Limerick City & County Council

Natura Impact Statement

Limerick City & Environs Flood Relief Scheme

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1 Introduction

1.1 Overview

The Scheme area for the Limerick City & Environs Flood Relief Scheme (hereafter referred to as the Limerick FRS), is located within the Shannon Upper and Lower River Basin and is subject to both coastal and fluvial flooding. The Office of Public Works (OPW) working in partnership with Limerick City and County Council (LCCC) and Clare County Council, completed the Shannon Catchment Flood Risk Assessment and Management (CFRAM) Study in 2018. The Shannon CFRAM Study identified Limerick City as an Area of Further Assessment and concluded that a flood relief scheme is to be undertaken.

Tetra Tech has been commissioned by LCCC as Engineering and Environmental Consultants to design and progress the delivery of a Limerick FRS. The objective of the overall project is the identification, design and submission (for planning consent) of a flood scheme, that is technically, socially, environmentally and economically acceptable, to alleviate the risk of flooding to the community of Limerick to a determined standard of protection, and to procure, manage and oversee the construction of that scheme.

This Maritime Usage Licence Application (MULA) is required to undertake site investigations (hereafter referred to as the SI works) within the upper Shannon Estuary. These SI works, which are discussed in more detail in **Section 2** below, are required to inform detailed construction and engineering design of the Limerick FRS and to provide baseline data for any subsequent environmental assessments. Information collected by the SI works will support the overall Limerick FRS project in its aim to alleviate coastal and fluvial flooding in Limerick City and surrounding areas. Therefore, this MUL represents a critical step towards supporting future climate resilience within the community of Limerick.

For the avoidance of doubt, no construction works associated with the flood relief scheme are included under this MUL application.

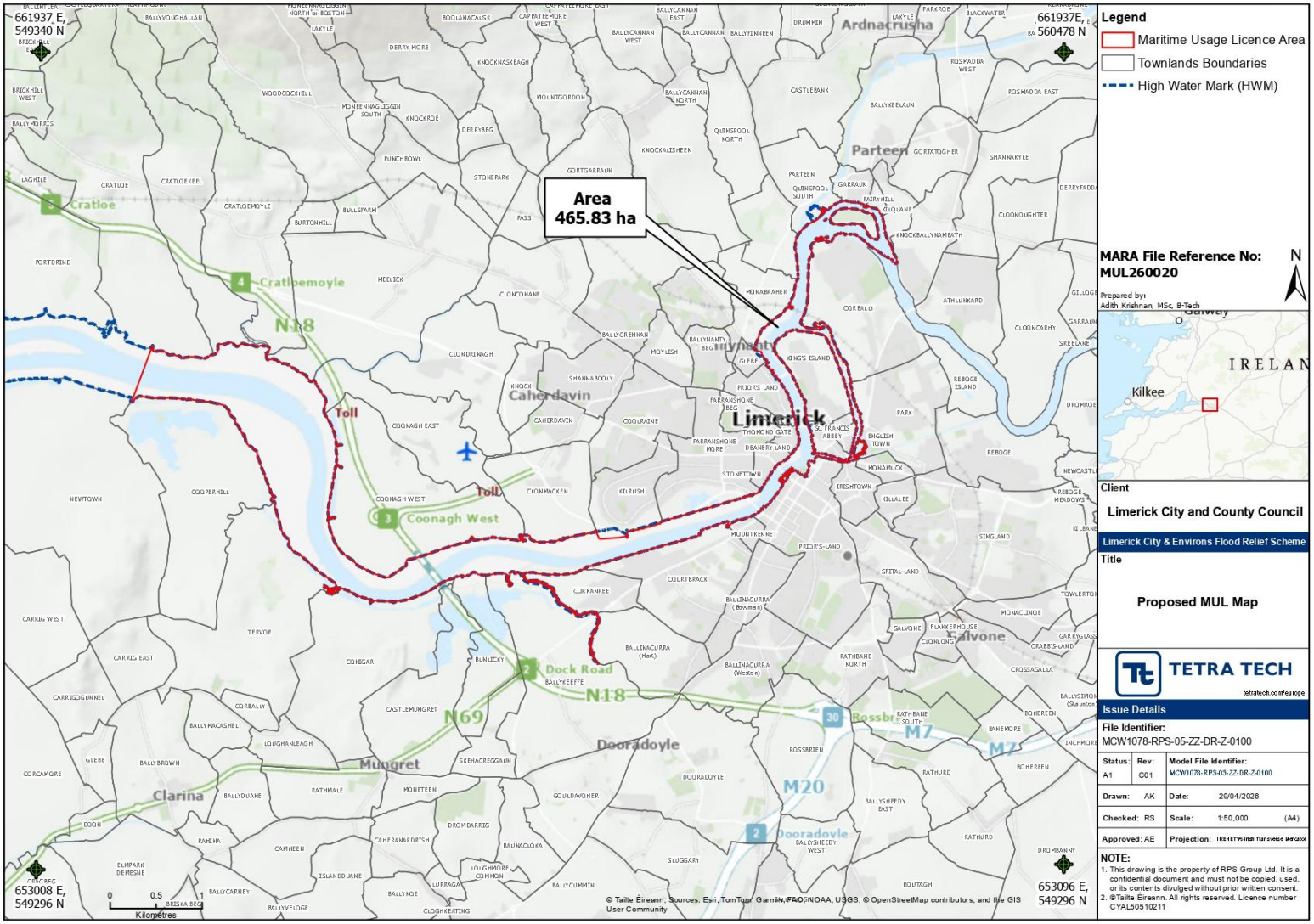


Figure 1-1: MUL Area for Proposed SI Works

1.2 Accompanying Report

The MULA consists of the following documents and reports:

- Maritime Usage Licence Application (MULA) Form and relevant attachments;
- Project Description;
- Supporting Information for Screening for Appropriate Assessment (SISAA) report;
- Annex IV Species Risk Assessment;
- Subsea Noise Technical Report; and
- Natura Impact Statement (NIS).

1.3 Purpose of this Report

This report has been prepared by Tetra Tech, on behalf of LCCC, to provide information on the SI Works proposed to be undertaken for the Limerick FRS project in support of the MULA to MARA. This report provides all necessary information to MARA to allow for completion of an Appropriate Assessment (AA) of the potential for adverse effects on the integrity of a European site(s), arising from the SI works either alone or in-combination with other plans or projects.

This report provides a brief description of the SI works, consisting of geophysical, geotechnical and environmental survey activities, that are proposed to be undertaken. A more detailed description is provided in the separate 'Project Description' document (Report ref: MCW1078-RPS-05-ZZ-RO-Z-1015). The Project Description includes details of the methods, equipment and quantities for proposed activities. The results of the SI works will be used to inform the detailed engineering design for the Limerick FRS and will also provide baseline data for subsequent environmental assessments.

1.4 Statement of Authority

The technical competence of the authors is outlined below.

Aoife Edgely is an Associate Marine Scientist in the Environmental Services Business Unit at Tetra Tech. She has over 15 years' experience in the marine science field and is a Chartered Environmentalist and a Full Member of the Institute of Environmental Sciences (IES). Aoife holds an honours degree in Environmental Science from Trinity College Dublin and a Master's in Marine Environmental Protection from Bangor University, Wales. MUL Aoife has delivered the environmental assessments for a wide range of marine and coastal projects, including environmental impact assessment (EIA), AA and Annex IV species reports.

Rachael Shaw is a Project Scientist in the Environmental Services Business Unit at Tetra Tech. She holds a Bachelor's Degree in Marine Science from the University of Galway and Master's Degree in Climate Change and Managing the Marine Environment from Heriot-Watt University Edinburgh. She has five years' experience working in consultancy, assisting

on a wide range of projects from offshore renewable energy projects to flood relief schemes, including marine and terrestrial surveys. She is a full member with IES.

Róisín Murphy is a Scientist in the Environmental Services Business Unit at Tetra Tech. She holds an honours degree in Zoology (B.Sc.) and Master's degree in Marine Biology, both from University College Cork. She has two years' experience as a Project Manager at Cork Nature Network, responsible for marine and river surveys, and has one years' experience in marine licensing and environmental assessments at Tt. She is a qualifying member with IES

1.5 Legislation

1.5.1 European Legislation

Council Directive 92/43/EEC of 21 May 1992 on the Conservation of Natural Habitats and of Wild Fauna and Flora (as amended) (the Habitats Directive) provides protection for habitats and species of European importance; Council Directive 2009/147/EC of the European Parliament and of the Council of 30 November 2009 on the Conservation of Wild Birds (codified version) (the Birds Directive) aims to protect all of the 500 wild bird species naturally occurring in the European Union (EU). Areas designated for protection under the Habitats Directive are described as Special Areas of Conservation (SAC) and those designated under the Birds Directive, as Special Protection Areas (SPA) and the sites are known collectively as European sites within the Natura 2000 network (see **Section 1.5.2.4**). As each member of the EU is required to designate areas in their jurisdictions, the establishment of this Natura 2000 network of sites under Articles 3 to 9 of the Habitats Directive is the key measure to protect nature and biodiversity in the EU.

Articles 6(3) and 6(4) of the Habitats Directive set out the decision-making tests for plans and projects likely to have a significant effect on or to adversely affect the integrity of European sites. Article 7 of the Habitats Directive extends the scope of its articles 6(3) and 6(4) to the Birds Directive.

Article 6(3) establishes the requirement for AA:

> ***"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 subjected to appropriate assessment of its implications for the site in view of the site's conservation objectives. Considering the conclusions of the assessment of the implications for the site and subject to the provisions of paragraph 4, the competent national authorities shall agree to the plan or project only after having ascertained that it will not adversely affect the integrity of the site concerned and, if appropriate, after having obtained the opinion of the public."***

Further detail on the stages of AA is provided in **Section 3.2** below.

In the context of the SI works to which this MULA relates, the Habitats and Birds Directives have been transposed into Irish Legislation under, amongst other things, the European Communities (Birds and Natural Habitats) Regulations 2011 (S.I. No. 477 of 2011), as amended.

Each European site has assigned Conservation Objectives (COs) and a list of Qualifying Interests (QI) in the case of SACs or Special Conservation Interests (SCI) in the case of SPAs. The CO concept appears in the eighth recital of the Habitats Directive which reads: "*whereas it is appropriate, in each area designated, to implement the necessary measures having regard to the conservation objectives pursued*". Article 1 then explains that

"*conservation means a series of measures required to maintain or restore the natural habitats and the populations of species of wild fauna and flora at a favourable status*".

The National Parks and Wildlife Service (NPWS) has established COs for each European site in Ireland. These are published on their website. NPWS advise in the general introductory notes of their site-specific conservation objectives (SSCO) series publications, that an AA based on their "*published conservation objectives will remain valid even if the CO targets are subsequently updated, providing they were the most recent objectives available when the assessment was carried out*". NPWS advise that to assist in that regard, it is essential that the date and version are included when objectives are cited.

1.5.2 National Legislation

1.5.2.1 Maritime Area Planning Act

The Maritime Area Planning Act, 2021 (as amended) (the MAP Act) established MARA. One of the functions of MARA is to consider applications for the granting of licences to undertake any of the activities included in Schedule 7 of the MAP Act.

The following definitions in relation to AA are included in Section 2(1) of the MAP Act:

> **"screening for appropriate assessment" shall be construed in accordance with, as appropriate—**
>
> **(a) section 177U of the Act of 2000, or**
>
> **(b) Part 5 of the European Communities (Birds and Natural Habitats) Regulations 2011 (S.I. No. 477 of 2011)**
>
> **"appropriate assessment" shall be construed in accordance with, as appropriate—**
>
> **(a) section 177V of the Act of 2000, or**
>
> **(b) Part 5 of the European Communities (Birds and Natural Habitats) Regulations (S.I. No. 477 of 2011);**

where the Act of 2000 refers to the Planning and Development Act 2000 (as amended).

Under Section 112 of the MAP Act, MARA has been designated as a competent authority for the purposes of Part 5 of the European Communities (Birds and Natural Habitats) Regulations 2011 (S.I. No. 477 of 2011) as amended*;* and AAs to which that Part applies.

MARA is required to carry out a screening for AA in accordance with Section 117(4)(a) of the MAP Act.

Where MARA determines that an AA is required it shall carry out the AA in accordance with Section 117(7)(a) of the MAP Act, 2021.

1.5.2.2 Screening in for Appropriate Assessment

Under Regulation 42(6) of the European Communities (Birds and Natural Habitats) Regulations 2011 (as amended) the competent authority shall determine that an AA of a plan or project *is required* where the plan or project is not directly connected with or necessary to the management of the site as a European site and if it cannot be excluded, on the basis of objective scientific information following screening under this Regulation, that the plan or project, individually or in combination with other plans or projects, will have a significant effect on a European site. Under Section 117(4) of the MAP Act the MARA shall, as soon as is practicable after it receives a MUL application and if it considers it necessary to do so in its capacity as the competent authority, carry out screening for AA in respect of the proposed maritime usage the subject of the application.

Where the competent authority determines that an AA is required, they shall make a determination under Article 6(3) of the Habitats Directive as to whether or not the proposed development would adversely affect the integrity of a European site and an AA shall be carried out by the competent authority before consent is given for the proposed development - see Regulation 42(11) European Communities (Birds and Natural Habitats) Regulations 2011 (as amended).

1.5.2.3Appropriate Assessment

In accordance with Section 117(6)(a) of the MAP Act, MARA requires that the applicant prepare and submit a Natura Impact Statement (NIS) as defined in Regulation 2 of the European Communities (Birds and Natural Habitats) Regulations, 2011 (as amended):

> **"Natura Impact Statement" means a report comprising the scientific examination of a plan or project and the relevant European Site or European Sites, to identify and characterise any possible implications of the plan or project individually or in-combination with other plans or projects in view of the conservation objectives of the site or sites, and any further information including, but not limited to, any plans, maps or drawings, scientific information or data required to enable the carrying out of an Appropriate Assessment.**

Following receipt of the NIS, MARA will, under Section 117(6)(b), satisfy itself as to the adequacy of the NIS and then write to the applicant to require them to give notice to the public that the application and supporting information has been provided to MARA. Following a consultation period of not less than 30 days, MARA will then carry out an AA in accordance with Section 117(7)(a).

1.5.2.4European Sites and Natura 2000 Sites

The term European site is defined in the European Communities (Birds and Natural Habitats) Regulations 2011 (as amended) as:

> **"European Site" means—**
>
> **(a) a candidate site of Community importance,**
>
> **(b) a site of Community importance,**

(c) a candidate special area of conservation,

(d) a special area of conservation,

(e) a candidate special protection area, or

(f) a special protection area;

The term Natura 2000 is defined in the same Regulations as:

> **"Natura 2000" means the European network of special areas of conservation under the Habitats Directive and special protection areas under the Birds Directive, provided for by Article 3(1) of the Habitats Directive and, for the purposes of these Regulations, includes European Sites.**

As such, and as adopted in this report, the term European site refers to one of the sites comprising the Natura 2000 network.

2 Project Description

A detailed Project Description report (Report ref: MCW1078-RPS-05-ZZ-RO-Z-1015), including drawings, has been included as a separate report to limit repetition and reduce the length of reports. Please refer to the Project Description for the detailed information on each of the SI activities summarised in the text below.

The MUL Area covers the geographical area where SI works are required below the high-water mark (HWM) within and immediately downstream of Limerick City in the upper Shannon Estuary. The MUL Area encompasses an area of 466 ha and is illustrated in **Figure 1-1.**

The SI works will comprise geophysical, geotechnical and environmental surveys. It should be noted that all locations shown are provisional only and subject to change due to evolving project options or on-site due to the presence of obstructions/refusals at individual locations.

For the avoidance of doubt, no construction works associated with the flood relief scheme are included under this MUL application.

The activities proposed to be carried out within the MUL Area are summarised in **Table 2-1** below.

Table 2-1: Proposed SI Works Activities

Survey Type	Survey Elements (indicative equipment)	Indicative Equipment (where applicable)	Maximum Quantity (where relevant)
Land-based Topographical Surveys (below HWM, on intertidal zone)	Survey station (e.g., tripod and total station) and mobile surveying equipment.	Hand-held pole mounted Global Navigation Satellite Systems (GNSS) devices.	N/A
Marine Geophysical Surveys (undertaken from survey vessel)	Multi Beam Echosounder (MBES)	Kongsberg EM series, Kongsberg Geoswath series, R2 Sonic series & Reson Teledyne Seabat series	N/A
	Side Scan Sonar (SSS)	Edgetech FS-4200 series, C-Max CM2 series and Klein System 3900-5000 or similar.	
	Sub-bottom profiler (SBP-C)	GeoAcoustics Geopulse series	

Survey Type	Survey Elements (indicative equipment)	Indicative Equipment (where applicable)	Maximum Quantity (where relevant)
	Sub-bottom profiler (SBP-P)	Innomar smart, quattro (QBM) sixpack (HBM), Innomar SES 2000 compact light, Innomar standard quattro (DBM) sixpack (DBM), Innomar medium 100	
Marine Geomagnetic Surveys (undertaken from survey vessel, no acoustic signal)	Magnetometer	Geometrics G-882, Marine Magnetics SeaSPY, G-Tec Magwing System or similar.	N/A
Marine Geotechnical Surveys (undertaken from survey vessel(s)/ jack-up barge; JUB/spud barge)	Rotary and cable percussive boreholes	Drill rig and JUB / drilling vessel	51
	Standard Penetration Tests (SPTs)	Split spoon sampler/JUB	
Marine Environmental Surveys (undertaken from survey vessel)	Drop-down video (DDV) and/or Remotely Operated Vehicles (ROV) survey.	Camera system	N/A
	Grab sampling (incl. contaminant sediment samples)	Hamon / Day / Van Veen Grab (0.1m2)	63
	Water quality samples, including conductivity, temperature and depth (CTD) Measurements.	CTD profiler and Niskin bottler sampler	20
Archaeological Surveys	Intertidal walkover surveys	See Section 2.7.1 of Project Description	N/A

Survey Type	Survey Elements (indicative equipment)	Indicative Equipment (where applicable)	Maximum Quantity (where relevant)
	Marine geophysical survey (this is the same campaign as the Marine Geophysical Surveys described above).	Same equipment as marine geophysical equipment listed	
	Sampling	See Section 2.7.3 of Project Description	N/A
	Dive survey	See Section 2.7.4 of Project Description	N/A
	Wade survey	See Section 2.7.5 of Project Description	N/A

The drawings prepared in support of the MULA are included in the Project Description document. As described in more detail in the Project Description document, the proposed locations shown in the figures and drawings are subject to refinement based on the results of the geophysical and environmental surveys. Similarly, a location may be moved due to the presence of obstructions/ refusals at individual locations, i.e. where a physical object, e.g. a subsurface boulder, prevents the borehole from going to its target depth. In such circumstances, the borehole location is moved to another nearby location away from the obstruction and drilled again to the target depth.

LCCC are seeking a MUL for a period of five years from the date of the granting of the licence. The programme of works for the SI works will be dependent upon award of the MUL and the appointment and availability of survey contractors. Based on the proposed scope of works to be conducted, it is expected that each geotechnical sampling location will take two days to complete; however, this is dependent on weather conditions and contractor/vessel availability. The geophysical survey is likely to take approximately one week to complete, while the environmental survey is likely to take approximately two weeks dependant on weather conditions and contractor/vessel availability.

3 Appropriate Assessment Methodology

3.1 Guidance

The following guidance has been used in the preparation of this NIS:

- EC (2000). Communication from the Commission on the Precautionary Principle. Office for Official Publications of the European Communities, Luxembourg;
- EC (2002). Assessment of Plans and Projects Significantly Affecting Natura 2000 Sites: Methodological guidance on the provisions of Article 6(3) and (4) of the Habitats Directive 92/43/EEC, Office for Official Publications of the European Communities, Luxembourg. European Commission;
- EC (2007). Guidance document on the strict protection of animal species of Community interest under the Habitats Directive 92/43/EEC. European Commission;
- DoEHLG (2009, rev. 2010). Appropriate Assessment of Plans and Projects in Ireland Guidance for Planning Authorities. Department of the Environment, Heritage and Local Government;
- EC (2013). Interpretation Manual of European Union Habitats. Version EUR 28. European Commission, Luxembourg;
- EC (2018). European Commission Notice C (2018) 7621 'Managing Natura 2000 Sites: the provisions of Article 6 of the 'Habitats' Directive 92/43/EEC', Office for Official Publications of the European Communities, Luxembourg;
- OPR (2021). Practice Note PN01: Appropriate Assessment Screening for Development Management. Office of the Planning Regulator, Dublin Ireland.
- EC (2021). European Commission Notice C (2021) 6913 'Assessment of plans and projects in relation to Natura 2000 sites – Methodological guidance on Article 6(3) and (4) of the Habitats Directive 92/43/EEC', Office for Official Publications of the European Communities, Luxembourg.

3.2 Stages

AA is a four-stage process with tests at each stage. The four stages are summarised diagrammatically in **Figure 3-1** below. An important aspect of the process is that the outcome at each successive stage determines whether a further stage in the process is required.

Stages 1-2 deal with the main requirements for assessment under Article 6(3) of the Habitats Directive. Stage 3 is a precursor to Stage 4 which is the main derogation step of Article 6(4).

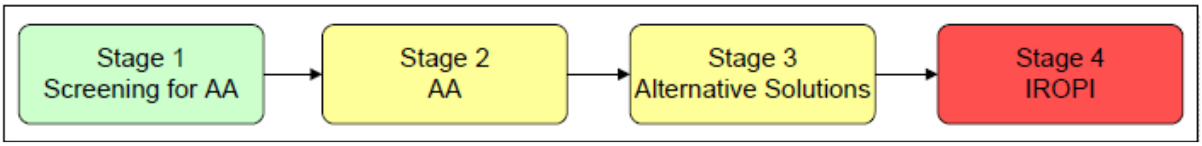


Figure 3-1: Four Stages of Appropriate Assessment

The screening for AA carried out by the competent authority (Stage 1), will determine whether an AA (Stage 2) of the proposed project is required. The purpose of the screening stage is to determine, on the basis of a preliminary assessment and objective criteria, whether a plan or project, alone and in-combination with other plans or projects, could have significant effects on a European site in view of the site's COs.

There is no necessity to establish such an effect; it is merely necessary for the competent authority to determine that there may be such an effect. The need to apply the precautionary principle in making any key decisions in relation to the tests of AA has been confirmed by the case law of the Court of Justice of the European Union (CJEU). Plans or projects that have no appreciable effect on a European site may be excluded. The threshold at this first stage is a very low one and operates as a trigger in order to determine whether a Stage Two AA must be undertaken by the competent authority on the implications of the proposed development for the COs of a European site. Therefore, where significant effects are likely, uncertain or unknown at screening stage, a second stage AA will be required.

Stage 2 is required if it cannot be excluded, on the basis of the objective information provided at Stage 1, that the proposed project, individually or in combination with other projects or plans, will have a significant effect on a European site, in view of the site's COs. In this case, a NIS must be prepared to assist the competent authority to conduct the Stage 2 AA. Stage 2 AA is a focused and detailed examination, analysis and evaluation carried out by the competent authority of the implications of the plan or project, alone and in-combination with other plans and projects, on the integrity of a European site in view of that site's COs. Case law has established that such an AA, to be lawfully conducted, in summary:

(i) must identify, in the light of the best scientific knowledge in the field, all aspects of the proposed development which can, by itself or in-combination with other plans or projects, affect the COs of the European site;

(ii) must contain complete, precise and definitive findings and conclusions and may not have lacunae or gaps; and

(iii) may only include a determination that the proposed development will not adversely affect the integrity of any relevant European site where the competent authority decides (on the basis of complete, precise and definitive findings and conclusions) that no reasonable scientific doubt remains as to the absence of the identified potential effects. If adverse impacts can be satisfactorily avoided or successfully mitigated at this stage,

so that no reasonable doubt remains as to the absence of the identified potential effects, then the process is complete. If the assessment is negative, i.e. adverse effects on the integrity of a site cannot be excluded, then the process must proceed to stage three and, if necessary, stage four.

If it is not possible during Stage 2 to avoid adverse effects on the integrity of one or more European sites through avoidance and/or mitigation, Stage 3 of the process must be undertaken which is to objectively assess whether alternative solutions exist by which the objectives of the plan or project can be achieved. If it can be demonstrated that there are no reasonable alternative solutions, the AA progresses to Stage 4. This final stage is undertaken when it has been determined that negative impacts on the integrity of a European site will result from a plan or project and there are no alternative solutions. At Stage 4 of the AA process, the competent authority must determine if, in spite of a negative assessment of the implications for the site and in the absence of alternative solutions, the project must nevertheless be carried out for imperative reasons of overriding public interest, or 'IROPI', including those of a social or economic nature. In such circumstances, the Member State is required to take all compensatory measures necessary to ensure that the overall coherence of Natura 2000 is protected.

While there is no prescribed form or content for reporting (DoEHLG, 2009) the methodology and format adopted in this report has been in accordance with the European Commission Methodological Guidance on the provision of Article 6(3) and 6(4) of the 'Habitats' Directive 92/43/EEC (EC, 2021) and the European Commission Guidance 'Managing Natura 2000 sites' (EC, 2018), guidance prepared by the NPWS (DoEHLG, 2009) and by the Office of the Planning Regulator (OPR, 2021).

As per DoEHLG (2009):

> **The first test is to establish whether, in relation to a particular plan or project, appropriate assessment is required.**

3.3 Identification of Relevant European Sites

3.3.1 Source-Pathway-Receptor Model

Relevant European sites were identified in the Supporting Information for Screening for Appropriate Assessment (SISAA) report (MCW1078-RPS-05-ZZ-RP-Z-0101) based on the identification of a 'zone of influence' (ZoI) of the SI works using a Source-Pathway-Receptor (S-P-R) model (OPR, 2021) where:

- A 'source' is defined as the individual element of the proposed works that has the potential to impact on a European site, its qualifying features, and its COs;
- A 'pathway' is defined as the means or route by which a source can affect the ecological receptor; and
- A 'receptor' is defined as the QI or Species of Conservation Interest (SCI) of the European site being assessed for which COs have been set.

An S-P-R model is a standard tool used in environmental assessment. In order for an effect to be likely, all three elements of this mechanism must be in place. The absence or removal of one of the elements of the mechanism results in no likelihood for the effect to occur. The S-P-R model was used to identify a list of European sites, and their QIs/SCIs, to which the SI works are linked. These are termed as 'relevant' sites/QIs/SCIs throughout this report.

3.3.2 Zone of Influence

Determination of the SI works' ZoI was achieved by assessing the SI works against the ecological receptors within the MUL Area, in addition to the ecological receptors that could be connected to and subsequently impacted by the project through abiotic and biotic vectors outside the boundary of the MUL Area.

The proximity of the SI works to European sites, and more importantly, proximity of the SI works to QIs and SCIs of the European sites, are of importance when identifying potential likely significant effects. In accordance with the OPR AA Screening Guidelines (2021), the S-P-R model has been used to identify the ZoI to ensure that relevant European sites are identified. The S-P-R model minimises the risk of overlooking distant or obscure effect pathways, while also avoiding an over reliance on arbitrary buffer zones within which all European sites should be considered, and which may be unsupported by scientific evidence (e.g., 15 km). This approach follows the DoEHLG 2009 guidance on AA which states that:

> **"For projects, the distance could be much less than 15 km, and in some cases less than 100m, but this must be evaluated on a case-by-case basis with reference to the nature, size and location of the project, and the sensitivities of the ecological receptors, and the potential for in combination effects" (DoEHLG, 2009; p.32, para 1).**

The ZoI of the SI works on mobile species (e.g., birds, mammals, and fish), and static species and habitats (e.g., saltmarshes, woodlands, and flora) is considered differently. Mobile species have 'range' outside of the European sites in which they are QI. The range of mobile QI species varies considerably, from several metres (e.g., in the case of whorl snails *Vertigo* spp.), to hundreds of kilometres (in the case of migratory wetland birds). A project's ZoI may extend well beyond the project boundary and can impact or have an effect on static species and habitats remote from the SI works; for example, where an aquatic QI habitat or plant is located many kilometres downstream from a pollution source. In particular, hydrological linkages between the SI works and European sites (and their QIs) can occur over significant distances; however, any effect will be site-specific depending on the receiving water environment and nature of the potential impact.

To this end, the ZoI for this project extends outside of the immediate SI works MUL Area to include ecological receptors connected to the project through proximity and connectivity through features such as watercourses and waterbodies in addition to potential connectivity through land and air. See **Section 4.1** for the identification of relevant European sites.

3.3.3 Adverse Effects on the Integrity of European Sites

The European Commission's 2018 Notice (EC, 2019) advises that the purpose of the AA is to assess the implications of the plan or project in respect of the site's COs, either individually or in-combination with other plans or projects. The conclusions should enable the competent authorities to ascertain whether the plan or project will adversely affect the integrity of the site concerned. The focus of the AA is therefore specifically on the species and/or the habitats for which the European sites is designated.

EC (2019) also emphasises the importance of using the best scientific knowledge when carrying out the AA in order to enable the competent authority to conclude with certainty that there will be no adverse effects on the integrity of the site. This guidance notes that it is at the time of adoption of the decision authorising implementation of the project that there must be no reasonable scientific doubt remaining as to the absence of adverse effects on the integrity of the site in question.

As regards the meaning of 'integrity,' this relates to ecological integrity. This can be considered as a quality or condition of being whole or complete. In a dynamic ecological context, it can also be considered as having the sense of resilience and ability to evolve in ways that are favourable to conservation.

The 'integrity of the site' can be usefully defined as (EC, 2019):

> **"The coherent sum of the site's ecological structure, function and ecological processes, across its whole area, which enables it to sustain the habitats, complex of habitats and/or populations of species for which the site is designated."**

EC (2019) notes that if the competent authority considers the mitigation measures are sufficient to avoid the adverse effects on site integrity identified in the AA, they will become an integral part of the specification of the final plan or project or may be listed as a condition for project approval.

EC (2019) advises that it is for the competent authority, in the light of the conclusions made in the appropriate assessment on the implications of a plan or project for the European sites concerned, to approve the plan or project. This decision can only be taken after they have made certain that the plan or project will not adversely affect the integrity of the site. That is the case where no reasonable scientific doubt remains as to the absence of such effects.

EC (2019) also reaffirms that the authorisation criterion laid down in the second sentence of Article 6(3) of the Habitats Directive integrates the precautionary principle and makes it possible effectively to prevent the protected sites from suffering adverse effects on their integrity as the result of the plans or projects. A less stringent authorisation criterion could not as effectively ensure the fulfilment of the objective of site protection intended under that provision. The onus is therefore on demonstrating the absence of adverse effects rather than their presence, reflecting the precautionary principle. It follows that the AA must be

sufficiently detailed and reasoned to demonstrate the absence of adverse effects, in light of the best scientific knowledge in the field.

3.3.4 Consideration of ex-situ effects

EC (2019) advises that Member States, both in their legislation and in their practice, allow for the Article 6(3) safeguards to be applied to any development pressures, including those which are external to European sites, but which are likely to have significant effects on any of them.

The CJEU developed this point when it issued a ruling in case C-461/17 Holohan v. An Bord Pleanála (now An Coimisiún Pleanála), that determined *inter alia* that Article 6(3) of the Habitats Directive must be interpreted as meaning that an AA must on the one hand, catalogue the entirety of habitat types and species for which a site is protected, and, on the other, identify and examine both the implications of the proposed project for the species present on that site, and for which that site has not been listed, and the implications for habitat types and species to be found outside the boundaries of that site, provided that those implications are liable to affect the COs of the site.

In that regard, consideration has been given in this NIS to inform AA to implications for habitats and species located both inside and outside of the European sites considered in the SISAA with reference to those sites' COs where effects upon those habitats and/or species are liable to affect the COs of the sites concerned.

3.3.5 Conservation Objectives

The COs for each European site are to maintain or restore the favourable conservation condition of the QI habitat(s) and/or the QI (or SCI for SPAs) species for which the site has been selected.

The favourable conservation status of a habitat is achieved when:

- Its natural range, and area it covers within that range, are stable or increasing;
- The specific structure and functions which are necessary for its long-term maintenance exist and are likely to continue to exist for the foreseeable future; and
- The conservation status of its typical species is favourable.

The favourable conservation status (or condition, at a site level) of a species is achieved when:

- Population dynamics data on the species concerned indicate that it is maintaining itself on a long-term basis as a viable component of its natural habitats;
- The natural range of the species is neither being reduced nor is likely to be reduced for the foreseeable future; and
- There is, and will probably continue to be, a sufficiently large habitat to maintain its populations on a long-term basis.

The COs of European sites published by the NPWS note that an AA based on the most up to date COs (which are defined by a list of attributes and targets) will remain valid even if the targets are subsequently updated, providing they were the most recent objectives available when the assessment was carried out.

The most up-to-date COs for the European sites being considered have been used in this NIS.

3.3.6 In-combination effects

Article 6(3) of the Habitats Directive requires that in-combination effects with other plans or projects are also considered. As set out in EC (2018), significance will vary depending on factors such as magnitude of impact, type, extent, duration, intensity, timing, probability, cumulative effects and the vulnerability of the habitats and species concerned.

EC (2021) notes that cumulative environmental effects can be defined as effects on the environment caused by the combined action of past, current, and future activities. Although the effects of one development may not be significant, the combined effects of several developments together can be significant.

EC (p.14, 2021) also notes that the “in-combination provision concerns other plans or projects that have been already completed, approved but uncompleted, or proposed (i.e., for which an application for approval or consent has been submitted).” And furthermore (p.31, ibid): “In addition to the effects of the plans or projects that are the main subject of the assessment, it may be appropriate to consider the effects of already completed plans and projects, including those preceding the date of transposition of the directive or the date of designation of the site. The effects of such completed plans and projects would typically form part of the site's baseline conditions which are considered at this stage.”

Plans and projects that have been approved in the past but have not yet been implemented or completed should be included in the in-combination provision. As regards other proposed plans or projects, on grounds of legal certainty it would seem appropriate to restrict the ‘in-combination’ provision to plans that have been proposed, (i.e., for which an application for approval or consent has been submitted) (EC, 2021).

This mirrors the advice contained in EC (2018) which advises that other plans or projects which are completed, approved but uncompleted, or proposed should be considered. EC (2018) specifically advises that “as regards other proposed plans or projects (i.e., other projects not proposed by the Applicant), on grounds of legal certainty it would seem appropriate to restrict the in-combination provision to those which have been actually proposed, i.e., for which an application for approval or consent has been introduced”.

The ability for impacts arising from the proposed project to overlap with those from other projects, plans and activities to result in adverse effects are considered. This means that, in most examples, an overlap of the physical extents of the impacts arising from the two (or more) projects, plans or activities must be established for an in-combination effect to arise. For example, for a cumulative sedimentation effect to be established between the proposed

project and another project, it must be established that the extent of sediment release from both projects has the potential to overlap and may affect a receptor at the same location.

Exceptions to this exist for certain mobile receptors that may move between, and be subject to, two or more separate physical extents of impact from two or more projects. For example, species such as otter may be affected by water quality impacts from the project, as well as those from other projects where the extent of another area affecting water quality does not directly overlap with that of the project. Where relevant, mitigation will be imposed as necessary to prevent adverse in-combination effects.

3.4 Ecological Desk Study

The SISAA (Report ref: MCW1078-RPS-05-ZZ-RP-Z-0101) details the results of the ecological desk study undertaken to describe the receiving environment of the SI works. Those details are not reiterated here to avoid repetition. A description of each European site is provided in **Section 5**.

4 Stage 1 Screening for Appropriate Assessment

4.1 SISAA Report

Through an assessment of the S-P-R model, which considered the ZoI of effects from the SI works, the following findings were reported by Tetra Tech in the SISAA report (Report ref: MCW1078-RPS-05-ZZ-RP-Z-0101):

The SI works are not connected with or necessary to the management of the nature conservation interest of any European site.

The SI works, in the absence of mitigation, have the potential to contribute to habitat loss, alteration or fragmentation, including increased suspended sediment concentrations (SSC)/smothering/water quality of Annex I habitats and Annex II migratory fish species of the:

- Lower River Shannon SAC.

The SI works, in the absence of mitigation, have the potential to contribute to the introduction/spread of invasive species which may impact the QI habitats in:

- Lower River Shannon SAC.

In the absence of mitigation, the geophysical and geotechnical surveys will introduce subsea noise that has the potential to impact on bottlenose dolphin of the:

- Lower River Shannon SAC.

In the absence of mitigation measures, the SI works will introduce above water noise, vibration and lighting that have the potential to impact on SCI bird species of the following European sites:

- River Shannon and River Fergus Estuaries SPA
- Lough Derg (Shannon) SPA

In the absence of mitigation measures, there is the potential for the SI works to result in likely significant in-combination effects, and these effects were screened in for further assessment.

The SISAA report concluded that it cannot be excluded, on the basis of objective information, that the SI works, individually or in combination with other plans or projects, will have a significant effect(s) on European sites. It is recommended that an NIS be prepared to assist MARA in conducting an AA should they agree with the findings of the SISAA.

4.2 MARA Screening Determination

MARA in their Screening for AA for a MUL Application dated 20th October 2026 (MUL260020) also determined that an AA was required. MARA identified the following potential impacts from the proposed SI works:

- Potential habitat disturbance from geotechnical activities (temporary and localised impacts on marine habitats);
- Potential barrier to connectivity (temporary and localised disruption to fish migration);
- Potential reduction in water quality (temporary and localised deterioration in water quality and impacts on migratory fish);
- Potential physical disturbance to juvenile lamprey (localised disturbance, injury or mortality of larval and juvenile lamprey);
- Potential underwater noise disturbance (temporary and localised disturbance to migratory fish and diving birds);
- Potential underwater noise and vibration disturbance (temporary and localised disturbance to common bottlenose dolphin); and
- Potential visual disturbance and above-water noise (temporary and localised disturbance and/or displacement of otter, diving birds and shorebirds/waterbirds).

This updated NIS takes into consideration fully the findings of MARA's AA Screening Determination, in addition to the impacts listed above in Section 4.1. European sites and their relevant QIs and SCIs screened in for appropriate assessment are listed in Table 4-1 below, along with links to their respective SSCOs. All QIs/SCIs and impact pathways screened in by MARA are included.

MARAs screening determination identified one additional project and five plans as having the potential to act in-combination with the proposed SI works. In-combination effects are considered in Section 5.7 of this NIS Report.

Table 4-1 European Sites and relevant QIs and SCIs screened in for Appropriate Assessment

European Site & site code	Distance from proposed MUL area (km)	List of Qualifying Interests	Connections (Source-pathway-receptor)	Qualifying Interests screened in	European Site screened in	Site-specific conservation objectives
Lower River Shannon SAC [002165]	0	**Estuaries [1130]** **Mudflats and sandflats not covered by seawater at low tide [1140]** **Water courses of plain to montane levels with the *Ranunculion fluitantis* and *Callitricho-Batrachion* vegetation [3260]**	Yes – potential habitat disturbance from geotechnical activities.	Yes	Yes	NPWS (2012) Conservation Objectives: Lower River Shannon SAC 002165. Version 1.0. National Parks and Wildlife Service, Department of Arts, Heritage and the Gaeltacht.
		***Petromyzon marinus* (Sea Lamprey) [1095]** ***Lampetra fluviatilis* (River Lamprey) [1099]** ***Salmo salar* (Salmon) [1106]**	Yes – i) potential barrier to connectivity; ii) potential underwater noise disturbance; iii) potential reduction in water quality; iv) potential physical disturbance to larval and juvenile lamprey			
		***Tursiops truncatus* (Common Bottlenose Dolphin) [1349]**	Yes – potential underwater noise and vibration disturbance			
		***Lutra lutra* (Otter) [1355]**	Yes – potential visual and above-water noise disturbance			
River Shannon and River Fergus	0	**Cormorant (*Phalacrocorax carbo*) [A017]** **Scaup (*Aythya marila*) [A062]**	Yes – i) potential visual and above-water noise disturbance ii)	Yes	Yes	NPWS (2012) Conservation Objectives: River Shannon

European Site & site code	Distance from proposed MUL area (km)	List of Qualifying Interests	Connections (Source-pathway-receptor)	Qualifying Interests screened in	European Site screened in	Site-specific conservation objectives
Estuaries SPA [004077]			potential underwater noise disturbance while diving			and River Fergus Estuaries SPA 004077. Version 1.0. National Parks and Wildlife Service, Department of Arts, Heritage and the Gaeltacht.
		Whooper Swan (*Cygnus cygnus*) [A038] Shelduck (*Tadorna tadorna*) [A048] Teal (*Anas crecca*) [A052] Light-bellied Brent Goose (*Branta bernicla hrota*) [A046] Pintail (*Anas acuta*) [A054] Ringed Plover (*Charadrius hiaticula*) [A137] Golden Plover (*Pluvialis apricaria*) [A140] Grey Plover (*Pluvialis squatarola*) [A141] Lapwing (*Vanellus vanellus)* [A142] Knot (*Calidris canutus*) [A143] Dunlin (*Calidris alpina*) [A149] Black-tailed Godwit (*Limosa limosa*) [A156] Bar-tailed Godwit (*Limosa lapponica*) [A157] Curlew (*Numenius arquata*) [A160] Redshank (*Tringa totanus*) [A162] Greenshank (*Tringa nebularia*) [A164] Black-headed Gull (C*hroicocephalus ridibundus*) [A179] Wigeon (*Mareca penelope*) [A855] Shoveler (*Spatula clypeata*) [A857]	Yes – potential visual and above-water noise disturbance			
		Wetland and Waterbirds [A999]	Yes – potential habitat disturbance			

European Site & site code	Distance from proposed MUL area (km)	List of Qualifying Interests	Connections (Source-pathway-receptor)	Qualifying Interests screened in	European Site screened in	Site-specific conservation objectives
			from geotechnical activities			
Lough Derg (Shannon) SPA	19	**Cormorant (Phalacrocorax carbo) [A017]** **Tufted Duck (Aythya fuligula) [A061]** **Goldeneye (Bucephala clangula) [A067]** **Common Tern (Sterna hirundo) [A193]** **Wetland and Waterbirds [A999]**	Yes - Above water noise disturbance	Y	Y	NPWS (2024) Conservation Objectives: Lough Derg (Shannon) SPA 004058. Version 1.0. National Parks and Wildlife Service, Department of Arts, Heritage and the Gaeltacht.

5 Assessment Of Adverse Effects

5.1 Introduction

The connectivity between the proposed SI works and relevant European sites has been assessed in the SISAA Report (Report ref: MCW1078-RPS-05-ZZ-RP-Z-0101). One SAC and two SPAs have been identified as relevant for this NIS (see **Section 4**). This NIS only assesses QIs and SCIs in relation to which it could not be excluded based on objective information following screening that the proposed SI works, either alone or in combination with other projects, would have a likely significant effect. This analysis is set out in the SISAA Report and the relevant QIs and SCIs and associated European sites are summarised in **Section 4** of this NIS report.

As the SISAA considered likely significant effects in line with the precautionary principle, interactions between the proposed SI works and the European sites identified in the SISAA will be investigated in more detail to establish whether there is a credible risk of interaction with the proposed SI works. Where no such interaction with a European site (or relevant QIs/SCIs) occurs, no further assessment will be undertaken. Where there is a credible interaction between the SI works and a European site, an assessment against the site's COs will be undertaken. Where appropriate, mitigation measures will also be considered.

5.2 Habitats

5.2.1 Overview of impacts to Habitats

In line with the precautionary principle, relevant QI habitats at the Lower River Shannon SAC were screened in for AA, as likely significant effects caused by extractive/intrusive survey techniques (i.e. benthic grab and geotechnical sampling) could not be excluded at the screening stage. It was considered that the proposed SI works could lead to habitat loss, alteration or fragmentation, as a result of direct removal/disturbance of habitats, smothering due to increased SSC and potential for the spread of invasive marine species.

The interaction between the proposed SI works and the SAC will be investigated in more detail to establish whether there is a credible risk of interaction with the QI habitats from the proposed SI works. Where no such risk of interaction occurs, no further assessment will be undertaken. Where there is a risk of interaction between the SI works to QI habitats, an assessment against the COs will be undertaken.

5.2.2 Habitat Disturbance

Intrusive or extractive SI works from geotechnical activities (e.g. grab samples and boreholes) can potentially damage habitats if undertaken directly on or through that habitat. Where a jack-up barge (JUB) or spud barge is used as a platform to undertake geotechnical surveys, the legs will result in disturbance to sediments during the placement operations (i.e. "spudding"). **Table 5-1** outlines the total area of sediment to be disturbed

and total volume of sediment to be removed within the MUL Area. In total, an area 417.9 m^2 of sediments will be disturbed, which equates to 0.00897% of the MUL Area. A total volume of 93.27 m^3 will be removed by grab and borehole sampling. Overall, the intrusive footprint of the SI works will be relatively limited in the context of the wider environment.

The sensitivity of a habitat will depend on the likelihood of damage (or tolerance/ resistance) and the rate of recovery (or resilience) once the pressure has abated (Tyler-Walters et al., 2023). In general, sedimentary habitats are considered to be less sensitive to damage from sampling as they have higher resistance and resilience to pressures such as removal and damage than more complex, hard substrate habitats like reefs. Intrusive/ extractive sampling associated with the SI works will be limited in scale and consists of small discrete sampling areas within a much wider estuarine environment. Given the dynamic nature of the Shannon Estuary at Limerick, it is anticipated that there will be rapid recovery of sedimentary habitats over a short number of tidal cycles and therefore, any impact to sedimentary habitats is fully reversible.

The land-based geophysical surveys (and archaeological surveys, if required) will involve a small team of surveyors walking along the estuary (below the HWM) using non-intrusive hand-held equipment such as pole-mounted devices. During these non-intrusive surveys, no sediment or vegetation will be removed or disturbed beyond baseline levels, and therefore there will be no habitat loss, alteration or fragmentation. Boat-based geophysical surveys will involve a small nearshore vessel within the estuary utilising non-intrusive techniques, therefore there is no potential for impacts to habitats due to boat-based geophysical surveys within the MUL Area. Therefore, only intrusive sampling methodologies (grab samples and geotechnical sampling) have the potential to remove and/or disturb sedimentary habitats within the Lower River Shannon SAC.

Habitat disturbance is discussed in more detail in **Section 5.2.5** below, due to the potential for likely significant effects due to geotechnical activities. Habitat disturbance is assessed against the SSCOs of the following QI's listed in **Table 5-2**;

- Mudflats and sandflats not covered by seawater at low tide (1140),
- Estuaries (1130),
- Water courses of plain to montane levels with the *Ranunculion fluitantis* and *Callitricho-Batrachion* vegetation (3260).

Table 5-1: Summary of SI works with potential to disturb / remove sediment within the MUL Area

Activity	Maximum Quantity*	Unit Area (m^2)	Area Disturbed (m^2)	Percentage of MUL Area Disturbed (466 ha/4.66 km^2)	Unit Volume Removed m^3	Maximum Volume Removed m^3
Geotechnical Surveys (boreholes) (300mm dia (based on casing diameter) x 25m deep)	51	0.071	3.6	0.00008	1.77	90.12
Env grab samples (max 63 grabs at 27 stations, 0.5m max depth)	63	0.1	6.3	0.00014	0.05	3.15
JUB/Spud legs (4 legs x max $2m^2$ each)	51	8.0	408.0	0.00876	N/A	N/A
Total	**N/A**	**N/A**	**417.9**	**0.00897**	**N/A**	**93.27**

5.2.3 Smothering (increased SSC)

SI works that extract or disturb sediment also have the potential to result in sediment becoming suspended in the water column, which has the potential to smother nearby sensitive community types or habitats. The Shannon Estuary is subject to permanent marine inundation with a tidal flow in a generally west to east reach of Limerick City (NPWS, 2012a). Turbidity levels are often high in the upper estuary due to the large riverine inputs of suspended material, with strong currents also frequent within the estuary (Shannon Foynes Port Company (SFPC), 2020). Therefore, it is anticipated that any suspended sediments will settle out of suspension rapidly, and that habitats in the region are adapted to natural levels of turbidity, given the regular tidal fluctuations within the Shannon Estuary.

5.2.4 Invasive Species

The desk study conducted as part of the SISAA Report (Report ref: MCW1078-RPS-05-ZZ-RP-Z-0101), identified records for two marine invasive animal species and four invasive plant species which are within or adjacent to the MUL Area. These are:

- Zebra mussel (*Dreissena polymorpha*)
- Quagga mussel (*Dreissena rostriformis bugensis*)
- Giant hogweed (*Heracleum mantegazzianum*)

- Himalayan balsam (*Impatiens glandulifera*
- Japanese knotweed (*Fallopia japonica*)
- Winter heliotrope (*Petasites fragrans*)

According to NBDC (2026a), there is one record of zebra and quagga mussel adjacent to the MUL Area at the mouth of Ted Russell Dock, approximately 34m from the MUL Area (both recorded on 27/07/2023). In the absence of mitigation, there is potential for the SI works to contribute to the spread or introduction of these invasive species further within the Shannon Estuary.

According to NBDC (2026b, c, d, and e) there are several recordings of the above invasive plant species along the riverbanks of the Shannon within the MUL Area. However, given that these species typically exploit linear corridors such as rivers or streams (NBDC, 2026f), the only SI works capable of causing further spread or introduction of these species are the land-based geophysical surveys. The land-based geophysical surveys will involve a small team of surveyors walking along the estuary (below the HWM) using non-intrusive hand-held equipment such as pole-mounted devices. However, it is not possible to completely rule out potential spread of invasive species due possible contamination by personal, vehicles, equipment etc.

Therefore, appropriate mitigation measures are required to reduce the spread of invasive plant and marine animal species. These measures are listed below in **Section 6.1.1**.

5.2.5 Lower River Shannon SAC

The Lower River Shannon SAC stretches along the Shannon valley from Killaloe in Co. Clare to Loop Head/Kerry Head. The site thus encompasses the Shannon, Feale, Mulkear and Fergus estuaries, the freshwater lower reaches of the River Shannon (between Killaloe and Limerick), the freshwater stretches of much of the Feale and Mulkear catchments and the marine area between Loop Head and Kerry Head (NPWS, 2013). The MUL Area is located wholly within the Lower River Shannon Estuary SAC, extending from Cooperhill in the west to Corbally in the east. The following QI habitats selected were identified as relevant to this MUL application in the SISAA:

- Mudflats and sandflats not covered by seawater at low tide (1140),
- Estuaries (1130),
- Water courses of plain to montane levels with the *Ranunculion fluitantis* and *Callitricho-Batrachion* vegetation (3260).

The overall COs for these QI habitats are to maintain in favourable conservation condition (NPWS, 2012b).

The area designated as ‘mudflats and sandflats not covered by seawater at low tide’ (shortened to ‘mudflats and sandflats’ in the following text for brevity) is widespread within the Lower River Shannon SAC and is estimated to cover 8,808 ha (NPWS, 2012b). This

habitat, as mapped by NPWS, overlaps with the MUL Area as far east as Shannon Bridge, however, it is expected that mudflats extend beyond this extent. Due to this overlap, there will be interaction between QI mudflats and sandflats and the proposed SI works, and further assessment against the COs of this QI habitat is considered necessary.

The area designated as QI estuaries is estimated at 24,273 ha (NPWS, 2012b). The MUL Area is located wholly within the NPWS mapped habitat area for this QI habitat, and therefore further assessment against the COs is considered necessary.

The extent of water courses of plain to montane levels with the *Ranunculion fluitantis* and *Callitricho-Batrachion* vegetation (hereafter referred as floating river vegetation for brevity), as mapped by NPWS, overlaps with the MUL Area along the margins of the estuary. While the known extents of the three sub-types (*Groenlandia densa* (L.) Fourr., Opposite-leaved Pondweed, *Schoenoplectus triqueter* (L.) Palla, Triangular Club-rush, Bryophyte-rich streams and rivers) have been broadly mapped within the SAC, the exact area of each has not been quantified (NPWS, 2012d). No area designated for bryophyte-rich streams and rivers has been mapped within the MUL Area; therefore, this species is not considered further in this assessment (NPWS, 2012d). Triangular club-rush is typically associated with bare tidal mud (Preston and Croft, 2001, Preston et al., 2002) and has been mapped along the banks of the Shannon from the western extent of the MUL Area along the northern boundary as far as Shannon Bridge. The same species has been mapped along the MUL Area southern boundary, including the Ballinacurra creek as far east as Spillanes Tower in Courtbrack, Co. Limerick. Another small area of triangular club-rush is located to the north-west of Kings Island, opposite BHP Laboratories along the eastern boundary of the MUL Area. The MUL Area overlaps a small area mapped as opposite-leaved pondweed on the banks of the Shannon Estuary on the approaches to Shannon Bridge in Limerick City. Therefore, further assessment against the COs is considered necessary.

5.2.5.1 Assessment against conservation objectives

Table 5-2: Site-specific conservation objectives for relevant qualifying interest habitats

Relevant Qualifying Interests	Site Specific Conservation Objective	Site Specific Attribute	Target	Assessment against Conservation Objective
Lower River Shannon SAC (IE002165) (NPWS, 2012b; Version 1, 07/08/2012)				
Mudflats and sandflats not covered by seawater at low tide [1140]	To maintain the favourable conservation condition	Habitat area	The permanent habitat area is stable or increasing, subject to natural processes.	Total habitat extent within SAC estimated as 8,808 ha (NPWS, 2012b) (See Section 5.2.5). This target refers to activities or operations that propose to permanently remove habitat and does not refer to long- or short-term disturbance of the biology of the site (NPWS, 2012b). If all grab/geotechnical sampling was to take place within the NPWS mapped QI Mudflat habitat, this would equate to 0.000005% of the total habitat extent. Mudflats and sandflats are naturally resilient and generally display good recoverability from physical disturbances (OSPAR, 2023). Therefore, no permanent removal of habitat or long-term disturbance will occur.
		Community distribution	Conserve the following community types in a natural condition: • Intertidal sand with *Scolelepis squamata* and *Pontocrates* spp. community; and, • Intertidal sand to mixed sediment with polychaetes, molluscs and crustaceans community complex.	According to mapping of marine community types by NPWS (2012c) the western half of the MUL Area overlaps with the following community types: • 'Estuarine subtidal muddy sand to mixed sediment with gammarids community complex' (213 ha), and; • 'Intertidal sand to mixed sediment with polychaetes, molluscs and crustaceans community complex' (8,596 ha) As a highly conservative assessment, if all grab/geotechnical sampling was to take place within the NPWS mapped community type 'Intertidal sand to mixed sediment', this would equate to just 0.0005% of the total habitat extent. Mudflats and sandflats are naturally resilient and generally display good recoverability from physical disturbances (OSPAR, 2023). Given the dynamic, tidal nature of the estuary and the temporary nature and limited extent of the SI works, it is expected that the sediment will return to its natural state over a number of tidal cycles (See Section 5.2.3). Mitigation

Relevant Qualifying Interests	Site Specific Conservation Objective	Site Specific Attribute	Target	Assessment against Conservation Objective
				measures are outlined in section 6.1.1 in relation to invasive species. Therefore, the community types will be conserved in a natural condition.
Estuaries [1130]	To maintain the favourable conservation condition	Habitat area	The permanent habitat area is stable or increasing, subject to natural processes.	Total habitat extent within the SAC is estimated as 24,273 ha (NPWS, 2012b) (See Section 5.2.5). This target refers to activities or operations that propose to permanently remove habitat and does not refer to long- or short-term disturbance of the biology of the site (NPWS, 2012b). If all grab/geotechnical sampling was to take place within the NPWS mapped QI Estuaries habitat, this would equate to 0.000172% of the total habitat extent. Mudflats and sandflats are naturally resilient and generally display good recoverability from physical disturbances (OSPAR, 2023). Therefore, no permanent removal of habitat or long-term disturbance will occur.
		Community distribution	Conserve the following community types in a natural condition: • Intertidal sand to mixed sediment with polychaetes, molluscs and crustaceans community complex; • Estuarine subtidal muddy sand to mixed sediment with gammarids community complex; • Subtidal sand to mixed sediment with *Nucula nucleus* community complex; • Subtidal sand to mixed sediment with *Nephtys* spp. community complex;	According to mapping of marine community types by NPWS (2012c) the western half of the MUL Area overlaps with the following community types: • 'Estuarine subtidal muddy sand to mixed sediment with gammarids community complex' (213 ha), and; • 'Intertidal sand to mixed sediment with polychaetes, molluscs and crustaceans community complex' (8,596 ha) See previous assessment for 'Intertidal sand to mixed sediment.' As a highly conservative assessment, if all grab/geotechnical sampling was to take place within the NPWS mapped community type 'Estuarine subtidal muddy sand to mixed sediment' this would equate to just 0.019% of the total habitat extent. Mudflats and sandflats are naturally resilient and generally display good recoverability from physical disturbances (OSPAR, 2023). Given the dynamic, tidal nature of the estuary and the temporary nature and limited extent of the SI works, it is expected that the sediment will return to its natural state over a number of tidal cycles (See Section 5.2.3). Mitigation measures are outlined in

Relevant Qualifying Interests	Site Specific Conservation Objective	Site Specific Attribute	Target	Assessment against Conservation Objective
			• Fucoid-dominated intertidal reef community complex; • Faunal turf-dominated subtidal reef community; and • Anemone-dominated subtidal reef community.	section 6.1.1 in relation to invasive species. Therefore, the community types will be conserved in a natural condition.
Water courses of plain to montane levels with the *Ranunculion fluitantis* and *Callitricho-Batrachion* vegetation [3260]	To maintain the favourable conservation condition	Habitat area	Area stable or increasing, subject to natural processes	The exact area for this QI has not been quantified. However, the MUL Area overlaps two of the three sub-types identified as discussed in Section 5.2.5; triangular club-rush and opposite-leaved pondweed. **Triangular club-rush** is found in three situations in the Shannon Estuary: as the outer zone of vegetation on mud banks of the main channel, on tributary and creek sides, and in lagoons (Deegan and Harrington, 2004). According to NPWS (2012d) it is known from both banks of the Shannon between Kings Island in Limerick City, Cratloe, Ballinacurra and Meelick Creek. It is typically associated with bare tidal mud closer to the water's edge (NPWS, 2012d). The land-based geophysical surveys will involve a small team of surveyors walking along the estuary (below the HWM) using non-intrusive hand-held equipment such as pole-mounted devices. During these non-intrusive surveys, no sediment or vegetation will be removed or disturbed beyond baseline levels, therefore the permanent habitat area will remain stable subject to natural processes. **Opposite-leaved pondweed** is known for the northern bank of the River Shannon at Shannon Bridge and the Limerick Park Canal, it is likely to be widespread in the tidal stretches of the Shannon including freshwater seepage areas (NPWS, 2012d). It is found on mud and sand habitats including finer sediment types in the Limerick Canal. This species is restricted to shallow, often near-stagnant waters and is able to tolerate moderate flow rates (Triturus, 2021). As its exact

Relevant Qualifying Interests	Site Specific Conservation Objective	Site Specific Attribute	Target	Assessment against Conservation Objective
				extents of this subtype are not mapped, there is potential for the SI works to overlap areas where it may be present (i.e. in open water). Mitigation measures are outlined in section 6.1.2. An ecologist will survey the estuary, including any creeks to be sampled, prior to mobilisation to identify any areas of floating river vegetation. Any areas observed will be mapped and avoided by intrusive sampling. Therefore, the habitat area will be stable or increasing subject to natural processes.
		Habitat distribution	No decline, subject to natural processes.	As stated above, mitigation measures are outlined in section 6.1.2. An ecologist will survey the estuary, including any creeks to be sampled, prior to mobilisation to identify any areas of floating river vegetation. Any areas observed will be mapped and avoided by survey activities. Therefore, there will be no decline to habitat distribution subject to natural processes.
		Hydrological regime: river flow	Maintain appropriate hydrological regimes	The target for this attribute is to maintain appropriate hydrological regimes. The proposed SI works will not interfere with the flow of the River Shannon therefore hydrological regimes will be maintained.
		Hydrological regime: tidal influence	Maintain natural tidal regime	The target for this attribute is to maintain natural tidal regime. The proposed SI works will not impact or change the natural tidal influence of the River Shannon therefore natural tidal regimes will be maintained.
		Hydrological regime: freshwater seepages	Maintain appropriate freshwater seepage regimes	The target for this attribute is to maintain freshwater seepage regimes. The proposed SI works will not involve any changes to impacts to freshwater seepages therefore freshwater seepage regimes will be maintained.
		Substratum composition: particle size range	The substratum should be dominated by the particle size ranges, appropriate to the	The target for this attribute is that the substratum should be dominated by the particle size ranges, appropriate to the habitat sub-type (frequently sands, gravels and cobbles). As stated above the proposed SI works will involve taking 51 no.

Relevant Qualifying Interests	Site Specific Conservation Objective	Site Specific Attribute	Target	Assessment against Conservation Objective
			habitat sub-type (frequently sands, gravels and cobbles)	boreholes and 63 grab samples within the MUL Area. Given the total disturbed area equates to 417.9 m^2, which is 0.00897% of the MUL Area within the Shannon Estuary, including the limited nature and scale of the proposed SI works. Particle size range will be appropriate to the habitat sub-type.
		Water quality: nutrients	The concentration of nutrients in the water column should be sufficiently low to prevent changes in species composition or habitat condition	The target for this attribute is that the concentration of nutrients in the water column should be sufficiently low to prevent changes in species composition or habitat condition. There is potential that the proposed SI works will cause increased SSC and contaminated sediment may be released into the water column given the historic tannery operations. However, given the small volume of sediment which will be removed (93.27 m^3), the shallow grab size (0.5 m depth) and the regular tidal fluctuations within the Shannon estuary which has a baseline level of SSC given its regularly freshwater influences, the water column should be sufficiently low to prevent changes in species composition or habitat condition.
		Vegetation composition: typical species	Typical species of the relevant habitat sub-type should be present and in good condition	The target for this attribute is that the typical species of the relevant habitat sub-type should be present and in good condition. As stated above, the only SI works capable of removing and/or disturbing these sub types include the land-based geophysical surveys. However, the land-based geophysical surveys will involve a small team of surveyors walking along the estuary (below the HWM) using non-intrusive hand-held equipment such as pole-mounted devices. During these non-intrusive surveys, no sediment or vegetation will be removed or disturbed beyond baseline levels, therefore the typical species the relevant habitat sub-type should be present and in good condition.
		Floodplain connectivity	The area of active floodplain at and upstream of the habitat should be maintained	The target for this attribute is that the area of active floodplain at and upstream of the habitat should be maintained. The

Relevant Qualifying Interests	Site Specific Conservation Objective	Site Specific Attribute	Target	Assessment against Conservation Objective
				proposed SI works will not impact active floodplains at or upstream of the habitat therefore these will be maintained.
		Riparian habitat	The area of riparian woodland at and upstream of the bryophyte-rich sub-type should be maintained	The target for this attribute is that the area riparian woodland at and upstream of the bryophyte-rich sub-type should be maintained. The proposed SI works will take place wholly within the MUL Area which does not overlap any woodland habitat. There is also no S-P-R connection to the QI Alluvial forests as this habitat is mapped in five locations[1] upstream of the MUL Area. These are located at Clara Glens Co. Limerick (15 km east), Doonass Demesne Co. Clare (6 km east), Newgarden north (7 km east), Knockanavar in Co. Tipperary 29 km east and Gortnaskehy (41 km southeast).

[1] Lower River Shannon SAC (site code 2165) Conservation objectives supporting document- Woodland Habitats Accessed November 2026

5.2.6 Conclusion

Based on the assessment of adverse effects presented in **Assessment against** conservation objectives

Table 5-2, and with the application of mitigation measures, as outlined in **Section 6**, it can be concluded that the favourable conservation condition of the following QI habitats will be maintained in the Lower River Shannon SAC, and as such, there will be no adverse effect on site integrity as a result of the SI works:

- Mudflats and sandflats not covered by seawater at low tide (1140),
- Estuaries (1130),
- Water courses of plain to montane levels with the *Ranunculion fluitantis* and *Callitricho-Batrachion* vegetation (3260).

5.3 Otter

5.3.1 Overview of impacts to Otter

In line with MARA's AA Screening Determination dated 20th October 2026 (MUL260020), otter of the Lower River Shannon SAC has been screened in due to potential visual and above-water noise disturbance. The interaction between the proposed SI works and the above SAC will be investigated in more detail to establish whether there is a credible risk to otter from the proposed SI works. Where no such risk exists, no further assessment will be undertaken. Where there is a risk of adverse effects from the SI works to otter an assessment against the COs will be undertaken.

5.3.2 Visual and above-water noise disturbance

As stated in the SISAA report (report ref: MCW1078-RPS-O5-ZZ-RP-Z-0101), the land-based geophysical surveys will involve a small team of surveyors walking along the estuary (below the HWM) using non-intrusive hand-held equipment such as pole-mounted devices. During these non-intrusive surveys, no above-water noise, vibration or light will be emitted beyond baseline levels (works will be taking place within the confines of Limerick City and Docks where regular industrial and commercial operations occur therefore there is a baseline level of human activity regularly occurring). It is therefore highly unlikely that there will be any interaction with otters during these surveys capable of disturbance.

Geotechnical sampling (i.e. borehole drilling and SPT's from a JUB/spud barge) within the estuary could, in theory, interact with commuting or foraging QI otters from the Lower River Shannon SAC and generate visual and above-water noise disturbance above baseline levels. Therefore, these activities are assessed against the COs of the below sites in more detail.

A desk-based study utilising records from NBDC (2026g) indicated that otters have been sighted in the last 10 years adjacent to the MUL Area. Three live otter sightings were recorded with the most recent sighting in 2023, approximately 210 m from the MUL Area at Bunlicky Lagoon. In 2017 and 2018 a live sighting was recorded at Limerick Boat Club and Curragower. Otter activity has previously been recorded in Limerick City, including a singular otter print, an otter spraint and a potential otter holt which were all recorded within Anacotty east during surveys prior to land-based GI works (RPS, 2023).

Proposed Mitigation

In order to avoid above-water disturbance impacts to otters, surveys will be carried out by a suitably qualified ecologist prior to the SI works to identify otter holts, couches or any evidence of otter activity. In the event that a holt is identified, the Applicant will comply fully with *TII Guidelines for the Treatment of Otters prior to the Construction of National Road Schemes (2025),* including no works taking place within 150 m of an active breeding hold and no wheeled or tracked vehicles of any kind within 20 m of an active, non-breeding holt.

5.3.3 Lower River Shannon SAC

The impacts associated with the SI works will be considered against the detailed COs and attributes for otter of the Lower River Shannon SAC below.

5.3.3.1 Assessment against the conservation objectives

Table 5-3 Site-specific conservation objectives for relevant Annex II otter for Lower River Shannon SAC

Relevant Qualifying Interests	Site Specific Conservation Objective	Site Specific Attributes	Target	Assessment against Conservation Objective
Lower River Shannon SAC (IE002165) (NPWS, 2012b; Version 1, 07/08/2012)				
Otter [1355]	To restore the favourable conservation condition	Distribution	No significant decline	As the proposed SI works overlap the Lower River Shannon SAC and as otter activity has been recorded within the MUL Area, there is potential for the geotechnical SI works to impact on the % of positive survey sites for QI otter. Therefore, to reduce potential adverse effects on otters which may utilise the MUL Area for foraging or commuting, the mitigation measures outlined previously and in Section 6 will apply. By avoiding sensitive areas used by otters, there will be no significant decline in the distribution of QI otters.
		Extent of terrestrial habitat	No significant decline. Area mapped and calculated as 596.8ha above HWM; 958.9ha along river banks/ around ponds	There will be no permanent obstruction of terrestrial, marine, freshwater (river) or freshwater (lake/lagoon) habitat for otter. While the SI works will be undertaken within the upper estuary of the River Shannon, activities will be temporary and will not involve the removal of any habitat. Mitigation measures (outlined previously and in Section 6) will ensure avoidance of sensitive areas used by otters, and therefore, there will be no significant decline in the extent of terrestrial, marine and freshwater
		Extent of marine habitat	No significant decline. Area mapped and calculated as 4,461.6ha	

Relevant Qualifying Interests	Site Specific Conservation Objective	Site Specific Attributes	Target	Assessment against Conservation Objective
		Extent of freshwater (river) habitat	No significant decline. Length mapped and calculated as 500.1km	(river/lagoon/lake) habitat at the Lower River Shannon SAC due to the proposed SI works.
		Extent of freshwater (lake/lagoon) habitat	No significant decline. Area mapped and calculated as 125.6ha	
		Couching sites and holts	No significant decline	As otters have been identified within the MUL Area, it is plausible to assume that couches or holt sites may also be located along the riverbanks in the adjacent areas of the SI works. As the geotechnical SI works have the potential to cause above-water noise disturbance to nearby otters, the mitigation measures outlined previously and in Section 6 will be implemented to ensure that works are not undertaken within 150 m of an active breeding holt and no tracked or wheeled vehicles will operate within 20 m of a active, non-breeding holt. No physical disturbance will occur at any otter holt or couch, and therefore there will be no decline to these habitats. Ensuring that works are a suitable distance from these sensitive areas will ensure that there will be no significant disturbance to otters using couching sites or holts.
		Fish biomass available	No significant decline	Given the limited extent and duration of the proposed SI works, the mobility of many prey species, and the availability of prey across broader foraging areas within the Lower River Shannon SAC, any potential reductions in prey availability are expected to be localised, temporary

Relevant Qualifying Interests	Site Specific Conservation Objective	Site Specific Attributes	Target	Assessment against Conservation Objective
				and reversible. There will be no significant decline in the availability of fish biomass to otters from the above SAC.
		Barriers to connectivity	No significant increase.	The only works that have the potential to create a temporary barrier to connectivity for otters crossing the estuary within the MUL Area are the JUB or spud barge associated with the geotechnical SI works. However, when on location a JUB is an elevated platform which sits above the waterline using its legs placed on the seabed for stability. A spud barge is a flat-bottomed barge which remains on the water surface and holds it position using spuds or steel piles lowered onto the seabed to prevent the vessel moving. While the presence of the JUB or spud barges could temporarily displace a commuting otter, the overall footprint of the SI works will be limited to one location at a time, with plenty of alternative stetches of coastline available for commuting. Therefore, there will be no significant increase in barriers to connectivity.

5.3.4 Conclusion

It can be concluded that the favourable conservation condition of QI otter will be maintained at Lower River Shannon SAC and as such, there will be no adverse effect on site integrity as a result of the SI works.

5.4 Migratory Fish

5.4.1 Overview of impacts to Migratory Fish

In line with the precautionary principle, migratory fish at the Lower River Shannon SAC were screened in for AA, as likely significant effects to migratory fish habitats caused by extractive/intrusive survey techniques (i.e. benthic grab and geotechnical sampling) could not be excluded at the screening stage. The interaction between the proposed SI works and the SAC will be investigated in more detail to establish whether there is a credible risk of interaction with the QI migratory fish species habitats from the proposed SI works. Where no such risk of interaction occurs, no further assessment will be undertaken. Where there is a risk of interaction between the SI works and migratory fish species habitats an assessment against the COs will be undertaken (See **Table 5-4** for assessment against the SSCOs for sea and river lamprey and Atlantic salmon).

Impacts screened in by MARA in their Screening for AA for a Maritime Usage Licence Application dated 20th October 2026 (MUL260020) for migratory fish species were:

- potential barrier to connectivity to fish migration (temporary and localised);
- potential reduction in water quality (temporary and localised);
- potential physical disturbance to juvenile lamprey (temporary and localised disturbance, injury or mortality); and,
- potential underwater noise disturbance (temporary and localised).

All potential impacts to migratory fish are addressed in the following sections, followed by an assessment against the conservation objectives.

5.4.2 Potential Barrier to Connectivity

According to Inland Fisheries Ireland, *"a barrier is anything in a river that might stop a fish from passing, migrating or slow it down on the way up-river. Barriers can be natural or man-made and include weirs, bridges, waterfalls, culverts, debris blockages and hydroelectricity generating stations".* Artificial barriers block up and downstream migration of salmon, river and sea lamprey, thereby limiting the species to lower stretches, restricting access to spawning areas, and creating genetically isolated populations (NPWS, 2012).

The only works that have the potential to create a temporary barrier to connectivity to migratory fish species are the legs of the JUB or spud barge associated with the marine geotechnical SI works. All other SI works will either be undertaken from a vessel or on land (below the high water mark), therefore there is no potential for those survey methodologies to create barriers to migrating fish up or downstream of the MUL Area.

When on location, a JUB is an elevated platform which sits above the waterline using its legs placed on the seabed for stability. A spud barge is a flat-bottomed barge which remains on the water surface and holds it position using spuds or steel piles lowered onto the seabed to prevent the vessel moving. As stated in the Project Description document

(report ref: MCW1078-RPS-05-ZZ-RP-Z-0105), the barge legs will cover a total area of between 0.2 m^2 to 2 m^2 per leg (a maximum of 8 m^2), depending on whether a spud barge or JUB is used. The overall footprint of the barge will be limited to one sampling location at a time, The structure will occupy a very small proportion of the estuary cross section, fish will be able to pass around the legs. with plenty of alternative estuarine area available for fish migration. The JUB and associated borehole equipment will not materially reduce passage opportunities and will not constitute a physical barrier to migrating fish. Therefore, there will be no significant increase in barriers to connectivity.

5.4.3 Potential Reduction in Water Quality

There is potential that the proposed SI works will cause temporary and localised water quality issues, including release of contaminants and increased SSC/turbidity). The total volume of sediment to be removed/disturbed is 93.27 m^3 across all intrusive survey types. The Shannon Estuary is subject to permanent marine inundation with a tidal flow in a generally west to east reach of Limerick City (NPWS, 2012a). Turbidity levels are often high in the upper estuary due to the large riverine inputs of suspended material, with strong currents also frequent within the estuary (SFPC, 2020). Therefore, it is anticipated that any suspended sediments will settle out of suspension rapidly, and that migratory fish species the region are adapted to natural levels of turbidity, given the regular tidal fluctuations within the Shannon Estuary.

According to Long et al. (2026), while sediment resuspension from geotechnical surveys is a primary impact pathway for fish and shellfish, disturbance is expected to be limited to localised, short-lived sediment plumes resulting in near-bed smothering and temporary water-column turbidity in the vicinity of the sampling location. For geotechnical surveys, the overall findings suggested that, on a precautionary basis, temporal and spatial overlap with sensitive life stages in gravel dominated spawning and nursery habitats should be avoided, particularly where multiple intrusive works may occur within the same area (Long et al., 2026). Therefore, mitigation measures are proposed in Section 6.1.3 which will avoid and reduce any potential water quality impact on lamprey species within the MUL Area.

5.4.4 Potential Physical Disturbance to Larval and Juvenile Lamprey

Intrusive or extractive SI works from geotechnical activities (e.g., grab samples and boreholes) have the potential to remove and/or disturb sediments and therefore potentially interact with migratory fish habitats. There is potential overlap between intrusive SI works, the migratory routes and potential spawning areas of these species while migrating to/from their natal rivers e.g., lamprey and salmon from the Mulkear river and downstream of weirs (See **Table 5-4** for assessment against the SSCOs for sea and river lamprey and Atlantic salmon).

Sea lamprey and River lamprey

There are two optimal habitat requirements for lamprey: adult spawning habitat and larval nursery habitat (NPWS, 2026). Spawning habitat is found in gravelled areas of main stem

SAC rivers with a moderate gradient and water velocity. Larval habitat consists of fine-grained areas of sediment in areas of deposition and of reduced velocity (NPWS, 2026). The Shannon River at Castleconnell and the Mulkear River at Annacotty (upstream of the MUL Area) are known hotspots for sea lamprey spawning within the Lower Shannon region (NPWS, 2026), and as such, lamprey spawning habitat is not expected within the tidal MUL Area. It is possible that juvenile lamprey (ammocoetes) may be present in muddy sediments within the MUL Area and, therefore, may be susceptible to habitat disturbance due to intrusive surveys (i.e. geotechnical and environmental sampling). Following initial consultation with IFI, it is understood that juvenile lamprey is likely to be present within suitable habitats in the MUL Area.

A maximum of 51 boreholes and 63 environmental grab samples will be taken within the MUL Area. As outlined in **Table 5-1**, the total area to be impacted will be 417.9 m^2, which equates to 0.00897% of the MUL Area (466 ha). The area of sediment to be removed or disturbed is therefore limited in the context of the wider area, however, it is acknowledged that the extents of lamprey nursery areas are unknown within the MUL Area.

The following mitigation is proposed in order to avoid and reduce impacts to juvenile lamprey habitats:

- Consultation with IFI will be undertaken to obtain up-to-date information on the locations of juvenile lamprey habitats within the MUL Area, and in the event of any overlap with intrusive sampling (environmental grab or geotechnical locations), these survey locations will be moved to avoid interaction with the habitats.
- All environmental grab samples will be inspected for lamprey ammocoetes, and where found, these will be gently returned to the estuary at a suitable site, as identified by a suitably experienced fisheries specialist.

Atlantic salmon

According to NPWS (2013) salmon have been observed spawning in the lower Shannon or its tributaries, noting that the Fergus, Mulkear and Feale rivers to be of particular importance. Salmon lay their eggs in fast-flowing well oxygenated water, buried in gravel and often upstream in a river's headwaters (IFI, 2023). While it is unlikely that salmon spawn within the MUL Area, due to the higher quality habitat upstream in the Mulkear, it is likely that they migrate to/from the sea through the area of SI works.

5.4.5 Potential Underwater Noise Disturbance

The proposed geophysical and geotechnical surveys within the MUL Area will produce underwater noise which has the potential to impact Annex II migratory fish.

The impacts of noise on fish can broadly be split into three categories: i) lethal and physical injury; ii) auditory injury; and iii) behavioural response. Hearing loss can be permanent or comprise a temporary reduction in hearing sensitivity (i.e. Temporary Threshold Shift (TTS)). At sound levels lower than those that may cause physical injury or mortality, noise

may also cause behavioural effects on a species, for example, avoidance of an area or changes in swimming speed (Mueller-Blenke., 2010). This may be significant if it causes, for example, a migratory species to be delayed or diverted from their course.

Most fish species are capable of hearing within a frequency range of 50 Hz up to 500 to 1,500 Hz. fishes generally cannot hear above 10 kHz, and if they can, the sensitivity is generally very poor (Nedwell, Edwards, Turnpenny and Gordon, 2004). Fish can be grouped into the following categories based on the presence or absence of a swim bladder and on the potential for that swim bladder to improve the hearing sensitivity and range of hearing (Popper et al., 2014):

- Group 1: fish with no swim bladder or other gas chamber - with regards to migratory fish, this includes **sea lamprey and river lamprey**. These species are less susceptible to barotrauma and only detect particle motion, not sound pressure. However, some barotrauma may result from exposure to sound pressure;
- Group 2: fish with swim bladders in which hearing does not involve the swim bladder or other gas volume - with regards to migratory fish, this category includes **Atlantic salmon**. These species are susceptible to barotrauma although hearing only involves particle motion, not sound pressure;
- Group 3: fish in which hearing involves a swim bladder or other gas volume - with regards to migratory fish, this category includes species such as Allis shad and Twaite shad. These species are susceptible to barotrauma and detect sound pressure as well as particle motion; and
- Fish eggs and larvae.

Migratory fish species which are QIs of the Lower River Shannon SAC and have potential connectivity with the MUL Area are: sea and river lamprey and Atlantic salmon. This NIS Report has drawn upon the results of the underwater noise assessment presented in full in the accompanying Subsea Noise Technical Report to inform this assessment of underwater noise effects on migratory fish. The thresholds for harm to fish species have been based on the sound exposure guidelines for fish proposed by the Washington State Department of Transport Biological Assessment Preparation for Transport Projects Advanced Training Manual (WSDOT, 2020) and the Canadian Department of Fisheries and Ocean Effects of Seismic energy on Fish: A Literature review (Worcester, 2006). The full details of this assessment have not been repeated here, but the main conclusions of the noise assessment relevant to Annex II migratory fish found that no impact would occur beyond 10 m of the sound sources for auditory injury during any activity type, while temporary threshold shift (TTS) could occur within 20 m during the geotechnical survey.

The underwater noise modelling for fish is highly precautionary, as the thresholds used relate to the most sensitive group (i.e. group 3 in which hearing involves a swim bladder) and to which lamprey and salmon do not belong. Additionally, the impact ranges assume

that no other noise sources are present and ignore animal habituation to ambient underwater noise conditions.

MARA has published a guidance document which provides a summary of current scientific knowledge of how marine geotechnical and geophysical site investigation surveys impact on fish and shellfish in Irish waters (Long et al., 2026). This guidance document identifies underwater noise as a key potential impact pathway for fish associated with marine geophysical and geotechnical surveys. Impulsive noise, particularly from high-energy seismic air guns, is most consistently linked to behavioural responses such as startle and alarm reactions, altered swimming and schooling behaviour, avoidance or temporary displacement, reduced foraging and possible disruption to communication and reproduction; injury, developmental abnormalities and occasional mortality are more strongly evidenced for fish eggs and larvae, although these findings are largely based on air-gun studies rather than routine site-investigation methods. Continuous noise from sources such as multibeam echosounders, side-scan sonar and drilling is generally associated with sub-lethal, context-dependent effects, including physiological stress, increased metabolic demand, altered behaviour, auditory masking and, in some cases, reduced reproductive success, with direct injury or mortality less consistently reported. The severity of effects is expected to depend on the acoustic characteristics and intensity of the source, exposure duration and predictability, species' hearing sensitivity, life stage, and the location of the survey.

The MUL Area is within the Shannon at Limerick City and is subject to a variety of vessels including cargo, tugboats and fishing vessels traversing the maritime area. Therefore, there is an existing level of ambient noise contributors within the MUL Area. Given the temporary and localised nature of the proposed SI works, ambient noise conditions, and the limited and precautionary risk ranges for fish, it is considered unlikely that there will be adverse effects to fish migrating through the Shannon Estuary. Out of an abundance of caution, given the potential for lamprey nursery areas within the MUL Area, the following mitigation is proposed to avoid and reduce underwater noise impacts to juvenile lamprey.

Proposed Mitigation

In order to avoid and reduce underwater noise impacts to juvenile lamprey habitats the following mitigation will be implemented:

- Consultation with IFI will be undertaken to obtain up-to-date information on the locations of juvenile lamprey habitats within the MUL Area, and in the event of any overlap with noise-producing activities, these survey locations will be moved to avoid interaction with juvenile lamprey habitats.

5.4.6 Lower River Shannon SAC

The impacts associated with the SI works will be considered against the detailed COs and attributes for migratory fish species of the Lower River Shannon SAC below.

5.4.6.1 Assessment against conservation objectives

Table 5-4: Site-specific conservation objectives for relevant qualifying interest migratory fish species

Relevant Qualifying Interests	Site Specific Conservation Objective	Site Specific Attributes	Target	Assessment against Conservation Objective
Lower River Shannon SAC (IE002165) (NPWS, 2012b; Version 1, 07/08/2012)				
Sea lamprey (*Petromyzon marinus*) [1095] River lamprey (*Lampetra fluviatilis*) [1099]	To restore maintain the favourable conservation condition (sea lamprey) To maintain the favourable conservation condition (river lamprey)	Distribution: extent of anadromy	Greater than 75% of main stem length of rivers accessible from estuary (sea lamprey). Access to all water courses down to first order streams (river lamprey).	As stated above in Section 5.4.2, the only SI works that have the potential to create a temporary barrier to connectivity are the legs of the JUB or spud barge. However, as the total area of the barge legs will occupy a maximum of 8 m^2, the overall footprint of the JUB will be spatially limited, with plenty of alternative space for fish to pass. Therefore the proposed SI works will not constitute a physical barrier to migration of sea/river lamprey.
		Population structure of juveniles	At least three age/size groups present	Juvenile lamprey or ammocoetes live as burrowing filter feeders in the sediment, for three to six years where they then transform into adults typically between July and September (Kurz and Costello, 1999). The habitat requirements for ammocoetes are highly specific, they settle in nursery habitats with fine, soft substrate in well-oxygenated, and slow-flowing water (NatureScot, 2026). As outlined above in Section 5.4.4, it is expected that juvenile lamprey habitat occurs within the MUL Area. As outlined in section 6.1.3, consultation with IFI will be undertaken to identify areas of known juvenile habitat and any overlapping sample locations will be moved to avoid the habitats. Any ammocoetes found during sediment sampling will be returned to the estuary. By adhering to these measures, the risk of interacting with juveniles is significantly reduced and thus, the population structure of juveniles within the SAC will be maintained.
		Juvenile density in fine sediment	Juvenile density at least 1/m² (sea lamprey) Juvenile density at least 2/m² (river lamprey)	Juvenile lamprey typically burrows in fine sediment in slow flowing water (NatureScot, 2026). The MUL Area is subject to regular, marine inundation with tidal fluctuations, strong currents and high turbidity levels with an average water flow of 208.1 m^3/s (SERBD, 2013), however, juvenile habitat is expected to occur within the MUL Area see Section 5.4.4. As outlined in section 6.1.3, consultation with IFI will be undertaken to identify

Relevant Qualifying Interests	Site Specific Conservation Objective	Site Specific Attributes	Target	Assessment against Conservation Objective
				areas of known juvenile habitat and any overlapping sample locations will be moved to avoid the habitats. Any ammocoetes found during sediment sampling will be returned to the estuary. By adhering to these measures, the risk of interacting with juveniles is significantly reduced and thus, the density of juveniles in fine sediment within the SAC will be maintained.
		Extent and distribution of spawning habitat	No decline in extent and distribution of spawning beds	The proposed SI works will not overlap key spawning habitats for lamprey species, which are located further upstream in the Mulkear River, a tributary of the Shannon and at Castleconnell. Therefore, there will be no decline in the extent and distribution of spawning beds.
		Availability of juvenile habitat	More than 50% of sample sites positive	As stated above in Section 5.4.4, habitat requirements for ammocoetes are highly specific, they settle in nursery habitats with fine, soft substrate in well-oxygenated, and slow-flowing water (NatureScot, 2026). As outlined in section 6.1.3, consultation with IFI will be undertaken to identify areas of known juvenile habitat and any overlapping sample locations will be moved to avoid the habitats. Any ammocoetes found during sediment sampling will be returned to the estuary. By adhering to these measures, the risk of interacting with juveniles is significantly reduced and thus, the availability of juvenile habitat within the SAC will be maintained.
Atlantic Salmon (*Salmo salar*) (only in fresh water) [1106]	To restore the favourable conservation condition	Distribution: extent of anadromy	100% of river channels down to second order accessible from estuary	A stated above in Section 5.4.2, the only SI works that have the potential to create a temporary barrier to connectivity are the legs of the JUB or spud barge. However, as the total area of the barge legs will occupy a maximum of 8 m^2, the overall footprint of the JUB will be spatially limited, with plenty of alternative space for fish to pass. Therefore the proposed SI works will not constitute a physical barrier to migration of salmon.
		Adult spawning fish	Conservation Limit (CL) for each system consistently exceeded	Salmon spawning typically occurs in the uppermost streams or headwater, where there is suitable substrate of well oxygenated loose gravel available (Marine Institute, 2026). It is therefore unlikely that salmon spawn within the MUL Area. As outlined previously, the SI works will be of a temporary nature and

Relevant Qualifying Interests	Site Specific Conservation Objective	Site Specific Attributes	Target	Assessment against Conservation Objective
				spatially limited, i.e. one grab sample or geotechnical sample will be taken at any one time, with sediments settling locally and rapidly. Therefore, there will be no significant interaction with migrating salmon and will not have any impact on the CL for the Shannon.
		Salmon fry abundance	Maintain or exceed 0+ fry mean catchment-wide abundance threshold value. Currently set at 17 salmon fry/5 min sampling	As stated above in Section 0, salmon spawning typically occurs in the uppermost part of streams/rivers or in suitable gravel substrate. As above, salmon fry are not expected within the MUL Area, therefore there will be no impact on salmon fry abundance.
		Out-migrating smolt abundance	No significant decline	The conservation objectives state that smolt abundance can be negatively impacted by estuarine pollution, predation, sea lice and passing through hydro-electric turbines. The SI works will not introduce pollution, predators or sea lice. While there will be localised disturbance of sediments during intrusive sampling, this will be of a temporary nature and spatially limited, with sediments settling locally and rapidly. Therefore, there will be no decline in out-migrating smolt abundance.
		Number and distribution of redds	No decline in number and distribution of spawning redds due to anthropogenic causes	Salmon spawn in clean gravels, with suitable spawning habitat on the Shannon main channel (NPWS, 2012b), upstream from the MUL Area. There will be no interaction with salmon redds, and no artificial barriers will be erected which may prevent salmon from accessing suitable spawning habitat.
		Water quality	At least Q4 at all sites sampled by EPA	As stated above, a small volume of sediment will be removed/disturbed due to the proposed SI works (maximum of 93.27 m^3). Long et al., (2026), stated that any disturbance including SSC due to geotechnical SI works will occur through isolated, short lived sediment plumes and temporary water column turbidity in the vicinity of the sampling locations. Given this in the context of the Shannon estuary, which is subject to permanent marine inundation with high turbidity levels in the upper estuary due to the large riverine inputs of suspended material, with strong currents also frequent within the estuary (SFPC, 2020), the SI works will not negatively impact water

Relevant Qualifying Interests	Site Specific Conservation Objective	Site Specific Attributes	Target	Assessment against Conservation Objective
				quality and therefore will not contribute to a deterioration in EPA Q values within the SAC.

5.4.7 Conclusion

Based on the assessment of adverse effects presented in **Table 5-4**, and with the application of mitigation measures, as outlined in **Section 6**, it can be concluded that the favourable conservation condition of river lamprey will be maintained in the Lower River Shannon SAC. While Atlantic salmon and sea lamprey are in unfavourable conservation condition within the Lower River Shannon SAC, it has been objectively demonstrated that the SI works will not lead to any further deterioration of the condition of this migratory fish species. As such, there will be no adverse effect on site integrity as a result of the SI works.

5.5 Marine Mammals

5.5.1 Overview of impacts to Marine Mammals

In line with the precautionary principle, bottlenose dolphin at the Lower River Shannon SAC was screened in for AA, due to the likelihood for significant effects as a result of underwater noise:

SSCOs for relevant marine mammal species at the SAC are provided in **Table 5-5**.

5.5.2 Underwater noise

A subsea noise assessment was undertaken to inform this NIS. The assessment and results are presented in the accompanying Subsea Noise Technical Report (Report ref: MCW1078-RPS-05-ZZ-RP-Z-0104). To assess the impacts of the SI works, two scenarios were modelled.

1. Geophysical survey using MBES, SSS, chirper/pinger SBP, parametric SBP and geophysical survey vessel. All equipment is assumed to be hull-mounted with no requirements for the use of an ultra-short baseline (USBL) acoustic positioning system.
2. Geotechnical survey using rotary coring, SPT, cable percussive drilling (which uses the SPT source as a proxy) and a tug vessel.

The results have been summarised below to present the ‘worst-case scenario’ with respect to injury and/or disturbance to bottlenose dolphin. Please note that the subsea noise assessment presents injury and disturbance ranges for all marine mammal hearing frequency groups, however, only the results relevant to bottlenose dolphin (high frequency hearing group; Southall et al., 2019) have been presented in this NIS.

5.5.2.1 Scenario 1: Geophysical Survey

Geophysical surveys during which the MBES, SSS, chirper/pinger SBP, parametric SBP and geophysical survey vessel are in operation have the potential to cause auditory injury to bottlenose dolphin within <10 m of the sound source, while temporary threshold shift (TTS) could occur out to 370 m. Behavioural disturbance could occur out to 1.4 km, although it should be noted that this is a highly precautionary figure (see explanation below).

5.5.2.2 Scenario 2: Geotechnical Survey

Geotechnical surveys comprising rotary coring, SPT, cable percussive drilling (which uses the SPT source as a proxy) and a tug vessel have the potential to cause auditory injury to bottlenose dolphin within <10 m of the sound source, while TTS will also be limited to within < 10 m. Behavioural disturbance could occur out to 750 m, although it should be noted that this is a highly precautionary figure (see explanation below).

For bottlenose dolphin, the geophysical survey represents the ‘worst case scenario’ with regard to underwater noise within the MUL Area. Auditory injury for bottlenose dolphin will

only occur close to the sound sources (<10 m), while modelled risk ranges for TTS extend out to 370 m.

5.5.2.2.1 Behavioural Disturbance

Risk ranges for behavioural disturbance were modelled applying the criterion strictly (i.e. unweighted for marine mammal hearing frequency). This means that, while the impact zones for behavioural disturbance appear large (up to a maximum 1.4 km for the geophysical surveys), the main energy will often be outside of the hearing range of the receiving marine mammal. The reason for these behavioural disturbance ranges is partly due to assumed 24-hour active survey duration in the modelling, however this 24-hour window is unlikely, particularly for geophysical surveys in this area. Additionally, these behavioural risk ranges are unlikely to be realised due to the constant presence of medium to large vessels in the area, including sonar-like sources (e.g. depth-gauges, fish-finders & echo-sounders), meaning the local animals are not naïve to the types of noise emitted from the activity and that the activity will often not be the loudest source of these types of noise.

Behavioural disturbance includes avoidance and changes in behaviour, and will be temporary and short term in duration, with rapid recovery once the survey vessel has left the area. No adverse effects to the integrity of bottlenose at the Lower River Shannon SAC due to behavioural disturbance are predicted.

5.5.2.2.2 Proposed Mitigation

As is standard practise, the DAHG (2014) "*Guidance to Manage the Risk to Marine Mammals from Man-made Sound Sources in Irish Waters*" will be implemented during the geophysical and geotechnical surveys. As part of the standard application of DAHG (2014) guidance, a qualified and experienced MMO will be appointed during geophysical and geotechnical surveys. The MMO will search for marine mammals within the monitored zone, which is a 500 m radial distance of the sound source. Sound-producing activity shall not commence until at least 30 minutes have elapsed with no marine mammals detected within the monitored zone by the MMO. In commencing sound producing activities using the equipment listed above, a "Ramp Up" (i.e. soft-start) procedure (i.e. 20 or 40 minute soft-start depending on the activity) must be used. Once the Ramp-Up procedure commences, there is no requirement to halt or discontinue the procedure at night-time, nor if weather or visibility conditions deteriorate nor if marine mammals occur within a 500 m radial distance of the sound source. If there is a break in sound output for a period greater than 30 minutes (e.g., due to equipment failure, shut-down, survey line or station change) then all Pre-Start Monitoring and a subsequent Ramp-up Procedure must be undertaken (DAHG Guidance, 2014). Full details on the implementation of soft starts, as laid out in DAHG (2014) is provided in **Section 6** Mitigation Measures.

5.5.3 Lower River Shannon SAC

The Shannon Estuary is one of the most important areas for bottlenose dolphins in Ireland, and the species is a QI of the Lower River Shannon SAC. A desk-based study is presented

in the SISAA (Report ref: MCW1078-RPS-05-ZZ-RP-Z-0101) which outlines that four individuals were recorded off Ted Russell Dock in Limerick City in May 2020 (NBDC, 2026)[2] while IWDG (2026) records indicate that between November 2025 and November 2026, there were no sighting of bottlenose dolphin recorded within the MUL Area. Therefore, although the MUL Area does not appear to be an important area for dolphins, they have the potential to be present and therefore, underwater noise from the geophysical and geotechnical SI works has the potential to interact with individuals. Therefore, an assessment will be undertaken against the COs below.

[2] NBDC Biodiversity Maps - Bottlenose Dolphin Accessed November 2026

5.5.3.1 Assessment against conservation objectives

Table 5-5: Site-specific conservation objectives for relevant qualifying interests of SAC

Relevant Qualifying Interests	Site Specific Conservation Objective	Site Specific Attributes	Target	Assessment against Conservation Objective
Lower River Shannon SAC (IE002165) (NPWS, 2012b; Version 1, 07/08/2012)				
Bottlenose dolphin (*Tursiops truncatus*) [1349]	To maintain the favourable conservation condition	Access to suitable habitat	Species range within the site should not be restricted by artificial barriers to site use.	The proposed SI works will not introduce any artificial barriers within the MUL Area which would restrict bottlenose dolphins' access to suitable habitat.
		Habitat use: critical areas	Critical areas, representing habitat used preferentially by bottlenose dolphin, should be maintained in a natural condition.	The two critical areas identified or bottlenose dolphin within the Shannon estuary are located at Kilcredaun Head in the outer estuary and further east into the estuary around Moneypoint and Tarbert/ Killimer (Ingram and Rogan, 2002). These critical habitats do not overlap the MUL Area and are located approximately 60 km and 44 km downstream respectively. Therefore, critical areas used by bottlenose dolphin will be maintained in a natural condition.
		Disturbance	Human activities should occur at levels that do not adversely affect the bottlenose dolphin population at the site	As outlined in Section 5.5.2 above, the worst-case scenario with respect to underwater noise is an impact range of <10m for auditory injury, and an impact range of 370m for TTS. As outlined in section 6.1.7 below, mitigation will be applied in line with DAHG (2014), comprising soft-starts of equipment, where possible, and MMO monitoring of a 500m zone around the sound sources. Injury and TTS ranges for all noise scenarios are within the 500m monitored zone, and as such, there will be no risk of auditory injury or TTS for bottlenose dolphins. Behavioural disturbance was modelled out to a maximum distance of 1.4km, however, as explained above, this is a

Relevant Qualifying Interests	Site Specific Conservation Objective	Site Specific Attributes	Target	Assessment against Conservation Objective
				highly conservative and unrealistic scenario. Realistic behavioural impacts are likely to be within a much lower range, i.e. until the next closest source of disturbance, such as a shipping vessel. Other factors to consider are habituation of bottlenose dolphins to vessels in the Shannon Estuary, their relatively limited use of the MUL Area and the temporary duration of the SI works. Underwater noise will not be introduced at levels that could result in significant negative impacts on individuals or the population of bottlenose dolphins.

5.5.4 Conclusion

Based on the assessment of adverse effects presented in **Table 5-5**, and with the application of mitigation measures, as outlined in **Section 6**, it can be concluded that the favourable conservation condition of bottlenose dolphin will be maintained in the Lower River Shannon SAC. As such, there will be no adverse effect on site integrity as a result of the SI works.

5.6 Birds

5.6.1 Overview of Impacts to Birds

In line with the precautionary principle, the following SPAs were screened in for AA, as likely significant effects due to above-water disturbance could not be excluded at the screening stage:

- River Shannon and River Fergus Estuaries SPA.
- Lough Derg (Shannon) SPA.

The interaction between the proposed SI works and the above SPAs will be investigated in more detail to establish whether there is a credible risk from the proposed SI works. Where no such risk to SCI birds exists, no further assessment will be undertaken. Where there is a risk of impact from the SI works to SCI birds, an assessment against the COs will be undertaken.

In line with MARA's AA Screening Determination dated 20th October 2026 (MUL260020), cormorant and scaup (*Aythya marila*) of the River Shannon and River Fergus Estuaries SPA has been screened in due to potential underwater noise disturbance while diving, and wetlands of the River Shannon and River Fergus Estuaries SPA have been screened in due to potential habitat disturbance from geotechnical activities. The interaction between the proposed SI works and the above SAC will be investigated in more detail to establish whether there is a credible risk to cormorant, scaup and wetlands due to the proposed SI works. Where no such risk exists, no further assessment will be undertaken. Where there is a risk of adverse effects from the SI works to cormorant, scaup and wetlands an assessment against the COs will be undertaken.

5.6.2 Above-water disturbance to birds

The SI works will be short term and temporary, however, there is potential for adverse effects as a result of above water noise and human presence from the geotechnical works, vessel-based surveys and walkovers within the estuary during the wintering bird season.

Disturbance to birds will be short-term and temporary. However, there is potential for adverse effects on the SCI species as a result of disturbance via noise, vibration, lighting and human presence. In general, birds are able to see and hear better than humans and are thus more sensitive to increased light and noise pollution. Light pollution can have a detrimental effect on the reproductive success of avian species (Senzaki et al., 2020) causing birds to nest earlier (up to a month earlier) than normal in open environments, such as grasslands and wetlands. This can result in chicks hatching at a sub-optimal time when sufficient food resources are not available. Conversely, noise pollution can cause birds to nest later than normal. The Estuarine & Coastal Studies (IECS) report (Cutts et al., 2009) defines disturbance in the general context as discrete events that disrupt ecosystem, community or population structures or in some way alter resource levels i.e., food and space. It may also influence the survival of individual birds and reduce the function of the

site either for roosting or feeding. The report states that disturbance varies in its magnitude, frequency, predictability, spatial distribution and duration, and species vary greatly in their susceptibility to disturbance and this susceptibility is likely to vary with age, season, weather and the degree of previous exposure. Effects of disturbance on the bird population within the Estuarine & Coastal Studies report were observed via observations of flight responses and or behavioural changes. With respect to specific noise levels the following response descriptors are given within the IECS report:

- Noise below 50 dB – low
- Regular noise 50 – 70 dB – low to moderate
- Irregular noise 50 – 70 dB – moderate
- Regular piling noise below 70 dB – moderate
- Irregular piling noise above 70 dB – moderate to high.

The airborne noise levels associated with the machinery and equipment for the GI works comprising the rotary cores, cone penetration tests will be similar to a tractor idling at 10m or car at 7m from the receptor (approximately 70 dB) which would result in a moderate response. Noise emissions from the borehole cable percussion (BHCP) (shell and auger) works may be intermittent but louder than 70 dB and therefore a higher chance of behavioural change/response. Noise during SPT testing within both rotary coring and borehole cable percussion will also be considerably louder than 70 dB. The SPT testing has the highest potential to cause disturbance as it produces the most noise and occurs in spurts during a 3-4 minute window, and 1-2 tests may occur in a day. During the testing, two metal parts are struck together creating significant disturbance for the duration of the test.

All proposed geotechnical sampling will take place within the estuary. Each borehole is expected to take approximately two days to complete, across approximately four tidal cycles. This means that for the majority of the time, geotechnical sampling will take place underwater, with extremely little to no transmission between the underwater noise produced and the air/surface of the water. There is potential, during the lowest tidal conditions, that the noise associated with the drilling and SPTs will be airborne rather than underwater.

The geotechnical sampling locations are concentrated within Limerick City, and it is expected that while there may be local micro-siting of locations, that geotechnical sampling is not required in the less urban environment to the west of the MUL Area. There is high residual noise already present in the form of traffic on roads and industrial works in the Ted Russell Dock. Ted Russell Dock in the city centre is an active dock that already has significant residual noise from delivery lorries, work vehicles and two excavators that crush metal at the ‘Scrap heap’ located within the Dock. To the north of the dock is Condell Road (R527) which is a very busy road that has a naturally high level of noise as a number of junctions are present on this road that cause traffic to back up here.

Despite the high baseline noise from traffic and industry within Limerick City, airborne noise from geotechnical sampling and in particular from SPT testing, has the potential to disturb the wintering species of the SPA, especially those foraging on exposed estuarine sediments. Therefore, as a precautionary measure, geotechnical sampling will not occur during the wintering bird season (September to March inclusive).

5.6.3 Underwater noise

There is potential for diving seabirds to interact with the marine surveys while underwater noise is being produced. Diving SCI species from the River Shannon and River Fergus Estuaries SPA are cormorant and scaup.

Hartley Anderson Limited (2020) provide a summary of the available evidence on the auditory abilities and effects of underwater noise of diving birds, however, this evidence is very limited. Findings from more recent empirical research on a cormorant subspecies suggest that at least some diving birds have underwater hearing sensitivity is at least as good as their aerial sensitivity (Larsen et al., 2020). A 2024 study of auks found that frequencies of sensitive hearing overlap with many anthropogenic noise sources, indicating susceptibility to disturbance from a range of noise types (Smith et al., 2024).

While seabird responses to approaching vessels are highly variable (e.g. Fliessbach et al. 2019), flushing disturbance would be expected to displace most diving seabirds from close proximity to the survey vessel, thereby limiting their exposure to the highest sound pressures generated. Similarly, behavioural disturbance of seabirds due to acoustic survey activities is most likely to be temporary displacement associated with the physical presence of the vessel, comparable to that experienced by routine shipping traffic (Hartley Anderson Limited, 2020) and when the survey vessel has left the area, birds can resume diving activities. Therefore, despite the findings of Smith (et al., 2024), impacts on bird fitness will not lead to population-level effects at SPAs.

Given the limited extent of sound-producing activity, the limited time diving birds spend underwater, and given that birds are likely to be temporarily displaced to the surrounding area due to the presence of the vessel, it is considered that there is a very low likelihood of interaction between underwater noise sources and diving birds during the proposed SI works. **Therefore, there will be no adverse effect on the integrity to cormorant and scaup due to underwater noise.**

5.6.4 Wetland habitat disturbance

The land-based geophysical surveys (and archaeological surveys, if required) will involve a small team of surveyors walking along the estuary (below the HWM) using non-intrusive hand-held equipment such as pole-mounted devices. Boat-based geophysical surveys will involve a small nearshore vessel within the estuary utilising non-intrusive techniques, therefore geophysical survey techniques will not remove wetland habitat. Intrusive or extractive SI works from geotechnical activities (e.g. grab samples and boreholes) have the potential to remove and/or disturb wetland habitat (including roosting and/or foraging

habitats) within the River Shannon and River Fergus Estuaries SPA. A maximum of 51 boreholes and 63 grab samples will be sampled within the MUL Area. Where a JUB or spud barge is used as a platform to undertake geotechnical surveys, the legs will result in disturbance to sediments during the placement operations (i.e. “spudding”). **Table 5-1** outlines the maximum quantities of each sampling activity type, area per sample and maximum area of sediment to be removed or disturbed. The total area of impact will be 417.9 m^2, which equates to 0.00897% of the MUL Area., and a negligible proportion of the overall wetland habitat area available (NPWS, 2012f: 32,261 ha or 322,610,000 m^2).

The sensitivity of a habitat will depend on the likelihood of damage (or tolerance/ resistance) and the rate of recovery (or resilience) once the pressure has abated (Tyler-Walters et al., 2023). In general, sedimentary habitats are considered to be less sensitive to damage from sampling than more complex, hard substrate habitats like reefs, as they have higher resistance and resilience to pressures such as removal and damage. Therefore, as the intrusive/ extractive sampling associated with the SI works will be limited in scale, and consists of very small sampling areas within a much wider estuarine environment, it is considered that there will be minimal impact to the wetland habitat of River Shannon and River Fergus Estuaries SPA due to the intrusive SI works. Given that Shannon estuary is a dynamic estuarine system exposed to both riverine and tidal influxes, it is expected that wetland habitats will return to baseline conditions over a number of tidal cycles.

Additionally, with the implementation of the following seasonal mitigation, these limited effects to the wetland habitats will not occur during the crucial wintering period:

- Geotechnical works (i.e., borehole drilling and SPT) will not be carried out within the MUL Area during the overwintering period (September to March, inclusive) in order to avoid disturbance to wintering waterbirds.

In summary, the impact to wetland habitat of River Shannon and River Fergus Estuaries SPA will be negligible as less than 1% of the available wetland habitat will be removed and/or disturbed, and SI works will not take place during the overwintering period. **Therefore, the favourable conservation condition of wetlands will be maintained and there will be no adverse effect on the integrity of River Shannon and River Fergus Estuaries SPA.**

5.6.5 River Shannon and River Fergus Estuaries SPA

The estuaries of the River Shannon and River Fergus form the largest estuarine complex in Ireland. The site comprises the entire estuarine habitat from Limerick City westwards as far as Doonaha in Co. Clare and Dooneen Point in Co. Kerry (NPWS, 2015). The site has vast expanses of intertidal flats which provides a rich food resource for the wintering birds. Salt marsh vegetation frequently fringes the mudflats and this provides important high tide roost areas for the wintering birds (NPWS, 2015). The site is of special conservation interest for holding an assemblage of over 20,000 wintering waterbirds. The site has internationally important populations of Light-bellied brent goose (*Branta bernicla hrota*) (494), dunlin (*Calidris alpina*) (15,131), black-tailed godwit (*Limosa limosa*) (2,035) and

redshank (*Tringa totanus*) (2,645). A further 17 species have populations of national importance. The site also supports a nationally important breeding population of cormorant (*Phalacrocorax carbo*).

Impacts due to above water disturbance, underwater noise and habitat distance to wetland habitat associated with the SI works will be considered against the detailed COs for the River Shannon and River Fergus Estuaries SPA in **Table 5-6** below.

5.6.5.1 Assessment against conservation objectives

Table 5-6 Site-specific conservation objectives for River Shannon and River Fergus Estuaries SPA

Relevant Special Conservation Interests[3]	Site Specific Conservation Objective	Site Specific Attribute	Target	Assessment of Conservation Objective
River Shannon and River Fergus Estuaries SPA (IE004077) (NPWS, 2012e; Version 1, 17/09/2012)				
Cormorant (*Phalacrocorax carbo*) [A017]	To maintain the favourable conservation condition	Breeding population abundance: apparently occupied nests (AONs)	No significant decline	Cormorants are known to nest on trees in Bunlicky Lake, approximately 50 m from the closest boundary of the MUL Area (Berrow et al., 2025). According to Berrow et al (2025) the number of AONs has increased from 93 in 2010 to 250 in 2024, indicating that this location is an importance nesting area for the species. Cormorants are known to have a minimum approach distance (MAD) of up to 100m in response to a pedestrian walking or running during the breeding season (Goodship and Furness, 2019). Although Bunlicky Lake is traversed by a busy national road, there is potential for airborne noise disturbance when geotechnical sampling occurs on nearby exposed sediments, in particular during SPT testing. Therefore, as outlined in section 6.1.6, on a precautionary basis, no geotechnical sampling will be undertaken within a 200m buffer of Bunlicky Lake during the breeding season (April to June). Therefore, there will be no decline in AONs as a result of the SI works.
		Productivity rate	No significant decline	As outlined in section 6.1.6, no geotechnical sampling will be undertaken within a 200m buffer of Bunlicky Lake during the cormorant breeding season (April to June). Therefore, there will be no significant decline in the productivity rate of cormorant.
		Distribution: breeding colonies	No significant decline	As outlined in section 6.1.6, no geotechnical sampling will be undertaken within a 200m buffer of Bunlicky Lake during the cormorant breeding season (April to June).

[3] The Wetlands SCI at River Shannon and River Fergus Estuaries SPA was screened out in the SISAA due to no likelihood for significant effects.

Relevant Special Conservation Interests[3]	Site Specific Conservation Objective	Site Specific Attribute	Target	Assessment of Conservation Objective
				Therefore, there will be no significant decline in the distribution of breeding colonies.
		Prey biomass available	No significant decline	Cormorant are highly specialised piscivores with moderate site fidelity. Feeding predominantly occurs in shallow intertidal waters, including the intertidal mudflats within River Shannon and River Fergus SPA (NPWS, 2012e). The SI works have the potential to remove a maximum of 417.9 m^2 of material which equates to just 0.00897% of the MUL Area. As cormorants have a mean max foraging range of 25.6km (Woodward et al., 2019), there will be ample alternative habitat for cormorant to forage within in the surrounding estuary. Therefore, there will be no significant decline to prey biomass.
		Barriers to connectivity	No significant increase	The SI works will not introduce any artificial barriers that may block or interfere with use of waters adjacent to the breeding colonies.
		Disturbance at the breeding site	Human activities should occur at levels that do not adversely affect the breeding cormorant population	As outlined in section 6.1.6, no geotechnical sampling will be undertaken within a 200m buffer of Bunlicky Lake during the cormorant breeding season (April to June). Therefore, there will be no disturbance capable of adversely affecting the breeding cormorant population.
		Population trend	Long term population trend stable or increasing	As outlined in section 6.1.6, no geotechnical sampling will be undertaken within a 200m buffer of Bunlicky Lake during the cormorant breeding season (April to June). Therefore, there will be no disturbance capable of adversely affecting the long-term population trend of breeding cormorant.
		Distribution	There should be no significant decrease in the range, timing or intensity of use of areas by cormorant other than that occurring from	See below for assessment of distribution of wintering SCI species at the SPA. Measures implemented will ensure no significant decrease is distribution of wintering cormorant at River Shannon and River Fergus SPA.

Relevant Special Conservation Interests[3]	Site Specific Conservation Objective	Site Specific Attribute	Target	Assessment of Conservation Objective
			natural patterns of variation.	
Whooper Swan (*Cygnus cygnus*) [A038] Light-bellied Brent Goose (*Branta bernicla hrota*) [A046] Shelduck (*Tadorna tadorna*) [A048] Wigeon (*Mareca penelope*) [A855] Teal (*Anas crecca*) [A052] Pintail (*Anas acuta*) [A054] Shoveler (*Spatula clypeata*) [A857] Scaup (*Aythya m*arila) [A062] Ringed Plover (*Charadrius hiaticula*) [A137] Golden Plover (*Pluvialis apricaria*) [A140] Grey Plover (*Pluvialis squatarola*) [A141] Lapwing (*Vanellus vanellus*) [A142] Knot (*Calidris c*anutus) [A143]	To maintain the favourable conservation condition	Population trend	Long term population trend stable or increasing	While the presence and operation of a survey vessel (geophysical or environmental sampling) may displace birds within its vicinity, any disturbance will be temporary and limited in extent. Survey vessels will need to operate during high tidal conditions, when wintering birds are typically at roost sites. Given that there is a reasonable baseline of vessel activity within the MUL Area, it is unlikely that the presence of one geophysical or environmental vessel travelling along a pre-defined trajectory or stationary while undertaking grab sampling will disturb waterbirds enough to contribute to a long term reduction in numbers at the site. Walkover geophysical surveys on the intertidal zone at low tide have the potential to disturb foraging or roosting wintering birds, however, these walkovers will be limited in extent and temporary, with birds able to utilise nearby wetland habitat and return to the area once surveys are complete. Walkover surveys will not contribute to a long-term reduction in numbers at the site. The geotechnical surveys to be undertaken within the estuary from JUBs will emit underwater noise, and little to none of this noise will transmit above the surface. However, as borehole drilling will take approximately two days to complete, across approximately four tidal cycles, there is potential, during the lowest tidal conditions for noise produced from drilling and SPTs to be airborne rather than underwater. While the majority of geotechnical sampling will take place within the urban part of the MUL Area where there is high baseline noise from traffic and industry, it is possible that airborne noise, particularly from SPT testing will disturb the wintering species of the SPA, particularly while foraging on exposed estuarine sediments.

Relevant Special Conservation Interests[3]	Site Specific Conservation Objective	Site Specific Attribute	Target	Assessment of Conservation Objective
Dunlin (*Calidris alpina*) [A149] Black-tailed Godwit (*Limosa limosa*) [A156] Bar-tailed Godwit (*Limosa lapponica*) [A157]				Therefore, as outlined in section 6.1.6, as a precautionary measure, geotechnical sampling will not occur during the wintering bird season (September to March inclusive). The non-breeding population trends of SCI waterbirds within River Shannon and River Fergus SPA will therefore not be adversely affected by the proposed SI works.
Curlew (*Numenius arquata*) [A160] Redshank (*Tringa totanus*) [A162] Greenshank (*Tringa nebularia*) [A164] Black-headed Gull (*Chroicocephalus ridibundus*) [A179]		Distribution	There should be no significant decrease in the range, timing or intensity of use of areas [by the relevant species] other than that occurring from natural patterns of variation.	As outlined above, there is potential for high airborne noise during geotechnical sampling at low tidal conditions within the estuary. Therefore, as outlined in section 6.1.6, as a precautionary measure, geotechnical sampling will not occur during the wintering bird season (September to March inclusive). Therefore, there will be no significant decrease in the range, timing or intensity of use of area by the SCI waterbirds within River Shannon and River Fergus SPA.
Wetland and Waterbirds [A999]	To maintain the favourable conservation condition	Wetland habitat area	The permanent area occupied by the wetland habitat should be stable and not significantly less than the area of 32,261 ha, other than that occurring from natural patterns of variation	As outlined above in Section 5.6.4, the only SI works that have the potential to remove/disturb wetland habitat is the intrusive or extractive SI works from geotechnical activities. However as stated above, the total area of impact will be 417.9 m^2, which equates to 0.00897% of the MUL Area., and a negligible proportion of the overall wetland habitat area available (NPWS, 2012f: 32,261 ha or 322,610,000 m^2). Additionally, with the implementation of the seasonal mitigation as outlined in Section 5.6.4, the permanent area occupied by the wetland will be stable and the favourable conservation condition will be maintained.

5.6.6 Lough Derg (Shannon) SPA - Ex-situ Effects

The SI works will overlap only with River Shannon and River Fergus Estuaries SPA, as described above. There will be no spatial overlap with any other SPAs, however, there is potential for wintering and breeding birds from nearby SPAs to utilise the MUL Area. The closest of these is Lough Derg (Shannon) SPA located 19 km away, across mainly agricultural lands. Although some waterbird species will be faithful to specific habitats within their wintering SPAs, many will at times also use habitats situated within the immediate hinterland of the site or in areas ecologically connected to the SPA (NPWS, 2014f). There is therefore a potential pathway for ex-situ effects as several bird species may at times use habitats outside of but ecologically connected to the SPA. Significant habitat change or increased levels of disturbance within these areas could result in the displacement of one or more of the listed waterbird species and/or a reduction on their numbers (NPWS, 2014f). In particular, wintering swan and goose species can have foraging ranges of up to 20 km from their night roosts (SNH, 2016).

Lough Derg SPA is located 19km northeast of the MUL Area, and of special conservation interest for both breeding and wintering birds. The site supports nationally important breeding colonies of common tern and cormorant and is also designated for nationally important wintering populations of tufted duck and goldeneye. While tufted duck and goldeneye are mobile species and may use habitat beyond the designated site boundary, they have small core foraging ranges and are not noted to utilise ex situ habitats (Burke et al., 2025). Therefore, it is not expected that these wintering water birds will travel 19km to forage within the MUL Area and these species will not be considered further for ex situ effects.

Cormorant has a mean maximum foraging range of 25.6km (Woodward et al., 2019) and therefore cormorants which nest at Lough Derg SPA may forage within the MUL Area. Common tern has a mean maximum foraging range of 19km and a maximum record foraging range of 30km (Woodward et al, 2019), therefore on a precautionary basis, common terns nesting at Lough Derg SPA may forage within the MUL Area.

Above water disturbance impacts associated with the SI works will be considered against the detailed COs for relevant SCIs for the Lough Derg SPA in **Table 5-7** below.

5.6.6.1 Assessment against conservation objectives

Table 5-7 Site-specific conservation objective for Lough Derg SPA

Relevant Special Conservation Interests	Site Specific Conservation Objective	Site Specific Attribute	Target	Assessment of Conservation Objective
Lough Derg SPA (IE004058) (NPWS, 2024; Version 1, 27/09/2024)				
Cormorant ((*Phalacrocorax carbo*) [A017] Common tern (*Sterna hirundo*) [A193]	To restore the Favourable conservation condition	Breeding population size (AONs)	Long term SPA population trend is stable or increasing	While it is possible that cormorants and common terns breeding at Lough Derg will forage within the MUL Area, there will also be ample alternative foraging habitat available along the Shannon Estuary, and there will be no SI works within the Lough Derg SPA. Therefore, there will be no decrease in the breeding population sizes or AONs at Lough Derg SPA due to the SI works.
		Productivity rate (number of fledged young per AON)	Sufficient to maintain a stable or increasing population	As outlined above, the mean max foraging range of cormorant is 25.6km, and common tern is 19km and therefore there will be plenty of alternative foraging habitat for breeding birds. There will be no interaction with fledging young at AONs and therefore no decrease in the productivity rates of these species at Lough Derg SPA due to the SI works.
		Distribution: extent of available nesting options within the SPA	Sufficient availability of suitable nesting sites throughout the SPA to maintain a stable or increasing population	As the MUL Area will not overlap Lough Derg SPA, the proposed SI works will not impact the extent of available nesting options in Lough Derg SPA.
		Forage spatial distribution, extent, abundance and availability	Sufficient number of locations, area of suitable habitat and available forage biomass to support the population target	As outlined above, the mean max foraging range of cormorant is 25.6km, and common tern is 19km and therefore there will be plenty of alternative foraging habitat for breeding bird along the Shannon Estuary. Therefore, there will be no significant decrease in the number of locations, area of suitable habitat and available forage biomass to support the populations of common tern and cormorant from Lough Derg SPA due to the SI works.

Relevant Special Conservation Interests	Site Specific Conservation Objective	Site Specific Attribute	Target	Assessment of Conservation Objective
		Disturbance at the breeding site	Disturbance occurs at levels that do not significantly impact on birds at the breeding site	SI works will not create disturbance at the breeding site in Lough Derg SPA.
		Disturbance at areas ecologically connected to the colony	Disturbance occurs at levels that do not significantly impact on breeding population	As outlined above, the mean max foraging range of cormorant is 25.6km, and common tern is 19km. While there may be limited interaction between the SI works and ex situ birds, due to the availability of alternative foraging habitat and the ability of these species to forage widely, there will be no significant impact on the breeding populations due to disturbance.
		Barriers to connectivity	No significant increase	There will be no barriers to connectivity to cormorant and common tern at Lough Derg SPA due to the SI works.

5.6.7 Conclusion

As described in **Section 5.6.5** above, the implementation of the following seasonal mitigation will avoid adverse effects to wintering waterbirds

- Geotechnical works (i.e., borehole drilling and SPT) will not be carried out within the MUL Area during the overwintering period (September to March, inclusive) in order to avoid disturbance to wintering waterbirds.
- Geotechnical works (i.e. borehole drilling and SPT) will not be carried out during the breeding season (April to June, inclusive) within 200m of Bunlicky Lake, to avoid disturbance to nesting cormorants.

With the implementation of the above mitigation measures, the conservation condition of the populations and distributions of SCI species at River Shannon and River Fergus Estuaries SPA and Lough Derg (Shannon) SPA will be maintained.

5.7 In-combination effects

Even if projects are unlikely to have adverse effects on their own, the effects in-combination with those of other plans or projects could be adverse. An in-combination assessment must be carried out to identify projects/plans that could act in-combination to affect site COs (OPR, 2021).

In the SISAA Report, an assessment of in-combination effects was carried out following MARA's stepwise approach outlined in their Technical Guidance document. A search was undertaken for other plans and projects that could act in-combination with the SI works, taking into account a Cumulative Effects Spatial Scope (CESS) of 5 km and a Cumulative Effects Temporal Scope (CETS) of plans or project likely to occur within the next six years. Impact pathways and predictions were considered and then relevant plans or project were identified. Full details of this assessment are provided in Section 6.3 of the SISAA Report (Report ref: MCW1078-RPS-05-ZZ-RP-Z-0101).

5.7.1 Plans

MARA's Screening Determination states that likely significant in-combination effects on the COs of European sites considered in their screening report could not be excluded at screening stage, between the following plans and the PUOSC SI works:

- The Climate Action Plan 2025,
- River Basin Management Plan (RBMP) 2022-2027,
- Limerick Development Plan 2022-2028,
- Clare County Development Plan 2023–2029, and
- Strategic Integrated Framework Plan for the Shannon Estuary (SIFP).

Following the identification of likely pathways for in-combination impacts, it is considered that for a plan to be able to act in-combination with the proposed SI works, it must determine the precise location of a project or designate specific land uses. While the SIFP identifies Limerick's Docks and adjacent lands as an area within which to promote sustainable economic development, no precise projects or designated land/marine uses are identified within the above plans which could meaningfully interact with the proposed SI works.

There are no anticipated in-combination effects from plans and therefore plan-level in-combination effects are screened out from further assessment.

5.7.2 Projects

Tetra Tech undertook a desk study using internet searches, planning databases and other available sources, as outlined below, to identify other projects and activities likely to overlap with the CESS and CETS of the proposed SI works, which have the potential to give rise to in-combination effects. Full details of this assessment are provided in Section 6.3 of the SISAA Report (Report ref: MCW1078-RPS-05-ZZ-RP-Z-0101). Based on the review of

other projects occurring within the CESS and CETS of the proposed SI works, there is potential that the following projects could act in combination with the proposed SI works:

- Shannon Foynes Dumping at Sea (S0009-03);
- Shannon Foynes Port Company Maintenance Dredging (FS006975);
- Limerick City and County Council King's Island Flood Relief Scheme (FS007190 and ACP306270).

MARA's AA Screening Determination concluded that, in addition to the above-listed projects, likely significant in-combination effects with the following project could not be ruled out:

MUL260004 Waterways Ireland Maintenance dredging of navigational channel upstream of Sarsfield Lock.

5.7.2.1 Shannon Foynes Port Company Maintenance Dredging and Dumping at Sea (FS006975 and S0009-03)

The Shannon Foynes Port Company is authorised to dredge an area of 2.613 ha at the entrance to Ted Russell dock, within the MUL Area. The foreshore licence commenced on 29 May 2023 and is valid for 8 years. The application stated that there would typically be one trailer suction hopper dredge campaign every two years, with plough dredging in late summer and winter, avoiding the period 1st February to 20th June.

The corresponding Dumping at Sea Permit (S0009-03) consents disposal of dredging materials from this area further downstream, approximately 600m from the western boundary of the Limerick FRS SI works MUL Area. The DaS Permit has an end date of 31/12/2026. The dredging and disposal activities could therefore overlap spatially and temporally with the proposed SI works, and therefore potential in-combination pathways are identified and assessed.

The Applicant (LCCC) has been undertaking ongoing engagement and coordination with the Shannon Foynes Port Company throughout the development of the FRS.

Habitats

The numerical modelling report (RPS, 2019) accompanying the foreshore licence application showed that levels of suspended material in the water column during dredging and the sedimentation rates as a result of dumping are similar to background conditions within the Shannon Estuary. The dredging and dumping campaigns will involve mobilisation of much greater volumes of sediment than those predicted for the SI works, and there is no potential for cumulative habitat loss or disturbance, as any localised elevations of suspended sediments will disperse to background levels during all projects. Therefore, the SI works will not act in-combination with the dredging/dumping activities to give rise to adverse effects on QI habitats.

Otter

FS006975 concluded that significant effects on otters from vessel noise and disturbance were unlikely, given the existing busy shipping environment and the limited additional disturbance associated with one vessel. Otters were screened in for the proposed SI works because they have been recorded within the MUL Area during the last 10 years and could be affected by visual and above-water noise disturbance.

The proposed SI works will include pre-construction ecological surveys to identify holts, couches and other otter activity, together with compliance with the TII (2025) otter guidelines. With these measures in place, the SI works are not expected to result in adverse in-combination effects with FS006975 or S0009-03 on otters.

Migratory fish

The NIS for the Shannon Foynes dredging identified that dredging and disposal of dredged materials could lead to barriers of migrating fish at Limerick Dock. As a result, an exclusion period is implemented during the migratory period (January to June) in order to avoid adverse effects to lamprey and salmon species. As the proposed SI works are not of a large enough scale to represent a barrier to migration, and as the Shannon Foynes dredging does not take place during the migratory period, there is no potential for in-combination barrier effects. The loss of juvenile lamprey habitat is not considered in the dredging documentation, however, it can be assumed that as this area of the estuary undergoes constant maintenance dredging, it does not represent ideal habitat.

FS006975/S0009-03 identified potential effects on fish migration and suspended solids. However, the relatively short duration of dredging and disposal activities, compared with the duration of fish migration periods, limits the potential for temporal overlap. Sediment-plume modelling predicted concentrations of approximately 30–60 mg/L, which are comparable to background turbidity in the Shannon Estuary.

Mitigation included an exclusion period from January to June for relevant loading and disposal operations and switching off the trailer suction hopper dredger pumps while manoeuvring. The proposed SI works will implement the mitigation described in Section 6.1.3. Subject to these measures, the SI works are not expected to result in adverse in-combination effects on migratory fish through barriers to movement, entrainment or reduced water quality.

No underwater-noise effects were identified for fish in the assessments of FS006975 or S0009-03, and the proposed SI works are not expected to generate significant underwater noise in relation to fish (see Section 5.4.5). In-combination effects from underwater noise are therefore not anticipated.

Marine mammals

The NIS submitted in support of FS006975 (RPS, 2019) noted that dredging may lead to an avoidance response by bottlenose dolphins. For the proposed Limerick FRS SI works, the modelled impact ranges are limited: less than 10 m for auditory injury and up to 370 m, on a

conservative basis, for temporary threshold shift (TTS). Nevertheless, behavioural disturbance could occur if dredging and SI activities take place simultaneously.

Therefore, there is potential for cumulative behavioural disturbance if maintenance dredging and SI activities overlap in time and space. The Applicant will avoid, as far as reasonably practicable, temporal overlap between the SI works and maintenance dredging. On this basis, and given the limited modelled impact ranges, **no adverse in-combination effects on bottlenose dolphins are anticipated**.

Wetland habitat and birds

FS006975/S0009-03 concluded that maintenance dredging would not result in the loss of intertidal mudflat or important wetland foraging habitat because dredging would be confined to subtidal areas. The proposed SI works could temporarily affect approximately 417.9 m² of wetland habitat, equivalent to 0.00897% of the MUL Area and a negligible proportion of the wider wetland resource.

For FS006975/S0009-03, disturbance impacts to SCI species of the River Shannon and River Fergus SPA were ruled out on the basis that the works will be temporary and localised, within a busy shipping area. It was concluded that the dredging will take place in the vicinity of busy ports and will not be different to the normal port activities. In this context, the dredging vessel is considered part of the background vessel activity in the area.

To minimise disturbance to wintering waterbirds and their associated habitat, the proposed SI works will not be undertaken between September and March. On this basis, and provided that the dredging remains confined to subtidal areas, no adverse in-combination effects on wetland habitat or wintering birds are anticipated.

FS006975/S0009-03 did not consider underwater noise impacts to diving bird species of the River Shannon and River Fergus Estuaries SPA. In Section 5.6.3, underwater noise impacts were considered and ruled out for diving bird species, given the baseline level of activity present and as diving species would be temporality displaced due to the presence of the vessel. It is considered that this assessment applies equally to vessels operating as part of the Shannon Foynes Port company maintenance dredging and therefore, there will be no potential for in-combination effects.

Summary

Although the dredging and disposal activities may overlap spatially and temporally with the proposed SI works, the short duration and limited extent of the activities, together with the stated seasonal, ecological and operational mitigation measures, mean that **no adverse in-combination effects are expected** on otters, migratory fish, water quality, underwater noise receptors, wetland habitat or birds.

There is potential for cumulative behavioural disturbance to bottlenose dolphins if maintenance dredging and SI activities were to overlap in time and space. The Applicant commits to continuing ongoing communication and programme coordination with Shannon Foynes Port Company, and will avoid, as far as reasonably practicable, temporal overlap

between the SI works and maintenance dredging (See Mitigation Measures Section 6.1.8). On this basis, and given the limited modelled impact ranges, **no adverse in-combination effects on bottlenose dolphins are anticipated**.

5.7.2.2 Limerick City and County Council King's Island Flood Relief Scheme (FS007190 and ACP306270)

LCCC was granted planning permission to construct a Flood Relief Development on King's Island in Limerick City. This was approved subject to conditions on 21/05/2021. Construction works are ongoing and within the CESS of the proposed SI works, therefore there is potential for spatial and temporal overlap with the proposed SI works. LCCC was also granted a foreshore licence (FS007190) for aspects of the same project within the foreshore extent. This licence was for a period of 35 years from the commencement date (18/04/2024).

Works within the foreshore are the construction of a fisherman's access path incorporating a new storm water outfall and non-return valve, removal of the existing boardwalk and construction of a new cantilevered boardwalk. Upgrade works will provide improved storm water drainage along the foreshore boundary, including removal of 5 existing manholes/ outfalls, replacement of a damaged vale and upsizing of existing outfalls with non-return valve. Temporary construction requirements are a riverside JUB for the cantilevered boardwalk and the new wall construction and access along the perimeter of the works.

As of 15/04/2026, construction for this project is still ongoing. Therefore, there is possible spatial or temporal overlap with the proposed SI works and some potential for in-combination effects due to habitat loss/disturbance, underwater noise and above-water disturbance effects within the MUL Area.

Habitats

As outlined above in the assessment of habitat impacts from the SI works alone (**Section 5.2**), the overall footprint of the SI works will be limited in the context of the full extent of relevant QI habitats (mudflats and sandflats and Estuaries). Mudflats and sandflats are naturally resilient and generally display good recoverability from physical disturbances (OSPAR, 2023). Therefore, the sedimentary habitats will quickly recover within this dynamic estuarine environment.

The NIS for the King's Island FRS identifies that pollution from hydrocarbon spills, concrete dust and silt runoff could impact water quality and community types for both the Estuaries and Mudflats and sandflats QI habitats. There is no potential for interaction as the SI works will be temporary and limited in extent. Any disturbances to estuarine habitats from JUB placement during temporary construction works will be minor and there is no potential for cumulation of habitat disturbance. Therefore, the SI works will not act in-combination with the King's island FRS construction activities to give rise to adverse effects on QI habitats.

FS007190/ACP306270 does not consider habitat disturbance to wetland habitats of the River Shannon and River Fergus Estuaries SPA within the NIS. Disturbance to wintering

birds was considered only in relation to above-water noise disturbance due to the construction and operation of activities. As stated in Section 5.6.4, the total area of impact due to the geotechnical SI works on wetland habitat will be 417.9 m^2, which equates to 0.00897% of the MUL Area, and a negligible proportion of the overall wetland habitat area available (NPWS, 2012f: 32,261 ha or 322,610,000 m^2). However, to further reduce any potential impact to wetland habitat on wintering bird species a seasonal mitigation will be put in place to ensure no SI works will be carried out during September to March to avoid disturbance to wintering water birds and their associated wetland habitat . Therefore, as there is no habitat disturbance impact to wetland habitat identified by the King's Island FRS, there will be no potential for in-combination effects.

Otter

FS007190/ACP306270 identified potential effects on otters from nighttime lighting near watercourses during construction of the Kings Island Flood Relief Scheme. Proposed mitigation included:

- A pre-construction otter survey 10 months prior to construction;
- An inspection of the development area immediately prior to site clearance to ensure no holts or couches have been created in the intervening period;
- Applying for a derogation licence if an holts or couches is identified;
- Ensuring that trenches do not create confined areas in which otters could become trapped;
- Installing escape ramps, with a maximum gradient of 45°, where necessary;
- Minimising construction lighting during hours of darkness and preventing illumination of riverbanks and floodplain areas; and
- Using the lowest practicable wattage for operational lighting and directing lighting away from riverbanks, floodplains and the water surface.

Subject to implementation of these measures and the otter mitigation proposed for the SI works in Section 6.1.4, the SI works are not expected to act in combination with the Kings Island Flood Relief Scheme to result in adverse effects on otters.

Migratory fish

The King's Island NIS identifies the potential for disturbance from the JUB legs on juvenile lamprey habitats, and outlines mitigation measures to avoid impacts to lamprey at these locations. With the implementation of mitigation during the proposed SI works and during the King's island construction, it is considered that there is no potential for in-combination effects to migratory fish species.

FS007190/ACP306270 does not directly address underwater noise, barriers to connectivity and water quality impacts relating to migratory fish species. However, mitigation measures are in place to mitigate construction and operational impacts on fish species including

seasonal restriction for salmon between November and March, electrofishing between July and September for juvenile lamprey and an ecologist on site during deployment of the JUB. Given the mitigation listed above for migratory fish species and those proposed as part of the SI works (Section 6.1.3), there will be no potential for in-combination effects.

Marine mammals

The King's Island FRS screened out bottlenose dolphin for likely significant effects. As the proposed SI works will implement the DAHG (2014) guidance to avoid underwater noise impacts to marine mammals, and as there is no underwater noise impact identified by the King's Island FRS, there will be no potential for in-combination effects.

Birds

The NIS for the King's Island FRS identified potential for disturbance to wintering birds only, and as the proposed SI works will not take place during the wintering period, there is no pathway for in-combination above water disturbance effects.

FS007190/ACP306270 did not consider underwater noise impacts to diving bird species of the River Shannon and River Fergus Estuaries SPA. In Section 5.6.3, underwater noise impacts were considered and ruled out for diving bird species, given the baseline level of activity present and as diving species would be temporality displaced due to the presence of the vessel. It is considered that this assessment applies equally to vessels operating as part of the King's Island FRS, therefore, there will be no potential for in-combination effects.

5.7.2.3Waterways Ireland (MUL260004)

MUL260004 is an application for the routine maintenance dredging of accumulated sediments within the existing navigational channel upstream and downstream of Sarsfield Lock, Limerick City. The MUL application was submitted on 22 July 2026 for a period of 10 years, with each dredging campaign expected to last approximately 15 days. The Applicant (LCCC) has been undertaking ongoing engagement and coordination with Waterways Ireland throughout the development of the FRS.

Wetland habitat and Birds

MUL26004 assessed potential effects on the wetlands of the River Shannon and River Fergus Estuaries SPA from:

- increased sediment deposition in Limerick Docks, the Inner Shannon Estuary and the Maigue Estuary; and
- potential lead contamination associated with dredging in the Abbey River.

The NIS concluded that any increase in sediment deposition would be negligible and would not adversely affect the physical structure of estuarine habitats supporting waterbirds.

The proposed SI works would affect approximately 417.9 m² of wetland habitat. This represents a negligible proportion of the overall wetland resource. Subject to the mitigation

described in Section 6.1.5, the limited scale of the SI works is not expected to result in significant additional sediment deposition or habitat disturbance when considered alongside MUL26004.

Lead contamination was also considered in the MUL26004 NIS. Dredging would be avoided in areas where elevated lead concentrations were identified or where the applicable Waste Acceptance Criteria were exceeded. Given the minimal sediment quantities to be disturbed by the proposed SI works in comparison to dredging, the limited scale of the proposed SI works will not result in significant additional sediment deposition or habitat disturbance when considered alongside MUL260004.

Underwater noise impacts to birds are not assessed as part of the NIS for MUL260004. As stated above in Section 5.6.3, underwater noise impacts were considered and ruled out for diving bird species, given the baseline level of activity present and as diving species would be temporality displaced due to the presence of the vessel. It is considered that this assessment applies equally to vessels operating as part of the maintenance dredging, therefore, there will be no potential for in-combination effects.

Otter

Otter was considered in the MUL260004 NIS in relation to very localised and temporary disturbance and/or displacement to otter potentially foraging in the area, however it was screened out due to the low potential for impact in the context of the already highly disturbed nature of the study area. As stated in Section 5.3.2, as otter has been recorded within the MUL Area in the last 10 years there is potential for above-water noise disturbance due to the proposed SI work, however with the inclusion of the mitigation measures set out in Section 6.1.4, any potential impacts to otters will be reduced to as low as practically possible within the MUL Area. Therefore, there is no potential for in-combination effects between the SI works and MUL260004.

Migratory Fish

The NIS for the MUL260004 recorded sea and river lamprey ammocoetes in very low densities within the proposed dredge areas upstream of Sarsfield Lock (0.07/m^2 and 0.13/m^2 respectively), but not downstream of same. The density of juvenile lamprey recorded from the study area confirms that the proposed works area is not particularly important for this species in terms of the COs of the SAC as a whole. However, as juvenile lamprey were recorded, the proposed dredge sites may therefore provide locally important habitat.

MUL260004 proposes mitigation in the form of electrical fishing prior to dredging for sea and river lamprey species, in consultation with IFI. The NIS concluded that the low densities of juvenile lamprey recorded coupled with the mitigation measures proposed will negate the potential for any significant effects on these species with regard to the integrity of the Lower River Shannon SAC.

As the proposed SI works are not of a large enough scale to represent a barrier to migration, and as electrical fishing is proposed prior to dredging and in consultation with IFI, there is no potential for in-combination barrier effects.

Underwater noise is not considered in the MUL260004 NIS, however, based on the assessment carried out in Section 5.4.3, adverse effects to fish due to a dredge vessel are not expected.

Water quality impacts were discussed in the MUL260004 NIS and concluded that any potential water quality impacts will be localised in view of the nature, extent and scale of the proposed works and the dilution potential of the River Shannon Estuary. Therefore, with the implementation of mitigation during the proposed SI works and during MUL26004 dredging operations, it is considered that there is no potential for in-combination effects to migratory fish species.

Marine mammals

MUL260004 screened out bottlenose dolphin for likely significant effect due to the distribution of bottlenose dolphin habitat and records within the outer estuary beyond the zone of influence of the proposed dredging. As discussed previously, the proposed SI works will implement the DAHG (2014) guidance to avoid underwater noise injury and TTS impacts to marine mammals. It is considered that there is potential for cumulative behavioural disturbance if maintenance dredging and SI activities overlap in time and space. The Applicant commits to continuing ongoing communication and programme coordination with Waterways Ireland, and will avoid, as far as reasonably practicable, temporal overlap between the SI works and maintenance dredging. On this basis, and given the limited modelled impact ranges, **no adverse in-combination effects on bottlenose dolphins are anticipated**.

5.8 In-combination Conclusion

Where there is temporal overlap between the SI works and maintenance dredging and associated dumping activities at the approach to Ted Russell Dock (Shannon Foynes Port Company) and at Sarsfield Lock (Waterways Ireland), there is potential for in-combination behavioural disturbance effects to bottlenose dolphin. The potential for cumulative effects on QI habitats, otter, migratory fish and wintering birds is considered negligible due to the localised and temporary nature of the SI works, the dynamic estuarine environment and the existing level of activity within the port area. The Applicant will maintain ongoing communication and programme coordination with Shannon Foynes Port Company and Waterways Ireland throughout the development of the proposed project. This engagement will continue through the lifetime of the MUL to ensure avoidance of temporal overlap between the SI geophysical and geotechnical activities and maintenance dredging activities, as far as reasonably practicable.

There is no identified pathway to in-combination effects with the King's Island FRS development. The implementation of mitigation measures for both projects will minimise

potential effects on QI habitats, migratory fish, marine mammals and birds. In particular, the SI works will not overlap with the wintering bird period, and the use of mitigation measures for underwater noise and temporary construction activities will avoid significant disturbance effects.

The relevant plans identified by MARA, including the Climate Action Plan 2025, the River Basin Management Plan 2022–2027, Strategic Integrated Framework Plan for the Shannon Estuary (SIFP) and the relevant development plans, do not specify project locations or land uses that could interact with the SI works; therefore, plan-level in-combination effects have been screened out.

6 Mitigation Measures

6.1 Mitigation of Adverse Effects

6.1.1 Avoidance of impacts due to invasive species

In order to avoid the spread or translocation of invasive alien species within the Lower River Shannon SAC, the following mitigation measures will be implemented.

- The proposed SI works will utilise industry standard practices to reduce the spread of invasive species, these include washing equipment before and after arrival to the site in a designated area, desk-based research of invasive species within the area and avoidance where possible.
- All reasonable practical measures will be taken to ensure that all vessels used are free of invasive species on their hulls and in their ballast water.

6.1.2 Avoidance of impacts to floating river vegetation

In order to avoid loss of floating river vegetation (i.e. QI habitat Water courses of plain to montane levels with the *Ranunculion fluitantis* and *Callitricho-Batrachion* vegetation [3260]), the following mitigation measures will be implemented:

- Prior to mobilisation of surveys, a suitably experienced ecologist will survey the areas of the estuary to be sampled from the banks to identify any area of floating river vegetation QI habitat. Areas observed will be mapped and avoided by survey activities.

6.1.3 Avoidance of impacts to migratory fish

In order to avoid and reduce impacts to juvenile lamprey and their habitats within Lower River Shannon SAC, the following mitigation measures will be implemented:

- Consultation with IFI will be undertaken to obtain up-to-date information on the locations of juvenile lamprey habitats within the MUL Area, and in the event of any overlap with intrusive sampling (environmental grab or geotechnical locations) or underwater noise-producing activities, these survey locations will be moved to avoid interaction with juvenile lamprey habitats.
- All environmental grab samples will be inspected for lamprey ammocoetes, and where found, these will be gently returned to the estuary at a suitable site, as identified by a suitably experienced fisheries specialist.

6.1.4 Avoidance of impacts to otter

In order to avoid above-water disturbance impacts to otters the following stepwise approach to mitigation will be followed:

- Surveys will be carried out by a suitably qualified ecologist prior to the SI works to identify otter holts, couches or any evidence of otter activity.

- In the event that a holt is identified, SI works will fully comply with *TII Guidelines for the Treatment of Otters prior to the Construction of National Road Schemes* (2025), including no works taking place within 150 m of an active breeding holt and no wheeled or tracked vehicles of any kind within 20 m of an active, non-breeding holt.

6.1.5 Standard water quality measures

As is standard procedure onboard vessels operating in the marine environment, the following standard measures will be implemented:

- All vessels will comply with international standards according to the MARPOL (maritime pollution) Convention and the Sea Pollution Acts with respect to wastewater and food waste discharges. Hazardous materials, radiation sources or chemicals will be stored, handled, used and documented in accordance with those legal provisions and also the Safety Health and Welfare at Work Act 2005, as amended, and associated regulations, which apply to vessels as places of work, and the Chemicals Act 2008, as amended, and associated regulations, accepted guidelines, and technical standards and requirements.
- An oil pollution emergency plan will be implemented onboard all survey vessels. This plan will specify:
    - Information on the location and detail of spill response resources on board
    - Information on crew training in relation to oil pollution response
    - How crew will interface with other vessel operators, where applicable.
- Spill kits will be stored on board all vessels and will also be available where machinery is operating in the intertidal zone. Any fluid leaks or spills will be cleaned up immediately. All machinery or vehicles on the intertidal area will be fuelled on the hard-standing surface of a car park or road and at least 10 m from a drain or gully.

6.1.6 Avoidance of disturbance impacts to birds

In order to avoid visual and above-water disturbance effects to birds species of River Shannon and River Fergus Estuaries SPA, the following mitigation measure will be implemented:

- Geotechnical works (i.e., borehole drilling and SPT) will not be carried out within the MUL Area during the overwintering period (September to March, inclusive) in order to avoid disturbance to wintering waterbirds.
- Geotechnical works (i.e., borehole drilling and SPT) will not be carried out during the breeding season within 200m of Bunlicky Lake, to avoid disturbance to nesting cormorants.

6.1.7 Avoidance of underwater noise impacts

Standard risk avoidance and/or risk reduction measures will be in place on geophysical and geotechnical survey vessels (including JUB), as required under *Guidance to Manage the*

Risk to Marine Mammals from Man-made Sound Sources in Irish Waters (DAHG, 2014). These measures will comprise visual observation during daylight hours (see Pre-Start Monitoring below) and the use of soft start procedures, where appropriate (see Ramp-Up / Soft Start Procedures below). Note that a soft-start is not required under guidance for the geotechnical drilling. The incorporation of these measures will avoid auditory injury and reduce disturbance to marine mammals.

The relevant text from DAHG (2014) has been included below. However, MMOs should review the source material prior to undertaking mitigation.

1. A qualified and experienced marine mammal observer (MMO) shall be appointed to monitor for marine mammals and to log all relevant events using standardised data forms.
2. Unless information specific to the location and/or plan/project is otherwise available to inform the mitigation process (e.g., specific sound propagation and/or attenuation data) and a distance modification has been agreed with the Regulatory Authority, acoustic surveying using the above equipment shall not commence if marine mammals are detected within a 500m radial distance of the sound source intended for use, i.e., within the Monitored Zone.

Pre-Start Monitoring

3. Sound producing activities shall only commence in daylight hours where effective visual monitoring, as performed and determined by the MMO, has been achieved. Where effective visual monitoring, as determined by the MMO, is not possible the sound-producing activities shall be postponed until effective visual monitoring is possible.
4. An agreed and clear on-site communication signal must be used between the MMO and the Works Superintendent as to whether the relevant activity may or may not proceed, or resume following a break (see below). It shall only proceed on positive confirmation with the MMO.
5. In waters up to 200m deep, the MMO shall conduct pre-start-up constant effort monitoring at least 30 minutes before the sound-producing activity is due to commence. Sound-producing activity shall not commence until at least 30 minutes have elapsed with no marine mammals detected within the Monitored Zone by the MMO.
6. This prescribed Pre-Start Monitoring shall subsequently be followed by a Ramp-Up Procedure which should include continued monitoring by the MMO.

Ramp-Up / Soft Start Procedure

7. In commencing sound producing activities using the equipment listed in **Table 2-1** the following Ramp-up Procedure (i.e., “soft-start”) must be used, including during any testing of acoustic sources, where the output peak sound pressure level from any source exceeds 170 dB re: 1µPa @1m:

a. Where it is possible according to the operational parameters of the equipment concerned, the device's acoustic energy output shall commence from a lower energy start-up (i.e., a peak sound pressure level not exceeding 170 dB re: 1µPa @1m) and thereafter be allowed to gradually build up to the necessary maximum output over a period of 20 minutes.

b. This controlled build-up of acoustic energy output shall occur in consistent stages to provide a steady and gradual increase over the ramp-up period.

c. Where the acoustic output measures outlined in steps (a) and (b) are not possible according to the operational parameters of any such equipment, the device shall be switched "on" and "off" in a consistent sequential manner over a period of 20 minutes prior to commencement of the full necessary output. In the case of sparkers/boomers, starting with the lowest electric discharge possible, and thereafter being allowed to gradually build up to the necessary maximum output over a period of 40 minutes.

8. In all cases where a Ramp-Up Procedure is employed the delay between the end of ramp-up and the necessary full output must be minimised to prevent unnecessary high-level sound introduction into the environment.

9. Once the Ramp-Up Procedure commences, there is no requirement to halt or discontinue the procedure at night-time, nor if weather or visibility conditions deteriorate nor if marine mammals occur within a 500m radial distance, of the sound source, i.e., within the Monitored Zone.

Breaks in sound output

10. If there is a break in sound output for a period greater than 30 minutes (e.g., due to equipment failure, shut-down, survey line or station change) then all Pre-Start Monitoring and a subsequent Ramp-up Procedure (where appropriate following Pre-Start Monitoring) must be undertaken.

Reporting

11. Full reporting on MMO operations and mitigation undertaken must be provided to the Regulatory Authority.

6.1.8 In-combination effects

In order to avoid the potential for in-combination underwater noise effects with the Shannon Foynes Port Company and Waterways Ireland maintenance dredging activities, the Applicant will maintain ongoing communication and programme coordination with both organisations. This engagement will continue throughout the lifetime of the MUL to avoid temporal overlap with maintenance dredging activities as far as reasonably practicable.

7 Conclusion

This NIS has examined the potential implications of the proposed project, alone and in combination with other plans and projects, on the integrity of the SACs and SPAs identified below, considering each European site's structure, function, and COs.

- Lower River Shannon SAC
- River Shannon and River Fergus Estuaries SPA
- Lough Derg (Shannon) SPA

MARA may use the information contained in this NIS for establishing its own complete, precise, and definitive findings and conclusions to ensure all reasonable scientific doubt has been removed regarding the effects of the proposed site investigations on relevant European sites. As stated above, no construction works associated with the flood relief scheme are included under this MUL application.

Following a comprehensive evaluation of the potential direct, indirect, and in-combination effects on the COs of relevant SACs and SPAs, mitigation measures were prescribed where necessary. Consequently, it has been concluded in this NIS that the proposed SI works, either alone or in-combination with any other plan or project, will not adversely affect the integrity of any European Site.

8 References

Berrow, S., Keegan, E., O'Connor, I. & Le Méléder, A. (2025). Cormorants *Phalacrocorax carbo* breeding in Special Protection Areas in the Shannon Estuary and adjacent waters, Irish Birds: 47 (1-8).

Burke, B., Kennedy, J., Gadd, R., Fitzgerald, N., Lynch, A., Caffrey, B., Walsh, A., Murray, T. & Kelly, S.B.A. (2025). The status and distribution of wintering waterbirds in Ireland in 2023: results from the Irish Wetland Bird Survey (I-WeBS). Irish Wildlife Manuals, No. 162. National Parks and Wildlife Service, Department of Housing, Local Government and Heritage, Ireland.

Cutts, N., Phelps, A. & Burdon, D. (2009). Construction and Waterfowl: Defining Sensitivity, Response, Impacts and Guidance, Report to Humber INCA, Institute of Estuarine and Coastal Studies, University of Hull.

Deegan, B. M., & Harrington, T. J. (2004). The Distribution and Ecology of *Schoenoplectus triqueter* in the Shannon Estuary. Biology and Environment: Proceedings of the Royal Irish Academy, 104B(2), 107–117. http://www.jstor.org/stable/20500213

Department of Arts, Heritage and the Gaeltacht (DAHG) (2014) Guidance to Manage the Risk to Marine Mammals from Man-made Sound Sources in Irish Waters. Dublin, Ireland, Department of Arts, Heritage and the Gaeltacht, 58pp.

DoEHLG (2009, rev. 2010). Appropriate Assessment of Plans and Projects in Ireland Guidance for Planning Authorities. Department of the Environment, Heritage and Local Government.

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

EC (2002). Assessment of Plans and Projects Significantly Affecting Natura 2000 Sites: Methodological guidance on the provisions of Article 6(3) and (4) of the Habitats Directive 92/43/EEC, Office for Official Publications of the European Communities, Luxembourg. European Commission.

EC (2007). Guidance document on the strict protection of animal species of Community interest under the Habitats Directive 92/43/EEC. European Commission.

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

EC (2018). European Commission Notice C (2018) 7621 'Managing Natura 2000 Sites: the provisions of Article 6 of the 'Habitats' Directive 92/43/EEC', Office for Official Publications of the European Communities, Luxembourg.

EC (2021). European Commission Notice C (2021) 6913 'Assessment of plans and projects in relation to Natura 2000 sites – Methodological guidance on Article 6(3) and (4) of the Habitats Directive 92/43/EEC', Office for Official Publications of the European Communities, Luxembourg.

Englund, A., Ingram, S. & Rogan, E. (2008). An updated population status report for bottlenose dolphins using the Lower River Shannon SAC in 2008, Department of Zoology, Animal Ecology and Plant Sciences, University College Cork, Ireland and Coastal and Marine Resources Centre, Environmental Research Institute, University College Cork, Ireland.

Goodship, N. & Furness, R.W. 2019. Seaweed hand-harvesting: literature review of disturbance distances and vulnerabilities of marine and coastal birds. Scottish Natural Heritage Research Report No. 1096. Available at: SNH Research Report 1096: Seaweed hand-harvesting: literature review of disturbance distances and vulnerabilities of marine and coastal birds

IFI (2023) Using Science to Support Salmon Conservation, Inland Fisheries Ireland. Available at: spotlight-series-salmon-conservation.pdf

Ingram SN, Rogan E (2002) Identifying critical areas and habitat preferences of bottlenose dolphins Tursiops truncatus. Mar Ecol Prog Ser 244:247-255 https://doi.org/10.3354/meps244247

IWDG (2026) Bottlenose dolphin species records. Available at: Irish Whale and Dolphin Group Accessed November 2026

JNCC (2015). Marine mammal observations during seismic surveys from 1994-2010. JNCC Report No. 463A, JNCC Peterborough 2015, ISSN 0963 8091.

Kurz, I. and Costello, M.J. (1999). An outline of the Biology, Distribution and Conservation of Lamprey in Ireland. Irish Wildlife Manuals, No.5. Duchas, The Heritage Service. Department of Arts, Heritage, Gaeltacht and the Islands. Dublin.

Marine Institute (2026). Salmon Life Cycle. Fisheries and Ecosystems. Available at: Salmon Life Cycle | Marine Institute. Accessed May 2026.

Long, A., Rickard, E., Holding, P., Dickerson, B., Hetherington, S., (2026). Review of Impacts of Geophysical and Geotechnical surveys on marine fish and shellfish in Irish waters.

NatureScot (2026). Lamprey. Available at: Lamprey | NatureScot. Accessed November 2026.

NBDC (2026a). Maps - Biodiversity Maps- Zebra Mussel and Maps - Biodiversity Maps- Quagga Mussel Accessed November 2026

NBDC (2026b). Maps - Biodiversity Maps- Giant Hogweed Accessed November 2026

NBDC (2026c). Available at: Maps - Biodiversity Maps- Himalayan balsam Accessed November 2026

NBDC (2026d). Available at: Maps - Biodiversity Maps- Japanese Knotweed Accessed November 2026

NBDC (2026e). Available at: Maps - Biodiversity Maps - Winter Heliotrope Accessed November 2026

NBDC (2026f). Available at: Himalayan_balsam_fact_sheet Accessed November 2026

NBDC (2026g). Available at: Maps - Biodiversity Maps - Eurasian otter Accessed November 2026

NPWS (2012a). Conservation objectives supporting document River Shannon and River Fergus Estuaries SPA (site code: 004077). Available at: https://www.npws.ie/sites/default/files/publications/pdf/004077_River%20Shannon%20and%20River%20Fergus%20Estuaries%20SPA%20Supporting%20Doc_V1.pdf

NPWS (2012b). Conservation Objectives Series Lower River Shannon SAC (site code: 002165). Available at: https://www.npws.ie/sites/default/files/protected-sites/conservation_objectives/CO002165.pdf

NPWS (2012c). Conservation objectives supporting document – marine habitats and species, Lower River Shannon SAC (site code: 002165). Available at: https://www.npws.ie/sites/default/files/publications/pdf/002165_Lower%20River%20Shannon%20SAC%20Marine%20Supporting%20Doc_V1.pdf

NPWS (2012d). Conservation objectives supporting document – Water courses of plain to montane levels with the *Ranunculion fluitantis* and *Callitricho-Batrachion* vegetation (habitat code 3260), Lower River Shannon SAC (site code: 002165). Available at: https://www.npws.ie/sites/default/files/publications/pdf/002165_Lower%20River%20Shannon%20SAC%20Water%20Courses%20Supporting%20Doc_V1.pdf

NPWS (2012e). Conservation Objectives Series River Shannon and River Fergus Estuaries SPA (site code: 004077). Available at: https://www.npws.ie/sites/default/files/protected-sites/conservation_objectives/CO004077.pdf

NPWS (2012f). Conservation objectives supporting document River Shannon and River Fergus Estuaries SPA (site code: 004077). Available at: https://www.npws.ie/sites/default/files/publications/pdf/004077_River%20Shannon%20and%20River%20Fergus%20Estuaries%20SPA%20Supporting%20Doc_V1.pdf

NPWS (2013). Site Synopsis Lower River Shannon SAC (site code: 002165). Available at: https://www.npws.ie/sites/default/files/protected-sites/synopsis/SY002165.pdf

NPWS (2015). Site Synopsis River Shannon and River Fergus Estuaries SPA (site code: 004077). Available at: https://www.npws.ie/sites/default/files/protected-sites/synopsis/SY004077.pdf

NPWS (2024). Conservation Objectives Series Lough Derg SPA (site code: 004058). Available at: https://www.npws.ie/sites/default/files/protected-sites/conservation_objectives/CO004058.pdf

NPWS (2025) The Status of EU Protected Habitats and Species in Ireland. Volume 3: Species Conservation Assessments. Department of Culture, Heritage and the Gaeltacht, Dublin. Available at: article-17-report-2025-volume-3.pdf

OPR (2021). Practice Note PN01: Appropriate Assessment Screening for Development Management. Office of the Planning Regulator, Dublin Ireland.

OSPAR (2023). Status Assessment 2023 - Intertidal Mudflats. Available at: ospar-assessments/committee-assessments/biodiversity-committee/status-assesments/intertidal-mudflats/

Preston, C.D. and Croft, J.M. (2001) Aquatic Plants in Britain and Ireland. Harley Books, Colchester.

Preston, C.D., Pearman, D.A. and Dines, T.D. (eds) (2002) New Atlas of the British & Irish flora. Oxford University Press, Oxford.

RPS (2019) SFPC Maintenance Dredging Foreshore Application - Appendix D Natura Impact Statement. Available at: Microsoft Word - Foreshore Application- Appendix D

Scottish Natural Heritage; SNH (2016). Assessing Connectivity with Special Protection Areas (SPAs) Guidance. Version 3 – June 2016.

Senzaki, M., Barber, J.R., Phillips, J.N., Cooper, C.B., Ditmer, M.A., Fristrup, K.M., McClure, C.J.W., Mennitt, D.J., Tyrrell, L.P., Vukomanovic, J., Wilson, A.A. & Francis, C. (2020). Sensory pollutants alter bird phenology and fitness across a continent, Nature, 587, 605-609. Available at: https://www.nature.com/articles/s41586-020-2903-7

Shannon Foynes Port Company (SFPC) (2020). Inspector's Report on a Dumping at Sea Permit Application. Available at: 090151b280792b02.pdf

Southeastern River Basin District (SERBD) (2013). Southeastern River Basin District Management System. Initial Characterisation Report. Physical Description. Available at: South Eastern River Basin District Management System. Initial Characterisation Report.

Southall, BL, Finneran, JJ, Reichmuth, C, Nachtigall, PE, Ketten, DR, Bowles, AE, Ellison, WT, Nowacek, DP & Tyack, PL (2019). 'Marine mammal noise exposure criteria: updated scientific recommendations for residual hearing effects', Aquatic Mammals, vol. 45, no. 2, pp. 125-232. https://doi.org/10.1578/AM.45.2.2019.125

Triturus (2021). Opposite-leaved pondweed (*Groenlandia densa*) survey of the Loughmore Canal, Co. Limerick. Report prepared by Triturus Environmental Ltd. for IDA Ireland.

Tyler-Walters, H., Tillin, H.M., d'Avack, E.A.S., Perry, F. & Stamp, T. (2023). Marine Evidencebased Sensitivity Assessment (MarESA) – Guidance Manual. Marine Life Information Network (MarLIN). Marine Biological Association of the UK, Plymouth, pp. 170. Available from https://www.marlin.ac.uk/publications

Woodward, I., Thaxter, C.B., Owen, E. & Cook, A.S.C.P. (2019). Desk-based revision of seabird foraging ranges used for HRA screening, BTO Research Report No. 724.