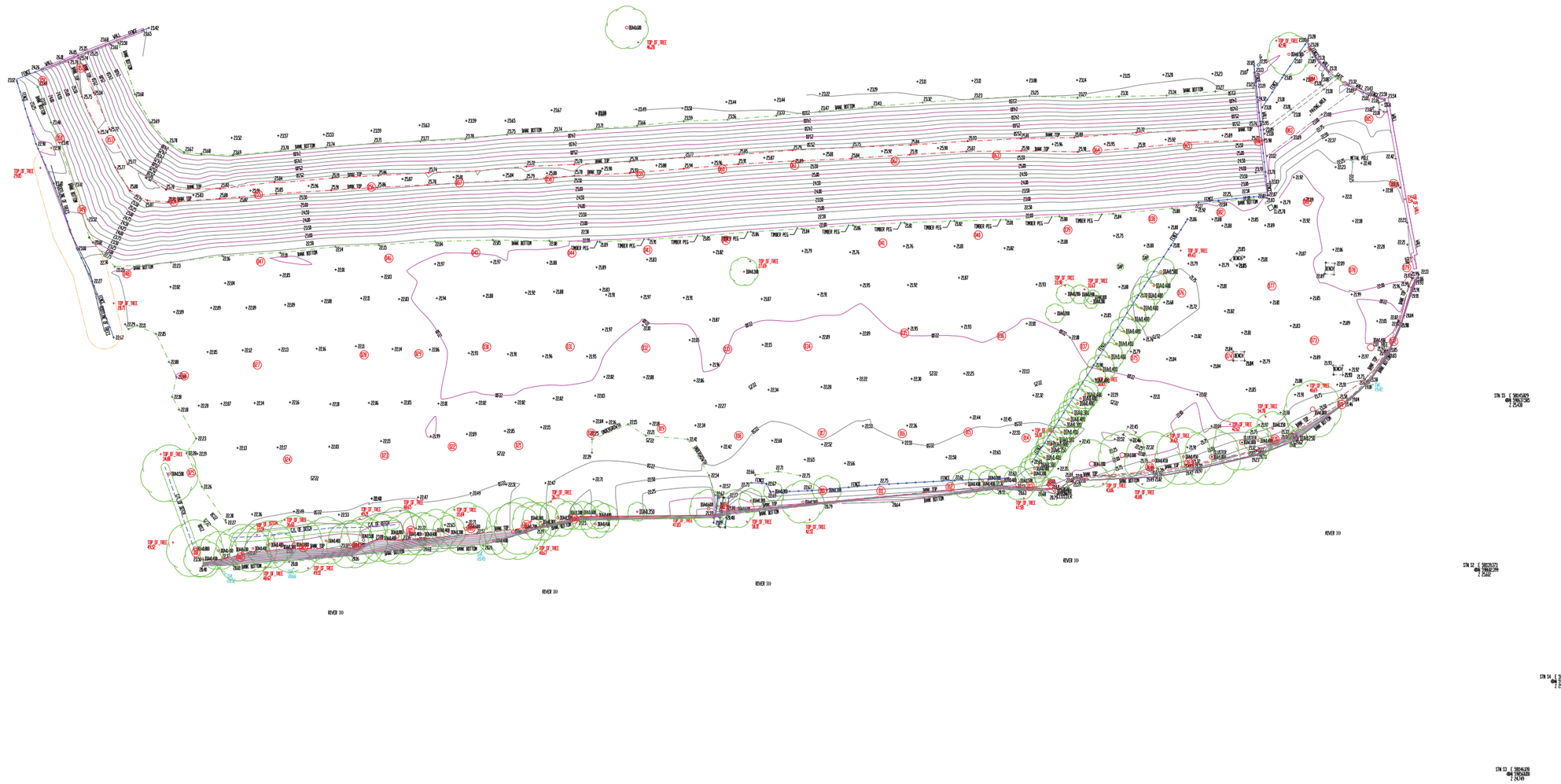
CLIENT: CORK COUNTY COUNCIL

DRAWING TITLE: FERMOY BRIDGE ELEVATIONS

SCALE: 1:150 (A1)

PROJECT - ORIGINATOR - VOLUME -LOCATION- TYPE - ROLE - NUMBER
19011-TJOC-PL-XX-DR-C-0087

REV: C01




# Topographical Survey

Scale 1:500

ITM NORTH

SURVEY NOTES

1. ALL LEVELS ARE RELATED TO MAUN HEAD DATUM (OSGM15)
2. ALL DIMENSIONS ARE IN METERS UNLESS OTHERWISE STATED.
3. ANY DESCRIPENCIES IN THE SURVEY SHOULD BE REPORED TO GEODATA SURVEYING LTD IMMEDIATELY.
4. DO NOT SCALE, THIS SHALL ONLY BE PERMITTED IN DIGITAL FORM.
5. GRID IS 20m X 20m

0 10m 20m 30m

1:500

SYMBOLS

| | | | | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| +0.00 | SPOT LEVEL | G | GULLY | AV | AIR VALVE | AJ | ARMSTRONG JUNCTION | | GATE | O/H ESB | OVERHEAD ESB LINE | SIGN | SIGN | UB | SOFFIT BEAM | +RIDGE | RIDGE LEVEL | | FOUL SEWER | | UNIDENTIFIED EM SIGNAL | | TRAFFIC |
| | CONTROL SURVEY STATION | WM | WATER METER | | FIRE HYDRANT | LP | LAMP POST | SW/0.00 | SURFACE WATER LEVEL | O/H TEL | OVERHEAD TEL LINE | DIA = 0.0m | TREE ACTUAL SPREAD | HK CL | SOFFIT CEILING | +EAVES | SOFFIT LEVEL | | STORM SEWER | | ELECTRICAL CABLE | | TRENCH |
| | MH CL | SV | SLUICE VALVE | TEL | TEL INSP CHAMBER | TP | TELECOM POLE | +BL0.00 | BED LEVEL WATERCOURSE | TL | TELECOM POLE | | TREE TAG NO. | HEAD | HEAD TO FFL | FFL100 | FINISH FLOOR LEVEL | | COMBINED SEWER | | PUBLIC LIGHTING | | COMBINED SEWER |
| | UL | SC | STOP COCK | MP | MINI PILLAR | EP | ESB POLE | +IL | INVERT LEVEL | +TOP | TOP TAG | | BOLLARD | WB | WINDOW BOARD TO FFL | +200 | PEG REF NUMBER | | ESB BOX | | UNIDENTIFIED GPR | | ESB BOX |

COORDINATE SYSTEM

ITM–Irish Transverse Mercator

KEY PLAN

| REVISION | DATE | DESCRIPTION | DRN BY | CKD BY |
|---|---|---|---|---|
| 02 | 04-06-20 | PHOTOS AND TREES | ML | KBB |
| 01 | 30-05-20 | TOPOGRAPHICAL SURVEY | ML | KBB |

RICS

SOCIETY OF CHARTERED SURVEYORS IRELAND

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Geodata Chartered Land Surveyors

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Phone: (+353) (0)23 8852798 Fax: (+353) (0)23 8852799
Email: info@geodatasurveying.ie Website: www.geodatasurveying.ie

Client: TJ O'Connor 7 Associates

Project: Fermoy, Co Cork.

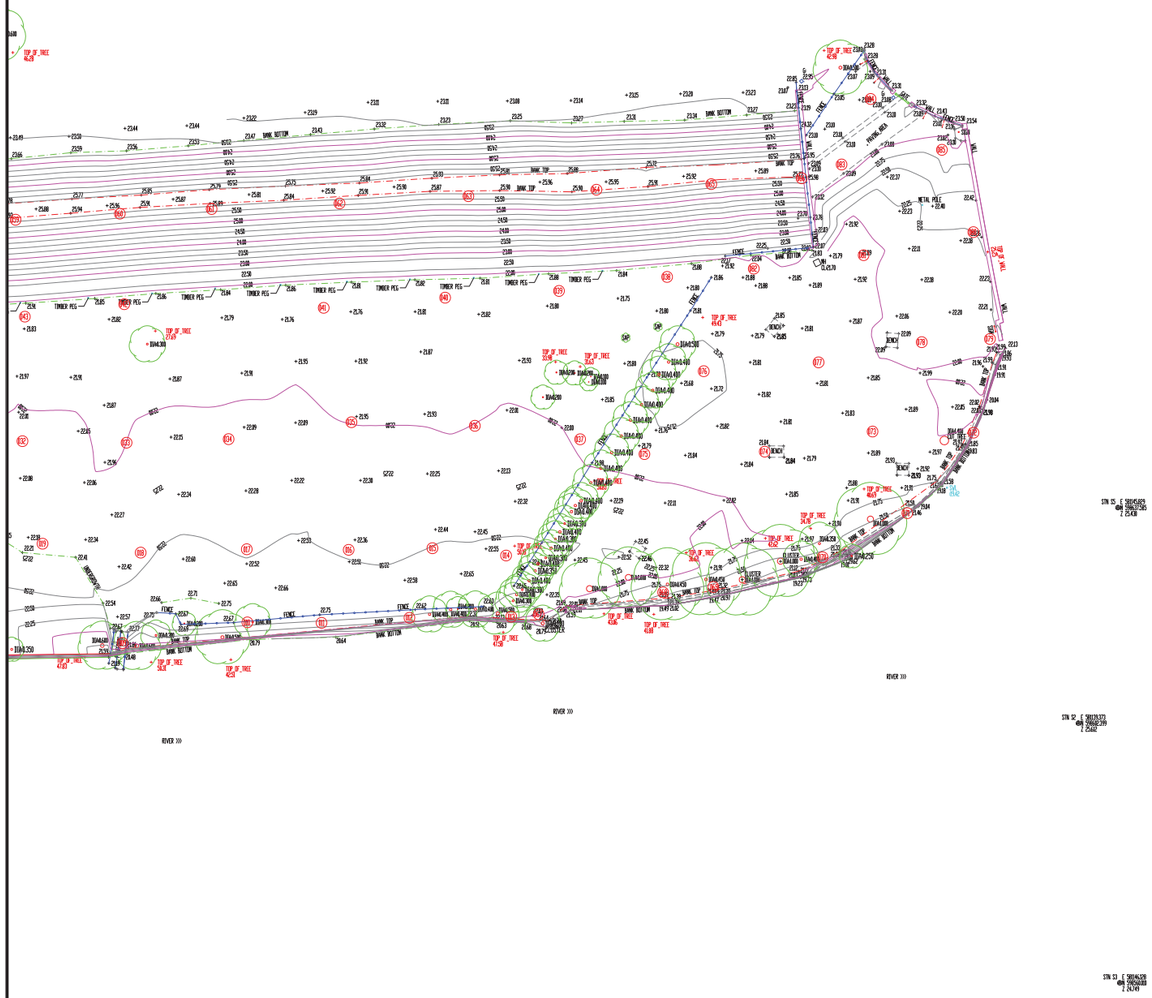
Title: Topographical Survey 2D

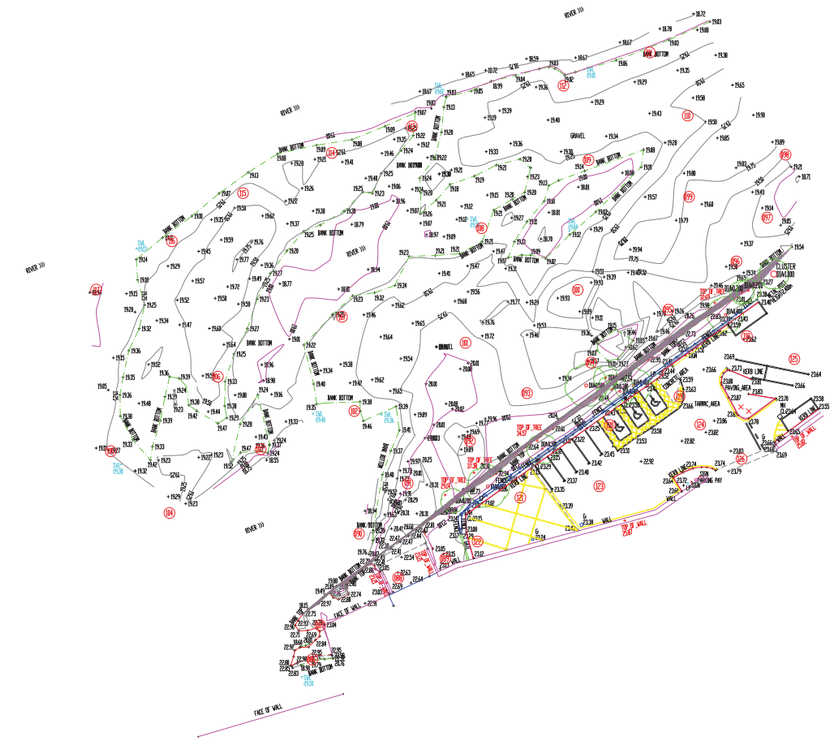
Scale: 1–500

Dwg. No: 20423–101

Date: 04–06–20

Sheet: A1




# Topographical Survey

Scale 1:500

ITM NORTH

SURVEY NOTES

1. ALL LEVELS ARE RELATED TO MALIN HEAD DATUM (OSGM15)
2. ALL DIMENSIONS ARE IN METERS UNLESS OTHERWISE STATED.
3. ANY DESCRIPENCIES IN THE SURVEY SHOULD BE REPORED TO GEODATA SURVEYING LTD IMMEDIATELY.
4. DO NOT SCALE, THIS SHALL ONLY BE PERMITTED IN DIGITAL FORM.
5. GRID IS 20m X 20m

0 10m 20m 30m

1:500

SYMBOLS

| | | | | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| +6.00 | SPOT LEVEL | G | GULLY | AV | AIR VALVE | AJ | ARMSTRONG JUNCTION | | GATE | D/H ESB | OVERHEAD ESB LINE | SIGN | SIGN | UB | SOFFIT BEAM | +RIDGE | RIDGE LEVEL | | FOUL SEWER | | UNIDENTIFIED EM SIGNAL | | TRAFFIC |
| | CONTROL SURVEY STATION | WM | WATER METER | | FIRE HYDRANT | LP | LAMP POST | SW 5.00 | SURFACE WATER LEVEL | D/H TEL | OVERHEAD TEL LINE | DIA = 6.0m | TREE ACTUAL SPREAD | SC CL | SOFFIT CEILING | +EAVES | SOFFIT LEVEL | | STORM SEWER | | ELECTRICAL CABLE | | TRENCH |
| MH CL | MANHOLE COVER | SV | SLUICE VALVE | TCI | TEL INSP CHAMBER | TP | TELECOM POLE | +BL6.00 | BED LEVEL WATERCOURSE | TL | TELECOM POLE | | TREE TAG NO. | HEAD | HEAD TO FFL | FFL 6.00 | FINISH FLOOR LEVEL | | COMBINED SEWER | | PUBLIC LIGHTING | | COMBINED SEWER |
| UL | UTILITY INSP CHAMBER | SC | STOP COCK | MP | MINI PILLAR | EP | ESB POLE | +IL | INVERT LEVEL | +TOP | TOP TAG | | BOLLARD | WB | WINDOW BOARD TO FFL | +200 | PEG REF NUMBER | ESB | ESB BOX | | UNIDENTIFIED GPR | ESB | ESB BOX |

COORDINATE SYSTEM

ITM-Irish Transverse Mercator

KEY PLAN

| REVISION | DATE | DESCRIPTION | DRN BY | CKD BY |
|---|---|---|---|---|
| 01 | 28-05-20 | TOPOGRAPHICAL SURVEY | AL | KDB |

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Geodata
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Phone: (+353) (0)23 8852798 Fax: (+353) (0)23 8852799
Email: info@geodatasurveying.ie Website: www.geodatasurveying.ie

Client: TJ O'Connor 7 Associates

Project: Fermoy, Co Cork.

Title: Topographical Survey 2D

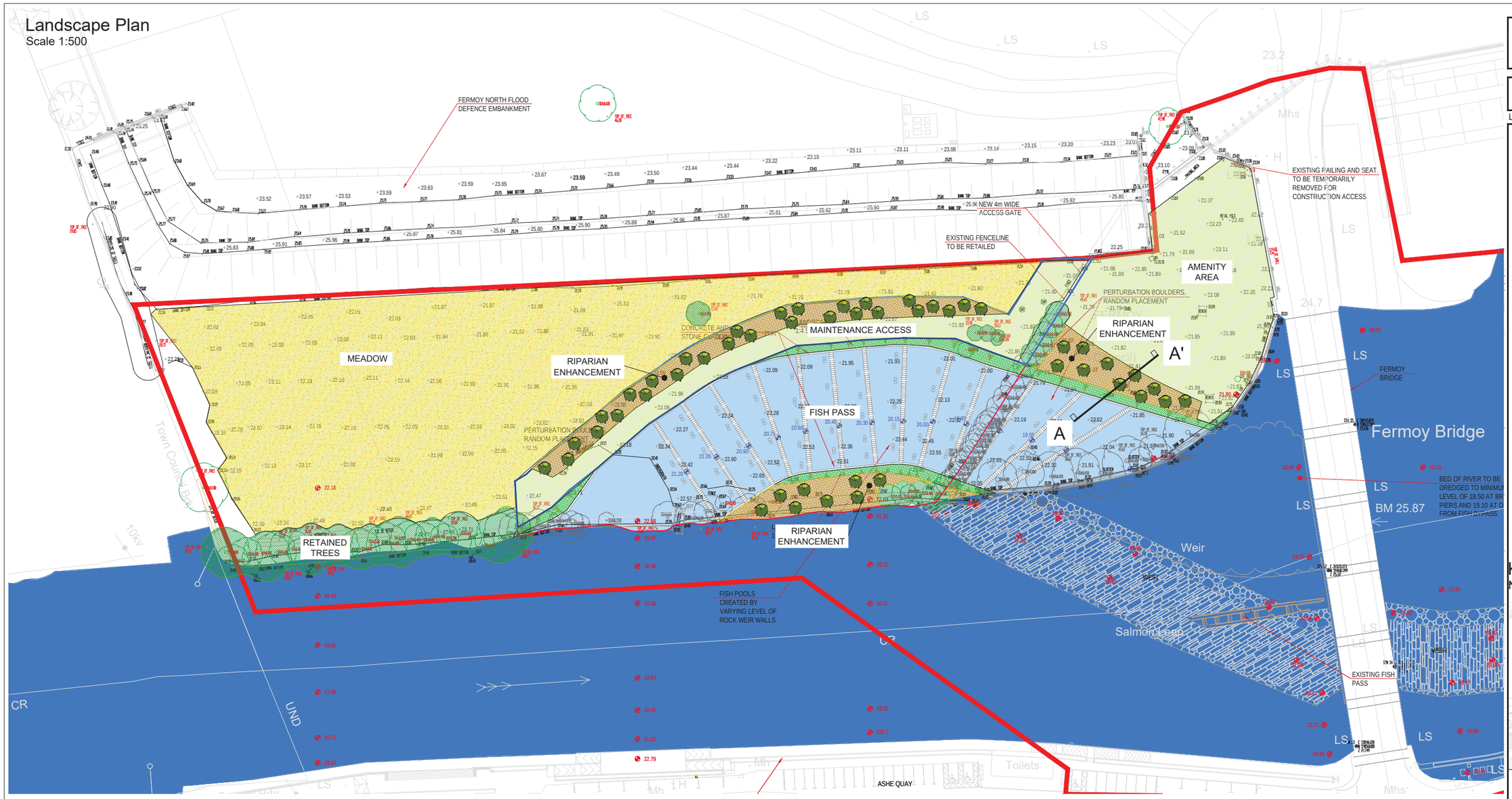
Scale: 1-500

Date: 28-05-20

Sheet: A1

Dwg. No: 20423-101

# Landscape Plan
Scale 1:500




doyle + otroithigh landscape architecture ltd.

North.

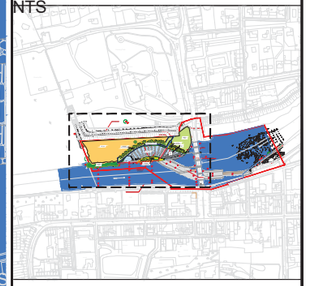
Note:

## Legend

**Legend:**

- Trees
  A mixture of native species are proposed including Alder, Willow, Scots Pine, Birch & Rowan - 12-14cms
- Existing retained trees protected during the site works
- Willow peg plants (locally sourced) set into bank beside fish pass
- **Native Species Riparian Enhancement**
  15% Alder - 8-10 cms Trees / 80-100cms Transplants
  15% Salix 8-10 cms Trees / 80-100cms Transplants
  10% Wild Cherry 8-10cms Trees / 80-100cms Transplants
  10% Bird Cherry 8.10cms Trees / 80-100cms Transplants
  10% Native Black Poplar 80-100cms Transplants.
  15% Holly 40-60Cms Transplants
  15% Blackthorn 90-120 Cms Transplants
  2.5% Bramble - 40-60cms Transplants
  2.5% Hazel - 60-90Cms Transplants
  2.5% Dog Rose - 60-90Cms Transplants
  2.5% Spindle - 90-120 Cms Transplants
- Grass Meadow
- Hardwearing dwarf amenity ryegrass for public access

## Keyplan
NTS



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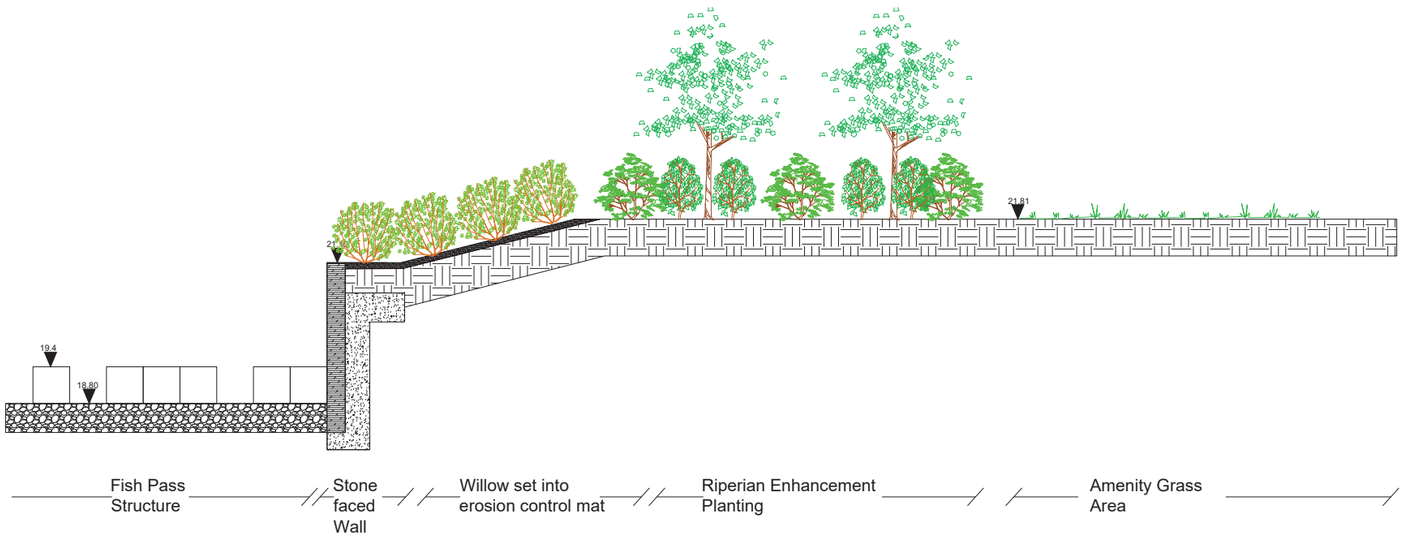
Scale 1:50




| Date | Note |
|---|---|

| | |
|---|---|
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| Drawing name: LANDSCAPE PLAN | Drawing number: LP-01-PP |

| Drawing scale @ A1: | Drawn by: | Checked by: |
|---|---|---|
| 1:500 & 1:50 | dos | dot |
| Status: Planning | | date: 04.04.2022 |


Contact details:
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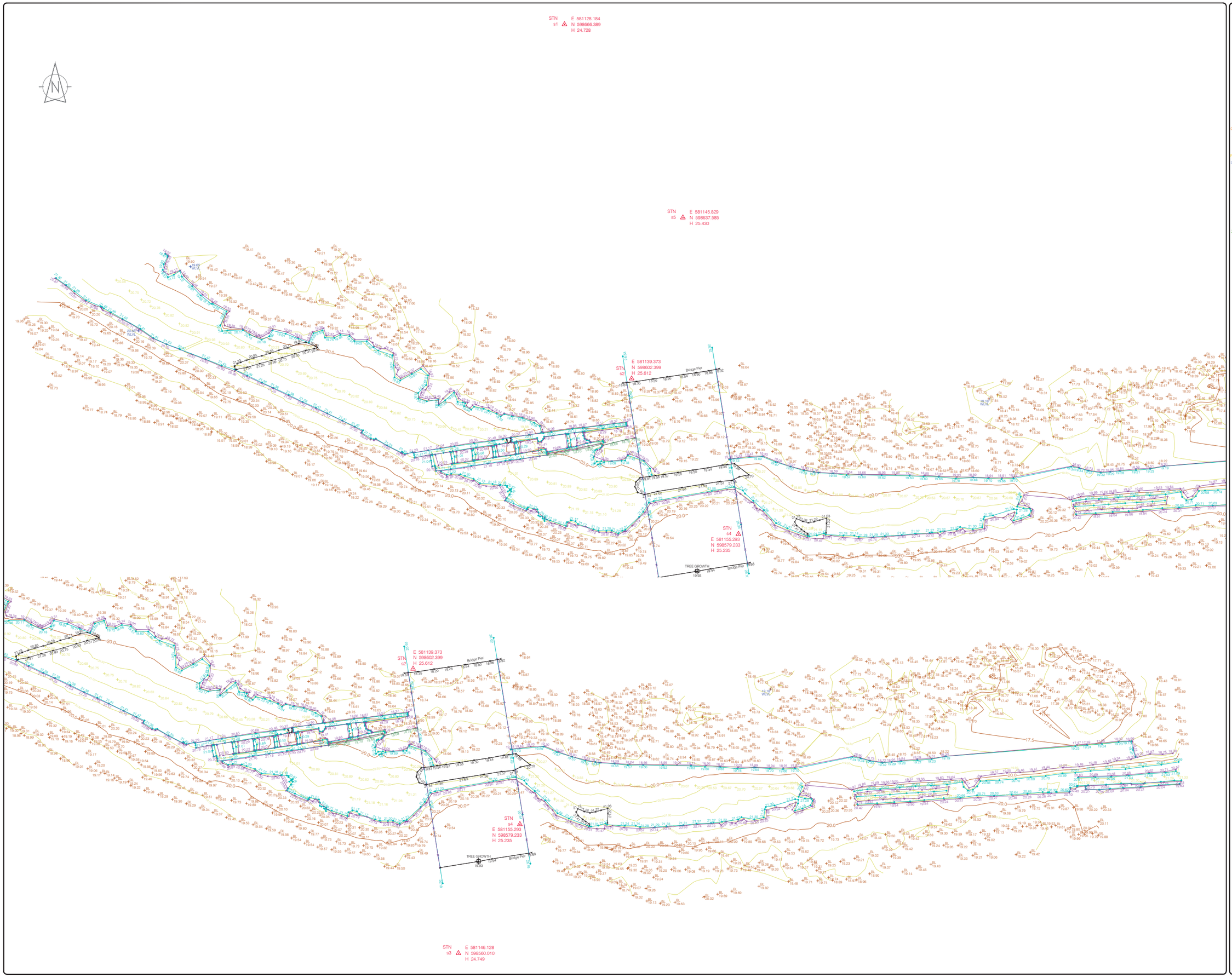
e-mail: linda@doyle-otroithigh.com
Daithi o'Troithigh (Director) mobile: 086 300 3499
e-mail: daithi@doyle-otroithigh.com

Office address:
Pembroke House
29-32 Upper Pembroke Street
Dublin 2

doyle + o'troithigh
landscape - architecture

www.doyle-otroithigh.com




## LEGEND

### Street furniture & Services

- Over Head Wires (LUAS) - Pylon ESB
- Flowerbed
- Pipe
- Lift
- Barrier
- Pump
- Trial Pit
- Bus/Tram Shelter
- Postbox
- Valve - General
- Water Valve
- Gas Valve
- Sluice Valve
- Air Valve
- Stop Cock
- C P Post
- Marker Post
- Traffic light
- Parking Meter
- Plane Aerial Mark
- Smart Card Validator
- Unknown Valve
- Road Sign
- Bus Stop
- Bollard
- Beacon
- Coalhole Cover
- Bore Hole
- Electricity Pole
- Telegraph pole
- OCS Pole
- CCTV Camera Pole
- Lamp Post
- Foul Manhole
- Surface Water MH
- Manholes
- Air Conditioning Vents
- Services Inspection Cover
- Traffic Inspection Cover
- Cable TV Inspection Cover
- ESAT Inspection Cover
- NTL Inspection Cover
- Eircom Inspection Cover
- Rodding Eye
- Phone Box
- Bench Seat
- Kiosk
- Gully
- Waste Bin
- Hydrant
- Fire Hydrant
- ESB Box
- ESB Inspection Cover
- Traffic Control Box
- LUAS Technical Cubicle
- Ticket Vending Machine
- Water Meter Cover
- Telecom Inspection Cover
- Monument / Toilets
- Tank Storage
- Basement: MH, Cover & Pipe
- Dished Aerial Mark
- Stay for pole
- Pipe Protection
- Washout
- Duct
- Gas Cover
- C P Box
- U/G Car Park Vent

### Natural Features

- Surface Change
- Land Drain
- Bottom of Slope
- Top of Slope
- Ditch
- Water Edge / Lake / Pond
- Hedge / Trees Drip Line / Vegetation
- Tree Coniferous
- Water Level
- Crown Level
- Invert level
- Bed Level
- Spotheight
- Top of Tree
- Tree Deciduous

### Golf

- Fair Way
- Green
- Tee Box

### Other

- Survey Station
- Photo point
- River Alignment

### Built Features

### Roads & Road Markings

- Building
- Edge of Road
- Kerb Bottom
- Kerb Top
- Bridge Abutment
- Bridge Deck
- Bridge Parapet
- Building Façade
- Footpath / Platform Train & Tram
- Damp Proof Course / Verge
- Bridge Pier / Wall & Gate Pillar / LUAS Trackbed
- Cycleway / Private Landing Area
- Fence
- Gate
- Road Centreline
- Top of Wall
- Hoarding
- Property Line
- Road Scar
- Top of Fence
- Floor Level
- Apex Height
- Eaves Height
- Parapet Height
- Soffit Elevation
- Step Level
- Concrete Pad
- Track
- Wall / Retaining Wall
- Railway / Tram Rail / Grating / Ramp
- Building Canopy / Roof / Overhang

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The Client must promptly notify the Company of any errors in mapping of which it becomes aware. If misleading, inaccurate or otherwise inappropriate information is brought to the Company's attention or the Company itself identifies any such imprecision or error in a survey, it shall use its reasonable endeavours to fix or remove it and if necessary in certain instances, the Company being on notice of any such misleading, inaccurate or otherwise inappropriate information, it will re-conduct the survey and reproduce the data to within the specified scale or accuracy.

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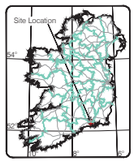

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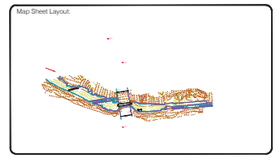

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| Drawn by : BK | Date: Aug 2018 | Grid System: | |
| Checked by : KC | Date: Aug 2018 | Irish National Grid ☐ ITM ■ | |

Revisions

| No. | Date | Description |
|---|---|---|
| 0 | 28.08.18 | First Drawing |

murphy SURVEYS
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Topographic surveys, Measured Building Surveys, Setting-Out, As-Built Surveys, Hydrographic Surveys, Legal Mapping, Pipeline Surveys, Services Location, Ground Penetrating Radar, Laser Scanning, Rectified Photography

Kildare Cork Belfast Glasgow London


**Head Office**

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Kilcullen Business Campus
Kilcullen Co. Kildare
Ireland

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Fax: (+353) 045 484004
Email: info@murphysurveys.ie


| | |
|---|---|
| **Client :** | TJ_O_Connor_&_Associates |
| **Project :** | 27232 18024_Fermoy_Weir |
| **Date :** 28.08.18 | **Scale :** 1:250@A1 |
| **Description :** | Topographical Survey |
| **Drawing Number :** | **FERMOY WEIR_PLAN** |

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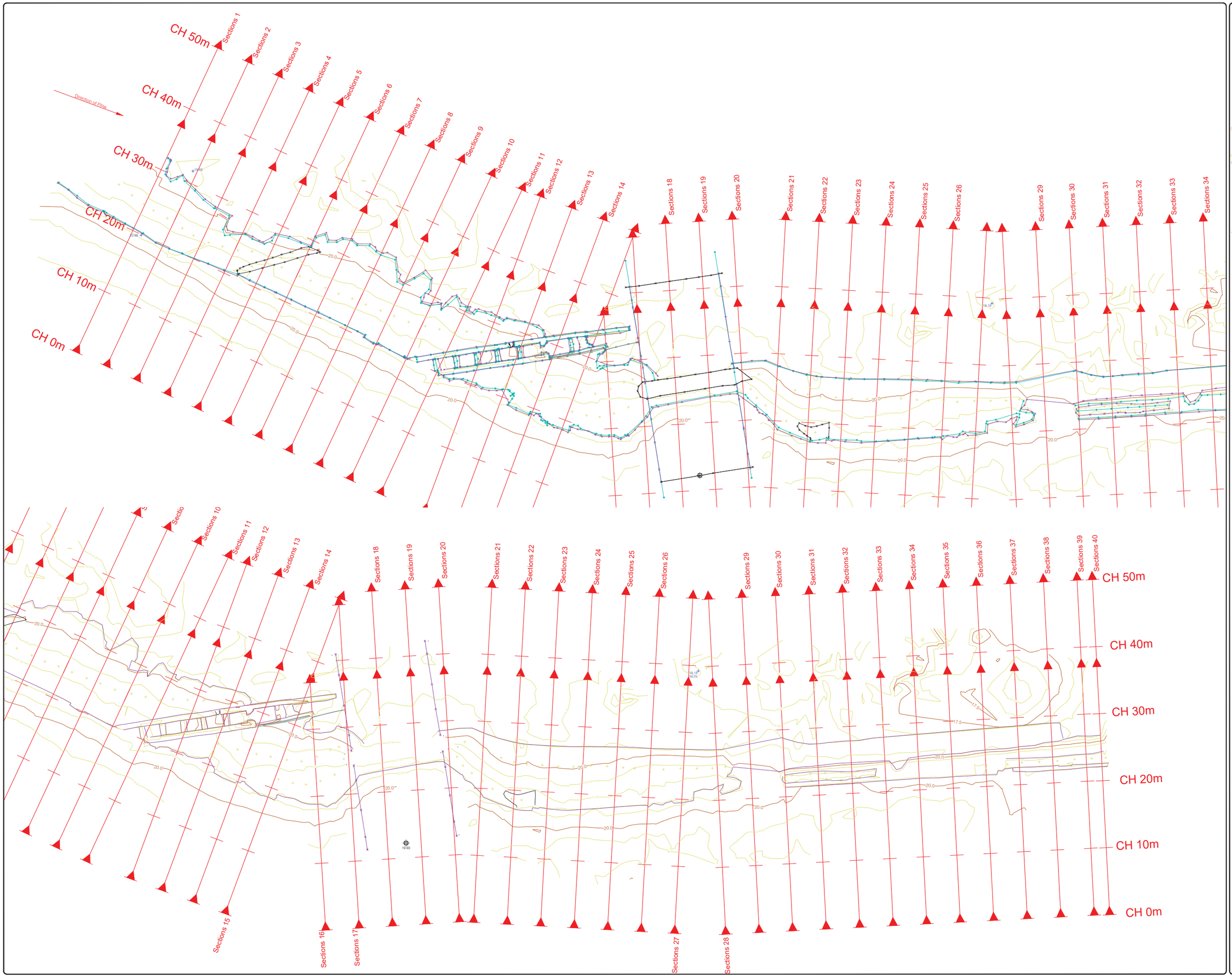


## LEGEND

### Street furniture & Services

- Over Head Wires (LUAS) - Pylon ESB
- Flowerbed
- Pipe
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- Barrier
- Pump
- Trial Pit
- Bus/Tram Shelter
- Postbox
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- Water Valve
- Gas Valve
- Sluice Valve
- Air Valve
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- Marker Post
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- Telegraph pole
- OCS Pole
- Lamp Post
- CCTV Camera Pole
- Foul Manhole
- Surface Water MH
- Manholes
- Air Conditioning Vents
- Services Inspection Cover
- Traffic Inspection Cover
- Cable TV Inspection Cover
- ESAT Inspection Cover
- NTL Inspection Cover
- Eircom Inspection Cover
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- Green
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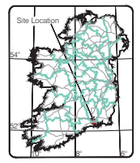
Site Location



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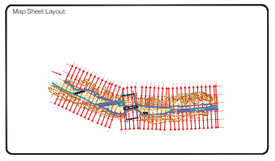

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| Surveyed by : MSL | Date: Aug 2018 | Datum: | Malin Head |
| Drawn by : BK | Date: Aug 2018 | Grid System: | |
| Checked by : KC | Date: Aug 2018 | Irish National Grid ☐ ITM ■ | |

Revisions

| No. | Date | Description |
|---|---|---|
| 0 | 28.08.18 | First Drawing |

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**Drawing Number :** FERMOY WEIR_CROSS SECTIONS_PLAN

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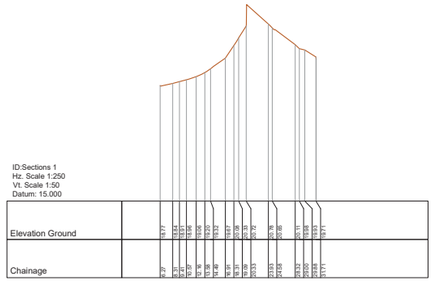


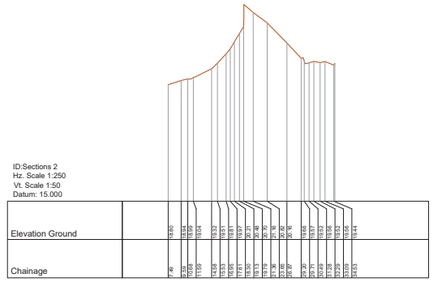


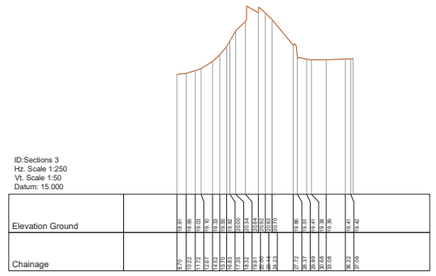


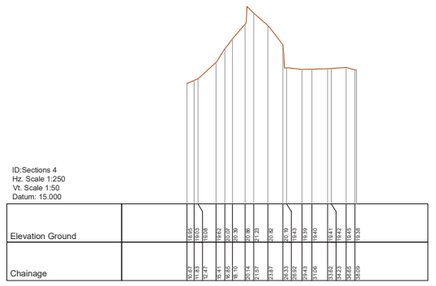


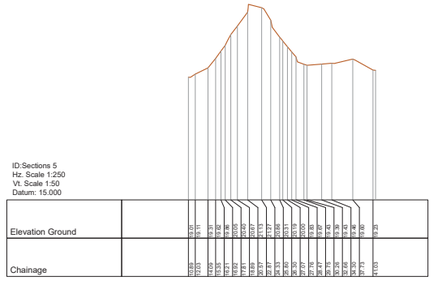


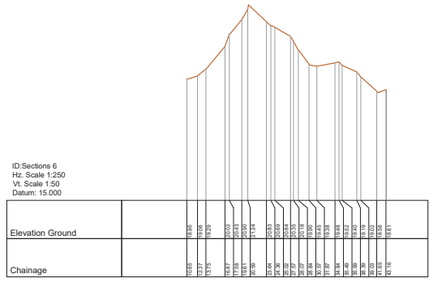


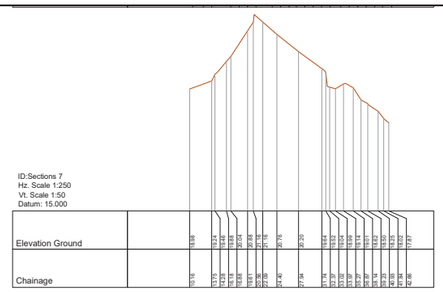


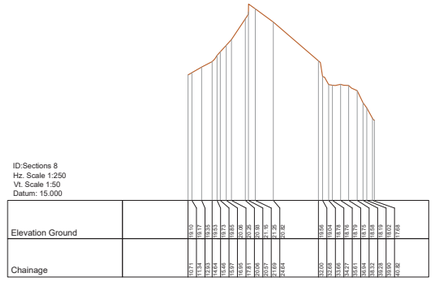


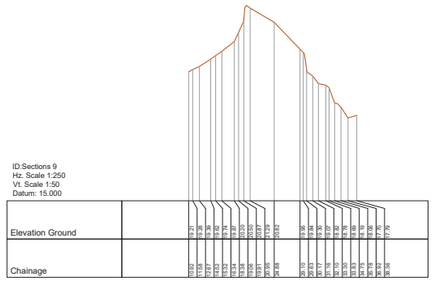


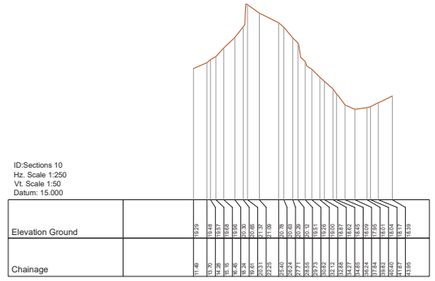


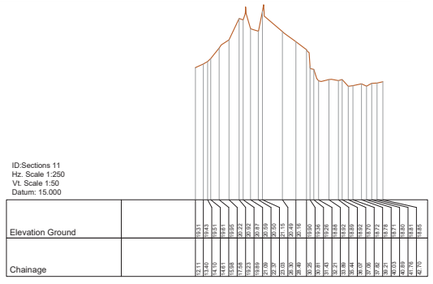


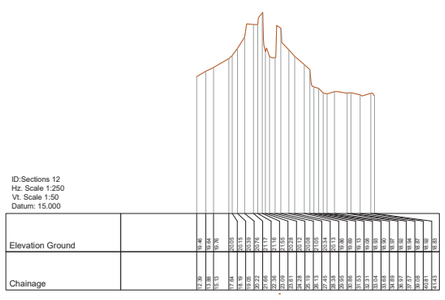


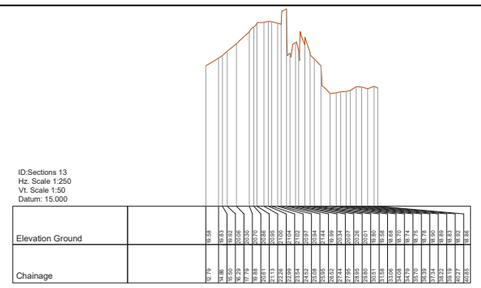


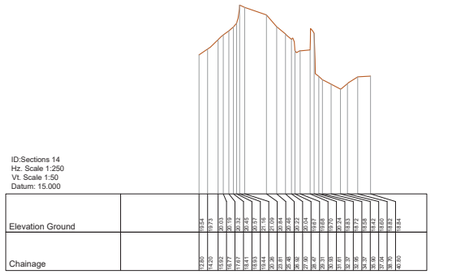


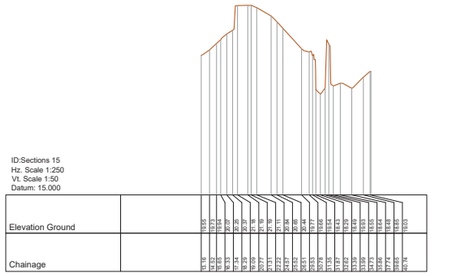


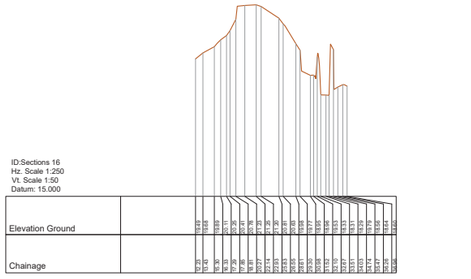


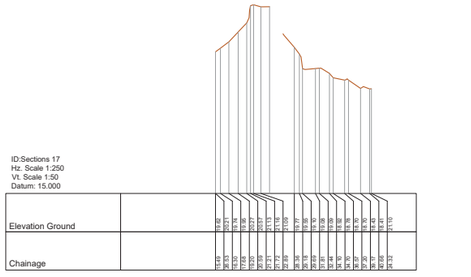


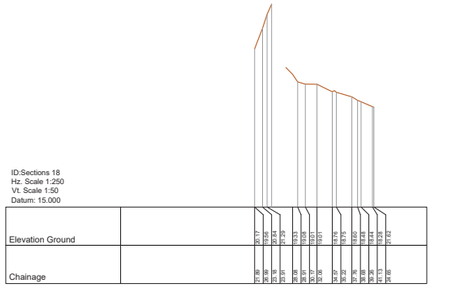


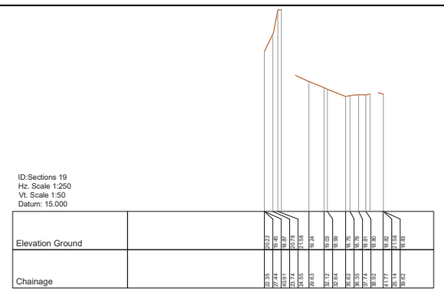


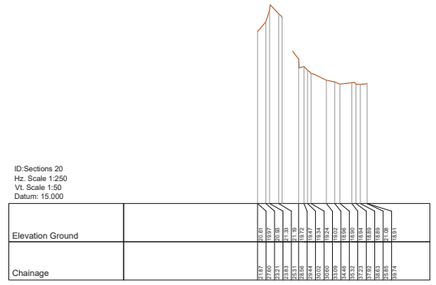


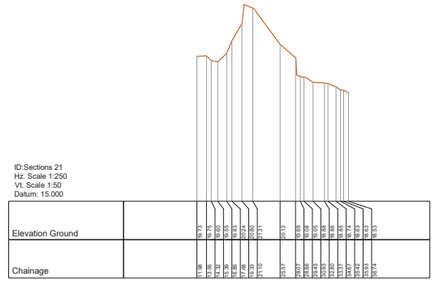


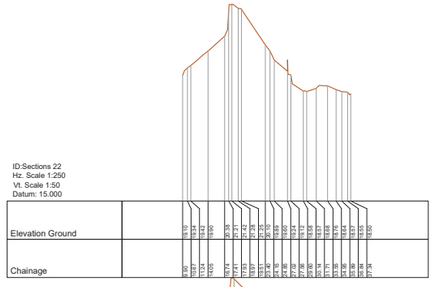


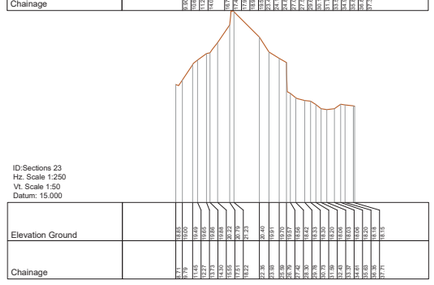


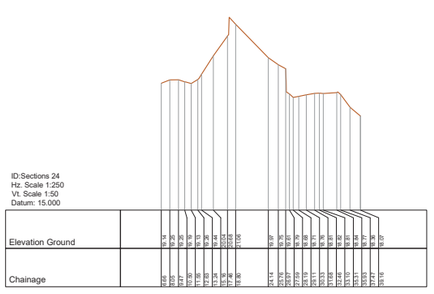


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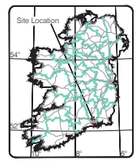


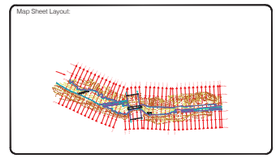


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Revisions

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**Drawing Number :** FERMOY WEIR_CROSS SECTIONS_PROFILE_01

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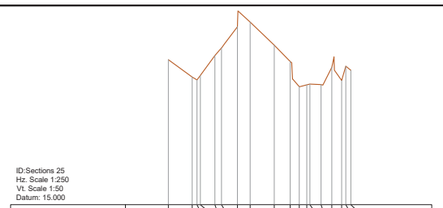

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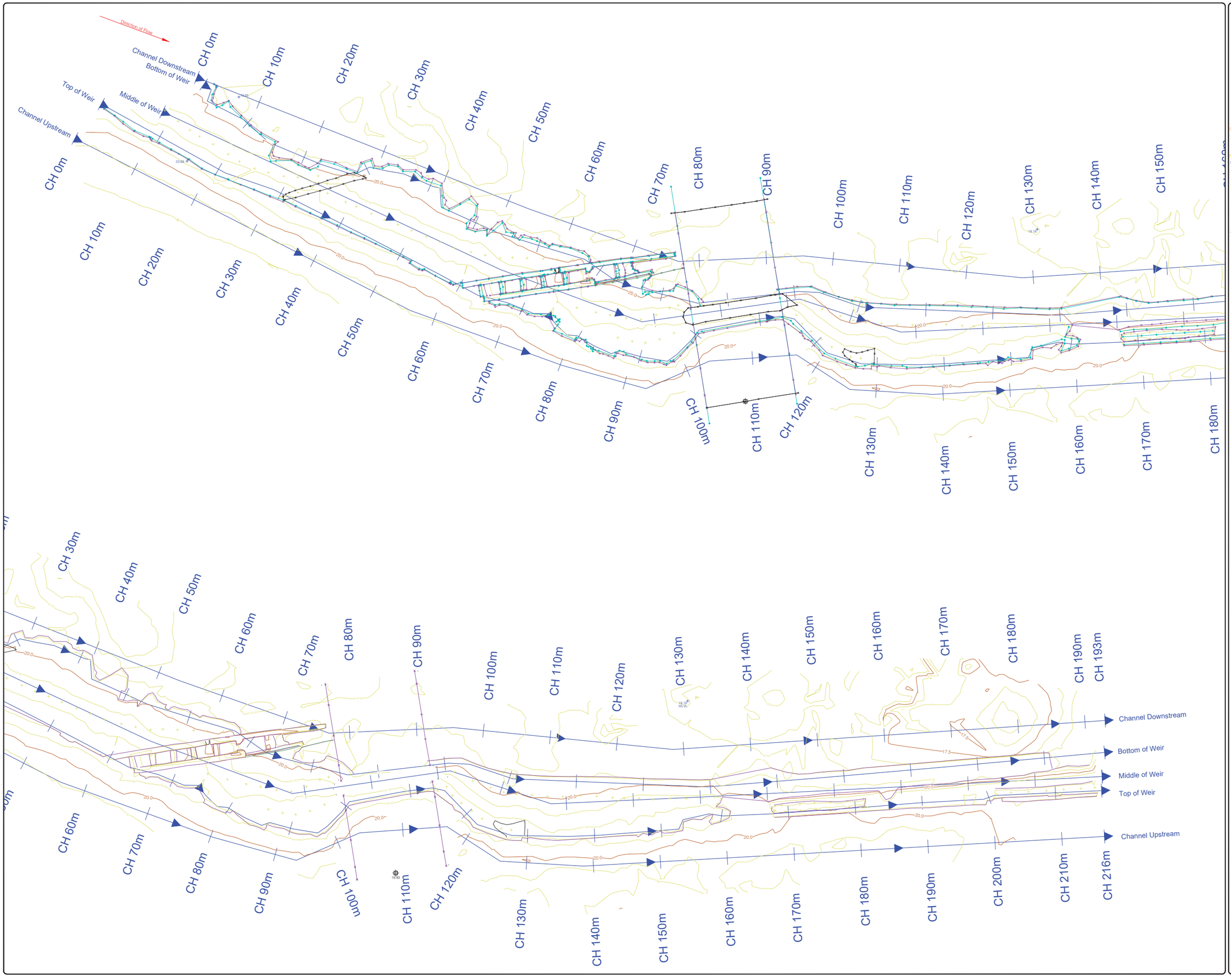


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Ditch
Water Edge / Lake / Pond
Hedge / Trees Drip Line / Vegetation
Tree Coniferous
Water Level
Crown Level
Invert level
Bed Level
Spotheight
Top of Tree
Tree Deciduous

### Golf

Fair Way
Green
Tee Box

### Other

Survey Station
Photo point
River Alignment

### Built Features

### Roads & Road Markings

Building
Edge of Road
Kerb Bottom
Kerb Top
Bridge Abutment
Bridge Deck
Bridge Parapet
Building Façade
Footpath / Platform Train & Tram
Damp Proof Course / Verge
Bridge Pier / Wall & Gate Pillar / LUAS Trackbed
Cycleway / Private Landing Area
Fence
Gate
Road Centreline
Top of Wall
Hoarding
Property Line
Road Scar
Top of Fence
Wall / Retaining Wall
Railway / Tram Rail / Grating / Ramp
Building Canopy / Roof / Overhang
Floor Level
Apex Height
Eaves Height
Parapet Height
Soffit Elevation
Step Level
Concrete Pad
Track

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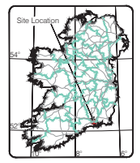

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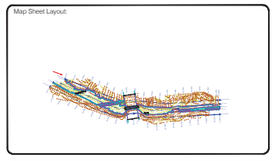

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| Drawn by : BK | Date: Aug 2018 | Grid System: | |
| Checked by : KC | Date: Aug 2018 | Irish National Grid ☐ ITM ■ | |

Revisions

| No | Date | Description |
|---|---|---|
| 0 | 28.08.18 | First Drawing |

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Phone: (+353) 045 484040
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Email: info@murphysurveys.ie


| | |
|---|---|
| **Client :** | TJ_O_Connor_&_Associates |
| **Project :** | 27232 18024_Fermoy_Weir |
| **Date :** 28.08.18 | **Scale :** 1:250@A1 |
| **Description :** | Topographical Survey |
| **Drawing Number :** | FERMOY WEIR_LONG SECTION_PLAN |

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Vt. Scale 1:50
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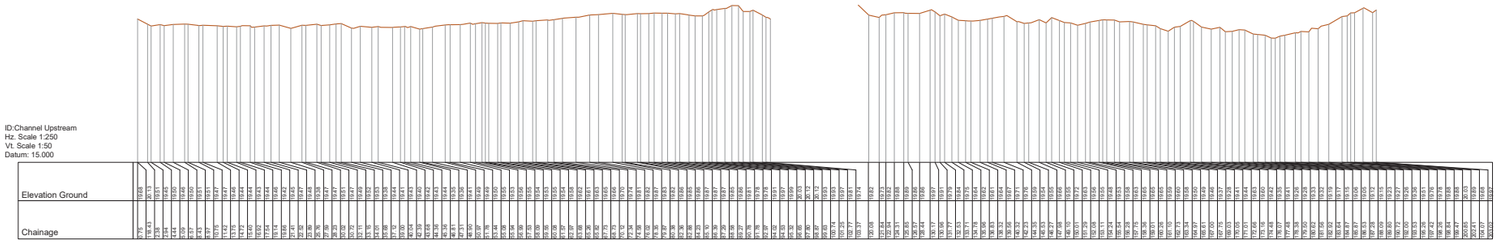


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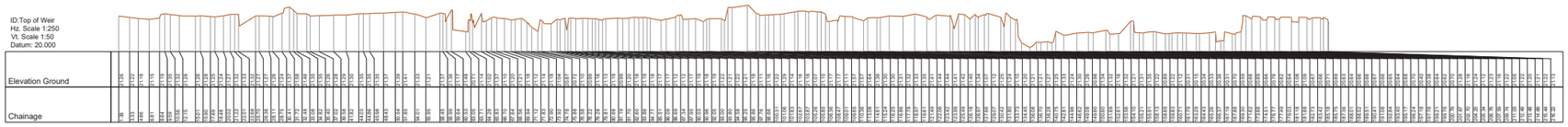


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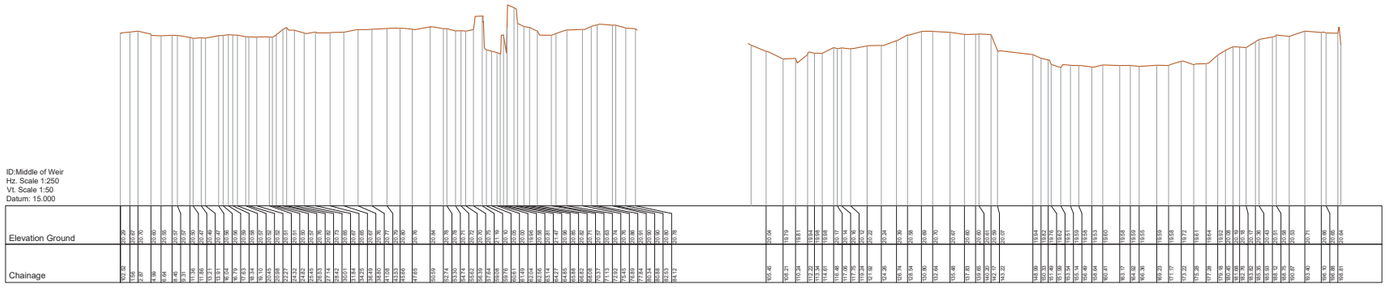


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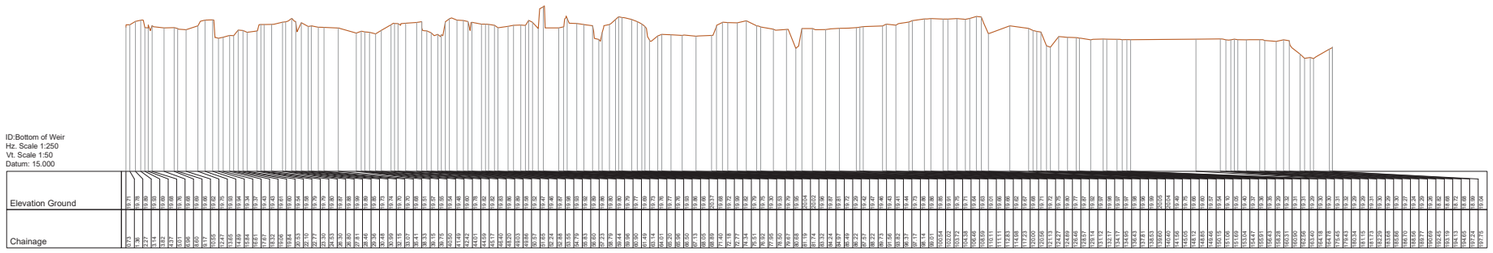


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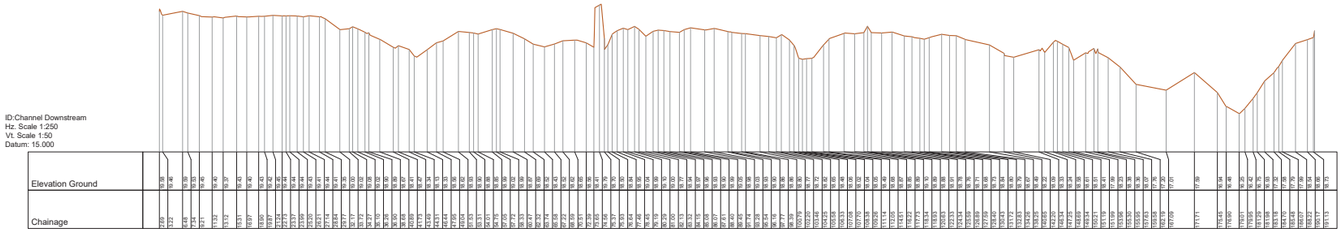


## LEGEND

### Street furniture & Services

- Over Head Wires (LUAS) - Pylon ESB
- Flowerbed
- Pipe
- Lift
- Barrier
- Pump
- Trial Pit
- Bus/Tram Shelter
- Postbox
- Valve - General
- Water Valve
- Gas Valve
- Sluice Valve
- Air Valve
- Stop Cock
- C P Post
- Marker Post
- Traffic light
- Parking Meter
- Plane Aerial Mark
- Smart Card Validator
- Unknown Valve
- Bus Stop
- Bollard
- Beacon
- Coalhole Cover
- Bore Hole
- Electricity Pole
- Telegraph pole
- OCS Pole
- CCTV Camera Pole
- Lamp Post
- Foul Manhole
- Surface Water MH
- Manholes
- Air Conditioning Vents
- Services Inspection Cover
- Traffic Inspection Cover
- Cable TV Inspection Cover
- ESAT Inspection Cover
- NTL Inspection Cover
- Eircom Inspection Cover
- Rodding Eye
- Road Sign
- Bench Seat
- Kiosk
- Gully
- Waste Bin
- Hydrant
- Fire Hydrant
- ESB Box
- ESB Inspection Cover
- Traffic Control Box
- LUAS Technical Cubicle
- Ticket Vending Machine
- Water Meter Cover
- Telecom Inspection Cover
- Monument / Toilets
- Tank Storage
- Basement: MH, Cover & Pipe
- Dished Aerial Mark
- Stay for pole
- Pipe Protection
- Washout
- Phone Box
- Duct
- Gas Cover
- C P Box
- U/G Car Park Vent

### Natural Features

- Surface Change
- Land Drain
- Bottom of Slope
- Top of Slope
- Ditch
- Water Edge / Lake / Pond
- Hedge / Trees Drip Line / Vegetation
- Tree Coniferous
- Water Level
- Crown Level
- Invert level
- Bed Level
- Spotheight
- Top of Tree
- Tree Deciduous

### Golf

- Fair Way
- Green
- Tee Box

### Other

- Survey Station
- Photo point
- River Alignment

### Built Features

### Roads & Road Markings

- Building
- Edge of Road
- Kerb Bottom
- Kerb Top
- Bridge Abutment
- Bridge Deck
- Bridge Parapet
- Building Façade
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- Eaves Height
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- Soffit Elevation
- Step Level
- Concrete Pad
- Track

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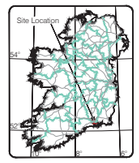


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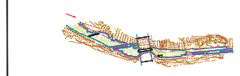

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| Surveyed by : | MSL | Date: | Aug 2018 | Datum: | Malin Head |
| Drawn by : | BK | Date: | Aug 2018 | Grid System: | |
| Checked by : | KC | Date: | Aug 2018 | Irish National Grid ☐ ITM ■ | |

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| No. | Date | Description |
|---|---|---|
| 0 | 28.08.18 | First Drawing |


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**Client :** TJ_O_Connor_&_Associates

**Project :** 27232 18024_Fermoy_Weir

**Date :** 28.08.18 **Scale :** AS SHOWN@A1

**Description :** Topographical Survey

**Drawing Number :** FERMOY WEIR_LONG SECTION_01

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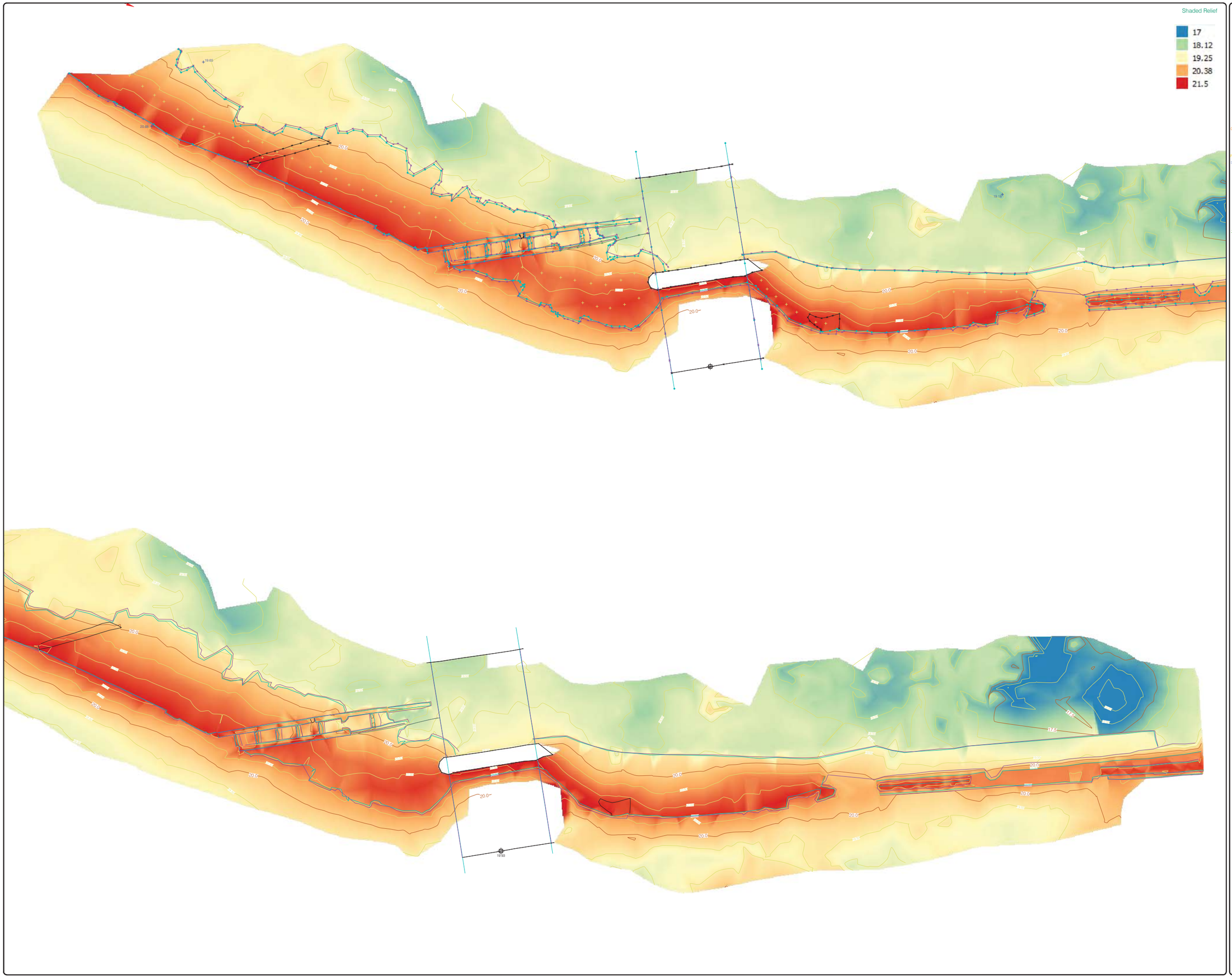


## LEGEND

### Street furniture & Services

| | | | | | |
|---|---|---|---|---|---|
| Over Head Wires (LUAS) - Pylon ESB | | RS | Road Sign | PBOX | Phone Box |
| Flowerbed | BS | Bus Stop | | Bench Seat | Duct |
| Pipe | BD | Bollard | | Kiosk | GAS Gas Cover |
| Lift | BEA | Beacon | GY | Gully | CPBox C P Box |
| Barrier | CH | Coalhole Cover | U/G Vent | | U/G Car Park Vent |
| Pump | BH | Bore Hole | BIN | Waste Bin | |
| Trial Pit | EP | Electricity Pole | HY | Hydrant | |
| Bus/Tram Shelter | TP | Telegraph pole | FH | Fire Hydrant | |
| Postbox | OCS | OCS Pole | EBOX | ESB Box | |
| Valve - General | CP | CCTV Camera Pole | ICB | ESB Inspection Cover | |
| Water Valve | LP | Lamp Post | TRF | Traffic Control Box | |
| Gas Valve | FMH | Foul Manhole | LUAS | LUAS Technical Cubicle | |
| Sluice Valve | SMH | Surface Water MH | | Ticket Vending Machine | |
| Air Valve | MH | Manholes | WM | Water Meter Cover | |
| Stop Cock | AC | Air Conditioning Vents | ICT | Telecom Inspection Cover | |
| CPP C P Post | ICU | Services Inspection Cover | | Monument / Toilets | |
| MK Marker Post | ICTC | Traffic Inspection Cover | | Tank Storage | |
| TL Traffic light | ICTV | Cable TV Inspection Cover | | Basement: MH, Cover & Pipe | |
| PM Parking Meter | ICES | ESAT Inspection Cover | XDAM | Dished Aerial Mark | |
| PAM Plane Aerial Mark | ICNC | NTL Inspection Cover | +STAY | Stay for pole | |
| SCV Smart Card Validator | ICEM | Eircom Inspection Cover | PP | Pipe Protection | |
| Unknown Valve | | Rodding Eye | | Washout | |

### Natural Features

| | | | |
|---|---|---|---|
| Surface Change | Water Level | Water Level | |
| Land Drain | CRWN | Crown Level | |
| Bottom of Slope | IL | Invert level | |
| Top of Slope | BL | Bed Level | |
| Ditch | SP | Spotheight | |
| Water Edge / Lake / Pond | TOT | Top of Tree | |
| Hedge / Trees Drip Line / Vegetation | | | |
| Tree Coniferous | | Tree Deciduous | |

### Golf

| | |
|---|---|
| FWAY | Fair Way |
| GREE | Green |
| TBOX | Tee Box |

### Other

| | |
|---|---|
| S1 | Survey Station |
| | Photo point |
| | River Alignment |

### Built Features

### Roads & Road Markings

| | | | |
|---|---|---|---|
| Building | Fence | FL 0.00 | Floor Level |
| Edge of Road | Gate | APX 0.00 | Apex Height |
| Kerb Bottom | Road Centreline | EV 0.00 | Eaves Height |
| Kerb Top | Top of Wall | PAR 0.00 | Parapet Height |
| Bridge Abutment | Hoarding | SOFF | Soffit Elevation |
| Bridge Deck | Property Line | STPL 5.12 | Step Level |
| Bridge Parapet | Road Scar | CONC | Concrete Pad |
| Building Façade | Top of Fence | | Track |

| | |
|---|---|
| Footpath / Platform Train & Tram | Wall / Retaining Wall |
| Damp Proof Course / Verge | Railway / Tram Rail / Grating / Ramp |
| Bridge Pier / Wall & Gate Pillar / LUAS Trackbed | Building Canopy / Roof / Overhang |
| Cycleway / Private Landing Area | |

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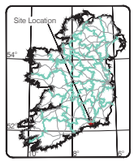


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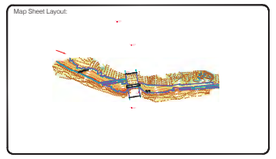

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| Drawn by : | BK | Date: | Aug 2018 | Grid System: | |
| Checked by : | KC | Date: | Aug 2018 | Irish National Grid ☐ ITM ■ | |

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| No. | Date | Description |
|---|---|---|
| 0 | 28.08.18 | First Drawing |

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Email: info@murphysurveys.ie

| | |
|---|---|
| **Client :** | TJ_O_Connor_&_Associates |
| **Project :** | 27232 18024_Fermoy_Weir |
| **Date :** 28.08.18 | **Scale :** 1:250@A1 |
| **Description :** | Topographical Survey |
| **Drawing Number :** | **FERMOY WEIR_DTM** |

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## LEGEND

### Street furniture & Services

- Over Head Wires (LUAS) - Pylon ESB
- Flowerbed
- Pipe
- Lift
- Barrier
- Pump
- Trial Pit
- Bus/Tram Shelter
- Postbox
- Valve - General
- Water Valve
- Gas Valve
- Sluice Valve
- Air Valve
- Stop Cock
- C P Post
- Marker Post
- Traffic light
- Parking Meter
- Plane Aerial Mark
- Smart Card Validator
- Unknown Valve
- Bus Stop
- Bollard
- Beacon
- Coalhole Cover
- Bore Hole
- Electricity Pole
- Telegraph pole
- OCS Pole
- CCTV Camera Pole
- Lamp Post
- Foul Manhole
- Surface Water MH
- Manholes
- Air Conditioning Vents
- Services Inspection Cover
- Traffic Inspection Cover
- Cable TV Inspection Cover
- ESAT Inspection Cover
- NTL Inspection Cover
- Eircom Inspection Cover
- Rodding Eye
- Road Sign
- Bench Seat
- Kiosk
- Gully
- U/G Car Park Vent
- Waste Bin
- Hydrant
- Fire Hydrant
- ESB Box
- ESB Inspection Cover
- Traffic Control Box
- LUAS Technical Cubicle
- Ticket Vending Machine
- Water Meter Cover
- Telecom Inspection Cover
- Monument / Toilets
- Tank Storage
- Basement: MH, Cover & Pipe
- Dished Aerial Mark
- Stay for pole
- Pipe Protection
- Washout
- Phone Box
- Duct
- Gas Cover
- C P Box

### Natural Features

- Surface Change
- Land Drain
- Bottom of Slope
- Top of Slope
- Ditch
- Water Edge / Lake / Pond
- Hedge / Trees Drip Line / Vegetation
- Tree Coniferous
- Water Level
- Crown Level
- Invert level
- Bed Level
- Spotheight
- Tree Deciduous

### Golf

- Fair Way
- Green
- Tee Box

### Other

- Survey Station
- Photo point
- Top of Tree

### Built Features

- Building
- Edge of Road
- Kerb Bottom
- Kerb Top
- Bridge Abutment
- Bridge Deck
- Bridge Parapet
- Building Façade
- Fence
- Gate
- Road Centreline
- Top of Wall
- Hoarding
- Property Line
- Road Scar
- Top of Fence
- Floor Level
- Apex Height
- Eaves Height
- Parapet Height
- Soffit Elevation
- Step Level
- Concrete Pad
- Track
- Footpath / Platform Train & Tram
- Damp Proof Course / Verge
- Bridge Pier / Wall & Gate Pillar / LUAS Trackbed
- Cycleway / Private Landing Area
- Wall / Retaining Wall
- Railway / Tram Rail / Grating / Ramp
- Building Canopy / Roof / Overhang

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North

Site Location

Map Sheet Layout

Map Sheet 0000

| | | | |
|---|---|---|---|
| Surveyed by : MSL | Date: Aug 2020 | Datum: Malin Head | |
| Drawn by : CE | Date: Aug 2020 | Grid System: | |
| Checked by : BK | Date: 12.08.20 | Irish National Grid ☐ ITM ■ | |

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|---|---|---|
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Fax: (+353) 045 484004
Email: info@murphysurveys.ie

**Client :** TJ O connor & Associates

**Project :** Fermoy Mill Race River Bed Survey

**Date :** 11.08.20 **Scale :** 1:150@A0

**Description :** River Bed Survey

**Drawing Number :** MSL3□□□0_01

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## Appendix 3. Aquatic baseline report for Fermoy Weir, Fermoy, Co. Cork Prepared by Triturus Environmental Ltd

# Aquatic baseline report for Fermoy Weir, Fermoy, Co. Cork

Prepared by Triturus Environmental Ltd. for

DixonBrosnan Environmental Consultants

**May 2021**

Please cite as:

Triturus (2021). Aquatic baseline report for Fermoy Weir, Fermoy, Co. Cork. Report prepared by Triturus Environmental Ltd. for DixonBrosnan Environmental Consultants. April 2021.

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# 1. Introduction

## 1.1 Background

Triturus Environmental Ltd. were contracted by DixonBrosnan Environmental Consultants (on behalf of Cork County Council) to undertake a baseline aquatic survey of the (Munster) River Blackwater in the vicinity of Fermoy Weir, Fermoy, Co. Cork.

The survey was undertaken to establish baseline aquatic and fisheries data used in the preparation of the Environmental Impact Assessment Report (EIAR) and Natura Impact Statement (NIS) for the proposed instream works on the River Blackwater (EPA code: 18B02). Works included the construction of a new fish pass structure (rock ramp) and repairs to the existing weir. The survey area, both upstream and downstream of Kent Bridge and the existing weir, was located in the Blackwater River SAC (site code: 002170) and also within the River Blackwater *Margaritifera* sensitive area (**Figure 2.1**).

The baseline survey was undertaken to establish the importance of the River Blackwater at Fermoy Weir in supporting qualifying interest species and habitats for the Blackwater River SAC (site code: 002170) (NPWS, 2012). The ecological surveys included detailed assessments of fisheries (including both salmonid and lamprey habitat), white-clawed crayfish (*Austropotamobious pallipes*), freshwater pearl mussel (*Margaritifera margaritifera*) and biological water quality (macro-invertebrates). An otter (*Lutra lutra*) survey was undertaken to identify any breeding or resting areas for the species in the vicinity of the proposed works. The surveys also considered the importance of the survey area in supporting the qualifying interest Annex I habitat 'Water courses of plain to montane levels, with submerged or floating vegetation of *Ranunculion fluitantis* and *Callitricho-Batrachion* or aquatic mosses [3260]' and non-qualifying interest Annex I habitat 'Hydrophilous tall herb fringe communities of plains and of the montane to alpine levels [6430]'.

## 1.2 Project description

A full description of the proposed works for the Fermoy Weir project are described in the accompanying EIAR for the project.

# 2. Methodology

## 2.1 Desktop review

A desktop review was undertaken to collate and review available information, datasets and documentation sources pertaining to the natural environment of the aquatic survey area. Records available on the National Biodiversity Data Centre (NBDC) website were reviewed.

A sensitive species data request for terrestrial and aquatic flora and fauna covering the 10km grid squares adjoining and containing the proposed River Blackwater works area (i.e. W79 & W89) was requested from the Department of Culture, Heritage and the Gaeltacht on Tuesday 28th July 2020 and received on 4th August 2020.

## 2.2 Walkover surveys

Site visits of the aquatic survey area were conducted on Tuesday 26th May, Monday 8th June, Thursday 9th and Sunday 26th July 2020 by Triturus Environmental Ltd. Survey sites were assessed in light of the proposed works, with survey effort focused on both instream and riparian habitats upstream and downstream of the existing weir. Aquatic surveys included a fisheries assessment (electro-fishing, see section 2.3 below and **Appendix A**), fisheries habitat appraisal, shad species eDNA analysis and a white-clawed crayfish assessment. A freshwater pearl mussel survey was also undertaken by Sweeney Consultancy in the vicinity of Fermoy Weir (see section 2.6 and **Appendix B).** A macrophyte survey was undertaken to establish the presence of the Annex I habitats 'Water courses of plain to montane levels, with submerged or floating vegetation of *Ranunculion fluitantis* and *Callitricho-Batrachion* or aquatic mosses [3260]' and ''Hydrophilous tall herb fringe communities of plains and of the montane to alpine levels [6430]'. Additionally, biological water quality (Q-sampling) was undertaken at *n*=4 sites (two upstream and two downstream of Fermoy Weir, **Figure 2.2**). An otter survey was undertaken to identify any breeding or resting areas for the species in the vicinity of the proposed works, in addition to other signs (e.g. spraint) which would help to establish the species' utilisation of the area (i.e. foraging and commuting).

A broad aquatic habitat assessment was conducted at each site 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:

- Channel width, depth profile and other physical characteristics.
- Substrate type, listing substrate fractions in order of dominance, i.e. bedrock, boulder, cobble, gravel, sand, silt etc.
- Flow type, listing percentage of riffle, glide and pool in the sampling area
- In-stream macrophyte and aquatic bryophytes occurring and their percentage coverage of the river bed at the sampling sites
- Riparian vegetation composition

The River Blackwater was divided into discrete survey sections to help provide focus on the distribution of species and habitats of conservation value relative to the proposed works. In this respect, a total of *n*=5 sections were surveyed (A to E; **Table 2.1, Figure 2.1**).

**Table 2.1** Aquatic survey site locations in the footprint of the Fermoy Weir works, Fermoy, Co. Cork.

| Section | Watercourse | EPA code | Location | ITM (x) | ITM (y) |
|---|---|---|---|---|---|
| A | River Blackwater | 18B02 | 100-200m upstream of Fermoy Weir | 581014 | 598585 |
| B | River Blackwater | 18B02 | 0-100m upstream of Fermoy Weir | 581117 | 598574 |
| C | River Blackwater | 18B02 | 0-100m downstream of Fermoy Weir | 581202 | 598603 |
| D | River Blackwater | 18B02 | 100-200m downstream of Fermoy Weir | 581313 | 598683 |
| E | Mill-race channel | n/a | O'Neill-Crowley Quay | 581300 | 598591 |

## 2.3 Aerial drone surveys

To further inform the walkover surveys and ensure the most contemporary mapping data was available for aquatic baseline surveys, an aerial fixed-wing drone survey was undertaken of the wider Fermoy Weir site in June 2020. A flight plan was specifically tailored to meet the needs of the project. The drone was programmed to fly at 120m elevation (Irish Aviation Authority regulated height), capturing high resolution imagery at a rate of 2cm per pixel with absolute accuracy of between 2-4cm (RTK activated). In order to capture a single ortho-mosaic, multiple images were taken and subsequently stitched together in post-processing to produce a single geo-referenced image of the entire study area (i.e. 100m upstream and downstream of the extent of the existing weir). Imagery was captured during calm, bright conditions (on the same day as the SONAR survey, see below) which allowed for the highest resolution and greatest level of detail.

## 2.4 SONAR survey

To determine the bathymetry and substrata-type (i.e. bottom hardness and rugosity[1]) within the survey sections of channel, a SONAR survey was undertaken during July 2020. Primarily, this approach helped to estimate the extent of and elucidate any potential (soft sediment) larval lamprey areas. The bottom hardness mapping also helped to inform the location of potential ammocoete burial habitat in poorly-accessible deeper water zones (i.e. >1.6m in depth). A Lowrance Elite 9HDS-Live SONAR unit was mounted on a 3m RIB equipped with a total-scan transducer to log bathymetry and bottom hardness and rugosity. Reefmaster v2.0 software was used to generate point clouds for map creation in ArcGIS v10.8.

[1] Rugosity is a 3-D measure of the topographic roughness or complexity of riverbed substrata (Brasington et al., 2012)

## 2.5 Fisheries assessment (electro-fishing)

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 an electro-fishing survey (*n*=5 sites; see **Table 2.1, Figure 2.1**) in the footprint of the proposed Fermoy Weir works. Permission was granted on Monday 29th June 2020 and the survey was undertaken Thursday 9th July 2020 following notification to Inland Fisheries Ireland (Macroom).

A single anode Smith-Root LR24 backpack (12V DC input; 300V, 100W DC output) was used to electro-fish sites on the River Blackwater in the footprint of the proposed Fermoy Weir works on Thursday 9th July 2020, following notification to Inland Fisheries Ireland (Macroom) and under the conditions of a Department of Communications, Climate Action & Environment (DCCAE) licence. 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 can be surveyed. Electro-fishing methodology followed accepted European standards (CEN, 2003) and adhered to best practice (e.g. CFB, 2008).

### 2.5.1 Salmonids and European eel

For salmonid species and European eel, as well as 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 approx. ≥50-75m 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 conductivity waters of the River Blackwater, a voltage of 250-275v, frequency of 45Hz and pulse duration of 3.5ms was utilised to draw fish to the anode without causing physical damage.

### 2.5.2 Lamprey

Electro-fishing for lamprey ammocoetes was conducted using targeted box quadrat-based electro-fishing (as per Harvey & Cowx, 2003) in objectively suitable areas of sand/silt, where encountered (including three targeted areas within site E3). 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, approx. 10–15 cm above the sediment, to prevent immobilising lamprey ammocoetes within the sediment. The anode was energised with 100V of pulsed DC for 15-20 seconds and then turned off for approximately five seconds to allow ammocoetes to emerge from their burrows. The anode was switched on and off in this way for approximately two minutes. Immobilised ammocoetes 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).

**Table 2.1** *n*=5 electro-fishing survey site locations on the River Blackwater in the vicinity of Fermoy Weir, Co. Cork.

| Site no. | Watercourse | EPA code | Location | X (ITM) | Y (ITM) |
|---|---|---|---|---|---|
| E1 | River Blackwater | 18B02 | Upstream of Fermoy Weir – along weir face | 581079 | 598606 |
| E2 | River Blackwater | 18B02 | Upstream of Fermoy Weir – along weir face | 581118 | 598589 |
| E3 | River Blackwater | 18B02 | Downstream of Fermoy Weir – north bank channel | 581189 | 598657 |
| E4 | River Blackwater | 18B02 | Downstream of Fermoy Weir – centre arch | 581167 | 598609 |
| E5 | River Blackwater | 18B02 | Downstream of Fermoy Weir – downstream of weir pool | 581248 | 598632 |

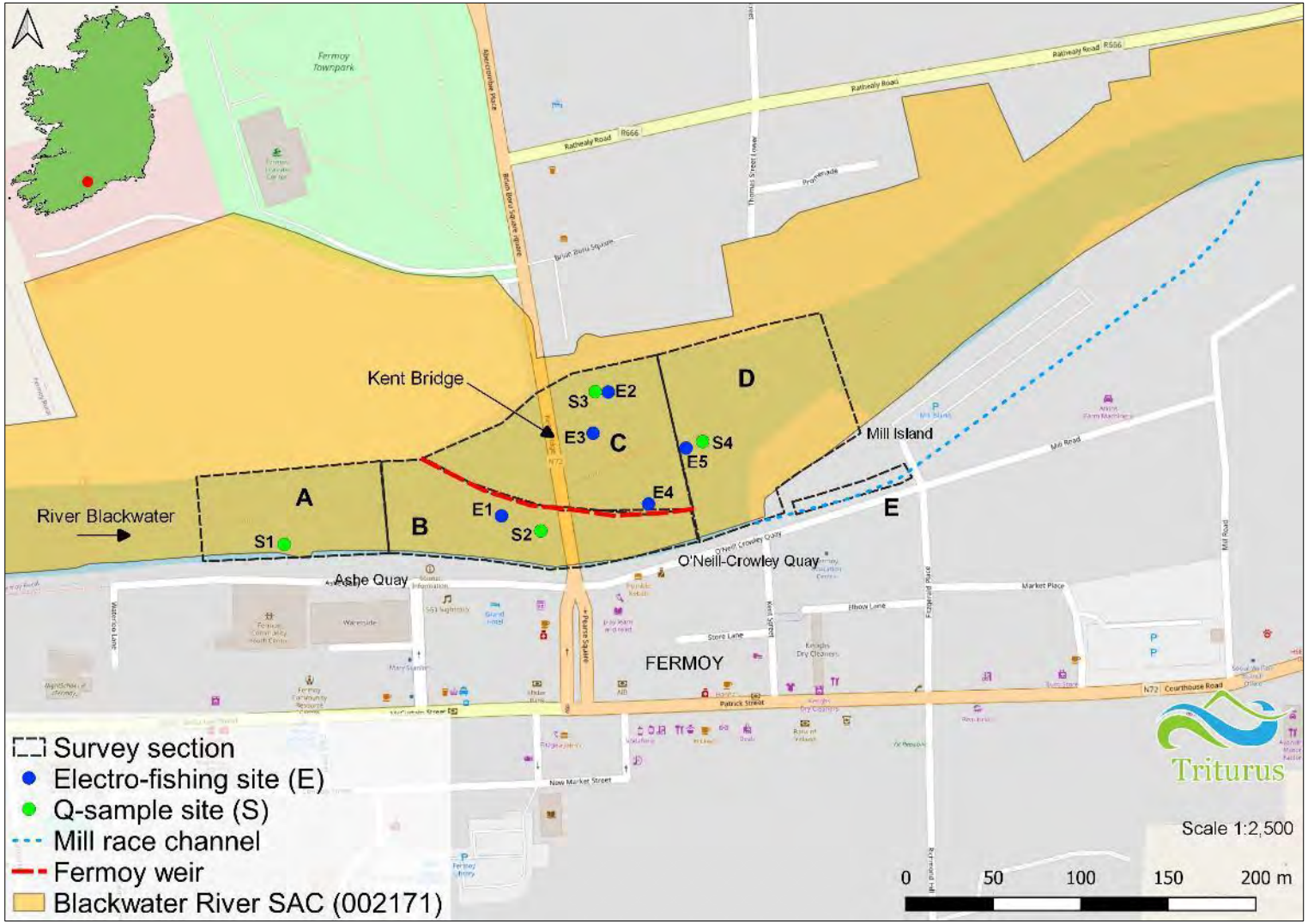


**Figure 2.1** Location of aquatic survey sections in the vicinity of the proposed Fermoy Weir works, Fermoy, Co. Cork

## 2.6 eDNA analysis for shad species

Given limited knowledge in the known distribution and range of qualifying interest twaite shad (*Alosa fallax fallax*) within the Blackwater River SAC (002170), environmental DNA (eDNA) analysis was undertaken on water samples collected on Thursday 21st May 2020 (**Table 2.2**). Sample collection overlapped with the seasonal migration of anadromous twaite shad into Irish rivers and coincided with the known peak spawning period of the species (King & Linnane, 2004; Doherty et al., 2004). Analysis sought to elucidate the longitudinal distribution of shad species (*Alosa* spp.) within the River Blackwater, clarifying whether or not shad species could access and utilise the Fermoy Weir area. As twaite and the closely-related allis shad (*Alosa alosa*) readily hybridise, it is not feasible to use eDNA assays (which are based on mitochondrial DNA) to speciate shad. Thus, analysis could only determine the presence or absence of *Alosa* species (i.e. twaite shad and allis shad). The presence of shad species DNA in a given sample specified their presence at that location during the sampling period. A negative result indicated the species was present at undetectable densities or not present at the time of sampling.

Water samples were collected by Triturus Environmental Ltd. staff on 21st May 2020 from four areas on the River Blackwater, namely 1) upstream Fermoy Weir, 2) downstream Fermoy Weir, 3) downstream Clondulane Weir and 4) Kitchen Hole, Cappoquin (a known shad spawning site on the River Blackwater) (**Figure 2.2**). Furthermore, to act as a control, a fifth sampling site was added from the River Barrow at St. Mullin's, Co. Carlow. This site is accepted to be the most important *Alosa* spp. spawning site in Irish waters (King & Linnane, 2004; Rooney et al., 2013).

Each sample (2L sterile bottle) consisted of three biological replicates. The replicates were sampled from a cross-sectional transect at each location to account for possible intra-site fidelity demonstrated by shad species (e.g. holding in deeper areas or aggregations near spawning sites). In addition to analysis for the presence of *Alosa* spp. eDNA, samples were also analysed for the presence of brown trout (*Salmo trutta*) eDNA to ensure the genetic material in the collected water samples could be amplified successfully (i.e. positive control for all samples). Samples were kept on ice until delivery to the lab and then frozen for later analysis. All eDNA samples were analysed by BIO ID Ltd. (Dublin).

**Table 2.2** Shad species (*Alosa* spp.) eDNA sampling locations on the River Blackwater and control site at St. Mullin's, River Barrow, May 2020

| Replicate | Watercourse | Location | ITM (x) | ITM (y) |
|---|---|---|---|---|
| 1A | River Blackwater | Upstream of Fermoy Weir | 580934 | 598578 |
| 1B | River Blackwater | Upstream of Fermoy Weir | 581103 | 598582 |
| 1C | River Blackwater | Upstream of Fermoy Weir | 581139 | 598568 |
| 2A | River Blackwater | Downstream of Fermoy Weir | 581157 | 598599 |
| 2B | River Blackwater | Downstream of Fermoy Weir | 581232 | 598610 |
| 2C | River Blackwater | Downstream of Fermoy Weir | 581345 | 598700 |

| Replicate | Watercourse | Location | ITM (x) | ITM (y) |
|---|---|---|---|---|
| 3A | River Blackwater | Downstream of Clondulane Weir | 584983 | 599845 |
| 3B | River Blackwater | Downstream of Clondulane Weir | 585026 | 599816 |
| 3C | River Blackwater | Downstream of Clondulane Weir | 585079 | 599749 |
| 4A | River Blackwater | Kitchen Hole, Cappoquin | 608567 | 599717 |
| 4B | River Blackwater | Kitchen Hole, Cappoquin | 608799 | 599825 |
| 4C | River Blackwater | Kitchen Hole, Cappoquin | 609818 | 599393 |
| 5A | River Barrow | St. Mullin's, Co. Carlow | 580934 | 598578 |
| 5B | River Barrow | St. Mullin's | 581103 | 598582 |
| 5C | River Barrow | St. Mullin's | 581139 | 598568 |

## 2.7 White-clawed crayfish survey

White-clawed crayfish (*Austropotamobius pallipes*) surveys were undertaken at the aquatic survey sites in May 2020 under a National Parks and Wildlife (NPWS) open licence (no. C79/2020), as prescribed by Sections 9, 23 and 34 of the Wildlife Act (1976-2012), to capture and release crayfish to their site of capture, under condition no. 5 of the licence. As per Inland Fisheries Ireland recommendations, the crayfish licence sampling moved in a downstream direction to minimise the risk of transfer invasive propagules (including crayfish plague, *Aphanomyces astaci*) upstream.

Hand-searching of instream refugia and sweep netting was undertaken according to Reynolds et al. (2010). A broad appraisal of white-clawed crayfish habitat in each survey section (A-E) was also carried out. Furthermore, a desktop review of the known distribution of crayfish within the wider River Blackwater catchment was also completed.

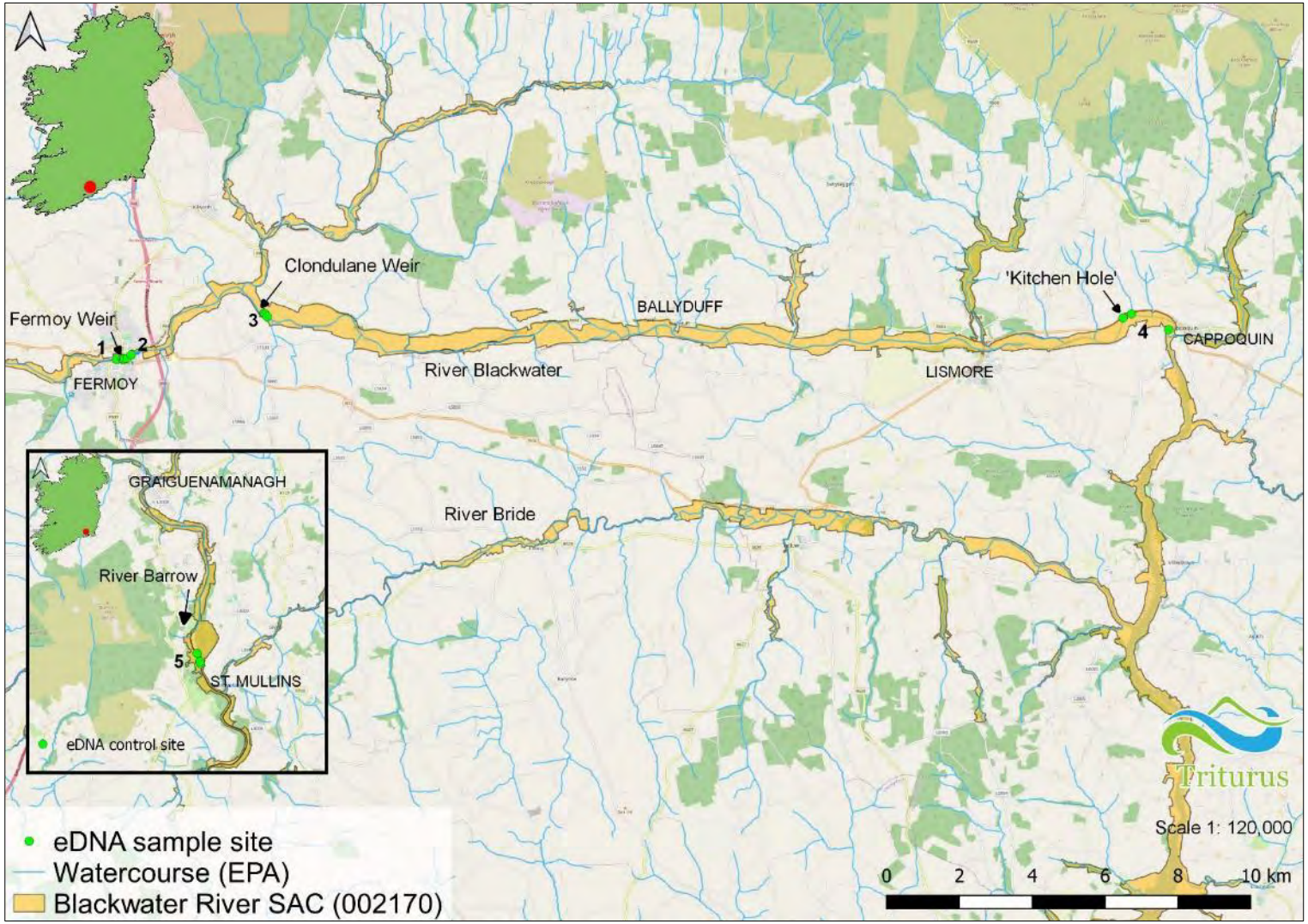


**Figure 2.2** Shad species (*Alosa* spp.) eDNA sampling sites on the River Blackwater (1-4) and control site on the River Barrow (5), July 2020

## 2.8 Freshwater pearl mussel survey

A freshwater pearl mussel (*Margaritifera margaritifera*) survey of the River Blackwater in the vicinity of Fermoy Weir (100m upstream and 100m downstream of Kent Bridge) was completed by Pascal Sweeny of Sweeny Consultancy on Friday May 29th 2020 (**Appendix A**). Conditions were suitable, with bright, sunny weather and good water visibility under base flow conditions. This helped to maximise visibility of pearl mussel against dark substrata and also improved chances of detection when mussels were filter feeding in brighter conditions. Pearl mussel surveys were carried out under a national open licence (licence no. C15/2020), issued by the National Parks and Wildlife Service (NPWS). The survey methodology used was in accordance with the Stage 1 & 2 guidelines given in Irish Wildlife Manual No. 12, NPWS (Anon., 2004).

For a more detailed methodology please refer to **Appendix A** (freshwater pearl mussel survey).

## 2.9 Otter survey

An otter (*Lutra lutra*) survey was undertaken for the River Blackwater in the vicinity of the proposed works area (i.e. 250m upstream and 250m downstream of Fermoy Weir). Survey methodology followed the novel total channel otter survey (TCOS) methodology as developed by Macklin et al. (2019). Otter signs (including spraints, prints, slides and latrines) in addition to the breeding and resting places of otters (i.e. holts and couches) were searched for. This was undertaken along all bankside areas on foot and by boat, in addition to mid-channel gravel shoals and islands located downstream of Kent Bridge. 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, crayfish, molluscs etc.).

## 2.10 Biological water quality (macro-invertebrates)

To evaluate biological water quality within the survey area, Q-sampling was carried out at *n*=4 sites in the vicinity of Fermoy Weir (S1-S4; **Figure 2.1**). Macro-invertebrate samples were converted to Q-ratings as per Toner et al. (2005). All samples were taken with a standard kick sampling hand net (250mm width, 500µm mesh size) from areas of riffle/glide utilising a two-minute sample, as per ISO standards for water quality sampling (ISO 10870:2012). Large cobble was also washed at each site, where present, and samples were elutriated and fixed in 70% ethanol for subsequent laboratory identification. Any rare invertebrate species were identified from the NPWS Red List publications for beetles (Foster et al., 2009), stoneflies (Feeley et al., 2020), mayflies (Kelly-Quinn & Regan, 2012) and other relevant taxa (i.e. Byrne et al., 2009; Nelson et al., 2011).

**Table 2.3** 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 | Moderately polluted | Unsatisfactory |
| Q2, Q1-2 or Q1 | Bad | Seriously polluted | Unsatisfactory |

## 2.11 Aquatic ecological evaluation

The evaluation of 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).

## 2.12 Biosecurity

A strict biosecurity protocol following the Check-Clean-Dry approach was employed during the survey. Equipment and PPE used was disinfected with Virkon® between survey sites to prevent the transfer of pathogens and/or invasive species between survey areas. Particular cognisance was given to the risk of spreading or introducing crayfish plague (*Aphanomyces astaci*), given the presence of white-clawed crayfish within the River Blackwater (including within the survey area). Equipment was disinfected and thoroughly dried (through UV exposure) prior to survey commencement. As per best practice, surveys were undertaken at sites in a downstream order (i.e. uppermost site surveyed first etc.) to prevent the upstream mobilisation of invasive propagules and pathogens. Any invasive species recorded within or adjoining the survey area were geo-referenced.

# 3. Results

The following section summarises each aquatic survey site in terms of aquatic habitats, physical characteristics and overall value for fish, macrophyte communities and macro-invertebrates. Biological water quality results are also summarised. Habitat codes are according to Fossitt (2000). Scientific names are provided at first mention only. An evaluation of the aquatic ecological importance of the survey areas based on the aquatic surveys is provided in **section 3.10**

## 3.1 Desktop review

A sensitive species data request for terrestrial and aquatic flora and fauna covering the 10km grid squares adjoining the proposed works area (i.e. W79 & W89) revealed records for a number of protected (freshwater) aquatic species in the vicinity of the proposed works area, as did data from the National Biodiversity Data Centre (NBDC).

Otter (*Lutra lutra*) records were widespread throughout the respective grid squares, on the River Blackwater and several tributaries (NBCD & NPWS data). Although no records overlapped the survey area, otter were known locally in the vicinity of Fermoy Weir (pers. obs.) see **section 3.8** below for otter survey results.

Numerous records for freshwater pearl mussel (*Margaritifera margaritifera*) were available for the respective grid squares, confined to the River Blackwater main channel. Whilst most records were for the river in the vicinity of Ballyhooly (upstream of Fermoy), two historical records were available for the Blackwater upstream (1917) and downstream (1987) of Fermoy town, respectively (NPWS data). Four live mussels were recorded at Fermoy Weir in 2011 but these are no longer present (see **Appendix A**).

A low number of records for white-clawed crayfish (*Austropotamobius pallipes*) were available for the River Blackwater near Ballyhooly (W79) but none overlapped with the survey area (NBDC & NPWS data). However, records compiled during the current study are presented in **section 3.6** below.

Numerous sea lamprey (*Petromyzon marinus*) records were available for the River Blackwater in the downstream vicinity of Fermoy Weir (c.50-400m downstream of weir during 2003; NPWS data). Numerous records were also available for the area downstream of Clondulane Weir (Careysville) also from 2003. Upstream of Fermoy, a known sea lamprey spawning site was present at Ballyhooly Bridge, with an additional record available for Castlehyde area in the vicinity of Fermoy town (2003 records; NBDC data). Whilst river lamprey (*Lampetra fluviatilis*) were known from the River Blackwater, only a single historical record which overlapped the survey area was available (approx. 50m downstream Fermoy Weir, no date provided; NPWS data).

Although no shad species records were available for the Fermoy area, two allis shad (*Alosa alosa*) records were available for the area c.1km downstream of Clondulane Weir (from 2003 & 2005; NPWS data; King & Linnane, 2004). Both twaite and allis shad are known from the lower reaches of the River Blackwater.

## 3.2 Summary of results by survey section

### 3.2.1 Section A – >100-200m upstream Fermoy Weir

Section A was located >100-200m upstream of the existing Fermoy Weir structure (**Figure 2.1; Plate 3.1**). This section was dominated by homogenous deep glide habitat, with the River Blackwater (lowland depositing watercourse, FW2)) averaging 40-50m wide and 2-3m in depth. The river flowed through a deep U-shaped channel, with steep marginal sloping areas. The river channel was highly modified along the south bank, being bound by built land (BL3) and retaining walls approx. 2m above the surface of the river at the time of survey (note: extremely low water levels at the time of survey, May-June 2020). The substrata were dominated by boulder and cobble (60% overall), with patches of coarse gravels. Some sand and silt accumulations were present along the littoral zone of steep river margins. Generally, the substrata were relatively highly bedded with moderate siltation. Instream macrophytes were limited given the mean depth, with sparse marginal growth of spiked water milfoil (*Myriophyllum spicatum*) and hemlock water dropwort (*Oenanthe aquatica*). Instream bryophytes were limited to occasional *Fontinalis antipyretica* on larger boulders. Filamentous algal cover was particularly high at the time of survey, especially in marginal slope areas. Given the paucity of macrophytes upstream of the weir, no good examples of the Annex I habitat 'Water courses of plain to montane levels, with submerged or floating vegetation of *Ranunculion fluitantis* and *Callitricho-Batrachion* or aquatic mosses [3260]' was recorded. No vegetation representative of 'Hydrophilous tall herb fringe communities of plains and of the montane to alpine levels [6430]' was recorded.

The north bank featured a scattered mature riparian treeline comprised of sycamore (*Acer psuedoplatanus),* elder (*Sambucus nigra*), ash (*Fraxinus excelsior*), aspen (*Populus tremula*), hawthorn (*Crataegus monogyna*), hazel (*Corylus avellana*) and occasional alder (*Alnus glutinosa*) and wych elm (*Ulmus glabra*). The scrubby understorey was dominated by bramble (*Rubus fruticosus* agg.) and nettle (*Urtica dioica*). Reed canary grass (*Phalaris arundinacea*) was common along channel margins, more so on the north bank. The river was bordered by improved agricultural grassland (GA1) to the north.

Section A was too deep to electro-fishing utilising backpack equipment (mostly >2m) and, therefore, no results were available. However, in terms of fisheries habitat, the deep glide habitat of section A offered good salmonid holding habitat, with nursery and spawning habitat much improved downstream of the weir. The river upstream of the weir offered very good European eel (*Anguilla anguilla*) habitat given the presence of deep water and frequent boulder/cobble refugia. Observably, the section also supported a large population of non-native dace (*Leuciscus leuciscus*), non-native roach (*Rutilus rutilus*) and other species such as minnow (*Phoxinus phoxinus*). Lamprey habitat was poor given the high average depth, slower flow and bedded substrata, resulting in a general lack of suitable sediment accumulations for ammocoetes and poor spawning habitat. White clawed crayfish habitat was of moderate quality with suitability mainly in the channel margins under boulder and large woody debris. However, only very low densities were recorded (see **section 3.5**). Freshwater pearl mussel habitat was poor given bedded substrata, seasonally low flows and evident siltation/enrichment. None were recorded present (**Appendix A**).

A biological water quality rating of **Q3-4**, corresponding to WFD **moderate status,** was assigned for this survey section (i.e. site S1, **section 3.9** & **Table 3.1**). No rare or protected macro-invertebrate species were recorded in the sample.

**Plate 3.1** Representative image of section A >100m upstream of Fermoy Weir, July 2020 (facing downstream towards bridge).

### 3.2.2 Section B – 0-100m upstream of Fermoy Weir

As per section A, Section B (located <100m upstream of the existing weir face) was dominated by homogenous deep glide habitat, with the River Blackwater averaging 40-50m wide and 2-2.5m in depth (**Plate 3.2, Figure 3.3**). The existing Fermoy Weir structure bisected the section immediately upstream of Kent Bridge. The structure was approx. 150m in length and ran from a NW to SE direction. Significant structural damage was evident along the weir face. The river in section B flowed through a deep U-shaped channel, with steep marginal sloping areas. The channel was highly modified along the south bank, being bound by built land (BL3) and retaining walls approx. 2m above the surface of the river at the time of survey (note: very low water levels at the time of survey, May-June 2020). The substrata were dominated by boulder and cobble (70% overall), with frequent patches of coarse gravels. Some sand and silt accumulations were present along the littoral zone of steep river margins. Generally, the substrata were bedded with moderate siltation. Instream macrophytes were limited given the deeper water and predominance of hard substrata, with sparse marginal growth of spiked water milfoil and yellow water lily (*Nuphar lutea*) and occasional small stands of hemlock water dropwort on exposed gravel shoals (often inundated at higher water levels). The weir structure supported sparse growth of hemlock water dropwort in addition to the aquatic mosses *Cinclidotus fontinaloides* and *Fontinalis antipyretica* on the wetted faces. Filamentous algal cover was particularly high at the time of survey, especially in marginal slope areas. Given the paucity of macrophytes upstream of the weir, no good examples of the Annex I habitat 'Water courses of plain to montane levels, with submerged or floating vegetation

of *Ranunculion fluitantis* and *Callitricho-Batrachion* or aquatic mosses [3260]' was recorded. No vegetation representative of 'Hydrophilous tall herb fringe communities of plains and of the montane to alpine levels [6430]' was recorded.

The north bank featured a scattered mature riparian treeline comprised of sycamore, elder, ash, aspen, hawthorn, hazel and occasional alder and wych elm. The scrubby understorey was dominated by bramble and nettle. The river was bordered by improved agricultural grassland (GA1) to the north.

Electro-fishing was undertaken at one site within (E1) within survey section B (**Figure 2.1**). A total of *n*=4 fish species were recorded (section 3.3). Atlantic salmon (*Salmo salar*) and brown trout (*Salmo trutta*) dominated, with low numbers of European eel and dace captured (see section 3.3).

White clawed crayfish habitat was of moderate quality, particularly in the vicinity of the weir structure where low densities were recorded (section 3.6). Freshwater pearl mussel habitat was poor given bedded substrata, seasonally low flows and evident siltation/enrichment. None were recorded present (see **Appendix A**).

A biological water quality rating of **Q3-4**, corresponding to WFD **moderate status**, was assigned for this survey section (i.e. S2, **section 3.9** & **Table 3.1**). No rare or protected macro-invertebrate species were recorded in the sample.

**Plate 3.2** Representative image of section B (0-100m upstream of Fermoy Weir), June 2020 showing old fish pass, facing downstream towards bridge.

### 3.2.3 Section C – 0-100m downstream Fermoy Weir

Section C, located downstream of the existing weir structure, featured faster and more heterogeneous flows than upstream. Structural damage to the weir in recent years had resulted in accelerated deep (>1.5m) fast glide habitat along the south bank (main flow), feeding a large, deep pool approx. 30m downstream of Kent Bridge, along O'Neill-Crowley Quay (section D, **Plate 3.3).** The river along the south bank was considerably shallower (<1m, often <0.5m) and dominated by riffle and shallow glide habitat, with pool-like/eddy habitat pool located in the vicinity of the bridge (i.e. between weir face and islands). Overall, the substrata were dominated by well-mixed gravels and small cobble in most areas. Fine sediment (silt and clay) accumulations were associated with instream macrophyte beds and had caused some local bedding of substrata. However, overall, the substrata were generally mobile and free from sedimentation. At low water levels, numerous small islands of exposed gravel and cobble were present immediately downstream of the bridge. The lee of these islands supported fine sediment accumulations ranging from 1-10cm in depth and offered good lamprey potential (see **section 3.3**).

The river channel was bordered to the north by a mature treeline comprising alder, ash and sycamore with elder, willow and hawthorn adjoining improved agricultural grassland (pasture). The south (town) bank along O'Neill-Crowley Quay was bound by retaining walls. The north bank of the river immediately downstream of the bridge featured muddy paludal areas supporting localised great yellow-cress (*Rorippa amphibia*), hemlock water dropwort (*Oenanthe crocata*), pink water speedwell (*Veronica catenata*) and water-forget-me-not (*Myosotis scorpioides*). These littoral species graded into more extensive swards of reed canary grass on drier ground (including islands). Muddy areas below the water line supported occasional stands of flowering rush (*Butomus umbellatus*) (one large 10m$^2$ stand) and infrequent branched bur-reed (*Sparganium erectum*). The upper drier gravel areas of instream islands supported great willowherb (*Epilobium hirsutum*), marsh willowherb (*Epilobium palustre*), ribwort plantain (*Plantago lanceolata*), common figwort (*Scrophularia nodosa*), charlock (*Sinapis arvensis*), vetch (*Vicia* sp.), creeping yellowcress (*Rorippa sylvestris*), bittercress (*Cardamine* sp.) and marsh woundwort (*Stachys palustris*). Exposed gravel and cobble littorals of such instream islands also supported frequent redshank (*Persicaria maculosa*), water pepper (*Persicaria hydropiper*) and fat hen (*Chenopodium album*) with less frequent patches of hemlock water dropwort. Curled dock (*Rumex crispus*) and creeping yellowcress were more localised. The muddy margins of these islands supported water plantain (*Alisma plantago-aquatica*) and water mint (*Mentha aquatica*). Himalayan balsam (*Impatiens glandulifera*) was occasional. Given the presence of ≥3 indicator species (see Devaney et al., 2013), the Annex I habitat 'Hydrophilous tall herb fringe communities of plains and of the montane to alpine levels [6430]' was also recorded in association with mid-channel islands and along the north bank of the river (downstream of Kent Bridge).

In contrast to upstream, macrophyte cover was high with growth dominated by water crowfoot (*Ranunculus* subspecies *Batrachion* agg.) vegetation, which formed large stands along the shallow fast glide of the north bank, downstream of the bridge (30% cover overall). Spiked water milfoil was also locally frequent with occasional *Callitriche* sp. between islands/gravel shoals and along muddy river margins. Small, localised stands of unbranched bur-reed (*Sparganium emersum*) were also present. *Fontinalis antipyretica* was recorded very locally on large cobble. The moss

species *Cinclidotus fontinaloides* was very abundant along the dry weir faces. Given the presence of ≥3 indicator species (see EC, 2013), the macrophyte community recorded was considered representative of the Annex I habitat 'Water courses of plain to montane levels, with submerged or floating vegetation of *Ranunculion fluitantis* and *Callitricho-Batrachion* or aquatic mosses [3260]'.

Electro-fishing was undertaken at three sites (E2, E3 and E4) within survey section C (**Figure 2.1**). A total of *n*=10 fish species were recorded across the three sites (i.e. Atlantic salmon, brown trout, minnow, roach, dace, European eel, three-spined stickleback (*Gasterosteus aculeatus*), gudgeon (*Gobio gobio*), stone loach (*Barbatula barbatula*) and *Lampetra* sp. (see section 3.3). Three discrete 2m$^2$ areas (i.e. A, B & C) in the vicinity of mid-channel islands were targeted for lamprey ammocoetes (i.e. site E5, **Figure 2.1**). All of these areas supported *Lampetra* sp. ammocoetes, with equivalent densities of 10.5, 12 and 15 ammocoetes per m$^2$ recorded, respectively (section 3.3).

Section C offered some excellent salmonid nursery habitat, with some locally excellent spawning substrata and holding habitat present also. European eel habitat was good overall. White-clawed crayfish habitat was good in the vicinity of Kent Bridge (particularly the northern half of the river) with moderate densities of juvenile and adult crayfish were recorded via sweep netting and snorkelling during the site visit (see **section 3.6**). Despite some improved suitability compared to upstream areas, no freshwater pearl mussel were recorded present in section C. Pearl mussel habitat was sub-optimal given seasonally low flows and evident siltation/enrichment (**Appendix A**).

A biological water quality rating of **Q4**, corresponding to WFD **good status**, was assigned for this site (i.e. site S3, **section 3.9** & **Table 3.1**). No rare or protected macro-invertebrate species were recorded in the sample.

**Plate 3.3** Representative image of the downstream extent of section C (0-100m downstream of Fermoy Weir), June 2020.

**Plate 3.4** Representative image of section C (0-100m downstream of Fermoy Weir), July 2020 showing existing wall (right) and mid-channel islands (left).

**Plate 3.5** Representative image of section C (0-100m downstream of Fermoy Weir), July 2020 facing upstream towards Kent Bridge from the O'Neill Crowley Quay retaining wall (large weir pool located in the right foreground was located within section D).

### 3.2.4 Section D - >100-200m downstream Fermoy Weir

Section D, located ≥100m downstream of the existing weir structure, was dominated by very fast glide and pool habitat, invariably <1m in depth. Deeper glide and pool was present >200m downstream (i.e. towards the downstream extent of Mill Island). The large pool associated with the existing weir, along O'Neill-Crowley Quay (**Plate 3.3**), ranged from 2-2.5m in depth at the time of survey (i.e. low water levels). Standing water/ponding (<0.3m max. depth) was present on and to the south of the large exposed gravel island (usually mostly inundated at normal water levels). In the river channel the substrata were dominated by cobble and coarse gravel. Large cobble and limited large boulders were present in the weir pool. Given high flow rates, the substrata were generally mobile and free from sedimentation although some shallow silt/sand accumulations were present in marginal slacks and in association with macrophyte beds.

The river channel was bordered to the north and south by a mature treeline comprising alder, ash and sycamore with elder, willow and hawthorn. Reed canary grass formed large stands on island centers with inundation zones colonised by annuals of exposed gravel. The upper drier gravel areas of instream islands supported great willowherb, marsh willowherb, ribwort plantain, common figwort, charlock, vetch (*Vicia* sp.), creeping yellowcress, bittercress (*Cardamine* sp.) and marsh woundwort. Exposed gravel and cobble littorals of such instream islands also supported frequent redshank, water pepper and fat hen with less frequent patches of hemlock water dropwort. Curled dock and creeping yellowcress were more localised. The muddy margins of these islands supported water plantain and water mint. Himalayan balsam was occasional. Given the presence of ≥3 indicator species (see Devaney et al., 2013), the river islands supported good examples of the Annex I habitat 'Hydrophilous tall herb fringe communities of plains and of the montane to alpine levels [6430]'.

In terms of macrophytes, *Ranunculus* subspecies *Batrachion* agg. vegetation was present but was localised in the main channel downstream of the pool and island (10% cover). Some limited spiked water milfoil and *Callitriche* sp. was present at the section C-D interface. *Fontinalis antipyretica* was recorded very locally on larger cobble and boulder. Given the presence of ≥3 indicator species (EC, 2013), the macrophyte community recorded was considered representative of the Annex I habitat 'Water courses of plain to montane levels, with submerged or floating vegetation of *Ranunculion fluitantis* and *Callitricho-Batrachion* or aquatic mosses [3260]'.

Electro-fishing was undertaken at one (E5) within survey section D (**Figure 2.1**). A total of *n*=3 fish species were recorded, with low numbers of dace, stone loach and three-spined stickleback present (see **section 3.3**). Section D offered excellent salmonid habitat overall, with high-quality spawning, nursery and holding habitat present. Lamprey spawning habitat was also present (including for sea lamprey) with some good European eel habitat associated with deeper pool areas. Good-quality white-clawed crayfish habitat was limited to the vicinity of the weir face and associated deep pool. Low numbers were recorded via sweep netting along the weir face adjoining this pool (see **section 3.6**). Despite some improved suitability compared to upstream areas, no freshwater pearl mussel were recorded present in section D. Pearl mussel habitat was sub-optimal given seasonally low flows and evident siltation/enrichment (**Appendix A**).

A biological water quality rating of **Q3-4**, corresponding to WFD **moderate status**, was assigned for this survey section (i.e. S4, **section 3.9** & **Table 3.1**). No rare or protected macro-invertebrate species were recorded in the sample.

**Plate 3.6** Representative image of section D (>100-200m downstream of Fermoy Weir), June 2020, facing downstream from the largest mid-channel island near Kent Bridge.

**Plate 3.7** Representative image of section D, July 2020, facing upstream towards Kent Bridge.

### 3.2.5 Section E – Mill-race channel

Site E represented the uppermost 100m of a disused mill race channel, that averaged 7-8m and 0.3-0.5m in depth at the time of survey. The channel was not located within the Blackwater River SAC site (**Figure 2.1**). Held between 2-3m-high retaining walls, the channel diverged from the River Blackwater through a flood wall (formerly sluice gates) near the weir pool along O'Neill-Crowley Quay/Mill Road. The channel rejoined the main river approx. 400m downstream. The channel supported standing water only at the time of survey (100% pool habitat), although it was known to convey significantly higher water volumes, seasonally. The channel substrata were dominated by deep silt, often >0.5m in depth. Otter prints (recently made) were recorded in the muddy paludal under the road bridge to the Mill Island car park (ITM 581346,598612).

The site was heavily-vegetated and supported a diverse macrophyte and riparian plant community. Instream, unbranched bur-reed was abundant, with frequent Canadian pondweed (*Elodea canadensis*), broad-leaved pondweed (*Potamogeton natans*) and common duckweed (*Lemna minor*). *Callitriche* sp. and water plantain were occasional. Given the presence of only two indicator species (*Potamogeton* sp. and *Callitriche* sp.; EC, 2013), the macrophyte community did not correspond to the Annex I habitat 'Water courses of plain to montane levels, with submerged or floating vegetation of *Ranunculion fluitantis* and *Callitricho-Batrachion* or aquatic mosses [3260]'.

The margins of the channel, exposed to occasional inundation, supported abundant reed canary grass with flowering rush, fool's watercress (*Apium nodiflorum*), water mint, blue water speedwell (*Veronica anagallis-aquatica*), bittersweet (*Solanum dulcamara*) and redshank. Given the good species diversity, the plant community of the upper reaches of the mill-race channel was considered representative of the Annex I habitat 'Hydrophilous tall herb fringe communities of plains and of the montane to alpine levels [6430]'.

Electro-fishing was not undertaken in section E. Due to poor connectivity with the main river, the survey reaches of the channel were of little fisheries value apart from for European eel. However, fisheries value improved considerably in the downstream reaches, where some good value as a coarse fish nursery was present.

Biological water quality was not assessed in survey section E due to Q-sampling unsuitability (i.e. non-flowing canal habitat) and no macro-invertebrate sweep sample was taken.

**Plate 3.8** Representative image of site E, the heavily vegetated mill-race channel downstream of the proposed works area, July 2020.

**Plate 3.9** Representative image of marginal vegetation including flowering rush representative of the Annex I habitat 'Hydrophilous tall herb [6430]', July 2020.

**Figure 3.1** Drone ortho-mosaic image of the Fermoy Weir survey area, June 2020

## 3.3 SONAR survey

As anticipated, the boat-based SONAR survey revealed a clear differential in the bathymetric profile upstream and downstream of the weir (**Figure 3.2**). Upstream of the existing weir (i.e. survey section A and most of section B) featured deeper glide habitat averaging 1.5-2.5m, while downstream the average depth of the areas dominated by faster-flowing glide habitat averaged 0.5-<1.5m. Although some locally deeper pool areas were present, the majority of survey sections C and D (downstream of the weir) were ≤1m in depth.

The plots of river hardness (**Figure 3.3**) and river bed rugosity (**Figure 3.4**) illustrated the dominance of softer substrata in the shallower areas, such as those in the vicinity of mid-channel islands downstream of Kent Bridge. These areas are indicated by higher relative scores in both the river hardness and rugosity maps (**Figures 3.3 & 3.4**). In this respect silt dominated areas are softer and smoother as reflected in the scores and concentrated in the northern half of the River Blackwater channel downstream of the weir. The deeper glide and pool areas (e.g. sections A and D) supported harder substrata with higher rugosities (greater substrata complexity/ roughness) with very localised lamprey ammocoete habitat (as illustrated by the dark red banding on **Figures 3.3 & 3.4**).

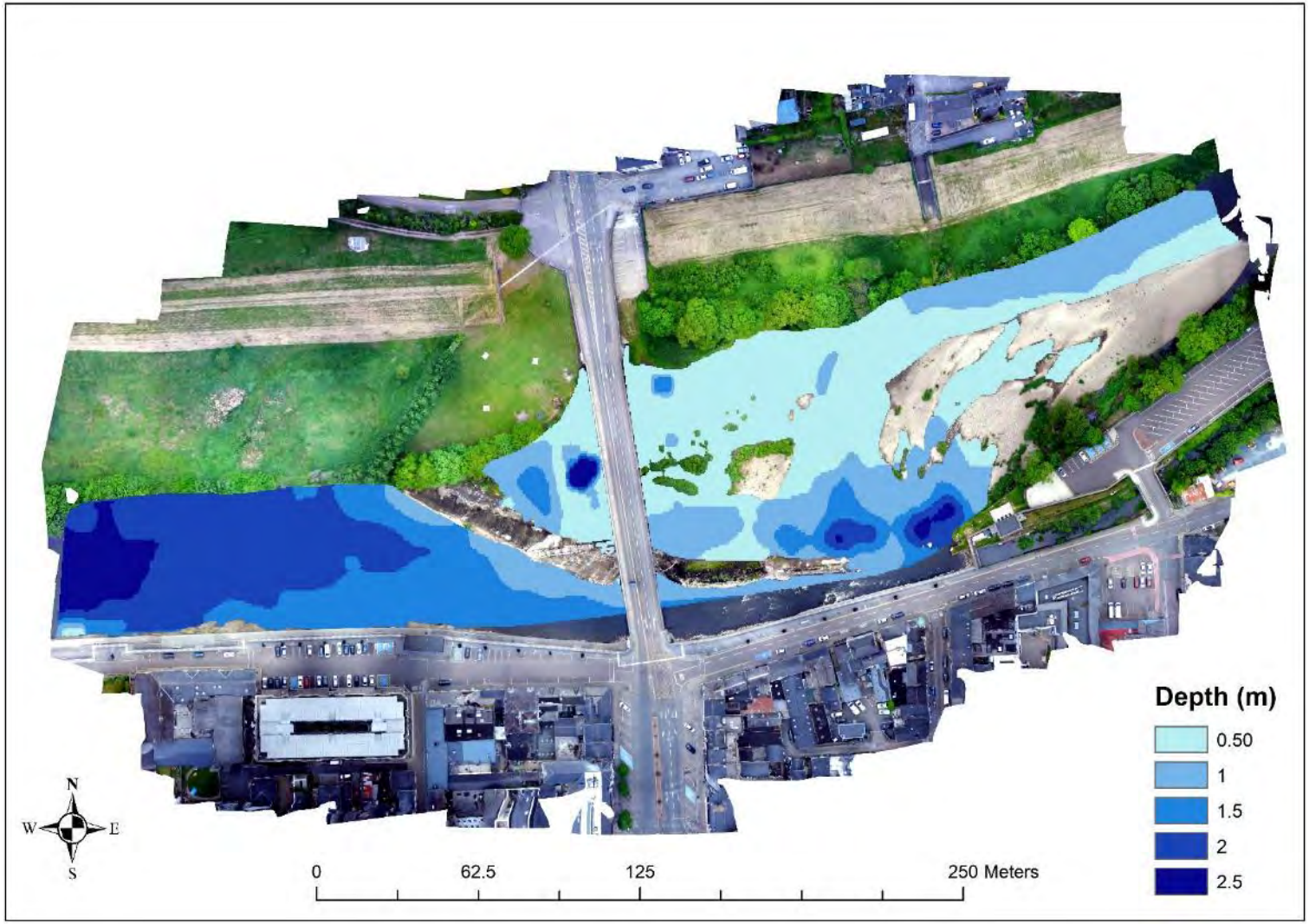


**Figure 3.2** Bathymetry map of the survey area, July 2020 (darker shading indicates deeper water)

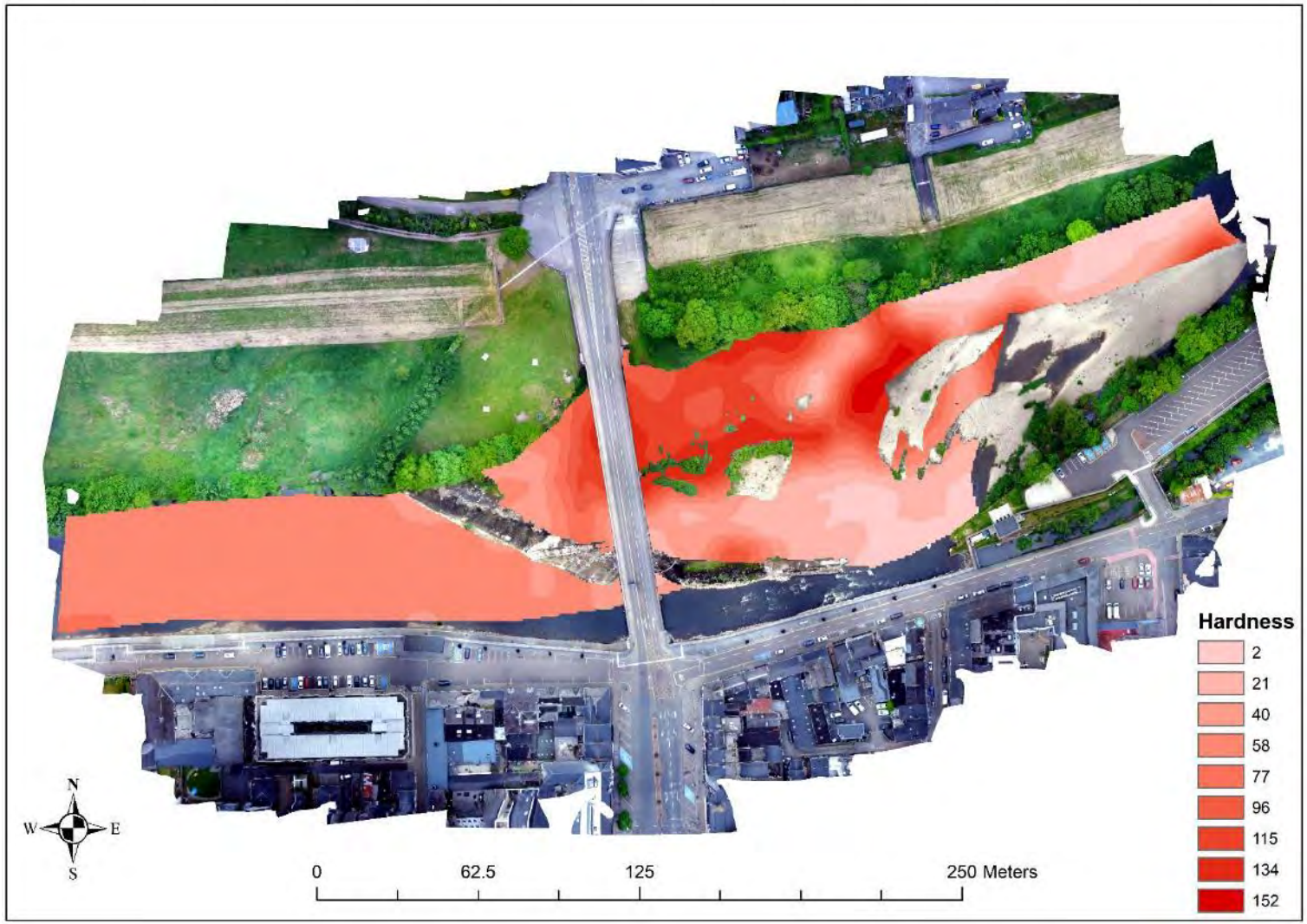


**Figure 3.3** Relative river bed hardness map of the survey area, July 2020 (darker shading indicates softer substrata)

**Figure 3.4** Relative river bed rugosity (roughness) map of the survey area, July 2020 (darker shading indicates areas of smoother substrate complexity)

## 3.4 Fisheries assessment (electro-fishing survey)

### 3.4.1 Site E1

A total of four fish species were recorded from site E1 (**Figure 3.5**), located along the existing weir face upstream of Kent Bridge. Atlantic salmon and brown trout parr dominated, with a low number of European eel also recorded. A single juvenile dace was captured although large shoals of juveniles and adults were observed during electro-fishing in the adjoining deep glide habitat (i.e. survey section B).

The area of river along the existing weir face (upstream of the bridge) was evidently of good value as a salmonid nursery. The abundant large cobble and boulder habitat provided valuable refugia from the main flow of the channel for both Atlantic salmon and brown trout. Similarly, the boulder-dominated areas and scoured weir face also provided some very good European eel refugia. The section along the weir face was not of value as a salmonid spawning habitat but did provide some localised holding habitat for migrating adults. The area was not of value for lamprey (no sediment accumulations or suitable spawning substrata).

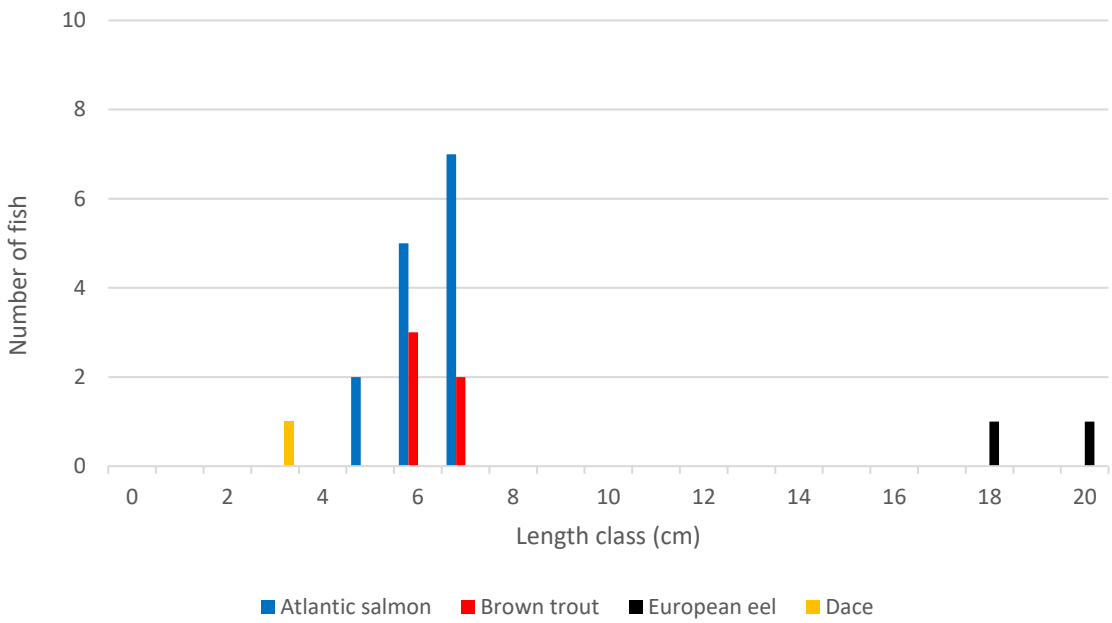


**Figure 3.5** Fish length frequency distribution recorded via electro-fishing from site E1 on the River Blackwater, Fermoy Weir, July 2020

### 3.4.2 Site E2

A total of eight fish species were recorded from site E2 (**Figure 3.6**), located along the north bank of the river downstream of Kent Bridge. Atlantic salmon parr (*n*=10) and minnow (*n*=12) were the most frequently recorded species. A single adult brown trout (FL 24.2cm) and juvenile roach was recorded in addition to low numbers of European eel, gudgeon and stone loach. A single *Lampetra* sp. ammocoete was also captured.

The north channel of the river downstream of Kent Bridge was a very good salmonid nursery habitat, supporting moderate densities of Atlantic salmon parr and low numbers of brown trout. The fast, shallow glide presented good salmonid spawning habitat (mobile, clean gravels/cobbles) whilst instream macrophytes (water crowfoot, spiked water-milfoil etc.) provided valuable refugia for juveniles. Holding habitat was largely absent in this area although was abundant downstream and adjoining the existing weir structure (south bank of river). *Lampetra* sp. spawning habitat was good overall, particularly adjoining mid-channel islands where finer gravel substrata were frequent. Although a single ammocoete was recorded, burial habitat was restricted to very small patches of shallow, soft sediment associated with instream macrophyte beds. However, excellent ammocoete habitat was present adjoining the mid-channel islands adjacent to the site (see section 3.4.3 below). European eel habitat was good in vicinity of the bridge structure, where frequent boulder and large cobble provided suitable diurnal refugia (**Plate 7.2**).

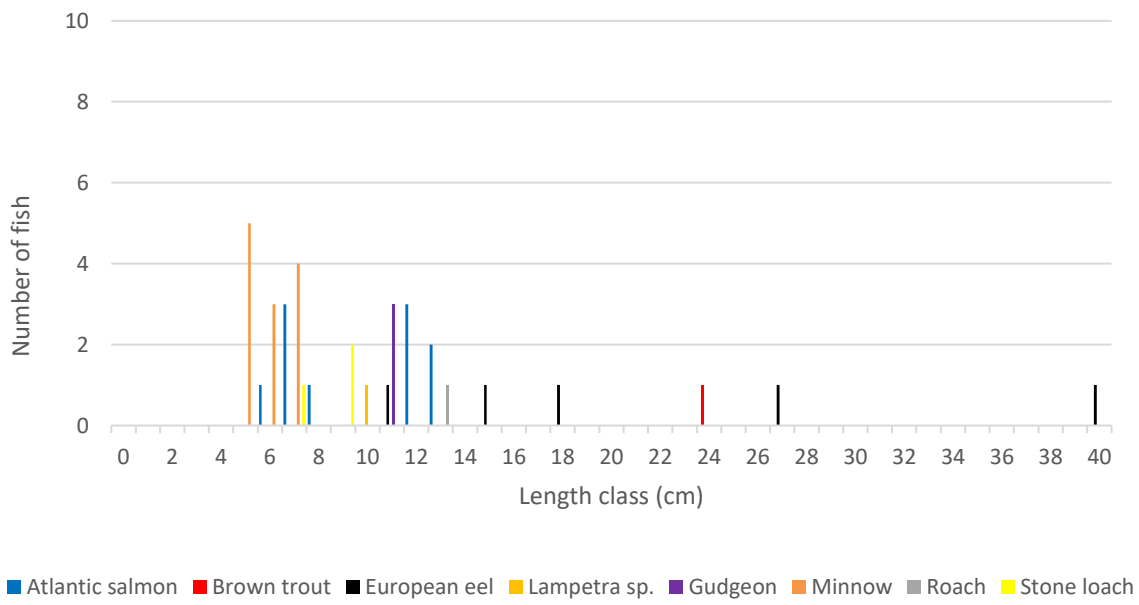


**Figure 3.6** Fish length frequency distribution recorded via electro-fishing from site E2 on the River Blackwater, Fermoy Weir, July 2020.

### 3.4.3 Site E3

Three discrete 2m$^2$ areas (i.e. A, B & C) in the vicinity of mid-channel islands within survey section C were targeted for lamprey ammocoetes (**Figure 2.1**). All of these areas supported *Lampetra* sp. ammocoetes, with equivalent densities of 10.5, 12 and 15 ammocoetes per m$^2$ recorded, respectively (**Figure 3.7, 3.8**). A range of size/age classes were present with ammocoetes ranging from 3.3-11.1cm total length (e.g. **Plate 7.4**). A low number of European eel elvers were also recorded from the sediment in area A (data not shown; 8.9-14.3cm TL; **Plate 7.5**).

Evidently, all three targeted areas were of high value to larval lamprey. These were located in areas adjoining shallow glide habitat (0.15-0.4m deep) and featured fine, organic-rich soft sediment accumulations of ≥5cm in depth. All three areas also adjoined fine gravel substrata suitable for *Lampetra* sp. spawning.

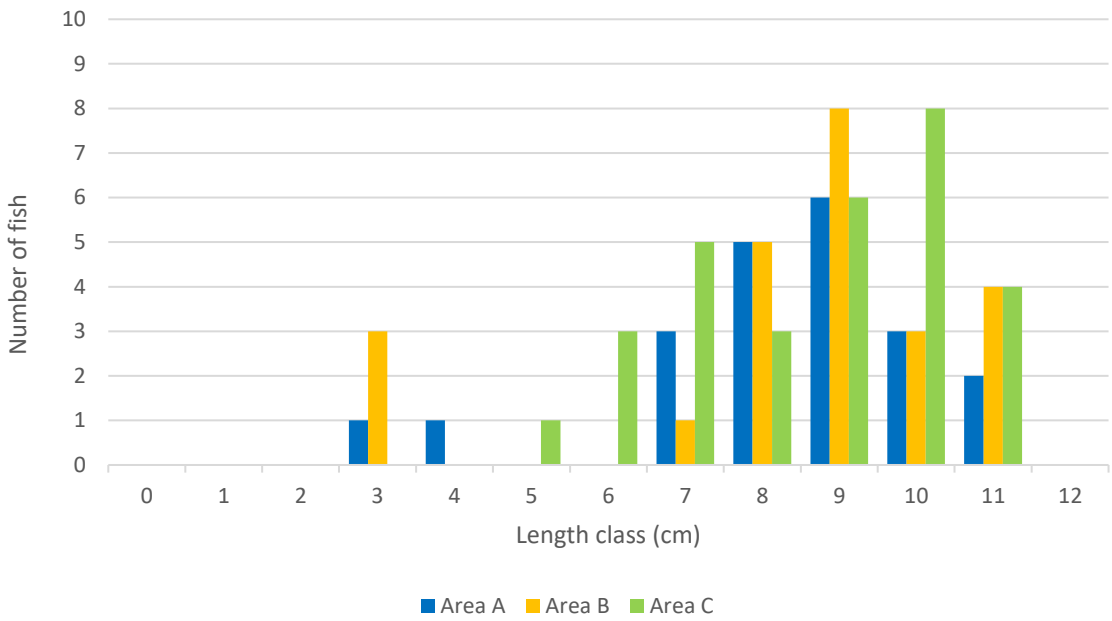


**Figure 3.7** *Lampetra* sp. ammocoete length distribution recorded via electro-fishing in areas A, B and C of site E3 on the River Blackwater, July 2020

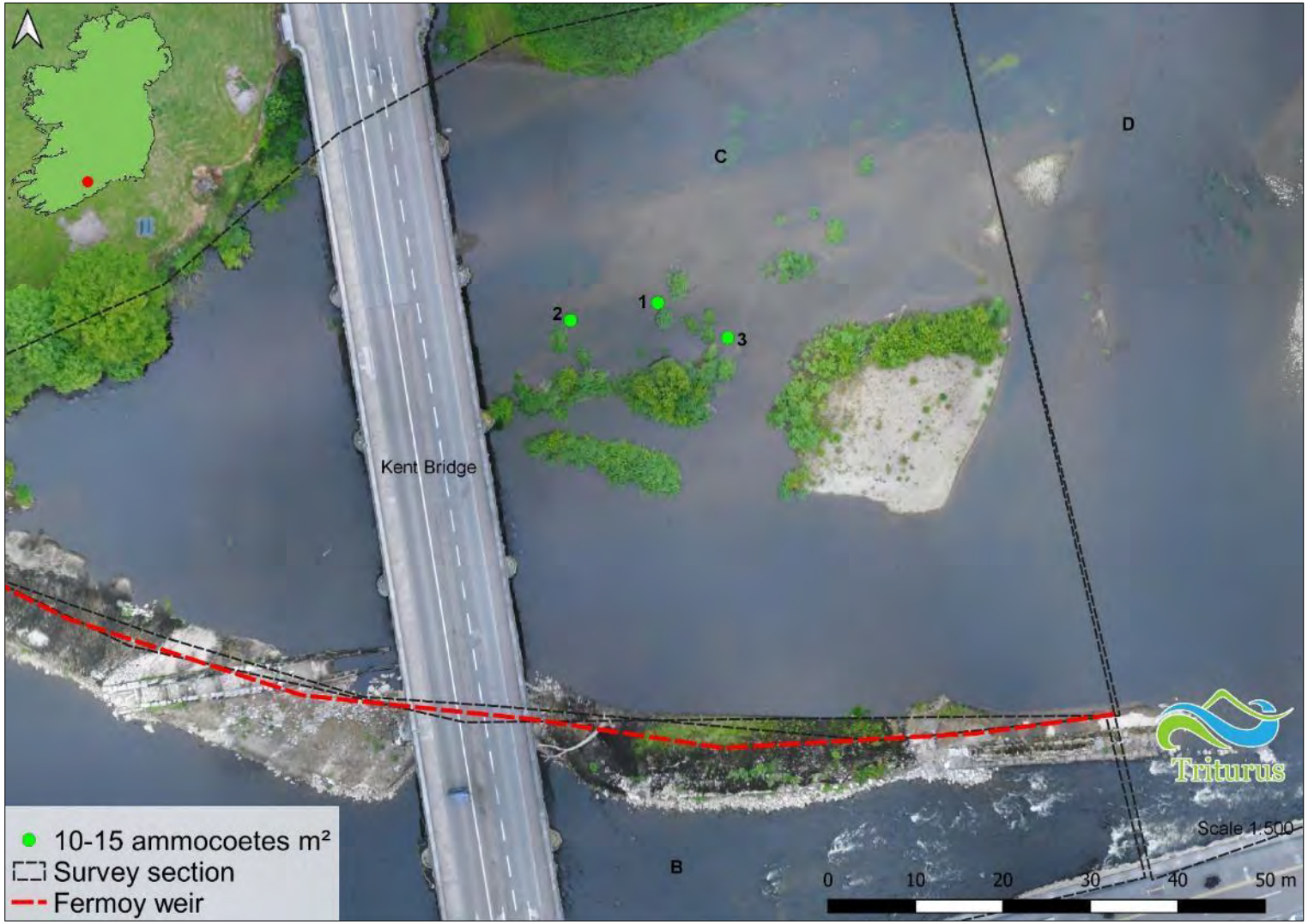


**Figure 3.8** Density of *Lampetra* sp. ammocoetes recorded from the three 2m$^2$ targeted areas within site E3, July 2020

### 3.4.4 Site E4

A total of five fish species were recorded from site E4 (**Figure 3.9**), located along the existing weir face downstream of Kent Bridge. Low numbers of Atlantic salmon parr, stone loach, juvenile dace and minnow were recorded, in addition to two juvenile European eel.

Site E4 was dominated by slow-flowing glide/pool at the time of survey (basal summer flows). As a result, the area supported only low densities of fish. Salmonid habitat was moderate overall, with the area of most value as a salmonid nursery and (particularly at higher water levels), holding habitat for adults. However, salmonid habitat was significantly improved in adjoining downstream areas (i.e. weir pool and main channel of the river). European eel habitat was good overall given the frequency of boulder refugia as well as scouring of the existing weir face which also offered diurnal refugia. The area was of little value as a lamprey spawning or nursery habitat given the typically low flows (mostly pool habitat). The area was of high value as a coarse fish nursery (e.g. dace, roach etc.).

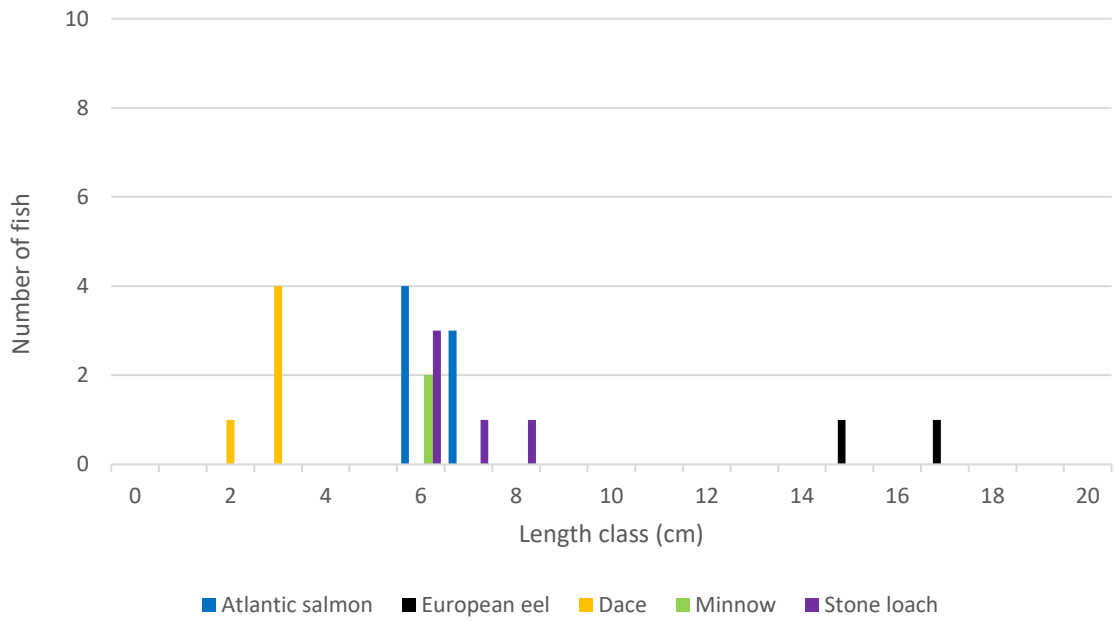


**Figure 3.9** Fish length frequency distribution recorded via electro-fishing from site E4 on the River Blackwater, Fermoy Weir, July 2020

### 3.4.5 Site E5

A total of three fish species were recorded from site E5 (**Figure 3.10**), located downstream of the largest island, downstream of Kent Bridge. Dace were the most frequently recorded species in this area (juveniles and adults), with low numbers of stone loach and three-spined stickleback also recorded.

Site E5 represented fast glide habitat adjoining the main flow of the river (deeper and faster glide/pool where electro-fishing was not possible). Although the area presented some excellent quality salmonid spawning habitat (clean and mobile gravel/cobble), as well as good nursery habitat downstream, no salmonids were recorded (these were likely present in adjoining deeper pool and glide areas). Dace were frequent in the shallower areas of fast glide adjacent to the main flow, with low numbers of stickleback and stone loach present in association with instream macrophytes located at the downstream extent of the section. The site was unsuitable for larval lamprey although some good spawning was present locally (no sediment accumulations present although some downstream near macrophyte beds). However, this area was more suited to larger lamprey species (e.g. sea and river lamprey) and Atlantic salmon. European eel habitat was poor in the shallow, fast glide but was considered very good in adjacent pool/deep glide areas.

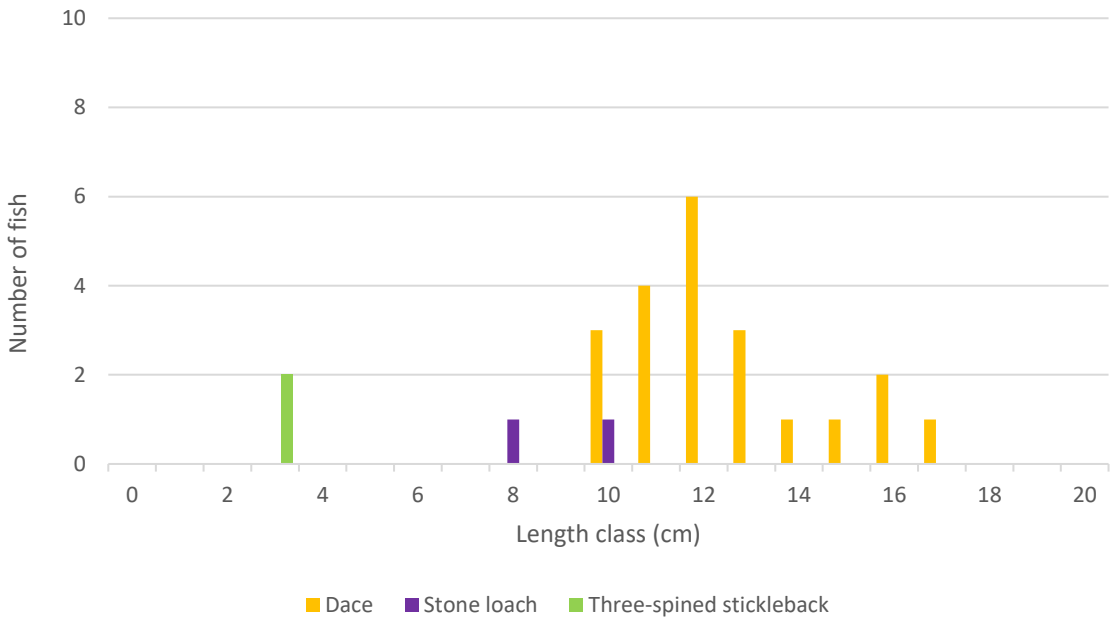


**Figure 3.10** Fish length frequency distribution recorded via electro-fishing from site E5 on the River Blackwater, Fermoy Weir, July 2020.

## 3.5 eDNA analysis for shad species

Shad (*Alosa* spp.) eDNA was detected from water samples collected from the 'Kitchen Hole' site on the River Blackwater at Cappoquin on Thursday 21st May 2020 (all replicates from sites 4A, 4B & 4C; **Figure 3.11**). However, no detectable concentrations of shad eDNA were recorded in water samples taken on the same day upstream of Fermoy Weir (samples 1A, 1B, 1C), downstream of Fermoy Weir (2A, 2B, 2C) or downstream of Clondulane Weir (3A, 3B, 3C) on the River Blackwater. This indicated the absence of *Alosa* spp. from these locations during the peak spawning migration sampling period (**Figure 3.12**). The positive control samples from St. Mullin's on the River Barrow (sites 5A, 5B & 5C) all contained *Alosa* spp. DNA (**Figure 3.11**). All samples from all sampling locations yielded detectable brown trout (*Salmo trutta*) eDNA qPCR reactions (data not shown), demonstrating that all samples contained DNA that could be amplified successfully.

The concentrations of eDNA ranged from the lowest of 0.054ng/L in sample 5A at St. Mullin's to the highest of 1.442ng/L in the 4C sample from Kitchen Hole, Cappoquin. Average eDNA concentrations (across biological replicates) ranged from the lowest at in St. Mullin's (0.233 ng/L ±SD 0.152) to the highest at Kitchen Hole, Cappoquin (1.351, ±SD 0.079) ng/L). There was a significantly higher concentration of *Alosa* spp. eDNA in the Munster Blackwater (Kitchen Hole, Cappoquin) than in the samples from River Barrow (St. Mullin's) (**Figure 3.11**).

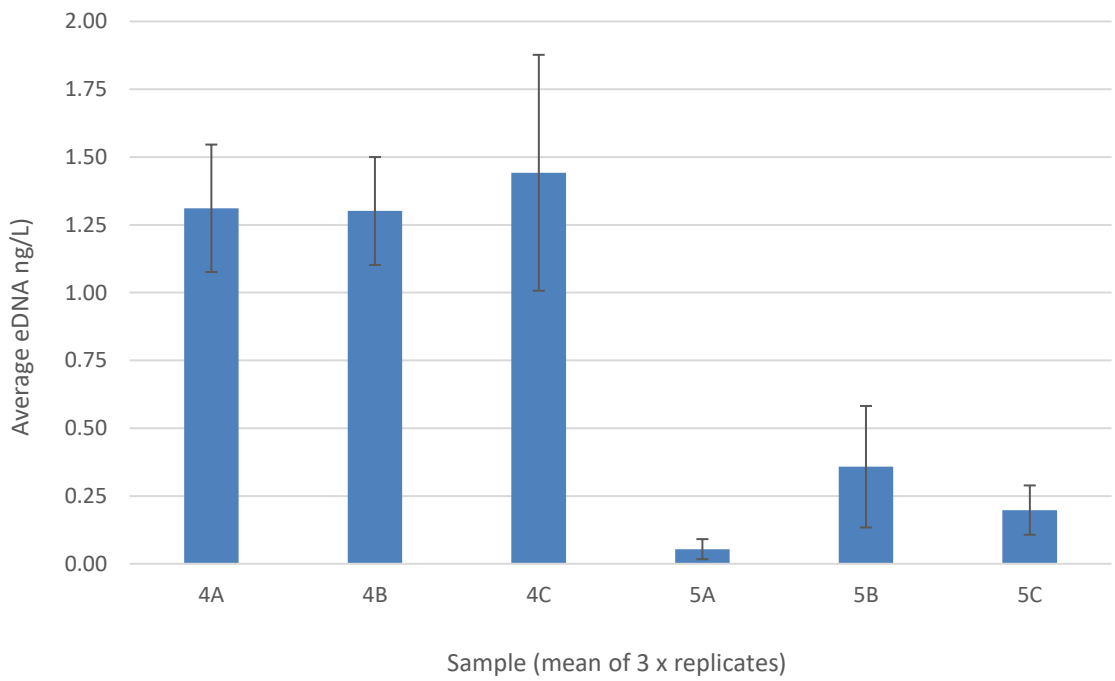


**Figure 3.11** Average eDNA concentrations (ng/l) ±SD of *Alosa* spp. eDNA recorded in water samples from 'Kitchen Hole', River Blackwater and control site at St. Mullin's, River Barrow, May 2020

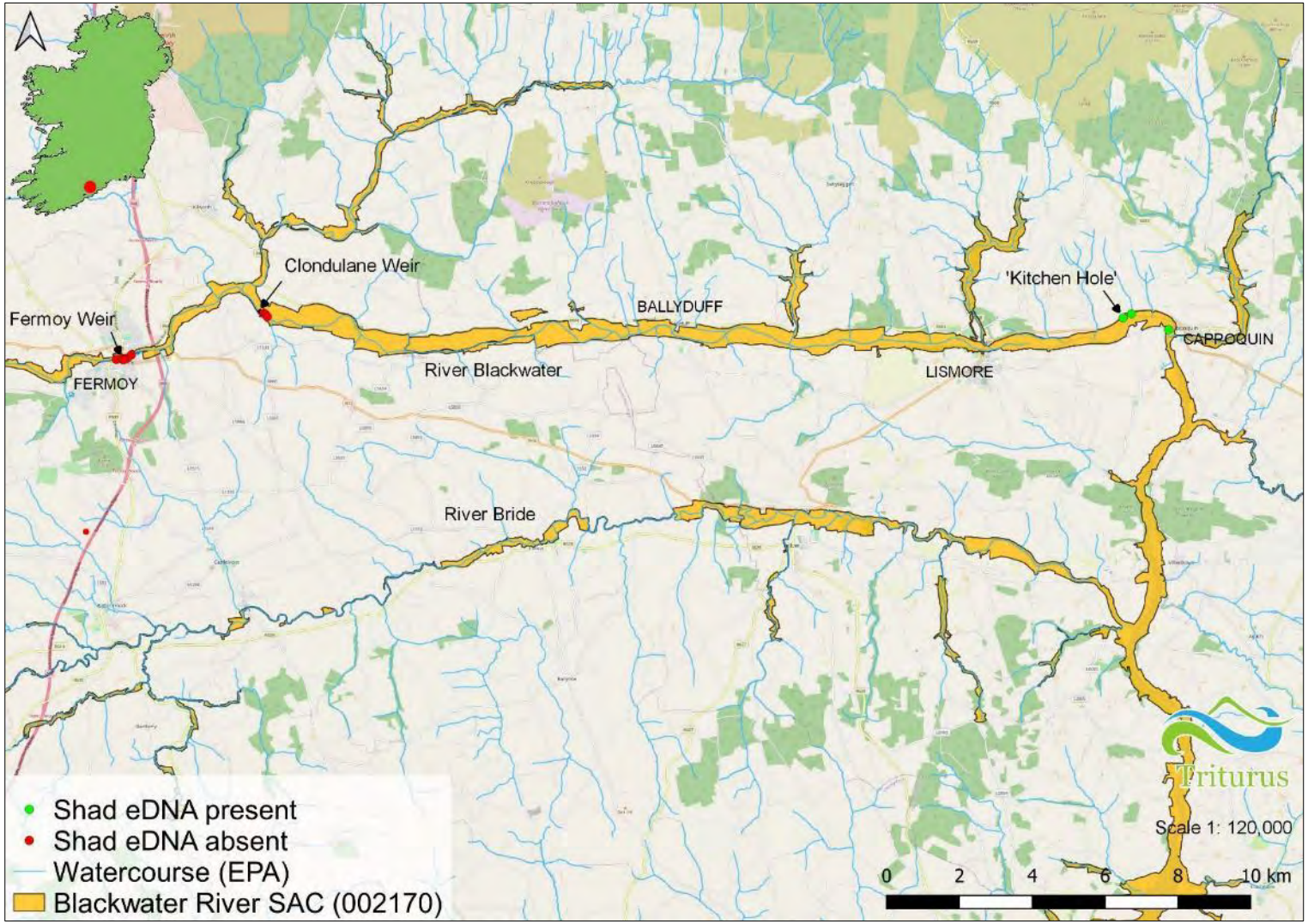


**Figure 3.12** Shad species (*Alosa* spp.) eDNA presence/absence in the River Blackwater samples, May 2020 (River Barrow positive control site not shown)

## 3.6 White-clawed crayfish survey

A total of *n*=32 white-clawed crayfish were recorded from the survey area in May 2020 via sweep netting and hand searching (**Figure 3.13**). Furthermore, abundant crayfish remains were identified in numerous otter spraints in the vicinity of the weir. The majority of captured crayfish were adults although the presence of a low number of juveniles indicated a local breeding population.

The best quality crayfish habitat within the survey area was present in section C in the vicinity of Kent Bridge (particularly in the vicinity of the northernmost arches), where frequent cobble/boulder substrata and crevices offered good quality refugia. The areas downstream of the weir face and underneath Kent Bridge supported the greatest numbers of crayfish, as recorded by sweep netting/hand-searching and snorkelling (*n*=21). Low numbers of crayfish were recorded from survey sections A (*n*=2) and B (*n*=4), respectively, where boulder, large woody debris and the weir face provided suitable refugia (upstream of the weir). Low numbers of crayfish (*n*=5) were also captured from the downstream extent of the weir face in survey section D, with low densities also observed via snorkelling the deep weir pool.

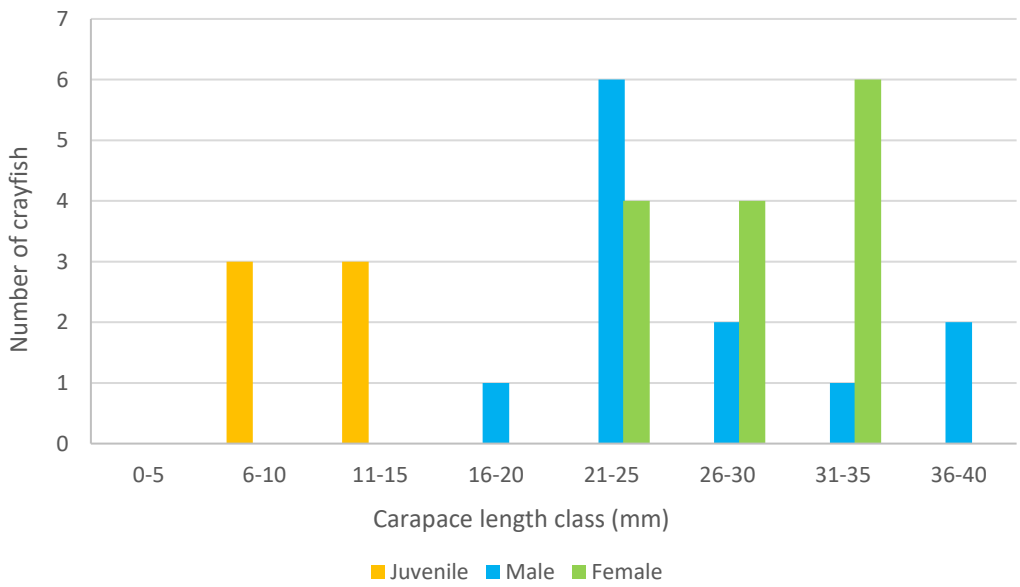


**Figure 3.13** Carapace length class and sex distribution of *n*=32 white-clawed crayfish recorded in the vicinity of Fermoy Weir, 2020

**Plate 3.10** White-clawed crayfish recorded via hand searching from survey section C, downstream of Fermoy Weir in the vicinity of Kent Bridge, May 2020

**Plate 3.11** Dead freshwater pearl mussel (*Margaritifera margaritifera*) shell recorded on mid-channel island, downstream of Kent Bridge in May 2020

## 3.7 Freshwater pearl mussel survey

No live freshwater pearl mussels were found in the section of the River Blackwater within 100m upstream and downstream of Kent Bridge. Several empty shells, likely washed from upstream areas, were found in gravel/cobble deposits (**Plate 3.11**). Please refer to **Appendix A** for the accompanying freshwater pearl mussel survey report.

## 3.8 Otter survey

A total of *n*=11 otter signs were recorded from the survey area in the vicinity of Fermoy Weir during June-July 2020 (**Figure 3.14**). The majority of signs were spraints although three couch sites and a holt were also recorded. The existing weir structure was evidently an important resting/feeding area for otter, with very regular spraint sites present in addition to couch areas. The holt was located along the heavily-vegetated south bank of the River Blackwater, approx. 180m downstream of the weir face.

**Plate 3.12** Very regular otter sprainting site (showing abundant white-clawed crayfish remains) recorded on the weir face downstream of Kent Bridge, July 2020

**Figure 3.14** Otter sign distribution recorded in the vicinity of the proposed works area at Fermoy Weir, July 2020.

## 3.9 Biological water quality

A total of *n*=31 species across *n*=28 families were recorded in the *n*=4 Q-samples collected in July 2020. The samples S1 and S2 were collected upstream of the weir and S3 and S4 downstream of the weir. A summary of results is presented in **Table 3.1** and **Figure 3.15** below.

Following the methodology of Toner et al. (2005), the Environmental Protection Agency (EPA) group invertebrates into classes whereby pollution intolerant species are denoted class A, and species with greater pollution tolerance fall into successive classes (B through E, respectively). As such, the presence or absence of these groups and their relative abundance facilitates an assessment of biological river health. Good status (Q4) unpolluted water quality is achieved according to the EPA if at least one Group A taxon is present in, at least, fair numbers (5-10% total sample composition). Group B taxa may be common or absent and *Baetis rhodani* (large dark olive mayfly) is often dominant. Other Group C taxa are never excessive and group D / E taxa are present in small numbers or absent (Toner et. al., 2005). Our results are discussed in this context in order to interpret potential changes in the macroinvertebrate community composition.

The invertebrate samples (S1 & S2) collected upstream of the weir in addition to S4 downstream had moderate status (Q3-4) biological water quality. The recorded water quality was assigned due to small numbers of clean water indicator group A, Heptageniidae mayfly species and a dominance of EPA group B and C invertebrates (moderate water quality indicators). These included the group B mayfly species *Centroptilum luteolum*, and group C mayfly species, *Seratella ignita* and *Caenis rivulorum*.

A single sample (S3) had Q4 (good status), unpolluted water quality. The sample was well represented by EPA group A clean water indicator species with the stonefly species, *Isoperla grammatica* and two mayfly species present from the group (i.e. *Ecdyonurus insignis* and *Ephemera danica*).

No invertebrate species of higher conservation value than 'least concern' were recorded in the invertebrate assemblage when compared to national red lists (Feely et al. 2020; Kelly-Quinn & Regan, 2012; Byrne et al. 2009; Foster et al. 2009).

**Table 3.1** Macro-invertebrate species composition and Q-ratings recorded on the River Blackwater in the vicinity of Fermoy Weir, July 2020

| Family | Species | S1 | S2 | S3 | S4 | EPA group |
|---|---|---|---|---|---|---|
| Perlodidae | *Isoperla grammatica* | | | 1 | | **A** |
| Heptageniidae | *Heptagenia sulphurea* | 1 | | | | **A** |
| Heptageniidae | *Ecdyonurus insignis* | | 2 | 2 | | **A** |
| Ephemeridae | *Ephemera danica* | | | 3 | 2 | **A** |
| Baetidae | *Centroptilum luteolum* | 5 | 6 | | 3 | **B** |
| Baetidae | *Baetis rhodani* | | | 1 | | **C** |
| Ephemerellidae | *Serratella ignita* | 9 | 8 | 10 | 2 | **C** |
| Caenidae | *Caenis rivulorum* | 14 | 4 | 16 | 3 | **C** |
| Leptoceridae | *Athripsodes cinereus* | 2 | | 2 | 5 | **B** |
| Limnephilidae | Not speciated - early instar | 1 | | | | **B** |
| Hydropsychidae | *Hydropsyche siltalai* | 4 | | 2 | 14 | **C** |
| Hydropsychidae | *Cheumatopsyche lepida* | | | | 4 | **C** |
| Polycentropodidae | *Polycentropus flavomaculatus* | 2 | 1 | 2 | | **C** |
| Dytiscidae | *Nebrioporus depressus* | | 1 | | | **C** |
| Elmidae | *Limnius volckmari* larva | | | 2 | 1 | **C** |
| Elmidae | *Elmis aenea* larva | 2 | | | | **C** |
| Neritidae | *Theodoxus fluviatilis* | 5 | | | | **C** |
| Bithyniidae | *Bithynia tentaculata* | 2 | 7 | 1 | | **C** |
| Planorbidae | *Planorbis planorbis* | | 2 | | | **C** |
| Valvatidae | *Valvata piscinalis* | 3 | 3 | | | **C** |
| Physidae | *Physa fontinalis* | | 2 | | | **D** |
| Sphaeriidae | *Pisidium* sp. | 1 | | | | **D** |
| Lymnaeidae | *Radix balthica* | 6 | 1 | 3 | 1 | **D** |
| Sphaeriidae | *Sphaerium corneum* | | 2 | | | **D** |
| Hirudinidae | *Pisciola geometra* | | | 2 | | **C** |
| Gammaridae | *Gammarus duebeni* | 2 | 8 | 4 | 8 | **C** |
| Assellidae | *Asellus aquaticus* | 5 | 1 | 4 | 9 | **D** |
| Simulidae | Not speciated | | | | 2 | **C** |
| Chironomidae excl. *Chrionomus* sp. | Not speciated | 5 | 6 | | 6 | **C** |
| Hydrachnidiae | Not speciated | 1 | | 1 | | **C** |
| Oligochaeta | Not speciated | | | 2 | 2 | **n/a** |
| **Taxon richness** | | **18** | **15** | **17** | **14** | |
| **Total abundance** | | **70** | **54** | **58** | **62** | |
| **Q Rating** | | **Q3-4** | **Q3-4** | **Q4** | **Q3-4** | |
| **WFD Status** | | **Mod** | **Mod** | **Good** | **Mod** | |

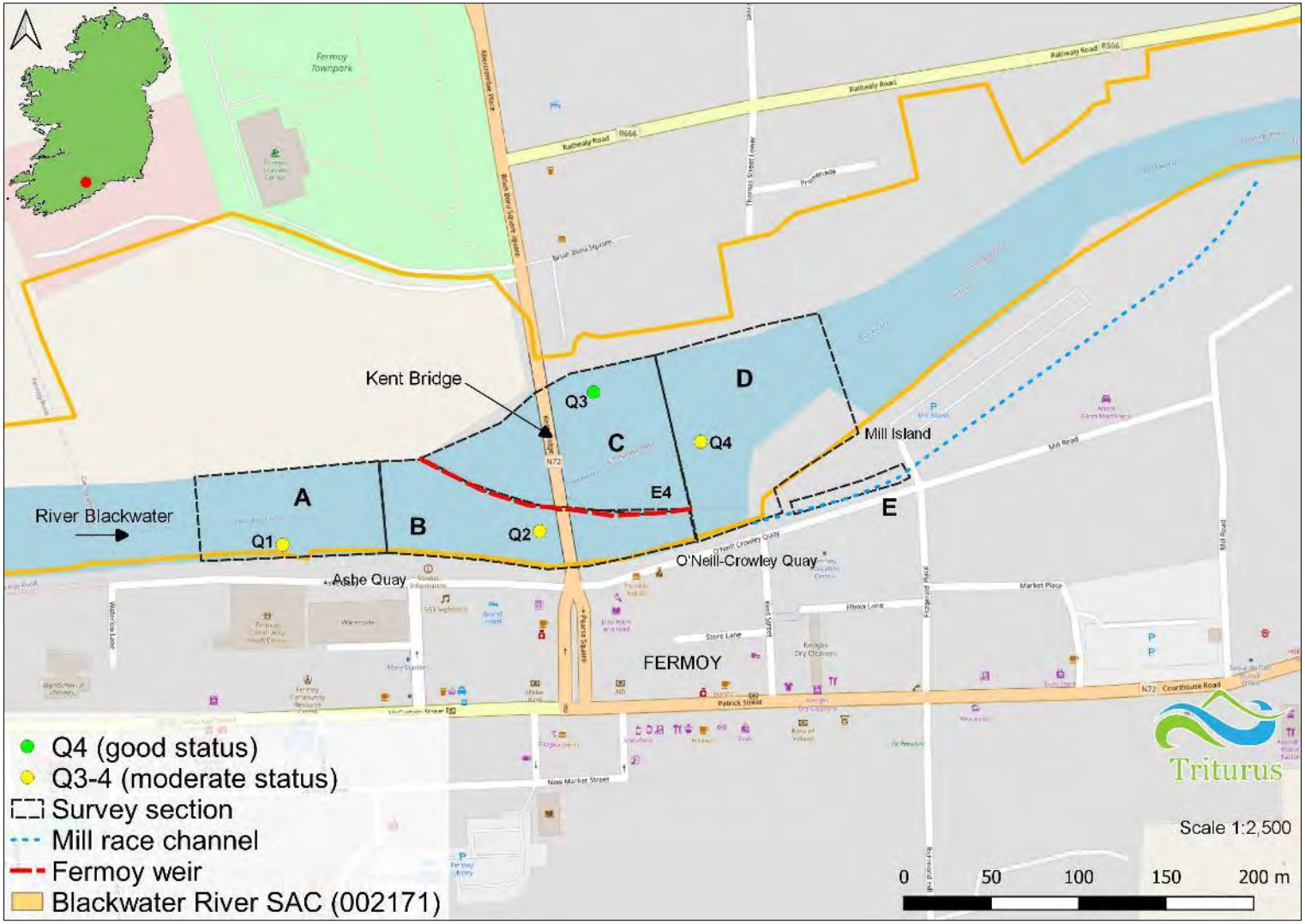


**Figure 3.15** Biological water quality (Q-ratings) recorded in the vicinity of Fermoy Weir, July 2020.

## 3.10 Aquatic ecological evaluation

An ecological evaluation of the survey area was based on the results of the aquatic surveys. All aquatic survey areas on the River Blackwater (i.e. sections A-D) were considered of **International importance** given they formed part of the Blackwater River SAC (002170). These survey sections were also considered of high value given the presence of qualifying interest *Lampetra* sp. ammocoetes, Atlantic salmon, white-clawed crayfish and otter in addition to the Annex I habitats 'Water courses of plain to montane levels, with submerged or floating vegetation of *Ranunculion fluitantis* and *Callitricho-Batrachion* or aquatic mosses [3260]' (sections C and D) 'Hydrophilous tall herb fringe communities of plains and of the montane to alpine levels [6430]' (sections C and D).

The mill race channel (survey section E) was located outside of the Blackwater River SAC boundary. However, given that the channel supported otter and herbaceous vegetation representative of the Annex I habitat 'Hydrophilous tall herb fringe communities of plains and of the montane to alpine levels [6430]', survey section E was considered of **local importance (high value)**.

# 4. Discussion

The baseline surveys focused on aquatic habitats in relation to Blackwater River SAC qualifying interest Atlantic salmon, twaite shad, lamprey species, white-clawed crayfish, freshwater pearl mussel, otter and floating river vegetation habitat, in addition to biological water quality (macro-invertebrates) and general aquatic ecology. The Fermoy Weir survey area was found to be of high value for Atlantic salmon, European eel and lamprey species (downstream of the weir in particular) and evidently supported otter, white-clawed crayfish and two Annex I aquatic habitats. No freshwater pearl mussels were recorded from the survey area.

## 4.1 Most valuable areas

### 4.1.1 Atlantic salmon

Although Atlantic salmon (and brown trout) were recorded upstream (site E1) and downstream (E2, E4) of Fermoy Weir, the best-quality salmonid habitat was present downstream (i.e. survey sections C and D). The northern extent of these sections (along the north bank of the river) was a particularly good nursery for salmonids (*Ranunculus*/macrophyte zone) and also offered some good-quality spawning substrata. Likewise, spawning habitat was good throughout much of the main channel in both sections C and D. Some excellent quality adult salmonid holding habitat was present in the large weir pool in addition to the deeper glide habitat downstream of the pool. Upstream of the weir (slower-flowing deep glide) also provided good holding habitat for migrating adults although this area was more suited to a range of coarse fish species such as dace, roach and minnow. The quality of salmonid habitat was very good overall although three of the four biological water quality samples were not meeting 'good status' WFD targets (i.e. Q3-4, moderate status, slightly polluted).

### 4.1.2 Lamprey

Survey sections C and D (downstream of Fermoy Weir) were of high value for *Lampetra* sp. lamprey, with both suitable spawning and ammocoete habitat present. The margins and littoral area of river islands downstream of Kent Bridge were provided the most suitable ammocoete habitat within the study area. Here, accumulations of fine, organic-rich soft sediment required by both larval river/brook and sea lamprey (Goodwin et al., 2008; Aronsuu & Virkkala, 2014) were present, varying in sediment depths of 5-15cm. Three such areas targeted for lamprey ammocoetes in close proximity to these islands (site E3), supported densities of 10.5, 12 and 15 *Lampetra* sp. ammocoetes per $m^2$, respectively. These densities compared favourably with the conservation objective of "Mean catchment juvenile density of brook/river lamprey at least $2/m^2$" for *Lampetra* sp. in the Blackwater River SAC (NPWS, 2012). Some suitable (though sub-optimal) ammocoete habitat was also present in association with macrophyte beds in these survey sections, although this was more limited in extent than the aforementioned island margins. Suitable lamprey spawning areas (ranging from finer gravels to larger cobbles) were present throughout survey sections C and D, with the slow, deeper glide upstream of the weir less suitable. A known historical sea lamprey and river lamprey spawning site was present in survey section D (tailing of large weir pool; NPWS data).

### 4.1.3 Twaite shad

Analysis of water samples for *Alosa* spp. eDNA during the species' known peak spawning migration (21st May 2020) supported the absence of shad from the River Blackwater upstream and downstream of Fermoy Weir and downstream of Clondulane Weir (**Figure 3.12**). However, *Alosa* spp. eDNA was detected from water samples collected from the 'Kitchen Hole' site on the lower (tidal) River Blackwater at Cappoquin. Our genetic results support the suspected distribution of shad species (majority considered to be twaite shad, *Alosa fallax*) within the River Blackwater, i.e. present to the tidal limit (King & Linnane, 2004; King & Roche, 2008).

Two records exist for allis shad (incidental rod and line captures) on the River Blackwater at Careysville (below Clondulane Weir) in 2003 and 2005, some 25km upstream of the tidal limit (King & Linnane, 2004; NPWS data) - the furthest upstream record for shad species in the River Blackwater SAC. Whilst allis shad are known to penetrate further up river catchments compared to twaite shad (Maitland & Hattin-Ellis, 2003; Jolly et al., 2012), the Clondulane Weir would appear to be an impassable barrier to both shad species in the River Blackwater, based on eDNA analysis. Unlike salmonids, weaker-swimming shad species are unable to traverse many instream barriers (Larinier & Travade, 2002). However, given their propensity for spawning in the lower (tidal) reaches of rivers, irrespective of upstream passage issues, twaite shad populations are often less impacted by barriers than other anadromous species (van Puijenbroek et al., 2018).

### 4.1.4 White-clawed crayfish

Despite being historically present in only the Awbeg River within the Munster Blackwater catchment, current white-clawed crayfish distribution is known from several other tributaries as well as the Blackwater main channel, both upstream and downstream of Fermoy (Smiddy & Saich, 2015). Moderate numbers of white-clawed crayfish were recorded from the vicinity of Fermoy Weir during the 2020 survey (*n*=32 total), including both adults and juveniles. The areas of channel underneath Kent Bridge (section C) represented the best quality crayfish habitat within the survey area, with ample boulder/cobble refugia present. These areas also supported the highest density of crayfish recorded. However, areas along the existing weir face (boulder-dominated habitat with frequent crevices) also provided valuable refugia for the species. The low densities of crayfish recorded from survey sections A, B and D reflected the difficulty in surveying these areas (deeper/faster water) rather than poor suitability. This was supported via snorkelling surveys of these areas which observed crayfish in deeper areas.

### 4.1.5 Freshwater pearl mussel

No live freshwater pearl mussels were found in the section of the River Blackwater within 100m upstream and downstream of Kent Bridge. The only habitat within 100m of the bridge that could be considered suitable for freshwater pearl mussels was located in survey section D, downstream of the large weir pool along the north bank of the river (i.e. fast glide with clean, cobble-dominated substrata) (**Appendix A**). Several empty shells, likely washed from upstream areas, were found in gravel/cobble deposits (**Plate 3.11**). Four live individuals recorded in 2011 were not present given changes in substrata and local hydrology (i.e. partial weir collapse). A reproducing population at this location was not considered possible given water quality issues (i.e. ≤Q4; **Table**

**3.1**). The changing morphology of the channel due to breaching of the weir and significant movement of gravels may also have impacted the small residual historical population.

Please refer to **Appendix A** for the accompanying freshwater pearl mussel survey report.

### 4.1.6 Otter

The Fermoy Weir survey area was evidently of high-value for otter, with a total of *n*=11 signs recorded during June-July 2020 (**Figure 3.14**). A single holt was located within the survey area approx. 180m downstream of the weir, on the heavily-vegetated south bank of the River Blackwater. The existing weir face was a regularly used feeding and resting area (i.e. couches). The presence of abundant white-clawed crayfish remains in multiple recorded spraints (e.g. Plate 3.12) indicated the prevalence of this prey species in the diet of local otter population. In turn, this highlighted the importance of areas with ample crayfish refugia (such as the weir face and underneath Kent Bridge) in supporting foraging otter. The highly-seasonal dietary link between white-clawed crayfish and otter has been frequently noted elsewhere in Ireland (pers. obs.; Kyne et al., 1989; Breathnach et al., 1993; Ottino & Giller, 2004; Reid et al., 2013) including within the Blackwater River SAC (Smiddy & Caich, 2015).

### 4.1.7 Floating river vegetation

Macrophyte communities representative of the Annex I habitat ''Water courses of plain to montane levels, with submerged or floating vegetation of *Ranunculion fluitantis* and *Callitricho-Batrachion* or aquatic mosses [3260]' ('floating river vegetation', FRV) were present within the River Blackwater survey area. Sections C and D, downstream of Fermoy Weir, supported frequent *Ranunculus* subspecies *Batrachion* agg. in addition to other indicator species (EC, 2013) including Callitriche sp., *Myriophyllum spicatum* and the moss *Fontinalis antipyretica*. The better-quality areas of FRV habitat could be considered as those featuring an overall higher percentage cover, i.e. survey section C downstream of Kent Bridge, along the north bank. Given the paucity of macrophytes, no good examples of this Annex I habitat were present upstream of the weir (survey sections A and most of B).

### 4.1.8 Hydrophilous tall herb habitat (non-qualifying interest)

Of note, several vegetated gravel islands located in the River Blackwater downstream of Fermoy Weir supported the non-qualifying interest Annex I habitat 'Hydrophilous tall herb fringe communities of plains and of the montane to alpine levels [6430]'. A number of positive indicator species (EC, 2013; Devaney et al., 2013) were recorded on exposed gravel shoals and their margins including *Epilobium hirsutum*, *Lythrum salicaria*, *Mentha aquatica*, *Myosotis scorpioides, Stachys palustris* and *Alisma plantago-aquatica*. River gravel islands (bars) are classified as vulnerable in the European Red List of Habitats, based on the criterion of a large reduction in the habitat area over the last 50 years (about 35%; Janssen et al., 2016). Such islands are ephemerally inundated at higher flows and subject to wetting and drying processes with changing water levels, thereby alternately offering terrestrial, wet and aquatic habitats (Zeng et al., 2015). Gravel bars and partially vegetated islands, such as those found downstream of Fermoy Weir, are key components of gravel-bed rivers (Edwards et al., 1999; Tockner et al., 2006) and are naturally highly dynamic

and morphologically complex systems. Therefore, gravel islands represent important instream habitat at the aquatic-terrestrial interface. In having an ecotonal position between aquatic and terrestrial environments, bars have the potential to support a varied and rich biota (Kalníková et al., 2020; Gilvear et al., 2007).

Good examples of the Annex I hydrophilous tall herb habitat was also present in the mill race channel (survey section E), located outside of the Blackwater River SAC boundary, as well as along the northern river margins of survey section C (downstream of the bridge) and to the south of the large gravel island near Mill Island (section D).

# 5. References


Anon (2004). *Margaritifera margaritifera*. Stage 1 and Stage 2 survey guidelines. Irish Wildlife Manuals, No. 12. National Parks and Wildlife Service, Department of Environment, Heritage and Local Government, Dublin, Ireland.

APEM (2004). Assessment of sea lamprey distribution and abundance in the River Spey: Phase II. Scottish Natural Heritage Commissioned Report No. 027 (ROAME No. F01AC608).

Aronsuu, K. & Virkkala, P. (2014). Substrate selection by subyearling European river lampreys (*Lampetra fluviatilis*) and older larvae (*Lampetra* spp.). Ecology of Freshwater Fish, 23: 644–655

Brasington, J., Vericat, D., & Rychkov, I. (2012). Modelling river bed morphology, roughness, and surface sedimentology using high resolution terrestrial laser scanning. Water Resources Research, 48(11).

Breathnach, S., & Fairley, J. S. (1993). The diet of otters *Lutra lutra* (L.) in the Clare river system. In Biology and Environment: Proceedings of the Royal Irish Academy (pp. 151-158). Royal Irish Academy.

Byrne, A. W., Moorkens, E. A., Anderson, R., Killeen, I. J., & Regan, E. (2009). Ireland Red List no. 2: Non-marine molluscs. National Parks and Wildlife Service, Department of the Environment, Heritage and Local Government.

CEN (2003). Water Quality - Sampling of Fish with Electricity. Document CEN EN 14011:2000.

CFB (2008). Methods for the Water Framework Directive. Electric Fishing in Wadeable Reaches. Central Fisheries Board. Unpublished report.

Devaney, F. M., Martin, J. R., O'Neill, F. H., & Delaney, A. (2013). Irish semi-natural grasslands survey (No. 4). Annual Report.

DixonBrosnan (2020). Natura Impact Statement (NIS) Emergency Maintenance Works Fermoy, Co. Cork. Report prepared by DixonBrosnan Environmental Consultants on behalf of the Office of Public Works (OPW). September 2020.

Doherty, D., O'Maoiléidigh, N., & McCarthy, T. K. (2004). The biology, ecology and future conservation of twaite shad (*Alosa fallax* Lacépède), allis shad (*Alosa alosa* L.) and Killarney shad (*Alosa fallax killarnensis* Tate Regan) in Ireland. In Biology and Environment: Proceedings of the Royal Irish Academy (pp. 93-102). Royal Irish Academy.

EA (2003). River Habitat Survey in Britain and Ireland: Field Survey Guidance Manual: 2003 Version. Forest Research. Environment Agency, UK.

EC (2013). Interpretation Manual of European Union Habitats, version EUR 28. European Commission. Available at: http://ec.europa.eu/environment/nature/legislation/habitatsdirective/docs/Int_Manual_EU28.pdf

Edwards, P. J., Kollmann, J., Gurnell, A. M., Petts, G. E., Tockner, K., & Ward, J. V. (1999). A conceptual model of vegetation dynamics on gravel bars of a large Alpine river. Wetlands Ecology and Management, 7(3), 141-153.

Feeley, H.B., Baars, J-R., Kelly-Quinn, M. & Nelson, B. (2020). Ireland Red List No. 13: Stoneflies (Plecoptera). National Parks and Wildlife Service, Department of Culture, Heritage and the Gaeltacht, Dublin, Ireland.

Fossitt, J. (2000). A Guide to Habitats in Ireland. The Heritage Council, Ireland.

Foster, G. N., Nelson, B. H. & O Connor, Á. (2009). Ireland Red List No. 1 – Water beetles. National Parks and Wildlife Service, Department of Environment, Heritage and Local Government, Dublin, Ireland.

Gardiner, R. (2003). Identifying lamprey. A field key for sea, river and brook lamprey. Conserving Natura 2000 Rivers, Conservation techniques No. 4. Peterborough. English Nature.

Gilvear, D., Francis, R., Willby, N., & Gurnell, A. (2007). Gravel bars: a key habitat of gravel-bed rivers for vegetation. Developments in Earth Surface Processes, 677–700. doi:10.1016/s0928-2025(07)11154-8

Goodwin, C.E., Dick, J.T.A. & Elwood, R.W. (2008). A preliminary assessment of the distribution of the sea lamprey (*Petromyzon marinus* L), river lamprey (*Lampetra fluviatilis* (L.)) and brook lamprey (*Lampetra planeri* (Bloch)) in Northern Ireland. Biology and Environment: Proceedings of the Royal Irish Academy 109B, 47-52.

Harvey, J. & Cowx, I. (2003). Monitoring the River, Sea and Brook Lamprey, *Lampetra fluviatilis, L. planer*i and *Petromyzon marinus*. Conserving Natura 2000 Rivers Monitoring Series No. 5, English Nature, Peterborough.

Janssen, J. A. M., Rodwell, J. S., Criado, M. G., Arts, G. H. P., Bijlsma, R. J., & Schaminee, J. H. J. (2016). European red list of habitats: Part 2. Terrestrial and freshwater habitats. European Union.

Jolly, M. T., Aprahamian, M. W., Hawkins, S. J., Henderson, P. A., Hillman, R., O'Maoiléidigh, N., … Genner, M. J. (2012). Population genetic structure of protected allis shad (*Alosa alosa*) and twaite shad (*Alosa fallax*). Marine Biology, 159, 675–687.

Kalníková, V., Chytrý, K., Biţa-Nicolae, C., Bracco, F., Font, X., Iakushenko, D., … Chytrý, M. (2020). Vegetation of the European mountain river gravel bars: a formalized classification. Applied Vegetation Science.

Kelly-Quinn, M. & Regan, E.C. (2012). Ireland Red List No. 7: Mayflies (Ephemeroptera). National Parks and Wildlife Service, Department of Arts, Heritage and the Gaeltacht, Dublin, Ireland.

King J. J. & Linnane S. M. (2004). The status and distribution of lamprey and shad in the Slaney and Munster Blackwater SACs. Irish Wildlife Manuals, No. 14. National Parks and Wildlife Service, Department of Environment, Heritage and Local Government, Dublin, Ireland.

King, J. J., & Roche, W. K. (2008). Aspects of anadromous allis shad (*Alosa alosa* Linnaeus) and twaite shad (*Alosa fallax* Lacépède) biology in four Irish Special Areas of Conservation (SACs): Status, spawning indications and implications for conservation designation. Hydrobiologia, 602, 145–154.

King, J. L., Marnell, F., Kingston, N., Rosell, R., Boylan, P., Caffrey, J. M., ... & Poole, R. (2011). Ireland red list no. 5: amphibians, reptiles & freshwater fish. National Parks and Wildlife Service, Department of Arts, Heritage and the Gaeltacht, Dublin, Ireland, 1-77.

Kyne, M., Smal, C., & Fairley, J. (1989). The Food of Otters *Lutra lutra* in the Irish Midlands and a Comparison with That of Mink Mustela vison in the Same Region. Proceedings of the Royal Irish Academy. Section B: Biological, Geological, and Chemical Science, 89B, 33-46.

Larinier, M., & Travade, F. (2002). The design of fishways for shad. Bulletin Francais de la Peche et de la Pisciculture, (364), 135-146.

Macklin, R., Brazier, B. & Sleeman, P. (2019). Dublin City otter survey. Report prepared by Triturus Environmental Ltd. for Dublin City Council as an action of the Dublin City Biodiversity Action Plan 2015-2020.

Maitland, P.S. (2003). Ecology of the River, Brook and Sea Lamprey. Conserving Natura 2000 Rivers Ecology Series No. 5. English Nature, Peterborough.

Matson, R., Delanty, K., Shephard, S., Coghlan, B., & Kelly, F. (2018). Moving from multiple pass depletion to single pass timed electrofishing for fish community assessment in wadeable streams. Fisheries Research, 198, 99-108.

Nelson, B., Ronayne, C. & Thompson, R. (2011). Ireland Red List No.6: Damselflies & Dragonflies (Odonata). National Parks and Wildlife Service, Department of the Environment, Heritage and Local Government, Dublin, Ireland.

Niven, A.J. & McCauley, M. (2013). Lamprey Baseline Survey No2: River Faughan and Tributaries SAC. Loughs Agency, 22, Victoria Road, Derry.

NPWS (2012). Conservation Objectives: Blackwater River (Cork/Waterford) SAC 002170. Version 1.0. National Parks and Wildlife Service, Department of Arts, Heritage and the Gaeltacht.

NRA (2009). Guidelines for Assessment of Ecological Impacts of National Road Schemes. National Roads Authority, Dublin.

Ottino, P., & Giller, P. (2004). Distribution, density, diet and habitat use of the otter in relation to land use in the Araglin valley, Southern Ireland. In Biology and Environment: Proceedings of the Royal Irish Academy (pp. 1-17). Royal Irish Academy.

Potter, I. C., & Osborne, T.S. (1975). The systematics of British larval lampreys. Journal of Zoology, 176(3), 311-329.

Reid, N., Thompson, D., Hayden, B., Marnell, F., & Montgomery, W. I. (2013). Review and quantitative meta-analysis of diet suggests the Eurasian otter (*Lutra lutra*) is likely to be a poor bioindicator. Ecological indicators, 26, 5-13.

Reynolds, J.D., Lynn, D., O' Keeffe, C., Lucey, J., Clabbey, K., McGarrigle, M. & King, J. (2010). Conservation assessment and current status of protected white-clawed crayfish, *Austropotamobius pallipes* (Lereboullet), in Ireland. Freshwater Crayfish 17: 123-127.

Rooney, S.M., O'Gorman, N.M., King, J.J. (2013). National Programme: Habitats Directive and Red Data Book Species Executive Report 2012. Inland Fisheries Ireland, Swords Business Campus, Swords, Co. Dublin, Ireland.

Smiddy, P., & Saich, C. (2015). Using Otter (*Lutra lutra*) diet to indicate presence of White-clawed Crayfish (*Austropotamobius pallipes*) populations. The Irish Naturalists' Journal, 34(1), 45-50.

Tockner, K., Paetzold, A, Karaus, U., Claret, C. and Zettel, J. (2006). Ecology of braided rivers. In: Smith G.H.S., Best J.L., Bristow C.S. and Petts, G.E. (Eds), Braided Rivers: Process, Deposits, Ecology and Management. Oxford: Blackwell, pp. 339–359.

Toner, P., Bowman, J., Clabby, K., Lucey, J., McGarrigle, M., Concannon, C., ... & MacGarthaigh, M. (2005). Water quality in Ireland. *Environmental Protection Agency, Co. Wexford, Ireland*.

van Puijenbroek, P. J., Buijse, A. D., Kraak, M. H., & Verdonschot, P. F. (2019). Species and river specific effects of river fragmentation on European anadromous fish species. River Research and Applications, 35(1), 68-77.

Zeng, Q., Shi, L., Wen, L., Chen, J., Duo, H., & Lei, G. (2015). Gravel bars can be critical for biodiversity conservation: A case study on Scaly-sided Merganser in South China. PloS one, 10(5).

# 6. Appendix A – freshwater pearl mussel survey report

* Report attached separately

# 7. Appendix B – assorted survey images

**Plate 7.1** Juvenile brown trout (top) and Atlantic salmon parr (bottom) recorded from electro-fishing site E1 on the River Blackwater upstream of Fermoy Weir, July 2020

**Plate 7.2** European eel observed in boulder habitat underneath Kent Bridge (electro-fishing site E2) on the River Blackwater, July 2020

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**Plate 7.8** River island vegetation representative of the Annex I habitat 'Hydrophilous tall herb fringe communities of plains and of the montane to alpine levels [6430]', located downstream of Fermoy Weir

Triturus

Triturus Environmental Ltd.

42 Norwood Court,

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## Appendix 4. A Survey of The Freshwater Pearl Mussel (*Margaritifera margaritifera*) at Fermoy Bridge on the Munster Blackwater River, Co. Cork by Sweeney Consultancy

# A Survey of
# The Freshwater Pearl Mussel (*Margaritifera margaritifera*)
# at Fermoy Bridge on the Munster Blackwater River, Co. Cork.

**May 2020**

**Sweeney Consultancy,**
***Rahan,***
***Mallow***
***Co. Cork.***
***Tel. 022/26780***

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# 1. INTRODUCTION

The freshwater pearl mussel (*Margaritifera margaritifera*) is on the IUCN Invertebrate Red Data List and is protected under the Convention on the Conservation of European Wildlife and Natural Habitats (Bern Convention). It is protected by law in Ireland under the 1976 Wildlife Act (S.I. 112, 1990) and is listed on Annex II and Annex V of the EU Habitats Directive (92/43/EEC).

Sweeney Consultancy was contracted to carry out surveys for freshwater pearl mussels from 100m upstream (ITM 581030 598585) to 100m downstream (ITM 581296 598660) of Fermoy Bridge, on the Munster Blackwater River, where repair works are proposed.

## 2. SURVEY METHODOLOGY

The survey was carried out under Licence No. C15/2020, issued by the National Parks and Wildlife Service. The survey methodology used was in accordance with the guidelines given in Irish Wildlife Manual No. 12, NPWS (Anon., 2004). Surveying was carried out on May 29, 2020, in bright weather, with good visibility.

Following an initial safety inspection and photographing of the stretch of river to be surveyed, Pascal Sweeney examined the riverbed visually, with a bathyscope and by snorkelling, depending on water depth. Biosecurity measures were strictly adhered to, with all equipment in contact with river water washed down with Virkon Aquatic disinfectant between sites. Notes were taken on the aquatic habitat conditions and suitability for freshwater pearl mussels, based on the criteria of Hastie *et al.* (2000) and Skinner *et al.* (2003).

# 3. RESULTS

## 3.1 River Habitat

Because Fermoy Weir crosses under the bridge and this weir is breached downstream of the bridge (Photo 1), the instream physical conditions vary considerably.

Photo 1: Fermoy Bridge and Weir, downstream view (Arches numbered from LHS to RHS)

Upstream of Arches 1 to 4, from the weir to the bridge, there is currently no flow (Photo 2), due to a break in the weir on the right-hand side downstream of the bridge. Upstream of the weir there is deep water with silted substratum. The habitat here is unsuitable for freshwater pearl mussels.

Photo 2: Upstream of Arches 1 to 4

The fish pass (now dry) on the weir is upstream of Arch 5 (Photo 3).

Photo 3: Dry fish pass upstream of Arch 5

The river upstream of Arches 6 and 7 is deep glide above of the weir (Photo 4). The habitat here is unsuitable for freshwater pearl mussels.

Photo 4: Upstream of Arches 6 & 7

For 50m downstream of Arches 1 to 3, there is slow shallow glide over silted gravel and cobble, with approximately 20% cover of water crowfoot (*Ranunculus spp.*) (Photo 5). The habitat here is unsuitable for freshwater pearl mussels.

Photo 5: Downstream of Arches 1 to 3

Vegetated gravel islands occur in the central part of the river  downstream of Arches 3 and 4 (Photo 6).

Photo 6: Vegetated gravel islands

Downstream of Arches 4 and 5, there is a slow back-currant from the strong flow at the broken section of the weir (Photo 7). The habitat here is unsuitable for freshwater pearl mussels.

Photo 7: Downstream of Arch 5

The 50m of river downstream of Arches 6 and 7 consists of fast turbulent run above the weir (Photo 8). The habitat here is unsuitable for freshwater pearl mussels. The water then passes through the breach in the weir and flows strongly over to the left hand side of the river (Photo 9), around a large bank of cobble that originated from the broken weir (Photo 10). This flow by the left bank is the only habitat within 100m of the bridge that could be considered suitable for freshwater pearl mussels (Photo 11).

Photo 8: Downstream of Arches 6 & 7

Photo 9: Flow from break in weir to left-hand side of river channel

Photo 10: Cobble bank from broken weir by right bank

Photo 11: Flow on left-hand side of river channel downstream of bridge

### 3.2 Freshwater Pearl Mussel Survey Results

In the survey carried out on 29/05/2020, no live freshwater pearl mussels were found in the section of the River Blackwater within 100m upstream and downstream of Fermoy Bridge. A few empty shells, washed down from upstream were found in gravel/cobble deposits.

## 4. COMMENTS

In 2011, Sweeney Consultancy was involved in survey work additional to the EIS for the Munster Blackwater River (Fermoy) Drainage Scheme for OPW. Four live freshwater pearl mussels were recorded, along the right bank adjacent to the Plomeur car park, approximately 250m downstream of the bridge. This location is now covered in a deep layer of stone from the broken weir (Photo 10).

The freshwater pearl mussel can live for over 100 years and requires very good water quality (Skinner *et al.*, 2003). The NS2 Project (2010) shows the main population of freshwater pearl mussels in the Blackwater occurring upstream of Mallow. Downstream of Mallow, freshwater pearl mussels have occasionally been recorded. Individual mature mussels are carried downstream in floods and settle in deep water, but are probably unlikely to successfully reproduce (Evelyn Moorkens *pers. comm.*). The empty shells found on 29/05/2020 could have originated much farther upstream. There is no suitable freshwater pearl mussel habitat from c. 500m downstream of Fermoy Bridge to Clondulane Weir over 5km downstream. In a survey carried out by Sweeney Consultancy for Inland Fisheries Ireland on 03/07/2016 from Clondulane Weir to Kilmurry Island, c. 5km farther downstream, no freshwater pearl mussels were recorded in the survey carried out. This survey was repeated on 19/09/2019 and again no mussels were found. In the past, NPWS staff have found a few individual mussels downstream of Clondulane Weir (Cyril Saich, *pers. comm.*). Given that Moorkens (2006) states that a reproducing pearl mussel population requires very high water quality, with phosphorus levels lower than the median level associated with EPA Q5 waters, and that since 1975, EPA have only recorded a Q-value above Q4 at one site downstream of Fermoy on one occasion, a reproducing population here is not possible.

## 5. REFERENCES

Anon (2004). *Margaritifera margaritifera*. Stage 1 and Stage 2 survey guidelines. *Irish Wildlife Manuals*, No. 12. National Parks and Wildlife Service, Department of Environment, Heritage and Local Government, Dublin, Ireland.

Hastie L.C., Boon P.J. and Young M.R. (2000). Physical microhabitat requirements of freshwater pearl mussel *Margaritifera margaritifera* (L.). *Hydrobiologia* 429 59-71

NS2 Project (2010) Freshwater Pearl Mussel Second Draft Munster Blackwater Sub-Basin Management Plan. (available on www.wfdireland.ie/docs/5_FreshwaterPearlMusselPlans )

Skinner, A, Young M. & Hastie, L. (2003). Ecology of the Freshwater Pearl Mussel. Conserving Natura 2000 Rivers Ecology Series No. 2 English Nature, Peterborough.

## Appendix 5. Tree survey and arboricultural impact assessment Fermoy Weir Development by Mark Donnelly BSc.

# TREE SURVEY AND ARBORICULTURAL IMPACT ASSESSMENT

# FERMOY WEIR DEVELOPMENT, FERMOY, CO. CORK.

**PLANNING REF .**

**SURVEY AND REPORT BY:**

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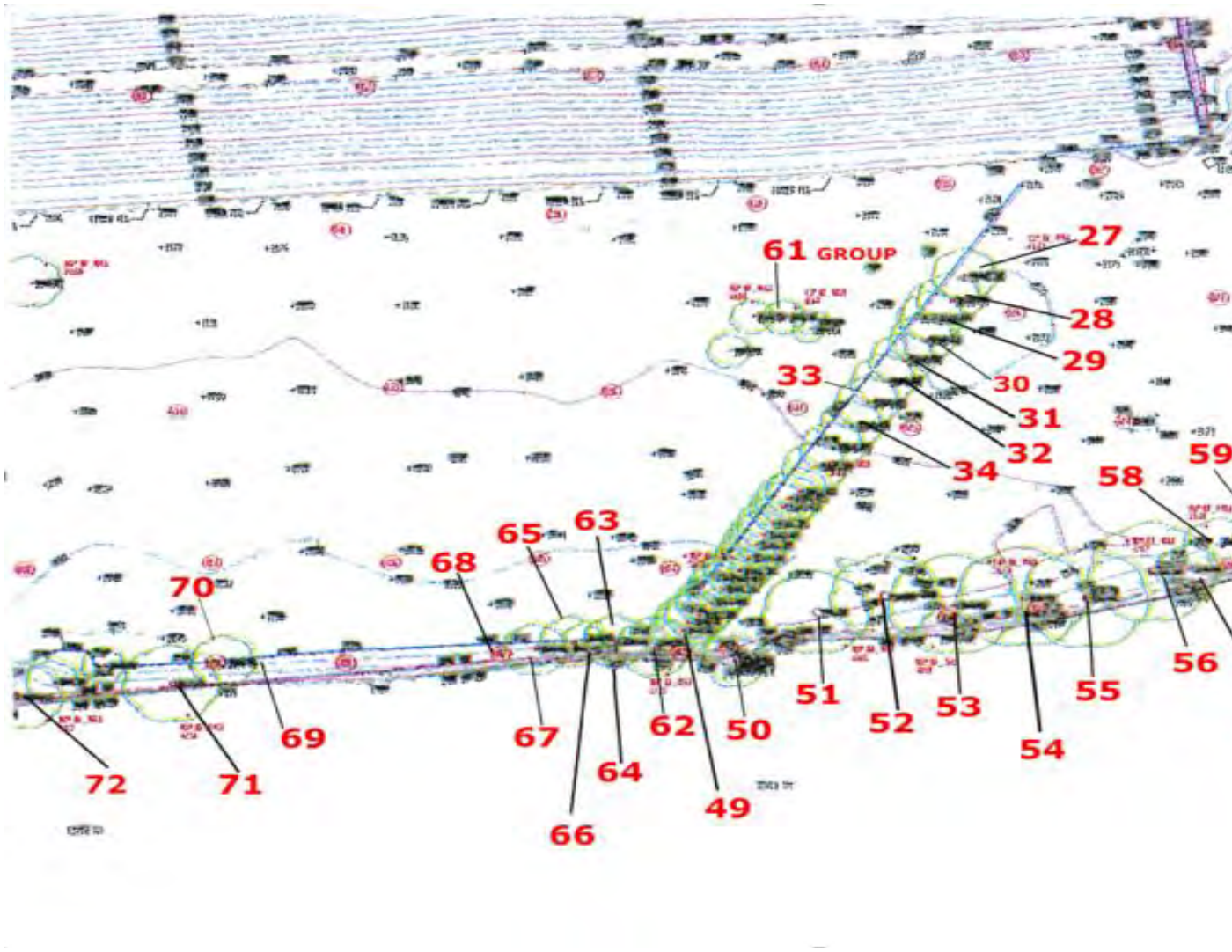


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## STATEMENT OF AUTHORITY

The author, Mark Donnelly, holds a BSc. Hons in Forestry from Bangor University, Wales, and is a member of the Institute of Chartered Foresters. He worked as an arboricultural consultant for the National Trust in Wales for 22 years and has worked as a lecturer in Forest Ecology at Bangor University. In Ireland, he has undertaken a range of arboricultural and ecological surveys for projects including wind farms, quarries, local authorities, housing developments, roads and pipelines.

## REPORT LIMITATIONS

The statements, findings and recommendations made within the report do not take into account any effects of extreme climate and weather incidences, vandalism, changes in natural and built environment around the trees after the date of this report nor any damage whether physical, chemical, or otherwise. Mark Donnelly cannot accept any liability in connection with the above factors, nor where recommended tree management is not carried out in accordance with modern tree care techniques.

The tree inspection is by visual observation on ground level and may be compromised by climbing plants, particularly ivy obscuring defects, and the time of year that the survey is carried out, for example, many decay fungi can only be observed seasonally.

## INTRODUCTION

The report was prepared as part of a planning application to Cork County Council for construction of a new fish pass and restoration of the existing weir in Fermoy town.

The aims of the report are:

1) To establish a baseline tree survey and description of the trees on the site with particular regard to safety management recommendations and an Arboricultural Method Statement.

2) To provide an assessment of arboricultural impacts for the proposed development..

3) To identify trees to be retained and provide recommendations for their management.

## SITE DESCRIPTION

GPS Grid Reference 52.13928 – 8.27673

The site is adjacent to the river Blackwater in the centre of Fermoy town. The trees are on the north bank upstream of Fermoy Bridge close to the existing weir and fish pass. It is a dry site with course loamy drift soil and siliceous stones but it is liable to flooding as it is below the towns flood defences and part of a recreational area, open to the public. It is within the Blackwater River SAC (002170).

## METHODOLOGY

The trees were surveyed on 31st July 2021. They were described and recorded as individual trees and there is one group. All were numbered and tagged with their locations marked on the site drawing. (Maps 2and3 appendix). Tree numbers marked on the map should be prefixed by 148. Visual assessment follows the standards in BS 5837 (2012). Trees in relation to design, demolition and continuation.

## Table 1: SURVEY KEY

| | | | | |
|---|---|---|---|---|
| 1. | **Tree Numbers** | Individual tree and Tree Groups (prefixed with G) have numbers to facilitate location on the site plan. | | |
| 2. | **Species** | Recorded with common name | | |
| 3. | **Age** | **IM** | An immature tree | greater than 150 mm diameter but regarded as a sapling |
| | | **SM** | Semi mature | a young tree but less than 50 % of its ultimate size |
| | | **M** | Mature | a tree having attained dimensions typical of a fully-grown specimen of its species |
| | | **OM** | Over Mature | An old specimen of a species showing signs of decline in health. Usual symptoms include crown starting to break up and decreasing in size. |
| 4. | **Girth** | Stem diameter (at approximately 1.3 m above ground) in mm | | |
| 5. | **Height** | Approximate tree height in meters. | | |
| 6. | **Spread** | Crown spread in meters. | | |
| 7. | **Condition** | **Good** | Full healthy canopy with good form and health | |
| | | **Fair** | A specimen whose overall condition is typical of the site and may exhibit slightly reduced leaf cover/minor deadwood or may be predisposed to defects, e.g., Coppiced growth, but otherwise in good health. | |
| | | **Poor** | A specimen which through defect or disease has a limited longevity or may be unsafe. | |
| 8. | **Comments** | Any information relating to trees condition not covered previously and recommendation for removal/retention. | | |
| 9. | **Recommendation** | General recommendations for retention, felling/removal and tree surgery. | | |
| 10. | **Tree Retention Category** | **A** | Indicates a tree of high quality and a good example of their species and of significant landscape value. Should contribute significantly to their environs for a minimum of 40years. | |
| | | **B** | Indicates a tree of moderate quality and value. Should contribute significantly for at least 20 years. | |
| | | **C** | Indicates a tree of low quality and value, that could contribute for at least 10 years. | |
| | | **U** | Indicates a tree of poor condition that should not be retained for more than 10 years. | |
| 11. | **RPA** | Root Protection Area as a radius measured from the tree centre in meters. RPA is the minimum radial range of tree protection necessary to safeguard trees roots and would normally be the same as the "Construction Exclusion Zone" enclosed by fencing during construction. The RPA is calculated as follows:<br><br><u>Single stem tree:</u><br>RPA radius – stem diameter x .12 (See Root Protection Area Table).<br><u>Trees with more than one stem arising below 1.50m above ground level:</u><br>RPA radius – equivalent resultant combined stem diameter for multi-stemmed trees.(RPA calculation is capped at 5 stems) | | |

## Table 2: ROOT PROTECTION AREAS

| Single stem diameter (mm) | Radius of nominal circle (m) | RPA ($m^2$) | Single stem diameter (mm) | Radius of nominal circle (m) | RPA ($m^2$) |
|---|---|---|---|---|---|
| 75 | 0.9 | 3 | 675 | 8.1 | 206 |
| 100 | 1.2 | 5 | 700 | 8.4 | 222 |
| 125 | 1.5 | 7 | 725 | 8.7 | 238 |
| 150 | 1.8 | 10 | 750 | 9 | 255 |
| 175 | 2.1 | 14 | 775 | 9.3 | 272 |
| 200 | 2.4 | 18 | 800 | 9.6 | 290 |
| 225 | 2.7 | 23 | 825 | 9.9 | 308 |
| 250 | 3 | 28 | 850 | 10.2 | 327 |
| 275 | 3.3 | 34 | 875 | 10.5 | 346 |
| 300 | 3.6 | 41 | 900 | 10.8 | 366 |
| 325 | 3.9 | 48 | 925 | 11.1 | 387 |
| 350 | 4.2 | 55 | 950 | 11.4 | 408 |
| 375 | 4.5 | 64 | 975 | 11.7 | 430 |
| 400 | 4.8 | 72 | 1000 | 12 | 452 |
| 425 | 5.1 | 81 | 1025 | 12.3 | 475 |
| 450 | 5.4 | 92 | 1050 | 12.6 | 499 |
| 475 | 5.7 | 102 | 1075 | 12.9 | 519 |
| 500 | 6 | 113 | 1100 | 13.2 | 547 |
| 525 | 6.3 | 124 | 1125 | 13.5 | 573 |
| 550 | 6.6 | 137 | 1150 | 13.8 | 598 |
| 575 | 6.9 | 150 | 1175 | 14.1 | 625 |
| 600 | 7.2 | 163 | 1200 | 14.4 | 652 |
| 625 | 7.5 | 177 | 1225 | 14.7 | 679 |

## Table 3: INDIVIDUAL AND GROUP TREE DETAILS

| No. | Species | Age Class | Girth | Height | Spread (m) | Condition | Tree Retention Category | Comments | Recommendations | Recommendations Compatible with proposed design |
|---|---|---|---|---|---|---|---|---|---|---|
| 18427 | Black poplar | M | 700 | 25 | 13 | Good | A | All topped at 6m in 2000<br><br>Row of trees 2-3m spacing<br><br>**NOTE: TREES 34-49 ARE NOT ARE NOT MARKED ON THE SITE MAP.**<br><br>Similar spread 10-13m<br><br>Similar condition | Retain | Yes |
| 18428 | Black Poplar | M | 500 | 25 | 12 | Good | A | | Retain | Yes |
| 18429 | Black poplar | M | 550 | 25 | 12 | Good | A | | Retain | Yes |
| 18430 | Black Poplar | M | 500 | 25 | 12 | Good | A | | Retain | Yes |
| 18431 | Black poplar | M | 550 | 25 | 12 | Good | A | | Retain | No |
| 18432 | Black Poplar | M | 530 | 25 | 12 | Good | A | | Retain | No |
| 18433 | Black poplar | M | 600 | 25 | 12 | Good | A | | Retain | No |
| 18434 | Black Poplar | M | 600 | 25 | 10 | Good | A | | Retain | No |
| 18435 | Black poplar | M | 500 | 25 | 12 | Good | A | | Retain | No |
| 18436 | Black Poplar | M | 520 | 25 | 10 | Good | A | | Retain | No |
| 18437 | Black poplar | M | 500 | 26 | 10 | Good | A | | Retain | No |
| 18438 | Lawson's Cypress | SM | - | - | - | Dead | - | Poplar same as 18427-18437 | Fell | Yes |
| 18439 | Black Poplar | M | 420 | 26 | | Good | A | | Retain | No |
| 18440 | Lawson's Cypress | - | - | | | Dead | - | | Fell | No |

| No. | Species | Age Class | Girth | Height | Spread (m) | Condition | Tree Retention Category | Comments | Recommendations | Recommendations Compatible with proposed design |
|---|---|---|---|---|---|---|---|---|---|---|
| 18441 | Black poplar | M | 450 | 26 | 10 | Good | A | Poplar same as 27-37 | Retain | No |
| 18442 | Lawson's Cypress | SM | 350 | 13 | 8 | Poor | V | | Fell | Yes |
| 18443 | Black Poplar | M | 480 | 26 | 10 | Good | A | | Retain | No |
| 18444 | Lawson's Cypress | SM | 350 | 12 | 8 | Poor | V | Suppressed | Fell | Yes |
| 18445 | Black Poplar | M | 400 | 26 | 10 | Good | A | | Retain | No |
| 18446 | Lawson's Cypress | SM | 350 | 13 | 8 | Poor | V | | Fell | Yes |
| 18447 | Black Poplar | M | 450 | 25 | 10 | Good | A | | Fell | No |
| 18448 | Lawson's Cypress | M | 350 | 13 | 8 | Poor | V | Supressed | Fell | Yes |
| 18449 | Black Poplar | M | 500 | 26 | 10 | Good | A | Suppressed | Retain | Yes |
| 18450 | Alder | M | 250 | 9 | 12 | Fair | B | Multi-stemmed 5 stems. At end of weir | Retain | Yes |
| 18451 | Lime | M | 1000 | 19 | 20 | Good | A | Large well-proportioned tree | Retain | No |
| 18452 | Lime | M | 1000 | 19 | 20 | Good | A | Large well-proportioned tree | Retain | No |
| 18453 | Norway Maple | SM | 400 | 16 | 16 | Fair | B | May collapse but good | Retain | No |
| 18454 | Lime | SM | 300 | 14 | 10 | Good | A | Suppressed tree but good form | Retain | No |
| 18455 | Norway Maple | SM | 410 | 15 | 16 | Poor | C | Broken crown | Fell | Yes |
| 18456 | Lime | M | 1000 | 19 | 16 | Good | A | Extensive epicormics | Retain | No |
| 18457 | Lime | SM | 250 | 15 | 15 | Poor | V?? | Multi-stemmed | Retain | No |
| 18458 | Lime | SM | 300 | 15 | 10 | Fair | B | | Retain | No |
| 18458 a | Ash | SM | 250 | 11 | 10 | Poor | V | Not tagged Multi-stemmed ??? | Fell | Yes |
| 18459 | Norway Maple | SM | 350 | 17 | 18 | Poor | V | Forked | Fell | Yes |

| No. | Species | Age Class | Girth | Height | Spread (m) | Condition | Tree Retention Category | Comments | Recommendations | Recommendations compatible with proposed design |
|---|---|---|---|---|---|---|---|---|---|---|
| 18460 | Lime | M | 1000 | 19 | 17 | Good | A | Epicormics | Retain | No |
| 18461 | Black poplar | IM | 180 | 11 | 10 | Good | A | Group of suckers x 6 max. diameter 180 | Retain | No |
| 18462 | Black poplar | M | 600 | 25 | 12 | Good | A | (end of line) on riverbank | Retain | No |
| 18463 | Lombardy poplar | M | 380 | 18 | 6 | Good | B | | Fell | Yes |
| 18464 | Alder | M | 550 | 8 | 10 | Poor | B | Over mature (biodiversity value) | Retain | Yes |
| 18465 | Lombardy Poplar | M | 350 | 16 | 6 | Good | B | | Fell | Yes |
| 18466 | Lombardy poplar | M | 350 | 16 | 6 | Good | B | (close to dead mature elm) | Fell | Yes |
| 18467 | Alder | M | 650 | 12 | 12 | Fair | B | Several main stems over river | Retain | Yes |
| 18468 | Alder | M | 500 | 12 | 10 | Fair | B | Over river | Retain | Yes |
| 18469 | Lime | IM | 200 | 10 | 6 | Good | A | Regrowth | Retain | Yes |
| 18470 | Lime | M | 900 | 18 | 11 | Good | A | | Retain | Yes |
| 18471 | Lime | M | 900 | 16 | 12 | Fair | B | Leaning over river (other half)? | Retain | Yes |
| 18472 | Black poplar | M | 700 | 21 | 10 | Good | A | | Retain | No |
| 18473 | Black poplar | M | 800 | 22 | 10 | Good | A | | Retain | No |
| 18474 | Lime | IM | 200 | 8 | 6 | Good | A | Regrowth from other tree | Retain | No |
| 18475 | Lombardy poplar | M | 450 | 18 | 8 | Good | B | | Fell | Yes |
| 18476 | Lombardy poplar | M | 350 | 10 | | Dead | B | | Fell | Yes |
| 18477 | Norway Maple | M | 400 | 16 | 10 | Poor | B | Forked | Fell | Yes |

| No. | Species | Age Class | Girth | Height | Spread (m) | Condition | Tree Retention Category | Comments | Recommendations | Recommendations compatible with proposed design |
|---|---|---|---|---|---|---|---|---|---|---|
| 18479 | Norway Maple | M | 400 | 16 | 10 | Good | A | | Retain | No |
| 18480 | Norway Maple | M | 400 | 15 | 12 | Good | B | Weak crown | Retain | No |
| 18481 | Alder | M | 420 | 14 | 10 | Fair | B | Over river | Retain | No |
| 18482 | Norway maple | SM | 300 | 16 | 10 | Fair | B | Poor branching | Fell | Yes |
| 18483 | Norway maple | SM | 300 | 15 | 10 | Fair | B | Forked | Fell | Yes |
| 18484 | Black poplar | M | 750 | 22 | 12 | Good | A | | Retain | Yes |
| 18485 | Norway Maple | M | 480 | 16 | 11 | Fair | B | Forked | Retain | Yes |
| 18486 | Sycamore | SM | 500 | 16 | 11 | Good | A | | Retain | Yes |
| 18487 | Norway Maple | SM | 400 | 16 | 12 | Fair | B | Forked | Retain | Yes |
| 18488 | Norway Maple | SM | 350 | 18 | 13 | Fair | B | Forked | Retain | Yes |
| 18489 | Norway maple | M | 480 | 16 | 13 | Fair | B | Poor branching | Retain | Yes |
| 18490 | Norway maple | SM | 400 | 17 | 14 | Fair | B | Poor branching | Retain | Yes |
| 18491 | Norway maple | SM | 350 | 15 | 12 | Fair | B | Poor branching | Retain | Yes |
| 18492 | Black poplar | M | 900 | 25 | 12 | Good | A | | Retain | Yes |
| 18493 | Norway maple | M | 480 | 14 | 12 | Good | A | | Retain | Yes |
| 18494 | Norway Maple | M | 480 | 14 | 12 | Fair | B | Poor branching | Retain | Yes |
| 18495 | Black poplar | M | 550 | 23 | 13 | Good | A | | Retain | Yes |
| 18496 | Norway Maple | M | 400 | 15 | 12 | Fair | B | 2 stems | Fell | Yes |
| 18497 | Black poplar | M | 850 | 23 | 16 | Good | A | | Retain | Yes |
| 18498 | Norway Maple | SM | 350 | 15 | 12 | Poor | B | Poor branching | Fell | Yes |
| 18499 | Norway Maple | SM | 400 | 16 | 12 | Poor | B | | Fell | Yes |
| 18500 | Norway Maple | M | 480 | 16 | 14 | Fair | B | | Fell | Yes |
| 18501 | Black poplar | M | 700 | 22 | 12 | Good | A | | Retain | Yes |
| 18502 | Norway Maple | SM | 350 | 16 | 12 | Fair | B | Forked | Retain | Yes |
| 18503 | Norway Maple | SM | 400 | 16 | 12 | Good | A | | Retain | Yes |
| 18504 | Black poplar | M | 700 | 21 | 13 | Good | A | Large Tree | Retain | Yes |

## DESCRIPTION OF WORKS

**Map 3 Location of trees in relation to proposed development (Note: Trees up to 18491 only)**

It is proposed to construct a fish bypass channel (map 1appendix)) around the existing weir on the north bank of the river Blackwater. These works would be carried out at the same time as weir reconstruction adjacent to the bypass channel.

The proposed works will encroach on amenity/recreation land and necessitate the removal of riverside trees and a parkland tree line.

**DISCUSSION**

The surveyed trees can be broadly divided into three phases of establishment:

1. Parkland planting, early 1800's.

2. Amenity planting 1980's.

3.Naturally regenerated trees, post 1900.

<u>1 Parkland planting</u>

Parkland planting, part of the Fermoy House landscaping dates from the early1800's. Nine trees along the river bank, all lime, date from this period. Six are on the proposed fish pass footprint- 51,52,56,57,60 and 74 and would need to be removed. Trees 51,51,56 and 60 are very large prominent trees and two – 57 and 74 are relatively low regrowth from the cut stumps of original trees.

Outside the proposed fish pass footprint three limes could be retained ( 69,70 and 71). However, 60 is regrowth from a cut stump and 70 is leaning over the river and would need to be cut back and allowed to coppice/regrow.

<u>2. Amenity planting</u>

Amenity planting during the 1980's along the river bank and on internal boundaries. Species planted are black poplar, Lombardy poplar, Norway maple, lime and Lawson's cypress.

The black poplar high trees and are prominent in landscape there are six individual trees 27,28,29,30 ,49 and 84 and one group, 61 that could be retained. The individual trees would need to be reduced in height to ensure their stability when neighbouring trees are felled. It should be noted that severed roots remaining on the site after excavation and construction will sucker and form dense regrowth.

There are three Lombardy poplars, 63,65 and 66 outside the proposed footprint however their height and form make them unsuitable for retention.

A total of eight Norway Maple are on the proposed footprint – 53,55,59,77,79,80,82 and 83. Only two of these trees are in good condition, the remaining six would not be suitable for long term retention anyway due to their poor branching structure and tendency for crown branches to collapse.

There are two semi-mature lime 54 and 58 on the proposed footprint, both would be suitable for long term retention.

The six Lawson's cypresses are growing amongst the black poplar and are suppressed. There are two dead trees. All are of low value and would be felled during development.

3. Naturally regenerated trees post 1900's.

Naturally regenerated trees have become established along the river bank since the1900's. They include alder, ash and sycamore all of which regenerate freely in damp fertile conditions.

Of particular value in the riparian habitats are alder, trees (50, 64,67 and 68) are multi-stemmed, and several are decaying. They are outside the fish pass footprint, are important for biodiversity and should be retained if possible.

Elm is present in the understorey, probably regrowth from mature trees lost to the endemic elm disease in the 1980's.

## SUMMARY AND RECOMMENDATIONS (Table 4)

To conclude the loss of the 1980's planted trees, poplar, Norway maple, lime and Lawson's cypress will impact negatively on the landscape, but they are easily replaced by replanting with similar species in the medium term and 10 trees in the immediate vicinity of the development can be retained.

Trees within the riparian zone, particularly the 4 mature alder should be retained if at all possible alongside the proposed fishpass. Alder will coppice from cut stumps if trees need to be cut back.

The mature limes planted in 1800 are a prominent landscape feature and have cultural interest, 6 of the 9 trees would need to be removed. Their loss would be substantial and negative.

## ARBORICULTURAL METHOD STATEMENT

Tree surgery works.

All works should be carried out to BS 3998(2010) Tree Work-Recommendations for professional tree surgeons.

**Table 4 : Trees outside the proposed development footprint which may be retained subject to construction access and working areas.**

| Tree no. | Species | Stem diameter (mm) | RPA (m) | Recommendations and Comments | |
|---|---|---|---|---|---|
| 18427 | Black Poplar | 700 | 8.4 | Retain | Reduce height 50% |
| 18428 | Black Poplar | 500 | 6.0 | Retain | |
| 18429 | Black Poplar | 550 | 6.6 | Retain | |
| 18430 | Black poplar | 500 | 6.0 | Retain | |
| 18449 | Black Poplar | 500 | 6.0 | Retain | |
| 18450 | Alder | 200 x 5 | 3.0 | Multi-stemmed. (Over weir, cut back) | |
| 18461 | Black Poplar | 180 | 2.2 | Retain, group | |
| 18463 | Lombardy Poplar | 380 | 4.5 | Fell | |
| 18464 | Alder | 550 | 6.6 | Retain | |
| 18465 | Lombardy poplar | 350 | 4.2 | Fell | |
| 18466 | Lombardy poplar | 350 | 4.2 | Fell | |
| 18467 | Alder | 650 | 7.8 | Retain, (over river) | |
| 18468 | Alder | 500 | 6.0 | Retain,(over river) | |
| 18469 | Lime | 200 | 7.2 | Retain, (regrowth from 600mm diameter stump). | |
| 18470 | Lime | 900 | 10.8 | Retain | |
| 18471 | Lime | 900 | 10.8 | Retain, (over river , cut back) | |
| 18484 | Black poplar | 750 | 9.0 | Retain, (reduce crown by 30%) | |
| 18485 | Norway maple | 480 | 5.7 | Retain | |

## APPENDIX 1: TREE PROTECTION

Root Protection Area (R.P.A) and Tree Protection Measures

The Root Protection Area is defined as a layout design tool indicating the minimum area, usually defined as the radius in metres, around a tree deemed to contain sufficient roots to maintain the trees viability. Protection of roots within the RPA is treated as a priority. When considering the consequences of development and construction activity in the vicinity of trees the R.P.A. which is calculated from the girth of the individual tree (12 x the girth at 1.5 metres above ground for a single stemmed tree) must be protected. The default position is that all structures must be located outside the R.P.A., however each tree should be assessed on a case by case basis and different trees species vary in their susceptibility to root disturbance. The R.P.A. for each tree retained on site needs to be protected by barriers before any materials or machines are brought on site, and before any demolition activity or stripping of top soil. British Standard Specifications are outlined in (Fig.1), below.

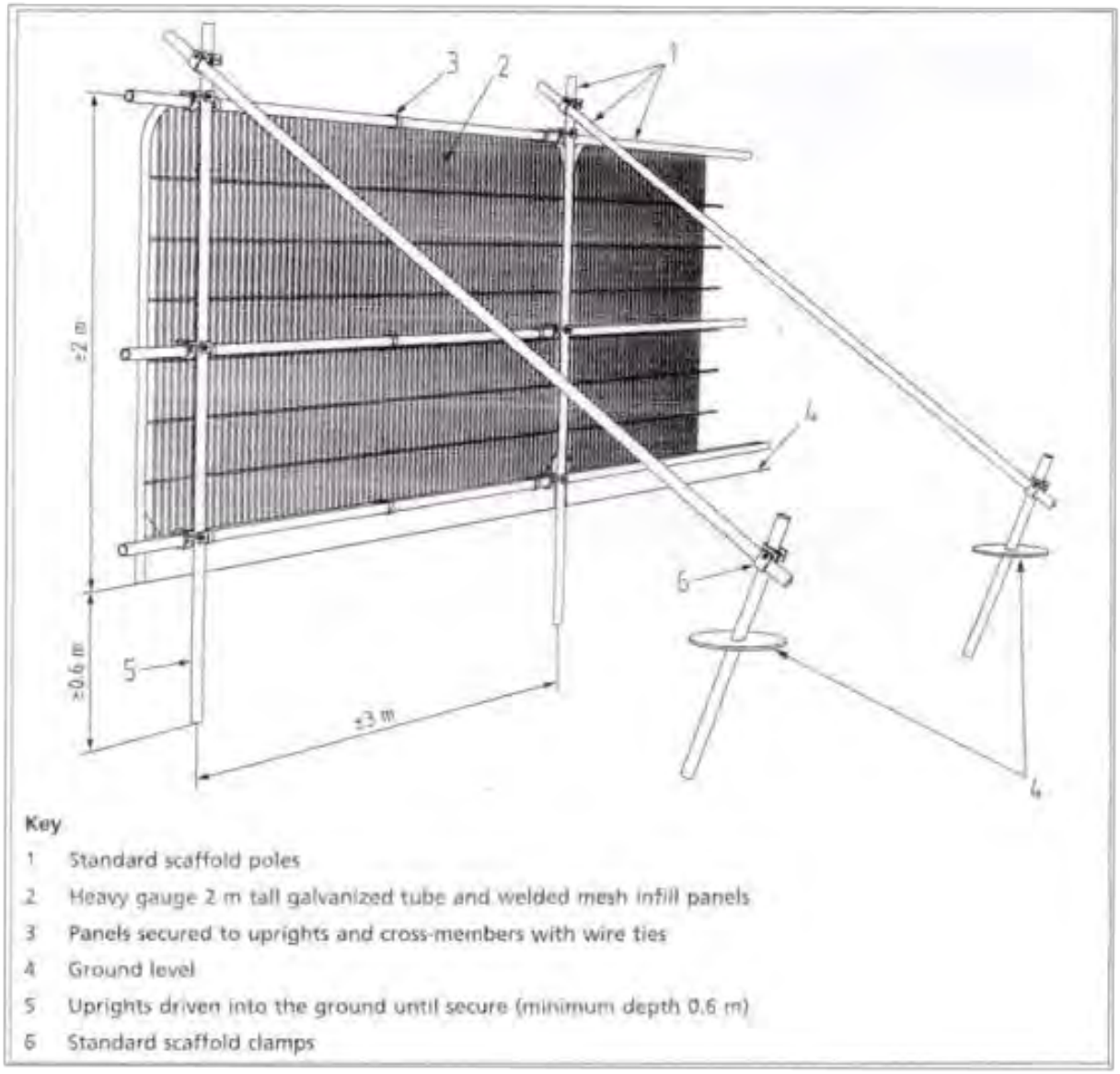



Fig.1 Default Specification for Protective Barrier

The area protected by barriers must be regarded as sacrosanct and the barriers must be fit for purpose. Where required, pre-construction tree work including crown reduction and thinning works should be carried out before protection measures are installed.
Where there is no alternative and construction work space or temporary access is justified within the R.P.A. new temporary ground protection should be installed as part of the implementation of physical tree protection measures prior to work starting on site. The objective is to avoid any compaction of soil within the R.P.A., even from the single passage of a heavy vehicle, especially in wet conditions so that tree root functions remain unimpaired.

Permanent Hard Surfacing within the R.P.A.

Within the R.P.A. unavoidable permanent hard surfacing should not exceed 20% of the area. Where necessary, works will be designed to avoid localised compaction and where a permeable surface is to be used by vehicular traffic, for example a geotextile can be used

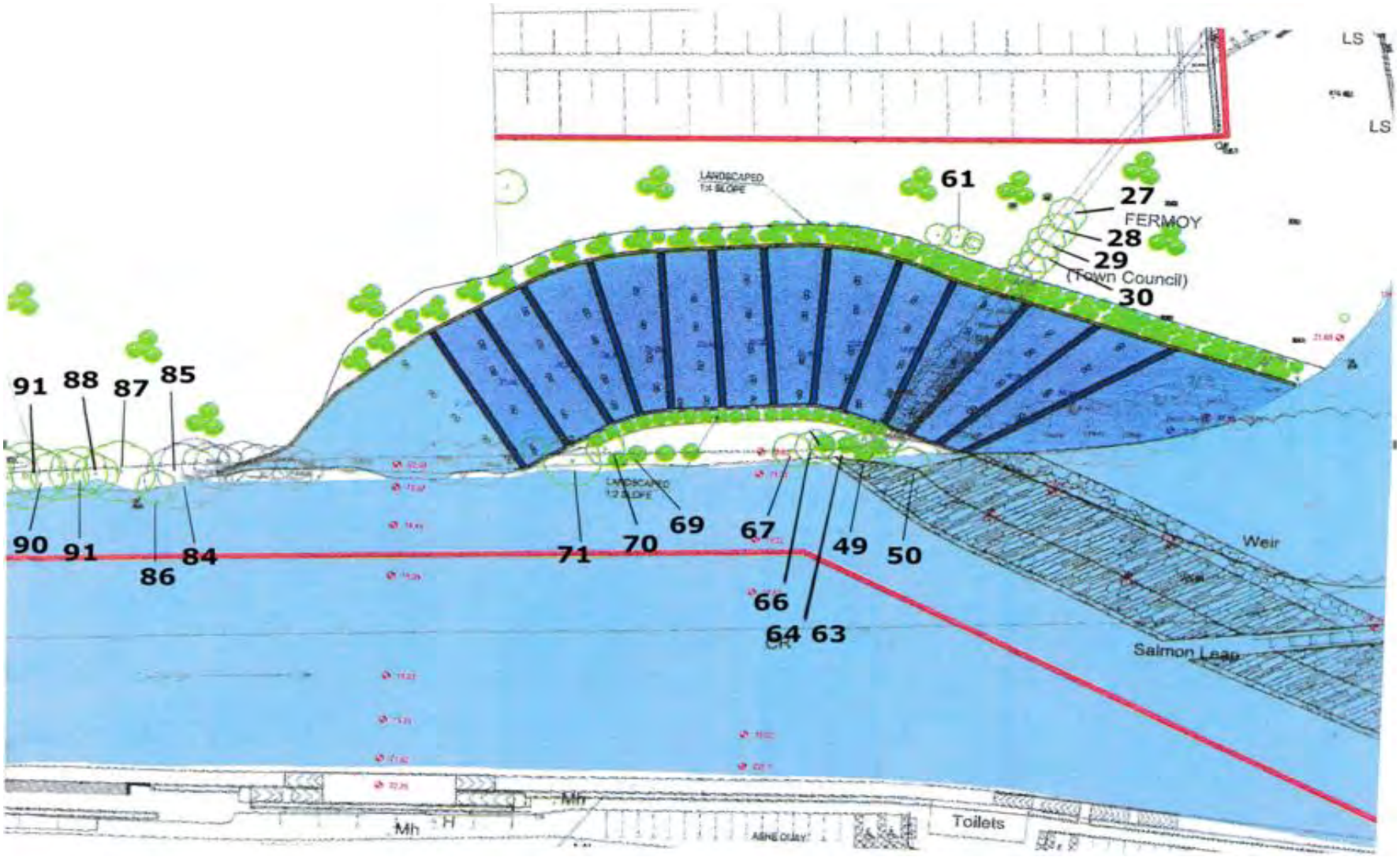
Excavation within the R.P.A.

Excavation needed for placement of kerbs and edgings with linear foundations can be especially damaging to tree roots within the R.P.A .and should be avoided either by the use of alternative edge supports or by not using supports at all.
The use of traditional strip footings for buildings within the RPA can result in extensive root loss and should also be avoided. Root damage can be minimised and mitigated against by ensuring beams and slabs are laid over roots at or above ground level and do not exceed a total area greater than 20% of the existing unsurfaced ground within the R.P.A. There should be no changes in ground levels within the R.P.A.

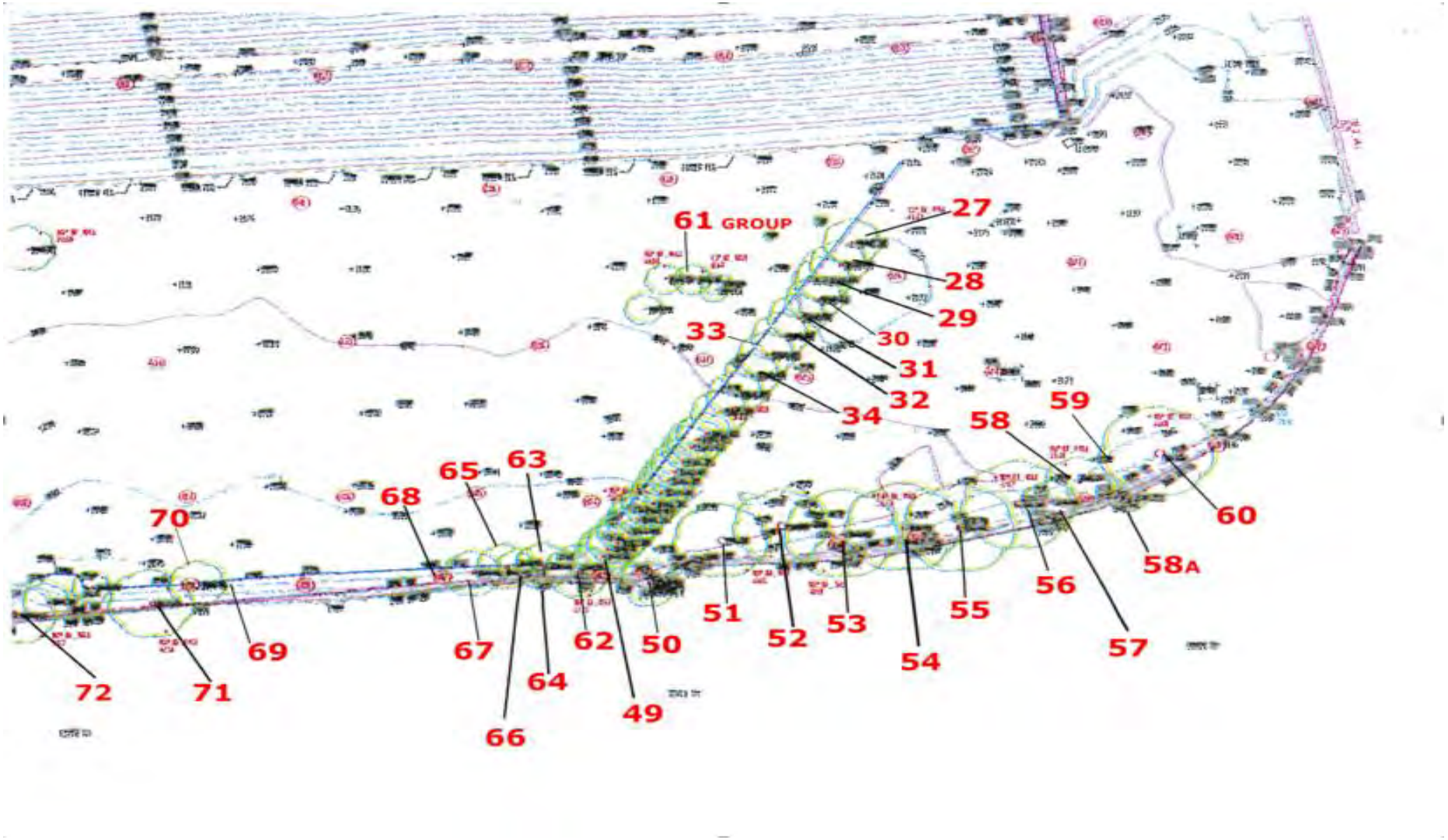
Additional Precautions outside the R.P.A. exclusion zone

Planning of site operations needs to take account of machinery/plant, particularly machines with booms and jibs, from coming into contact with above ground branches etc of retained trees. Also any materials whose accidental spillage would cause damage to a tree should be stored and handled well away from the outer edge of its R.P.A.

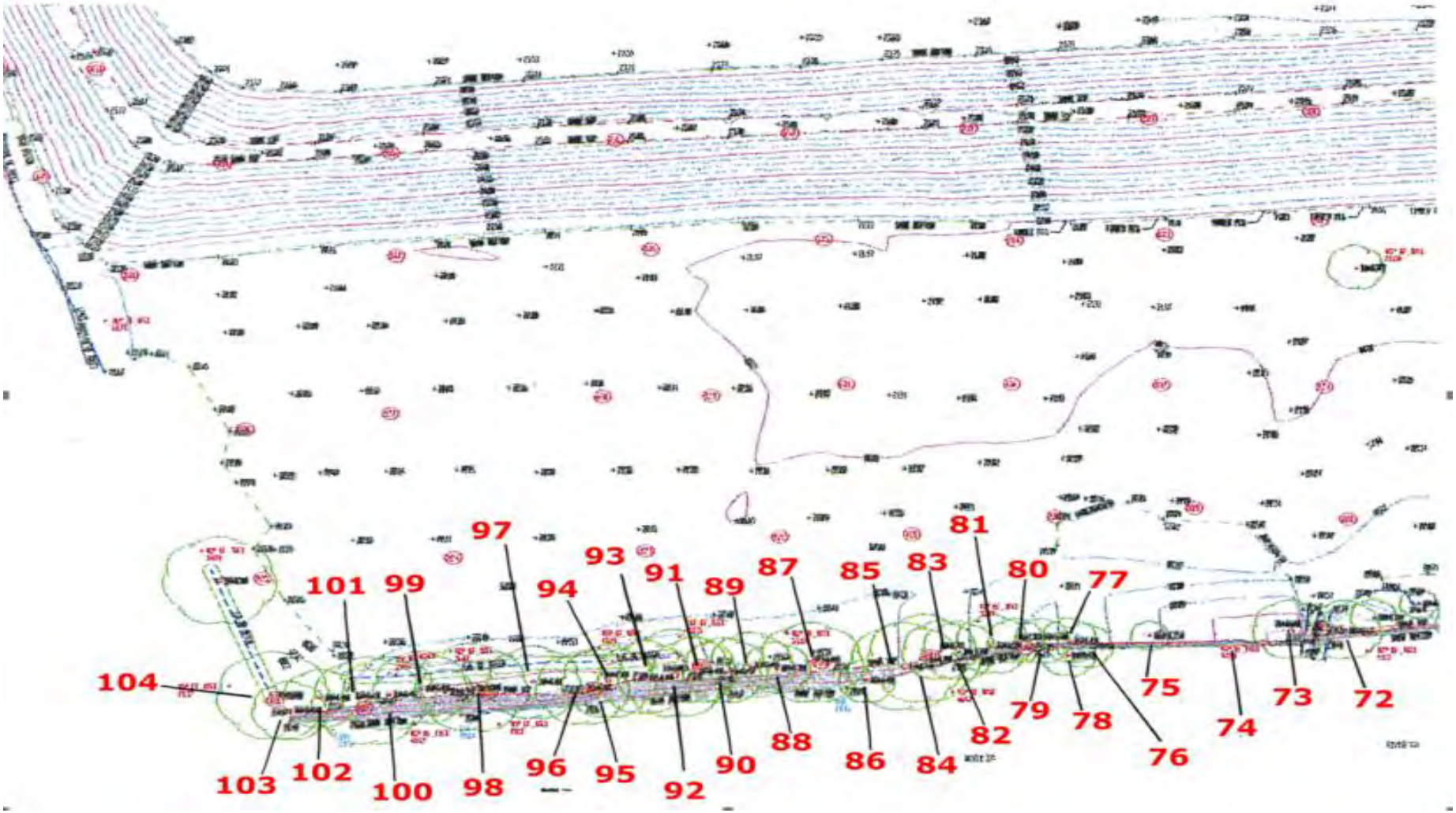
**APPENDIX2 : MAP 1 Trees outside footprint of proposed fish Bypass**



**APPENDIX 3: MAP 2 Locations of individual trees (Eastern area)**



## APPENDIX 4: MAP 3 Locations of individual trees (Western area)



# Appendix 6. Hydraulic design review and fish bypass channel assessment

**Technical Note**

**HaskoningDHV UK Ltd.**
**Water & Maritime**

| | |
|---|---|
| To: | T.J. O'Connor |
| From: | Mark Donoghue |
| Date: | Friday, 08 October 2021 |
| Copy: | - |
| Our reference: | BI1645-RHD-ZZ-XX-NT-Z-0002 |
| Classification: | Project related |
| Checked by: | Peter Brunner |
| **Subject:** | **Fermoy Fish Pass – Hydraulic Design Review** |
| | Appendix A – CFD Modelling Technical Note |

# 1 Background

T.J. O'Connor & Associates have been engaged by Cork County Council to develop a scheme for the remediation of a 200-year-old protected weir structure on the river Blackwater at Fermoy and to provide a bypass channel for fish passage.

After undertaking a preliminary design assessment considering a range of options, T.J. O'Connor & Associates received approval from Cork County Council to proceed on the basis of remediation of the weir, mill race and existing fish pass alongside the construction of a rough channel pool bypass for fish passage on the north bank of the river.

T.J O'Connor commissioned Royal HaskoningDHV to assist in confirmation of the hydraulic design of the bypass channel in combination with the remediated weir.

This technical note presents the findings of the review of the hydraulic design of the fish pass.

# 2 Proposed Design

The proposed design overall comprises a bypass channel with a rough-channel pool pass (a combination of a close-to-nature style fish ramp and a technical pool and weir pass). The bottom ramp and pools are formed by embedded transverse boulder bars/weirs. The bypass comprises 13 weirs, set 7.9m apart (centre to centre), with each weir crest at 600mm above the bed. In each weir there are five, 0.5m (500mm) wide gaps/slots, to enable fish to swim up the bypass channel. The gaps/slots are staggered/offset in consecutive weirs for better dissipation of flow energy and to prevent discharge jets passing straight through pools. The average gradient of the bed of the bypass channel is approximately 1:10.

The following documents provided by T.J. O'Connor & Associates were reviewed:

- Draft / Issued for information drawing pack issued by (refer to drawing issue sheet dated 22/06/21).
- Spreadsheet: 19011-TJOC-XX-XX-CA-C-5500_Rough_Channel_Pool_Pass_Calculations.

# 3 Target Species

We understand that the fish pass is designed to provide passage for salmon, lamprey, trout, twaite shad, eels and crayfish. Salmon and river lamprey are qualifying interest features of the River Blackwater Special Area of Conservation (SAC). For the purposes of this review, it is assumed that the Fermoy Fish Pass will operate all year as opposed to shorter periods coinciding with movement patterns of particular species.

## 3.1 Fish passage flow criteria

**Table 1** and **Table 2** provide approximate values of swim speeds and minimum depths for key fish species which the Fermoy Fish Pass should accommodate for a range of flows. It should be noted, if information on fish migration and flow is not available for the site, then it is suggested that the facility for upstream migration should be designed to operate across a flow range from Q90 to Q10 for salmon; Q95 to Q10 for sea trout and brown trout; Q50 to Q20 for coarse fish and shad; and Q99 to Q70 for eel.

It should be noted, on the condition that the flow velocity remains significantly less than the maximum speed, fish can swim more or less at their cruising speed through a fish pass.

***Table 1** – Generic Swim Speeds of Key Fish Species and Migration Windows*

| Species | Mean Burst (Swim) Speed | Median Sustained Swim Speed | Maximum Swim Speed | Upstream Migration Window |
|---|---|---|---|---|
| **Salmon** | > 1.2 m/s | - | 4.5 - 6.5 m/s | October to May (Key Spawning Season, although peak months are October to November for salmonids) |
| **Sea / Brown Trout** | 1 35 m/s | 1.17 m/s | 1.8 - 5 m/s | |
| **European Eel** | 1.14 m/s | 0.25 m/s | Young eel < 0.5 m/s | |
| | | | Adult eel <1.5 m/s | |
| **Coarse Fish (based on Chub)** | 1.3 m/s | 0.93 m/s | 4 m/s | April – July |
| **Sea Lamprey** | - | - | 5 m/s | |
| **River Lamprey** | - | - | 3.5 m/s | |
| **Allis shad** | - | - | 4.1 - 6.1 m/s | |
| **Twaite shad** | 1.52 - 2.06 m/s | 0.44 – 0.59 m/s | 2.7 - 5.4 m/s | |

Source: IFM/Environment Agency Fish Pass Manual (2015); The ICE Protocol for Ecological Continuity-Assessing the Passage of Concepts, Design and Application (2014); CSAS Fish Swimming Performance Database and Analyses (2016)

*Table 2 – Generic Swim Depths of Key Fish Species*

| Species | Minimum Depths (m) |
|---|---|
| **Salmon** | 0.2 m |
| **Sea / Brown Trout** | 0.05 m – 0.1 m |
| **European Eel** | 0.2 m |
| **Coarse Fish (based on Chub)** | 0.05 m – 0.1 m |
| **Sea Lamprey** | 0.15 m |
| **River Lamprey** | |
| **Allis shad** | 0.2 m – 0.3 m |
| **Twaite shad** | |

Source: The ICE Protocol for Ecological Continuity-Assessing the Passage of Concepts, Design and Application (2014)

# 4 Computational Fluid Dynamics (CFD)

To inform the hydraulic design review, Computational Fluid Dynamics (CFD) model was used to determine if flow conditions within the fish bypass channel complied with the requirements for a variety of fish species (presented in **Table 1** and **Table 2**). A technical note on the CFD modelling exercise is provided to TJ O'Connor as separate deliverable with reference: BI1645-RHD-ZZ-XX-NT-Z-0001

An initial design option was tested in the CFD model, however results showed that the required velocity threshold was exceeded within most of the gaps/slots in the first (most upstream) fish pass weir. To reduce velocities, a revised option was modelled which incorporated increasing the width of three of the gaps/slots and incorporating a flat "sill" in the bed immediately upstream of the first weir.

The revised option of the design was tested for the three flow conditions (Q50, 0.7AADF and 1.0AADF). Results showed that the velocities remain relatively high i.e. above the $2ms^{-1}$ threshold stated in DVWK guidance within two of the five gaps at the first fish pass weir, however velocities in the other three gaps were tolerable for different fish species.

The CFD model results also show that there is no issue with exceeding the flow velocities threshold throughout the rest of the fish pass, where velocities are well below $1ms^{-1}$ and therefore compliant with the fish swim speeds in Table 1.

# 5 Design Review

**Table 3** presents observations on the proposed design against key criteria for a fish pass.

***Table 3** – Key Criteria of Fish Pass and Suitability of Proposed Design*

<table>
<tr><th>Item</th><th>Criteria</th><th>Proposed Design</th></tr>
<tr><td>1</td><td>The size of the fish pass required is dictated by the flow requirements which are either larger than 12.5% of the long-term mean flow or 50% of the flow upstream of the weir as advised by Inland Fisheries Ireland (IFI), the governing body responsible for reviewing and approving the design of fish passes.</td><td>Calculations provided give:
<table>
<tr><th>Event</th><th>Bypass flow $m^3s^{-1}$</th><th>% of total flow in bypass</th></tr>
<tr><td>Q95</td><td>8.582</td><td>100</td></tr>
<tr><td>0.7AADF</td><td>17.150</td><td>52</td></tr>
<tr><td>1.0AADF</td><td>20.298</td><td>43</td></tr>
</table>
AADF is 47.4 $m^3s^{-1}$.<br>12.5% of AADF is 5.9 $m^3s^{-1}$<br><br>Given the length of the existing weir crest, it would be extremely difficult to accurately split the low flows between the main channel and bypass and therefore 100% of the Q95 flow through the bypass is prudent.<br><br>The 43% of AADF in the bypass is slightly outside the IFI recommendations. However, this still represents a significant proportion of the flow. Alternate guidance from the IFM Fish Pass Manual recommends a minimum of 5% AADF and if possible “considerably more (≥10%)” in order to provide a sensible size of fishway with good attraction for watercourses in England & Wales.</td></tr>
<tr><td>2</td><td>For the entrance of a fishway to be detected by the majority of upstream migrating organisms, it must be positioned at the bank of the river where the current is highest. Placing the outflow of the fish pass in the immediate vicinity of the weir minimizes the formation of a dead zone between the obstruction and the fish pass entrance, increasing the likelihood of fish finding the pass. (DVWK, 2002).</td><td>Entrance well located on left bank at upstream extent of existing weir.</td></tr>
</table>

| Item | Criteria | Proposed Design |
|---|---|---|
| 3 | Entrance must be positioned where fish concentrate while moving upstream; and if possible, the entrance of the fish pass should be at the bank, parallel to the main direct of flow. Attracting current that leaves the fish pass entrance at a maximum angle of 45 degrees is the most effective for fish (DVWK, 2002). | Entrance well positioned. The orientation of the existing weir will lead to fish moving upstream along the structure, attracted towards the flows emerging from the bypass channel. Existing salmon leap to be infilled to focus flows in bypass channel. |
| 4 | The bottom of a fish pass should be covered along its whole length with a layer at least 0.2 m thick of a coarse substrate. Ideally the substrate should be typical for the river. From the hydraulic engineering point of view, a coarse substrate is necessary for the creation of an erosion-resistant bottom; while providing a suitable substrate for eels and lamprey. However, the bottom material used for this should be as close to natural as possible and should form a mosaic of interstices with a variety of differently sized and shaped gaps due to the varied grain size. (DVWK, 2002). | Long section (0054)<br>“Selected suitable river gravels, excavated from downstream channel”.<br>“500mm layer of quarry run rock, max size 250kg. |
| 5 | Downstream extent: The velocity at which the attracting current exits the fish pass should be within the range of 0.8 to 2.0 m $s^{-1}$. Generally, except for special cases, flow velocity should not exceed 2.1$ms^{-1}$ (DVWK, 2002). | CFD modelling indicates velocities less than 1.0$ms^{-1}$ at the downstream extent of the bypass channel for all modelled events. |
| 6 | Upstream extent: Strong turbulence greater than 2$ms^{-1}$ must be avoided at the exit area of the fish pass (DVWK, 2002). | CFD modelling indicates general channel velocities less than 1.0$ms^{-1}$ at the upstream extent of the bypass channel for all modelled events. Flow velocities local to the gaps/slots in the upstream weir are slightly greater but remain below 2$ms^{-1}$ for all modelled events. |
| 7 | The maximum permissible flow velocity in fish passes is 2.0$ms^{-1}$ (DVWK, 2002). | CFD modelling indicates flow velocities lower than 2.0$ms^{-1}$ throughout the pass. Higher velocities are identified local to the low flow channel / slots in the upstream weirs.<br><br>Perturbance boulders could be added to disrupt flow and slow velocities in the upper pools. Included on plan drawing (0053) throughout all pools (“Perturbation boulders, random placement”). No details are provided but these will need to be sized, |

<table>
<tr><th>Item</th><th>Criteria</th><th>Proposed Design</th></tr>
<tr><td></td><td></td><td>distributed and secured/embedded to suit flow conditions.<br><br>Velocities may appear high for eels, however the nature of the bed and bank material (natural rock with interstices) should provide an effective substrate to ease movement. This may also assist passage of lamprey.<br><br>The proposed pass may not be suitable for shad as this species is known to have very specific requirements. These fish have been found to require the presence of vertical visual references, and enough free space to accommodate the passage of large shoals of fish at the same time. The IFM Fish Pass Manual states that vertical slot passes with a minimum free gap of 0.45m have been found to be the only truly effective pass for shad. The 0.5m width of the gaps in the boulder bars aligns with this requirement and modelled flow velocities are appropriate, however monitoring is recommended to confirm efficacy.</td></tr>
<tr><td>8</td><td>Volumetric power dissipation should be limited to 150 – 200 W/m$^3$ (DVWK, 2002).</td><td>Volumetric power dissipations calculated for the 12 pools are comfortably within the limits for all modelled flows. The IFM Fish Pass Manual recommends that as the number of pools increases, maximum values should be at the lower end of the acceptable range.
<table>
<tr><th>Event</th><th>Max power dissipation W/m$^3$</th><th>Min power dissipation W/m$^3$</th></tr>
<tr><td>Q95</td><td>80</td><td>30</td></tr>
<tr><td>0.7AADF</td><td>120</td><td>50</td></tr>
<tr><td>1.0AADF</td><td>130</td><td>60</td></tr>
</table>
There is scope to include perturbance boulders to further dissipate energy without significant reduction in pool volume. This approach may be prudent</td></tr>
</table>

| Item | Criteria | Proposed Design |
|---|---|---|
| | | to disturb the jets from the gaps / slots in the upstream weir/bar. |
| 9 | The width of the rough-channel pool pass channel should not be less than 1.5 m and the clear distance between the boulder bars should be 1.5 to 2.5 m. The minimum water depth required is h = 0.4 m (DVWK, 2002). | Mean channel width 28m, distance between boulder bars 6.9m (7.9m centre to centre).<br><br>CFD modelling indicates minimum water depth in all pools is greater than 0.4m in all the modelled flows. |

# 6 Conclusion

Based on a review of the information provided and a CFD modelling exercise, the proposed fish pass design at Fermoy will provide suitable hydraulic conditions for passage of a range of target fish species.

It should be noted that the DVWK guidance suggests that the characteristics of irregular rough-channel pool passes cannot be calculated accurately and that a degree of testing and modification should be allowed for during the construction phase. Post construction monitoring of the efficacy of the fish pass for the various target species is also recommended, particularly for shad.

# 7 References

(DVWK, 2002). Fish Passes: Design, Dimensions and Monitoring.

Institute of Fisheries Management (IFM)(2015). Fish Pass Manual: Guidance Notes on The Legislation, Selection and Approval of Fish Passes in England And Wales. (First Prepared by the Environment Agency).

## Appendix 7. Trex Ecology Operational Monitoring Review

# P2022012 Fermoy Fish Pass Operational Monitoring

2 Banks Crescent

Crieff

PH7 3SR


## Client

TJ O'Connor and Associates

## Submission Date

March 2022

## Authors


Tommy McDermott

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# 1. Introduction

## 1.1. River Blackwater

The River Blackwater (Munster – hereafter simply the Blackwater) rises in the Mullaghareirk Mountains in County Kerry flowing eastward through Counties Cork and Waterford for approximately 169km, passing through Fermoy, before discharging into the Celtic Sea at Youghal. The river is both a conservation and sporting channel of significance and is commonly regarded as one of the best salmon fishing rivers in Ireland. In 2022 it is an "open" fishery (Inland Fisheries Acts 1959 – 2017, Byelaw No. 994,2021) with almost 4,000 catch and kill tags available. The most recent data found suggests the Blackwater may consistently meet the relevant target to permit the killing of salmon (i.e., a harvestable fraction of the population is available without risking the designating conservation stock level), (Gargan et al, 2021).

The river also constitutes the Blackwater River (Cork/Waterford) Special Area of Conservation (SAC), Site Code 002170. Relevant designating features of this SAC include Atlantic salmon, twaite shad, and the three native species of lamprey (brook, river, and sea). Other designating species which are reliant on healthy fish populations include the critically endangered Freshwater Pearl Mussel (FPM) and the otter. Although not a qualifying feature the critically endangered European eel is present in the system.

A large barrier downstream at Clondulane has the potential to restrict access to Fermoy for several fish species (Triturus, 2021; AMBER barrier database, accessed 23/03/2022). It is an assumption that this barrier will be mitigated in the near future (it is currently under a High Court removal order - AMBER barrier database, accessed 23/03/2022).

## 1.2. Fermoy weir

Fermoy Weir is a protected structure located on the main channel of the Blackwater within the town of Fermoy and was built to power a mill approximately two hundred years ago. The weir has partially collapsed and is in an advanced state of decay. The weir is probably passable to salmonid species (based on the continuing open nature of the fishery), however less athletic fish species such as lampreys and shad may not to be able to move beyond the location (no formal assessment of fish passability was seen). A small fish pass (step pool or similar) is present on the central weir face, although based on imagery seen this is exposed.

From an ecological perspective, either continued degradation of the weir to the point of complete channel reconnection or weir removal is the most desirable outcome, delivering significant benefit in time to all ecological communities; and evidence is available on the creation of spawning habitat upstream following loss of head after the breach (AMBER barrier database, accessed 23/03/2022). However, the protected status of the weir, the potential short-term risk to SAC designating features, and local interest in retaining the impoundment means weir removal is not desired.

Therefore, a programme was initiated to restore the weir while also providing fish passage at the location (the Proposed Project). The planning red-line, presented within the overall area of the proposed works, is presented in Figure 1.1. overleaf.

## 1.3. Project Background

TJ O'Connor and associates therefore engaged DixonBrosnan Environmental Consultants (EcIA and NIS with Triturus Environmental Ltd undertaking baseline aquatic assessment) and Royal Haskoning DHV (RHDHV – fish pass design and hydraulic) to provide all necessary environmental and ecological documentation in support of a planning application to repair the weir and provide fish passage.

The specific fish passage requirements, outlined in a screening response letter received from Department of Culture, Heritage and Gaeltacht were:

- To permit passage of all relevant fish species beyond the location; and
- Supported the overall SAC conservation objective of 75% channel access to sea lamprey and twaite shad.

An operational monitoring process to determine the effectiveness of the fish pass, once constructed, was also requested and Trex Ecology Ltd were approached to undertake a determination of options to assess the effectiveness of the fish pass constructed as part of the Proposed Project.

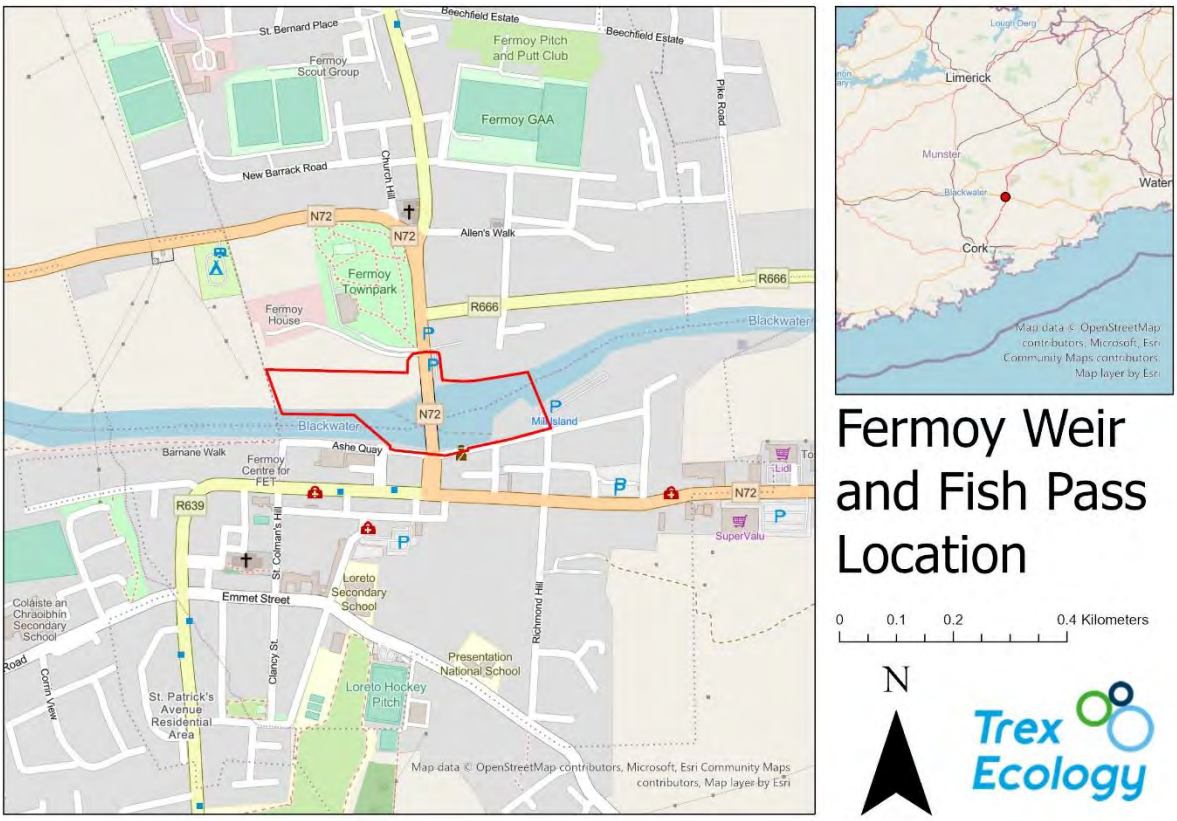


**Figure 1.1. Site location with Proposed Project red line**

## 1.4. Project scope

The project scope was discussed during a phone call with TJ O'Connor and Associates (the Client). The scope was agreed and commissioned on the 15th of March following proposal submission, to be delivered by the 25th of March.

Specifically, Trex Ecology were commissioned to deliver the following;

1. A high-level review of the provided documentation describing passage conditions for all relevant receptors within the Blackwater SAC site designation.
2. Identification of suitable post operational monitoring approaches to determine the efficacy of the bypass channel for fish migration, focused on the relevant receptors from the Blackwater SAC designation.
3. A technical note detailing the findings and conclusions from the above tasks.

Services were to be provided by Tommy McDermott, Aquatic Ecologist at Trex Ecology. After completion of an M.Res at Queens University Belfast (QUB) focusing on the implications of flow pattern change on Atlantic salmon population in the River Bush, Co. Antrim, Tommy remained at QUB as a variously postgraduate researcher, Research Fellow, and Research Associate, including co-development of the Irish hydromorphology assessment method for WFD purposes in collaboration with NIEA. After this he worked at APEM and cbec ecoengineering in senior roles prior to starting Trex Ecology in 2014. Since then, he has worked on over 40 barrier projects in some form, including fish pass programme design project management for Rivers Trusts, design contributions for Regulators, and enhanced mitigation of existing barriers for major energy companies. He also regularly designs and delivers baseline, construction, and operational monitoring programmes of biotic features for river restoration, fish passage, and Utility projects. He is a licensed pearl mussel professional contributing to numerous consultancy and research projects and project partners, and certified electrofishing team leader and a full member of the Institute of Fisheries Management.

### 1.5. Purpose of this document

This document presents the finding of the commission, a high-level review of fish passage conditions for all relevant receptors, and the post-operational monitoring approaches identified to determine the efficacy of the bypass channel for fish migration.

# 2. Approach

## 2.1. Approach justification

The short time frames meant the approach focused solely on an assessment of provided information and review of other key sources. No site visit was undertaken.

## 2.2. Review of available information and options assessment

A review of all provided information was undertaken to understand the project background, design considerations and processes, and identify constraints which could limit the range of monitoring options. Once complete, a range of monitoring approaches were assessed, and the most appropriate monitoring option(s) proposed.

## 2.3. Supporting information.

A complete inventory of received information is provided in Appendix A. Other information as obtained will be cited in the appropriate fashion.

## 2.4. Receptors

The receptors included within this document have been introduced in Section 1. However, there are critical differences in life history and physical abilities which are relevant and should be understood.

### Atlantic salmon

Salmon are potentially the most visible of the receptors, constituting the basis of a major sport fishery in the region. Although they are capable of traversing many natural barriers, the hydraulic conditions at man-made barriers make it very difficult or impossible for fish to move upstream. The passability of a barrier to salmon (and indeed all fish) is also not standard across all passage flow windows and individual fish; flows, fish size, date, and location of the barrier can influence whether a barrier is passable on a given day. However, of the fish species identified here, they are the most able to take advantage of a suitable flow window to migrate beyond an obstacle.

Adult salmon may look to move through the site on any day of the year. Smolts will move downstream through the site in April/May.

### Lampreys

Lampreys are one of three eel-like species comprising two genera (*Lampetra* spp. and *Petromyzon*) native to Ireland. River and sea lamprey are obligate parasites as adults which migrate to sea returning to freshwater to breed. Brook lamprey undertake more local migrations within rivers and do not have a parasitic adult phase. They are generally poor swimmers with no jump capabilities; however, they do have significant burst-swimming capability given their attachment to fast, athletic marine fish and marine mammals. Where barriers are absent river and sea lamprey can extend significant distances upstream (Maitland 2003). For brook lamprey the issue of barriers is less of a constraint as they do not need to migrate to sea and therefore can exist in local populations, albeit disconnected.

Adult migrations normally occur in late winter/early spring with spawning around March-June. Juvenile movements can occur at any time of the year.

### Twaite shad

Twaite shad are a clupeid (herring-like) fish found along the south coast of Ireland. They migrate into rivers to spawn. There is evidence for defined spawning areas in shad (Acolas et al, 2004) which means barriers between the sea and these areas can have significant detrimental population effects,

as they cannot jump (Maitland & Hatton-Ellis, 2003). They are capable of penetrating significant distances into catchments in the absence of barriers (Maitland & Hatton-Ellis, 2003). While they are not poor swimmers, their energetic abilities are not comparable to salmonids.

Adults return to rivers in spring to breed. After incubation, the eggs hatch and fry begin to move into estuarine areas almost immediately.

### European eel

Juvenile European eel enter freshwater for non-breeding purposes, returning to the sea for reproduction, which is in contrast to the behaviours of other fish described above. This means that juveniles attempting in-river migrations can be small. However, eel are capable of leaving the main channel of rivers and climbing up and around obstacles when conditions remain damp and climbing medium (such as moss) is present. Eel passes are often utilised at newer weirs due to hydraulic conditions; however, features at a weir can facilitate their passage, particularly at older structures. This should not be taken as an assumption of passability at all weirs.

Juvenile eels begin river entry in March, with the peak returns normally occurring in May and June.

# 3. Assessment

## 3.1. Fish pass design

### Design criteria and option chosen

A range of fish passage options were presented within the NIS (DixonBrosnan, 2021a). As Trex Ecology were not part of the Proposal during the design optioneering, we have assumed that the description within the NIS reflects an abridged version of the design pathway. The option chosen (Option 9) permitted full reinstatement of the weir structure while placing a large rough bypass channel along the northern bank. The complete weir reinstatement makes pass efficacy of vital importance as any reduced passage performance means there may be no alternative upstream route for fish.

For the purposes of clarity, here the entrance means the downstream end, while the exit is the upstream end. This differs from the RHDHV design reports.

### Designed Option 9

A representative image of the designed option is show below in Figure 3.1.

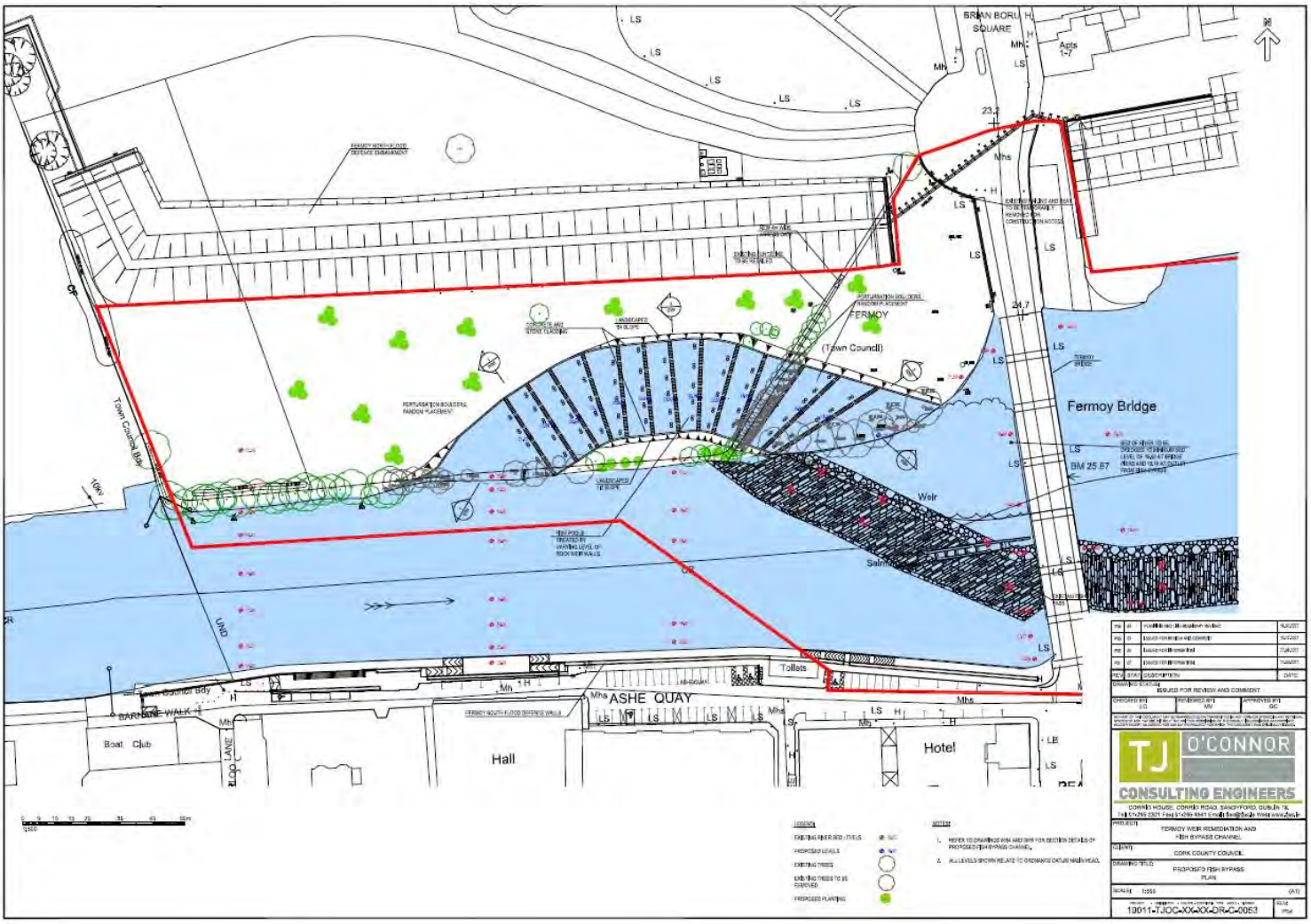


**Figure 3.1. Bypass channel plan view**

Design guidance appears to have been a combination of IFI project specific guidance, the EA fish pass manual (referred to as the IFM or Institute of Fisheries Management manual) (EA 2010), the Deutscher Verband fur Wasserwirtschaft und Kulturbaur guidance produced for the Food and Agriculture Organisation (DVWK 2002), the ICE Protocol (ICE 2014) and CSAS fish swimming performance database. For reference, the EA (2010) manual and the Sniffer Barrier Protocol (WFD 111) (2017) are commonly used for fish pass design in Scotland by Trex Ecology; however, instruction from Scottish regulators often corresponds to certain flow windows and certain species to meet WFD targets only, and the expanded guidance portfolio here most probably reflects the greater target fish community.

The pass is essentially a large pre-barrage fish pass arranged as a channel bypass and consists of 13 pre-weirs of 0.6m crest, with 7.9m gaps. These correspond to equal or greater than the guidance for pre-barrage construction within EA (2010). Within each pre-weir or barrage are five gaps, arranged disorderly to prevent excessive streaming velocities. The gaps extend to bed level and no jump is required. This is an important consideration for lamprey and shad in particular.

The entrance is co-located with the toe of the weir. This means that as long as attractant flow is suitable, fish will quickly find the entrance rather than spend time attempting to follow flow up the weir face. The likely passage routes to the weir cannot be determined here, but given the width of the proposed entrance, it should be readily findable (should flow conditions allow).

The flow apportionment into the structure represents 100% of the flow at Q95 (which is the lowest window at which fish migrations are proposed within the EA fish pass manual (EA, 2010). This means that the pass should be wet at all times. This reduces to 43% by 1 AADF. IFI guidance (within RHDHV 2021a) requested 50% of flow reaches the fish pass as a minimum however, given the relative length of the weir crest v the fish pass crest, attracting flow should still be sufficient. Such a sizeable proportion of flow to the pass also suggests most fish which migrate downstream (resident fish, salmonid kelts, salmonid smolts, adult eel, juvenile lamprey, juvenile shad) will stand a good chance of moving through the pass. Conversely, considering this level of flow, abundant debris will move into the pass which has the potential to reduce efficacy.

In-pass velocities are generally low (RHDHV 2021a). However, the CFD report (RHDHV 2021b) does appear to show velocities approaching or >2.0m/s at the fish pass exit within a vertical slice at 20.8m OD. This is discussed and adaptive management proposed.

If we assume there will be flows approaching or greater than 2.0m/s at the most upstream section of the pass, within the slots, then certain considerations become vital. Firstly, tired fish may struggle to make it past the final step having moved through 12 previous structures, if they do not rest. CFD models do show low flows regularly elsewhere within the pass, so perhaps the addition of cover within the pass would allow recuperation and recovery prior to completing passage. Secondly the maximum burst speed capabilities of the target fish species do not appear to be breached.

Overall, and based on the second CFD model the fish pass should be easily found and potentially passable at migratory flows. It should be remembered that although fish species may potentially migrate during most flow windows, the bulk of migration occurs at the most appropriate window for that species at that point in the river. Therefore, fish may gather at the toe of each pre-weir, and the bottom of the pass itself awaiting better conditions. Cover will therefore be vital. Monitoring of the fish pass performance in the “real world” may also be necessary, and the final design should include some ability to reorder structures in response to observed velocities.

## 3.2. Operational monitoring

The scoping response states; "*It is recommended that proposals for the monitoring of the efficacy of the fish pass, particularly in relation to twaite shad access, are included in the NIS.*"

Given the range of designating fish species which are likely to avail of the pass and/or wish to pass the site, it is not possible to provide a one-for-all fish monitoring assessment. Similarly, the effectiveness of fish passes cannot be taken at face-value as many claimed for passibilities are not reflected in reality (Noonan et al, 2011). There is also the distance between the *built-as-designed* ethos for construction, and the intricate web of factors which influence whether or not an individual fish manages to pass through a fish pass.

The statement from the Scoping Response is also ambiguous. The efficacy of the fish pass may refer to whether the fish pass is performing *as designed* as opposed to expectations for passage within a natural river system with debris, biological factors and seasonality all playing a role. It also states monitoring is required in relation to "…twaite shad access… (in relation to fish pass efficiency);" but access to a fish pass does not mean successful passage. We are also left guessing as to whether shad must be prioritised.

So, in the interests of clarity this document makes the following assumptions:

I. The efficacy of the fish pass in allowing migratory fish species to successfully pass beyond the Fermoy weir is to be monitored, not the *as designed* state;
II. All species are relevant; however, shad are of particular interest; and
III. Only upstream migrating fish are to be included within the monitoring package.

## 3.3. Monitoring Options

### Counter technology

Fish counters are a common technology now used worldwide to assess fish populations without the intrusive sampling methods otherwise used. The counter network in Ireland is run by IFI with the most recent available report (IFI 2021) presenting data from 29 counters throughout the country. Most are Logie resistivity counters although a small number of Vaki (optical, infrared) counters are operational. They have to potential to quantify fish passage at a location.

As communicated to Trex Ecology, early discussions on counter deployment reflected a desire that any technology used should align with the counter network currently being operated i.e., Vaki or Logie. These counters are being used to understand long-term trends in adult salmonid abundance, not simply to assess passability at structures; therefore, the cost of operations should only be borne by the Project Proposal for a limited amount of time, after which their use as proof of passage would be unnecessary. Ideally their operation would then transfer to IFI who would fund them. However, upfront cost may be considerable.

The size of the pass structure makes it unsuitable for most counter technologies. Vaki counters would be unsuitable unless five chambers were deployed (one at each upper pre-weir gap). It could be argued that this should replicated at the downstream pre-weir gaps to assess what proportion of the fish which enter the fish pass successfully complete the fish pass. For a Logie counter the same issues apply, with the installation of crump structures at each gap needed. The Proposed Project design would need modification to house associated kit and a power supply delivered to the pass.

Two portable sonar of the split beam or ARIS type could be deployed without the requirement for design changes to the Proposal. However, given the range of target species and the period in the

year which they would need to be deployed to encounter fish migrating (e.g. – shad in spring/summer, grilse in summer, multi-sea-winter salmon in autumn, winter and potentially early spring, lamprey in late winter and early spring, eel in early summer), this would be unsuitable for mobile (i.e., non-fixed) telemetry. Fixed options are available but do not align with IFI's network.

A budget for both counter options (fixed and mobile, purchase and operation) could potentially breach €1,000000. It should also be considered that during higher flow events, salmon in particular may find routes over the weir, while juvenile eel may just climb over the structure.

### Electrofishing and mark recapture

The purpose of electrofishing would be to assess juvenile densities of the target fish species and, over time build a picture of population change which can be attributed to the increased passage facilitated by the Fermoy fish pass. It would not specifically quantify fish passage.

A Before-After Control-Impact (BACI, Stewart-Oaten & Murdoch 1986) is the optimum design for river restoration studies (Roni, 2005). To achieve this a robust baseline of Control and Impact survey locations need to be established and, at a minimum, surveyed for three years prior to construction to establish some measure of variance in pre-works population size. Due to quite different habitat use by juveniles; lamprey and salmon could not be surveyed together and would need individually tailored survey programmes, lamprey requiring Point Abundance Sampling (Harvey & Cowx, 2003 as per the Triturus Environmental's lamprey survey for EcIA), while salmonids would require fully quantitative sampling due to the statistical limitations of timed, semiquantitative surveys (Honkanen et al., 2019). The latter would be difficult to achieve in mainstem channels. Electrofishing surveys for shad would be redundant as fry leave the spawning area post hatch and drop into the estuary almost immediately.

Once again, the issue of cost is relevant. As the mainstem could not be quantitatively surveyed, the focus of the monitoring would have to be in tributaries of suitable width (12m maximum is a good maximum guideline). This would then complicate the study results as any observed change could simply reflect impacts in the channel of survey. To therefore limit the potential impact of site effects, the number of sampling sites would need to be exceptionally large, and the survey programme extend for several years. At 2-3 sites per day (depending on densities), across the catchment, £30,000 per year budget would not be deemed excessive for a statistically designed survey programme, with no guarantee that results would be robust. This would then need a partner lamprey programme, and another programme of monitoring (based on adult spawning behaviour) for shad.

As the Blackwater is an SAC, there is an assumption that Site Condition Monitoring (SCM) is undertaken at regular intervals to understand the state of the qualifying interests. Therefore, over time there should be an increase in the abundance and spatial distribution of the target species. Reviewing future SCM data may be appropriate for shad and lamprey in particular, where issues of system penetration by those species are a key driver of the fish pass design

Mark-recapture in some fashion could be a useful tool to assess specific fish passage rates. The section below the weir could be netted during peak migration time for the target fish, which are then marked in some fashion (e.g., tattoo or small fin-clip). These fish would then be released, recaptured, and used to estimate passage (see Travade & Larinier, 2002 for details). However, shad may not respond well to marking.

### Environmental DNA

Environmental DNA (eDNA) is a relatively innovative approach which is proving an effective monitoring tool for understanding relative abundance and fish community composition in Freshwater Environments. In particular work on the Severn system in the UK (Unlocking the Severn) is using eDNA to assess relative composition of fish communities set against the backdrop of weir mitigation (e.g., Antognazza et al, 2021a). These studies use a universal primer (e.g. MiFish-U-F/R (Miya et al, 2015)) metabarcoding approach to assess all present species and returned confident results of species not recorded during standard catchment electrofishing. The use of eDNA also extended to shad only studies (Antognazza et al, 2021b).

eDNA has already been shown to determine shad presence within the EcIA study (Triturus Environmental, 2021). Should a metabarcode approach prove excessively expensive or not currently commercially available, then specific primers for shad and lamprey (e.g., Zancollin et al, 2018) should be used. An opportunity to include primers for FMP (Wacker et al, 2019) is available also.

eDNA has the potential to determine fish passage by those fish which are most likely to expand their range within the Blackwater due to weir mitigations. However, this method cannot quantify fish passage rates at the Fermoy site.

## 3.4. Proposed options

### Counters

The use of counters is the only approach where fish pass efficacy could be quantified over the range of flows where fish would attempt passage; however, it is scoped out here on the grounds of cost and reduced efficiency due to the size of the fish pass. Nonetheless a discussion with IFI in respect to counter installation (with a Conditioned design variation allowing for the addition of a counter housing while IFI fund the technology a possibility) could be useful for population monitoring in the long-term should other technologies or approaches become available.

### Electrofishing and mark recapture

This approach is also scoped out on the grounds of cost, proportionality, and effectiveness. To undertake an electrofishing approach to assess overall effect of the Fermoy fish pass on the fish designating features would involve a significant outlay in time, effort, and cost. The potential for this approach to achieve the aims is debatable on such a large catchment scale. This effort is also considered disproportional to the Proposed Project, which, although likely to be expensive, is still only the installation of one fish pass. Electrofishing is a blunt tool and is only really robust when used over large spatial and temporal scales and set within a designed framework.

### eDNA

Proof of concept of eDNA approaches has already been provided within the EcIA. Here we propose that this is expanded to include a metabarcoding approach, or a combined shad/lamprey approach to assess the impact of the fish pass on those species which are most likely to benefit from an operational fish pass. We consider the fish community metabarcoding approach the most suitable, as it would be prudent to monitor potential impacts on all species. This is because, once complete, the pass may be the only upstream route for all fish. It is recognised that an eDNA approach will not quantify fish passage, however it is the most applicable method to assess the success of the fish pass.

To establish a pre-construction baseline, a complete eDNA assessment should be carried out every year prior to construction, with overall community composition metrics (e.g., Bray-Curtis or Shannon

(Quinn & Keogh, 2000)) and measures of species abundance calculated. A temporal mean and variation of these metrics should be produced (the baseline) and compared with post construction results when available. Where a result from above the weir falls outside the pre-construction baseline range, an investigation should be undertaken.

Where eDNA results show a decline in fish abundance above the weir, a suitably qualified fish ecologist should be engaged to review all outputs and assess whether declines are due to the fish pass, or whether other impacts or population dynamics are responsible.

The locations to be surveyed are shown below in Figure 3.2. These are as per the Triturus Ltd study with the addition of one further control on the River Bride. This is to limit the risk that confounding factors within the Barrow could result in false conclusions.

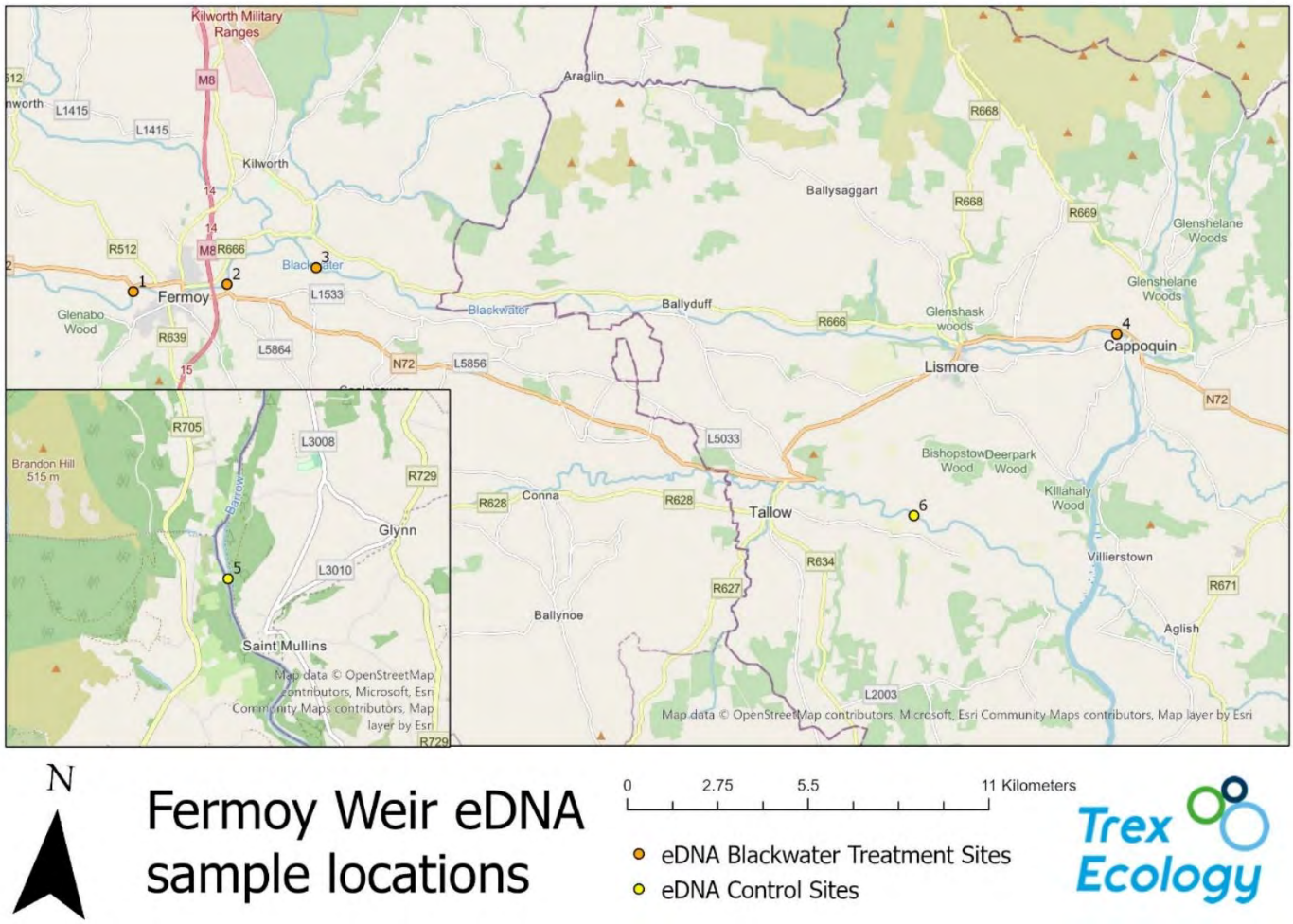


**Figure 3.2. Proposed eDNA sample locations**

If possible, the baseline should include a minimum of three years data collection (although this may not fit within the timeframes for construction). As shad and sea/river lamprey are unlikely to be present above the weir, the absence of a three-year baseline (i.e., one or two years) may not impact significantly on results for those two species. However as presented earlier, BACI-type designs are most appropriate. Samples should be taken in June once shad adults have returned.

The post operational monitoring should occur for ten years post construction, with yearly monitoring for two years, after which samples should be taken every two years. This means it will include greater than one complete life cycle of the oldest fish to have been hatched following

completion (e.g., a multi-sea winter salmon, which smolted at 3+, spent 3 winters at sea, spawning on the 4th winter).

### 3.5. Additional monitoring

This report has been unable to recommend a specific approach to quantify fish pass success due to factors discussed. Therefore, additional monitoring of the hydraulic performance of the structure is recommended.

Despite the operational monitoring assumptions presented in Section 3.2, the review of the fish pass design shows flow velocities within the pass itself, and in particular at the most upstream pre-weir, require assessment post-construction. This is problematic as the large size of the pass would make it unsafe to monitor during higher flow windows where fish migration rates would peak; therefore, we propose an impeller is used to assess flow velocities within the pass at Q95 flows (the lowest modelled flows). Should these measurements show velocities in excess of those required for passage or variation from the model, then remediation should be implemented. The design team may propose other, fixed monitoring equipment.

It should be considered that post construction adaption of a fish pass is common, and consistent with the recommendations provided in other associated documentation for this Proposed Project.

# 4. Conclusions

## 4.1. Overall

- Due to factors such as river size, range of target species, cost and effectiveness, no monitoring approach can be proposed to fully quantify fish passage.
- Monitoring approaches are proposed therefore to verify hydraulic performance of the pass, and to monitor the relative abundance and distribution of fish communities within the Blackwater following fish pass construction.

## 4.2. Fish pass design

- The fish pass is a large structure with an associated high volume of total flow; however, it does not meet the 50% requirement proposed by IFI at 1 AADF. Nonetheless concentration of 43% of flow (at that flow level) within a much smaller relative area is likely to allow fish to easily find the entrance.
- Flow velocity at the exit breaches the 2m/s velocity at certain points, although does not seem to breach the burst swimming capabilities of many fish. These points should be monitored post construction at safe flows.
- Some post construction adjustment may be necessary.

## 4.3. Monitoring

- On the grounds of cost and effectiveness direct monitoring (i.e., electrofishing surveys) and counters have been ruled out.
- eDNA methods have been proposed as the most effective solution give catchment location of the fish pass, the range of target fish with distinct life history traits and behaviours, and catchment size.
- A metabarcode all-species approach is proposed, although at a minimum shad and lamprey spp. should be included.
- A baseline should be established, with post operational monitoring to extend to ten years.
- An opportunity to include FPM within the eDNA monitoring programme exists.

## 5. References

Acolas, ML, Begout Anras ML, Veron V, Jourdan H, Sabatie MR & Bagliniere JL. 2004. An assessment of the upstream migrating and reproductive behaviour of allis shad (*Alosa alosa* L.) using acoustic tracking. ICES Journal of Marine Science, 61:1291-1304

Antognazza CM, Britton JM, Read DS, Goodall T, et al. 2021a. Application of eDNA metabarcoding in a fragmented lowland river: Spatial and methodological comparison of fish species composition. *Environmental DNA*. **3**:458-471.

Antognazza CM, Britton JM, De Santis V, Kolia K, et al. 2021b. Environmental DNA reveals the temporal and spatial extent of spawning migrations of European shad in a highly fragmented river basin. *Aquatic Conservation: Marine and freshwater ecosystems*, **31**:2029 – 2040.

Baudoin JM, Burgun V, Chanseau M, Larinier M, Ovidio M, Sremeski W, Steinbach P & Voegtle B. 2014. The ICE protocol for ecological continuity. ONEMA. 200pp

DixonBrosnan, 2021a. Natura Impact Statement: Fermoy weir remediation and fish bypass channel, Fermoy, Co. Cork. Planning Document prepared on behalf of Cork County Council. 126 pp

DixonBrosnan. 2021b. EcIA: Fermoy weir remediation and fish bypass channel, Fermoy, Co. Cork. Planning Document prepared on behalf of Cork County Council. 109 pp

DVWK. 2002. *Fish Passes: Design, Dimensions and Monitoring*. Guidance Manual produced fur the UN FAO. 139pp.

EA 2010. *Environment Agency Fish Pass Manual.* Technical manual prepared by the Environment Agency, Bristol. 369 pp.

Gargan P, Fitzgerald C, Kennedy R, Maxwell H, McLean S & Millane M. 2021. *The status of Irish salmon stocks in 2020 with catch advice for 2021*. Report of the Technical Export Group om Salmon (TEGOS) to the North-South Standing Scientific Committee for Inland Fisheries. 53 pp.

Honkanen HM, Boylan P, Dodd JA & Adams CE. 2019. Life stage-specific, stochastic environmental effects overlay density dependence in an Atlantic salmon population. *Ecology of Freshwater Fish*. **28**:156-166.

IFI. 2021. *IFI consolidated fish counter summary report*. Technical Summary produced by Inland Fisheries Ireland. 62pp.

Maitland P. 2003. Ecology of the river, brook, and sea lamprey. Conserving Natura 2000 Rivers Ecology Series No.5. English Nature. Peterborough. 54pp

Maitland P & Hatton-Ellis TW. 2003. *Ecology of the Allis and Twaite Shad*. Conserving Natura 2000 Rivers Ecology Series No.3. English Nature. Peterborough. 32pp.

McDermott T, Hunt J, Girvan J & Adams C. 2020. Eddleston Water restoration project: Fish monitoring programme 2017-2019. Report prepared for the Tweed Forum. 61pp.

Miya M, Sato Y, Fukunaga T, Sado T et al. 2015. MiFish, a set of universal PCR primers for metabarcoding environmental DNA from Fishes: Detections of more than 230 subtropical marine species. *Royal Society Open Science*, **2**. Noonan MJ, Grant JWA & Jackson CD. 2011. A quantitative assessment of fish passage efficiency. Fish and Fisheries. 13:450-464

Quinn G & Keough M. 2011. Experimental Design and Data Analysis for Biologists. Cambridge.

RHDHV 2021a. Fermoy Fish Pass– CFD modelling. Report prepared by Royal Haskoning DHV for TJ O'Connor and Associates. 18pp.

RHDHV 2021b. Fermoy Fish Pass – Hydraulic Design Review: Appendix A – CFD modelling note. Report prepared by Royal Haskoning DHV for TJ O'Connor and Associates. 7pp.

Roni P. 2005. *Monitoring Stream and Watershed Restoration*. Northwest Fisheries Science Center. 337pp

Sniffer. 2017. WFD111 Phase 2a: Course resolution rapid assessment methodology to assess obstacles to fish migration 2010. Technical Manual produced by Sniffer, Edinburgh. 78.

Stewart-Oaten A, Murdoch WW & Parker KR. 1986. Environmental Impact Assessment: "Psuedoreplication" in Time? *Ecology*. **67**:929-940

Triturus Environmental. 2021. *Aquatic baseline report for Fermoy Weir, Fermoy, Co. Cork*. Report prepared for DixonBrosnan Environmental Consultants. 60pp.

Travade F & Larinier M. 2002. Monitoring techniques for fishways. *Bulletin Francaise la Peche et de la Pisciculture.* Chapter 12 Special Supplement, **346**:166-180

Wacker S, Fossay F, Larsen BM, Brandsegg H, Sivertsgard R, & Karlsson S. 2019. Downstream transport and seasonal variation in freshwater pearl mussel (*Margaritifera margaritifera*) eDNA concentration. *Environmental DNA*, **1**:64-73.

Zancolli G, Foote A, Seymour M & Creer S. 2018. *Assessing lamprey populations in Scottish rivers using eDNA: proof of concept*. Scottish Natural Heritage Commissioned Report. No. 984. 27pp.

# Appendix I Data Received

A full list of all the documents that were received and reviewed is available in Table A1.1.

**Table A1.1: Documents received and reviewed**

| Document Description | Date Received | Document Type |
|---|---|---|
| Site Location | 14/03/2022 | Drawing |
| Site Layout | 14/03/2022 | Drawing |
| Aerial View | 14/03/2022 | Drawing |
| Ex Site Plan | 14/03/2022 | Drawing |
| Key Plan | 14/03/2022 | Drawing |
| Fish Pass Plan | 14/03/2022 | Drawing |
| Fish Pass Long Section | 14/03/2022 | Drawing |
| Fish Pass Sections | 14/03/2022 | Drawing |
| Plan Existing Weir | 14/03/2022 | Drawing |
| Existing Sections | 14/03/2022 | Drawing |
| Plan Proposed Weir | 14/03/2022 | Drawing |
| Proposed Sections | 14/03/2022 | Drawing |
| Proposed Sections | 14/03/2022 | Drawing |
| Proposed Sections | 14/03/2022 | Drawing |
| Ex Weir Condition 2018 | 14/03/2022 | Drawing |
| Ex Weir Area 1 | 14/03/2022 | Drawing |
| Ex Weir Area 2 | 14/03/2022 | Drawing |
| Ex Weir Area 3 | 14/03/2022 | Drawing |
| Ex Weir Area 4 | 14/03/2022 | Drawing |
| Ex Weir Area 5 | 14/03/2022 | Drawing |
| Ex Fish Ladder Plan | 14/03/2022 | Drawing |
| Ex Fish Ladder Details | 14/03/2022 | Drawing |
| Appendix 3 of Fermoy Weir Baseline Aquatic Report | 14/03/2022 | Report |
| Fermoy Fish Bypass – CFD Modelling | 14/03/2022 | Report |
| Fermoy Fish Pass – Hydraulic Design Review | 14/03/2022 | Report |
| Ecological Impact Assessment (EcIA) | 14/03/2022 | Report |
| Project Planning Response | 21/03/2022 | Report |
| Natura Impact Statement (NIS) | 16/03/2022 | Report |

## Appendix 8. Invasive Species Management Plan (ISMP)

DixonBrosnan
environmental consultants

# Outline Invasive Species Management Plan (ISMP)

Fermoy Weir Remediation and Fish Bypass Channel,

Fermoy, Co, Cork.

On Behalf of

Cork County Council

May 2022

www.dixonbrosnan.com

# DixonBrosnan

environmental consultants

| Project | Outline Invasive Species Management Plan (ISMP) Fermoy Weir Remediation and Fish Bypass Channel, Fermoy, Co, Cork | |
|---|---|---|
| Client | Cork County Council | |
| Project Ref. | 2091 | |
| Report No. | 2091.03 | |
| Client Ref. | - | |
| **Date** | **Revision** | **Prepared By** |
| 29/04/22 | First Draft | Carl Dixon BSc MSc |
| 27/05/22 | Issue to Client | Cian Gill MSc |
| | | |

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# 1. Introduction

DixonBrosnan were commissioned to survey for invasive species at the proposed Fermoy Weir Remediation and Fish Bypass Channel works, Fermoy Co. Cork.

This report was prepared by Carl Dixon MSc (Ecological Monitoring) and Cian Gill MSc (Ecological Monitoring).

Carl Dixon MSc (Ecology) is a senior ecologist who has over 20 years' experience in ecological and water quality assessments. Carl Dixon holds an Honours Degree (BSc) in Ecology and a Masters (MSc) in Ecological Monitoring from UCC. He is a senior ecologist who has over 25 years' experience in ecological assessment. Prior to setting up DixonBrosnan Environmental Consultants in 2000, Carl set up and ran Core Environmental Services which included Rural Environmental Protection Scheme (REPS) planning for landowners and ecological assessments. Carl has particular experience in freshwater ecology including electrofishing fish stock assessments and water quality assessments. He also has considerable experience in habitat mapping and mammal ecology including survey work and reporting in relation to badgers and bats. Other competencies include surveys for invasive species and bird surveys. Carl has extensive experience with regards to EIAR and NIS mitigation and impact assessment. He has particular experience in large-scale industrial developments with extensive experience in complex assessments as part of multi-disciplinary teams. Such projects include gas pipelines, incinerators, electrical cable routes, oil refineries and quarries.

Cian Gill MSc (Ecology) is a qualified ecologist with ten years' experience working with wildlife and ecology-based NGOs and public bodies in Ireland, the UK and the US. Past projects include invasive species planning for the city of Rosemount, Minnesota, and the Under The Sea project for Essex Wildlife Trust. Recent projects include ecological reports for Cork-based housing and private developments.

# 2. Invasive species

## 2.1 Desktop Review

Non-native plants are defined as those plants which have been introduced outside of their native range by humans and their activities, either purposefully or accidentally. Invasive non-native species are so-called as they typically display one or more of the following characteristics or features: (1) prolific reproduction through seed dispersal and/or re-growth from plant fragments; (2) rapid growth patterns; and, (3) resistance to standard weed control methods.

Where a non-native species displays invasive qualities and is not managed it can potentially: (1) out compete native vegetation, affecting plant community structure and habitat for wildlife; (2) cause damage to infrastructure including road carriageways, footpaths, walls and foundations; and, (3) have an adverse effect on landscape quality. The NBDC lists a number of both aquatic and terrestrial high impact invasive species which have been recorded within grid square W89 (**Table 1**).

**Table 1. High impact invasive flowering plant species recorded in W89**

| Species group | Species name |
|---|---|
| flowering plant | Canadian Waterweed (*Elodea canadensis*) |
| flowering plant | Cherry Laurel (*Prunus laurocerasus*) |
| flowering plant | Giant Hogweed (*Heracleum mantegazzianum*) |
| flowering plant | Indian Balsam (*Impatiens glandulifera*) |
| flowering plant | Japanese Knotweed (*Fallopia japonica*) |
| flowering plant | *Rhododendron ponticum* |

Source NBDC: 28/10/21

The control of invasive species in Ireland comes under the Wildlife (Amendment) Act 2000, where it states that

*'Any person who— [...] plants or otherwise causes to grow in a wild state in any place in the State any species of flora, or the flowers, roots, seeds or spores of flora, ['refers only to exotic species thereof'][...] otherwise than under and in accordance with a licence granted in that behalf by the Minister shall be guilty of an offence.'*

The Birds and Natural Habitats Regulations 2011 (SI 477 of 2011), Section 49(2) prohibits the introduction and dispersal of species listed in the Third Schedule, which includes Rhododendron *Rhododendron ponticum* and Japanese Knotweed *Fallopia japonica*, as follows: *"any person who plants, disperses, allows or causes to disperse, spreads or otherwise causes to grow [….] shall be guilty of an offence."*

## 2.2 Site Survey

Two Third Schedule invasive species were recorded within the proposed development site. Himalayan Balsam both juvenile and adult plants, is widely scattered throughout the riparian zone. One area of Japanese Knotweed was recorded on the southern banks of the proposed development site (**Figure 1**). No other invasive floral species were recorded.

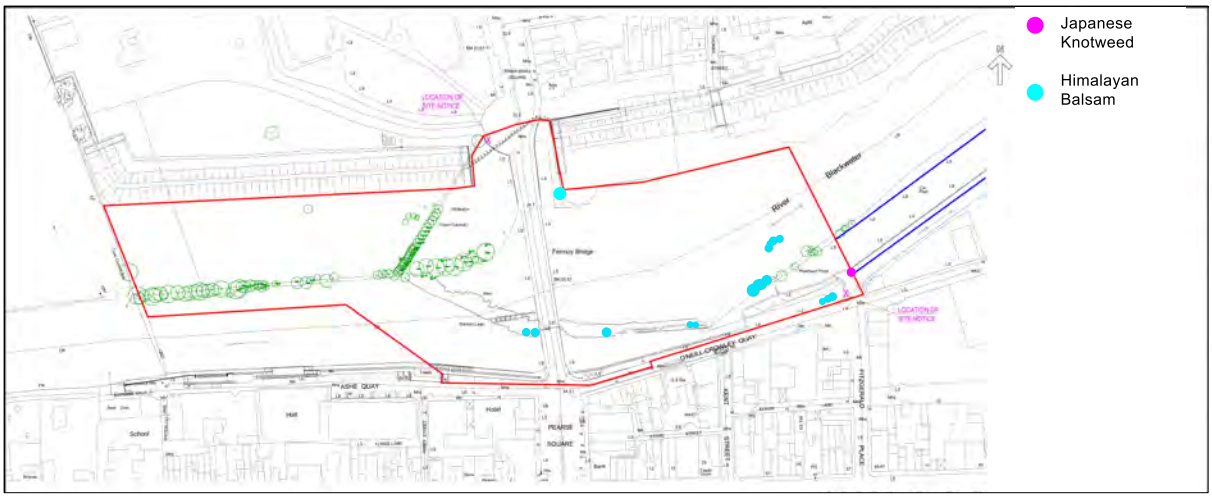


**Figure 1. Location of invasive species proposed development site**

## 2.3 Japanese Knotweed

Japanese Knotweed is a highly invasive, non-native species which was originally introduced as an ornamental plant but has since spread along transport routes and rivers to become a serious problem. This species can grow up to 2-3 m in height and can dominate an area to the exclusion of most other plants (**Figure 2**). It can form an extensive network of rhizomes (roots) which cause problems when managing this species. The rhizomes also allow the plant to survive over winter when the over ground conspicuous leafy part of the plant dies back to a brown wasted stem.

Japanese Knotweed spreads rapidly in the wild by natural means or by humans. Spread is solely by vegetative means, either fragments of rhizome or stem. Negative impacts include outcompeting native flora, contributing to river bank erosion and increasing the likelihood of flooding. This plant has the ability to grow through tarmac and concrete, although only if a weakness already exists and therefore must be cleared completely before starting to build or lay roads.

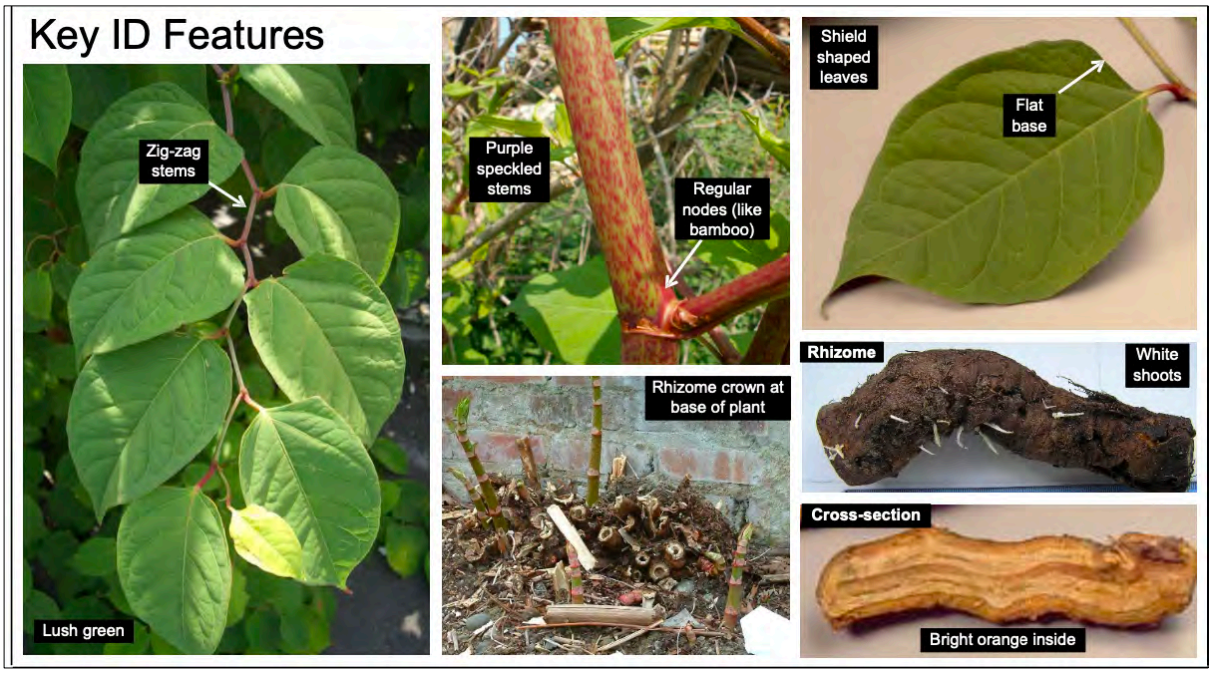


**Figure 2. Characteristics of Japanese Knotweed**

## 2.4 Himalayan Balsam

Himalayan Balsam is an invasive terrestrial plant species that was first introduced in the Ireland in 1800's as an ornamental garden plant. Since it was introduced, it has spread to most parts of Ireland. Due to the nutrient poor soil and cold temperatures in its home range, the Himalayas, it has adapted to develop thousands of seeds, which are dispersed widely as the ripe seedpods shoot their seeds up to 7m (22ft) away. Due to our warmer climate and nutrient rich soils, it has thrived here and became highly invasive. Once established in the catchment of a river the seeds, which can remain viable for two years, are transported further afield by water.

Himalayan Balsam is a tall, attractive, annual herb with explosive seed heads (**Figure 3**). Although easy to identify as a mature plant with its pink-purple flowers, fleshy stem and

characteristic leaves, the seedlings and last year's dead stems of this perennial are more difficult to spot. Spreads solely by seeds, which are small and easily carried by wind or water. This species out-competes native species in ecologically sensitive areas, particularly riverbanks. Where it grows in dense stands along riverbanks it can impede flow at times of high rainfall, increasing the likelihood of flooding. Die back of extensive stands over winter can leave riverbanks bare and exposed to erosion.

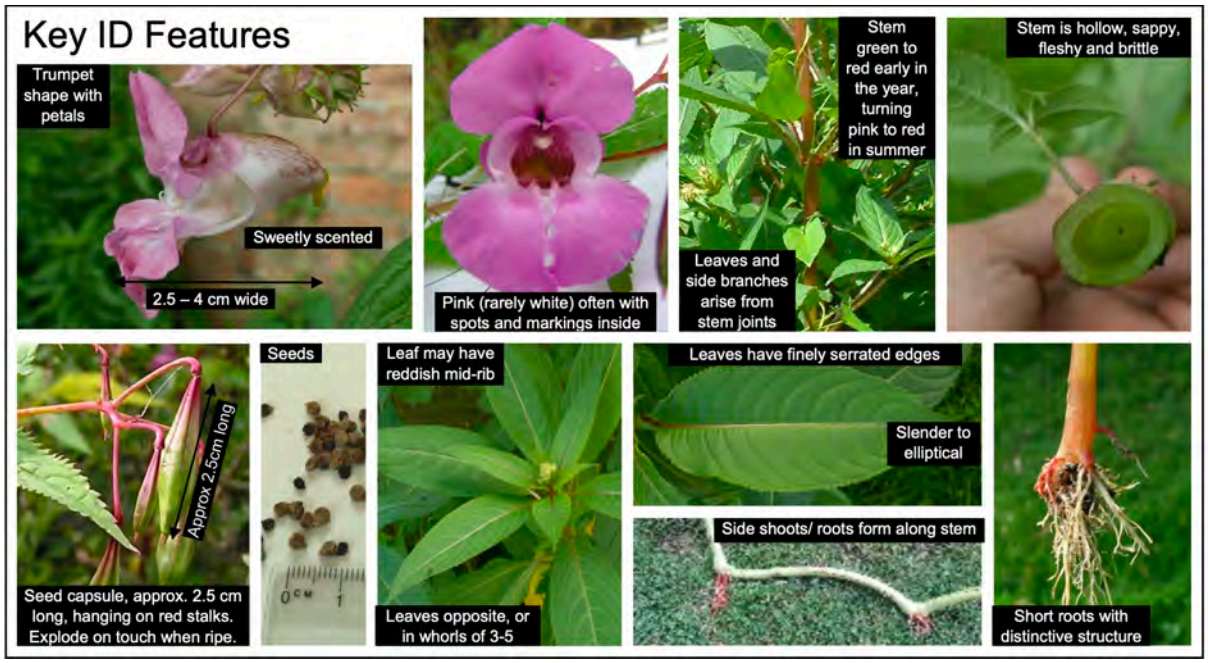


**Figure 3. Characteristics of Himalayan Balsam**

## 3. Japanese Knotweed Management During Construction Phase

This purpose of this plan is to:

- Identify the extent of the infestation on the site
- Ensure further growth and spread of the plant on the site does not occur
- Ensure the plant is not spread to other sites either adjacent to the infested site or through transportation of contaminated soil to another site
- Identify the best method for managing and controlling Japanese Knotweed and other invasive species on the site with regard to the proposed site works and construction methods
- Communicate the plan to all site operatives to ensure success of the plan
- Document and record the treatment and management methods carried out on site for future reference, for future site owners and site users and to avoid litigation.

The contractor will employ a suitably qualified ecologist to update the plan prior to the commencement of construction. The updated plan will contain the following:

- Site background including proposed works

- Extent of the Japanese Knotweed infestation
- Specific control plan to be put in place
- Site hygiene protocols
- Responsible individuals
- Follow up requirements
- Any other relevant information

### 3.1 Management Options for Knotweed Species

There are a number of suitable management options to control and prevent the spread of Japanese Knotweed. The methodology outlined in this document will be updated, if required, based on an up to date survey of the contaminated area. The proposed management plan will be agreed with Cork City Council prior to the works being carried out. It should be noted that:

- Where any infested material (soil containing Japanese Knotweed is to be taken off site, a licence to transport the material will be required from National Parks and Wildlife Service (NPWS).
- A landfill, which is licensed to accept such material, will be identified to dispose of the excavated material. The landfill site operator will be informed of what the material contains.
- Where herbicide treatment will be used, consideration will be given to the proximity of the herbicide treatment to other vegetation/habitats.

For all management plans, site hygiene protocols will be implemented. These protocols will apply to sites which are infested with Knotweed and those where Knotweed is not growing to prevent contaminated material being brought to site. Site hygiene protocols are outlined in **Section 3.3** below.

### 3.2 Pre-Construction Survey

Since invasive species spread quickly, prior to the commencement of treatment, a pre-construction survey will be undertaken to identify the extent of invasive species at that time. The survey will be undertaken by a suitably qualified ecologist. This information will be utilised to update the ISMP.

### 3.3 Site Hygiene at Contaminated Area

Construction equipment, vehicles and footwear may provide a vector for the spread of invasive species. Maintaining site hygiene at all times in an area affected by invasive species is essential to prevent further spread.

The following site hygiene measures will be implemented for the contaminated area:

- Understand the potential extent of the rhizome (root) system underground – up to seven metres horizontally and three metres vertically.
- Where possible, the contaminated area will be avoided and fenced off, or the extent of the rhizomes clearly marked.
- If possible, the use of machinery with tracks will be avoid contaminated areas. Movement of machinery between contaminated and non-contaminated areas must be controlled and adequate power washing measures implemented.
- Areas where contaminated soil is to be stockpiled on site will be clearly identified and marked out.
- Designated entry and exit points will be identified for personnel on foot and for small mobile equipment. A delineated access track, to be maintained free of Japanese Knotweed, will be established through the site to minimise the spread of Knotweed species by permitted vehicles accessing the site.
- Vehicles, including footwear and tools, leaving the site will be inspected for any plant material and washed down (using a pressure washer) in a dedicated vehicular wheel wash down facility, which will drain into a contained area within the site. Particular care is required with tracked machines.
- Vehicles used in the transport of contaminated material will be visually checked and washed down into a contained area before being used for any other work, either in the same area or on a different site.
- Only vehicles required for essential works including site investigation works will be brought on site and the number of visits minimised as much as practicable.
- Material gathered in the dedicated wash down contained areas will be appropriately disposed of off-site.
- For any subsoil or topsoil entering the site, the supplier will be required to provide an assurance that it is free of Japanese Knotweed.
- All site personnel will be made aware of measures to be taken and will be informed of the requirements of the ISMP.
- Site hygiene signage, in relation to the management of invasive species, will be erected.

### 3.4 Management Options

In addition to the possible advance treatment works and pre-construction survey, when the works areas become available to the contractor for enabling works, areas identified as requiring specific invasive species treatment will be demarcated and the designated control measures implemented at the earliest possible stage to reduce the risk of spread along the proposed scheme or beyond the land take.

There are a number of management options that may be implemented to control and prevent the spread of invasive species. These are presented in the sections below.

Those involved in the application of herbicides/pesticides will be competent to do so and, consequently, will have sufficient training, experience and knowledge in the area of herbicides/pesticides application.

All staff involved in the application of herbicides/pesticides will have received appropriate training, which may include achieving competency certification in the safe use of herbicides/pesticides through a National Proficiency Tests Council registered assessment centre or achieving an appropriate FETAC award in this area.

It is likely that chemical treatment, as described in **Section 3.5** will be the most suitable method for the identified invasive species.

### 3.5 Chemical Treatment

The control of Japanese Knotweed will require the use of herbicides, which can pose a risk to human health, to non-target plants or to wildlife. In order to ensure the safety of herbicide applicators and of other public users of the site, it is essential that a competent and qualified person carries out the herbicide treatment. A qualified and experienced contractor will be employed to carry out all treatment work.

The contractor will follow the detailed recommendations of the following documents for the control of invasive species and noxious weeds:

*Chapter 7 and Appendix 3 of the TII Publication: The Management of Noxious Weeds and Non-Native Invasive Plant Species on National Roads (NRA, 2010)*

*Best Practice Management Guidelines for Japanese Knotweed (Invasive Species Ireland, 2015)*

*Circular Letter NPWS 2/08 Use of Herbicide Spray on Vegetated Road Verges (National Parks and Wildlife Service 2008)*

These documents include measures to aid the identification of relevant species, with details for the timing, chemicals and methodology for chemical control, and for measures to avoid environmental damage during the use of herbicides.

Chemical treatment involves the application of an herbicide to invasive species plant such as Japanese Knotweed stands without any excavation or removal of the plant material. The preferred types of herbicides to be used in the treatment of Knotweed are Glyphosate and 2,4-D Amine.

If herbicide is applied as the treatment option, it may need to be reapplied for up to five years after the first application to ensure the plant control measures have been effective.

Glyphosate is non-persistent and can be used near water but it is not selective (i.e. it is a broad spectrum chemical and will impact all plant species) whereas 2,4-D Amine can be persistent for up to one month, and can also be used near water but is more selective on certain plants. The selection of chemical by the contractor and supervising ecologist will depend on seasonal factors, site conditions, proximity to water, surrounding habitats etc.

The most effective time to apply Glyphosate is from July to September (or before cold weather causes leaves to discolour and fall). The majority of herbicides are not effective during the winter dormant stage because they require living foliage to take up the active ingredient.

Reapplication rates will depend on site specific considerations including the extent of the infestation, its location, and the time of year treatment commences. Details of the proposed chemical treatment plan will be included in the updated ISMP based the proposed work programme.

Foliar treatment (spraying) is usually applied with a sprayer such as a knapsack sprayer or a larger spray system. It is important to use a treatment dye to identify clearly all areas treated. Foliar treatment is an efficient way to treat large monocultures of invasive plants, or to spot-treat individual plants that are difficult to remove mechanically such as Japanese Knotweed.

In the case of Knotweed, depending on weather and temperatures in the days following the initial treatment, and to ensure optimal uptake of herbicide into the rhizome system, a second similar treatment will be required usually within ten days, before the internal vascular system is no longer capable of translocating the herbicide to the root system.

While the upper surface of the leaves will be easier to treat, it is also important to treat the leaf under surface as Knotweed possesses many stomata openings on the leaf under surface. Dead stems can be cut, removed and burned on/off site in accordance with the relevant legislation.

The stem injection method is sometimes used for Japanese Knotweed control. This treatment requires a higher concentration of the active ingredient than is used in foliar applications. It involves the use of a specialist herbicide injection tool whereby the injection tool injects the herbicide directly into each of the canes approximately 20-30cms from the base of each cane (between the 1st and 2nd nodule).

Subsequently approximately 10 mL of herbicide mix is injected into each cane at a ratio of 5:1 through the use of a specialist stem injection tool. The application of glyphosate-based products by injection is most effective when applied in the early Autumn (mid to late Sept). Regrowth will occur in subsequent years, albeit much less vigorously, which will require follow up treatment at the appropriate time of year. Spot treatment will be required each year until no regrowth is observed.

In order to ensure that the use of herbicides does not contravene legislation, the contractor must comply with Circular Letter NPWS 2/08 *Use of Herbicide Spray on Vegetated Road Verges* from the National Parks and Wildlife Service dealing with the application on to non-target areas.

### 3.6 Excavation and Chemical Treatment On-Site

This option employs both physical and chemical methods of treatment. This method is employed in situations where treatment of invasive species, in particular Knotweed, is required to be completed in a relatively short timeframe. Generally, digging up the rhizomes and re-cultivating it stimulates plant growth and will result in more successful herbicide application and management.

In summary, this management method requires cutting and killing of the surface plant. The cut material must be left on top of plastic sheeting until dried out and subsequently monitored for any sign of regrowth. Storage of cut material should not take place within flood risk zone of a river. The cut material should not be placed in a green waste recycling bin. Once dried out, the material should be burned on site in accordance with the relevant legislation. The surface of the affected area should be raked with tines to remove crowns and surface material, and in order to break up the rhizomes, bringing them to the surface, which will stimulate leaf production. This will make the plant more vulnerable to herbicide treatment. The more rhizomes that are brought to the surface, the more growth will occur, allowing for a more successful treatment. An excavator can be used to scrape the surface crowns and rhizomes into a pile and then to cultivate the ground to stimulate rhizomes to produce a higher density of stems for treatment. Reapplication of herbicide may be required for up to five years after initially application, subject to the site-specific management plan.

### 3.7 Excavation and burial

Excavated material containing Knotweed can also be buried on site. This will require burying the material at a depth of at least five metres. The contaminated material must be covered with a root barrier membrane before being backfilled with topsoil, or other, suitable fill material. The manufacturer's guarantee is required that the membrane will stay intact for at least 50 years. An accurate map and record of the location of the burial site, to prevent any future accidental disturbance, is required, and future owners must be informed of its position. If soil containing Japanese Knotweed is stockpiled, the material must be stored in a manner that will not harm health or the environment. The stockpile should be on an area of the site that will remain undisturbed. The area should be clearly fenced and marked with warning signs, and the stockpile should be regularly treated with herbicide to prevent any regrowth or re-infestation.

As a precaution, the stockpiled material should be laid on a root barrier membrane and covered to avoid contaminating the site further. The contractor must also comply with all waste legislation.

### 3.8 Excavation and root barrier cell method

Excavated material containing Knotweed can also be buried on site within a root barrier membrane cell. The procedure is similar to that described in **Section 3.7** above.

This method will require burying the material at a depth of at least two metres. The contaminated material must be placed in a contained cell formed by a root barrier membrane before being backfilled with topsoil, or other, suitable fill material. The manufacturer's guarantee is required that the membrane will stay intact for at least 50 years. The method for stockpiling prior to burial would be as described as above. The contractor must also comply with all waste legislation.

### 3.9 Excavation and bund method

Where there is not sufficient depth on a site excavated material can be placed in a structured bund. The bund will comprise a raised area above ground level or a shallow excavation, no more than 0.5m deep, and lined with a root barrier membrane. The manufacturer's guarantee is required that the membrane will stay intact for at least 50 years. This method of treatment

can also be used where Knotweed material needs to be moved from a location and there is another area of the site available to contain it.

The aim of this method is to concentrate the rhizome material into the upper surface of the bund, where it will grow and be controlled by herbicide. If the rhizome is buried deep, it will become dormant when inside the bund and regrow when the apparently clean soil is used for landscaping on the site. The bund location needs to be clearly marked by warning signs and protected from potential accidental damage. Reapplication of herbicide may be required for up to five years after the initial application, subject to the site-specific management plan.

The appointed contractor must comply with waste legislation if this method is to be considered.

### 3.10 Excavation and removal from site

Where the above treatment options are not possible because the site is too small to contain excavated material, or too shallow for burial, or where there is a lack of space or where the infestation simply cannot be avoided by the construction works, removal of excavated material may be the only option. If any invasive species plant material is collected (e.g. by hand-pulling or mowing), it is important that its disposal will not lead to a risk of further spread. Where there are small amounts of Knotweed material to be removed it is possible to double bag the material and send to a licenced waste facility for disposal. Where the amount of material is larger in volume, it will be necessary to haul it from site to a suitably licenced waste facility.

Invasive species material, particularly roots, flower heads or seeds, must be disposed of at licensed waste facilities appropriately buried, or incinerated in compliance with the relevant legislation. Disposal must be carried out in accordance with the relevant waste management legislation. Invasive species plant material or soil containing residual herbicides may be classified as either ‘hazardous waste’ or ‘non-hazardous waste’ under the terms of the Waste Management Acts, and both categories may require special disposal procedures or permissions. If the material has been treated with a persistent herbicide, the excavated material must be classified as hazardous waste and must be disposed of to a hazardous waste facility. Advice would need to be sought from a suitably qualified waste expert regarding the classification of the waste and the suitability of different disposal measures.

The movement of invasive plant material requires a licence from the NPWS under Section 49 of the European Communities (Birds and Natural Habitats) Regulations, 2011 (as amended).

### 3.11 Preferred Treatment Option

The Knotweed within the proposed development boundary is located on existing flood defence structures. As there is the potential for flooding to impact on the area currently contaminated with Knotweed species, there is the potential for fragments of Knotweed to be spread from the works area and inadvertently distributed off-site.

Having assessed the available management options and constraints associated with this particular site, it has been concluded that in-situ chemical treatment prior to construction, careful management of the works and continued in-situ chemical treatment post construction is the preferred option. This is primarily due to the following significant constraints;

- The Knotweed contamination adjoining the Mill Race is located on an existing flood defence structure and although limited works within this area will occur, it is preferable

to avoid large scale excavation and removal of Knotweed contaminated material which could damage the existing flood defence structure and increase the risk of flooding to the site.

- The risk of fragments of Knotweed being spread outside of its current distribution is high as high flood levels could result in fragments of Knotweed, which are dislodged during site works, being carried downstream along the River Blackwater and thus impacts on off-site receptors could occur.

- Given that flooding could impact on existing stands of Knotweed, large scale foliar spraying is not recommended and therefore only stem injection and spot treatment is practical as a first treatment method. For the re-growth material within the site or juvenile plants, a foliar spray application using a cowled knapsack sprayer will allow for efficient treatment when stems are too small and fragile to use stem injection.

Therefore, the following methodology is proposed:

1. Contractor will commence chemical treatment of the Knotweed species in this area, in order to avoid the continued spread of the species. The preferred method for initial treatment is stem injection and spot treatment. This will be carried out under the supervision of a qualified ecologist who will ensure that the correct methodology and appropriate site hygiene methods are utilised. This ISMP will be updated by the supervising ecologist if required. Early treatment will effectively reduce the length of time that chemical treatment will be required. It is noted that Knotweed can persist for long periods and the sooner treatment commences, the more rapidly this species will be eradicated from the works area.

2. Prior to the commencement of site works, the extent of contamination will be determined by site investigations including trial pits. This information will be used to determine the area of contamination taking into account that the roots of Knotweed can extend 7m from the parent plant. If it is determined by visual inspections/trial hole investigation that viable plants remain within the work area the spreading of this viable Knotweed plant material outside the current area of contamination is not permitted.

3. Following the above, the identified area of contamination will be clearly fenced and all works in relation to Knotweed will be carried out only within this fenced area.

4. Where possible, contaminated soil will remain on-site and be treated. The transport of any material that must be removed off site for disposal, as part of the construction works, will require a licence from the NPWS.

5. Any excavations that are carried out as part of the project, must be contained within this area and the spread of any fragments of viable plant material or contaminated soil outside of this area must be effectively prevented. All hygiene protocols as listed in this ISMP must be effectively implemented.

6. Any contaminated material including material from the wash down area must be contained within the identified and fenced contaminated area or removed to a suitably licenced facility offsite in line with standard hygiene measures.

7. Once works within the contaminated area is complete a follow-up programme of works will commence to treat any regrowth of Knotweed. This will consist of stem injection and spot treatment and it will continue until the supervising ecologist can certify that Knotweed has been effectively eradicated.

8. The application of herbicide (injection/spot treatment) must take into account the risk of flooding which must be assessed immediately prior to the use of herbicides. Treatment will not be carried out when heavy rain is forecast or in the winter period when there is a higher risk of flooding and adverse weather. It is noted that site hygiene is of particular importance in areas prone to flooding.

The treatment programme will be carried out by a suitably qualified person who has experience of treating invasive species and will be carried out in line with the herbicide manufacturer's instructions. A five-year monitoring programme will be put in place to ensure that the herbicide has been successful

## 4. Himalayan Balsam Management During Construction

Any Himalayan Balsam within the works will be hand-pulled and bagged prior to the commencement or site works. It will be then placed in a designated area of the site to decay. The seeds are not particularly robust but may survive for 18 months so a two-year programme of control, which will extend beyond the construction period, will be required. All machinery leaving the site will be washed down in a designated wash down area in proximity to the site exit to prevent seeds from being spread outside the site boundary.

If and where contaminated soil or heaps of high-risk invasive species (i.e. Himalayan Balsam) are to be stockpiled, the area will be clearly marked out on site. These areas will not be within 50m of any watercourse or flood zone.

## 5. Conclusions

Two high risk invasive species were recorded within the proposed development site i.e., Japanese Knotweed and Himalayan Balsam.

Japanese Knotweed is a high risk invasive plant species and will be treated in accordance with this ISMP. The primary concern is the presence of Knotweed species within the flood embankment area where works are proposed. Herbicide treatment of Knotweed via stem injection and spot treatment will commence as soon as practically possible under the supervision of a qualified ecologist. Site investigations will be carried out prior to the commencement of works to determine if Knotweed species are still present and the degree of contamination.

This information will be utilised to determine the extent of the contaminated area and will be utilised to update this ISMP. Detailed fencing and hygiene protocols will ensure that viable plant material will not be spread outside of its current distribution area. Following completion of works, monitoring and treatment protocols will be implemented to ensure any regrowth is effectively treated.

No impediment to the removal of these species within the study area, as part of a detailed invasive species management plan, have been identified.

This outline ISMP will be updated by the supervising ecologist based on up-to-date survey data, prior to the commencement of proposed development.