Hartley Anderson Limited

Marine Environmental Science and Consultancy

Article 12 Risk Assessment

Cross Shannon Cable Project Foreshore Licence Application

Report to
Department of Housing, Local Government and Heritage

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SECTION 1 - INTRODUCTION

1.1 Background

Arup with Hartley Anderson Limited have been commissioned by the Department of Housing, Local Government and Heritage (DHLGH) to conduct an Article 12[1] Risk Assessment of an application for a Foreshore Licence for a proposed electricity transmission infrastructure development and associated works (known as the 'Cross Shannon Cable Project'). The application by EirGrid plc. (the licensed Transmission System Operator (TSO) who is applying for a licence to be granted to ESB Networks, the Transmission Asset Owner (TAO)), generally comprises the laying of four 400 kV underground cables (UGC) across the Lower Shannon Estuary, between the existing Moneypoint 400 kV Electricity Substation in the townland of Carrowdotia South, Co. Clare and the existing Kilpaddoge 220/110 kV Electricity Substation in the townland of Kilpaddoge, Co, Kerry. The connection at Moneypoint will be at the existing substation on ESB lands. The connection at Kilpaddoge requires an extension of 5,500m^2 to the existing substation on ESB lands.

In September 2020, EirGrid applied to An Bord Pleanála (Ref. ABP-307798-20) for the same electricity transmission infrastructure to be considered as a Strategic Infrastructure Development (SID). In June 2021 An Bord Pleanála granted planning permission, subject to conditions, to EirGrid for the installation of the Shannon Electricity Cables.

1.2 Relevant consultation responses

The licence application was open for public consultation between 7th May to 7th June 2021. Responses relevant to this Article 12 Risk Assessment are provided in Table 1.1.

[1] Article 12 of the Habitats Directive addresses the protection of species listed in Annex IV(a). The article applies throughout the natural range of the species within the EU and aims to address their direct threats, rather than those of their habitats.

Table 1.1: Responses from prescribed bodies to the consultation

Statutory Body	Applicant's Response
Marine Institute Observation 1 A foreshore application has been submitted for the Cross Shannon Subsea Cable project development by EirGrid Plc. The development comprises the installation of a 400kV circa 5km AC (alternating current) underground cable between the existing Moneypoint 400kV GIS substation in County Clare and the existing Kilpaddoge 220kV substation. Laying of 400 kV Submarine Cables across the Lower Shannon Estuary, including: • The laying of 4 no. 400 kV submarine cables (approx. 2.8 km each) from the proposed land-submarine transition bays located east of the existing Moneypoint Generation Station in Co. Clare across the Lower Shannon Estuary to the proposed 400 kV Air Insulated Switchgear (AIS) Compound at the existing Kilpaddoge 220/110 kV Electricity Substation in Co. Kerry. The submarine cables will be installed by standard submarine installation techniques, which primarily involves them being buried in the seabed. • The installation of communication links between both substations, this will take the form of a fibre optic cable that will be integrated into each of the proposed 400 kV cables. • The installation of fibre optic cables for maintenance and cable monitoring, this will take the form of an armoured fibre cable wrapped helically around each of the proposed 400 kV cables. • Associated works in the foreshore include the reinforcement of the ground beneath and around the cables by various methods including concrete ramps, concrete cable channels, infilling with gravel/concrete, articulated pipes, gabion wall and rock protections where required. A Planning and Environmental Considerations Report and Natura Impact Statement (NIS) were prepared and submitted with the application. These documents consider both the onshore and foreshore aspects of the overall project.	The Applicant noted that the issue of EMF was responded to in the further information submitted to An Bord Pleanála (Planning Permission - Applicant Response to ABP, December 2020). The following further information was provided. Electric and magnetic fields, often referred to as EMFs, are produced both naturally and as a result of human activity. EirGrid designs, develops and operates the transmission grid in accordance with stringent safety recommendations which are made by national and international agencies. The proposed cable will include a sheath covering that will act to reduce the emission of electric fields to negligible levels. The following sections therefore relate to static magnetic fields produced by the transmission of electricity. The environmental assessment of the potential effect of EMF fields on behaviours of marine species was informed by a review of available literature. Reviews of studies on the effects of EMF emissions in migratory fish species have reported a lack of data on Atlantic salmon (*Salmo salar*) and sea trout (*Salmo trutta*) (e.g. Waterside Ecology 2017, Gill and Bartlett 2010). To overcome this lack of data, Gill and Bartlett (2010) appraised the likely responses of Atlantic salmon and sea trout to EMF based on documented responses of other salmonid species, (e.g. Lohmann *et a*l. 2008; Putman *et al*. 2014). Studies undertaken by Lohmann *et al*. (2008) and Putman *et al.* (2014) on salmonid species including sockeye salmon (*Oncorhynchus nerka*), chinook salmon (*Oncorhynchus tshawytscha*), chum salmon (*Oncorhynchus keta*) suggested that earth's magnetic field combined with other directional information, such as stellar cues, are used to identify particular coastal or oceanic regions. If salmonids do use magnetic cues for orientation or navigation it is likely that these cues are used at a large spatial scale and during the oceanic phase of outward and homeward migrations (Lohmann *et al.,* 2008; Putman *et al.,* 2014).

Statutory Body	Applicant's Response
The NIS identifies the likely interactions between the proposed project and the conservation features of all Natura 2000 sites in the vicinity. With certain mitigation measures, the interactions identified during construction conclude that the construction phase of the development is unlikely to impact on the integrity of the conservation sites. What does not appear to have been considered in the NIS is the operational aspects of the development and if this may have an impact on certain conservation features. In particular, no consideration is given to the likely impact of the operation of 400 kV DC transmission line and if this will be any different to the current configuration that uses 220 kV. In particular, the impact that magnetic fields may have on designated fish species (Salmon, lamprey) and marine mammals (Bottlenose dolphin) should have been considered. The closest licenced aquaculture site (T06/233) to the proposed development is approximately 4km. On the basis of the information provided in the planning report, the development is unlikely to impact on any licenced aquaculture activities. There are no known fisheries in the area. It should be noted the closest aquaculture site indicated in the Planning and Environmental Considerations Report is identified as T08/004BO and while this is correctly identified as a fishery order area, it should be noted that this is not a licenced aquaculture site and is not governed by DAFM aquaculture licencing legislation (Fisheries Act 1997).	Once an appropriate coastal region is identified, migration to home (natal) rivers is likely dependent on olfactory cues, with chemical cues extending from natal rivers strongly implicated in the final phases of salmonids migrations (Stabell, 1984; Johnstone *et al*. 2012). Thorstad *et al.* (2011) suggested that once salmon have reached sheltered fjords and sea lochs olfactory cues are the most important sense for homing. Given that the last phase of the spawning migration in salmonids is primarily governed by olfactory cues (Thorstad *et al.* 2011) it can be concluded that salmonid species migration will not be significantly affected by EMF produced by the Cross Shannon cable. As for salmonid species, cross ocean migration in European eel (*Anguilla anguilla*) is likely to be influenced by the species ability to detect the earth's magnetic field (Durif *et a*l. 2013; Naissbett-Jones *et al*. 2017), when located closer to the coast olfaction play a large part in locating river and streams (Waterside Ecology 2017). A number of studies have reported no evidence that EMF presents obstructions to eel migrations. Westerberg and Lagenfelt (2008) assessed migration behaviour of the European eel passing an underwater high voltage cable extending between the Swedish mainland and the island Öland. The study reported that while eel reduced its swimming speed when crossing the cable there was no evidence that the cable was acting as an obstruction to migration. Similarly, a two year field study of migrating Silver eels passing the Baltic Cable showed the species crossed the cable with the same probability as if it were absent (Westerberg 2000). While a number of individuals changed their course slightly when passing the cable it was concluded that the cable did not pose a threat to migration. Given the above, it can be concluded that European eel migration will not be significantly affected by the proposed development. The review by Gill and Bartlett (2010) reported that there was no evidence that sea lampreys possess an ability to detect magnetic fields.

Statutory Body	Applicant's Response
	Furthermore, the review reported no evidence that EMF plays any role in species migration during their homeward migrations to coasts and estuaries. Once at the coast lamprey appear to locate streams using a three-phase strategy (Vrieze *et al*. 2011). The first phase is the initial vertical and horizontal exploration of shorelines. This brings the species close to the mouth of rivers. Once at a river mouth the species turn to face into oncoming currents (rheotaxis). The last phase involves using olfactory cues, whereby adult sea lampreys 'sniff out' rivers populated with juvenile lampreys (Bjerselius *et al*. 2000; Polkinghorne *et al*. 2001; Waterside Ecology 2017). Given the above, sea lamprey migration will not be significantly affected by the proposed development. In studies investigating the effect of EMF on the decapod crab *Cancer pagurus*, Scott *et al*. (2019) investigated reported crabs showed a clear attraction to EMF and significantly reduced their time spent roaming. Experiments have reported varied responses in elasmobranchs to EMF. For example, Gill *et al.* (2009) reported the lesser spotted dogfish (*Scyliorhinus canicula*) were more likely to be found close to the energized cable. The study also showed some thornback ray (*Raja clavata*) individuals moved more in the vicinity of the EMF. Hutchison *et al.* (2018 and 2020) investigated the effect of EMF associated with high voltage cables on the decapod American lobster (*Homarus americanus*) and the elasmobranch Little skate (*Leucoraja erinacea*). The studies showed that when exposed to EMF American lobster exhibited a subtle change in exploratory behavioural activity while little skate exhibited a strong exploratory/ foraging behavioural activity. While the behavioural changes are likely to have biological relevance in terms of how the animals will move around and be distributed within a cable EMF zone, it is considered that EMFs did not constitute a barrier to movements across the cable for either lobsters or skates. Consequently, it can be concluded that EMF produced by the proposed development is unlikely to significantly affect decapod (e.g. crab, lobster) or elasmobranch species (e.g. dogfish, skate, ray). No data were found that marine mammals are negatively impacted by EMF.

Statutory Body	Applicant's Response
	With regard to the nearest aquaculture site, the information provided by the Marine Institute is noted.
Marine Institute (MI) Observation 2 in light of Applicant's response of 08 June 2021 Having reviewed the response from the applicant, the Marine Institute had a number of observations: 1. The NIS is supposed to be a stand-alone document and should not have to rely on information derived from a communication during a separate licencing process. 2. Furthermore, it is important to note that in relation to the submission as it related to aquatic species, that the lack of evidence of impact is not evidence of no impact. While the Marine Institute accepts that, for some species, magnetic fields as navigational aids may be replaced by olfactory cues in riverine situations, this does not mean that the sensitivity to magnetic fields is disabled. 3. The Marine Institute suggests that the operators, if licenced, engage in research to address the issues raised in the attached (see Appendix 1) reprint which have direct relevance to the issues highlighted. The recommendations therein will help identify (and model) specific interactions and behavioural modification (if any) between aquatic species and EMF. Notwithstanding and specifically in relation to the Foreshore licencing process, the Marine Institute was broadly satisfied with the response and had no further observation	The Applicant noted that, in line with its strategic commitment to update the EirGrid Evidence-Based Studies, to reflect marine receptors in 2023, EirGrid commits to engage with all relevant stakeholders, including the Marine Institute, in the coming years. The updates will include reviewing the evidence base for, and potential options to conduct primary research in, EMF. It is noted that, in their submission of 21 July 2021, the Marine Institute has stated that it is broadly satisfied with the response and have no further observations in relation to the Foreshore licencing process. EirGrid has no further response to make in this regard.
Marine Institute (MI) Observation 3 in light of Applicant's response of 23 August 2021 The Marine Institute welcomed the commitment for future research with regard to EMF and will engage where relevant. The Marine Institute had no more observations on this application	There were no further comments.

1.3 Legislative context

The *Foreshore Act 1933* (as amended), requires that a lease or licence must be obtained from the Minister for Housing, Local Government and Heritage for the carrying out of works or placing structures or material on, or for the occupation of or removal of material from, State-owned foreshore.

The 1992 EU Habitats Directive (Council Directive 92/43/EC) and Birds Directive (2009/147/EC) are transposed into Irish law by Part XAB of the *Planning and Development Act 2000* (as amended) and the *European Communities (Birds and Natural Habitats) Regulations 2011* (as amended).

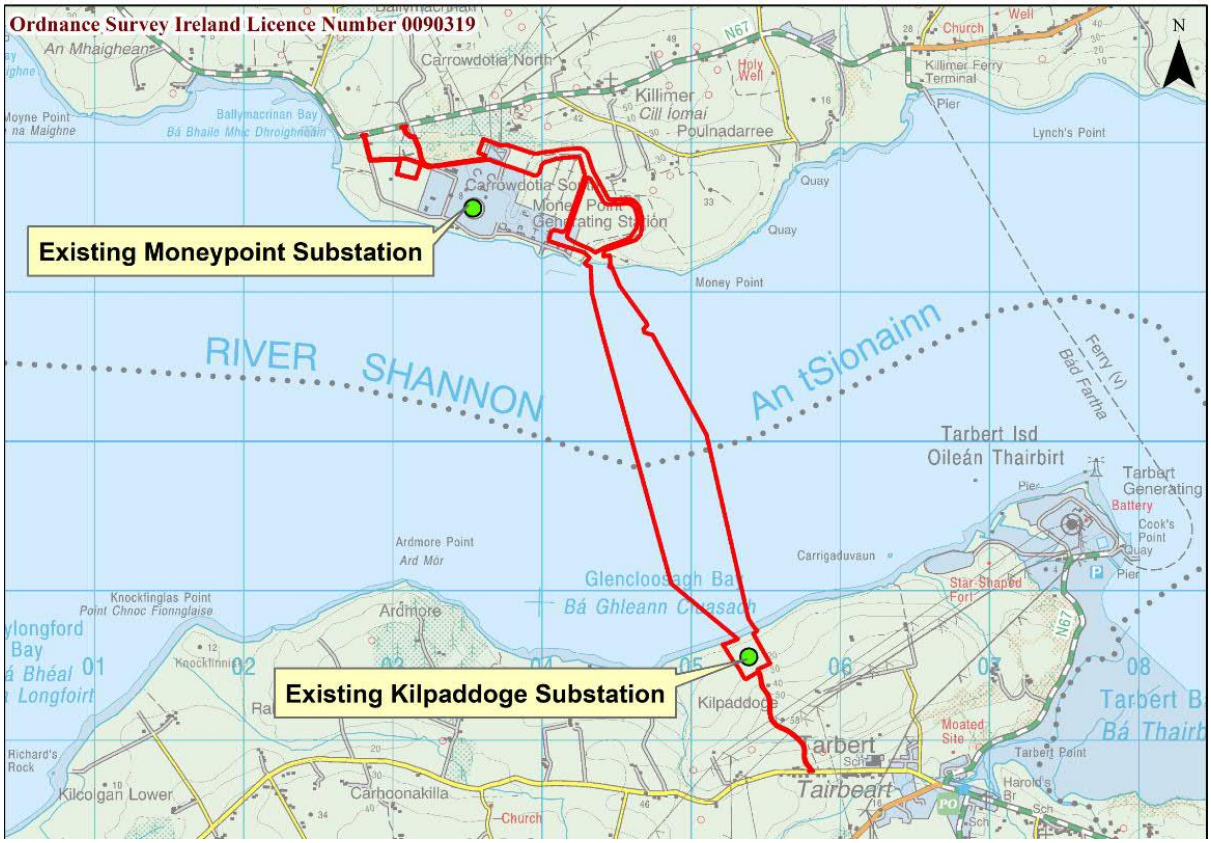
In addition to the requirement to consider potential effects of a plan or project on European Sites under Article 6(3) of the Habitats Directive, the Directive requires consideration of the potential effects on species listed under Annex IV of the Directive (termed Annex IV species). Under Article 12, Annex IV species are afforded strict protection throughout their range, both inside and outside of designated protected areas. All cetaceans are included in Annex IV of the Directive.

SECTION 2 - DESCRIPTION OF PROPOSED WORKS

2.1 Proposed project location and description

The Cross-Shannon Cable 400 kV Project involves the laying of four new cables across the Shannon Estuary (in the seabed) between the Moneypoint 400 kV Electricity Substation in the townland of Carrowdotia South County Clare and Kilpaddoge 220/110 kV Electricity Substation in the townland of Kilpaddoge County Kerry. The connection at Moneypoint will be at the existing substation on ESB lands. The connection at Kilpaddoge requires an extension of 5,500m^2 to the existing substation on ESB lands (Figure 2.1).

Figure 2.1: Proposed Project Location



2.2 Route description

The proposed development mainly consists of:

- An onshore development comprising 2 main elements: connection at Moneypoint Substation and connection at Kilpaddoge Substation;
- A submarine development, consisting of the laying of four 400 kV submarine cables across the Lower Shannon Estuary. The Foreshore consent application FS007083 refers to this part of the proposed development, specifically covering the impacted sites below the bed and shore, below the line of high-water of ordinary or medium tides. The Foreshore Licence Area (98.15 ha) is highlighted in red on Figure 2.2 which also shows the proposed submarine cable corridor.

Figure 2.2: Foreshore Licence Area

2.2.1 Onshore development

The following information is provided as context as with respect to onshore development, only the cable landfalls on either side of the estuary is subject to foreshore consent.

Connection at Moneypoint Substation

Moneypoint Electricity Generating Station is an existing operational coal fired power station which consists of three generators to produce electricity to supply the main transmission network. Moneypoint 400 kV substation is a Gas Insulated Switchgear (GIS) type substation and is located inside the existing operational Moneypoint Electricity Generating Station. The substation is the marshalling point for the electricity, and it acts as a node on the transmission network.

The landfall generally comprises concrete cable troughing, associated civil works and transition joint bays. The joint bays enclose the connections made between the land-based cables and the submarine cables. The proposed northern landfall is located to the south of the main coal yard / ash storage area on third party lands.

The transition area, comprising four individual transition joint bays, each with the approximate footprint of 10m (length), 2.5m (width) and 2m (depth). This arrangement also includes a land submarine transition joint bay for the spare submarine cable.

The jointing bay will be constructed with concrete floor and sidewalls. Once the cables are connected to the relevant joints within the jointing bay, compact cement-bound sand is put into

the bay to surround the cables and joints. Additional sand and excavated material is then backfilled into the bay and the bay is subsequently covered over.

The geology of the nearshore approaches / intertidal area will determine how the cables will be installed into the transition joint bay. Usually, a cable is brought ashore by an open cut trench requiring access for excavation equipment. Where a rock shelf is present, further civil works will be required, taking the form of gabion bags filled with stone and revetments to support the approach by securing and protecting the cable installation. Cylindrical metallic cable protectors will also be installed as necessary at these locations to provide mechanical protection to the cables.

Connection at Kilpaddoge Substation

Kilpaddoge station is a relatively newly constructed 220 / 110 kV GIS substation to the south of the Shannon Estuary in County Kerry. In order for the 400 kV cable circuit to connect to the station at Kilpaddoge a power transformer is required. This transformer is a piece of outdoor electrical plant that is used to change the system voltage from 400 kV to 220 kV, which is the operating voltage at Kilpaddoge. An extension to the existing Kilpaddoge Electrical Substation of approximately 5,500m^2 will be required to facilitate new 400 /220 kV AIS equipment and associated compound.

The proposed 400 kV cable circuit will run south from the southern landfall to the existing Kilpaddoge 220 kV GIS substation via a 400 kV AIS bay and a 400 / 220 kV power transformer. The proposed landfall is located approximately 60m north of the existing substation. No specific details are provided by the applicant on the Kilpaddoge landfall.

2.2.2 Submarine / River Shannon crossing

The new 400 kV submarine cable route runs from a landfall adjacent to the Moneypoint Electricity Generating Station on the north side of the Shannon Estuary to a landfall at Glencloosagh Bay, directly to north of Kilpaddoge substation on the south side. The overall estimated submarine cable route length is approximately 2.8km. The area of the proposed submarine cable corridor between the high-water mark of ordinary or medium tides (MHWM) on each shoreline (for which this application for consent is applied) is approximately 0.737km^2.

A communication link will also be provided between both substations, this will take the form of two fibre optic cables laid alongside or integrated into the proposed 400 kV cables. Environmental constraints, including the archaeological potential within the study area, were considered in parallel with the design optioneering process in determining the proposed route corridor.

The riverbed varies along the proposed route alignment from fine to coarse gravelly sand to fine sand. The gravelly clay is limited to the near shore areas. The proposed installation techniques (see below) are suitable given the sediment conditions encountered along the corridor.

2.3 Installation of submarine cables

2.3.1 Plant and equipment

The proposed submarine equipment includes:

- Primary Cable Laying Barge (CLB) or Cable Laying Vessel (CLV)
- Cable floatation devices for submarine-landfall pull in

- Cable burial tool
- Pre-lay Grapnel (PLG) and launch vessel
- Mass Flow Excavator (MFE) tool and launch vessel
- Post-lay trench jetting tool
- Support / guard vessel(s)
- Rock protection installation vessel
- Cylindrical cable protection.

It is anticipated that the launch vessel for the PLG and MFE will be the same vessel.

2.3.2 Installation sequence

The proposed installation sequence is summarised below. The actual methods and sequence of the cable installation are subject to detailed design, pre-construction surveys and review by stakeholders, authorities and contractors:

1. Moneypoint and Kilpaddoge landfall works (excavation and civil works). Site preparation works including civil and earthworks are required at both landfalls to re-profile the existing coastline to the final design profile to enable the cable pull in to take place. Following cable installation at Moneypoint, the concrete slipway structure will be backfilled (where appropriate) and encased by a pre-cast concrete slab that will sit on top of the backfilled material. Rock protection will be installed in front of the coastline at the toe of the concrete slipway to mitigate the risk of erosion underlying or outflanking the new structure. Earthworks at Kilpaddoge will likely involve installation of rock / gravel filled gabion bags or backfill material to prevent deep burial of the cable that could induce the risk of cable de-rating. Following cable installation, the existing coastline will be reinstated to its original profile and level. Rock protection may be installed in front of the coastline;

2. Route clearance (pre-lay grapnel run) along all four cable alignments;

3. Seabed preparation works along all four cable alignments. Seabed slopes between 10-25 degrees are observed in marine survey data near to the northern landfall. The steepest slopes angles occur for approximately 25-50m, between the 5m and 10m bathymetry contour. At these locations, seabed preparational works, such as rock filter bag placement, may be required to reduce the slope angles for cable installation purposes;

4. Submarine works for each cable alignment (assume starting with Cable No.1, most westerly alignment):
    a. Sand wave re-profiling/dispersal by Mass Flow Excavation (MFE). A MFE tool will be used to flatten sand waves with amplitudes of more than 0.5m and allow a cable burial tool to bury the cable to a controlled and determined depth. Sand wave reprofiling is required along approximately a 2km chainage of each cable alignment.
    b. Post-MFE route clearance (secondary pre-lay grapnel run) to clear any obstructions which may have been exposed during the use of the MFE tool.
    c. Moneypoint landfall cable pull-in. The CLB/CLV will start from a position approximately over the 15m bathymetry contour (less than 100m from the shoreline at Moneypoint). A messenger wire will be transported by a support vessel to shore and passed through the cable quadrant, over onshore cable rollers, and up to the cable winch. The winch will then pull the cable from the CLB/CLV to beyond the transition joint bay (TJB) at the top of the cliff. Here,

the cable armouring is removed and secured to an armour clamp which will likely be incorporated into the seaward concrete wall of the TJB (subject to the Contractors design).

d. Submarine cable installation. A number of techniques may be employed including using a cable burial tool or jetting tool to install the cable (as described in Section 2.2.3.4 of the AA Screening and NIS report.

5. Repeat step 4 for cable no.2, no.3 and no.4. All sequences detailed in steps 4 above will be repeated until all four cables have been installed to KP2.2[2] and pulled ashore to Kilpaddoge.

6. Post lay submarine cable installation for all four cables. After all four cables have been installed (buried) between KP0.0 and 2.2, post-lay burial of all four cables between KP2.2 and 2.8 will take place. A cable burial tool or jetting tool, either remotely operated (ROV) or pulled by a combination of the onshore winch and marine vessel.

7. Landfall and submarine cable protection installation for all four cable alignments. Additional protection over the buried in submarine works areas (below LAT) will be installed by a specialist marine contractor with a marine vessel. Based on the preliminary burial risk assessment and the results of the marine surveys, approximately 1km of additional protection is identified as required at the approach to northern landfall, near the centre of the channel and southern landfall. Local rock supplies will be used as the priority but imported rock may be necessary. In either case it would be common practice that the rock grade, quality is screened and tested such that it meets the design specification as defined at the detailed design stage. A rock specification will ensure that fines are removed, and rock is washed if necessary.

8. Post construction survey campaigns (cable burial depth and bathymetric surveys) to confirm the target burial depth has been achieved. Future marine surveys will assist in monitoring the performance of the cables over the life of the new asset.

2.3.3 Duration of works

Subject to the grant of statutory approvals, it is programmed that construction will commence in 2022, for it to become fully operational by the end of 2023.

For the submarine development, the cable installation within the Shannon Estuary is expected to take approximately three weeks to complete. Each cable installation run is anticipated to take approximately 3-5 days to complete. These works will be carried out seven days a week 24 hours a day. The duration of the works is indicative only, safety requirements for the installation operations / procedures and weather condition may ultimately dictate the final programme. Also, works associated with the submarine cable installation will be carried out outside of the peak dolphin calving season (August) depending on weather conditions.

2.4 Operation of the cables

If a fault/break is caused to a cable, a repair operation would be undertaken by a cable vessel, retrieving the faulted section of cable to the vessel and repairing on board. The repaired cable would then be returned and reburied in the seabed, using the ROV mounted cable burial technique, to the approximate original location.

[2] The applicant's document uses chainage to describe the horizontal distance along the cable routes, starting at KP0.0 at Moneypoint, and ending at KP2.8 at Kilpaddoge.

2.5 Decommissioning of the cables

Following the guidelines from the Commission for Regulation of Utilities (CRU) on decommissioning of submarine cables, typically such assets have an operational lifetime of at least 50 years. Depending on the results of the regular maintenance surveys carried out during the project operation, an exact timing for the decommissioning will be determined.

When decommissioning the sub-marine development, the cables will be disconnected at the landward joints and the cable will be left in the seabed. The sea protection rocks overlying the cables will not be recovered. The land-based transition joint pits are also to be left in situ.

SECTION 3 - RELEVANT ANNEX IV SPECIES

Under Article 12 of the Habitats Directive, Annex IV species are afforded strict protection throughout their range, both inside and outside of designated protected areas. Those Annex IV species that could potentially occur at the proposed works and surrounding waters are described below.

3.1 Cetaceans

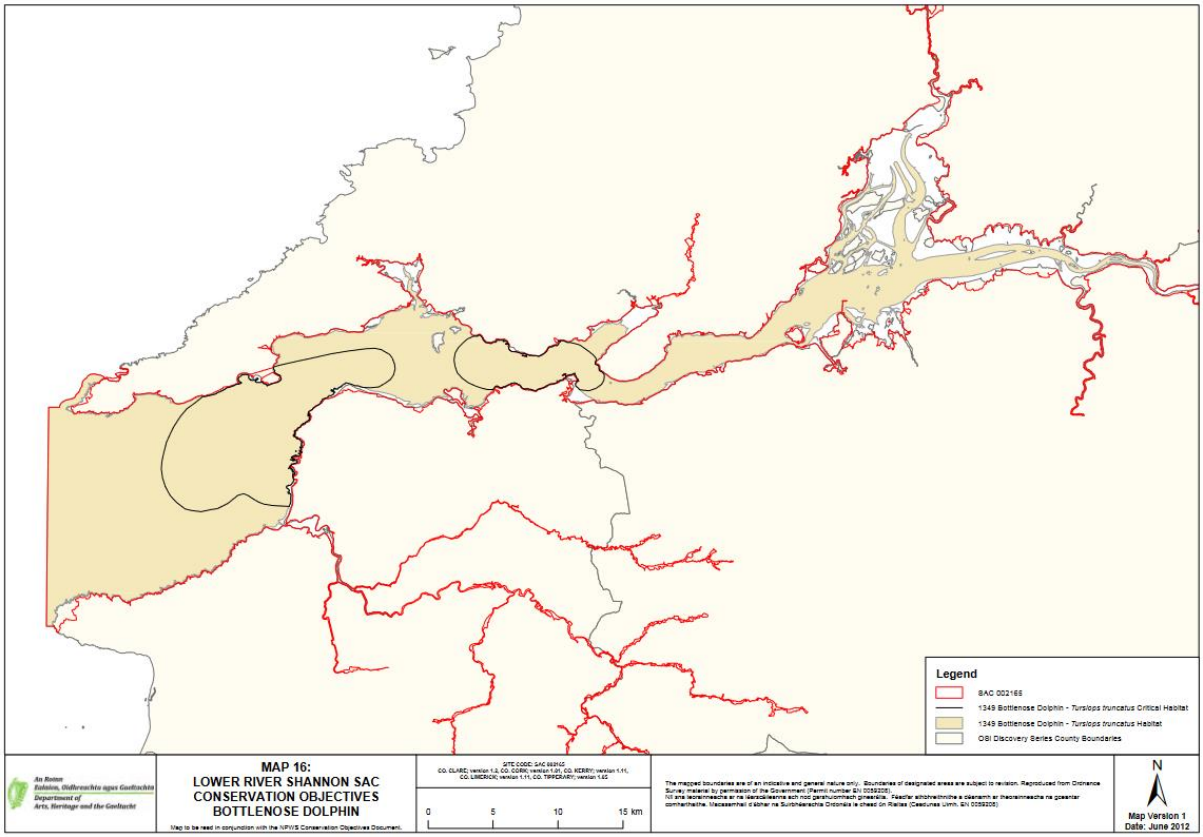
Section 7.3.2 of the Planning and Environmental Considerations Report (PECR) indicates that the NBDC records two species of marine mammal: bottlenose dolphin (*Tursiops truncatus*) and common dolphin (*Delphinus delphis*) (although the common dolphin appear to be primarily from the IWDG strandings database). Harbour porpoise (*Phocoena phocoena*), although rare, are also present in the area (Berrow, *pers. comm*., see also[3]).

Section 7.3.3.2 of the PECR indicates that the Shannon Estuary is the most important site in Ireland for bottlenose dolphins and was designated as a cSAC for the species in 1999 (Berrow *et al*. 2012). A study on genetics of bottlenose dolphins in Ireland suggested that the bottlenose dolphins in the Shannon Estuary are genetically discrete and thus of very high conservation value (Mirimin *et al.* 2011). The population at the site was estimated in 2006 to be approximately 140 individuals (NPWS 2013). The most recent surveys of the species in the estuary were undertaken during June to early October 2018 and estimated the population to be approximately 139 (Rogan *et al*. 2018). The population size estimated in 2018 was reported by Rogan *et al*. (2018) to lie within the range of population estimates calculated for the site since 1997 and indicated a stable population size. Bottlenose dolphins in the Shannon Estuary calve between June and September with the peak calving period occurring in August (Ingram 2000).

The proposed development is in an area of the Lower River Shannon SAC identified as important for bottlenose dolphin (NPWS 2012). Specifically, the proposed development is located in a critical habitat area identified for the species (NPWS 2012). Critical habitat areas are preferentially used by the species. Furthermore, the proposed development is located in an area identified by Berrow *et al.* (2012) as having high habitat suitability for the species (see Figure 3.1). Surveys reported by Rogan *et al.* (2018) indicated relatively high counts of the species in the vicinity of the proposed development area.

[3] https://iwdg.ie/porpoises-in-the-shannon-estuary-20th-march-2018/

Figure 3.1: Bottlenose dolphin critical areas, representing habitat used preferentially by the species



Source: NPWS (2012)

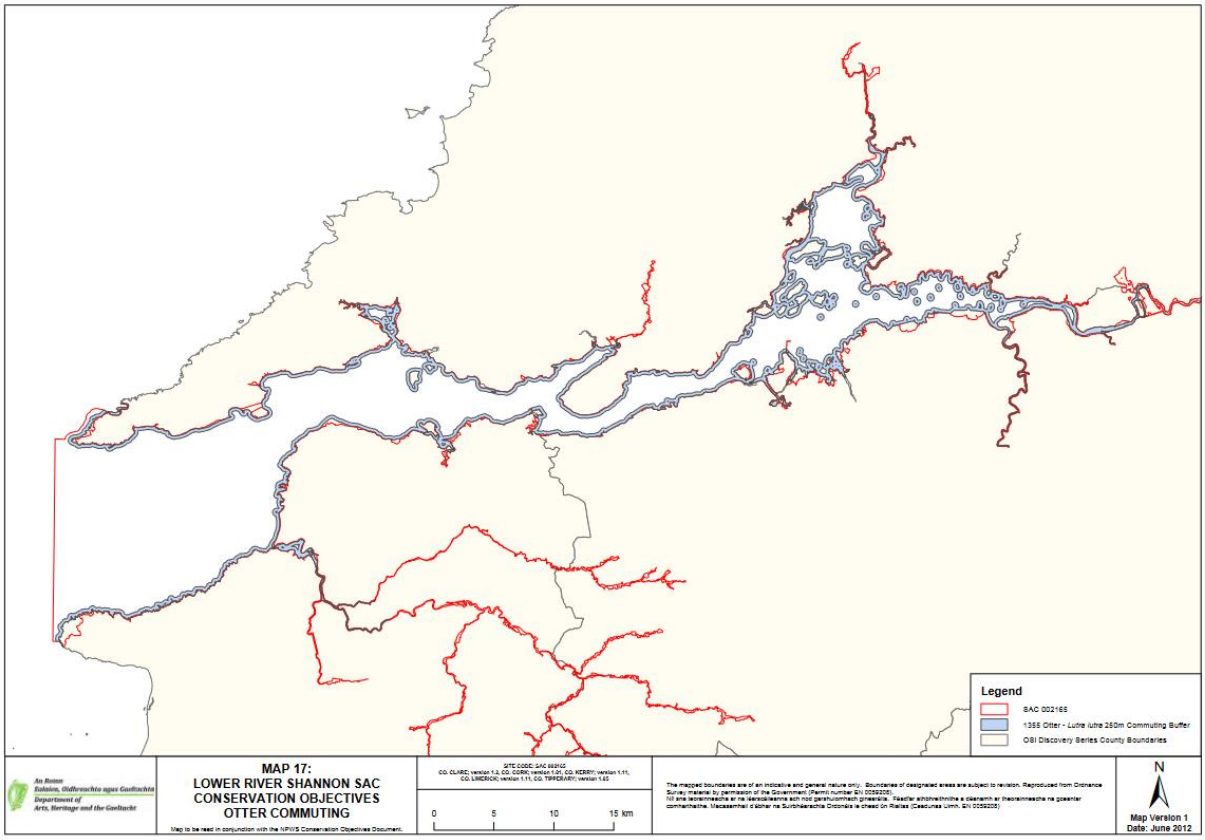
3.2 Other Annex IV species

Otter typically forage within 80m of the coastline but can transverse distances of up to 500m between islands and between the mainland and islands (Section 7.3.3.2 of PECR). Figure 3.2 indicates the otter commuting area within the Lower River Shannon SAC based on otters foraging within 80m of the shoreline (HWM) (NPWS 2012). Their habitat overlaps the coastal section of the cable laying area. Bailey & Rochford (2006) revealed that otters are present throughout the Shannon Estuary. The sightings reported through the National Biodiversity Data Centre identify areas where freshwater enters the estuary as being more typical of otter usage e.g. Ballylongford Bay, Tarbert Bay, Kilrush (data from the *Lutra lutra* database held by the National Biodiversity Data Centre[4]).

No evidence of otter holts or resting sites were observed within the proposed development site. That being said, otters do have the potential to occur within the proposed development area for periods of time.

[4] https://maps.biodiversityireland.ie/Map/Terrestrial/Species/119290

Figure 3.2: Otter commuting area within the Lower River Shannon SAC



Source: NPWS (2012)

Five species of marine turtle have been recorded in the seas around Ireland and the UK: leatherback turtle (*Dermochelys coriacea*), loggerhead turtle (*Caretta caretta*), Kemp's ridley turtle (*Lepidochelys kempii*), green turtle (*Chelonia mydas*) and hawksbill turtle (*Eretmochelys imbricata*). The leatherback turtle is the largest of the marine turtles and is the only species of turtle to have developed adaptions to cold water (Goff & Stenson 1988).

A significant majority of turtle sightings recorded in Irish waters are of the leatherback turtle (King & Berrow 2009), which migrates into the waters of the Celtic and Irish Seas in response to the distribution of the gelatinous zooplankton which make up their favoured diet (Doyle *et al.* 2008, Fossette *et al.* 2010). Tagging studies show that they migrate across the Atlantic from the eastern American mainland and the Caribbean (Hays *et al*. 2004, Doyle *et al*. 2008). Sightings in the wider region are concentrated off the south and west of Ireland, the southwest of England and the west coast of Wales. Most sightings occur in the summer, peaking in August (Penrose & Gander 2016, Botterell *et al*. 2020). The decadal trends of leatherback turtle records in Ireland and the UK show a general increase, peaking in the 1990s from which it has since decreased. Data from the National Biodiversity Data Centre[5] reflects these patterns with the predominance of sightings in the south and west of Ireland, although only a single record from the inner Shannon Estuary in 1970. Aerial surveys for the ObSERVE project from 2015-2016 recorded a handful of leatherback turtle sightings at the southern limits of Irish offshore waters in summer (Rogan *et al*. 2018).

[5] https://maps.biodiversityireland.ie/Species/128443

SECTION 4 - RISK ASSESSMENT

4.1 Potential impacts associated with proposed works

4.1.1 Vessel and construction noise disturbance

Based on previous similar works in the Shannon, it is anticipated that a CLB/CLV vessel of *ca*. 125m in length will be employed to conduct the cable laying. Other project vessels that will be used include a launch vessel and guard/ support vessel(s). Vessel noise is a combination of tonal sounds at specific frequencies (e.g. propeller blade rotational frequency and its harmonics) and broadband noise (Vella *et al*. 2001). Propeller cavitation noise is the primary source of sound from vessels underway, whilst noise from propulsion machinery originates inside a vessel and reaches the water via the vessel hull. Noise from shipping is roughly related to vessel size, larger ships have larger, slower rotating propellers, which produce louder, lower frequency sounds (SMRU 2001).

Overall, vessel noise covers a wide range of frequencies from 10Hz to 10kHz. A typical 12m fishing vessel moving at 7 knots will have a peak frequency of 300Hz with sound pressure level of 150dB re 1 µPa at 1 m (DAHG 2014). Several studies have described and reviewed underwater sounds from a variety of larger commercial ships in transit (e.g. OSPAR 2009, Bassett *et al*. 2012, McKenna *et al*. 2012, Veirs *et al*. 2016). In general, support and supply vessels (50-100m) are expected to have broadband source levels in the range 165-180dB re 1µPa@1m, with the majority of energy below 1kHz (OSPAR 2009). Larger vessels of 100-300m length, including tankers, bulk carriers and container ships, produce higher source levels generally in the range of *ca*. 175-190dB re1 μPa^2 (OSPAR 2009, McKenna *et al*. 2012). While most energy from these larger vessels is below 200Hz, median received levels above those of ambient levels (+ 5-13dB) have also been reported at higher frequencies of 10,000-40,000Hz up to a distance of 3km from the source (Veirs *et al*. 2016). Of potential relevance, the use of thrusters for DP has been reported to result in increased sound generation of ~10dB compared to the same vessel in transit: measurements at 600m range to an offshore supply vessel of 79m length recorded broadband SPL (18-3,000Hz) of 148dB re 1µPa (root-mean-squared, rms) when in DP mode, compared to 135.5dB re 1µPa rms when in transit at a speed of 10 knots (Rutenko & Ushchipovskii 2015).

The predominantly low frequency sound produced by large vessels (<200Hz) will likely be detectable by the marine mammal receptors described in Table 4.1. However, the source level is very unlikely to be above the PTS threshold except within a very short distance of the vessel. Of the species likely to occur in the area, the harbour porpoise (very high-frequency hearing group) has the lowest threshold criteria for the onset of PTS from non-impulsive sounds. However, the primarily low frequency nature of the vessel noise is likely below the porpoise's hearing range.

Table 4.1: TTS and PTS thresholds for marine mammals exposed to non-impulsive noise

Hearing group	Very high frequency (e.g. harbour porpoise)	High Frequency (e.g. bottlenose dolphin, common dolphins)
Generalised hearing range [frequency of best hearing]	13 kHz - 140 kHz [105 kHz]	150 Hz – 160 kHz [55 kHz]
PTS (dB re 1µPa^2s)	173	198
TTS (dB re 1µPa^2s)	153	178

Source: Southall et al. (2007, 2019), Kastelein et al. (2015)

These source levels are also the proposed injury threshold criteria (PTS) for non-impulsive noise for high frequency cetaceans (which includes common bottlenose dolphin, 198 dB re 1 µPa²s) (Southall *et al*. 2019). There is potential for some behavioural disturbance of common bottlenose dolphin in response to vessel noise (reviewed by Erbe *et al.* 2019). Whilst the area of potential disturbance will be highly localised (i.e. within a few hundred metres radius), transient and of short overall duration, the relatively narrow channel and slow-moving installation vessel could impact the movement of dolphins along the estuary, particularly on the northern side which appears more suitable for dolphins (Figure 3.8 of the AA Screening and NIS report). Therefore mitigation measures (Section 4.2) are proposed to minimise the potential for disturbance.

Available information on potential effects of underwater sound on marine turtles is very limited (Nelms *et al*. 2016). The hearing range of cheloniid species has been estimated at between 50-2,000Hz, with highest sensitivity below 400Hz (Popper *et al*. 2014). For leatherback turtles, measurements made on hatchlings suggested a similar low frequency sensitivity, with sound detection ranging between 50 and 1,200Hz when in water and between 50 and 1,600Hz in air (Dow Piniak *et al*. 2012). Underwater noise generated by the proposed construction vessels may be detectable by leatherback turtles, although their rarity in the area dictates that very few individuals are likely to be exposed to noise levels beyond that of the background for the region.

Any otters in the area will have very limited exposure to underwater noise given they are predominantly terrestrial animals which may utilise coastal waters to forage. Given the lack of evidence of otter or holts during surveys of the area and the limited sources of freshwater in the immediate area, it may not represent a particularly suitable habitat for otter. Whilst otters may commute through the area (see Figure 3.2), the potential for noise during landfall construction activities to cause significant disturbance to otters is unlikely given the limited temporal and spatial extent of the works.

4.1.2 Habitat disturbance

Construction activities such as cable burial, pre-lay grapnel clearance and the mass flow excavator will all cause disturbance to the habitats along the route between Moneypoint and Kilpaddoge. Bottlenose dolphins will not be impacted by sediment resuspension caused by cable laying as these species are adapted to living in the highly turbid estuarine waters of the Shannon Estuary.

As above, the lack of evidence of otter or holts during surveys of the area and the limited sources of freshwater in the immediate area, indicate that the area is unlikely to represent a suitable habitat for otter. Therefore the limited spatial extent of landfall construction activities are unlikely to represent significant habitat disturbance to otters.

4.1.3 In-combination effects

The Electricity Supply Board (ESB) is proposing to develop a Synchronous Condenser on land at Moneypoint Power Station, Carrowdotia, Co. Clare. An AA screening assessment for the development noted that piling works during the construction phase of the development may result in elevated underwater noise in the immediate vicinity of the Moneypoint site which could affect bottlenose dolphin. The NIS prescribed a marine mammal observer (MMO) operating in accordance with ‘Guidance to Manage the Risk to Marine Mammals from Man-made Sound Sources in Irish Waters’ as mitigation to alleviate the potential for adverse effects on the Lower River Shannon SAC. The Synchronous Condenser development will be delivered over a 12–18 month programme (as per the planning application). There is potential for the works to coincide with the Cross Shannon 400 kV project which could in turn exacerbate the noise

effects on the bottlenose dolphin qualifying interest. Therefore, mitigation measures (Section 4.2) are proposed to minimise the potential for disturbance.

The applicant noted the proposed LNG terminal at Ballylongford, Co. Kerry (Shannon Technology and Energy Park) and that potential in-combination effects could arise if both projects are constructed at the same time. As part of the STEP project, the sources of underwater noise considered that could arise were modelled including noise from jetty pile driving activities, noise from a range of vessels including a combination of the FRSU, the LNG carrier vessels and tugs that will be in use during operations at the LNG terminal, commercial vessels heading up and down river and the cross-Shannon ferry (Vysus 2021). An ecological impact assessment (LGL 2021), was prepared of these noise sources on the Shannon dolphins and porpoises, and other species.

The report (LGL 2021) concluded that pile driving was the only source of noise that had the potential to cause a permanent threshold shift (PTS) for dolphins. Sources of continuous non-impulsive sounds (such as vessel noise) had no potential for PTS. The report concluded that the potential disturbance exposures would have no more than a minor impact, such as localised short-term avoidance of the area around the activities by individual animals, with no effect on the population. Based on these findings, the applicant concluded that the temporary presence and additional noise emitted from the cable laying vessel will only have a minor effect and an insignificant effect on the noise climate; consequently significant noise effects will not occur to the population of dolphins present in the Lower Shannon.

4.2 Mitigation measures

EirGrid and the cable laying operators will implement impact mitigation and monitoring measures in relation to marine mammals as outlined in DAHG Guidance to Manage the Risk to Marine Mammals from Man-made Sound Sources in Irish Waters (DAHG 2014), and will consult with IWDG.

Specifically, the contractor will implement the measures and protocols described in Section 4.3.4 of the guidance. In summary, trenching and cable laying activity will not commence until after the successful completion of pre-start visual monitoring, undertaken by MMOs as per DAHG guidance, with no marine mammals observed over the required monitoring period in the monitored zone. The works will commence with a ‘soft-start’ procedure to allow marine mammals to vacate the works area. In addition, having regard to consultation with the NPWS, no works will occur during the month of August which coincides with the peak calving/breeding period for the species.

In the event that the construction phase of the development is delayed more than 12 months after the initial surveys, a post consent verification otter survey will be undertaken within the ZoI of the proposed development site to establish the presence of any otters.

4.3 Conclusion

With implementation of the above mitigation measures, it is very unlikely that there will be negative residual impacts from the proposed works on Annex IV species in the area. It is also very unlikely that any animals will be injured or killed as a result of the proposed works.

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