

# Natura Impact Statement for Ardcahan Bridge, Co. Cork



Prepared by Triturus Environmental Ltd. for Fehily Timoney and Company

**August 2023**

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# 1. Introduction

## 1.1 Background

Triturus Environmental Ltd. were contracted by Fehily Timoney and Company to provide information necessary to enable the competent authority to conduct an Article 6(3) Appropriate Assessment of proposed bridge rehabilitation works at Ardcahan Bridge, approximately 4km north of Dunmanway, Co. Cork. Ardcahan Bridge is a six-arch structure with each span width being approximately 5-6m. The bridge is located on the Bandon River (EPA code: 20B02), traversing the R587 road, directly downstream of the confluence with the River Caha River (EPA code: 20C01) (**Figure 1.1**).

An Article 6(3) Appropriate Assessment Screening report has been prepared as part of an accompanying report (Triturus, 2023). The screening report has identified the European Sites upon which the proposed development has the potential to result in likely significant effects, and the pathways by which those effects may occur. It has also identified those qualifying interests which have the potential to be affected by the proposed development. Therefore, an Appropriate Assessment must be carried out in respect of the project by the competent authority under the European Communities (Birds & Natural Habitats) Regulations 2011-2021 (S.I. No. 477/2011). It should be noted that the proposed Ardcahan Bridge repair works are not directly connected with the management of a European site.

This Natura Impact Statement (NIS) has been prepared based on the conclusions of the AA Screening report. The purpose of this report is to evaluate whether the project, individually or in combination with other plans and projects, would have an adverse effect on the integrity of any European site, in view of that European site's conservation objectives and in view of the best available scientific knowledge.

This report has been prepared using the following guidance documents;

- DEHLG (2009). Appropriate Assessment of Plans and Projects in Ireland - Guidance for Planning Authorities.
- European Commission (2019). Managing Natura 2000 sites: the provisions of Article 6 of the Habitats Directive 92/43/EEC. Brussels, (2019/C 33/01). OJ C 33, 25.1.2019.
- European Commission (2021). Assessment of Plans and Projects Significantly Affecting Natura 2000 sites: Methodological Guidance on the Provisions of Article 6(3) and 6(4) of the Habitats Directive 92/43/EEC.
- Fry & Scott (2011). Developing IBIA: A standardised AA review package. In Impact Assessment and Responsible Development for Infrastructure, Business & Industry: 31st Annual meeting of IAIA, Puebla, Mexico (Vol. 29).
- Möckel, S. (2017). The European ecological network "Natura 2000" and the appropriate assessment for projects and plans under Article 6(3) of the Habitats Directive. In: Möckel S (Ed.) 'Natura 2000 appropriate assessment and derogation procedure – legal requirements in the light of European and German case-law'. Nature Conservation 23: 1–29.
- OPR (2021). Appropriate Assessment Screening for Development Management. OPR Practice Note PN01. Office of the Planning Regulator. March 2021.

## 1.2 Need for Appropriate Assessment and legislative requirements

Special Areas of Conservation (SACs) and Special Protection Areas for birds (SPAs) are sites that form part of a network, known as Natura 2000 sites, to be designated across Europe in order to protect biodiversity within the EU. SACs are designated under the EU Habitats Directive (92/43/EEC), as transcribed into Irish law by the European Communities (Natural Habitats) Regulations, 1997, while SPAs are designated under the EU Birds Directive (79/4089/EEC, as amended and codified in 2009/147/EC). The European Communities (Birds and Natural Habitats) Regulations, 2011 (S.I. 477/2011) revoked the 1997 Regulations (and amendments) as well as the European Communities (Birds and Natural Habitats) (Control of Recreational Activities) Regulations 2010. The purpose of the 2011 Regulations was to address transposition failures identified in the Court of Justice of the European Union (CJEU) judgements. Following additional amendments in 2013 (S.I. 499/2013), 2015 (S.I. 355/2015) and 2021 (S.I. 293/2021), the regulations are now cited as the European Communities (Birds and Natural Habitats) Regulations 2011-2021.

Article 6(3) of the EU Habitats Directive states that: “Any plan or project not directly connected with or necessary to the management of the [Natura 2000] 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.” Such an assessment is known as an Appropriate Assessment (AA). This provision is transposed into Irish legislation by Part XAB of the Planning and Development Acts, Section 177U(4) of which provides for AA screening as follows: “The competent authority shall determine that an appropriate assessment of [...] a proposed development [...] is required if it cannot be excluded, on the basis of objective information, that the [...] development, individually or in combination with other plans or projects, will have a significant effect on a European site.”

## 1.3 Conclusions of Article 6(3) Appropriate Assessment Screening report

The Article 6(3) Appropriate Assessment Screening report identified the potential for the proposed development to result in likely significant effects on the following European Site:

- Bandon River SAC (002171)

While there are no instream works proposed, Ardcahan Bridge is situated directly within the River Bandon SAC (**Figure 1.1**). Therefore, the potential for significant effects via direct impacts to qualifying interest habitats and species or indirectly through deterioration of water quality for the following qualifying interest species and habitats;

- *Margaritifera margaritifera* (Freshwater pearl mussel) [1029]
- *Lampetra planeri* (Brook lamprey) [1096]
- Water courses of plain to montane levels with the *Ranunculion fluitantis* and *Callitricho-Batrachion* vegetation [3260]’

While not a pristine example of the habitat, potential for significant effects on the Annex I Habitat, ‘Alluvial forests with *Alnus glutinosa* and *Fraxinus excelsior* (Alno-Padion, Alnion incanae, Salicion albae) [91E0]’ is also considered possible in light of proposed tree limb cutting.



**Figure 1.1** Location of Ardcahan Bridge on the R587 Road, 4km north of Dunmanaway, Co. Cork

## 2. Development description

### 2.1 Site location

Ardcahan Bridge is located on the upper Bandon River (20B02), within the River Bandon SAC (002171) and is situated on the R587 road, directly downstream of the Bandon River confluence with the River Caha (20C01) confluence (**Figures 1.1 and 2.4**).

### 2.2 Proposed development

In summary, the rehabilitation at Ardcahan Bridge will require the following works according to the Construction Environmental Management Plan (CEMP). The works will take place over a 6 to 10 week period (July to September inclusive).

#### Temporary Site Compound:

During the construction phase, it will be necessary to provide temporary facilities for construction personnel. This project will have 1 no. temporary compound located near the entrance to the site which will include welfare facilities. The location of the temporary site compound is proposed to be set back c. 30m from the south west corner of the bridge, as shown in Figure 3 1. The temporary compound shall be constructed with crushed rock aggregate hard standings with low dust content. Temporary facilities will be removed, and the lands reinstated upon completion of the construction phase.

Facilities to be provided in the temporary site compound will include the following:

- Welfare facility
- Employee parking
- Contractor lock-up facility
- Bottled water for potable supply
- Water tanker to supply water used for other purposes
- Fuel storage
- Diesel generator
- Storage areas
- Waste management areas

The site compound is located in agricultural land within the Bandon River SAC (see Figure 2-1).



**Figure 2.1** Site compound location south west of Ardcahan Bridge

Corrosion Repairs & Minor Parapet Repairs:

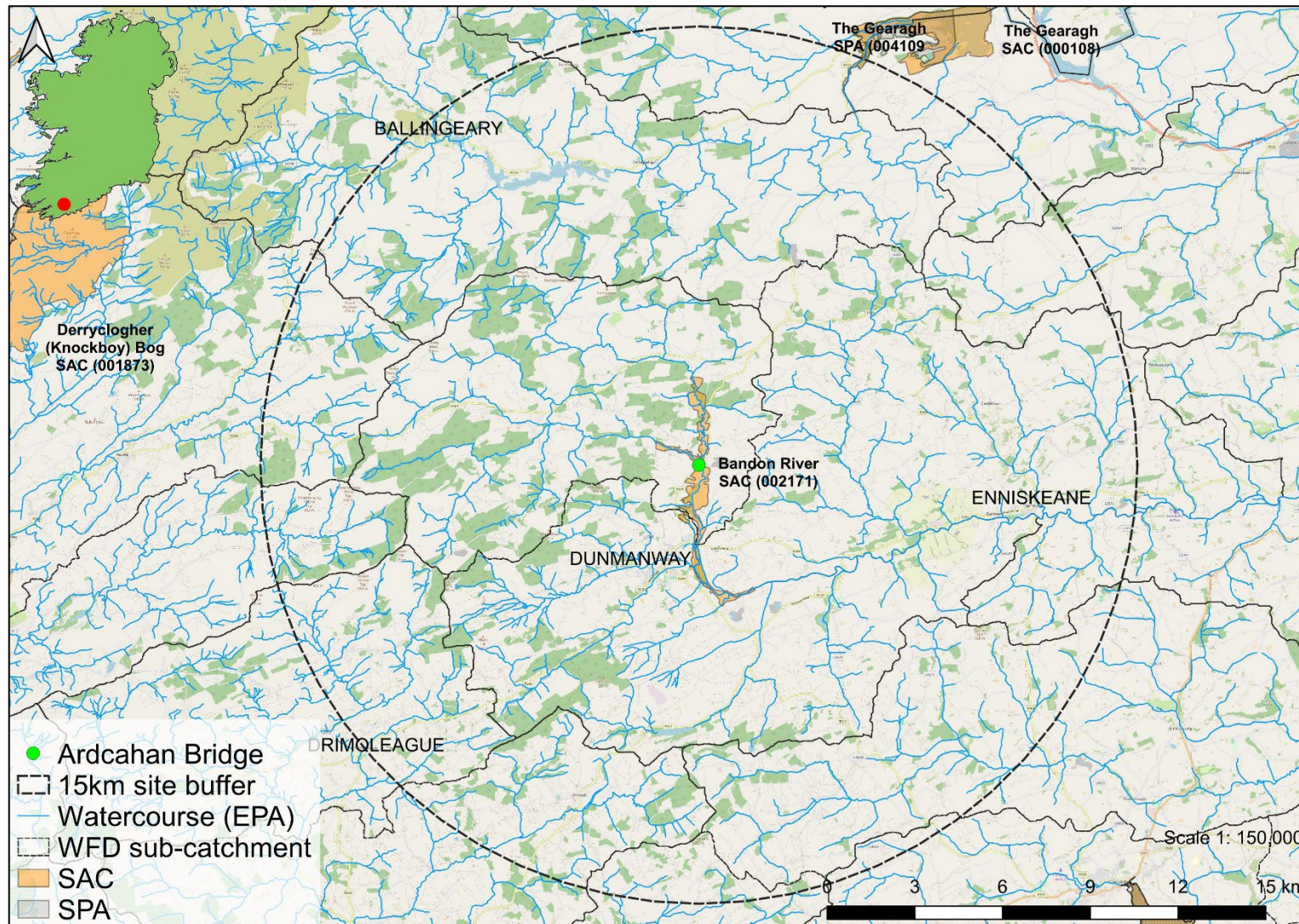
1. To facilitate the installation of the scaffold, vegetation within a 2-meter width on either side of the bridge face will be cut back.
2. A scaffold shall be installed to allow access to the underside of the bridge arches.
3. Steel beams to be sandblasted to SA2.5 as per detail provided in Drawings P1959-ARDH-0004. Note that one operator will carry out the sandblasting using appropriate sandblasting equipment accessing the beams surface from the scaffold provided. Sandblasting equipment typically consists of a chamber in which sand and air are mixed. The mixture travels through a hand-held nozzle to direct the particles toward the surface of work.
4. Welding of additional steel plate at the bottom flange of existing steel beams as shown in Drawings P1959-ARDH-0004. One operative will carry out the welding using portable electric welding equipment accessing the beams surface from the scaffold provided.
5. A protective paint system to be applied to all exposed steel work, Hempel Hempadur Mastic 45880/1 or similar approved to be applied by brush in 2 coats of minimum 190 micron DFT (dry film thickness). One operative will paint the steel beams accessing them from the scaffold provided.
6. Steel Drip Strips will be positioned along the bottom edge of the bridge parapet on both sides of the bridge, the holes will be drilled along the bridge as per the spacing shown in drawing P1959-ARDH-0004 and bolted through with post-fixed mechanical anchors as shown in drawings P1959-ARDH-0004. The position of these elements is shown on drawings P1959-ARDH-0004.
7. Cracking at Deck Pier interface to be injected with Epoxy Resin. Prior the injection, the crack and surrounding surface will be cleaned to allow the paste-over to bond to sound concrete. The epoxy resin will be pressure pumped locally (directly into the cracks) to close the cracks at the Deck/Pier interface. The deck/pier interface is above the waterline.
8. Vegetation on the internal side of the existing parapet and drainage outlets to be cleared from structure.



9. Minor repairs to missing sections of render shall be carried out along the parapet as shown in P1959-ARDH-0003. Repairs to be carried out by hand by an operator accessing the parapet surface from the deck/scaffolding level.
10. New Black PVC drain pipe to be positioned in the existing drainage outlets location and fixed in place with mortar from the deck level.
11. Scaffold to be removed.

Deck Works:

1. Upon completion of the corrosion repairs it is proposed to repair the road surfacing on this bridge. A road closure and diversion will be required to facilitate these works.
2. The existing road surface shall be scarified, and the existing surface shall be removed and the concrete surface of the bridge deck exposed.
3. Any defects encountered when deck is exposed to be repaired using an appropriate concrete repair mortar. This will only include small localised repairs with concrete repair mortar, limited to the top side of the deck.
4. A trial hole and rebar scan shall be completed to confirm deck reinforcement and strength. The trial hole will be superficial and will not penetrate the entire thickness of the deck. If this investigation is unsatisfactory, Cork County Council may introduce a weight limit to the bridge.
5. A spray applied bridge deck waterproofing system shall be installed.
6. Kerb drain (feeding to new Black PVC drainage outlet) and concrete rubbing strip to be installed by an operator accessing the area from the deck level.
7. The pavement surface shall be laid, sand asphalt followed by HRA, high friction colour contract surfacing shall be applied.



**Figure 2.2** Location of Ardcahan Bridge relative to European sites within a 15km buffer

## 3. Receiving environment

### 3.1 Desktop study

A desktop study was carried out to collate available information on the site's existing environment. This comprised a review of the following publications, data sources and datasets:

- Cork County Development Plan 2022-2028
- County Cork Biodiversity Action Plan 2009-2014
- Cork County Council Planning Enquiry System
- National Parks and Wildlife Service (NPWS) [website](#) and metadata available
- OSI Aerial photography and 1:50,000 mapping
- National Biodiversity Data Centre (NBDC) (on-line map-viewer, [available here](#))
- DAFM Forestry Licence viewer ([available here](#))
- BirdWatch Ireland website
- Teagasc soil area maps (NBDC website)
- Geological Survey Ireland (GSI) area maps
- Environmental Protection Agency (EPA) water quality data
- River Catchment & Sub-catchment WFD datasets

### 3.2 Consultation

Details of the proposed bridge rehabilitation works, with an invitation for comment and input, were sent to the National Parks and Wildlife Service (NPWS) and Inland Fisheries Ireland (IFI) on the 14<sup>th</sup> March 2023. A response was received from IFI on the 4<sup>th</sup> April 2023 (see below) based on the original scope of works which has now been revised (refer to meeting with NPWS 8<sup>th</sup> June 2023 below). The main proposed revision to the construction works was the removal of all instream works to minimise risks to the highly sensitive pearl mussel population present in the footprint of the bridge structure.

The numbered list below comprises the written consultation response received from IFI on 4<sup>th</sup> April 2023.

1. All works are carried out in accordance with the IFI "Guidelines on protection of fisheries during construction works in and adjacent to waters".
2. Instream works are limited to the period July to September inclusive.
3. Only dry gravel or other riverbed material above the waterline at the line of the works should be removed.
4. Instream tracking should be avoided where at all possible.
5. Contaminated (suspended solids, hydrocarbon, cement products etc) construction runoff must be collected and disposed of in a manner so that pollution of surface waters cannot occur.

6. On commencement and for the duration of construction a daily ongoing inspection programme of surface waters in the vicinity of the site should be undertaken, with any escape of contaminants notified immediately to IFI.
7. All watercourse instream works should be carried out in the dry.
8. IFI would ask to be notified prior to the commencement of works.
9. Provision is made for the advance removal and relocation of fish stocks by means of electro-fishing as necessary when instream works occur.
10. The free passage of fish should not be obstructed either during or a result of the works. In relation to the installation of rip rap on the riverbed this must be undertaken in a manner that does not form an obstacle to fish passage post works

While no written communication was received from the NPWS at the time of writing, verbal communication with the NPWS based on the site visit carried out on the 8<sup>th</sup> June 2023 is summarised below. Following the onsite meeting and identification of ecological constraints associated with the original scope of works, Cork County Council and Fehily Timoney removed the requirement for instream works (i.e. removal of gravel build up from the eastern arch) as it was determined that these works could not be completed without the destruction of riparian tree root systems and associated bank destabilisation. However, to facilitate scaffold construction, localised tree trimming within 2m of the bridge structure would be required.

The NPWS requested that chemical water testing be carried out before, during and after construction to ensure no deterioration in water quality.

This NIS report thus focused on the works as proposed under the revised scope (i.e. no instream works, scaffold installation and bridge deck and corrosion remediation only).

### 3.3 Ecological surveys

Terrestrial and aquatic ecological surveys were undertaken on the River Bandon on the 3<sup>rd</sup> July 2022. The objective of the site visit was to establish the presence of qualifying interest habitats and or species in the footprint of the proposed bridge remediation works. It also helped to gain an overview of features of ecological importance (i.e., non-qualifying interest habitats/species). A summary of previous surveys undertaken is also provided below.

Stage I and Stage II freshwater pearl mussel surveys covering a larger section of the Bandon River up and down stream of the bridge were completed under NPWS licence C165/2019 on 11<sup>th</sup> and 12<sup>th</sup> July 2019 in bright weather, with good underwater visibility and under base flow conditions (Triturus, 2019a).

Aquatic ecology walkover surveys were conducted on 12<sup>th</sup> and 13<sup>th</sup> May 2019, with survey effort focused on both instream and riparian habitats at each site. Surveys focused on 150m both upstream and downstream of the bridge site (Triturus, 2019b).

Terrestrial ecological surveys were undertaken on 8<sup>th</sup> May 2019. Further ecological information in light of advanced project design was gathered during the onsite consultation meeting on 8<sup>th</sup> July 2023, and previously recorded baseline conditions were also confirmed. The objective of these visits was to gain an overview of the bridge location regarding the presence of invasive plant species; and habitats or species that are protected. The area surveyed was the riparian corridor surrounding the bridge, defined as up to 10m either side from the riverbanks and 150 m upstream and 150 m downstream of the bridge. The following were assessed during the walkover: habitats, mammals (excluding bats), avifauna, and other terrestrial taxa (Fehily Timoney, 2023). The results and findings of these terrestrial ecology surveys are outlined in the accompanying construction environmental management plan prepared by Fehily Timoney and Company.

## Occurrence of Qualifying Interest Species & Habitats

### i) Freshwater Pearl Mussel

Results from the pearl mussel surveys showed that algal growth was also visible on both live and dead freshwater pearl mussel shells upstream (and downstream) of the bridge, typically in pool areas adjoining glide and riffle where stable cobble was present amongst gravels. Pearl mussels (both live and dead) were also present upstream of the bridge with small numbers present in gravels at the mouth of the adjoining Caha River. Limited pearl mussel habitat was present under the bridge structure. Further details on numbers recorded are detailed below.

Results from the stage I and II freshwater pearl mussel surveys showed that pearl mussels were well distributed throughout the Ardcahan survey sections with the highest densities recorded in the immediate downstream vicinity ( $\leq 5$  m) of the bridge structure. At this location, unbedded cobble and gravel substrata provided stable footing opportunities for mussels in deep glide areas downstream of the bridge. However, filamentous algal cover (indicating enrichment) and siltation were evidently causing stress to some mussels (approx. 20% of individuals) in this area at the time of survey. Other areas such as survey section B (50- $\leq 125$  m downstream of bridge), which comprised stable cobble in deeper glide, also supported moderate quality pearl mussel habitat (87 live mussels recorded), albeit siltation pressures were still evident. Indeed, siltation and eutrophication pressures have already been identified as significant in the Bandon catchment and are seriously impacting pearl mussel habitat. Recent significant native woodland removal and instream works approx. 6.5 km upstream at Keenrath (pers. obs.) during 2018 and 2019 has resulted in further destruction of pearl mussel habitat and evident deterioration of water quality (pers. obs.). Continued pressure from land use activities is continuing the long-term trend of habitat deterioration in the catchment and has to be reversed in order to restore habitat quality for pearl mussel if the river population is to be prevented from extinction. The most recent surveys carried out on July 3<sup>rd</sup> 2022 recorded n=14 mussel in the bridge apron. These are summarised in Table 1 below. Given the limitations of correct GPS signal accuracy under the bridge structure the occurrence of mussel is recorded relative to each of the bridge arches in Table **3.1 below**. Span 1 is on the east side of Ardcahan Bridge with span 6 on the west side.

**Table 3.1** Location of freshwater pearl mussel relative to bridge arch

Span No.	Number of Mussels	Location of mussel under arch facing upstream	Notes on habitat
Span 1	None	None	Dry arch with large pile of gravels, localised ponding water near pier
Span 2	4 + 2	3 on downstream side of span right hand side (c. 3m) and 2 mussels c. 2.5m downstream centre	Situated in cobble and gravels downstream of apron
Span 3	4	3 at upstream side of span on left hand side near pier and 1 no. mussel centre on downstream side	Situated in void between historical cobble apron
Span 4	3	2 at upstream side of span on left hand side near pier and 1 no. mussel centre on downstream side	Situated in void between historical cobble apron
Span 5	1	Single mussel at centre of arch downstream side	Situated in void between historical cobble apron
Span 6	None present	None present	Dry arch during summer surveys with large gravel bank
Total mussels	14	n/a	n/a

## ii) Floating River Vegetation

In light of poor consensus of the broad definition of floating river vegetation habitat, the precautionary approach employed by (Macklin & Brazier, 2022; Denyer, 2017) was used to define areas supporting Annex I FRV habitat [3260]. Typically, this required the presence of three or more indicator species (Weekes et al., 2018; Kelleher, 2011; EC, 2013) in an area of habitat. However, this classification was cognisant of local hydromorphological conditions and expected phytosociological<sup>1</sup> attributes for habitat sub-types. For example, FRV habitat in faster flowing areas dominated by *Ranunculus* spp. can often be represented by as few as two indicator species (pers. obs.).

The macrophytes recorded at Ardcahan bridge included the *Ranunculus penicillatus* var. *penicillatus* (A), fool's watercress (*Apium nodiflorum*) (R), branched bur-reed (*Sparganium erectum*) (R), hemlock water-dropwort (*Oenanthe crocata*) (O), water forget-me-not (*Myosotis scorpioides*) (R), water pepper (*Persicaria hydropiper*) (R), brooklime (*Veronica beccabunga*) (R), water plantain (*Alisma plantago-aquatica*), intermediate water-starwort (*Callitriche hamulata*) (R), common water-starwort (*Callitriche stagnalis*) (R) and marsh ragwort (*Jacobaea aquatica*) (R). With regards bryophyte species the shaded cobble in the channel supported locally frequent jagged germanderwort (*Riccardia chamedryfolia*) and occasional greater water-moss (*Fontinalis antipyretica*).

Given the presence of *Ranunculus*, *Callitriche* and aquatic bryophyte indicator species, the habitat upstream and downstream of the Ardcahan Bridge apron supported plant communities indicative of

<sup>1</sup> the branch of ecology dealing with the origin, composition, structure, and classification of plant communities

the Annex I Habitat Water courses of plain to montane levels with the *Ranunculion fluitantis* and *Callitriche-Batrachion* vegetation [3260]' (Plates 3.1 & 3.2).

### iii) Brook Lamprey

Brook lamprey spawning habitat is widespread both upstream and downstream of Ardcahan Bridge with fine and medium gravels with coarse sand with low to moderate siltation. Juvenile lamprey ammocoetes habitat was more localised and predominantly restricted to the large depositing area downstream of the bridge and apron adjoining the right hand bank. The habitat quality was considered very good overall for spawning and nursery.



Plate 3.1 Representative image of the River Bandon upstream of Ardcahan Bridge



Plate 3.2 Representative image of the River Bandon downstream of Ardcahan Bridge





**Plate 3.3** Pascal Sweeney conducting pearl mussel surveys in the vicinity of the bridge structure

## 4. Potential for Adverse Effects on Site Integrity

### 4.1 Potential impacts on Bandon River SAC (002171)

The potential for adverse effects to Bandon River SAC (002171) qualifying interest species freshwater pearl mussel and brook lamprey because of bridge remediation works at Ardcahan Bridge has been identified, owing to the situation of the bridge within the European site. The potential sensitivity of qualifying interest species is significant (in the absence of mitigation) given the presence of qualifying interest freshwater pearl mussel [1029], brook lamprey [1096], 'Water courses of plain to montane levels with the *Ranunculion fluitantis* and *Callitricho-Batrachion* vegetation [3260]' and 'Alluvial forests with *Alnus glutinosa* and *Fraxinus excelsior* (Alno-Padion, Alnion incanae, Salicion albae) [91E0]' in close proximity to the works. These qualifying interests would be vulnerable to water quality-related impacts including sedimentation, hydrocarbons, concrete, resins and paint used during construction with alluvial forest habitat being at risk from tree limb cutting to facilitate scaffold construction. These are discussed below.

#### 4.1.1 'Do-nothing' scenario

Under the 'do-nothing' scenario, the proposed bridge remediation works at would not proceed and the existing structure would remain in place. However, deterioration of the bridge from flood damage may result in further significant bridge remediation works in the future, that could in theory increase the level of projected impact should more significant structural repair works be required.

#### 4.1.2 Potential construction phase impacts

The main impacts from the proposed bridge rehabilitation works on the Bandon River SAC (002171) are expected to occur during the construction phase. Primarily, these risks relate to water pollution and or contamination via siltation, cement products, resins and waterproofing chemicals such as steel paint. As previously stated tree limb cutting to facilitate scaffold construction may also impact qualifying interest alluvial woodland. The potential impacts relating to specific construction-phase activities on the aquatic environment are discussed in detail below.

##### 4.1.2.1 Potential water quality impacts

Bridge repair works including deck replacement and steel refurbishment may result in the escapement of suspended solids, hydrocarbons or cement, which could impact water quality and, thus, qualifying interest species within the Bandon River SAC (002171) (**Figure 3.1**).

Of primary concern is the potential for impacts to qualifying interest freshwater pearl mussel (see below) where significant populations are known from this part of the River Bandon catchment (**Figure 4.1**). The closest pearl mussel population in relation to the bridge works are under the bridge structure inclusive of areas immediately upstream and downstream (refer to **Table 3.1** results). Transportation of sediments into surface waters as bridge works may increase the turbidity within the system, reducing foraging activity and growth of pearl mussel populations in the vicinity of the bridge. Changes in oxygen and pH levels as a result of sediments clogging interstitial spaces in stream substrata can negatively affect survival of juvenile mussels (Hyvärinen et al., 2021).

However, the freshwater pearl mussel population of the Bandon River SAC was recorded to have 0% of the mussels under the 30mm and 65mm size class categories indicating low or absent recruitment (DEHLG, 2010). Therefore, potential impacts may be limited to adult populations.

Bridge remediation works involving the sandblasting of steel, render repairs, drainage outlet upgrade, waterproofing of deck, resin injection and painting of steel may also result in the release of chemicals and or sediment to the River Bandon, which has the potential to impact qualifying interest brook lamprey and pearl mussel through direct mortality and or impacts to sediment quality (i.e. spawning and or pearl mussel habitat). Concrete and other cement-based products are highly alkaline and corrosive and can have significant negative impacts on water quality and aquatic biota. Machinery used for the scarification of the bridge deck etc. may also lead to pollution of the River Bandon from the spillage of fuels and hydrocarbons, that could cause potential significant negative effects.

Suspended solids can also damage fish spawning substrata through the blocking of interstitial spaces, preventing oxygen diffusion and effecting egg/larval development, or directly smothering attaching and burrowing invertebrates, causing mortalities and changes to fish and invertebrate community composition at the local scale. This would be of particular concern for smaller species such as brook lamprey, which require clean, fine gravels in which to dig their redds (Lasne et al., 2010; Rooney et al., 2013; Dawson et al., 2015). Finer gravel substrata have an inherently higher risk of clogging, given the small size of interstitial spaces compared to larger cobble, for example. Siltation may also impact populations of non-qualifying interest Atlantic salmon, which serve as hosts for freshwater pearl mussel larvae (glochidia).

An increase in suspended solids can also have negative effects on instream flora, including Annex I 'Water courses of plain to montane levels with the *Ranunculion fluitantis* and *Callitricho-Batrachion* vegetation [3260]' habitat, through a reduction in light penetration and habitat heterogeneity, thus altering overall aquatic ecology. This is also an indicator habitat of river hydromorphology inclusive of associated bed quality which if altered can impact suitable conditions for other species such as qualifying interest pearl mussel.

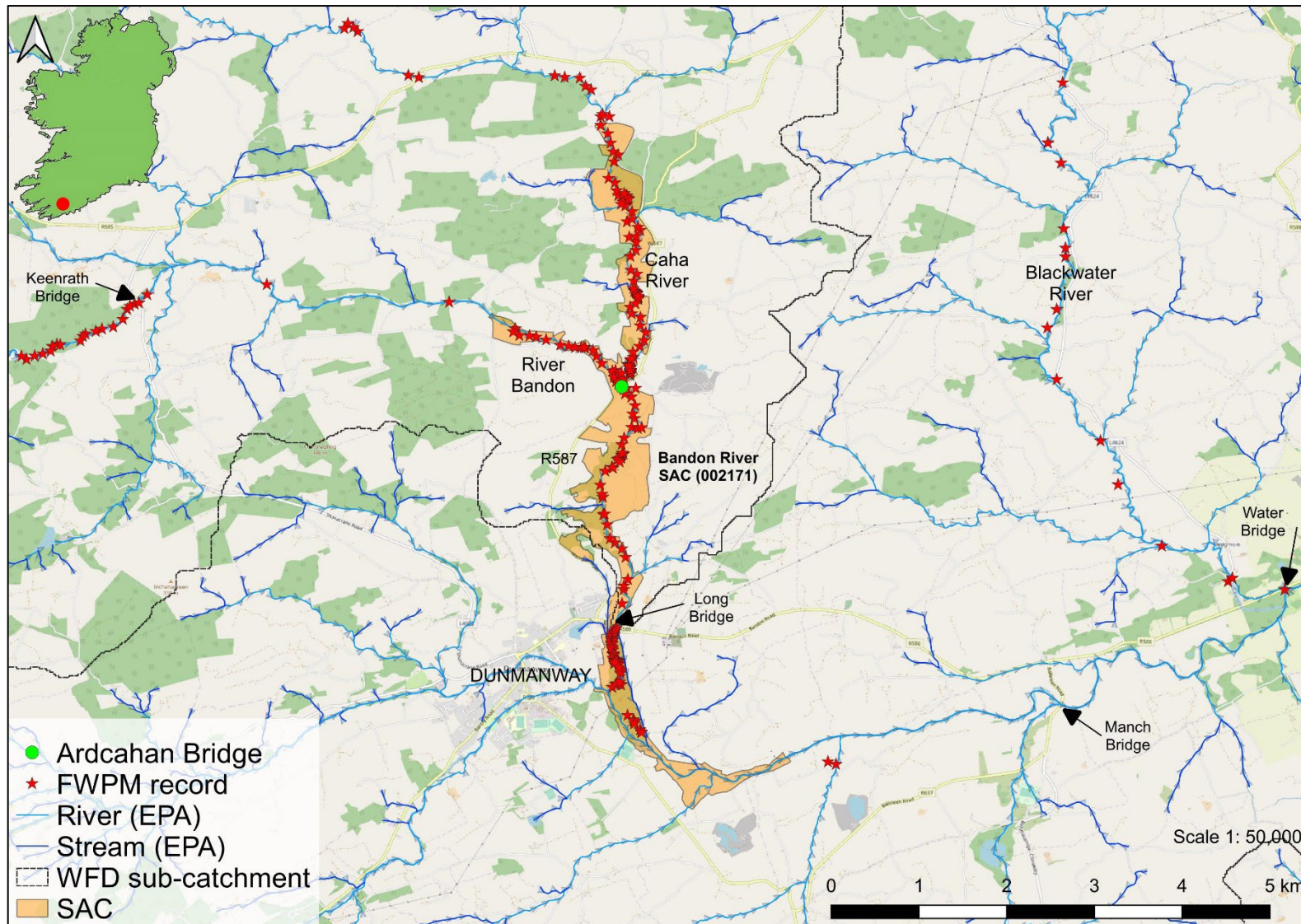
Potential impacts to Bandon River SAC (002171) qualifying interest brook lamprey and 'Water courses of plain to montane levels with the *Ranunculion fluitantis* and *Callitricho-Batrachion* vegetation [3260]' habitat via water quality effects are considered adverse on the integrity of the European site, in the absence of mitigation. While impacts to floating river vegetation may be localised any change in the abundance of crowfoot communities may have consequences for freshwater pearl mussel given changes in riverine flow regimes during low summer flows, increased thermal stress and deoxygenation for example as a result of sedimentation. For freshwater pearl mussel, potential effects resulting from the proposed works are considered significant and permanent in context of the integrity of the European site, in the absence of mitigation.

#### 4.1.2.2 Potential impacts resulting from invasive species spread

No aquatic or terrestrial invasive species were recorded in the vicinity of Ardcahan Bridge on 3<sup>rd</sup> July 2023 apart from a small area of winter heliotrope (*Petasites pyrenaicus*) on the road verge. The nearest invasive Japanese knotweed is known from the 2km grids W25U and W25P along the R585 and R587 roads, respectively (NBDC data). This species can cause impacts to river bank stability, thus increasing rates of erosion and suspended solids entering watercourses.

However, the risk of spreading this plant species is low considered its location outside the works area and the localised, small-scale nature of the proposed works. Furthermore there are no requirements for instream works and there will be no interference with riparian areas adjoining Ardcahan Bridge.

Potential impacts to Bandon River SAC (002171) qualifying interests, including freshwater pearl mussel, through the spread of invasive species resulting from the bridge remediation works will not result in adverse impacts to the integrity of European site, in the absence of mitigation.



**Figure 4.1** Location of Ardcahan Bridge relative to Bandon River SAC (002171) freshwater pearl mussel populations (NPWS data)

**Table 4.1** Identification of adverse effects on Bandon River SAC (002171) site integrity (pre-mitigation)

Qualifying Interests	Potential for adverse effects?	Rationale	Potential effects	Duration of effects
<i>Margaritifera margaritifera</i> (freshwater pearl mussel) [1029]	Yes	Pearl mussel populations within the Bandon River SAC (002171) (Caha River) in the direct footprint of Ardcahan Bridge (n=14 mussels) with significant populations also present immediately upstream and downstream	Transportation of sediment into surface waters as a result of water pollution (e.g. sediment) may increase the turbidity within the River Bandon, reducing feeding (filtering) activity and growth of downstream pearl mussel populations, even causing direct mortality should sediment build up around mussels footed in gravels. Changes in oxygen and pH levels as a result of sediments or chemicals clogging interstitial spaces (redox reduction) of stream substrates can affect negatively on survival of juvenile mussels. Siltation can also impact the survival and health of salmonid populations which serve as hosts for freshwater pearl mussel larvae (glochidia). Other chemicals released in significant volumes e.g. hydrocarbons, bridge waterproofing, resins and cement could also cause direct mortality. Changes in the abundance of water crowfoot surrounding mussels may increase thermal stress to mussels and potentially increase algae on spawning sediments, negatively impacting mussel habitat quality and survivorship.	<b>Permanent and significant adverse in the context of the European site</b>
<i>Lampetra planeri</i> (brook lamprey) [1096]	Yes	Brook lamprey spawning habitat is present both upstream and downstream of Ardcahan Bridge with significant ammocoetes burial habitat present downstream of the bridge on the right hand side of the channel (significant build up of soft organic rich sediment for burial)	The release of sediments and chemicals as a result of bridge remediation works would have the potential to impact on downstream brook lamprey ( <i>Lampetra planeri</i> ) spawning and nursery habitat.	<b>Significant adverse, short-term in the context of the European site</b>

Qualifying Interests	Potential for adverse effects?	Rationale	Potential effects	Duration of effects
Water courses of plain to montane levels with the <i>Ranunculion fluitantis</i> and <i>Callitricho-Batrachion</i> vegetation or aquatic mosses [3260]	Yes	Habitat supporting floating river vegetation is present both upstream and downstream of Ardcahan Bridge	The release of sediments and or chemicals as a result of bridge remediation works would have the potential to impact on downstream 'water courses of plain to montane levels with the <i>Ranunculion fluitantis</i> and <i>Callitricho-Batrachion</i> vegetation habitat.	<b>Significant adverse, short-term in the context of the European site</b>
Alluvial forests with <i>Alnus glutinosa</i> and <i>Fraxinus excelsior</i> (Alno-Padion, Alnion incanae, Salicion albae) [91E0]	Yes	<p>Narrow strips of riparian woodland (WN5) dominated by grey willow (<i>Salix cinerea</i>) forming gallery woodland are present upstream and downstream of Ardcahan Bridge along the immediate riparian zones. These wooded areas occur on mixed mud and gravel deposits closer to the river and extend into drier ground further back from the water, resulting in species associated with wet conditions occurring in proximity to drier/more generalist plant species.</p> <p>Individual specimens of Ash (<i>Fraxinus excelsior</i>), blackthorn (<i>Prunus spinosa</i>) and sycamore (<i>Acer pseudoplatanus</i>) were also recorded. Other plant species present include hedge woundwort (<i>Stachys sylvatica</i>), nettle (<i>Urtica dioica</i>), broadleaved plantain (<i>Plantago major</i>), hemlock water dropwort (<i>Oenanthe crocata</i>), marsh marigold (<i>Caltha palustris</i>), fool's watercress (<i>Apium nodiflorum</i>), valerian (<i>Valeriana officinalis</i>), ivy (<i>Hedera helix</i>) remote sedge (<i>Carex remota</i>), wood avens (<i>Geum urbanum</i>), meadowsweet (<i>Filipendula ulmaria</i>), <i>Galium</i> sp., bramble (<i>Rubus fruticosus</i>), <i>Rumex</i> sp., false brome (<i>Brachypodium sylvaticum</i>), scaly male fern</p>	Given that examples of gallery woodland with links to the qualifying interest habitat 'Alluvial forests with <i>Alnus glutinosa</i> and <i>Fraxinus excelsior</i> (Alno-Padion, Alnion incanae, Salicion albae)' are present in the vicinity of Ardcahan Bridge there is potential to impact this habitat during scaffold construction. The cutting back of tree limbs in riparian habitat sharing links with the Annex I, Alluvial woodland habitat may alter water flow pathways, reduce the capacity for local development of this habitat while also increasing light penetration to the bed, increasing algal proliferation and or the surface area of water crowfoot ( <i>Ranunculus</i> vegetation).	<b>Significant adverse, short-term in the context of the European site</b>

Qualifying Interests	Potential for adverse effects?	Rationale	Potential effects	Duration of effects
		<p>(<i>Dryopteris affinis</i>) and marsh ragwort (<i>Jacobaea aquatica</i>).</p> <p>This habitat has links with the Annex I habitat 'Alluvial forests with <i>Alnus glutinosa</i> and <i>Fraxinus excelsior</i>' [91E0] but the fragmented nature of the stands being narrow and disconnected with the floodplain, reduced their quality. However, with continued succession and natural hydromorphological change (i.e. anastomosing of the river around mature willow) into the adjoining floodplain, the habitat quality and extent would improve overtime.</p>		



### 4.1.3 Operational phase impacts

There will be no likely adverse effects during the operation of the bridge post construction to the integrity of the River Bandon SAC. This is considered given the bridge remediation works will not adversely alter the flow regime and fundamentally change the river hydromorphological character given the localised nature of the works inclusive of localised tree limb cutting. There will be no blockages to fish passage given the absence of instream works with repairs to the bridge structure only above the summer base flow 95%ile water levels.

### 4.1.4 Cumulative impacts

To determine any potential impacts acting in combination with the proposed bridge works, a planning search limited to applications submitted within the areas overlapping and surrounding Ardcahan Bridge during the previous 5 years was conducted on the 10<sup>th</sup> June 2023 (using the sources outlined in section 3). Active and granted planning applications were limited to permitted developments and planning retentions, including a 10-year permission for the proposed development of a 110kV electricity substation including 2 no. control buildings associated electrical plant and equipment, underground electricity cabling, fencing, alterations to a previously permitted borrow pit, permission granted in April 2018 (planning ref. 17431).

There is an application for an afforestation project consisting of 13.22ha which received approval on 6<sup>th</sup> May 2022 (project no. CN85109), and an application for an afforestation project consisting of 10.55ha which received approval on 28<sup>th</sup> September 2022 (project no. CN87623).

No potential cumulative impacts expected.

The main threats to the integrity of Bandon River SAC (002171) include, but are not limited to, discharges and flooding modifications (NPWS, 2019). Located in an agricultural landscape, watercourses in the vicinity of Ardcahan Bridge are also considered at risk from agricultural impacts. Thus, there exists the potential for bridge works to combine with water quality pressures on the qualifying interests of the SAC, such as via the release of suspended solids, hydrocarbons or other pollutants to surface waters.

However, in light of the scale and nature of the proposed works inclusive of the absence of instream works, there are not predicted to be any cumulative impacts arising from the proposed bridge works in-combination with other plans, projects or land practices.

## 4.2 Assessment of potential effects on Bandon River SAC (002171) conservation objectives

Section 4.1 above has evaluated the potential impacts as a result of remediation works to Ardcahan Bridge on the Bandon River SAC (002171) qualifying interest species and habitats. In light of these potential impacts, the following qualifying interests were selected for further assessment;

- *Margaritifera margaritifera* (Freshwater pearl mussel) [1029]
- *Lampetra planeri* (Brook lamprey) [1096]

- Water courses of plain to montane levels with the *Ranunculion fluitantis* and *Callitricho-Batrachion* vegetation [3260]'
- Alluvial forests with *Alnus glutinosa* and *Fraxinus excelsior* (*Alno-Padion*, *Alnion incanae*, *Salicion albae*) [91E0]

#### 4.2.1 *Margaritifera margaritifera* (freshwater pearl mussel) [1029]

Within the most recent River Bandon SAC sub-basin management plan (DEHLG, 2010), the freshwater pearl mussel population was recorded to have 0% of the mussels under the 30mm and 65mm size class categories indicating low or absent recruitment. The same report stated that the Bandon population was in unfavourable conservation status and catchment-wide measures were required to reduce significant levels of siltation and eutrophication that were seriously impacting pearl mussel habitat and resulting in serious population declines.

**Table 4.2** below assesses the potential for the proposed bridge remediation works to affect conservation objectives and targets for freshwater pearl mussel within the Bandon River SAC (002171). Given the high sensitivity of the species to siltation and other water quality-related effects, it is considered that the proposed works may result in an indirect significant water quality impact to the species through sedimentation and a reduction of water quality. Pearl mussel occur at high densities immediately downstream of the bridge apron and at low densities locally under other spans of the bridge at low densities. Mussels in the footprint of the bridge could be impacted by sedimentation and other water pollution (e.g. cement, hydrocarbons and or waterproofing compounds). A decline in water quality could significantly impact freshwater pearl mussel populations present in the vicinity of Ardcahan Bridge via impacts to habitat extent, water quality, substratum quality and host fish (i.e. salmonid) populations. While adult pearl mussel can close their shells during periods of heavy siltation, prolonged closure during heavy silt loading episodes can lead to death through starvation or oxygen deprivation (Moorkens, 1999). Heavy loads of siltation can also result in the premature release of glochidia (larvae) and poor survival in substrata due to degradation by sedimentation. Poor substrata conditions are associated with high redox loss (i.e. low levels of oxygen when compared with open water). Therefore, mitigation is required to ameliorate any significant negative effects on local populations inclusive of the prevention of inadvertent release of chemicals including hydrocarbons, water proofing product and or cement. Furthermore, changes in the abundances of water-crowfoot through sedimentation may increase thermal stress and or encourage algae proliferation due to increased light that would further impact habitat quality.

**Table 4.2** Assessment of impacts to conservation objectives of freshwater pearl mussel (*Margaritifera margaritifera*) [1029]

Attribute/measure	Target	Assessment of potential effects	Mitigation required
Distribution	Restore distribution to 12.2km	Transportation of sediment and or chemicals into surface waters as a result of bridge remediation works may increase the turbidity within the system, reducing feeding/filtering activity, growth and survival of downstream pearl mussel populations. Changes in the abundance of water-crowfoot vegetation may increase thermal stress to pearl mussel, increase algae cover on the bed that would cause adverse effects to mussel populations.	Yes
Population size	Restore population to at least 50,000 adult mussels	Transportation of sediment and or chemicals into surface waters as a result of bridge remediation works may increase the turbidity within the system, reducing feeding/filtering activity, growth and survival of downstream pearl mussel populations. Changes in the abundance of water-crowfoot vegetation may increase thermal stress to pearl mussel, increase algae cover on the bed that would cause adverse effects to mussel populations.	Yes
Population structure: recruitment	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	Transportation of sediment and or chemicals into surface waters as a result of bridge remediation works may increase the turbidity within the system, reducing feeding/filtering activity, growth and survival of downstream pearl mussel populations. Changes in the abundance of water-crowfoot vegetation may increase thermal stress to pearl mussel, increase algae cover on the bed that would cause adverse effects to mussel populations.	Yes
Population structure: adult mortality	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	Transportation of sediment and or chemicals into surface waters as a result of bridge remediation works may increase the turbidity within the system, reducing feeding/filtering activity, growth and survival of downstream pearl mussel populations. Changes in the abundance of water-crowfoot vegetation may increase thermal stress to pearl mussel, increase algae cover on the bed that would cause adverse effects to mussel populations.	Yes
Suitable habitat: extent	Maintain habitat extent at 12.2km in the Bandon system and any additional stretches necessary for salmonid spawning	Transportation of sediment and or chemicals into surface waters as a result of bridge remediation works may increase the turbidity within the system, reducing feeding/filtering activity, growth and survival of downstream pearl mussel populations. Changes in the abundance of water-crowfoot vegetation may increase thermal stress to pearl mussel, increase algae cover on the bed that would cause adverse effects to mussel populations.	Yes
Suitable habitat: condition	Restore condition of suitable habitat	Transportation of sediment and or chemicals into surface waters as a result of bridge remediation works may increase the turbidity within the system, reducing feeding/filtering activity, growth and survival of downstream pearl mussel populations. Changes in the abundance of water-crowfoot vegetation may increase thermal stress to pearl mussel, increase algae cover on the bed that would cause adverse effects to mussel populations.	Yes

Attribute/measure	Target	Assessment of potential effects	Mitigation required
Water quality: macroinvertebrate and phytobenthos (diatoms)	Restore water quality macroinvertebrates: EQR greater than 0.90 (Q4-5 or Q5); phytobenthos: EQR greater than 0.93	Transportation of sediment and or chemicals into surface waters as a result of bridge remediation works may increase the turbidity within the system, reducing feeding/filtering activity, growth and survival of downstream pearl mussel populations. Changes in the abundance of water-crowfoot vegetation may increase thermal stress to pearl mussel, increase algae cover on the bed that would cause adverse effects to mussel populations.	Yes
Substratum quality: filamentous algae (macroalgae); macrophytes (rooted higher plants)	Restore substratum quality- filamentous algae: absent or trace (less than 5%); macrophytes: absent or trace (less than 5%)	Transportation of sediment and or chemicals into surface waters as a result of bridge remediation works may increase the turbidity within the system, reducing feeding/filtering activity, growth and survival of downstream pearl mussel populations. Changes in the abundance of water-crowfoot vegetation may increase thermal stress to pearl mussel, increase algae cover on the bed that would cause adverse effects to mussel populations.	Yes
Substratum quality: sediment	Restore substratum quality- stable cobble and gravel substrate with very little fine material; no artificially elevated levels of fine sediment	Transportation of sediment and or chemicals into surface waters as a result of bridge remediation works may increase the turbidity within the system, reducing feeding/filtering activity, growth and survival of downstream pearl mussel populations. Changes in the abundance of water-crowfoot vegetation may increase thermal stress to pearl mussel, increase algae cover on the bed that would cause adverse effects to mussel populations.	Yes
Substratum quality: oxygen availability	Restore to no more than 20% decline from water column to 5cm depth in substrate	Transportation of sediment and or chemicals into surface waters as a result of bridge remediation works may increase the turbidity within the system, reducing feeding/filtering activity, growth and survival of downstream pearl mussel populations. Changes in the abundance of water-crowfoot vegetation may increase thermal stress to pearl mussel, increase algae cover on the bed that would cause adverse effects to mussel populations.	Yes
Hydrological regime: flow variability	Restore appropriate hydrological regime	Given the absence of instream works at Ardcahan Bridge there is considered to be no significant adverse effects to pearl mussel through changes in flow regime.	No
Host fish	Maintain sufficient juvenile salmonids to host glochidial larvae	Transportation of sediments and chemicals into surface waters as a result of bridge remediation works may lead to sedimentation and accumulation of toxic chemicals in instream substrata (gravels) which are important salmonid spawning habitats. This can lead to a reduction of suitable salmonid spawning habitat and/or mortality of developing salmonid eggs within gravels.	Yes
Fringing habitat: area and condition	Restore the area and condition of fringing habitats necessary to support the population	Given the absence of instream works at Ardcahan Bridge and the location of the site compound (temporary works measure) in agricultural grassland habitat only there is considered to be no significant adverse effects to pearl mussel fringing habitat.	No

#### 4.2.2 Water courses of the plain to montane levels with *Ranunculon fluitantis* and *Callitricho-Batrachion* vegetation or aquatic mosses [3260]

**Table 4.3** below assesses the potential for the proposed bridge remediation works to affect conservation objectives and targets for 'Water courses of the plain to montane levels with *Ranunculon fluitantis* and *Callitricho-Batrachion* vegetation [3260]' habitat within the Bandon River SAC (002171).

Siltation may increase coverage of certain rooted macrophyte species (e.g. *Ranunculus* sp.), decreasing overall plant species diversity and also habitat quality for freshwater pearl mussel. Siltation may also cause plant death via smothering.

**Table 4.3** Assessment of impacts to conservation objectives of Water courses of the plain to montane levels with *Ranunculon fluitantis* and *Callitricho-Batrachion* vegetation [3260] habitat

Attribute/measure	Target	Assessment of potential impacts	Mitigation required
Habitat area	Area stable or increasing, subject to natural processes	Transportation of sediment and or chemicals into surface waters as a result of bridge remediation works may increase the turbidity within the River Bandon, decreasing available habitat for certain macrophytes & aquatic bryophytes and potentially causing death via smothering. Siltation may also increase coverage of certain rooted macrophyte species (e.g. <i>Ranunculus</i> sp.), decreasing overall plant species diversity and also habitat quality for freshwater pearl mussel .	Yes
Habitat distribution	No decline, subject to natural processes	As above	Yes
Hydrological regime: river flow	Maintain/restore appropriate hydrological regimes	Given the absence of instream works at Ardcahan Bridge there is considered to be no significant adverse effects to floating river vegetation through changes in flow regime.	No
Hydrological regime: groundwater discharge	Maintain appropriate hydrological regime	No predicted impacts to groundwater given the nature of proposed works.	No
Substratum composition: particle size range	Maintain/restore appropriate substratum particle size range, quantity and quality, subject to natural process	Transportation of sediment and or chemicals into surface waters as a result of bridge remediation works may increase the turbidity within the River Bandon, decreasing available habitat for certain macrophytes & aquatic bryophytes and potentially causing death via smothering. Siltation may also increase coverage of certain rooted macrophyte species (e.g. <i>Ranunculus</i> sp.), decreasing overall plant species diversity and also habitat quality for freshwater pearl mussel .	Yes
Water quality	Restore appropriate water quality to support the natural structure and functioning of the habitat	The escapement of suspended solids, hydrocarbons, waterproofing compound, resins or cement during the construction phase has the potential to negatively impact on water quality.	Yes

Attribute/measure	Target	Assessment of potential impacts	Mitigation required
Typical species	Typical species of the relevant habitat sub-type should be present and in good condition	Sedimentation, chemical release and or the deterioration of water quality has the potential to affect habitat quality downstream of the works area, decreasing available habitat for certain macrophytes & aquatic bryophytes and potentially causing death via smothering. Siltation (via fine sediment) may also increase coverage of certain rooted macrophyte species (e.g. <i>Ranunculus</i> sp.), decreasing overall plant species diversity (especially re: aquatic bryophytes)	Yes
Floodplain connectivity: area	The area of active floodplain at and upstream of the habitat should be maintained/ restored	No predicted impacts to floodplain connectivity given the absence of instream works or to riparian integrity. No changes to flow regimes through structure.	No
Riparian habitat: area and condition	Restore the area and condition of fringing habitats necessary to support the habitat and its sub-types	No predicted impacts to riparian fringing habitat given the nature of the proposed works (i.e. no instream works and no tree cutting or special access requirements through riparian corridors).	No

#### 4.2.3 *Lampetra planeri* (brook lamprey) [1096]

**Table 4.4** below assesses the potential for the proposed bridge remediation works to affect conservation objectives and targets for brook lamprey with the Bandon River SAC (002171). Given the location of the site within the River Bandon River SAC, it is considered that the proposed bridge remediation works may result in a significant water quality effect on brook lamprey life stages through sedimentation and a reduction of habitat quality (e.g. quality & extent of spawning habitat, juvenile population structure etc.). Chemical release may also impact juvenile nursery habitat quality while also damaging spawning habitat quality and or in an emergency spillage situation directly kill lamprey.

**Table 4.4** Assessment of impacts to conservation objectives of *Lampetra planeri* (brook lamprey) [1029]

Attribute/measure	Target	Assessment of potential impacts	Mitigation required
Distribution	Access to all water courses down to first order streams	There are no instream works proposed meaning no barriers to larval lamprey drift or the local movement of non-anadromous brook lamprey adults will be affected.	No
Population structure of juveniles	At least three age/size groups present	Sedimentation as a result of repair works has the potential to affect adult spawning habitat quality downstream of the works area, thus altering juvenile population structure.  Changes in oxygen (of sediment) and or the escapement of suspended solids or chemicals (i.e. hydrocarbons, cement and or waterproofing compound) during the construction phase has the potential to negatively impact on water quality, causing impacts to overall brook lamprey population structure.	Yes
Juvenile density in fine sediment	Mean catchment juvenile density at least 5/m <sup>2</sup>	As above	Yes

Attribute/measure	Target	Assessment of potential impacts	Mitigation required
Extent and distribution of spawning habitat	No decline in extent and distribution of spawning beds	Sedimentation of instream substrata as a result of works and or chemical release has the potential to affect adult spawning habitat quality downstream of the works area	Yes
Availability of juvenile habitat	More than 50% of sample sites positive	Sedimentation of instream substrata and or chemical release as a result of the proposed works has the potential to affect juvenile habitat quality downstream of the works area.	Yes
Riparian habitat: area and condition	Restore the area and condition of fringing habitats necessary to support the habitat and its sub-types	No predicted impacts to riparian fringing habitat given the localised nature of the proposed works (i.e. no instream works and tree limb cutting within 2m of the bridge only).	No

#### 4.2.4 Alluvial forests with *Alnus glutinosa* and *Fraxinus excelsior* (Alno-Padion, Alnion incanae, Salicion albae)

**Table 4.5** below assesses the potential for the proposed bridge remediation works to affect conservation objectives and targets for Alluvial forests within the Bandon River SAC (002171). Given the location of the site within the River Bandon River SAC, it is considered that the proposed bridge remediation works may result in impacts to the habitat given proposed tree limb cutting.

**Table 4.5** Assessment of impacts to conservation objectives for Alluvial forests with *Alnus glutinosa* and *Fraxinus excelsior* (Alno-Padion, Alnion incanae, Salicion albae)

Attribute/measure	Target	Assessment of potential impacts	Mitigation required
Habitat Area (HA)	Area stable or increasing, subject to natural processes, at least 27.7ha for the sub-site (Milleenanannig, NSNW site code 1306) surveyed. See map 2 for surveyed area.	Alluvial forests with <i>Alnus glutinosa</i> and <i>Fraxinus excelsior</i> (Alno-Padion, Alnion incanae, Salicion albae)* occur in an area of braided river channels and islands downstream of the Long Bridge in Bandon River SAC. As part of the National Survey of Native Woodlands (NSNW; Perrin et al., 2008), the sub-site Milleenanannig (NSNW site code 1306) was surveyed and mapped and the minimum area of alluvial forest in the SAC is estimated to be 27.7ha. Map 2 shows the surveyed area classified as 91E0* (27.7ha). Approximately 0.28ha of 91E0* habitat downstream of the Long Bridge requires further restoration following bank clearance in 2015 (after Ross, 2017). It is important to note that further unsurveyed areas may be present within the SAC.	No
Habitat Distribution	No decline, subject to natural processes. The surveyed woodland location is shown on map 2.	No decline, subject to natural processes. The surveyed woodland location is shown on map 2 Distribution based on Perrin et al. (2008). Note that further unsurveyed areas may be present within the SAC.	No
Woodland size	Area stable or increasing. Where topographically possible, "large"	The target areas for individual woodlands aim to reduce habitat fragmentation and benefit those species requiring 'deep' woodland conditions (Peterken, 2002). In some cases, topographical constraints may restrict expansion.	Yes

Attribute/measure	Target	Assessment of potential impacts	Mitigation required
	woods at least 25ha in size and "small" woods at least 3ha in size		
Woodland structure, cover & height	Total canopy cover at least 30%; median canopy height at least 7m; native shrub layer cover 10-75%; native herb/dwarf shrub layer cover at least 20% and height at least 20cm; bryophyte cover at least 4%	The target aims for a diverse structure with a canopy containing mature trees, shrub layer with semi-mature trees and shrubs, and well-developed field layer (herbs and dwarf shrubs) and ground layer (bryophytes). Assessment criteria are described in Daly et al. (in prep.) and O'Neill and Barron (2013).	Yes
Woodland community diversity, structure and extent	Maintain diversity and extent of community types	Described in Perrin et al. (2008) and NPWS internal files. See also the Irish Vegetation Classification (Perrin, 2016; <a href="http://www.biodiversityireland.ie/projects/nationalvegetation-database/irish-vegetation-classification">www.biodiversityireland.ie/projects/nationalvegetation-database/irish-vegetation-classification</a> )	No
Woodland structure: natural regeneration	Seedlings, saplings and pole age-classes of target species for 91E0* woodlands and other native tree species occur in adequate proportions to ensure survival of woodland canopy	The target species for 91E0* are alder ( <i>Alnus glutinosa</i> ), ash ( <i>Fraxinus excelsior</i> ) and willows ( <i>Salix</i> spp.). Assessment criteria are described in Daly et al. (in prep.) and O'Neill and Barron (2013)	No
Hydrological regime: flooding depth/height of water table	Appropriate hydrological regime necessary for maintenance of alluvial vegetation	Periodic flooding is essential to maintain alluvial woodlands along river and lake floodplains, but not for woodland around springs/seepage areas. The Milleenanannig sub-site (NSNW site code 1306) is on a floodplain and, in wetter months, channels fill and create a series of islands (Perrin et al., 2008)	Yes
Woodland structure: dead wood	At least 19 stems/ha of dead wood of at least 20cm diameter	Dead wood is a valuable resource and an integral part of a healthy, functioning woodland ecosystem. Dead wood comprises old senescent trees, standing dead trees, fallen dead wood (including large branches) and rotten stumps of any tree species. Assessment criteria are described in Daly et al. (in prep.) and O'Neill and Barron (2013)	Yes
Woodland structure: veteran trees	No decline	Veteran trees are important habitats for bryophytes, lichens, saproxylic organisms and some bird species. Their retention is important to ensure continuity of habitats/niches and propagule sources	Yes
Woodland structure: indicators of local distinctiveness	No decline	Includes ancient or long-established woodlands (see Perrin and Daly, 2010), archaeological and geological features as well as red listed and other rare or localised species	Yes
Woodland structure: indicators of overgrazing	All five indicators of overgrazing absent	There are five indicators of overgrazing within 91E0*: topiary effect on shrubs and young trees; browse line on mature trees; abundant dung; severe recent bark stripping; and trampling (Daly et al., in prep.)	No



Attribute/measure	Target	Assessment of potential impacts	Mitigation required
Vegetation composition: native tree cover	No decline. Native tree cover at least 90% of canopy; target species cover at least 50% of canopy	The target species for 91E0* are alder ( <i>Alnus glutinosa</i> ), ash ( <i>Fraxinus excelsior</i> ) and willows ( <i>Salix</i> spp.) (Daly et al., in prep.; O'Neill and Barron, 2013). Species present reported in Perrin et al. (2008) and NPWS internal files	<b>No</b>
Vegetation composition: typical species	At least 1 target species for 91E0* woodlands present; at least 6 positive indicator species for 91E0* woodlands present	A variety of typical native species should be present, depending on woodland type. The target species for 91E0* are alder ( <i>Alnus glutinosa</i> ), ash ( <i>Fraxinus excelsior</i> ) and willows ( <i>Salix</i> spp.). Positive indicator species for 91E0* are listed in Daly et al. (in prep.) and O'Neill and Barron (2013). Species present reported in Perrin et al. (2008) and NPWS internal files	<b>No</b>
Vegetation composition: negative indicator species	Negative indicator species cover not greater than 10%; regeneration of negative indicator species absent	Negative indicator species (i.e. any non-native species, including herbaceous species) should be absent or under control. In general, the following are the most common non-native invasive species in 91E0* woodlands: sycamore ( <i>Acer pseudoplatanus</i> ), beech ( <i>Fagus sylvatica</i> ) and horse-chestnut ( <i>Aesculus hippocastanum</i> ) (Daly et al., in prep.)	<b>Yes</b>
Vegetation composition: problematic native species	Cover of common nettle ( <i>Urtica dioica</i> ) less than 75%	Common nettle ( <i>Urtica dioica</i> ) is a positive indicator species for 91E0* but, in some cases, it may become excessively dominant. Increased light and nutrient enrichment are factors which favour proliferation of common nettle (Daly et al., in prep.)	<b>No</b>

### 4.3 Mitigation measures

The potential for the Ardcahan Bridge remediation works to cause significant impacts to Bandon River SAC (002171) qualifying interest species and habitats has been identified given direct connectivity with the European site. Mitigation measures are, therefore, required to avoid impacts. Of particular concern are potential water quality impacts which may affect the aquatic qualifying interests of Bandon River SAC (002171), most notably freshwater pearl mussel and brook lamprey due to the proximity of a known populations in relation to the works. Furthermore, the Annex I Habitat, Water courses of the plain to montane levels with *Ranunculion fluitantis* and *Callitriche-Batrachion* vegetation [3260] also occurs in close proximity to the bridge both upstream and downstream and as such also requires mitigation to protect the habitat.

The following best-practice mitigation measures, which incorporate the recommendations arising from consultation with Inland Fisheries Ireland (Macroom) and the Development Applications Unit (DAU) of the National Parks and Wildlife Service (NPWS), will be implemented in order to reduce or avoid potential impacts to aquatic qualifying interest species and habitats within the Bandon River SAC (002171). Some of the key features of the environmental management strategy as described in the CEMP are outlined below.

Mitigation measures for the Ardcahan Bridge remediation works were drafted in consideration of the following consultation responses, legislation and guidance:

- Video Conference with NPWS, 15th December 2020.
- IFI Consultation Response dated 4th April 2023.
- Site meeting with NPWS and IFI dated 8<sup>th</sup> June 2023 (observation via personal communication).
- Council Directive 92/43/EEC on the conservation of natural habitats and of wild fauna and flora;
- Directive 2009/147/EC of the European Parliament and of the Council of 30 November 2009 on the conservation of wild birds;
- Directive 2000/60/EC of the European Parliament and of the Council of 23 October 2000 establishing a Framework for Community Action in the Field of Water Policy;
- IFI (2016). Requirements for the Protection of Fisheries Habitat during Construction and Development Works at River Sites;
- IFI (2016). Guidelines for the Crossing of Watercourses During the Construction of National Road Schemes;
- The Planning System and Flood Risk Management - Guidelines for Planning Authorities - Department of Environment, Heritage and Local Government (DoEHLG) and the Office of Public Works (OPW);
- CIRIA Environmental Good Practice on Site;
- Best Practice Guide BPGCS005, Oil Storage Guidelines;
- CIRIA Control of Water Pollution from Linear Construction Sites. Technical Guidance (C648);
- CIRIA Control of Water Pollution from Construction Sites. Guidance for Consultants and contractors (C532);
- CIRIA Sustainable Construction Procurement. A Guide to Delivering Environmentally Responsible Projects (C571);
- UK Pollution Prevention Guidelines (PPG):
  - PPG1: Understanding your environmental responsibilities – good environmental practice;
  - PPG2: Above Ground Oil Storage Tanks;
  - PPG3: Pollution Prevention Guidelines;
  - PPG4: The Disposal of Sewage where no Mains Drainage is Available;
  - PPG5: Works in, near or liable to affect Watercourses;
  - PPG6: Working at Construction and Demolition Sites;
  - PPG7: The Safe Operation of Refuelling Facilities;
  - PPG8: Safe Storage and Disposal of Used Oil;
  - PPG21: Pollution Incident Response Planning;
  - PPG22: Dealing with Spills; and
  - PPG26: Drums and intermediate bulk containers.
- South Western River Basin District River Basin Management Plan (2009-2015);
- Biological River Water Quality Data (EPA)

While no written communication was received from the NPWS at the time of writing, verbal communication with the NPWS based on the site visit carried out on the 8<sup>th</sup> June 2023 is summarised below. Following the onsite meeting and identification of ecological constraints associated with the original scope of works, Cork County Council and Fehily Timoney removed the requirement for instream works (i.e. removal of gravel build up from the eastern arch) as it was determined that these works could not be completed without the destruction of riparian tree root systems and associated bank destabilisation. However, to facilitate scaffold construction, localised tree trimming within 2m of the bridge structure would be required.

The NPWS requested that chemical water testing be carried out before, during and after construction to ensure no deterioration in water quality.

This NIS report thus focused on the works as proposed under the revised scope (i.e. no instream works, scaffold installation and bridge deck and corrosion remediation only).

#### 4.3.1 Mitigation by design

- All site clearance works to minimise land take of habitats and flora and restricted to the establishment of the site compound area in agricultural grassland. No impingement on the riparian treelines of the River Bandon required and no instream works.
- Aggregate with low content of fines will be used for construction of the temporary compound hard standing in order to minimise sediment washout.
- A geotextile layer shall be installed under the site compound hard standing to minimise soil disturbance when the hard standing material is removed.
- All washout will be carried out in a dedicated area of the temporary compound as shown in CEMP Figure 3-1. Small mortar mixers will be required to be cleaned in a designated concrete wash-out area (Figure 3-1). A purpose-built concrete wash-out facility will be installed to separate solids and liquids. Solids shall be removed to an appropriate waste management facility, wastewater will be collected in a secondary holding tank for recycling in the washing process. Wash-out facilities will be positioned away from drainage features and fuel storage areas. The area will be re-vegetated following the completion of works. Silt fencing will be left around any bare ground areas until they have re-vegetated.
- A suspended scaffold supported by the bridge deck shall be designed by a temporary works design specialist. Suspended scaffold to be installed in order to provide access to the bridge arch, this will fully encase the bridge and will be supported by the bridge itself. Note that the scaffold will be fully installed from the bridge without the need for any access to the riverbed. This will prevent any instream works and prevent impacts to pearl mussel situated under the footprint of the bridge. The scaffold construction will require tree limb cutting but this will be limited to overhanging limbs within 2m of the bridge structure.

No main stems will be cut and an ECoW will supervise the cutting to ensure only the minimum amount of limbs are removed to prevent excessive light penetration of the riverbed. The localised and minimal removal of tree limbs will prevent adverse effects to gallery woodland habitat that has links with the Annex I Habitat, 'Alluvial forests with *Alnus glutinosa* and *Fraxinus excelsior* (Alno-Padion, Alnion incanae, Salicion albae)'.

### 4.3.2 Water quality

- A CEMP with ecological mitigation is included within the application for consent for the proposed development. The ecological mitigation including that from the NIS will be reviewed by an appointed Ecological Clerk of Works (ECoW). The mitigation considers all potentially polluting activities from the construction stage and includes mitigation measures for critical elements such as storage and handling of potentially polluting materials.
- All efforts to minimise pollution and siltation escapement to the river will be made in light of proposed bridge remediation works and an Ecological Clerk of Works (EcoW) will be present to supervise works and as informed by their knowledge of the site's ecological sensitivities (i.e. pearl mussel and other downstream qualifying interest habitats/species).
- Silt fencing will be erected on the downslope side of the site compound location.
- Daily inspections of surface waters in the vicinity of the site will be undertaken, with any escape of contaminants notified immediately to IFI.
- Wheel wash facilities will be located at the site entrance to reduce construction traffic fouling public roads. Each wheel wash will come with a water tank which will be filled regularly. These units will be self-contained and will filter the waste for ease of disposal. Waste will be removed from each unit and from the site to an appropriate waste management facility by the proposed contractor.
- Operations to cease during and after periods of heavy rainfall, due to the potential for loss of nutrients and/or mobilisation of sediment, fine organic matter and debris into receiving waters. Heavy rain is defined by Met Éireann as a precipitation rate that exceeds 2 mm per hour averaged over 3 or 6 hours. Consult the Met Éireann website [www.met.ie](http://www.met.ie) and review the forecast details for the meteorological station nearest to the site. While no instream works are required this will ensure that risks to the flooding of the suspended scaffold and material contained on the structure can be cleaned and removed before potential river spates.
- All temporary works shall be designed to accommodate water levels up to 0.75m (71.03m AOD malin). Where water level exceeds 0.5m (70.78m AOD Malin) rising temporary works shall be demobilised.
- Water levels will be monitored at all times by site management to anticipate flood events. Works will cease during spate events and the works area will be prepared to ensure that flood risk will not result in material escapement or spills which may indirectly impact qualifying interest habitats or species downstream.
- Chemical testing will be undertaken as per the NPWS request from the site meeting on the 8<sup>th</sup> June 2023. Turbidity and pH will be measured daily with a site log kept. Sampling of suspended solids will be taken upstream and downstream weekly, prior to commencement and during works. Should results show a 10% increase in suspended solids or turbidity downstream of the site this will be brought to the attention of the contractor by the ECoW and any suitable contingency measures will be instigated. Silt levels in the downstream river gravels should not be artificially elevated as defined in the thresholds of the Freshwater Pearl Mussel Regulations S.I. No. 296 of 2009 and those conditions outlined under best guidance for freshwater pearl mussel (CEN, 2017).
- Machinery will only be refuelled in the site compound, located a safe distance from the Bandon River or potential surface water pathways (i.e.,  $\geq 25$ m). Any diesel or fuel oils stored on site will be bunded to 110% of the capacity of the storage tank. Design and installation of fuel tanks will

be in accordance with best practice guidelines BPGCS005 (Oil Storage Guidelines). Mobile bowzers, tanks and drums will be stored in a secure, impermeable storage area, away from drains and open water. Ancillary equipment such as generators, fuel storage tanks will be contained within a bunded area. Only designated trained operators will be authorised to refuel plant on site and emergency spill kits will be present at equipment for all refuelling events. An emergency spill kit with absorbers etc. is to be kept on site in the event of an accidental spill.

- Paint will be stored in a bunded container.
- Statutory check to be carried out on machinery weekly (GA2 Form).
- A field tent and bund to be erected on the scaffolding to contain and prevent any contaminants or debris from sandblasting, welding, painting, rendering, drainage outlet upgrades and any associated activities from falling into the river. The scaffold tent and bund will be cleaned and material to be sent to an appropriate off-site waste management facility. Field tent to be sealed to ensure sand and debris won't leak out to the river.
- Clean sand only to be used during sandblasting.
- Prior to deck works, the deck drainage outlets shall be blocked with a waterproof membrane to prevent run off or debris entering the water course. Deck drainage outlets shall be reinstated following completion of deck works.

#### 4.3.3 Tree Branch/Limb Cutting

- Tree branch/limb cutting will only be undertaken within 2m of the Ardcahan Bridge structure. The branches/limbs will only be cut by hand and all work will be supervised by an ECoW.
- There will be no interference with the main stems or root systems of riparian trees within 2m of the bridge structure.
- Any large tree limbs removed will be cut into 1m sections and placed on the lower river bank downstream of the bridge to provide deadwood supply to the river. This will be supervised by the ECoW.

#### 4.3.4 Invasive species (biosecurity)

- All contractors must implement routine cleaning and drying of their equipment once they leave a site and before using it again on a new watercourse. Best practice according to the Check-Clean-Dry approach will be followed to minimise the risk of introducing invasive species to the proposed works area, which may impact on qualifying interest habitats and species. There were no invasive species recorded in the vicinity of Ardcahan Bridge apart from a small stand of winter heliotrope. This species will not be encroached upon as it does not occur in the footprint of the works and thus there will be no risk of further spread.
- During the duration of the proposed bridge remediation works, all plant/equipment used onsite shall be cleaned, dried and disinfected prior to and after demobilisation from the works area.
- To prevent spread of hazardous invasive species (and pathogens), high-pressure steam cleaning of all items of plant and equipment to be used in and adjacent to waters will be undertaken prior to and after use. The wash-down area will be located in the site compound area.

All PPE including waders, boots etc. will be treated using Virkon Aquatic disinfectant prior to use in and adjacent to waters. The treated materials will be allowed to dry before use, and this treatment will be carried each time new equipment arrives on-site.

- Importation of materials to the site shall comply with Regulation 49 of the EC (Birds and Natural Habitats) Regulations 2011-2021.

#### 4.3.5 Operational phase mitigation to protect qualifying interests

There will be no significant change to the usage of the road crossing following remediation. Therefore, traffic volumes will remain consistent with existing use. There will be no hydrological change to the channel given the absence of instream works and or works requiring the removal of riparian trees.

#### 4.3.6 Decommissioning phase mitigation to protect qualifying interests

Decommissioning of Ardcahan bridge is not proposed, and therefore decommissioning phase mitigation is not required.

### 4.4 Residual Effects

Residual effects (i.e., post-mitigation) to Bandon River SAC (002171) qualifying interest habitats and species are summarised in **Table 4.4** below.

Taking cognisance of measures incorporated into the project design and mitigation measures to avoid effects which are considered in the preceding section, the proposed project will not have any adverse effect on the integrity of the Bandon River SAC considering these site's conservation objectives and status.

**Table 4.5** Identification of residual adverse effects to qualifying interests of Bandon River SAC (002171) (post-mitigation)

Qualifying Interests	Potential for residual adverse effects	Rationale	Potential residual effects
Margaritifera margaritifera (freshwater pearl mussel) [1029]	No	The small number of mussels n=14 in the direct vicinity of the bridge structure will be avoided by suspended scaffold to facilitate bridge works without piers in the water column. No instream works proposed. Strict adherence to the CEMP in accordance with NPWS and IFI requirements will ensure best approach to mitigation. Works supervision by ECoW will ensure implementation of schedule of mitigation and ongoing monitoring inclusive of water quality throughout construction.	No significant impacts to freshwater pearl mussel or their conservation objectives predicted following implementation of the mitigation measures outlined above
Lampetra planeri (brook lamprey) [1096]	No	No instream works. Strict adherence to the CEMP in accordance with NPWS and IFI requirements will ensure best approach to mitigation. Works supervision by ECoW will ensure implementation of schedule of mitigation and ongoing monitoring inclusive of water quality throughout construction.	No significant impacts to brook lamprey or their conservation objectives predicted following implementation of the mitigation measures outlined above
Water courses of plain to montane levels with the Ranunculion fluitantis and Callitriche-Batrachion vegetation or aquatic mosses [3260]	No	No instream works. Strict adherence to the CEMP in accordance with NPWS and IFI requirements will ensure best approach to mitigation. Works supervision by ECoW will ensure implementation of schedule of mitigation and ongoing monitoring inclusive of water quality throughout construction.	No significant impacts to this Annex I habitat or its conservation objectives predicted following implementation of the mitigation measures outlined above
Alluvial forests with <i>Alnus glutinosa</i> and <i>Fraxinus excelsior</i> (Alno-Padion, Alnion incanae, Salicion albae) [91EO]	No	Tree limb cutting will be limited to within 2m of the existing Ardcahan Bridge structure. Only limbs/ branches will be removed with no interference to the main stems of riparian trees. The tree cutting will be supervised by an ECoW inclusive of the establishment of access and egress routes to the bridge.	No significant impacts to this Annex I habitat or its conservation objectives predicted following implementation of the mitigation measures outlined above

#### 4.5 Stage Two - Natura Impact Statement summary and conclusion

This report provides the necessary information to enable the competent authority to perform the required Appropriate Assessment for the remediation works at Ardcahan Bridge on the River Bandon, thereby enabling the competent authority to perform its statutory function and comply with Article 6(3) of Council Directive 92/43/EEC on the conservation of natural habitats and of wild fauna and flora ('Habitats Directive'), in addition to the European Communities (Birds and Natural Habitats) Regulations 2011-2021.

This Natura Impact Statement has considered the potential for the proposed project to give rise to adverse effects on the integrity of the Bandon River SAC (002171) alone and in combination with other plans and projects, considering the site's structure, function and conservation objectives. Where potentially negative effects were identified, mitigation measures have been recommended to prevent these effects.

In conclusion, following a comprehensive evaluation of the effects on the qualifying interests and conservation objectives for the SAC following the implementation of the proposed mitigation measures, it has been concluded that there will be no residual effects. Therefore, the proposed bridge remediation works will not have an adverse effect on the integrity of the qualifying interest species and habitats of the Bandon River SAC (002171).



## 5. References

- CEN (2017). Water quality - Guidance standard on monitoring freshwater pearl mussel (*Margaritifera margaritifera*) populations and their environment. CEN - EN 16859
- Consultation (Conference Call) (NPWS, Cork Co. Council, FT, 2020). Online video conference call 15<sup>th</sup> December 2020. Participants - Jervis Good, Kathryn Freeman, Declan O'Donnell (NPWS); Mark O'Sullivan (Cork Co. Council); Tadhg Landers, Ben O Dwyer (Fehily Timoney); Ross Macklin (Triturus).
- Consultation Response (IFI, 2023). Response via email dated 4<sup>th</sup> April 2023 from Michael Mc Partland, Senior Fisheries Environmental Officer, Macroom.
- Dawson, H. A., Quintella, B. R., Almeida, P. R., Treble, A. J., & Jolley, J. C. (2015). The ecology of larval and metamorphosing lampreys. In *Lampreys: biology, conservation and control* (pp. 75-137). Springer, Dordrecht.
- DEHLG (2009). *Appropriate Assessment of Plans and Projects in Ireland. Guidance for Planning Authorities.* Department of the Environmental Heritage and Local Government.
- DEHLG (2010). *Second Draft Bandon Freshwater Pearl Mussel Sub-basin Management Plans (2009-2015).* March 2010. National Parks and Wildlife Service, Department of the Environment, Heritage and Local Government, Dublin. Available at: <https://www.catchments.ie/download/freshwater-pearl-mussel-plans-2009-2015/>
- Denyer, J. (2017). *Enniscorthy Flood Defence Scheme: macrophyte survey.* Report prepared for Scott Cawley Ltd. by Denyer Ecology, June 2017.
- 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](http://ec.europa.eu/environment/nature/legislation/habitatsdirective/docs/Int_Manual_EU28.pdf)
- EPA (2013). *Integrated Biodiversity Impact Assessment – Streamlining AA, SEA and EIA Processes: Practitioner's Manual.* STRIVE Report Series No. 106 EPA STRIVE Programme 2007–2013. Prepared for the Environmental Protection Agency by Ainhoa González.
- European Commission (2000). *Managing Natura 2000 Sites: The Provisions of Article 6 of the Habitat's Directive 92/43/EEC (2000 and updated draft April 2015).*
- European Commission (2019). *Managing Natura 2000 sites: the provisions of Article 6 of the Habitats Directive 92/43/EEC.* Brussels, (2019/C 33/01). OJ C 33, 25.1.2019.
- 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.*
- European Commission (2021). *Assessment of Plans and Projects Significantly Affecting Natura 2000 sites: Methodological Guidance on the Provisions of Article 6(3) and 6(4) of the Habitats Directive 92/43/EEC.*
- European Commission (2007). *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 European Commission.

European Commission (2018). Managing Natura 2000 sites: The provisions of Article 6 of the 'Habitats' Directive 92/43/EEC. Commission notice, November 2018.

Fehily Timoney (2020) Ecological Appraisal Report for Cork County Bridge rehabilitation Contract 2, 2019 South & West Regions: Ardcahan.

Fehily Timoney & Company (2023) Cork County Bridge Rehabilitation Services. Ardcahan Bridge Construction Environmental Management Plan.

Fry, J. & Scott, P. (2011). Developing IBIA: A standardised AA review package. In Impact Assessment and Responsible Development for Infrastructure, Business & Industry: 31st Annual meeting of IAIA, Puebla, Mexico (Vol. 29).

Hyvärinen, H., Saarinen-Valta, M., Mäenpää, E., & Taskinen, J. (2021). Effect of substrate particle size on burrowing of the juvenile freshwater pearl mussel *Margaritifera margaritifera*. *Hydrobiologia*, 848(5), 1137-1146.

Kelleher, C. (2011). Floating river vegetation (EU Habitat code 3260) – a review of the habitat description and its distribution in Ireland. Unpublished report for National Parks & Wildlife Services. Department of Arts, Heritage and the Gaeltacht, Dublin, Ireland.

Lasne, E., Sabatie, M-R. & Evanno, G. (2010) Communal spawning of brook and river lampreys (*Lampetra planeri* and *L. fluviatilis*) is common in the Oir River (France). *Ecology of Freshwater Fish* 2010: 19: 323–325.

Macklin, R. & Brazier, B. (2022). Floating river vegetation survey of the lower River Slaney for the Enniscorthy Flood Relief Scheme. Report prepared by Triturus Environmental Ltd. for Mott MacDonald. December 2022.

Malmqvist, B. (1980). The spawning migration of the brook lamprey, *Lampetra planeri* Bloch, in a South Swedish stream. *Journal of Fish Biology*, 16(1), 105-114.

Möckel, S. (2017). The European ecological network “Natura 2000” and the appropriate assessment for projects and plans under Article 6(3) of the Habitats Directive. In: Möckel S (Ed.) Natura 2000 appropriate assessment and derogation procedure – legal requirements in the light of European and German case-law. *Nature Conservation* 23: 1–29.

Moorkens, E.A. (1999). Conservation Management of the Freshwater Pearl Mussel *Margaritifera margaritifera*. Part 1: Biology of the species and its present situation in Ireland. *Irish Wildlife Manuals*, No. 8.

Moser, M. L., Almeida, P. R., Kemp, P. S., & Sorensen, P. W. (2015). Lamprey spawning migration. In *Lampreys: biology, conservation and control* (pp. 215-263). Springer, Dordrecht.

NPWS (2010). Appropriate Assessment under Article 6 of the Habitats Directive: Guidance for Planning Authorities. Circular NPW 1/10 & PSSP 2/10.

NPWS (2016). Conservation Objectives: The Gearagh SAC 000108. Version 1. National Parks and Wildlife Service, Department of Arts, Heritage, Regional, Rural and Gaeltacht Affairs.

NPWS (2019). Conservation Objectives: Bandon River SAC 002171. Version 1. National Parks and Wildlife Service, Department of Culture, Heritage and the Gaeltacht.

- NPWS (2019a). The Status of EU Protected Habitats and Species in Ireland. Volume 2: Habitat Assessments. Unpublished NPWS report. Edited by: Deirdre Lynn and Fionnuala O'Neill;
- NPWS (2019b). The Status of EU Protected Habitats and Species in Ireland. Volume 3: Species Assessments. Unpublished NPWS report. Edited by: Deirdre Lynn and Fionnuala O'Neill;
- NPWS (2020). Conservation objectives for The Gearagh SPA [004109]. Generic Version 7.0. Department of Culture, Heritage and the Gaeltacht.
- NRA (2005). Guidelines for the Crossing of Watercourses During the Construction of National Road Schemes.
- NRA (2009). Environmental Assessment and Construction Guidelines. Published by the National Roads Authority.
- NRA (2010). Guidelines on The Management of Noxious Weeds and Non-Native Invasive Plant Species on National Roads. National Roads Authority. December 2010.
- NRA (2013). Introduction to the NRA Design Manual for Roads and Bridges.
- OPR (2021). Appropriate Assessment Screening for Development Management. OPR Practice Note PN01. Office of the Planning Regulator. March 2021.
- OPW (2021). Design Guidance For Fish Passage on Small Barriers. Office of Public Works, Galway.
- Rooney, S.M., O'Gorman, N. & King, J.J. (2013). Aspects of brook lamprey (*Lampetra planeri*) spawning in Irish waters. *Biology and Environment: Proceedings of the Royal Irish Academy* 113B: 1-13
- Triturus (2019a). Stage I and II Freshwater Pearl Mussel surveys at Lisheenleigh & Ardcahan Bridges, River Bandon & River Blackwater, Co. Cork. Report prepared by Triturus Environmental Ltd. on behalf of Fehily Timoney & Company. December 2019.
- Triturus (2019b). Aquatic baseline survey of selected bridge sites, Co. Cork [Edited for Ardcahan Bridge or site 3]. Report prepared by Triturus Environmental Ltd. on behalf of Fehily Timoney & Company. May 2019.
- Triturus (2023). Appropriate Assessment Screening for Ardcahan Bridge, Co. Cork. Report prepared by Triturus Environmental Ltd. for Fehily Timoney and Company. March 2023.
- Weekes, L., Kącki, Z., FitzPatrick, Ú., Kelly, F., Matson, R., & Kelly-Quinn, M. (2018). An Irish national vegetation classification system for aquatic river macrophytes. *Applied Vegetation Science*, 21(2), 322-340.



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