Celtic Interconnector Project

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Environmental Impact Assessment Report supporting the Foreshore Licence Application

March 2021

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EIRGRID

Report for

EirGrid plc and Réseau de Transport d'Électricité

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Document revisions

No.	Details	Date
1	Draft for client review	January 2021
2	Incorporation of client comments	February 2021
3	Inclusion in Draft Application File	March 2021

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Glossary

AA	Appropriate Assessment
AIS	Automatic Identification System
BAS	Burial Assessment Study
CBRA	Cable Burial Risk Assessment
CEF	Connecting Europe Facility
CPCS	Cable Protection Complementary Study
DEFRA	Department for Environment Food and Rural Affairs
DOL	Depth of Lowering
EC	European Commission
EEZ	Exclusive Economic Zone
EIA	Environmental Impact Assessment
EIAR	Environmental Impact Assessment Report
EPC	Engineering Procurement Construction
EQS	Environmental Quality Standard
ESAS	European Seabirds at Sea
EU	European Union
FLO	Fisheries Liaison Officer
GES	Good Environmental Status
HVDC	High Voltage Direct Current
HRA	Habitats Regulations Assessment
ICES	International Council for the Exploration of the Seas
IUCN	International Union for the Conservation of Nature
JER	Joint Environmental Report
JNCC	Joint Nature Conservation Committee
KP	Kilometre Point
MCAA 2009	Marine and Coastal Access Act
MCMS	Marine Case Management System
MCZ	Marine Conservation Zone
MFE	Mass Flow Excavator

MHWS	Mean High Water Springs
MMO	Marine Management Organisation
MW	Megawatt
NCA	National Competent Authority
NSCOG	Northern Seas Offshore Grid
OGA	Oil and Gas Authority
PCI	Project of Common Interest
PEXA	Practice and Exercise Areas
RTE	Réseau de Transport d'Electricité
SAC	Special Area of Conservation
SCANS	Small Cetaceans in European Atlantic waters and the North Sea
SFWD	Shellfish Waters Directive
SI	Statutory Instrument
SPA	Special Protection Area
SSSI	Site of Special Scientific Interest
TEN-E Regulation	European Union Regulation No. 347/2013 on guidelines for Trans-European Network for Energy
TOC	Total Organic Carbon
TOM	Total Organic Matter
TSO	Transmission System Operator
TSS	Traffic Separation Scheme
UK	United Kingdom
UKHO	United Kingdom Hydrographic Office
UXO	Unexploded Ordnance
VMS	Vessel Monitoring Service
WFD	Water Framework Directive
ZoI	Zone of Influence

5 Description of the landfall

Commented [A2]: Placeholder: Preface to be prepared and included, outlining relationship between this document and Vol 3D Part 1, prior to submission of the final Application File.

Claycastle Beach, south of Youghal, Co. Cork, was selected as the best performing of the identified Irish landfall options [Celtic Interconnector Step 4A and Step 4B Reports]. The two HVDC cables and the fibre optic link will be buried within pre-installed Steel / High Density Polyethylene (HDPE) conduits beneath the beach and car park at Claycastle Beach with the HVDC cables entering the two underground concrete chambers of the TJB. There will be one communications chamber which will house the joint between the submarine communications / fibre optic link and the terrestrial communications / fibre optic link. Further details on the chambers are available in Volume 3C. In order to minimise the disruption to the beach area and ensure that the main construction activities occur outside the bathing season it is proposed to construct the landfall in two phases. Phase One involves the pre-installation of conduits while Phase Two involves the pull-in and burial of the cables.

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The exact details of the landfall construction shall be determined in the detailed design phase. There are two options. The first is to install the conduits almost to the LAT level and thus minimise disruption to the beach during the bathing season but increase the construction effort in phase one. The second is to install the conduits below the carpark and extending only a short distance below the beach, thus significantly reducing the construction effort, in particular there would be no requirement for a causeway and the extent of cofferdam piling would be minimal thus reducing associated noise and traffic. However, it would result in short duration exclusion zone and detours on the beach during the cable installation.

As Option 1 above represents the worst case scenario from an EIAR perspective, and Option 2 does not introduce new or additional concerns, the impact of Option 1 is considered in this assessment. Where Option 2 presents a significant difference or is out of line with the scope of Option 1 it is included.

Figure 5.1 Phase One landfall construction for Option 1

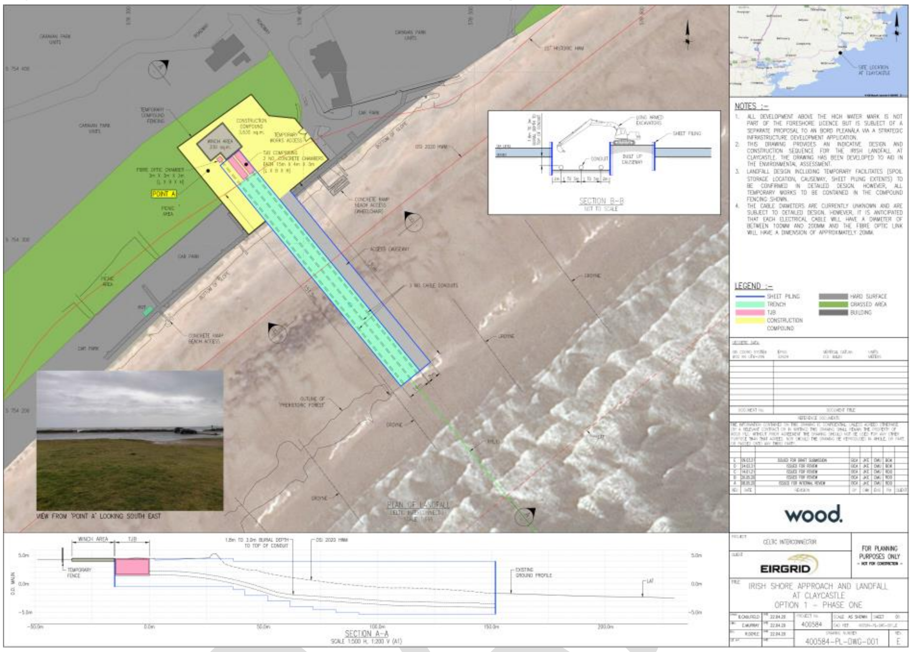


Figure 5.2 Phase One landfall construction for Option 2

5.1 Cable Conduits

Three cable conduits are conservatively assumed, one for each cable (import HVDC cable, export HVDC cable, and fibre optic link). The carbon steel conduits will be designed with a specific gravity of approximately 1.4 - 1.6 to ensure against liquefaction. The size of the conduit has been conservatively based on an internal diameter of 300mm. Alternative conduit material such as HDPE may be used. It should be noted that HDPE is buoyant when flooded and will require the installation of concrete collars to ensure ballast even when trenched in the nearshore.

The conduits will be installed at a 5m spacing between centres and will extend from the TJB (located shore side of the beach parking lot) to approximately 150m into the intertidal zone in Option 1 and to the top of the beach in Option 2.

In Option 1 the conduit cable entry point is located within the intertidal zone, approximately 50m shoreside of Lowest Astronomical Tide (LAT). The advantages of locating the conduit cable entry point above LAT is that it will enable land-based installation equipment to be used. This removes the requirement for an extended cofferdam / causeway at the landfall and the use of a pre-lay dredging spread beyond LAT.

The burial depth to top of conduit varies from 3.0m onshore to 1.8m offshore at the conduit entry point.

Figure 5.3 Steel (Left) and HDPE (Right) Conduits

5.2 Landfall Interface Construction Works

The cable landfall installation method selected for Claycastle Beach is an open cut installation method to be constructed in two phases. Horizontal Directional Drilling (HDD) is not feasible due to the distance to the 5m water depth required for the offshore supporting vessel,and the gentle sloping nature of the beach and nearshore.

5.2.1 Phase One Installation

The first phase of the installation involves the installation of pre-installed conduits within a trench excavated across the beach, and extending across an existing car park located above the beach to the area of the TJB.

Within the beach area, the trench will be excavated using land-based equipment such as long arm excavators. Option 1 will require the aid of a temporary sheet piled cofferdam to ensure trench stability and an adjacent temporary causeway for access. The trench will be backfilled, and site reinstated to its original condition following phase one installation (approximately 10 weeks).

Temporary sheet pilling (cofferdam) and the installation of a temporary causeway will be required to achieve the required DOL for the cable installation and prevent the ingress of seawater and sediments. The steel sheet-piles will be installed using a pilling rig comprising hydraulic vibratory hammers. The piling rig will typically work from the beach outward, using the formed temporary causeway as an access route.

The cofferdam will be approximately 130m long and formed from two lines of sheet piles installed parallel to the centreline of the conduits. The cofferdam will also be enclosed by sheet piles at its offshore end. With the conduits installed at a 5m spacing between centres, a 14m wide cofferdam is conservatively assumed to be sufficient. The cofferdam will be installed from a temporary causeway constructed adjacent to the cofferdam.

It is assumed that the temporary causeway will also be enclosed by sheet piles on all shore facing sides to mitigate against the ingress of seawater and sediments particularly at high tides. The causeway will be of sufficient width to allow heavy land-based equipment to manoeuvre during trench excavation and conduit installation. An 8.0m wide causeway (est. 6000m^3) is assumed to be sufficient. The temporary causeway shall be constructed from aggregate material to provide sufficient strength to support excavating equipment. The temporary causeway will be constructed, utilized and removed during the 10week period of phase one.

Option 2 would not require a causeway and cofferdam would be minimal (approx. 5m)

The proposed offshore trench, cofferdam and temporary causeway for Option 1 are illustrated in Figure 5.4 and Figure 5.5.

Figure 5.4 Temporary Works – Trench, Cofferdam, Causeway (typ. N.T.S)

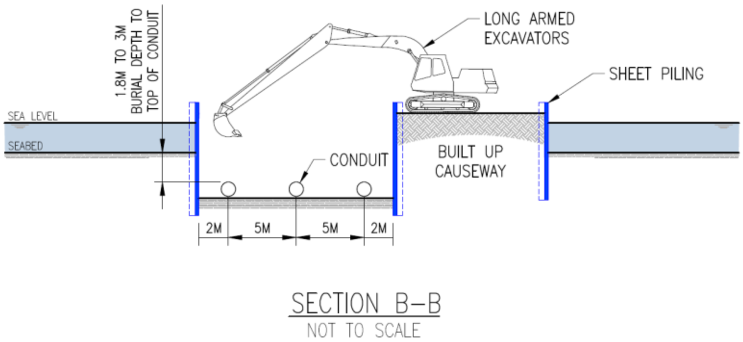


Figure 5.5 Temporary Works – Cofferdam and Causeway Construction

Following installation of the temporary cofferdam the trench shall be excavated using long armed excavators from the causeway. The trench depth tapers from 3m at the onshore connection point to the TJB, to 1.8m in the intertidal area. Figure 5.6 provides a sketch of this phase of installation. Spoil material from the trench (est. 4000m^3) shall be stored within a temporary construction compound (detailed in Section 5.3), to be located onshore on hard standing. Storage and re-use of spoil will allow the site to be restored to its previous condition following the installation of the conduits. Stored spoil shall be adequately covered to prevent exposure to the elements.

Following completion of the trench the conduits shall be transported from a staging area located in the hard standing car park within the construction compound and will be laid above ground in the trench on top of support structures such as sandbags, trestles, and plinths. Conduit pipe segments (3m-5m) shall be strung together by welding to form the conduit pipe string and transferred shoreward using lifting machinery as shown in Figure 5.7.

Figure 5.6 Temporary Works – Trench Excavation

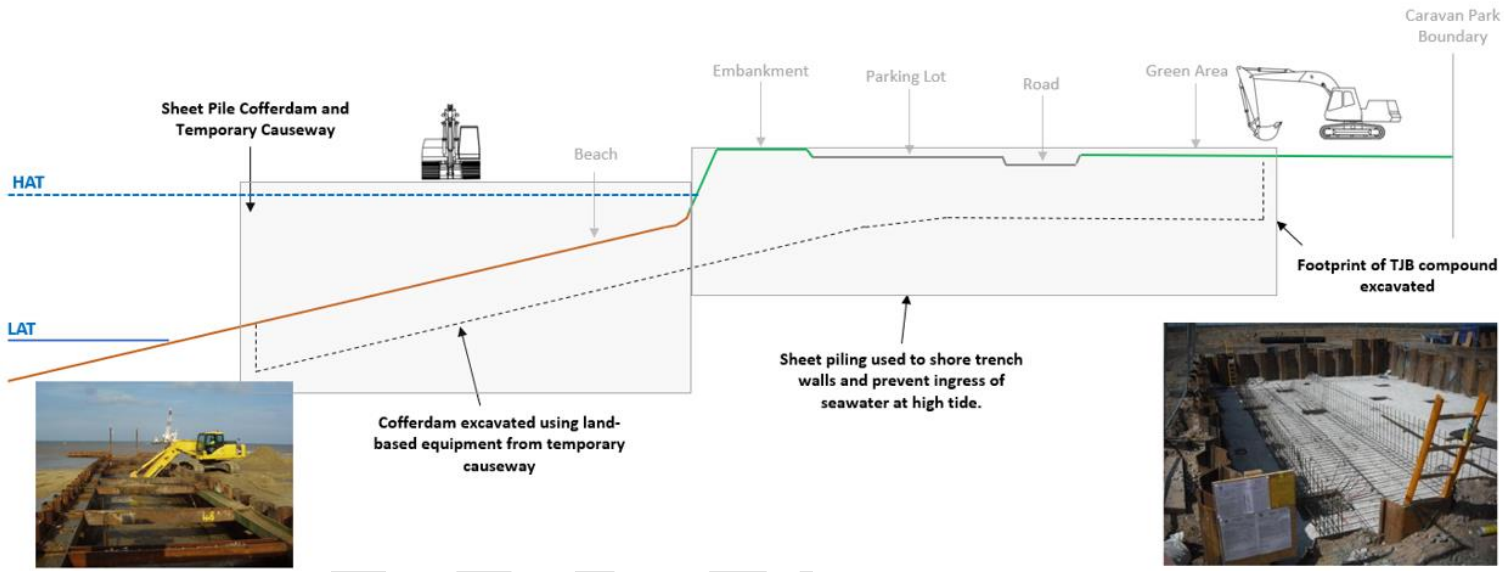
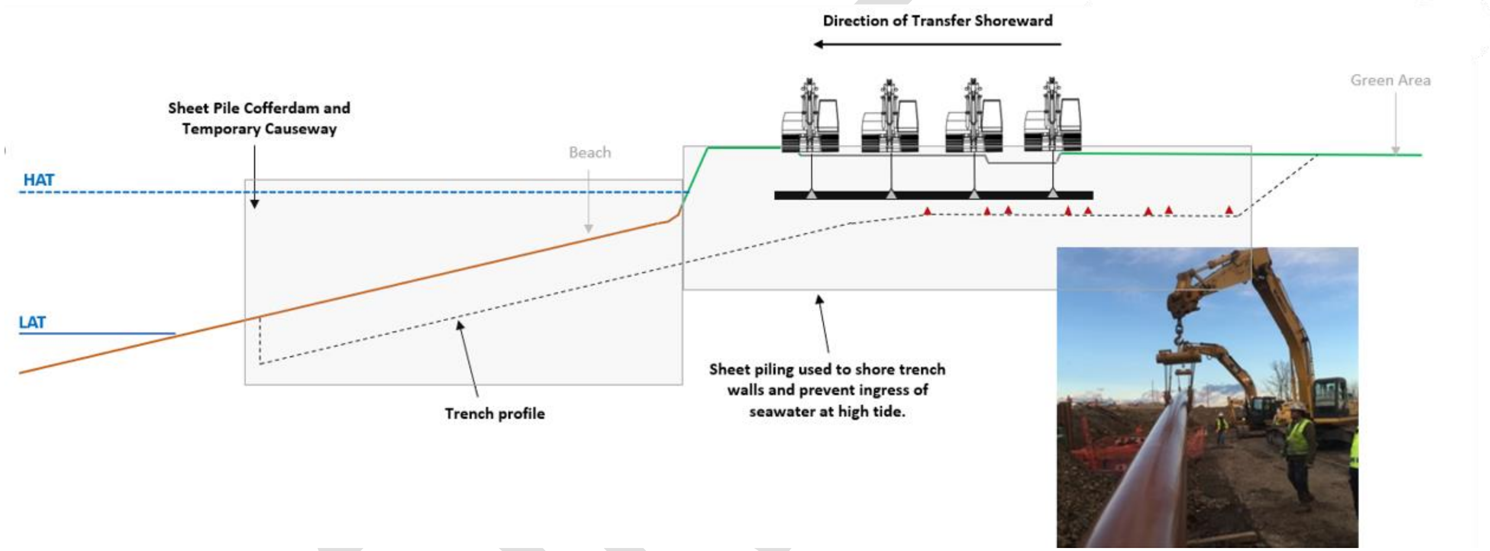


Figure 5.7 Temporary Works – Conduit installation



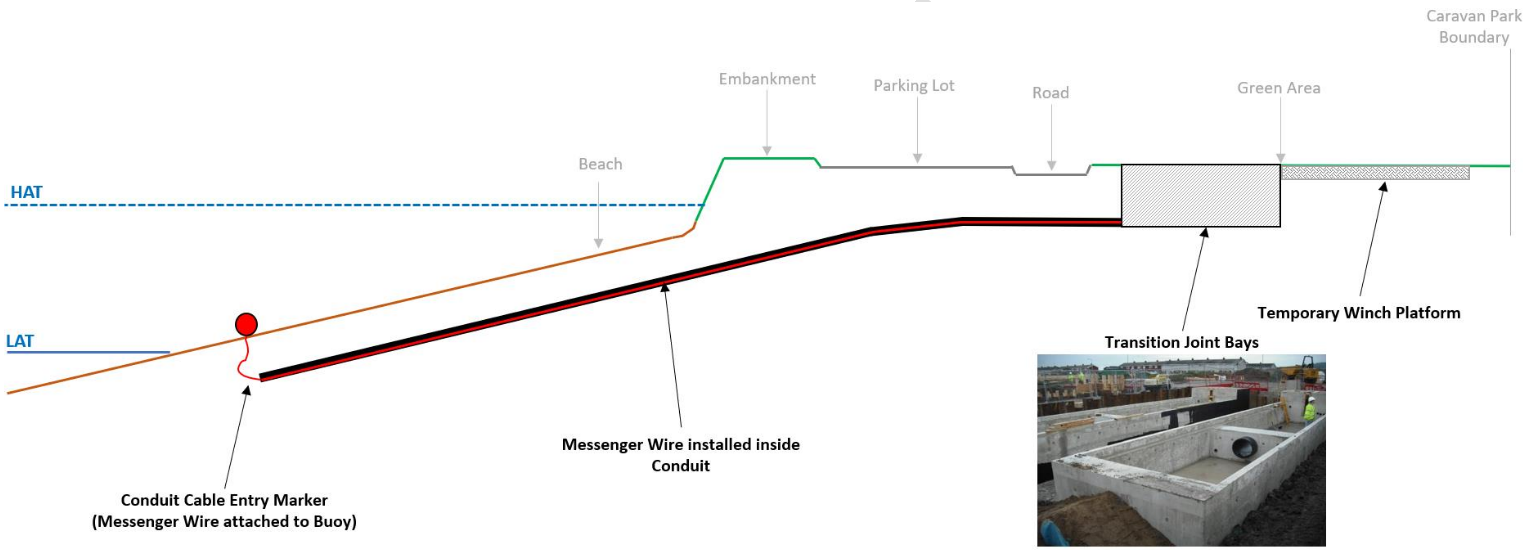
Following the installation of the conduits any temporary conduit supports within the trench will be removed and a messenger wire will be pre-installed within the conduits. The trench spoil will be returned to the trench to re-instate the beach to its prior condition. The temporary causeway and cofferdam will be removed and the car park will be re-instated.

A temporary winch platform will be required for phase two. The temporary winch platform will be established on the shore side of the TJB in order to pull the cables through the conduits and into the TJB. It is proposed to construct this platform during phase one to minimise disruption to third parties in phase two.

It is assumed that a 20m-by-20m winch platform will be sufficient for this operation. The platform will be of hard standing, typically compacted aggregate. The platform will be level; however, a slight sloping angle may be advantageous for cable vertical alignment during the pull operations and to manage surface water drainage.

Figure 5.8 shows the installation layout at the end of phase one with the beach restored to its prior condition and the temporary winch platform and conduit end pipe marker the only visible installation elements.

Figure 5.8 Phase One Post-Construction



5.2.2 Phase Two Installation

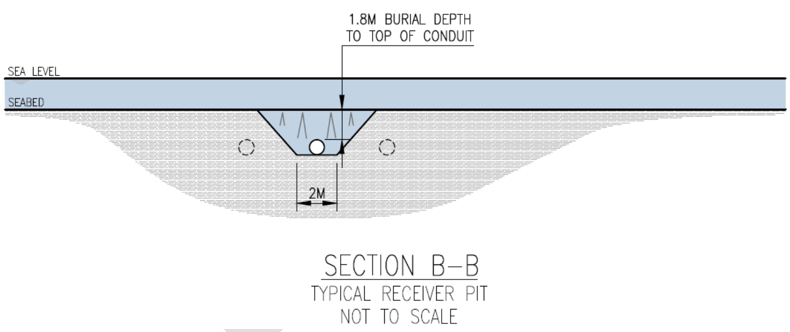
The second phase of the installation sequence involves pull-in of the offshore cables through the pre-installed conduits and into the TJB using a cable winch spread. The location of the receiver pit will vary between Option 1 and Option 2, however, all other activities are similar. Option 2 would require exclusion of the public from a 50m corridor of the beach for 2-3 days for the installation of each cable, however, the car park would remain fully accessible and allow for diversion around the exclusion zone.

The receiver pit for each of the cable conduit entry points will be a tapered trench approximately 10m long. The trench will start from the end of the conduit and extend towards LAT where it will taper up to the seabed. This receiver pit is required to retrieve the pre-installed messenger wire from the end of the conduit and to provide a smooth transition from the seabed down to the conduits during cable pull-in.

The receiver pit will be excavated using land-based equipment at low tide to minimise sediment dispersal within the water column. It is envisaged that each receiver pit will be excavated separately just prior to the associated cable pull-in operation and backfilled prior to excavation of the next receiver pit for the next cable pull-in.

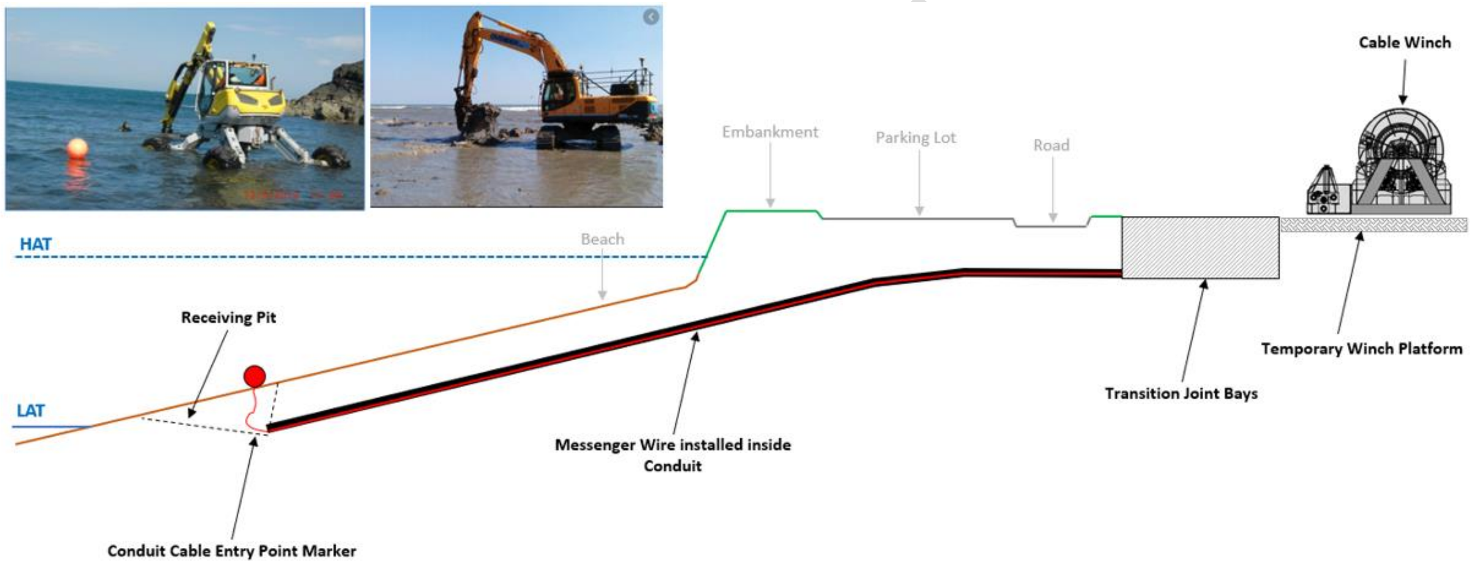
The typical receiver pit that is proposed for each of the cable conduit entry points is illustrated in Figure 5.9.

Figure 5.9 Temporary Works – Cable Conduit Entry Excavation



A cable winch shall be installed on the temporary plinth located behind the transition joint bay. The onshore end of the messenger wire shall be retrieved from the TJB and connected to the cable winch wire. Figure 5.10 shows the arrangement once the cable winch has been installed.

Figure 5.10 Temporary Works – Cable Winch installed



The submarine cables shall arrive on site aboard a cable lay vessel. The messenger wire shall be transferred to the cable lay vessel for connection to the end of the submarine cable as shown in Figure 5.11.

The submarine cable is then floated / pulled onto shore with the aid of temporary buoyancy aids which are removed prior to pull into the conduit. The temporary buoyancy aids are retrieved by the cable lay vessel as shown in Figure 5.12. The winch is used to pull the cable ends up to the TJB. Once the cable is secured in the TJB, the offshore cable lay and burial process shall commence. For this, a plough / jetter shall be transferred to the beach to bury the cable seaward. Following departure of the cable lay equipment, the receiving pit shall be filled in and the beach restored to its prior condition as shown in Figure 5.13.

Figure 5.11 Messenger Wire Transfer to Cable Lay vessel

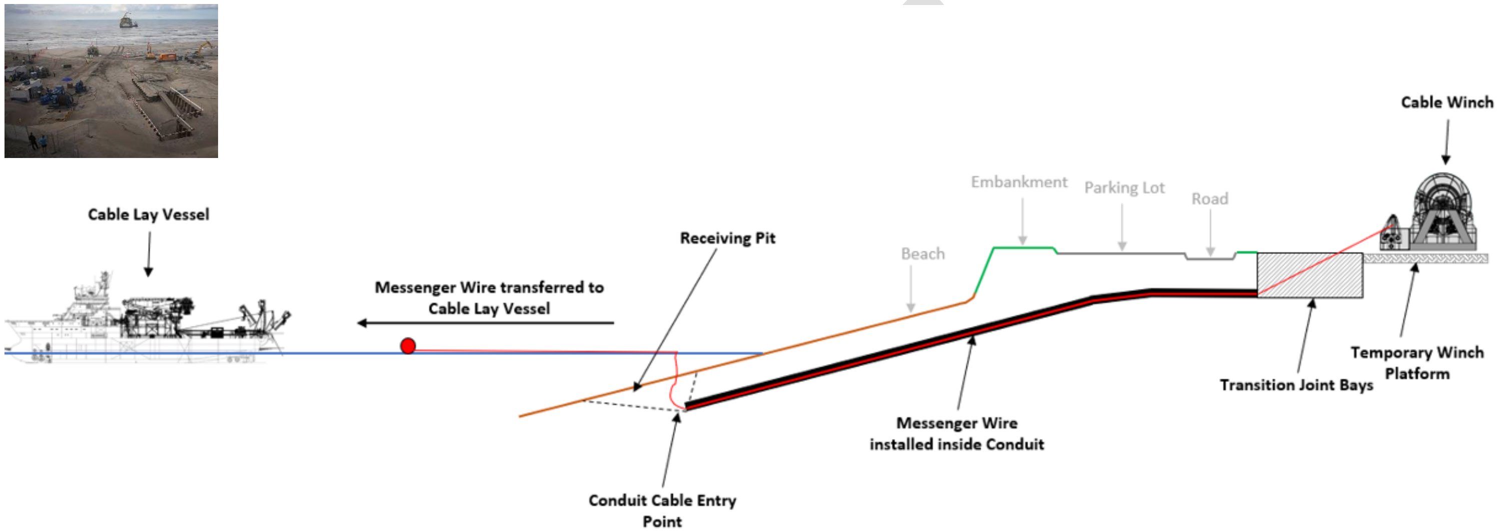


Figure 5.12 Submarine Cable floated to Shore

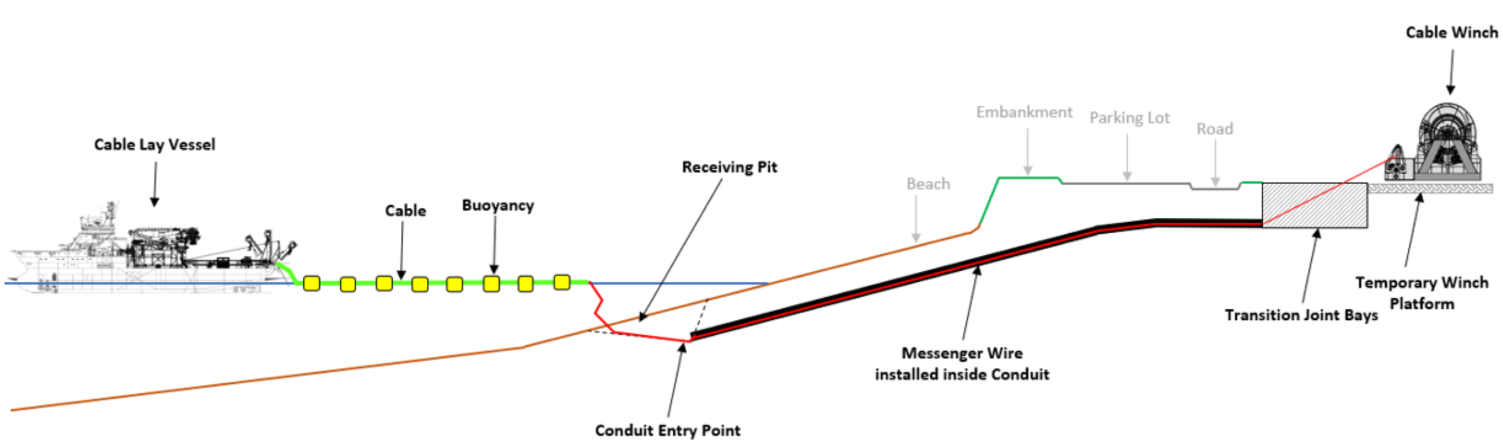


Figure5.13 Phase Two Post-Construction

5.3 Temporary Construction / Laydown Areas

5.3.1 Irish Landfall Interface Area: Phase One Construction

Land take of approximately 3,360m^2 is required along the beach, the car park, and the section of grass which separates the car park from the year-round holiday park for phase one as shown in Figure 5.14. This area will be used for installation of the onshore trench, the TJB and the winch platform.

Access shall be through a temporary gate located at the car park entrance utilizing the current access road. All installation workers will be directed to use the designated access/egress routes only.

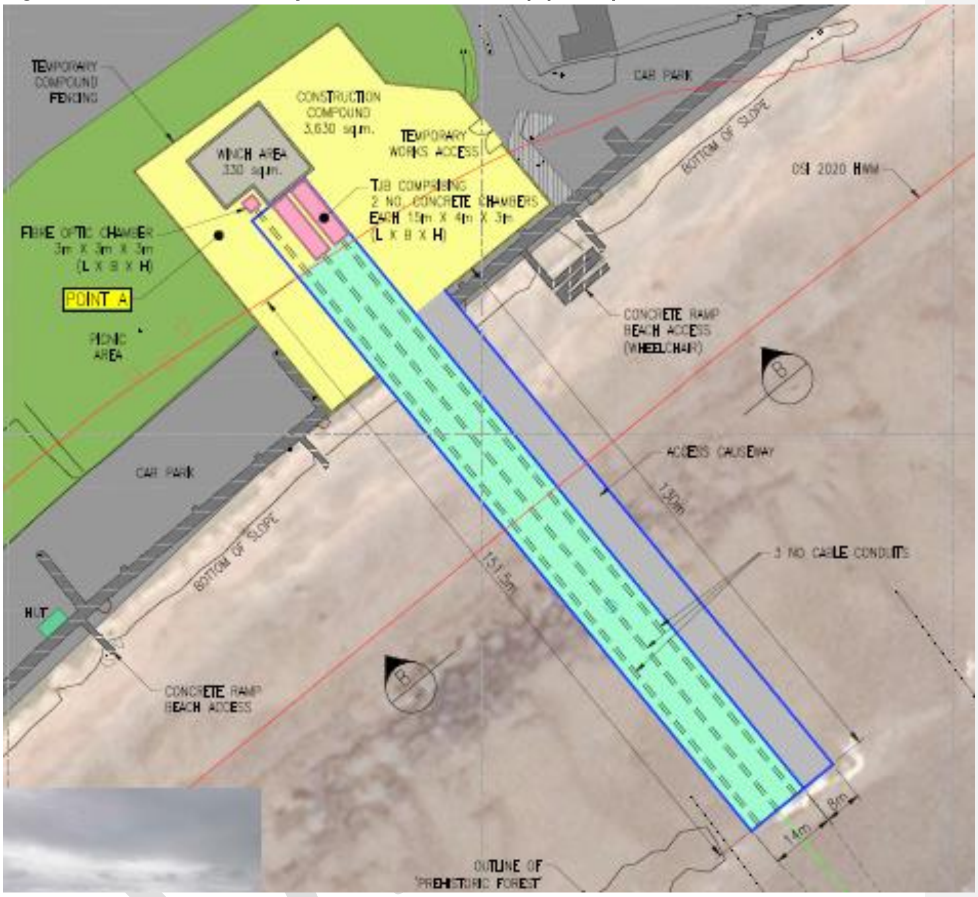
Temporary facilities will be provided which will include installation phase car parking, welfare facilities and laydown areas as necessary. The hard standing car park area will be used as a staging area for all installation activities. Any discharges from temporary welfare facilities will be connected to a sealed holding tank to be emptied and disposed of off-site by a licensed contractor to a licenced facility, operating within its design capacity.

Storage of fuel and refuelling will be within bunded hardstanding areas. Water will be brought to site via tankers as required.

Land take of approximately 2,860m^2 is also required into the intertidal zone for installation of the sheet pile cofferdam and temporary causeway.

Construction and laydown areas for phase one installation are shown in Figure 5.14.

Figure 5.14 Construction/laydown Area Phase One (Option 1)



5.3.2 Irish Landfall Interface Area Phase Two Construction

In phase two, a land take of approximately 1,750m^2 is required in the section of grass that separates the car park from the year-round holiday park. This area will be used for the winch, its retaining system (back anchorage) and all associated equipment. Car park access to the general public shall not be disturbed at this time. Access to the site shall be through a temporary gate to the public car park.

In Option 1 Limited land take is also required in the intertidal zone around each of the conduit cable entry points. This is required to retrieve the pre-installed messenger wire from the end of the conduit prior to cable pull-in. In Option 2 an exclusion corridor will extend from the receiving pit at the top of the beach to the water line during cable installation. Access to the car park will remain allowing diversions for those walking on the beach. Construction and laydown areas for phase two installation are shown in Figure 5.15.

Figure 5.15 Construction / Laydown Area Phase Two

5.4 Construction Traffic

5.4.1 Irish Landfall Phase One

The construction of the cofferdam and causeway associated with Option 1 represents the worst case scenario for construction traffic and is therefore described below.

The installation vehicle movements for the transportation of steel for the cofferdam and aggregate material for the temporary causeway are estimated at 60 ingress / egress movements for the cofferdam and 1,200 ingress / egress movements for the temporary causeway. This is expected to take approximately 4 weeks in two phases; installation and removal.

Approximately 100 sections of steel conduits shall be transported to the installation site on flatbed lorries each being 3m-5m in length. This will require approximately 30 vehicle movements over a three-week period. Construction vehicular movements are envisaged to occur via the N25 and the local road to Claycastle Beach, thereby avoiding the built-up area of Youghal. However, a construction access route, in particular for larger vehicles, will be agreed between the appointed contractor and the Local Authority prior to commencement of main development at the Landfall Interface area.

The number of installation workers required during the installation phase is expected to peak at approximately 30 persons for the submarine cable landfall. Approximately 40 light vehicle movements per day will be required to transport these workers to and from the sites. Parking will be required for the duration of the works.

Following completion of the trench backfill the car park section which was removed for the trench shall be re-instated necessitating an additional 10 access / egress movements to supply tarmacadam.

Note: This does not include the installation of the TJB which is discussed in Volume 3C.

5.4.2 Irish Landfall Phase Two

The installation vehicle movements for the second phase are estimated at 100 ingress / egress movements which may include at least 2 abnormal load movements for the delivery and retrieval of the cable winch.

The number of installation workers required during the installation phase is expected to peak at approximately 10 persons for the submarine cable landfall. Approximately 10 light vehicle movements per day will be required to transport these workers to and from the sites. Parking will not be required within the compound for the duration of the works in order to maintain public access to the car park which shall also be used for construction workers parking.

5.5 Outline Construction Schedule and Timing of Works

Subject to the grant of statutory approvals, it is programmed that installation of the offshore route will commence in 2024, for it to become fully operational by the end of 2026.

5.5.1 Irish Landfall Phase One Installation

The first phase of the installation sequence will be focused outside the peak summer months, i.e. October 2024 to April 2025, to avoid conflicting with the tourism season at Claycastle Beach. It involves the installation of pre-installed conduits within a trench excavated across the beach. The estimated duration for Option 1 phase one is anticipated to take approximately 10 weeks and is detailed as follows:

- Mobilisation / Site Preparation – 1 week.
- Landfall Civil Works – 4 weeks.

- Conduit stringing and Installation – 3 weeks.
- Backfilling and Site Reinstatement – 2 weeks.

The estimated duration for Option 2 phase one is anticipated to take approximately 6 weeks and is detailed as follows:

- Mobilisation / Site Preparation – 1 week.
- Landfall Civil Works – 2 weeks.
- Conduit stringing and Installation – 2 weeks.
- Backfilling and Site Reinstatement – 1 week.

This activity is expected to coincide with the installation of the TJB, which is further detailed in Volume 3C.

The durations of the works provided above are indicative only and based on an assumed work week Monday to Friday 7am to 7pm and Saturday from 7am to 2pm. The duration of certain works could be shortened by shift-work seven days a week, 24 hours a day – this will be agreed by the appointed contractor and the Local Authority prior to the commencement of main construction as part of a Construction Environment Management Plan (CEMP). Safety requirements for the installation operations / procedures and weather condition may ultimately dictate the final programme.

5.5.2 Irish Landfall Phase Two Installation

Subject to approval from the relevant authorities, the second phase of the installation sequence would be focussed on the summer months, i.e. May 2024 to September 2024, to coincide with favourable weather windows for offshore cable installation. The cable may be laid away from or towards the Irish shore. Schedule certainty shall be subject to progress rates from offshore cable installation if the cable is laid towards shore. There would be greater certainty should the offshore cable installation commence in Ireland and be away from shore.

Note the installation of the 3 cables will not occur simultaneously and therefore works described here may need to happen on three separate occasions.

The estimated overall duration for each cable pull-in in phase two is anticipated to take approximately 2 weeks, detailed as follows:

- Mobilisation / Site Preparation / Winch Setup – 1 week.
- Cable Pull (total) – 3 days.
- Cable Jointing Activities / Site Reinstatement – 1 week.

The durations of the works provided above are indicative only and based on a work week Monday to Friday 7am to 7pm and Saturday from7 am to 2pm. The duration of certain works could be shortened by shift-work seven days a week, 24 hours a day. Safety requirements for the installation operations / procedures and weather condition may ultimately dictate the final programme.

5.5.3 Construction Plans

The installation of the Irish landfall shall form part of the Construction Environmental Management Plan (CEMP), Traffic Management Plan and Construction Waste Management Plan for all onshore installation of the Celtic Interconnector. The Environmental Clerk of Works (EnCoW) shall also be responsible for the landfall installation works. Further details can be found in Volume 3C.

5.6 Decommissioning

The Celtic Interconnector is strategic infrastructure of National and European importance. While not currently envisaged to occur, it will be decommissioned in the scenario that it ceases operation. However, the operational life of the submarine cables, and other equipment, is expected to be 40 years, and it is reasonably envisaged that they will be replaced with new apparatus at that time. If replaced, the submarine cables will either be left in place or will be removed for recycling in accordance with the relevant waste management regulations in place when decommissioning takes place.

Where decommissioning works are required to remove infrastructure, these will be the subject of future consent applications as appropriate, to include relevant environmental assessments.

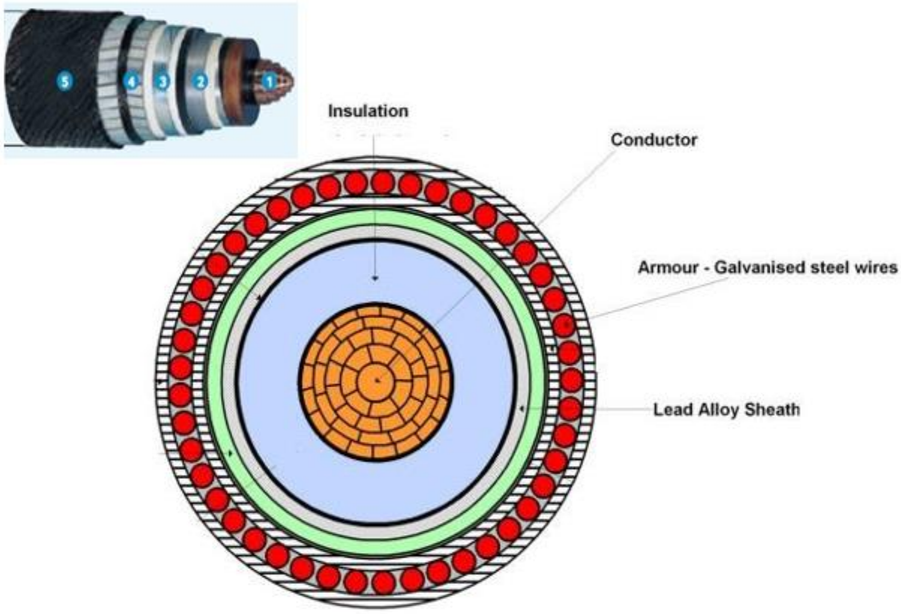
6 Description of the offshore cable

The Celtic Interconnector project within the offshore zone almost entirely comprises the laying of a submarine cable package. The submarine cable package is comprised of a pair of electrical cables as well as a fibre optic link. The purpose of the fibre optic link is to enable communication and operational control between converter stations at either end of the cable – one in Ireland and one in France. It is anticipated that each electrical cable will have a diameter of between 100mm and 200mm and the fibre optic link will have a dimension of approximately 20mm.

Each electrical cable will use HVDC technology between the two converter stations. HVDC is the global standard for the transfer of electricity over long distances in the submarine environment.

Figure 6.1 provides an illustration of a typical cross section for each of the electrical cables. The submarine cables will comprise a number of elements including a central metallic conductor made of copper or aluminium that is surrounded by insulation. A lead alloy sheath will be located outside of the insulation layer; this in turn will be surrounded by armouring that is made of galvanised steel wires. This will all be contained within an external protection layer. The operational life of the electrical cables is expected to be approximately 40 years.

Figure 6.1 Typical Cross-section of Submarine Cable



6.1 Cable Route

6.1.1 Irish Territorial Waters

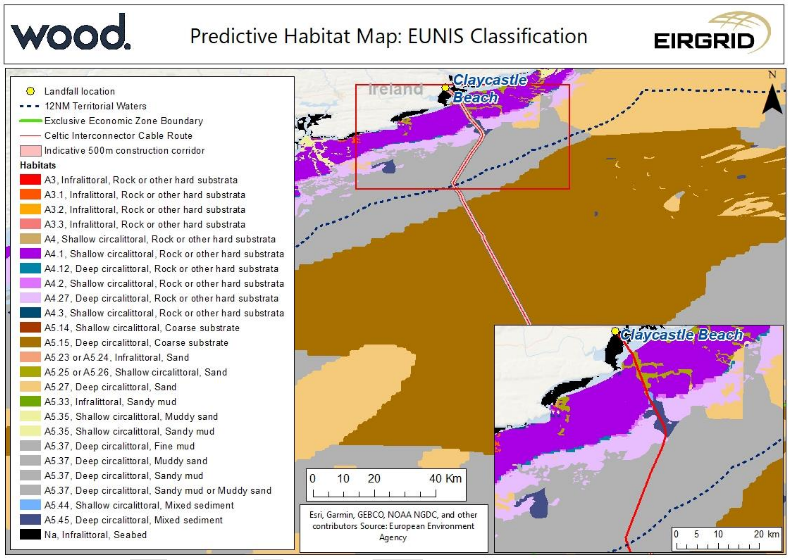
The cable route through Irish Territorial Waters is approximately 34km in length (Kilometre Point (KP) 0.0 to KP 34.0) and extends from Claycastle Beach, County Cork to the 12 nautical mile (nm) limit.

The landfall at Claycastle Beach is located approximately 2km south west of the town of Youghal and is formed by a long gently sloping sandy beach. The intertidal region is approximately 200m long with a sloping gradient of approximately 4 degrees. Beyond the intertidal zone the seabed profile is relatively flat with gentle gradients leading to an uninterrupted smooth progression to the 10m water depth at approximately KP 2.9.

The offshore cable route follows a sediment channel identified within the band of bedrock present along this coastline providing ease of burial to the required target depths. The cables shall be buried beneath the seabed to varying depths between 0.8m and 2.5m depending on identified fishing and shipping risks, seabed conditions along the route and seabed mobility. Following installation, there will be no restrictions on fishing or other activities over the cable.

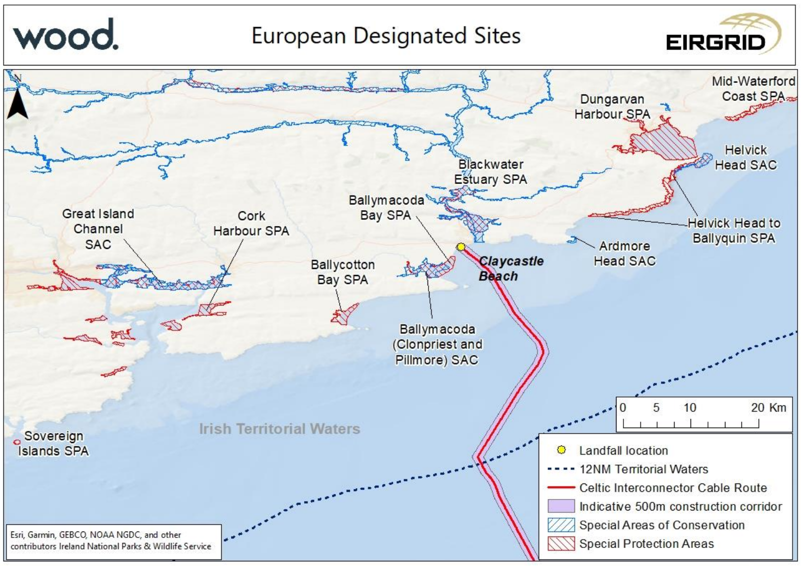
The benthic surveys of the Claycastle Beach approach route (Figure 6.2) indicated that both intertidal and subtidal communities over the proposed cable route have low sensitivity and high resilience to the proposed cable laying. Notably, benthic surveys did not record any potential Annex I habitats currently protected under the EC Habitats Directive such as pockmark features, biogenic reefs or geological reefs.

Figure 6.2 Irish EEZ – Cable Route and Predictive Habitat Map



The cable route to Claycastle Beach also avoids all European sites designated for nature conservation as shown in Figure 6.3. The route also avoids all nationally designated sites for nature conservation.

Figure 6.3 Irish Territorial Waters – Cable Route and European Designated Sites



The metocean conditions in the area (i.e. combined oceanographic and climatic conditions) are characterised by very weak currents and tides, dissipated swell but strong wind fields. Nearshore, waves approach from a south to south-west direction. Current magnitudes are low (less than 0.15m/s on average), however stronger currents (up to 0.175m/s on average) are observed along the approach to Claycastle Beach due to tidal eddies.

Wave-induced sediment mobility only occurs close to shore with a probability of occurrence of 20%. There is decreasing impact up to the 60m water depth, beyond which there is no more influence on surficial sediments. Current-induced sediment mobility occurs mostly beyond the 80m water depth with a lower probability of occurrence inshore. The sediment thickness that can be impacted by mobility across the offshore part of the route is generally less than 1m.

Erosion and deposition do occur on Claycastle Beach. Evidence for this lies with attempts in the past to control longshore drift by building groynes and dumping rock along the coast. The depth of burial of existing groynes suggests that the beach is more of depositional rather than an erosional environment. The hydro-sedimentary study performed shows that the Claycastle Beach has a low potential for erosion, with 1m erosion expected after a 50-year event.

While nothing of particular archaeological significance was found, peats (potentially Mesolithic) identified on Claycastle Beach are of archaeological potential.

6.1.2 Irish Exclusive Economic Zone

The cable route through the Irish EEZ is approximately 117km in length (KP 34.0 to KP 151.0).

The sediment coverage for the majority of this section of the cable route is considered good, consisting of a combination of dense sand, sandy gravel and high strength clay. There is approximately 33km of the marine route (KP 57.5 to KP 90.7) that has more challenging strata, consisting of underlying chalk. The anticipated target depth of lowering (DOL) of the cable beneath the nominal seabed varies between 0.8m and 2.5m and is based on seabed geology and the variable risk profile that exists from anchor penetration and fishing gear in the vicinity.

The metocean conditions are characterised by weak currents and tides, medium exposure to swell but a very strong wind field.

Current-induced sediment mobility occurs mostly in water depths of 80m or greater. The sediment thickness that can be impacted by mobility along this section of the route is generally less than 1m.

6.2 Marine Construction Works

The installation of the submarine cable will typically follow a sequence similar to the following:

- Contractor survey, route engineering and finalisation;
- Unexploded Ordnance (UXO) intervention campaign (if required);
- Boulder clearance;
- Sandwave pre-sweeping (not required in Irish Territorial waters or Irish EEZ);
- Pre-lay grapnel runs;
- Construction of infrastructure crossings;
- Pre-lay route survey;
- Cable lay;
- Post-lay survey;
- Cable burial;
- External / Secondary protection; and
- Post-burial survey.

Commented [A4]: Placeholder: An appendix, considering and assessing the presence and handling of UXO, is currently in preparation, and will be ready for submission with the final Application File. Within the current EIAR, the approach has been to not include UXO within impact assessments, on the assumption that the chance of encountering them during works is low.

6.2.1 Survey, Route Engineering and Finalisation

The installation contractor will survey, and have responsibility for, finalisation of the marine route. The contractor will carry out route engineering to optimise conditions for the specific installation tools / techniques to be used. This will include finalisation of extents of areas for boulder clearance, sandwave pre-sweeping, and deployment of the different burial tools.

6.2.2 UXO Clearance

It is not anticipated that UXO clearance will be necessary in Irish waters. Magnetometer surveys undertaken to date (in 2015 and 2018) have not identified a high potential for UXO targets along the cable route in Irish waters. Pre-installation surveys of the cable route will further determine the presence of any UXO. In the unlikely event that UXO are found, they will be either avoided, removed or detonated in situ under licence (informed by relevant environmental assessments) held by the Engineering, Procurement and Construction (EPC) contractor. A full UXO survey campaign will be performed prior to cable installation.

Commented [A5]: Placeholder: An appendix, considering and assessing the presence and handling of UXO, is currently in preparation, and will be ready for submission with the final Application File. Within the current EIAR, the approach has been to not include UXO within impact assessments, on the assumption that the chance of encountering them during works is low.

6.2.3 Boulder Clearance

Certain portions of the cable route are populated by boulders in varying concentrations. In the first instance, the recommended approach would always be to avoid problematic targets or areas by detailed route engineering and design. Nevertheless, unavoidable boulders are a common challenge for submarine cable projects in and around the Islands of the North Atlantic and Channel area.

Boulder clearance (where required) is generally undertaken in three ways:

1. The boulders may be pre-cleared using a purpose-built plough, or individually using a grab, in advance of cable lay / burial operations.
2. The boulders may be dealt with on an as-encountered basis. In this case the options available would be limited to use of a grab or (if possible) micro-routing of the cable.
3. The concentration of boulders may be deemed prohibitive and the decision may be taken to use secondary protection only (e.g. rock placement).

The range of options for boulder mitigation is illustrated on against a spectrum of increasing boulder density as shown in Figure 6.4, with examples of clearing equipment presented in Figure 6.5.

Figure 6.4 Boulder Options Summary

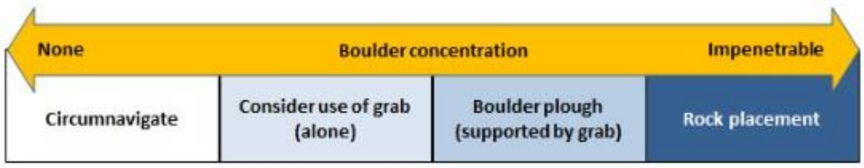


Figure 6.5 Ecosse SCAR Plough (Left) & Boulder Grab (Right)

6.2.4 Sandwave Sweeping

It is not anticipated that sandwave sweeping will be necessary in Irish waters as sandwaves have not been identified in surveys to date.

6.2.5 Pre-Lay Grapnel Run

Pre-lay grapnel runs will be required along the cable route on the seabed to ensure debris, for example redundant cables, fishing gear, discarded ropes, are cleared in advance of cable lay. The cable footprint on the seabed is anticipated to be approximately 5.0m wide. However, this may increase to approximately 15.0m during seabed preparation and cable installation works due to the size of the equipment deployed for these activities.

6.2.6 Construction of Infrastructure Crossings

Rock placement or concrete mattresses/sleepers will be utilised for the installation of third-party infrastructure crossings. Concrete mattresses are prefabricated and consist of a number of concrete block sections connected by polypropylene rope.

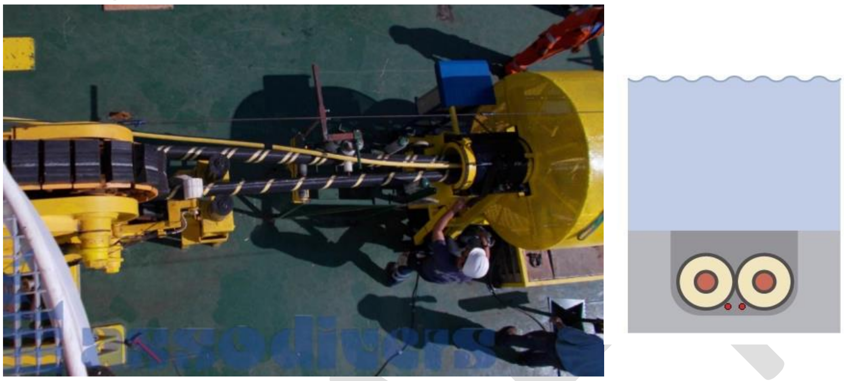
There are six in-service telecommunication cable crossings identified along the cable route in Irish EEZ waters. Each cable crossing will require a specific crossing design to be agreed with each asset owner.

6.2.7 Cable Lay & Burial

It is anticipated that the submarine cable will be installed in a bundled configuration, with the fibre optic link also installed within the bundle. Bundling the cables (as shown in Figure 6.6) ensures the installation footprint is minimised (reducing boulder sweeping and potential rock volumes). There is a wide range of vessels available on the market (see Figure 6.14 for a typical pipe laying vessel) with the capacity to install cables of the dimensions proposed for the Celtic Interconnector. A number of high-capacity cable laying vessels have been built in recent years, specifically designed for large cable projects and typically with twin carousels.

The submarine cable is loaded on to the cable laying vessels into the carousel located on-board and is fed to the laying arm at the rear of the vessel to be to its position on the ocean floor. The cable laying vessels have the ability to simultaneously lay and bury the cables.

Figure 6.6 Power cables and fibre optic link going through bundle machine (courtesy of AssoDivers)



The burial technique will vary depending on geology of the seabed. The sediment coverage along the cable route is considered good, consisting of a combination of loose to dense sand, dense sandy gravel and high strength clay. Cable installation is envisaged using standard burial tools (plough or a mechanical trenching tool). There should be no requirement for rock trenching. There is approximately 33km of the marine route in the Irish EEZ (KP 57.5 to KP 90.7) that has more challenging strata, consisting of underling chalk. Sections of this route may pose a challenge to cable burial using standard burial tools and may require the use of specialist rock cutting tools for trenching.

Cable burial is the preferred method of cable protection in so far as the underlying seabed geological conditions allow.

Cable burial tools fall broadly into three main categories:

1. Plough;
2. Jetter; and
3. Mechanical Trencher.

Ploughs (such as that presented in Figure 6.7) may be of displacement and non-displacement varieties. Displacement ploughs are used to dig trenches in the sediment in advance of cable installation. A back-filling pass may be employed post lay to close the trench back over the cable. A non-displacement plough works by passing the cable through the plough share to a level below the seabed with minimum disturbance and leaving an effectively closed trench in its wake.

Jetting tools (such as that presented in Figure 6.8) work by fluidisation and are therefore generally used in soft seabeds such as clays and silts, with small grain sizes. They perform less well in sands and gravels, and particularly cobbles. Such conditions may also prevent passage of the jetting swords through the seabed. Water jetting may be employed as a standalone method or form part of a hybrid solution. Jetting (only) tools work by injecting high-pressure water into the soil to fluidise it and allow the cable to sink into the seabed. They are consequently generally used for fairly soft, penetrative soils.

The category of tool most commonly used for the granular sediments that cover the vast majority of the cable route is the mechanical or hybrid trenching machine (Figure 6.9). Such tools are controlled remotely and run on tracked wheels along the seabed, burying the cable beneath the body of the machine.

Specialist heavy duty equipment such as rock cutters may be employed if ground conditions are too difficult to penetrate using standard burial tools.

A burial assessment study (BAS) has been completed for the project in accordance with industry guidance recommendations, i.e. Cable Burial Risk Assessment (CBRA). This study identified the target depths of lowering (DOL) of the cable into the seabed along the cable route. The target DOL will vary depending upon seabed geology and also with the variable risk profile that exists from anchor penetration and fishing gear etc.

Figure 7.7 Prysmian Plough

Figure 6.8 Nexans CAPJET Jetter

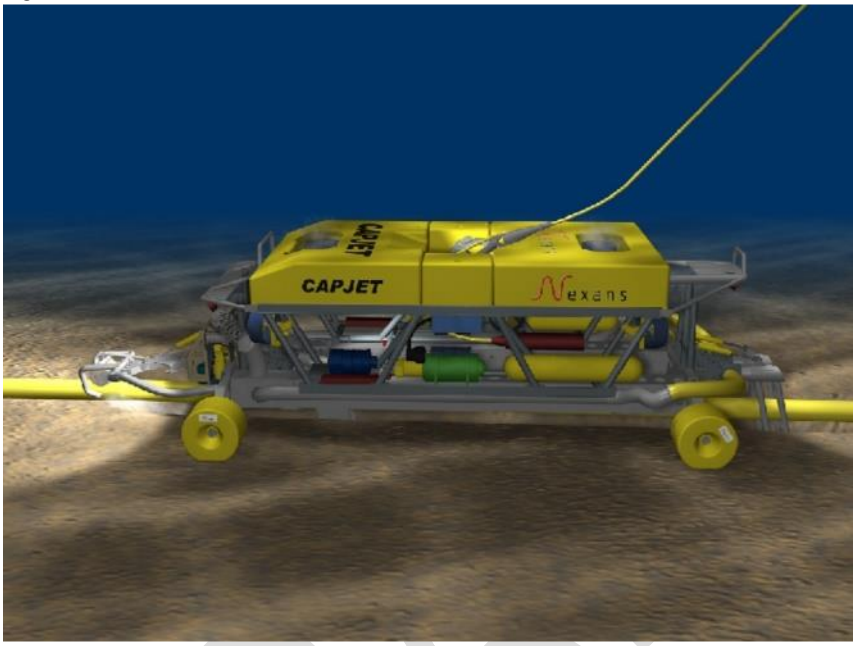


Figure 6.9 ASSO Trencher

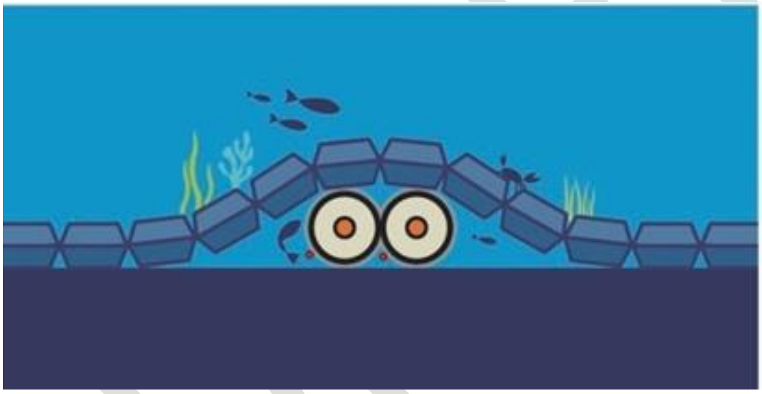
6.2.8 External Protection

Rock placement as a means of primary cable protection is not envisaged along the cable route in Irish waters. Some secondary rock protection may be required where the target DOL is not fully achieved. The level of secondary rock protection shall be minimised as much as possible through the best endeavours of the installation contractor to achieve the required level of protection through burial. The level of potential rock protection in Irish territorial waters is between 0km and 3km in the worst case, or 0 tonne to 10 tonnes. The level of potential rock protection in Irish EEZ is between 0km and 30km in the worst case, or 0 tonnes to 80 tonnes.

The primary external protection approach is through rock placement (Figure 3.10). However, a number of other options could be considered, notably concrete mattressing (Figure 3.11). These other options however, are only economic over short distances and are considered a more localised solution (for example at infrastructure crossings). Rock placement would be sourced from regulated quarries.

Figure 6.10 Rock Placement

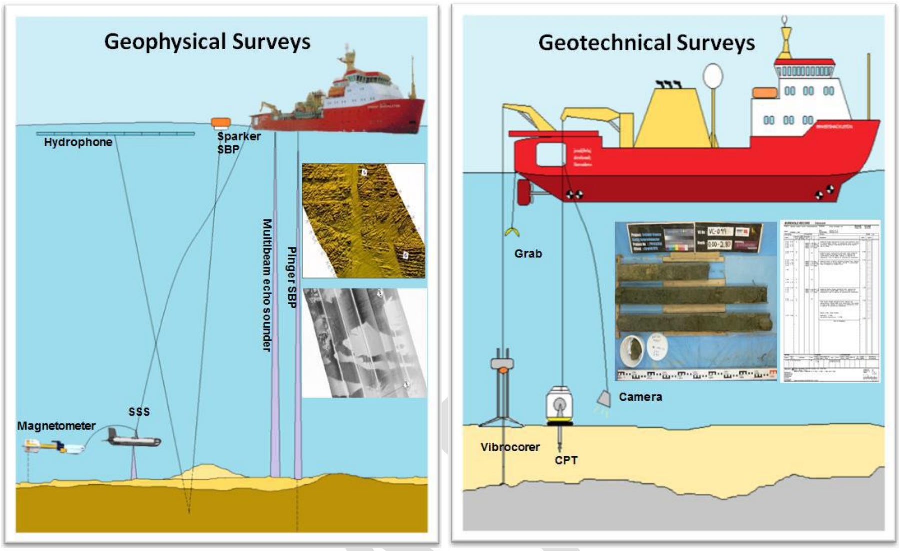
Figure 6.11 Concrete Mattressing



6.3 Offshore Construction Traffic

The offshore works involve a number of vessels and activities as discussed in Section 6.2. The first vessel will be a survey vessel comprising approximately 15 persons on board (POB). This may on occasion require access to Cork Harbour, particularly in adverse weather conditions.

Figure 6.12 Typical Survey Vessels and Activities



The preparatory works shall be carried out in advance of cable lay with a vessel of approximately 30-40 POB. This may on occasion require access to Cork Harbour, particularly in adverse weather conditions.

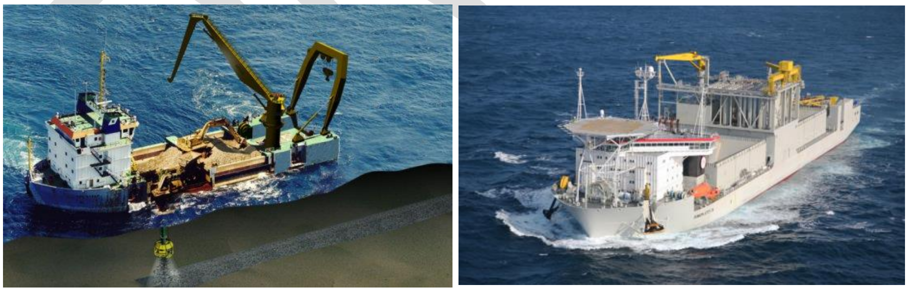
Figure 6.13 Typical Seabed Preparation Vessels

The cable lay vessel (approx. 90 POB) shall arrive at site fully laden with all equipment required to perform the installation activity. The method to transfer the plough from the vessel to the beach may require an additional abnormal load movement through Cork Port. However, it is envisaged that the plough shall be transferred on a shallow draft barge at high water and lifted by on-board crane and placed in the receiving pit.

Figure 6.14 Typical Cable Lay Vessels

A rock trenching vessel and rock placement vessel may be required in the Irish EEZ. If these vessels are required, the rock trenching vessel, with approximately 30-40 POB, will perform post-lay burial activities; the rock placement vessel, with approximately 30-40 POB will deploy secondary rock protection.

Figure 6.15 Typical Rock Placement Vessel



There will also be a number of general supply vessels required during the course of construction and also a rock supply vessel if rock placement is required.

6.4 Outline Construction Schedule and Timing of Works

Subject to the grant of statutory approvals, it is programmed that installation of the offshore route will commence in 2024, for it to become fully operational by the end of 2026.

6.4.1 Offshore Works

The offshore works involve a number of vessels and activities as discussed in Section 6.3. The first activity will be the pre-lay survey expected to last 28 days in Irish waters and performed well in advance of the main construction activity.

The preparatory works shall be carried out in advance of cable lay for approximately 30 days in Irish TW and EEZ.

Offshore Cable installation is envisaged using standard burial tools (plough or a mechanical trenching tool). There is approximately 33km of the marine route in the Irish EEZ (KP 57.5 to KP 90.7) that has more challenging strata, consisting of underling chalk. Sections of this route may pose a challenge to cable burial using standard burial tools and may require the use of specialist rock cutting tools for trenching. The overall schedule for cable lay and burial in Irish Territorial Waters and EEZ excluding weather or mechanical damage stand by is 60 days.

A rock placement vessel, only if required in the Irish EEZ, will follow cable installation and be required in Irish TW and EEZ for between 0 days and approximately 16 days.

The durations of the works provided are indicative only and based on 24/7 operations. Safety requirements for the installation operations / procedures and weather condition may ultimately dictate the final programme.

6.5 Decommissioning

The Celtic Interconnector is strategic infrastructure of National and European importance. While not currently envisaged to occur, it will be decommissioned in the scenario that it ceases operation. The operational life of the submarine cables, and other equipment, is expected to be at least 40 years, and it is reasonably envisaged that they will be replaced with new apparatus at that time. If replaced, the submarine cables will either be left in place or will be removed for recycling in accordance with the relevant waste management regulations in place when decommissioning takes place.

Where decommissioning works are required to remove infrastructure, these will be the subject of future consent applications as appropriate, to include relevant environmental assessments.

7 Alternatives

7.1 Cable Route Development

The focus of this Consideration of Alternatives is focused on alternative cable routes.

The history of the development of the Project route in terms of information gathered and decisions taken in respect of alternative routes is follows:

- **Late 2013 to early 2014**: Early desktop studies identified six main corridors for the route "Trunk" from the Cork or Waterford / Wexford coasts to the Côte des Légendes or the Rade de Brest coasts. Nominal points were chosen offshore of the landfall area to facilitate comparison of the six main trunk options as shown in Figure 7.1.

  The main route options were as follows:

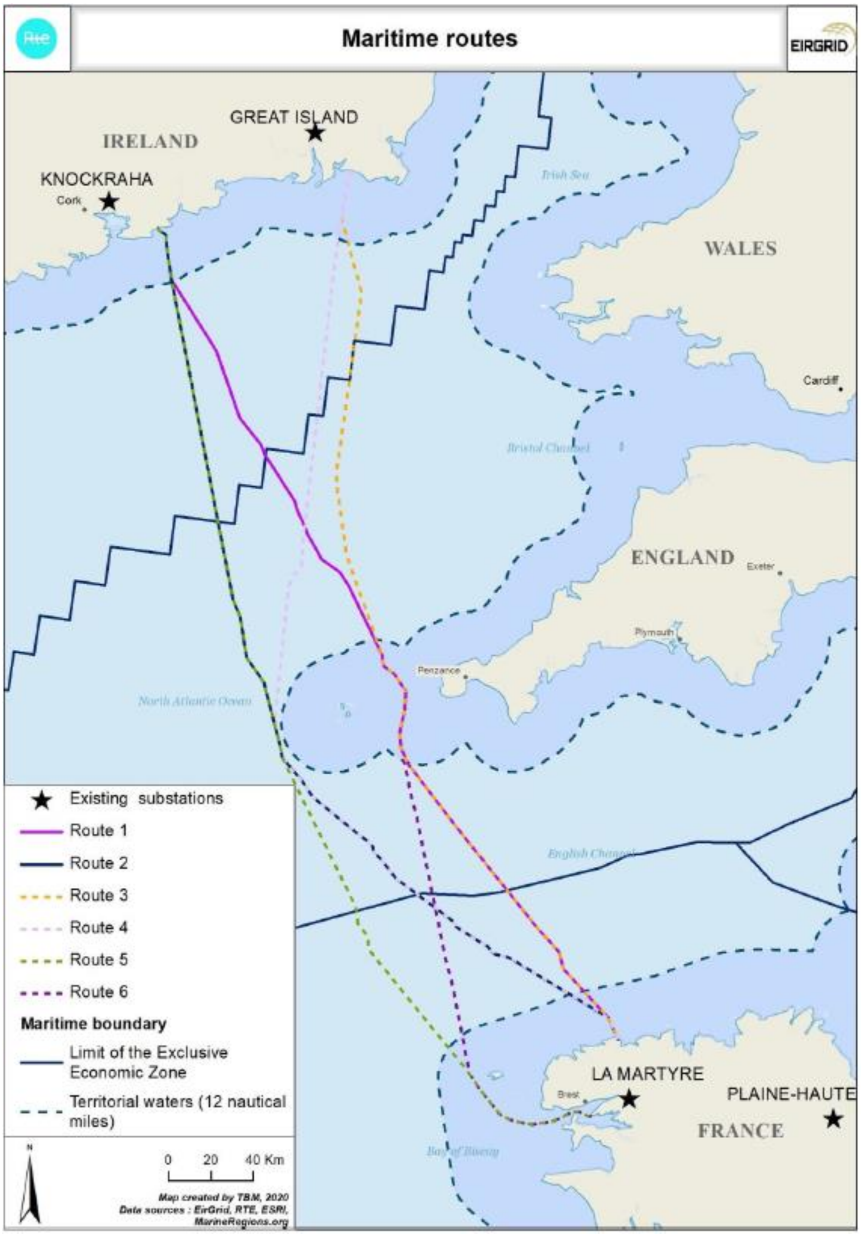
- Route 1: Cork Coast to Côte des Légendes inside UK Territorial Waters.
- Route 2: Cork Coast to Côte des Légendes outside UK Territorial Waters.
- Route 3: Waterford / Wexford Coast to Côte des Légendes inside UK Territorial Waters.
- Route 4: Waterford / Wexford Coast to Côte des Légendes outside UK Territorial Waters.
- Route 5: Cork Coast to Rade de Brest outside UK Territorial Waters.
- Route 6: Waterford / Wexford Coast to Rade de Brest inside UK Territorial Waters.

  These six route options were assessed in detail and then ranked based on a range of different constraints such as environmental, technical, third-party and commercial constraints. Of the six routes identified, two were initially recommended for further investigation, namely, Route 1 and Route 2.

  These routes were considered the favoured options due to a combination of the level and type of constraints present along their routes and commercial factors such as their overall length. Route 1 was the shortest route and the second least constrained route. Route 2 was the third shortest route and the least constrained route.

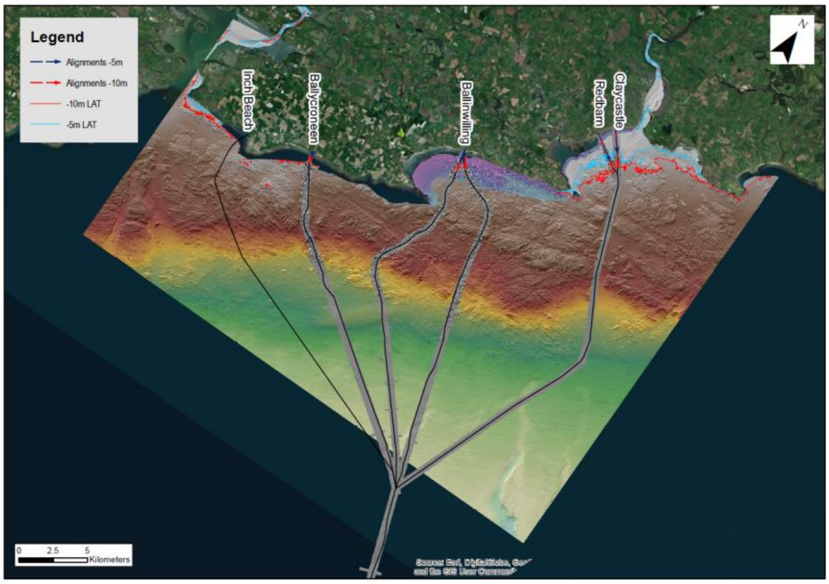
  Overall, and although marginally greater in length, the best performing option identified was Route 2 (the least constrained) and this was chosen for detailed marine survey in 2014 / 2015. Further information can be found in the Celtic Interconnector Step 2 Report.

Figure 7.1 Locations of the six offshore routes studied and feasible connection substations



- **Early to mid-2014**: Onshore studies were conducted in both Irish and French territories to identify a range of specific landfall sites in all areas considered.
- **Mid / late 2014 to mid-2015**: Route-specific studies (marine and foreshore archaeology, UXO studies) were commissioned focusing on the best performing marine route. In addition, route modifications were made during the marine survey campaigns.
- **Late 2015 to mid-2016**: Further engineering studies (detailed fishing and shipping, burial studies and geoarchaeological assessment of vibrocore logs) were carried out to further examine the preferred route.
- **Early 2016**: The BAS identified the need for analysis of two additional options for the Irish landfalls, and a route adjustment at the French landfall approach. The survey scope for 2017-2018 was determined accordingly. The five main Irish landfall options considered are presented in Figure 7.2.

Figure 7.2 Irish Landfall Options



- The landfalls were spaced along a 27km section of the east Cork coast. From West to East these are:

- Inch Beach (IN);
- Ballycroneen (BA);
- Ballinwilling (BW2 to the west, BW1 to the east);
- Redbarn (RE); and
- Claycastle Beach (CL – the best performing option).

- **Late 2017**: A geophysical survey campaign was undertaken covering alternative Irish landfall options and deviation near the French coast.
- **Late 2017 to early 2018**: A Cable Protection Complementary Study (CPCS) was performed to optimise all routes to minimise identified installation challenges.
- **May and June 2018**: A geotechnical survey campaign (including updated UXO surveys) was undertaken covering alternative Irish landfall options and deviation near the French coast.
- **Mid to Late 2018**: A Metocean and Hydrosedimentary study was completed along the cable route and nearshore branches.
- **Late 2018 to mid-2019**: A landfall feasibility study was undertaken for the Irish and French landfalls. An Offshore Constraints Report (xxx) was produced for the Irish landfall options.

Commented [A6]: Placeholder: Reference to be included.

- **Early to mid-2019**: The BAS was re-assessed using a Cable Burial Risk Assessment (CBRA) method to revise the burial depths.
- **Mid 2019**: An External Protection Feasibility Study was prepared to develop an understanding of the external protection requirements and designs that may be required for the route.
- **Late 2019**: The Step 4a Consultants Options Development Report (xxx) was issued and included discussion on the shortlisted landfall options, Claycastle beach, redbarn beach and ballinwilling strand.

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- **Late 2020**: The Step 4b Consultants Options Development Report (xxx) was issued and Claycastle beach was identified as the Best Performing Option.

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7.2 Landfall Route Selection

Claycastle Beach emerged as the overall best performing option following an evaluation of route options for the following five constraints types:

- Technical;
- Environmental;
- Deliverability;
- Socio-economic; and
- Economic.

The key determining factor was that the Claycastle Beach route follows a sediment channel identified within the band of bedrock (rocky outcrops / subcrops) that stretches along the Cork coastline. This band of bedrock represents a significant technical challenge to the project as it restricts the performance of standard burial tools. Cable burial in sediment results in only temporary disruption of the seabed during trenching operations.

Each of the alternative cable landfall routes passes through the band of bedrock to varying distances, and extensive rock cutting would be required that would result in a permanent deformation of the seabed. External protection in the form of rock placement would also be required where the target depth of lowering could not be achieved through rock cutting. Underwater noise levels with potential to affect marine mammals would be greater where rock cutting activity is undertaken. Rock trenching carries a higher risk of damage to the cable than installation in sediment.

Social impacts (albeit temporary) associated with the installation of the cable at Claycastle Beach (for example in respect of local amenity and tourism, and fishing) could largely be avoided with the implementation of standard construction phase mitigation such as timing of works and the implementation of an effective Construction Environmental Management Plan (CEMP) and Traffic Management Plan (TMP).

A number of consultations were held with local fisheries representatives which provided valuable information with regard to timing of offshore cable lay activities to avoid specific fishing seasons in the area and those minimise the impact on fisheries.

The benthic surveys of the Claycastle Beach route indicated that no environmentally sensitive habitats or benthic communities were recorded that would prohibit operations over the proposed cable route. This included, notably, an absence of potential Annex I habitats currently protected under the EC Habitats Directive such as pockmark feature, biogenic or geological reefs. The benthic survey data shows that on average there were fewer species and individuals at the Claycastle Beach landfall route, relative to other routes.

In summary, the Claycastle route, while longer, offers less unforeseen additional contingency in schedule, cost and deliverability during construction as sediment coverage is good and installation is most straightforward with standard tools employed.

8 Population and human health

8.1 Introduction (Objectives)

This chapter of the EIAR assesses the likely significant effects of the proposed development on population and human health, and presents possible mitigation measures to avoid, reduce, or offset potential adverse impacts.

The effects can be considered as falling into two main types – those related to communities living and working near the cable route, arising principally as a result of construction activities, and those related to the wider benefits for communities from an enhanced electricity and communications network.

Guided by the overarching application of the methodologies specified below, the assessment of effects near the cable route focuses primarily on the effects related to construction works on and near the beach, the offshore installation, and the interaction with current uses. These effects are considered with reference to:

- Volume 3D Part 1 EIAR for Ireland Offshore (Introductory Chapters) - Chapter 1: Description of the Landfall; Volume 3D Part 1 EIAR for Ireland Offshore (Introductory Chapters) - Chapter 2: Description of the Offshore cable;
- Volume 3D Part 2 EIAR for Ireland Offshore (Specialist Chapters) - Chapter 14: Shipping and Navigation; and
- Volume 3D Part 2 EIAR for Ireland Offshore (Specialist Chapters) - Chapter 15: Commercial Fishing.

The wider effects of the enhanced electricity and communications network include benefits to communities providing equipment and services during construction, such as cable and hire of cable-laying vessels, as well as lower energy costs, lower carbon impacts, increased tax revenues, and other economic benefits from construction and operation.

The following effects are scoped out:

- The potential effects of electromagnetic interference on health. This is because the many undersea cables in operation, including in Ireland, and the established body of related evidence indicates that they are not seen as giving rise to significant impacts on populations, assuming their installation follows good practice; and
- Transboundary effects. This is because the effects from the interconnector overall are considered to be attributed to each section and assessed within their respective EIARs and so do not cause additional transboundary effects beyond the boundary of each section.

8.2 Methodology and Limitations

8.2.1 Legislation and Guidance

The sources listed in Table 8.1 have been consulted for relevant advice and guidance.

Table 8.1 Source of guidance

Guidance	Relevance
Environmental Protection Agency Ireland: Guidelines on the information to be contained in Environmental Impact Statements (2002).	Current assessment guidance from the government in Ireland.
Environmental Protection Agency Ireland: Advice notes on current practice (in the preparation of Environmental Impact Statements) (2003).	Further advice relating to guidance from the government in Ireland.
Environmental Protection Agency Ireland: Guidelines On the information To be contained in Environmental impact Assessment reports (Draft 2017)	Supplementary assessment guidance from the government in Ireland to help practitioners during the transition to new regulations transposing Directive 2014/52/EU
OSPAR Commission: Assessment of the environmental impacts of cables (2009)	Generic information with previous examples on the effects of cables.
United Nations Environment Programme: EIA Training Resource Manual.	A well-established and extensive resource with a range of guidance on many elements of EIA implementation.
The International Finance Corporation Introduction to Health Impact Assessment (2009).	The introduction to Health Impact Assessment from a branch of the World Bank takes the approach of assessing impacts within specific Environmental Health Areas which collectively cover similar topic areas to the WHO in their guidance and tools (above).
International Union for the Conservation of Nature: Social Impact Assessment in Environmental & Social Management System.	The guidance provides a succinct summary of the key elements in assessment as and supplementary guidance focusing on the natural context.
Glasson, J, Socio-economic impacts 1: economic impacts (2009)	This source of socio-economic guidance is from the practitioners' established general reference for Environmental Impact Assessment.

Guidance	Relevance
International Association for Impact Assessment: Social Impact Assessment: Guidance for Assessing and Managing the Social Impacts of Projects.	The guidance provides a thorough source of detailed methodologies for conducting activities supporting social assessment particularly those for identifying and representing community issues and assessing methods of resolution.
The World Health Organization Health Impact Assessment guidance, tools, and methods.	The guidance, tools and methods are recognised as the leading international authority on the completion of health impact assessments.

8.2.2 Desktop Studies

Data and Surveys

A number of previous reports from EirGrid are relevant to the assessment, as well as tourism surveys available from Fáilte Ireland, and supporting government data. These are listed in the bibliography and include:

- EirGrid, Celtic Interconnector, Strategic Social Impact Assessment Scoping Report, April 2019;
- EirGrid, Social Impact Assessment Baseline Report Celtic Interconnector Project, April 2017;
- Fáilte Ireland, data relating to tourism activities, attractions, and accommodation;
- Irish government data published by Central Statistics Office (CSO), Ireland;
- Cork County Council, Youghal, A Heritage-Led Vision to the Next Decade, 2018; and
- Tourism in a heritage town in the South East of Ireland: Current offering, gaps & opportunities. Wright, Angela. (11th Annual Tourism and Hospitality Research in Ireland Conference (THRIC), 2015-06).

8.2.3 Field Studies

Telephone contact was made with local business representatives to research the local use of Claycastle Beach and establish the extent of offshore uses that might be affected. For the onshore uses, the proprietor of a local Bar and Restaurant, provided a summary description which is below and reflects the character and topics of conversation. An indication of the level of activity in the offshore small business sector was provided by a representative of a local charter boat fishing company. Both were contacted on 9th December 2020.

Onshore perspective, provided by the proprietor the local Bar and Restaurant

Number of visitors - Claycastle Beach is a very sandy beach and 9km long. It is a very popular and busy beach used by *"thousands"* of people in summer, due in particular to its nice sandy nature. On an average day there are 2,000 to 3,000 people walking / dog walking. The IronMan brings the most people in the year. There are 2,500 participants who tend to bring their families which brings the number up to 5,000 people. The total number of people there on the day (viewers, participants, etc.) can be between 12,000 and 15,000.

Periods of use - In terms of day-to-day use of the beach, it is used at all times from 7:30am with people walking and jogging. In good weather, there are people all day long. Weekends bring even more people. The summer brings more people, but winters are busy with walkers / joggers too. Since the beginning of the pandemic, the area has seen the number of people on the beach double and almost triple. Winter swimming has become very popular.

Activities - The beach is used for walking, dog-walking, wind surfing, angling, fishing, and sailing. Local sports team train on the beach all year round.

Seasons and types of people - The summer brings tourists from Germany, England, the United States, and increasing numbers of visitors from Asia. The beach also attracts domestic tourists all year round. Many people come from a 30-mile radius.

Offshore perspective provided by local charter boat fishing company

The local charter boat fishing companies activities take place at sea about 10 miles offshore and are sea angling and diving. They do not make specific use of the beach but noted the Ironman competition on the beach and the new boardwalk, as well as the large carpark by the beach. They were aware of a shore angling club.

8.2.4 Methodology for Assessment of Effects

Distance and scope

The geographical scope of the proposed development assessed in this chapter is determined with reference to the construction, operational and decommissioning activities required in a section of the route of the proposed new interconnector between Ireland and France. The interconnector has two electricity cables and one fibre-optic cable, and the section of the route assessed here is from Calycastle Beach in County Cork, to the limit of the Irish EEZ.

The installation of the cables requires construction works on and near Claycastle Beach, which is in close proximity to the town of Youghal, is one of the established town beaches and linked to it with a boardwalk. As such, the onshore area of influence is selected to be Youghal town and the assessment considers effects on the current resident and visitor populations, many of whom would be expected to be aware of and to make use of Claycastle Beach. Offshore, potential effects of construction may arise for recreational and commercial users, such as fishing and shipping fleets and the zone of influence is taken as that used to assess shipping and navigational effects (See Volume 3D Part 2 EIAR for Ireland Offshore (Specialist Chapters) - Chapters 14 and 15) with supplementary consideration of nearshore activities which result primarily from use of the beach, such as recreational boating.

During operation, the cables provide benefits resulting from more efficient use of electricity and communication networks but are not expected to have locally specific impacts related to the populations affected by this section of the cable route.

Decommissioning activities are similar in nature to construction and require a similar scope of effects to be considered.

Assessment of Significance

The significance of the impacts on population and human health is the primary concern of the assessment and is undertaken with and without taking account of measures providing mitigation. The assessment first considered impacts according to the estimated magnitude of change from the baseline and the sensitivity of receptors including only the mitigating measures 'embedded' in the design, such as the adoption of good practice techniques. Further sets of measures that enhance or mitigate socio-economic and health impacts were considered separately, to derive the residual impacts used for the final assessment of significance.

Magnitude of change

The 'magnitude of change' is used to describe an effect which can be represented as varying over a range. Simple effects are represented with quantitative indicators, but semi-quantitative or qualitative indicators are used to cover aspects such as:

- the duration and frequency of effects and whether they are permanent or time-limited (short, medium, long);
- the direction of change and its reversibility; and
- the probability of occurrence.

The assessment of the magnitude of change is based on a comparison with baseline conditions and / or with comparators from similar developments or modelled scenarios.

Sensitivity of receptors

Impacts are defined in terms of their consequences for one or more receptors. Receptors cover human populations broadly defined and may be characterised as individuals, groups, communities, business sectors, recreational groups or in an extensive variety of other ways which also depend on the type of impact.

The sensitivity of a receptor is a summary term that describes the ability of the receptor to withstand or absorb change within the period of time the impact is expected to occur, and without a fundamental change to its character or attributes. Sensitivity has no single interpretation and is seen as capturing the concept of a value that is potentially threatened or enhanced.

Sensitivity of receptors may depend on their current and future characteristics as well as the nature of the impact, reflecting aspects such as:

- Vulnerability due to pre-existing social circumstances or health conditions;
- Cultural values, including public interest, perceptions towards a risk or potential change, and acceptability;
- Environmental vulnerability of habitats important in the socio-economic and health context;
- The direction, duration, and reversibility of the specific impacts; and
- The capacity and availability of resources or contextual factors.

Determination of significance

Table 8.2 shows that the magnitude of effects and their resulting significance, is assessed based on the combination of the magnitude of an impact and the value and sensitivity of the affected receptor. The magnitude of effects is identified as ranging between Negligible to Substantial. Effects identified as 'moderate', 'major' or 'substantial' are considered 'significant'. Professional judgement will be used to determine if effects identified in the 'minor or moderate' category are either 'not significant' or 'significant', respectively.

A clear assessment of significance has been made and considered aspects such as:

- reflecting procedure and guidance applicable in the jurisdiction for Ireland;
- consistency, showing reference to underlying reasoning and rationales where applicable;
- using widely agreed reference points, such as health, safety, and environmental standards;
- meeting public concerns, particularly over health and safety; and
- being easy-to-use and explain.

Where other information is not available, professional judgement has been used to assess impacts in a manner that aims to reflect whether the general population would judge the impact to be of concern.

Table 8.2 Significance evaluation matrix

		Magnitude of Impact				
		No Change	**Negligible**	**Low**	**Medium**	**High**
Value and sensitivity of receptor	**Negligible**	Negligible	Negligible	Negligible or Minor	Negligible or Minor	Minor
	Low	Negligible	Negligible or Minor	Negligible or Minor	Minor	Minor or Moderate
	Medium	Negligible	Negligible or Minor	Minor	Moderate	Moderate or Major
	High	Negligible	Minor	Minor or Moderate	Moderate or Major	Major or Substantial
	Very high	Negligible	Minor	Moderate or Major	Major or Substantial	Substantial

Summary of significance

The summary of significance is presented in a table showing each effect identifying whether it is beneficial or adverse together with additional summary information.

8.2.5 Difficulties Encountered

Availability of recent data on tourism

Tourism data, of the very specific nature that would be most valuable for this assessment, was not available for recent years. However, older information, for example on seasonal profiles, was fortunately available and provides a level of detail that is not commonly available for studies on communities of this size.

Covid-19 pandemic effects

Tourism has been disrupted during 2020 as a result of the effects of the Covid-19 pandemic. Tourism is a major consideration in the assessment of impacts. This assessment was conducted with the intention of assuming conditions that prevailed pre-Covid-19 with the rationale that tourism is likely to return once the pandemic has been brought under control. Some effects of Covid-19, such as greater use of the Claycastle Beach since the pandemic began, are however mentioned in the assessment because they were referred to by local people during field studies and might not be expected.

More generally, the pattern of use of the beaches is likely to differ as a result of Covid-19, and this pattern is essentially unknown. The assessment presented below is based on information indicating the probable success of mitigating measures in circumstances without the pandemic. It is probable that a similar approach to mitigation may be appropriate in circumstances with the pandemic, though caution is required, as there is the potential for unexpected effects from the pandemic. For example, while there may be fewer events and fewer tourists, residents may have more free time and so spend much longer on the beach or undertaking activities more directly affected by the Project, such as angling. Also, there may be an increase in domestic tourism as foreign travel becomes curtailed. Youghal provides access to many of the features that people see as an antidote to lockdown measures, and may see a sudden boom, potentially exceeding pre-Covid-19 forecasts, when lockdown controls are either relaxed or lifted.

8.2.6 Receiving Environment

Location

The Celtic Interconnector crosses Claycastle beach which is on the outskirts of Youghal and within easy walking distance of the town centre. Claycastle beach is one of three beaches near Youghal within areas visited regularly by residents and visitors making use of the town's facilities and attractions. The section of the cable route assessed here extends from the beach to the limit of the Irish Territorial Waters and on to the boundary of the Irish EEZ. The locations of populations potentially affected include the town of Youghal and its surrounding area, as well as the ports, shipping lanes, and sea areas utilised by recreational and commercial users offshore.

Figure 8.1 Map of Celtic Interconnector landfall relative to the town of Youghal

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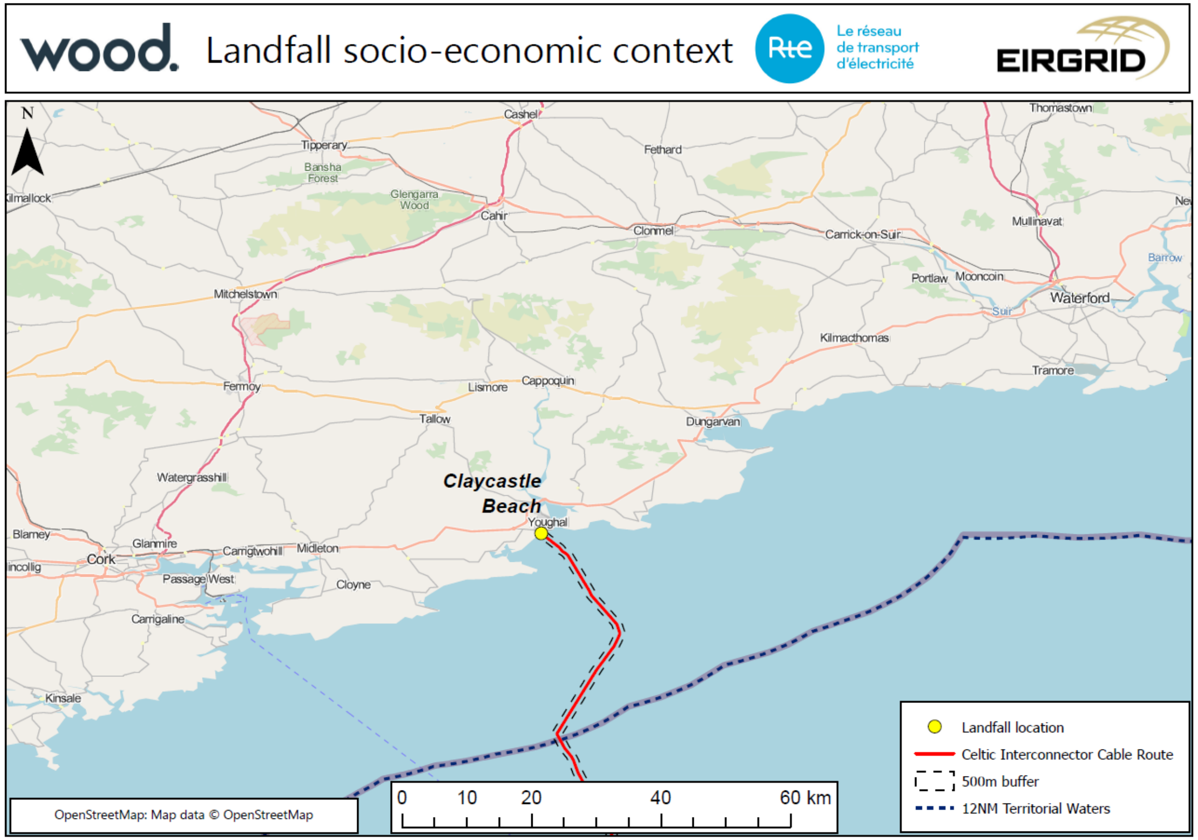
Figure 8.2 Map of wider area, including Cork and Waterford



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Population

Youghal has a population of 8,339 people[1] and lies a little less than halfway (51km)[2] along the direct route by road (121km) between the two major towns of the South and South East of Ireland, Cork, population 119,230 and Waterford, population 53,504, the second and tenth largest towns in Ireland respectively according to the 2016 Census.

The population in Youghal has a similar age structure to that of Ireland as a whole, as well as of the region of County Cork, showing only small differences in recent trends. At all geographical levels population is shown as falling by 1-2% per year in the age groups associated with younger families (0-5, 18-24, and 25-44 years old) while there are increases in the older age groups, particularly 65 – 84 years old as a result of the aging of the baby boomer generation (see Table 8.3).

Table 8.3 Population by age group and annual average percentage change in population between 2016 and 2011

Commented [A11]: Placeholder: All data to be reviewed and cross-checked against equivalent onshore chapters / assessments, prior to submission of final Application File, including checks for any more recently-available data.

	Population (2016)			**Annual average % change since 2011**		
	State	**Co. Cork**	**Youghal**	**State**	**Co. Cork**	**Youghal**
0-5 years	403,919	38,286	669	-1%	-2%	-1%
6-17 years	786,583	73,874	1,373	2%	1%	2%
18-24 years	392,502	29,796	568	-1%	-1%	0%
25-44 years	1,406,291	118,068	2,214	-1%	-2%	-2%
45-64 years	1,135,003	102,192	2,173	2%	1%	2%
65-84 years	570,012	48,293	1,216	4%	4%	3%
85 years and over	67,555	5,611	126	3%	4%	0%
Total	4,761,865	416,120	8,339	1%	0%	0%

Source: Central Statistical Office, Ireland; Product NDP, Code NPA02; data.cso.ie (accessed on 6th December 2020)

[1] Including the local rural area.
[2] Distances are calculated using AA routeplanner. [Available at https://www.theaa.com/route-planner/route] Checked on 6 December 2020

While there is a decline in the 25-44 age group at all geographic levels as a proportion of the population, this is more marked in Youghal, which has seen a fall in this age group from 30% to 26% over the five years from 2011 to 2016, similar to the fall observed for County Cork (32% to 28%) and greater than the fall for the population at national level (32% to 30%) (see Table 8.4). As a result, the size of the population of Youghal in the 25-44 age group is approximately 248 fewer than it would have been had it matched the national trend.

Table 8.4 Age Structure of the Population in 2016 and 2011

	2011			**2016**		
	State	**Co. Cork**	**Youghal**	**State**	**Co. Cork**	**Youghal**
0-5 years	9%	10%	9%	8%	9%	8%
6-17 years	16%	17%	15%	17%	18%	16%
18-24 years	9%	8%	7%	8%	7%	7%
25-44 years	32%	32%	30%	30%	28%	27%
45-64 years	23%	23%	24%	24%	25%	26%
65-84 years	10%	10%	13%	12%	12%	15%
85 years and over	1%	1%	2%	1%	1%	2%

Source: Central Statistical Office, Ireland; Product NDP, Code NPA02; data.cso.ie (accessed on 6 December 2020)

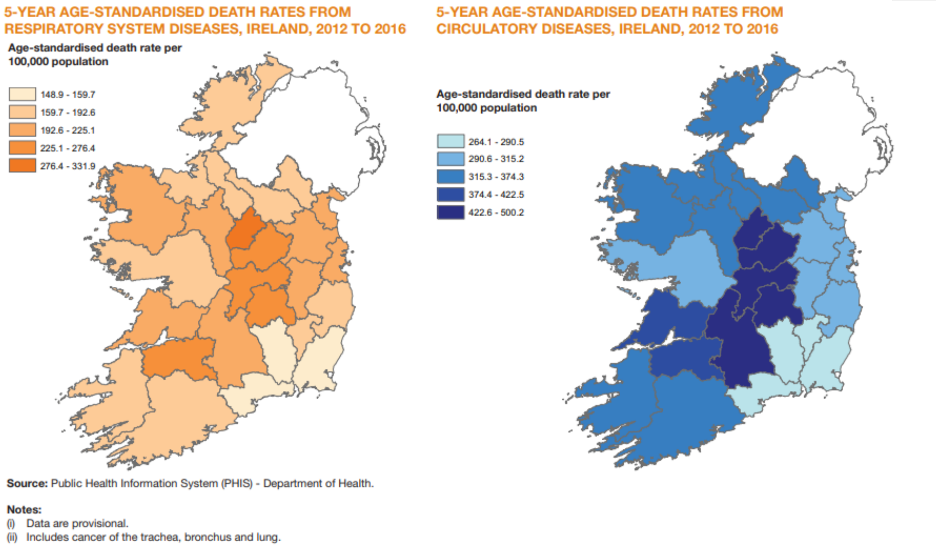
There have been less marked decreases in the 18-24 year old age group, where Youghal has seen a slight increase of 1.4% for the total of this age group (9 people) in comparison with falls at County (-4.3%) and State level (4.5%). There are slight falls in the youngest age group (0-5 years old), while there are slight increases in the number of school age children (6-17).

While the causes are inherently uncertain, population changes are consistent with migration of people away from the area in the 25-44 year old age group, leading to fewer young children, while the increase in 18-24 year-olds may reflect an influx of workers responding to new tourism opportunities in the region.

Health

The health of the local population is good compared to other regions of Ireland. While Youghal is within County Cork it is on the edge of the Waterford area, which is one of the few areas with the highest health rating in Ireland for respiratory and circulatory diseases. County Cork as a whole is in the second and third category (of five) for respiratory and circulatory diseases respectively (see Figure 8.3).

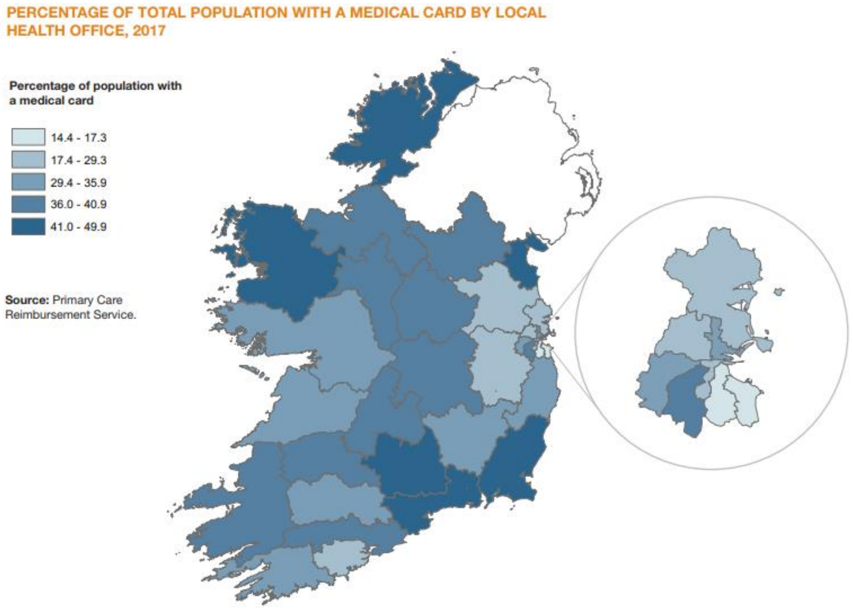
Figure 8.3 5-year Age-standardised Death rates in Ireland from Respiratory and Circulatory Diseases for the period 2012 to 2016



Source: Public Health Information System (PHIS) – Department of Health

The proportion of the population with a medical card is amongst the highest in Ireland. The medical card provides state-funded health benefits, and its prevalence indicates that the population are likely to have better uptake than the average for health services and their health is likely to be better overall. (See Figure 8.4).

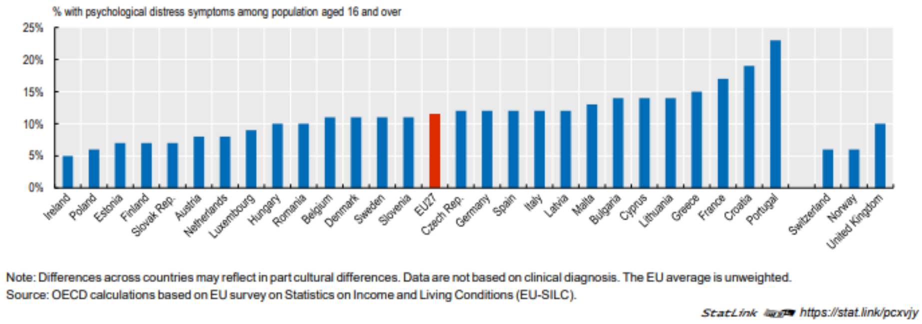
Figure 8.4 Percentage of Total Population with a Medical Card, by Local Health Office, 2017



Source: Primary Care Reimbursement Service, Ireland

Ireland has the lowest reported level in Europe in 2018 for the prevalence of psychological distress symptoms and this indicates a generally good level of mental health (see Figure 8.5). While more detailed statistics are not available. Youghal has many environmental aspects which contribute to good mental health as well as a large visitor population who benefit from them.

Figure 8.5 Prevalence of psychological distress symptoms for EU countries, 2018



Source: OECD calculations based on EU survey on Statistics on Income and Living Conditions (EU-SILC), 2018

The health benefits related to use of the sea are influenced by the availability of safe bathing waters. The Claycastle Beach and the two others at Yougal are amongst the eight in County Cork, and 80 across Ireland, which in 2021 met a standard sufficient to receive the 'Blue Flag' award, a prestigious international accolade indicating the highest quality in water, facilities, safety, environmental education, and management.

Economy

Ireland's economy has grown substantially between 2011 and 2017. In 2015, there is a significant distortion in the growth trend as a result of the introduction of a lower corporation tax leading to the transfer of over Euro 300bn of assets into Irish companies and related corporate restructuring[3]. Excluding this effect, the overall economy in Ireland grew by an average of 5%. Youghal lies next to the border between South and South-East Ireland and the economic performance of both are shown, with growth rates of 3% and 7% respectively. Recent growth from 2016 to 2017 is 10% for Ireland, with more similar rates of 13% in the South and 12% in the South East (see Table 8.5).

The growth across all individual economic sectors and regions shown is positive on average (see Table 8.6). The sector with the greatest average growth across Ireland as a whole is agriculture, which achieves 14%, in comparison to 4% for manufacturing and 6% for services, which covers the tourism sector important to Youghal. The services sector is the largest of the three sectors and makes up 60% of the total economy (167bEuro out of 277bEuro). It has the steadiest growth and is possibly the least affected by the 2015 corporate restructuring. 40bEuro of the services sector occurs in the South and 8.7bEuro in the South East.

[3] See https://www.independent.co.uk/news/business/news/ireland-s-economy-grows-26-3-2015-corporations-flock-low-tax-rate-a7133321.html

Table 8.5 Economic performance (GVA) for Ireland and regions in the South and the South-East (mEuro)

				As % of GVA 2011			Year on year growth		
	State	**Southern**	**South-East**	**State**	**Southern**	**South-East**	**State**	**Southern**	**South-East**
2011	155,972	51,652	9,030	100%	100%	100%	-	-	-
2012	159,902	52,975	9,324	103%	103%	103%	3%	3%	3%
2013	163,744	52,262	11,171	105%	101%	124%	2%	-1%	20%
2014	177,290	54,931	10,916	114%	106%	121%	8%	5%	-2%
2015(1)	243,962	104,253	13,231	156%	202%	147%	38%	*90%*	*21%*
2016	251,546	98,778	13,423	161%	191%	149%	3%	-5%	1%
2017	276,194	111,343	14,978	177%	216%	166%	10%	`13%	12%

Notes:
Statistical definition: "Gross Value Added at Basic Prices"
'(1) Figures influenced by corporate responses to tax changes and not included in averages
Source: Central Statistical Office, Ireland; Product NDP, Code NPA02; data.cso.ie (accessed on 6 December 2020)

Table 8.6 Economic growth in Agriculture, Manufacturing and Services for Ireland and regions in the South and South East

	Agriculture			Manufacturing			Services		
	State	**South**	**South-East**	**State**	**South**	**South-East**	**State**	**South**	**South-East**
2012	-17%	-24%	-31%	2%	3%	11%	3%	3%	1%
2013	14%	20%	17%	2%	-9%	61%	5%	8%	10%
2014	24%	22%	14%	11%	4%	-29%	8%	6%	10%
2015(1)	-5%	-8%	3%	106%	211%	28%	12%	12%	16%
2016	11%	11%	5%	0%	-9%	37%	5%	4%	-6%
2017	36%	47%	51%	6%	15%	26%	11%	7%	1%
Average	14%	15%	11%	4%	0%	21%	6%	5%	3%
GVA in 2017 mEURO	3,484	1,999	566	106,237	69,267	5,695	167,524	40,491	8,766

Notes:
Statistical definitions: "Gross Value Added at Basic Prices" for "Agriculture, Forestry and Fishing", "Manufacturing, Building and Construction", "Market and Non Market Services"
(1) Figures influenced by corporate responses to tax changes and not included in averages
Source: Central Statistical Office, Ireland; Product NDP, Code NPA02; data.cso.ie (accessed on 6 December 2020) and
https://www.independent.co.uk/news/business/news/ireland-s-economy-grows-26-3-2015-corporations-flock-low-tax-rate-a7133321.html

Employment and Skills

The labour force employed in Ireland has seen overall growth of 3.4% between 2011 and 2016 (0.7% per year), which compares with slightly lower growth of 2.5% (0.5% per year) in the South East (See Table 8.7).

The labour force in the three largest economic sectors (Wholesale and retail trade, Manufacturing, Health and social work) makes up a similar proportion of the economy collectively (33% in Ireland and 35% in the South East) and for each sector individually. These sectors have also seen similar levels of growth over the period.

The differences in growth arise mainly from the relatively sizeable sectors covering Information and communication services (growth of 26.3% nationally and 9.5% in the South East) and Professional, scientific and technical activities (growth of 15.1% nationally and 10.8% in the South East). These two are the main reason for net growth nationally after taking account of the reduction in the labour force employed in construction which has seen a fall of approximately 20% nationally and in the South East. The sectors in the South East with that show higher than national growth in sectors of appreciable size or show very high levels of growth regardless of their size are: Manufacturing (1.9% but 0.2% nationally); Health and social work (12.5% but 12.2% nationally); Education (5.4%, but 4.3% nationally) and Administrative and support service activities (23.4%, but 8.2% nationally).

Table 8.7 Population in Labour Force (Excluding First Time Job Seekers) 2011 to 2016, by Economic Sector

Economic Sector	Population				% in each sector		Growth over 5 years	
	2011		2016		2016		2016	
	State	Sth. East	State	Sth. East	State	Sth. East	State	Sth. East
Agriculture, forestry and fishing (A)	97,473	12,385	93,104	12,522	4%	6%	-4.5%	1.1%
Mining and quarrying (B)	6,534	649	5,603	524	0%	0%	-14.2%	-19.3%
Manufacturing (C)	218,205	22,154	218,626	22,568	10%	12%	0.2%	1.9%
Electricity, gas, steam and air conditioning supply (D)	12,071	656	13,431	753	1%	0%	11.3%	14.8%
Water supply; sewerage, waste management and remediation activities (E)	10,579	839	11,063	855	0%	0%	4.6%	1.9%
Construction (F)	154,067	16,034	124,205	12,547	5%	6%	-19.4%	-21.7%
Wholesale and retail trade; repair of motor vehicles and motorcycles (G)	300,794	27,354	291,970	26,280	13%	14%	-2.9%	-3.9%
Transportation and storage (H)	87,736	6,062	86,194	5,950	4%	3%	-1.8%	-1.8%
Accommodation and food service activities (I)	121,670	11,375	129,402	11,836	6%	6%	6.4%	4.1%

Economic Sector	Population				% in each sector		Growth over 5 years	
	2011		2016		2016		2016	
	State	Sth. East	State	Sth. East	State	Sth. East	State	Sth. East
Information and communication (J)	75,290	3,583	95,054	3,925	4%	2%	26.3%	9.5%
Financial and insurance activities (K)	97,972	5,740	94,910	5,826	4%	3%	-3.1%	1.5%
Real estate activities (L)	9,274	653	9,480	583	0%	0%	2.2%	-10.7%
Professional, scientific and technical activities (M)	103,289	7,128	118,928	7,895	5%	4%	15.1%	10.8%
Administrative and support service activities (N)	72,328	5,134	78,230	6,335	3%	3%	8.2%	23.4%
Public administration and defence; compulsory social security (O)	117,200	8,884	108,820	8,308	5%	4%	-7.2%	-6.5%
Education (P)	176,349	14,780	183,980	15,581	8%	8%	4.3%	5.4%
Human health and social work activities (Q)	206,159	17,605	231,218	19,813	10%	10%	12.2%	12.5%
Arts, entertainment and recreation (R)	34,746	2,728	37,104	2,851	2%	1%	6.8%	4.5%
Other	47,543	4,058	50,196	4,429	2%	2%	5.6%	9.1%

Economic Sector	Population				% in each sector		Growth over 5 years	
	2011		2016		2016		2016	
	State	Sth. East	State	Sth. East	State	Sth. East	State	Sth. East
Industry not stated	248,758	21,550	291,085	24,675	13%	13%	17.0%	14.5%
Total at work	2,198,037	189,351	2,272,603	194,056	100%	100%	3.4%	2.5%

Source: Central Statistical Office, Ireland; Product C2016P11, Code EB034; data.cso.ie (accessed on 06 December 2020)

The pattern of skills in the labour force recorded in occupational statistics reflects the trends identified above in the economic sectors (see Table 8.8). Overall growth shows similar levels and differences with national growth slightly greater at 3.2% than the 2.7% seen for County Cork. The proportions of the labour force in each occupational group are almost identical, with the proportion that are farmers being the only group showing a difference of more than 1% (5% in County Cork and 3% nationally). The changes in occupational groups between 2011 and 2016 also follow a very similar pattern. Notable differences are that the growth in Employers and managers is 5.4% in County Cork compared to 2.7%, growth in semi-skilled occupations is 5.1% in County Cork and 1.8% nationally, while the reduction in skilled manual trades is 8.4% in County Cork and 11.5% nationally. In the largest occupational group (non-manual) growth is 3.6% in County Cork and 3.0% nationally.

Table 8.8 Population Aged 15 Years and Over 2011 to 2016, by occupational group

Occupational Group	**Population**				**% in each sector**		**Growth over 5 years**		**% female**	
	2011		**2016**		**2016**		**2016**		**2016**	
	State	**Co. Cork**	**State**	**Co. Cork**	**State**	**Co. Cork**	**State**	**Co. Cork**	**State**	**Co. Cork**
A. Employers and managers	317,812	26,516	326,273	27,896	14%	14%	2.7%	5.2%	39%	38%
B. Higher professional	155,015	14,120	174,615	15,781	8%	8%	12.6%	11.8%	39%	40%
C. Lower professional	300,053	26,824	327,717	29,155	14%	15%	9.2%	8.7%	64%	65%
D. Non-manual	539,713	44,014	555,675	45,580	24%	23%	3.0%	3.6%	71%	72%
E. Manual skilled	210,086	19,296	185,937	17,676	8%	9%	-11.5%	-8.4%	5%	5%
F. Semi-skilled	209,534	19,652	213,295	20,646	9%	10%	1.8%	5.1%	39%	38%
G. Unskilled	81,511	5,927	78,497	5,604	3%	3%	-3.7%	-5.4%	37%	35%
H. Own account workers	113,097	10,715	105,646	9,941	5%	5%	-6.6%	-7.2%	17%	22%
I. Farmers	80,974	11,146	76,412	10,434	3%	5%	-5.6%	-6.4%	10%	11%
J. Agricultural workers	12,712	1,213	13,328	1,241	1%	1%	4.8%	2.3%	24%	17%
Z. All others gainfully occupied and unknown	211,696	13,621	246,642	14,223	11%	7%	16.5%	4.4%	43%	46%
All socio-economic groups	2,232,203	193,044	2,304,037	198,177	100%	100%	3.2%	2.7%	100%	100%

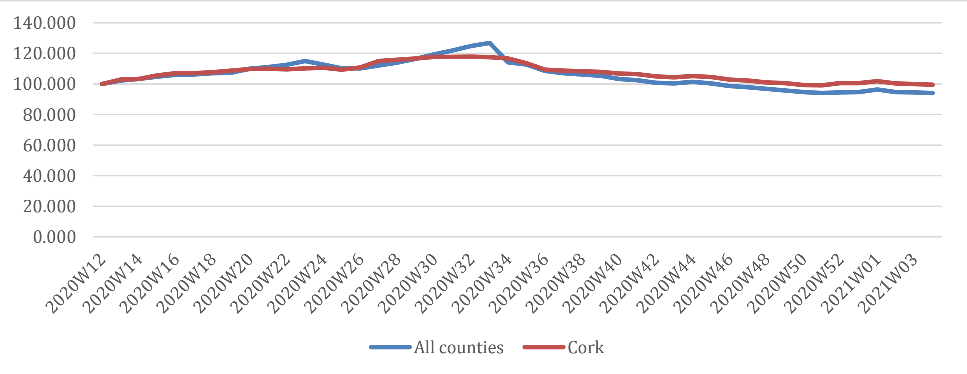
Source: Central Statistical Office, Ireland; Product C2016P11, Code EB072; data.cso.ie (accessed on 6 December 2020)

Unemployment and Deprivation

Historically, the unemployment rate in County Cork has been lower than the national rate. in 2011, when the national rate was 19%, in County Cork it was 14.8% and in 2016, when the national rate was 12.9%, it was 9.2% in County Cork.[4]

Recently, the Live Register[5], which shows the numbers of people (with some exceptions) registering for statutory entitlements including Jobseekers Benefit and Jobseekers Allowance at local offices of the Department of Social Protection, reported 15,292 people registering in County Cork and 188,543 across Ireland at the end of January 2021. Comparisons of recent trends are shown in Figure 8.6 which indicate that unemployment in County Cork reflects the national pattern. Note that it is compiled using the current methodology 'in the traditional way' which identifies the effects of the pandemic using separate reporting.[6]

Figure 8.6 Number of people on the Live register for statutory entitlements in relation to unemployment in 2020 and 2021

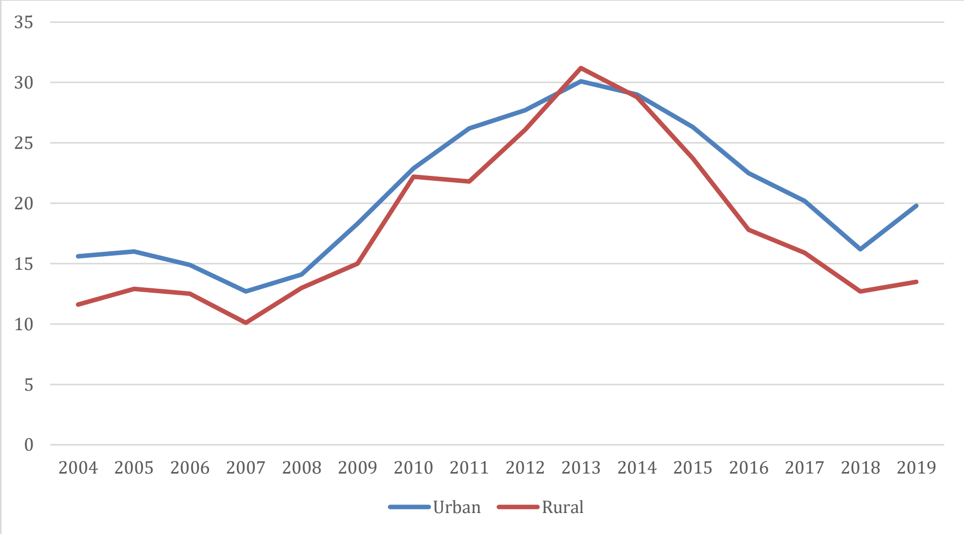


Note: Numbers are indexed to values prevailing at 2020 week 12
Source: Central Statistical Office, Ireland; Product LR, Code LRW03; data.cso.ie (accessed on 5th February 2021).

Deprivation has been falling nationally since the peak in 2013, currently by a third in urban areas and over a half in rural areas (see Figure 8.7).

[4] Source: Central Statistical Office, Ireland; Product C2016P11, Code EB016; data.cso.ie (accessed on 6th December 2020)
[5] https://www.cso.ie/en/interactivezone/statisticsexplained/labourmarket/whatistheliveregister/
[6] https://www.cso.ie/en/releasesandpublications/in/mue/inlrmue/

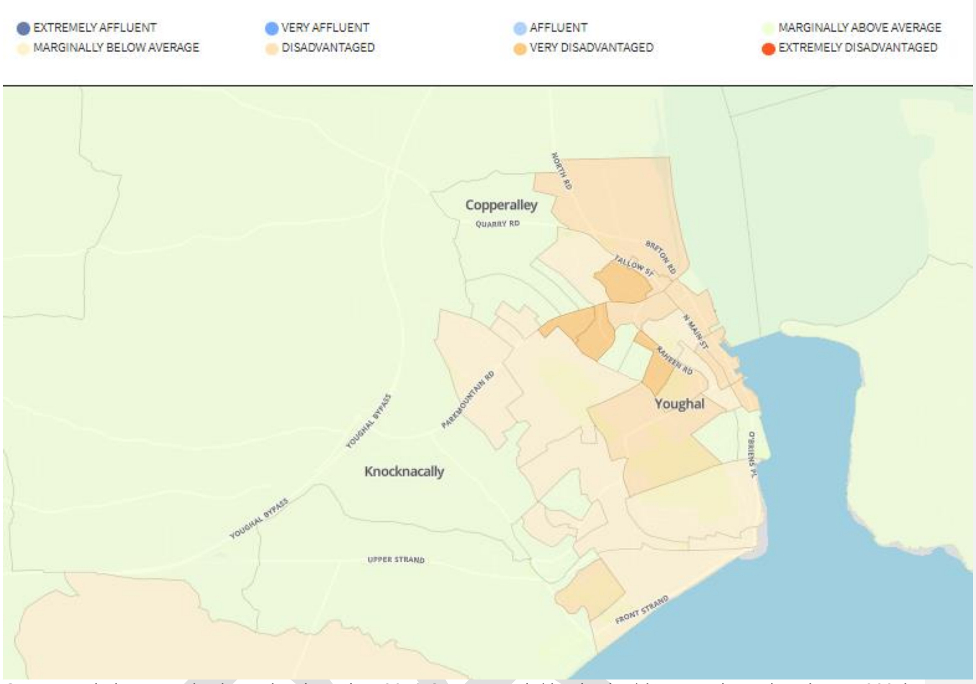
Figure 8.7 Deprivation in Urban and Rural Ireland as Percentage of the Population for the period 2004 to 2019



Source: Central Statistical Office, Ireland; Product SILC, Code SIA19; data.cso.ie (accessed on 5 February 2021)

In the area around Youghal, deprivation as indicated by the Pobal HP Deprivation Index occurs more in the town than in the surrounding districts. Figure 8.8 shows the Index based on the 2016 Census and it is derived from 10 key indicators including the proportion of skilled professionals, education levels, employment levels, and single-parent households found in an area.

Figure 8.8 Deprivation in the area of Youghal in 2016



Source: Pobal HP Deprivation Index, based on 2016 Census; rte.ie/deprivation/ (accessed on 5th February 2021)

History and Culture

Youghal is mentioned in 853 as a port of the ancient Kingdom of Munster, with Viking fleets using it as a base for raids along the coast, and subsequent history recording its importance as a port and industrial centre. The town walls were built in 1250 and it retains other physical reminders of the medieval, Georgian, and Victorian eras as well as connections with historical figures from Walter Sir Raleigh, who was Mayor of Youghal in the 1580s, to Richard Boyle (the 1st Earl of Cork), and Oliver Cromwell. St. Mary's Collegiate Church has a nationally significant collection of tomb sculptures from the 7th to 13th centuries and is one of the best-preserved medieval church sites in Ireland.

In the 19th century, Youghal was a popular destination for railway excursions from Cork and, while the track is now removed, there have been occasional attempts to bring the route back into operational use, and current plans to introduce a walking and cycling path from Youghal to Middleton[7].

While the population fell in the 1980s, the establishment of the Socio-Economic Development Group (YSEDG) in 2007 led to a heritage-led regeneration strategy with Youghal benefitting from the Historic Towns Initiative. This was established by the

[7] *Youghal, A Heritage-Led Vision to the Next Decade*. Cork County Council. 2018

Department of Arts, Heritage and the Gaeltacht, the Heritage Council and Fáilte Ireland in 2014 with funding allocated for a heritage painting scheme, and refurbishment and marketing of historic parts of the towns and quays. Youghal has recently opened a heritage centre in the former covered market recording the long and varied history of the area. **Error! Bookmark not defined.**

Youghal provides cultural tourism, which combines the physical heritage of buildings and archeology with the cultural heritage of people and traditions and is now a significant location within the geographic area, currently marketed as Irelands 'Ancient East'.

There is a significant number of festivals in, and associated with, the local area that reflect local history and traditions as well as new perspectives. These are reported as follows[7]:

- **The Emer Casey Memorial 5K Run / Walk (Mid May)** - This growing sporting event attracts participants from athletic clubs and fun runners from across Ireland and overseas.
- **Moby Dick Festival (Over three days in June)** - Inspired by the filming of Moby Dick in Youghal. This festival is centred on family activities, live entertainment and food; it includes live web link-ups with New Bedford, Massachusetts, USA for literary debates.
- **Queen of the Sea Festival (July)** - The major annual event for Youghal with a weekend of free activities on land and sea, culminating in the crowning of the Queen of the Sea and a firework display.
- **Food / Mackerel Festival (Mid-August)** - Focusing on the town's natural amenities - fish (primarily mackerel) and local foods and offerings with live entertainment and family participation.
- **Youghal Vintage Family Fun Day (A Sunday in August)** - Centred on vintage farm machinery and including family participation.
- **IRONMAN athletic competition (August)** - Youghal hosted the inaugural edition of IRONMAN in 2019, and is reported to have an impact of Euro6.3m on the region[8].
- **Youghal Medieval Festival (End of August)** - This award-winning event takes please at St. Mary's College Gardens within the 13th Century Town Walls to celebrate Youghal's unique history and heritage.
- **Moby Dick Triathlon Youghal (September)** - Recently established and hosted by the South Coast Triathlon Club, this event is attracting significant interest and activity both locally and nationally.
- **Youghal Celebrates History (September)** - An annual history conference, organized by the voluntary group, Youghal Celebrates History, two days, with speakers, field trips and activities relating to Youghal's heritage.

[8] See https://youghal.ie/ironman/

- **Halloween Festival Youghaloween Spooktacular (End October)** - This event was devised to help promote Youghal during the off-peak season and has earned a reputation for innovative and unique events.
- **Christmas Festival (Christmas Period)** – Beginning with illumination of Christmas lights at the end of November, the period also includes parades, choir singing on streets, street music and indoor and outdoor markets.
- **All Ireland Cod Championship (November / December)** – a popular national championship inaugurated in 2013 in Youghal.

Tourism

County Cork is one of the most visited regions of Ireland, and Youghal has significant presence as a tourist location within it. For the tourist, Youghal offers historical interest across many eras and an “exquisite beach location”[9] with 5km of beaches as well as a range of other facilities including four town parks[7,7]. The understanding of tourism in Youghal benefits from the availability of a unique and detailed 2016 study (Wright, 2016)**Error! Bookmark not defined.** as well as later more general references.

The number of tourists visiting Youghal is estimated to be between 30,000 and 50,000 according to the definitions adopted both by Wright, 2016 and the national and regional reporting by Fáilte Ireland, the main agency for tourism statistics in Ireland. In 2014, Wright estimates 32,910 tourists visiting in total, split approximately equally between bus visitors (15,066) and other tourists (17,844) (see Table 8.9).

Table 8.9 Number of visitors to Youghal in the Tourist Season (March to October)

	March	April	May	June	July	August	September	October	Total
Visitors	226	801	2055	2421	4190	4492	2610	1049	17,844
Bus visitors	144	734	2244	2881	2458	2997	2877	731	15,066
Totals	370	1535	4299	5302	6648	7489	5487	1780	32,910

*Source: Youghal Chamber Tourism & Development, 2014, as quoted.**Error! Bookmark not defined.***

There is a pronounced seasonal profile with 75% of tourists visiting in the four summer months (June-September) and 50% visiting in just the two months of July and August (see Table 8.10).

[9] See Wright, 2016, referenced in the End notes.

Table 8.10 Proportion of total visitors to Youghal in each month of the Tourist Season (March to October)

	March	April	May	June	July	August	September	October	Total
Visitors	1%	4%	12%	14%	23%	25%	15%	6%	100%
Bus visitors	1%	5%	15%	19%	16%	20%	19%	5%	100%
Totals	1%	5%	13%	16%	20%	23%	17%	5%	100%

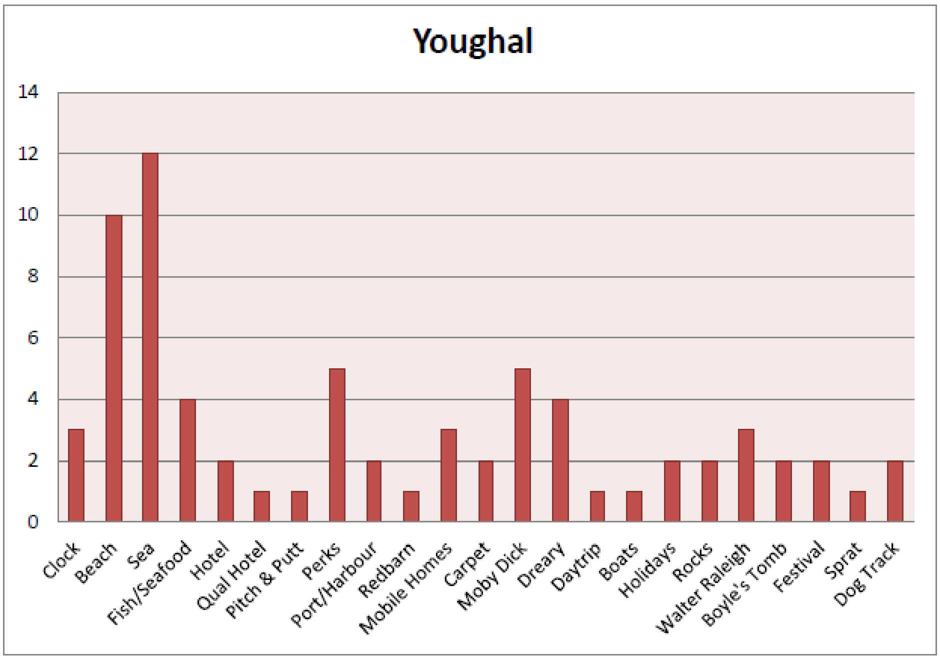
Source: Calculations from Youghal Chamber Tourism & Development, 2014, as quoted ***Error! Bookmark not defined.***.

Visitor numbers have increased significantly since 2014. The Youghal Heritage Centre opened subsequently and is reported by Fáilte Ireland to have had 43,605 visitors in 2017, exceeding the number visiting the town (32,910) in 2014, and putting it 14th on the list of 40 visitor attractions in County Cork and 13th out of the list of 387 attractions across all Ireland. The other main cultural attraction, the Collegiate Church of St Mary's Youghal, had an estimated 12,000 visitors, making it 22nd on the list for County Cork.

In 2014, Youghal is reported as having 20 establishments providing food and lists 20 activities, including walking, sailing, cruising, bird-watching, tennis, golf, and there is now an increased range of facilities.

The face-to-face survey conducted at the time (in 2014) requested opinions from interviewees regarding their 'top of mind' associations with Youghal. Figure 8.9 presents the result of the survey and shows that the primary categories were sea and beach, with both scoring more than double the score of the next most popular category. The survey also highlighted the importance of the 'blue flag' status for bathing waters and a range of possible improvements including, in relation to the marine environment, more visitor moorings, a marina, boating and angling stands as well as more general needs for increased visitor accommodation for peak season and better walkways.

Fig 8.9 Survey Results for 'Top of Mind' associations reported by Interviewees in Youghal



*Source: Wright, 2016**Error! Bookmark not defined.***

The development of a heritage offer to increase tourism is described in the strategic planning document from Cork County Council – 'Youghal, A Heritage-Led Vision to the Next Decade', which presents a significant list of enhancements to the town. It also includes those likely to increase visitors overall, as well as increase use of the beach and the areas near the sea. They include enhancement of coach parking facilities at Raheen Road, Phase 2 of the eco-boardwalk from Claycastle through to Redbarn, and developing the lighthouse as a tourist experience.

8.2.7 Accommodation Facilities

Youghal provides a range of types of accommodation with Wright, 2016 identifying hotels, self-catering facilities, guesthouses, sites for camping and caravanning, and stately homes. In 2016, these provided the capacity to accommodate almost 3,500 visitors (see Table 8.11). At the time, all sectors were reporting strong growth with a requirement for two hotels additional to the existing 10 in the vicinity of Youghal. As of 2016, there were 11 guesthouses and 157 self-catering units within the area.

Table 8.11 Visitor accommodation capacity in Youghal

Accommodation type	Units	Capacity (persons)	As % of total
Caravan and Camping	441	1,566	45%
Guest House and B&B	45	107	3%
Hotel (rooms)	390	857	24%
Self-Catering	157	873	25%
Stately Home	33	95	3%
Total	1,066	3,498	100%

*Source: Wright, 2016****Error! Bookmark not defined.***

Use of Claycastle Beach

Claycastle Beach is used by residents and visitors from Youghal, as well as being a significant attraction in its own right used by visitors from further afield who can use dedicated parking that avoids the town centre.

The estimates of numbers of people using the beach are informed by the estimates of overall tourist numbers to Youghal and have been checked more recently in December 2020 with the proprietor of the restaurant near the site of the proposed development.[10] Of these, accommodation capacity is most representative of peak levels and it indicates, using 2014 data, that up to 3,500 visitors might be staying at any one time in the town. In addition, there may be day-trippers as well as residents who make use of the beach. This is almost certainly an under-estimate compared to current provision, as improvements planned at the time have now been implemented.

In comparison, the aggregate number of visitors to the town in the same year at the peak for the month of August was a peak of 7,500 (see Table 8.9), though not all of these will have stayed for the whole month and so will not be resident all at the same time. In crude terms, if each visitor had stayed for two weeks, then these 7,500 visitors would have consumed the full 3,500 accommodation capacity, but if each had stayed just one week, then only half the accommodation would have been required. No sufficiently detailed and complementary information is available on the number of days that visitors stay, and this is likely to be specific to the location, though it is probable visit lengths are longer in summer, especially as almost half the accommodation is for camping and caravanning.

The number of days that visitors stay is likely to be specific to the location, and sufficiently detailed and complementary information is unavailable for Youghal, though it is probable visit lengths are longer in summer, especially as almost half the accommodation is for camping and caravanning.

[10] See *Field Studies* section above.

There is also no specific information on the time spent by a visit to the beach and simple changes in visit length from 1 hour to 2 hours, or from half a day to a day would double overall estimates of the numbers on the beach at any one time.

The manager of Clancy's Bar and Restaurant, located by the beach, was contacted for information. He reported that Claycastle is a popular and busy beach and *"thousands"* of people use the beach in summer. In quantitative terms, he estimated that on an average day there are 2,000 to 3,000 people walking or dog-walking. At the annual peak when the Ironman competition takes place, he estimated 5,000 participants and family, and between 12,000 and 15,000 people attending on the day. Outside the peak, the beach is in use throughout the day, with walkers and dogwalkers from 7.30am, and people staying all day in good weather. Winter days are also busy with winter swimming becoming popular, and sports teams training on the beach all year round. Since the beginning of the Covid-19 pandemic, the area has seen the number of people on the beach double and almost triple.

The size of Claycastle Beach and the availability of other beaches in the area means that users probably do not consider that there are constraints on beach capacity, though there may be constraints on access or parking. This feature contributes generally to volatility in levels of use while the use of the beach for one-off events such as the Ironman, which draws in a very high number of visitors and requires extensive road closures to manage traffic, further indicates that the numbers that could use the beach are potentially very high.

While there is significant uncertainty as to the upper level of estimated visitor numbers occurring on a regular basis, the lower estimates based on the information available already imply significant use, and this is consistent with information such as other plans for extension of the boardwalk.

The beach is gentle shelving, and the area of the beach covered by water changes significantly between low and high tides. Visitors walking along the beach have fewer possibilities to avoid obstructions and this can lead to concentrations of visitors at choke points on the footpaths, particularly for those people who are less mobile or are avoiding getting wet.

Overall, the use of the beach is expected to be highly variable but to have both a significant lower and ongoing level of use as the potentially for much higher levels of use with associated pressure on supporting facilities and beach access points.

8.3 Characteristics of the Development

The proposed development requires installation and operation of two electrical and one fibre-optic cables along a linear corridor from Ireland to France.

The landfall is on the long gently sloping sandy beach at Claycastle approximately 2km south west of the centre of Youghal town. Offshore, the cable route from the beach crosses a gently sloping 200m intertidal region and then follows a sediment channel through the coastal bedrock with the cables buried to depths between 0.8m and 2.5m depending on seabed conditions and risks to fishing and shipping. The cable route then covers 34km from Claycastle Beach to the 12 nautical mile limit of the Irish Territorial Waters, and then a further 117km to the boundary of the Irish EEZ. Following installation, there will be no restrictions on fishing or other activities over the cable.

Phase one of the installation is planned to take place between October 2024 and April 2025 in a 10-week period outside the peak summer months. It requires the installation of pre-installed conduits within a trench excavated across the beach and Claycastle Beach car park. The trench will be protected by temporary sheet piling forming a cofferdam approximately 130m long and 14m wide, with a temporary causeway 8m wide alongside sufficient to support heavy land-based equipment. The cable is joined to the onshore section in the part of the trench called a Transition Joint Bay (TJB). Land take of approximately 3,360m^2 is required along the beach, the car park, and grass between the car park and year-round holiday park to install the onshore trench, the TJB, and the winch platform required for cable pulling in phase two. Where the cables cross the beach, three cable conduits are assumed with burial depths varying from 3.0m onshore to 1.8m offshore. The 10-week duration of the works is indicative and assumes a working week of Monday to Friday 7am to 7pm and Saturday from 7am to 2pm.

Phase two is estimated to take approximately 4 weeks and requires a land take of approximately 1,750m^2 in the grassed area between the car park and the year-round holiday park. Limited land take is also required in the intertidal zone to excavate a receiver pit from the end of the conduit seaward to enable cable pull-in.

8.3.1 Cable Protection

Purchase and installation of cable protection leads to generation of revenues in the supply chain for materials, equipment and labour, and to economic and employment effects according to the type of protection employed. The contractor for the works will seek to generate local economic benefits particularly for works which can be subcontracted in County Cork.

8.4 Likely Significant Effects of the Development

8.4.1 Do Nothing

Due to the type of development, it is unlikely that the Celtic Interconnector has led to any expectations which have already resulted in socio-economic or health effects. As a result, people are unlikely to have taken action or incurred costs specifically in relation to it. Even if they have, it is unlikely that these cannot be recovered or mitigated in another way.

The Do nothing scenario is therefore assessed as being associated with no significant effects.

8.4.2 Construction Phase

A beach is commonly understood to be a relatively open area often with easy and accessible parking unencumbered by the types of construction works proposed for the Celtic Interconnector.

During the installation phase there are potential effects on terrestrial and marine uses of the beach below MHWM. The different sub-phases of the construction phase have similar but not identical effects, and many will affect the same receptors.

The sub-phases that are defined for the purposes of assessment of effects on population and human health are:

- **Sub-phase 1** - Construction of the cable pit and associated offshore works, expected to take 10 weeks;
- **Sub-phase 2** – An interim period of a few months when the cable pit will be temporarily shielded, and no works will be carried out; and
- **Sub-phase 3** - Cable installation, including pull-though. expected to take 4 weeks.

Impacts on beach users

All three sub-phases require site works and use of construction equipment in a way that will reduce the width of the beach and occupy parts of the related facilities such as car parking and grassed areas. For this reason alone they will have a negative impact on beach users. In addition, in sub-phases 1 and 3, greater use of the car parking area will be temporarily required for transfer of construction equipment, which will reduce parking capacity and access. The works themselves are likely to encourage interest from the public and may become a destination of sorts. This may lead to a need for a higher level of site protection, which is likely to extend the footprint of the site and exacerbate potential disruption. During sub-phase 2, when the site is more unattended, there is the potential for vandalism and impacts on safety from unauthorised access.

The scale of impact is related to the size of the site, which varies for the three sub-phases, and the sensitivity is related to the type and level of beach use.

Many beach users will encounter the works. This is because beach users arriving by vehicle will use the parking near the project site, and the site is within range of even a short walk from the town centre along the beach, as well as from the neighbouring holiday park. Furthermore, beach users may have few alternatives but to pass close to the site, and the choice of routes will be reduced under some tidal or weather conditions. The current need for social distancing between people exacerbates potential impacts.

In addition, beach users who participate in water sports and angling may be more affected by parking curtailment, as it may affect transport of equipment to the beach. They are also affected by the parts of the Celtic Interconnector that extend offshore, which may limit access to parts of offshore areas and may, for example for windsurfers, affect the nature of their experience.

A number of events organised in the town such as the Ironman competition bring specific requirements for use of the beach as well for use of other facilities also needed for the Celtic Interconnector, such as the use of parking and use of the road system for access. Of the annual regular events, the Ironman competition is understood to be the event that brings the greatest impacts on the beach, and so provides a reference point for the assessment of the effects of the development of events more generally.

Construction activities for the Celtic Interconnector are not expected to be undertaken at the time of the Ironman event, as this would be practically difficult and potentially hazardous due to the generally increased numbers of people. However, any site works already begun would form an obstruction on the beach and potentially occupy the parking areas. The types of impacts included all those related to general beach use but exaggerated due to the much larger crowds. In addition, specific requirements of an event may lead to additional impacts, for example on the planned competition course and / or specific access, safety or management measures for competitors, spectators, and event staff.

Other festivals and events also result in increased numbers of visitors in the town and the vicinity, though many do not have the specificity of requirements of Ironman for use of the beach and foreshore facilities. However, many of these events take place in the tourist season over the summer, and any aspects of the Celtic Interconnector which disrupt the regular summer use of the beach would lead to impacts of the same type but of increased magnitude, reflecting the additional visitors to the event. The Celtic Interconnector would cause effects which affect all such events over the construction phase.

While the types of impacts are similar for all three sub-phases, as they result from the same causes and affect the same receptors, the sub-phases can be compared in relative terms. The footprint of the Celtic Interconnector would be smallest in sub-phase 2 as no construction activities would be being undertaken on the site, and no ancillary impacts from transport requirements, such as parking, would occur. It would however be the longest sub-phase. Sub-phase 3, when the cable is installed is potentially the shortest in time, potentially hours or days, but requires pulling equipment that extends the furthest beyond the cable pit and into the parking area, and so would create the greatest obstruction. Sub-phase 1, the initial construction of the cable pit, falls between these two, with movements of materials and workers requiring less space around the site than for pulling the cable in sub-phase 3, but lasting longer.

The number of visitors whose access to and use of the beach is affected by the Celtic Interconnector is potentially “in the thousands”, as this is the level described by the restaurant manager familiar with the location. While anecdotal, both the level and implied variability are consistent with more quantitative information, and this is an arguably succinct expression of the reality of the quantitative level of impact. When specific events are running, the levels are understood to be much greater, requiring road closures and crowds and traffic management.

Overall, the sensitivity of beach users is assessed as ‘high’. The magnitude of impact is assessed as ‘high’ and the effects are assessed as ‘major’ and ‘significant’.

Impacts on marine users

The main impacts on marine users in the area arise from the additional vessel movements and disturbance to the marine environment resulting from the operations to prepare the sea floor and install the cable as well as any prior investigatory operations. In contrast to the impacts arising at the beach and foreshore in sub-phase 1, which are planned to take place over a 10-week period, the impacts offshore occur for short periods, reflecting in part the desire to limit the high daily costs of employing the specialist vessels required.

Cable installation associated with the Celtic Interconnector requires a relatively large ocean-going vessel to proceed slowly (at 275m / hour) along the direction of the planned route with very little deviation with a surrounding mobile safety zone of 500m in radius. At the point where the cable makes the transition from sea to land, as occurs at Claycastle Beach, a coordinated installation exercise is required using additional smaller vessels, divers and pulling equipment on the foreshore, as well as appropriate weather. Closer to the shore the effects of the project are greatest when the operation to transition the cable laying from sea to land takes place as the corridor which the vessels require would effectively form a barrier to other marine users starting from and extending seaward from the shoreline.

The main impact on marine users is related to the lack of flexibility in the positioning of the vessels associated with the Celtic Interconnector and in the timing of operations. The rules for marine navigation have developed over centuries to include provisions related to vessels which for many possible reasons are restricted in their movements (or similarly are out of control)[11]. Impacts from the Celtic Interconnector would potentially occur if other marine users have requirements which would be affected by operation of these basic rules, such as a conflicting need to go to the same specific location at the same specific time.

The cable laying vessels will be categorised as vessels of restricted manoeuvrability, operating and navigational rules will therefore require other vessels to take appropriate avoidance measures. There is also a static exclusion zone around works in the nearshore and a mobile exclusion zone around the cable laying vessels during installation. The Celtic Interconnector route crosses fishing areas and five active subsea cables. The cable laying vessels associated with the project may occupy and prevent access to individual fishing areas for the time it takes to install the cable, may introduction obstructions on vessel routes, and may damage or interrupt operations of existing cables. Of these, damage to cables is unlikely to occur because of their known positions and proposed engineering designs.

In the nearshore area, the vessels associated with the Celtic Interconnector may additionally affect activities more closely related with the coast, including inshore commercial fishing, angling and recreational boating. The need to access sections of the nearshore area and move parallel to the coast is the common requirement for vessels in the nearshore (including for example kite-surfing) that are potentially affected by the proposed development. The assessment of navigation uses as criteria the temporary nature of the restriction, the fact that the beach will be restored immediately and that the timing is outside the main recreation season to consider this effect 'minor'. The displacement of recreational activity that would result from navigational effects will result in some inconvenience for recreational users but is unlikely to curtail it due to the range of alternatives in the near vicinity, including sections of the shore which remain accessible.

Further offshore in the EEZ, the larger vessels fitted with AIS detectors showing their position at all times are mainly sailing to or from Cork Harbour and a majority (51%) of those within the first 100km of the offshore cable route are fishing and recreational vessels. There

[11] International Regulations for Preventing Collision at Sea 1972 (COLREGS) transposed into Irish law through the Merchant Shipping (Collision Regulations) (Ships and Water Craft on the Water) Order 2012 (S.I. No. 507/2012).

are no offshore energy developments (windfarms, oil and gas platforms) at the water surface within the vicinity of the cable route.

Youghal accommodates occasional visits by commercial vessels up to around 4,000 deadweight tonnage as well as smaller fishing and recreational vessels. There is a single company (Sea hunter) based in Youghal identified as providing recreational services to small groups which could be potentially affected by the offshore and nearshore effects resulting from the Celtic Interconnector. However, conversation with them highlighted that their main activities were sea angling and diving, which took place approximately 10 miles offshore, and they did not state any concerns not already covered here. Offshore, Sea hunter has a wide range of choices across a range of climatic and sea conditions and their operations are unlikely to overlap with the Celtic Interconnector even without deliberately seeking to avoid it.

The effects on marine users who are commercial fishers would result from effects on fishing activities from which they benefit, which would result in turn from disruption to fishing and a fall in the value of catches. The local inshore fishing fleet is based at ports which lie between Kilmore Quay, 70 miles north east of the Irish landfall point, and Kinsale which is 40 miles south and the value of landings is worth more than Euro 31m (see Volume 3D Part 2 EIAR for Ireland Offshore (Specialist Chapters) - Chapter 15: Commercial Fishing). None of the fleet is based at Youghal. The assessment of commercial fishing (see Volume 3D Part 2 EIAR for Ireland Offshore (Specialist Chapters) - Chapter 15: Commercial Fishing) concludes that effects on fishing are negligible or minor and not significant. Knock-on economic effects would be muted as both fishers and fishing business (boat) owners would be able to mitigate effects through redeployment and would not require any adaptation in behaviour beyond that required more generally.

Overall, the sensitivity of marine users is assessed as ‘low’. The magnitude of impact is assessed as ‘low’ and the effects are assessed as ‘negligible’ and ‘not significant’.

Impacts on the businesses in the vicinity of Youghal

The businesses most likely to be affected are those serving the tourist industry together with those that may supply services to the proposed development.

The majority of tourists are not likely to see construction works and associated operations generally as an attraction. However, because a cable installation is a once-in-a-lifetime event, any minor impacts are likely to be tolerated and installation of the Celtic Interconnector is also likely to generate interest from some tourists, particularly when complex and rare operations such as cable-pulling are involved. Nevertheless, it is assumed the Celtic Interconnector will not be associated with additional marketing to deliberately attract tourists even if the effects on beach users would allow this safely. Even with good practice procedures for communications in place, tourists will be unlikely to hear of the Celtic Interconnector in advance of a planned visit and so are unlikely to change their plans as a result. As a result, there will be no effects from changes in demand for the tourist industry supplying them.

Businesses in the vicinity of Youghal are more likely to be aware of the project and there is the potential for disruption to access, to flows of traffic and people, and to supply chains (such as for deliveries, labour or locally caught fish). The levels of possible disruption depend on the use of the parking facilities near the proposed development, the effectiveness of existing traffic and crowd management schemes, and any knock-on effects resulting from impacts already identified for the project.

Local businesses may benefit from sales of food or other services, such as transport, purchased directly for the proposed development or indirectly by staff or suppliers in the supply chain. However, the quantities purchased are either likely to be small compared to revenues generated by tourism or small because the specialist services required are unlikely to be met from a local supplier.

Overall, the magnitude of impact is assessed as 'low' and the receptor sensitivity is assessed as 'low', and the effects assessed as 'negligible' and 'not significant'.

Impacts on economy and employment

The installation of the cable will require the deployment of a workforce and purchase of services in a chain of supply. The execution of the complete project requires a range of services some of which are common to all parts, such as cable manufacture, while others are focused on marine or terrestrial elements, such as vessel hire.

The scope of the project is specified using a geographical definition which covers only part of the complete cable route from Ireland to France and this implies that impacts generated or described at the level of the overall project also may also be subdivided.

The impacts on economy and employment depend on the overall procurement and resourcing plan for the Celtic Interconnector and lead to potential impacts at regional, national and international levels. The specialist nature of the required services will determine the levels of expenditure on goods and services in Youghal, County Cork, and across Ireland, with benefits arising for the local and national economies from the commitment to use local employment, goods and services wherever possible.

As the effects are difficult to quantify, a conservative approach is used and the magnitude of impact is assessed as 'low' and the receptor sensitivity is assessed as 'low', and the effects assessed as 'negligible' and 'not significant'.

Impacts on government revenues

The installation of the cable will generate revenue and trade flows which are taxable. A part of these overall effects can be considered applicable to the section of cable covered by the scope of this proposed development. The effects are likely to be proportionate to those on the economy.

Using a similarly conservative approach, the magnitude of impact is assessed as 'low' and the receptor sensitivity is assessed as 'low', and the effects assessed as 'negligible' and 'not significant'.

8.4.3 Operational Phase

Impacts on energy use and security

The cable will provide increased energy security and enable access to a larger wider energy market. A part of these overall effects can be considered applicable to the section of cable covered by the scope of this assessment.

While the effects of the interconnector overall will be higher, the effects attributable to this section are smaller and difficult to quantify. A conservative approach is used and the magnitude of impact is assessed as 'low' and the receptor sensitivity is assessed as 'low', and the effects assessed as 'negligible' and 'not significant'.

Impacts on government revenues

The operation of the cable will generate revenue and trade flows which are taxable. A part of these overall effects can be considered applicable to the section of cable covered by the scope of this assessment. The effects reflect financial flows related to energy use and security.

Using a similarly conservative approach, the magnitude of impact is assessed as 'low' and the receptor sensitivity is assessed as 'low', and the effects assessed as 'negligible' and 'not significant'.

8.4.4 Decommissioning Phase

Placeholder: Standard decommissioning text to be incorporated here.

Commented [A12]: Placeholder: Standard text to be included prior to submission of final Application File.

8.4.5 Cumulative Effects

There are no known developments which could lead to cumulative effects, in particular no other projects have been identified involving construction activity or new seabed installations on the open coast in the vicinity in the cable route (see Volume 3D Part 2 EIAR for Ireland Offshore (Specialist Chapters) - Chapter 14: Shipping and Navigation).

8.5 Mitigation and Monitoring Measures

Commented [A13]: Placeholder: Mitigation and monitoring measures remain under review / discussion, and will be finalized prior to submission of final Application File.

8.5.1 Construction Phase

Standard construction phase mitigation will be used such as such as scheduling of works and the implementation of an effective Construction Environmental Management Plan (CEMP) and Traffic Management Plan (TMP). Elements of these that are of specific relevance are described below.

Scheduling of works

Construction activities are planned to take place over short periods, avoiding as far as possible the peak tourist season and specific events. The approach to design of the construction plan includes flexibility to allow for circumstances such as the combination of a fixed date for an event, a weather window, and restrictions on vessel deployment schedules.

Barriers, pedestrian routes, traffic and crowd management

The site design for the Celtic Interconnector Project includes covers management of the interaction between the site and public, including methods such as safety barriers, temporary walkways and signage. Site works will be designed to accommodate specific recreational uses.

Public information

Public information will be provided about the works including: signage at and near the site; information at tourist information points; timely distribution of information to civic authorities and local organisations. There will be identification of and engagement with organisations assessed as likely to be particularly concerned or affected.

Monitoring plan

Implementation of a monitoring plan on ongoing works on activities related to use of the beach and near shore.

Regular monitoring

Regular physical monitoring of the site and additional monitoring of the construction site as appropriate before, during and after natural events, organised events (such as festivals) or other circumstances in which any aspect of works, barriers or associated safety equipment and procedures may be detrimentally affected.

8.5.2 Operational Phase

Public information and signage

Statutory requirements for indicating cable locations will be met and be supplemented with additional information depending on any additional requirements identified by local authorities.

Regular monitoring

There will be regular and appropriate ad-hoc monitoring and verification of the safety and security of cable, protective enclosures, signage and associated equipment. There will be Regular review of the plan for monitoring and verification.

8.5.3 Residual Effects

A summary of the residual effects identified through the assessment is presented in Table 8.12.

Table 8.12 Visitor accommodation capacity in Youghal

Potential Impact Receptor	Value and sensitivity of receptor	Magnitude of impact	Significance of effects before mitigation	Mitigation	Significance of effects after mitigation
Construction Phase					
Beach users	High	High	Major - Significant	Walkway design; Scheduling of works;	Moderate - Significant

Potential Impact Receptor	**Value and sensitivity of receptor**	**Magnitude of impact**	**Significance of effects before mitigation**	**Mitigation**	**Significance of effects after mitigation**
				Use of alternative locations; Public information	
Businesses in the vicinity of Youghal	Low	Low	Negligible – Not significant	Not required	Negligible – Not significant
Economy and Employment	Low	Low	Negligible – Not significant	Not required	Negligible – Not significant
Government revenues	Low	Low	Negligible – Not significant	Not required	Negligible – Not significant
Marine users – commercial fishers	Low	Low	Negligible – Not significant	Not required	Negligible – Not significant
Operational Phase					
Energy use and security	Low	Low	Negligible – Not significant	Not required	Negligible – Not significant
Government revenues	Low	Low	Negligible – Not significant	Not required	Negligible – Not significant

8.6 Bibliography

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9 Air quality and climate

9.1 Introduction

This chapter considers the likely significant impacts of the Celtic Interconnector Project on sensitive ecosystems as a result of changes to regional air quality during operation and the impact of the greenhouse gas (GHG) emissions associated with the Project on the global climate.

The Project could result in a net change in emissions from the power generation sector. Net changes in nitrogen oxides (NO_X) and sulphur dioxide (SO_2) will be determined and assessed in terms of contribution to acid and nutrient deposition. The only receptor for GHG assessment is the global climate. Any increase or decrease to GHG emissions against the future baseline can be considered to be significant based on their effect on the global climate, which is the largest interrelated cumulative environmental effect.

All other impacts related to emissions of pollutants to air were removed from the scope of the assessment at the scoping stage. The vulnerability of the Project to climate change was also removed from the scope of the assessment at the scoping stage on the basis that the projections for climate change and the hazards associated with changes to the climate are unlikely to affect offshore Project assets or the environmental mitigations put in place and there is no potential for a significant effect.

9.2 Methodology and Limitations

9.2.1 Legislation and Guidance

Air Quality

Under Directive 2016/2284/EU on the reduction of national emissions of certain atmospheric pollutants (European Parliament, 2016[12]) (the National Emissions Ceilings Directive, or NECD), EU Member States are required to draw up, adopt and implement a national air pollution control programme. Member States should comply with the emission reduction commitments set out in the NECD from 2020 to 2029 and from 2030 onwards. Nitrogen oxides (NO_X) and sulphur dioxide (SO_2) are included in the NECD, in part because of the effects of these pollutants on natural ecosystems. As part of this Directive, the Ireland National Air Pollution Control Programme (NAPCP) was produced in 2019 and projects emissions up to 2030 under 'With Existing Measures' (WEM) and Projected emission reductions 'With Additional Measures' (WAM) scenarios (Government of Ireland, 2019[13]).

The National Clean Air Strategy (currently under development) identifies emissions from transport, industry, agriculture, and shipping as key sources of atmospheric pollutants in Ireland, as well as emissions from the domestic use of solid fuel in some areas (DECC,

[12] European Parliament, (2016). Directive 2016/2284 of the European Parliament and of the Council on the reduction of national emissions of certain atmospheric pollutants. [online] Available at: https://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:32016L2284&from=EN [Accessed 20 Nov 2020]
[13] Government of Ireland. (2019). Ireland NAPCP 2019 (Final). [Online]. Available from: https://ec.europa.eu/environment/air/pdf/reduction_napcp/IE%20final%20NAPCP%2013Feb20.pdf [Accessed 20 Nov 2020]

2020[14]). However, the geographical location of Ireland and the prevailing south-westerly wind direction typically results in a good supply of relatively clean air from the Atlantic Ocean.

The Ambient Air Quality and Cleaner Air for Europe (CAFE) Directive (2008/50/EC) was transposed into Irish legislation by the Air Quality Standards Regulations 2011 (S.I. No. 180 of 2011). The CAFE directive sets limit values for pollutants. These are not considered to be relevant for this assessment as it focusses on the effect of regional changes in air quality on sensitive ecosystems.

GHG Assessment

The United Nations Framework Convention on Climate Change (UNFCCC) is the major international body responsible for managing climate change and carbon emissions. In 2015, it adopted the Paris Agreement, which aims to limit *"the increase in the global average temperature to well below 2°C above pre-industrial levels and to pursue efforts to limit the temperature increase to 1.5°C above pre-industrial levels"*. Ireland is aligned to this goal and will contribute to the Agreement through Nationally Determined Contributions (NDC) commitments.

The European Green Deal presented in December 2019 includes measures that will move the EU towards a climate-neutral economy. It includes a goal to achieve net zero GHG emissions for EU countries by 2050, mainly by cutting emissions, investing in green technologies and protecting the natural environment. The European Commission have proposed a European Climate Law which would write this goal into law (European Parliament, 2020[15]). The 2030 climate and energy framework include EU-wide targets and policy objectives for 2021-2030 and includes targets to increase the renewable energy share and reduce GHG emissions.

The Monitoring Mechanism Regulation (MMR) (EC No. 525/2013) requires EU Member States to report national projections of anthropogenic GHG emissions every two years for 2020, 2025, 2030 and 2035, by gas (or group of gases) and by sector. These are reported for 'with existing measures' (WEM) and 'with additional measures' (WAM) scenarios (EEA, 2020[16]). WEM projections take into account the (current) existing domestic policies and measures while WAM projections also consider additional (Planned) domestic policies and measures.

The EU Effort Sharing Regulation (Regulation (EU) 2018/842) requires that Ireland reduce its GHG emissions not included in the EU Emissions Trading Scheme (ETS) by 20% below 2005 levels by 2020. Ireland is not on track to achieve this target (EPA, 2020c[17]). Under the

[14] The Department of the Environment, Climate and Communications (DECC). (2020). The national clean air strategy [online]. Available from: https://www.gov.ie/en/policy-information/26f183-environmental-policy/#air-quality [Accessed 20 Nov 2020]
[15] European Parliament (2020). Establishing the framework for achieving climate neutrality and amending Regulation (EU) 2018/1999. [Online]. Available from: https://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:52020PC0080&from=EN [Accessed 20 Nov 2020]
[16] European Environment Agency (EEA), (2020). Member States' greenhouse gas (GHG) emission projections. [online]. Available from: https://www.eea.europa.eu/data-and-maps/data/greenhouse-gas-emission-projections-for-7 [Accessed 20 Nov 2020].
[17] EPA (2020c). Ireland's Greenhouse Gas Emissions Projections 2019-2040. [Online]. Available from: https://www.epa.ie/pubs/reports/air/airemissions/ghgprojections2019-2040/ -[Accessed 23 Nov 2020]

EU Effort Sharing Regulation, Ireland's target for 2021 to 2030 is to reduce GHG emissions by 30% compared to 2005 levels.

Ireland's National Policy Position on Climate Action and Low Carbon Development sets Ireland's long-term vision of low-carbon transition based on a reduction in CO_2 emissions of at least 80%, relative to 1990 levels, by 2050 across the electricity generation, built environment and transport sectors. The legal framework for this policy is within the Climate Action and Low Carbon Development Bill 2015, which commits to the development of National Mitigation Plans and National Climate Change Adaptation Frameworks. In October 2020, The Irish Government published the draft text for the Climate Action and Low Carbon Development (Amendment) Bill, which commits Ireland to move to a climate resilient and climate neutral economy by 2050 (DECC, 2020[18]). The Climate Action Plan from 2019 presents actions that put in place a decarbonisation pathway to 2030 and is consistent with the adoption of a net zero target in Ireland by 2050 (Government of Ireland, 2019[19]).

Ireland's Energy Policy aims to allow Ireland *"to achieve a transition to a low-carbon, climate-resilient and environmentally sustainable economy"*. Targets for 2030 are included in the policy including achieving 70% renewable electricity and a 30% reduction in CO_2 emissions.

9.2.2 Desktop Studies

Air Quality

Air quality in Ireland is monitored by the Environmental Protection Agency (EPA) and mapped as an index for health (AQIH). AQIH is based on measurements of five key air pollutants that can be harmful to human health. These are ozone (O_3), nitrogen dioxide (NO_2), sulphur dioxide (SO_2), and particulates as PM2.5 and PM10.

The nearest air quality monitoring stations to the Landfall Interface Area at Claycastle Beach are in Waterford (approximately 60km to the northeast), in Cobh and at Cobh harbour (both approximately 30km to the west-southwest). The air quality at all three monitoring sites is currently indexed by the EPA as 1 at Waterford and Cobh, and as 2 at Cobh harbour. Modelled data shows an index of 1 at Youghal, and between 1 and 2 at Claycastle Beach (EPA, 2020[20]). An index of 1-3 falls with the 'good' air quality band. This means that there is a very low risk of health-related concerns for at-risk individuals and for the general population.

Commented [A14]: Placeholder: To be reviewed prior to submission of final Application File

The National Parks and Wildlife Service (NPWS) is responsible for the designation of conservation sites in Ireland. There are over 100 Special Protection Areas (SPAs) and over 400 Special Areas of Conservation (SACs) in Ireland[21]. Many of these sites will contain

[18] Department of the Environment, Climate and Communications (DECC), (2020). Climate Action and Low Carbon Development (Amendment) Bill 2020. [Online]. Available from: https://www.gov.ie/en/publication/984d2-climate-action-and-low-carbon-development-amendment-bill-2020/ [Accessed 20 Nov 2020]
[19] Government of Ireland (2019). Climate Action Plant 2019 to tackle climate breakdown. [Online]. Available from: https://assets.gov.ie/25419/c97cdecddf8c49ab976e773d4e11e515.pdf [Accessed 20 Nov 2020]
[20] Environment Protection Agency (EPA), (2020a). EPA Maps – Air Quality Index Regions Layer. {online}. Available from: https://gis.epa.ie/EPAMaps/ [Accessed 21 Nov 2020]
[21] NPWS Protected Sites in Ireland. [Online]. Available from: https://www.npws.ie/protected-sites

species that are sensitive to nutrient nitrogen deposition (NO_X emissions) and acid deposition (NO_X and SO_2 emissions) which are considered in this assessment.

GHG Assessment

The only receptor for GHG emissions is the global climate. Provisional data for 2019 suggest Ireland's GHG emissions were 59.90 million tonnes carbon dioxide equivalent ($MtCO_2e$) (EPA, 2020b[22]). GHG emissions from energy industries accounted for 15.0% of GHG emissions and have been reducing since 2016, primarily due to reduced use of coal and peat and an increased use of natural gas and renewables in electricity generation. Final figures for 2019 GHG emissions will be published in 2021.

9.2.3 Field Studies

The national AQIH monitoring data is a reliable data source and given the good air quality at the Project site identified by the EPA, site-specific primary data has not been collected for the Project. No survey work has been necessary specifically for the GHG assessment.

9.2.4 Methodology for Assessment of Effects

Air quality

There is no guidance on the assessment of impacts of emissions to air that is specific to the installation of subsea cables. The assessment of impacts on both regional air quality and greenhouse gas emissions rely on the quantification of the total emissions from the Project. The total emissions from the Project will be quantified and compared to a future baseline scenario where the Project is not in place in order to understand the net effect of the Project. The future baseline will consider the influence of not improving interconnectivity on the energy grid mix in Ireland.

Emissions of nitrogen oxides (NO_X) and SO_2 will be considered to determine the likely effects on sensitive habitats and species. These will be considered against the 2030 projections in the Ireland NAPCP.

GHG assessment

Commented [A15]: Placeholder: Further liaison between onshore and offshore assessment leads to be undertaken, and text reviewed / revised as appropriate prior to submission of the final Application File.

The approach is to quantify GHG emissions and then contextualise them against the national budgets/commitments for reducing GHG emissions.

GHG emissions are quantified as carbon dioxide equivalent (CO_2e)[23].

A range of GHG emissions sources have been considered in the quantification assessment. The approach presented in this Volume of the EIAR does not represent a full life-cycle assessment as Volume 3D EIAR Ireland Offshore only considers the Project elements from the Landfall Interface out the limit of the Irish Exclusive Economic Zone (EEZ). Analysis of GHG emissions relating to the onshore components of the Project are presented in Volume 3C EIAR Ireland Onshore. The emission sources considered in this assessment are:

[22] EPA (2020). Ireland's Provisional Greenhouse Gas Emissions. [Online]. Available from: https://www.epa.ie/pubs/reports/air/airemissions/ghgprovemissions2019/ [Accessed 20 Nov 2020]
[23] Carbon dioxide equivalent (CO_2e) is a term for describing different greenhouse gases in a common unit. For any quantity and type of greenhouse gas, CO_2e represents the amount of CO_2 which would have the equivalent global warming impact.

- **Embodied emissions** – to estimate GHG emissions associated with the materials used to construct the Project including landfall installation works, submarine cables, concrete mattresses / rock placement at cable crossings and rock placement for external cable protection.
- **Transport of materials to site** – to estimate GHG emissions from transport of materials, vessels, equipment and workers to onshore and offshore sites.
- **On-site energy usage** – to estimate GHG emissions associated with the installation works including on-site plant equipment at the landfall construction site, and GHG emissions associated with ships conducting the offshore cable laying works.
- **Avoided emissions** – the emissions avoided from fossil fuel-based energy generation as a result of the Project.

A proportionate approach is taken to ensure that undue attention is not placed on emissions sources that have very limited impact on the overall scale of emissions. Emission sources that contribute <1% of emission inventories have been excluded from the assessment.

Activity data (material type, quantities required, progress rates, etc.) for each emission source has been primarily based on the details within the current design of the Project described in Volume 3D Part 2 EIAR for Ireland Offshore (Specialist Chapters) - Chapter 5: Description of the Landfall and Chapter 6: Description of the Offshore Cable. Where this information does not yet exist due to the design stage, information has been sourced from relevant specialists within the design team, literature studies or previous studies conducted as part of earlier preliminary work for this Project. This data has been multiplied by relevant emission factors sourced from the Inventory of Carbon and Energy (ICE) Database and literature studies to calculate the associated emissions measured in kilo-tonnes of CO_2e ($ktCO_2e$).

Although detailed Project design has not yet taken place, estimated quantities of materials needed for the onshore works (including the temporary causeway, sheet piles, winch platform and steel conduits) have been established using expert judgement of the engineering design team. These have been multiplied by emission factors sourced from the Inventory of Carbon and Energy (ICE) Database (Circular Economy, 2019[24]).

[24] Circular Economy (2019). Embodied Carbon – The ICE Database. [Online]. Available from: https://circularecology.com/embodied-carbon-footprint-database.html [Accessed 20 Nov 2020]

Embodied carbon of the cable has been estimated at 191.2 tCO_2e / km based on recent studies of similar design to the Project (Birkeland, 2011[25]; Arvesen et al, 2014[26]; North Connect, 2018[27]; AQUIND Limited, 2019[28]).

There are six in-service telecommunication cable crossings identified along the cable route considered in this assessment (see Volume 3D Part 2 EIAR for Ireland Offshore (Specialist Chapters) - – Chapter 12 Material Assets for details), all in Irish EEZ waters. Each cable crossing will require a specific crossing design to be agreed with each asset owner at a later date. Crossing protection will be based on either the use of concrete mattresses or rock placement. An assumption of three crossings by each method has been used. Typical quantities of rocks (1,237m^3) and concrete (75.6m^3) required per crossing have been estimated and multiplied by emission factors sourced from the Inventory of Carbon and Energy (ICE) Database (Circular Economy, 2019) as described in Table 9.1.

Estimated rock quantities for secondary rock protection are provided in Volume 3D Part 1 EIAR for Ireland Offshore (Introductory Chapters) – Chapter 3: Alternatives Considered and Volume 3D Part 2 EIAR for Ireland Offshore (Specialist Chapters) - Chapter 5: Description of the Landfall and Chapter 6: Description of the Offshore Cable. These have been multiplied by emission factors sourced from the Inventory of Carbon and Energy (ICE) Database (Circular Economy, 2019).

Table 9.1 GHG emission factors for materials from the ICE Database

Material	Emission factor (kgCO_2e/kg)
Aggregate	0.00747
Steel (world average)	1.55
Steel (UO pipe)	3.03
Concrete (general)	0.103
Stone	0.079

[25] Birkeland, C. (2011). Assessing the Life Cycle Environmental Impacts of offshore Wind Power Generation and Power Transmission in the North Sea. [Online]. Available from: https://ntnuopen.ntnu.no/ntnu-xmlui/bitstream/handle/11250/257062/440527_FULLTEXT01.pdf?sequence=1&isAllowed=y [Accessed 20 Nov 2020]

[26] Arvesen, A., R. Nes, D. Huertas-Hernando, and E. Hertwich. (2014). Life cycle assessment of an offshore grid interconnecting wind farms and customers across the North Sea. [Online]. Available from: https://core.ac.uk/download/pdf/52112382.pdf [Accessed 20 Nov 2020]

[27] North Connect. (2018). 2018 HVDC Cable Planning Application and Marine License Documents: Chapter 9 Air Quality. [Online]. Available from: http://marine.gov.scot/sites/default/files/09_air_quailty_0.pdf [Accessed 20 Nov 2020]

[28] AQUIND Limited. (2019). Environmental Statement – Volume 1 – Chapter 28 Carbon and Climate Change. [Online]. Available from: https://infrastructure.planninginspectorate.gov.uk/wp-content/ipc/uploads/projects/EN020022/EN020022-000596-6.1.28%20ES%20-%20Vol%201%20-%20Chapter%2028%20Carbon%20and%20Climate%20Change.pdf [Accessed 20 Nov 2020]

The number of vehicle movements for the landfall construction activities are provided in Volume 3D Part 1 EIAR for Ireland Offshore (Introductory Chapters) – Chapter 3: Alternatives Considered and Volume 3D Part 2 EIAR for Ireland Offshore (Specialist Chapters) - Chapter 5: Description of the Landfall and Chapter 6: Description of the Offshore Cable.. These have been multiplied by a representative distance of 100km for HGV trips (to encompass major cities relatively local to the Site, in the Southern Region of Ireland) and 15km for worker trips, representative of the average commuting distance for Irish workers (Central Statistics Office, 2016[29]). The distance and number of trips has been multiplied by emission factors for average sized 50% laden HGV and average sized petrol cars taken from Department for Business, Energy and Industrial Strategy 2020 emission factors (BEIS, 2020[30]).

Transportation of materials, ships and crew, and equipment to offshore sites is assumed to be by marine methods (i.e. boats, not helicopters). Transit times have been estimated based on anticipated origin ports (Table 9.2).

Table 9.2 Port origins, estimated transit times and assumed number of journeys for the different vessel types required in the installation phase

Vessel type	Port origin	Transit time assumed (hours)*	Assumed number of journeys
Geophysical survey vessel	UK location based on 2015 Geophysical survey conducted on the Project	20.5	One return journey for pre-work survey, one return journey for post-work survey
Route clearance vessel	Continental Europe based on anticipated suppliers	46.2	One return journey
Cable lay vessel			Two return journeys accounting for one winter de-mobilisation period during the construction phase
Supply barge (cable laying supplies)			Based on one return journey per month of the construction period, assumed to be 2 months
Supply barge (rock placement)	Norway	77.6	Based on one return journey

[29] Central Statistics Office. (2016). Census of Population 2016 – Profile 6 Commuting in Ireland. [Online]. Available from: https://www.cso.ie/en/releasesandpublications/ep/p-cp6ci/p6cii/p6td/ [Accessed 20 Nov 2020]
[30] Department for Business, Energy and Industrial Strategy (BEIS). (2020). UK Government GHG Conversion Factors for Company Reporting. Available from: https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/891106/Conversion_Factors_2020_-_Full_set__for_advanced_users_.xlsx [Accessed 20 Nov 2020]

*Transit times are based on average transit times, based on a travel speed of 13 knots) to representative ports of the origin location. The transit time from UK ports is based on the average of transit time from the following ports: Liverpool and Portland Harbour. The transit time from continental Europe ports is based on the average of transit time from the following ports: Rotterdam, Antwerp, Hamburg, Bremerhaven and Le Havre. The transit time from Norwegian ports is based on the average of transit time from the following ports: Tromso, Bergen, Haugesund, Stavanger, Oslo, Drammen and Kristiansand.

Fuel efficiency of the different ship types has been estimated based on previous studies and typical ships, see Table 9.3.

Table 9.3 Fuel efficiency of different vessel types required in the installation phase

Vessel type	Fuel efficiency (l / hour)	Source
Geophysical survey vessel	104	Based on efficiency of S.V Bibby Tethra used in 2015 Geophysical survey for the Project
Route clearance vessel	442	Based on typical anchor-handling vessels (Bourbon, 2009[31]; Bourbon, 2014[32]; Clarkons Research, 2007[33])
Cable lay vessel	573	Birkeland, 2011
Supply barge (cable laying supplies)	100	Birkeland, 2011
Supply barge (rock placement)	100	Birkeland, 2011

Based on the hours of transit and fuel efficiency of the vessels, the volume of fuel has been determined. It has been assumed that all vessels use heavy fuel oil (HFO). Emission factors for HFO have been determined based an average factor of 3,085kgCO_2e / tonne derived from the average of three datasets (BEIS, 2020; IMO, 2014[34]; EPA, 2014[35]).

Energy use for processes on construction vessels have been estimated based on the HFO consumed during the construction processes (ie not including the transit times). Hours of use have been estimated based on rates described in Volume 3D Part 1 EIAR for Ireland

31 Bourbon. (2009). Ailette – Oil recovery anchor handling tug supply vessels. [Online]. Available from: https://www.bourbonoffshore.com/sites/default/files/documents-associes/pdf/ailette-64-mt-bp.pdf [Accessed 20 Nov 2020]
32 Bourbon. (2014). Bourbon Liberty 300 Series – Anchor handling Tug Supply Vessel. [Online]. Available from: https://bourbonoffshore.com/sites/default/files/documents-associes/pdf/bourbon-liberty-300-series-commercial-leaflet.pdf [Accessed 20 Nov 2020]
33 Clarksons Research. (2007). Anchor Handling Tugs and Supply Vessels. [Online]. Available from: https://www.crsl.com/samples/AHTS-W-JAN-07-Sample(1).pdf [Accessed 20 Nov 2020]
34 International Maritime Organization (IMO). (2014). Third IMO Greenhouse Gas study 2014. [Online]. Available from: https://glomeep.imo.org/wp-content/uploads/2016/06/GHG3-Executive-Summary-and-Report_web.pdf [Accessed 20 Nov 2020]
35 Environmental Protection Agency (EPA). (2014). Emission Factors for Greenhouse Gas Inventories. [Online]. Available from: https://www.epa.gov/sites/production/files/2015-07/documents/emission-factors_2014.pdf [Accessed 20 Nov 2020]

Offshore (Introductory Chapters) – Chapter 3: Alternatives Considered and Volume 3D Part 2 EIAR for Ireland Offshore (Specialist Chapters) - Chapter 5: Description of the Landfall and Chapter 6: Description of the Offshore Cable, and previous surveys for the Project. The pre-clearance of boulders is assumed to require 30 days of shipping time based on expert judgement from the engineering design team. Vessel efficiencies and HFO emission factors are calculated as for marine transport emissions.

Energy use from on-site landfall construction processes has been estimated as 4.69% of the emissions from embodied carbon associated with the cable, based on recent case studies similar to the Project (Xodus Group[36], 2012; AQUIND Limited, 2019; Royal HaskoningDHV, 2020[37]). This is in lieu of more detailed information for construction processes on site which will not be available until later in the design process.

The quantified emissions are considered in relation to their impact on the global climate system, which is achieved by contextualising them against their impact on the Irish Government's ability to meet its stated climate targets.

9.2.5 Difficulties Encountered

No difficulties were encountered in the development of this Chapter.

9.3 Receiving Environment

Air quality

NO_X contributes to acid deposition and eutrophication which can lead to damages to soil and water quality. SO_2 emissions also contribute to the acidification of soil, lakes and rivers. SO_2 is responsible for acid rain which is a cause of deforestation. Total emissions are considered to evaluate the effect of the Project on ecological sites in general in the region. The full range of effects on specific sites is considered in in Volume 3D Part 2 EIAR for Ireland Offshore (Specialist Chapters) - Chapter 13 – Biodiversity.

GHG assessment

The receptor for all GHG emissions is the global climate. Given the global impacts of climate change and the globally-recognised requirement to limit GHG emissions to maintain global average temperature increase below 2°C, as laid out in the Paris Agreement, the receptor is considered highly sensitive to emissions. GHG emissions to the receptor are considered direct and negative, and the effects on the receptor are permanent.

9.4 Characteristics of the Development

Air quality

Pollutants (NO_X, SO_2 and CO_2) will be emitted to air during the installation of the cable as a result of the movements of road vehicles and vessels and the operation of ancillary equipment and machinery with combustion engines for activities related to seabed

[36] Xodus Group. (2012). Carbon Life Cycle Assessment Report L30056-S00. [Online]. Available from: https://nngoffshorewind.com/files/offshore-environmental-statement/Appendix_10.2_Life_Cycle_Carbon_Analysis.pdf [Accessed 20 Nov 2020]
[37] Royal HaskoningDHV. (2020). Norfolk Borseas Offshore Wind Farm: Carbon Footprint Assessment. https://infrastructure.planninginspectorate.gov.uk/wp-content/ipc/uploads/projects/EN010087/EN010087-002432-Carbon%20Footprint%20Assessment.pdf [Accessed 20 Nov 2020]

preparation, cable laying, and the installation of cable protection and cable crossings. The vessel types that will be used during the installation phase are described in Volume 3D Part 2 EIAR for Ireland Offshore (Specialist Chapters) - Chapter 5: Description of the Landfall and Chapter 6: Description of the Offshore Cable.

GHG assessment

The materials used during installation of the Project, particularly the cable itself, will have an associated carbon footprint (its embodied carbon).

During operation, it is anticipated that the Project will lead to reduced NO_X, SO_2 and CO_2 emissions. The Project will connect regions currently isolated from European energy markets, strengthen existing cross-border interconnections, and help integrate Renewable Energy Sources (RES) (EirGrid and RTE, 2018[38]). The increased reliance on variable RES generation means that weather will have a greater impact on the future energy system. In this context, the Project will help to maintain security of supply (SoS) while optimising the efficient use of energy resources. As a result, the amount of power generated by combustion of fossil fuels will be reduced.

9.5 Likely Significant Impacts of the Development

9.5.1 Do Nothing

Air quality

Air quality is generally expected to improve with time as a result of policy measures such as the introduction of more stringent emissions standards for motor vehicles.

As summarised in Table 9.4, which includes data provided by the European Environment Agency (EEA, 2019[39]), baseline and Future Do Nothing NOx and SOx emissions for Ireland are expected to fall between 2017 and 2030. In contrast, NOx and SOx emissions from the energy industries are projected to rise.

GHG assessment

Total GHG emissions at a national level are anticipated to decrease over time as a result of decarbonisation efforts and emission reduction targets and initiatives.

Table 9.4 summarises CO_2e emissions data provided by the Environmental Protection Agency (EPA, 2020c) under the WEM scenario. Under the do nothing alternative, the emissions projected for future years (for example, 2030) are lower than estimated emissions at present, for both Ireland (all sectors) and for the energy industries alone.

[38] EirGrid and RTE (2018). Cletic Interconnector Project -Investment Request File. [Online]. Available from: https://www.cru.ie/wp-content/uploads/2018/12/CRU18265a-Celtic-Investment-Request.pdf [Accessed 20 Nov 2020]

[39] EEA (2019). National Emission Ceiling Directive (NECD) - Projected emissions by aggregated NFR sectors. [Online]. Available from: https://cdr.eionet.europa.eu/ie/eu/nec_revised/projected/envxiuy3g/ [Accessed 23 Nov 2020]

Table 9.4 Baseline and Future Do Nothing Emissions (kT / year)

Pollutant	Source	2017	2018	2020	2025	2030
NO_X	Energy industries (Combustion in power plants and Energy Production)	8.481	-	10.126	11.517	11.968
	National Total for the entire territory	108.264	-	95.008	88.307	86.194
SOx (as SO_2)	Energy industries (Combustion in power plants and Energy Production)	4.031	-	5.010	5.113	5.119
	National Total for the entire territory	13.219	-	13.809	12.324	11.266
CO_2e*	Energy industries	-	10,630.81	11,400.34	10,228.82	8,742.43
	National Total	-	60,934.54	63,149.75	62,251.20	59,665.65

*Note CO_2e emissions are based on the "with existing measures" scenario which assumes no additional policies and measures beyond those already in place by the latest national GHG emission inventory data at the end of 2018. This does not include any measures included within Ireland's 2019 Climate Action Plan, published in June 2019.
Empty cells indicate where no data is available from these sources.

9.5.2 Installation Phase

Air Quality

Pollutants (NO_X, SO_2 and CO_2) will be emitted to air during the installation of the cable as a result of the movements of road vehicles and vessels and the operation of ancillary equipment and machinery with combustion engines for activities related to seabed preparation, cable laying, and the installation of cable protection.

As detailed in Volume 3D Part 1 EIAR for Ireland Offshore (Introductory Chapters) – Chapter 3: Alternatives Considered and Volume 3D Part 2 EIAR for Ireland Offshore (Specialist Chapters) - Chapter 5: Description of the Landfall and Chapter 6: Description of the Offshore Cablethe requirements for road vehicles will be short-term. For example, 1,200 ingress / egress movements for the temporary causeway over approximately 4 weeks in two phases; installation and removal. Similarly ship movements will be required for short durations. For example, the overall schedule for cable lay and burial in Irish Territorial Waters and EEZ excluding weather or mechanical damage stand-by is 60 days. Operations of this duration will have negligible emissions relative to regional emissions.

GHG assessment

This section quantifies the GHG emissions during the installation phase. Projected GHG emissions associated with the installation of the Project are estimated to be 70.61 ktCO_2e. The breakdown of emissions by the different sources is described in Table 9.5.

Table 9.5 GHG emissions associated with the installation of the Project

Activity		**GHG emissions (ktCO_2e)**	**% contribution to total emissions**
Embodied carbon emissions	Landfall construction works	0.08	0.1%
	Submarine cable	57.74	82.48%
	Cable crossings	0.85	1.2%
	Rock placement for external cable protection	3.76	5.4%
Transport of materials to site	Landfall construction works	0.12	0.2%
	Marine Transport	0.58	0.8%
On-site energy use	Landfall construction works	2.89	4.1%
	Shipping emissions	4.08	5.8%
Total		70.10	100%

9.5.3 Operational Phase

Air Quality

Reductions in NOx and SOx emissions and comparison to energy sector and national totals for each pollutant are shown in Table 9.6. These emission reductions have been approximated using the 2030 ratios for NOx : CO_2 and SOx: CO_2 from electricity production shown in Table 9.4. CO_2 emission reductions are quantified below.

The results in Table 9.6 show that the Project is likely to reduce annual emissions of NO_X and SO_2 from the energy sector by between around 1% and 7%. The maximum reductions correspond to 1% and 3% of the national totals for NO_X and SO_2, respectively. The Project is therefore considered to have a minor beneficial effect on emissions of these pollutants.

GHG assessment

This section quantifies the GHG emissions during the operational phase. The Project in its entirety is predicted to allow for the integration of between 688 and 884GWh a year of RES (depending on future energy scenario for Europe) in 2030. This corresponds to a reduction in CO_2 emissions of between 65 and 605kt / year due to changes in generation dispatch and unlocking RES potential (EirGrid and RTE, 2018). On average, the Project leads to a CO_2 reduction of 331ktCO_2 / year.

The results in Table 9.6 show that the Project is likely to reduce annual CO_2 emissions from the energy sector by between around 1% and 7%. The maximum reductions correspond to 1% of the national total for CO_2.

Projections for CO_2e emissions to 2040 are additionally available under a ‘with additional measures’ scenario which includes measures within Ireland’s 2019 Climate Action Plan, including the 700MW Celtic Interconnector to France coming on-stream in 2026. Under this scenario GHG emissions from energy industries are anticipated to reduce by 1,734.35ktCO_2e in 2030 relative to the ’with existing measures’ scenario described in Table 9.4. The calculated CO_2e reductions from the Project account for 3.8% to 34.9% of this reduction (average 17.9%).

The operational life of the electrical cables is expected to exceed 40 years and therefore the total operational saving will be a minimum 2,600 – 24,200ktCO_2 (average of 13,240ktCO_2). Installation GHG emissions for the Irish offshore sector of the Project therefore account for 0.53% of the Projects operational carbon saving[40].

The use of vessels deploying subsea survey and monitoring equipment such as multibeam echosounder for completion of periodic operational maintenance surveys will use similar equipment and methods to those described during installation. Vessel movements are expected to be infrequent and of a relatively short duration. Emissions will therefore be negligible for the purpose of this assessment.

Sulphur hexafluoride (SF_6) is universally used as the interrupting medium (dielectric) for high-voltage circuit breakers and therefore leakage may occur at the circuit breaker for the switchgear. This has been assessed within the onshore GHG assessment. Leakage within the scope of this offshore component is considered negligible.

Table 9.6 Changes in Emissions as a Result of the Project

Pollutant	Reduction	Reduction (kT / year)	% 2030 Energy	% 2030 Total
NO_X	Minimum	0.0890	0.74%	0.10%
	Maximum	0.8282	6.92%	0.96%
	Average	0.4257	3.56%	0.49%
SOx (as SO_2)	Minimum	0.0381	0.74%	0.34%
	Maximum	0.3542	6.92%	3.14%
	Average	0.1821	3.56%	1.62%
CO_2e*	Minimum	65	0.74%	0.11%

[40] Note this is likely an over-estimation as the installation emissions are quantified as carbon dioxide equivalent whereas the lifetime carbon reduction associated with the Project is measured as carbon dioxide only.

Pollutant	Reduction	Reduction (kT / year)	% 2030 Energy	% 2030 Total
	Maximum	605	6.92%	1.01%
	Average	311	3.56%	0.52%

*Note CO_2e emissions are based on the "with existing measures" scenario which assumes no additional policies and measures beyond those already in place by the latest national GHG emission inventory data at the end of 2018. This does not include any measures included within Ireland's 2019 Climate Action Plan, published in June 2019.

9.5.4 Decommissioning Phase

A decommissioning plan will be developed prior to the decommissioning phase of the Project, which is anticipated to occur no sooner than 40 years from the start of operation. It is currently anticipated that the cable will be left in-situ where deemed environmentally acceptable and with the understanding that this may require long term monitoring and maintenance. Under this scenario, vessel movements are expected to be in line with those described for subsea surveys and monitoring during operational maintenance and are therefore considered to be negligible for the purpose of this assessment.

Commented [A16]: Placeholder: Decommissioning text remains under review, and will be finalized prior to submission of the final Application File.

9.5.5 Overall GHG Effects

This Project will interconnect power grids and is anticipated to facilitate development and use of RES (EirGrid and RTE, 2018). The average projected emissions reduction is 331kt/ year CO_2 per year in 2030. The calculated GHG emissions for this section of the Project, which are almost entirely related to installation, account for 0.53% of the Project's operational carbon saving over its operational life.

The Project is therefore assessed as having a beneficial effect on GHG emissions over its lifetime. Estimating the scale of that beneficial effect would require an assessment of the GHG emissions associated with the entire interconnector Project, rather than this element of it. However, given the low operational emissions, the estimations of onshore GHG emissions produced concurrently, and the operational lifespan of at least 40 years where GHG emissions from energy production from non-renewable sources are being avoided, it is clear that a net GHG benefit would be apparent.

9.5.6 Cumulative Effects

With the Project, integration with RES will be improved, increasing the viability of RES projects and therefore enabling further reductions in emissions.

The receptor for CO_2e emissions is the global climate and the impacts will be global and cumulative in nature. It is the cumulative effect of all CO_2e emissions that contribute to climate change rather than the impacts of one specific project or indeed one country. Therefore, both the air quality and GHG assessments in this chapter can be regarded as a cumulative assessment of the impacts of NOx, SOx and CO_2e emissions. No further assessment has therefore been undertaken.

9.6 Mitigation and Monitoring Measures

Commented [A17]: Placeholder: Mitigation and monitoring measures remain under review / discussion, and will be finalized prior to submission of the final Application File.

9.6.1 Installation Phase

As the Project as a whole will reduce emissions of NO_X, SO_2 and CO_2e, no further mitigation is considered to be necessary.

The later stages of the design will seek to limit GHG emissions from the earliest stage possible to ensure the greatest reductions can occur. The following high-level approach shall be applied and developed when seeking to reduce GHG emissions (as stipulated within PAS 2080):

- Build nothing: The design will evaluate the basic need for an asset and / or programme of works and shall explore alternative approaches to achieve outcomes set by the asset owner / manager;
- Build less: The design will evaluate the potential for re-using and / or refurbishing existing assets to reduce the extent of new construction required;
- Build clever: The design will consider the use of low carbon solutions (including technologies materials and products) to minimise resource consumption during the construction, operation and user's use stages of the asset or programme of work; and
- Build efficiently: The design will use techniques (e.g. construction, operational) that reduce resource consumption during the construction and operation phases of an asset or programme of work.

9.6.2 Operational Phase

As the Project as a whole will reduce emissions of NO_X, SO_2 and CO_2e, no further mitigation is considered to be necessary.

9.6.3 Residual Impacts

The Project as a whole will reduce emissions of NO_X, SO_2 and CO_2e, and therefore be beneficial with regards to both regional air pollutants and GHG emissions.

10 Marine sediments quality

10.1 Introduction

This chapter provides an overview of the marine sediment quality likely to be present along and adjacent to the proposed Celtic Interconnector route and considers the potential significant impacts that the marine cable installation and operation may have on marine sediment quality, as well as the mitigation measures to be implemented to avoid, reduce, and offset any potential impacts.

This chapter deals with potential effects of changes to marine sediment quality arising from the installation of the Celtic Interconnector cable, including landfall at Claycastle Beach, and cable protection as required. However, marine sediment quality has the potential to be influenced by other receptors, such as marine physical processes, and changes to marine sediment quality may subsequently cause effects on receptors covered in other chapters. Due to these interactions, this chapter should therefore be read in conjunction with a number of other chapters of Volume 3D Part 2 EIAR for Ireland Offshore (Specialist Chapters), including;

- Chapter 11: Marine Physical Processes
- Chapter 12: Marine Water Quality
- Chapter 13: Biodiversity
- Chapter 19: Commercial fisheries

10.2 Methodology and Limitations

10.2.1 Legislation and Guidance

Key legislation relevant to the assessment of potential effects on marine sediments and sediment quality includes:

- The Convention for the Protection of the Marine Environment of the North-East Atlantic (the "OSPAR convention") 1992 including; (i) the OSPAR Hazardous Substances Strategy; and (ii) Strategy for a Joint Assessment and Monitoring Programme (JAMP);
- EC Directive 92/43/EEC on the conservation of natural habitats and of wild flora and fauna (the Habitats Directive); and
- The Marine Strategy Framework Directive (MSFD) (2008/56/EC).

There are currently no European statutory standards against which to assess the quality of marine sediments. Instead, contaminant levels can be compared to OSPAR background assessment criteria (BAC), which are defined in relation to background concentrations (ie concentrations expected in pristine environments), Cefas Action Levels, which are used as standards for dumping of dredged material at sea in the UK (MMO, 2020), and Canadian Sediment Quality Guidelines (Canadian Council of Ministers of the Environment, 1995), which establish likely biological impacts of a given level of contamination, to give an estimation of potential impact. In addition, contaminant levels in marine sediments can be compared to Effects Range Low (ERL) and Effects Range Median (ERM) values determined by Long *et al*. (1995). The ERL and ERM guidelines represent thresholds between minimal (< ERL = < 25% incidence), possible (ERL ≤ ERM = 25-75% incidence), and probable (> ERM = > 75% incidence) adverse biological effects. Adverse biological effects include, for example, altered benthic communities (depressed species richness or total abundance) and elevated sediment toxicity.

Changes to marine sediments and sediment quality have the potential to affect marine water quality through changes in turbidity and release of contaminants. The following legislation is also therefore relevant to the assessment in this chapter:

- The Water Framework Directive (WFD) 2000 (2000/60/EC);
- The Bathing Water Directive (BWD) 2006 (2006/7/EC);
- The Shellfish Waters Directive (SFWD) 2006 (2006/113/EC); and
- The Priority Substances Directive (2013/39/EU), amending the original Priority Substances Directive (2008/105/EC).

The WFD and MSFD seek to ensure, respectively, Good Ecological Status and Good Environmental Status (GES) within designated water bodies with the MSFD covering waters beyond 1 nautical mile (nm) and the WFD covering freshwater, transitional and coastal waters up to 1nm. Broadly, GES for the marine environment means that marine waters are:

- Ecologically diverse;
- Clean, healthy and productive; and
- Used sustainably, so that the needs of current and future generations are safeguarded.

A Water Framework Directive Assessment has been carried out for the Project and is presented in Volume 8C. The WFD Assessment identified, as part of the screening process, two WFD waterbodies which could potentially be impacted by the Project. These are Youghal Bay (IE_SW_020_0000) and Western Celtic Sea (IE_SW_010_0000). Effects on marine water quality are covered in Volume 3D Part 2 EIAR for Ireland Offshore (Specialist Chapters) - Chapter 12: Marine Water Quality and in the WFD Assessment presented in Volume 8C.

The BWD and the SFWD are only applicable at designated bathing waters and shellfisheries, respectively.

The Irish landfall will be at Claycastle Beach near Youghal, County Cork. As this area is a designated bathing beach, the BWD is applicable. Effects on Bathing Waters are covered in the Water Framework Directive Assessment that has been carried out for the Project, presented in Volume 8C and effects on marine water quality are covered in Volume 3D Part 2 EIAR for Ireland Offshore (Specialist Chapters) - Chapter 12: Marine Water Quality.

The SFWD concerns the quality of shellfish waters and applies to both coastal and brackish waters. Annex I to the Directive sets requirements for the physical-chemical parameters (oxygen content, temperature, salinity etc.) in shellfish waters as well as requirements regarding the contaminants present. The nearest designated shellfish waters are at least 4km from the Celtic Interconnector cable route. The Project does not intersect with any designated shellfisheries.

The Priority Substances Directive aims to control pollution caused by certain dangerous substances discharged to the aquatic environment. Two lists of compounds have been established. List I contains substances regarded as being particularly dangerous because of their toxicity, persistence and bioaccumulation and the discharge of which must be eliminated. List II contains substances which are less dangerous, but which nevertheless have a deleterious effect on the aquatic environment and the discharge of which must be reduced. Effects on marine water quality are covered in Volume 3D Part 2 EIAR for Ireland Offshore (Specialist Chapters) - Chapter 12: Marine Water Quality.

10.2.2 Desktop Studies

A detailed metocean study was carried out by Open Ocean in order to provide a detailed description of the wind, wave, current and water level conditions along the Celtic Interconnector route. The Celtic Interconnector corridor was broken down into an offshore section, corresponding to regions in which the water depth exceeds 30m, and a nearshore section, where a dedicated current model was created.

A hydro-sedimentary study was carried out by ACRI-HE in 2018/2019, which assessed the potential for sediment mobility induced by currents and waves along the Celtic Interconnector route, in areas where vibrocore samples were acquired and granulometry analyses were carried out.

Sediment chemistry samples were collected as part of the benthic surveys conducted along the cable route. Where appropriate, additional third-party information has been used to supplement these data.

10.2.3 Field Studies

A number of marine and coastal surveys have been completed along the proposed cable route, with findings and wider reporting being provided by:

- CELTIC Interconnector Study Synthesis. Prepared by Wood Group for EirGrid & RTE. Doc Ref: 400584-PL-REP-001, Rev: H. July 2019;
- Celtic Interconnector Project. Volume 1 - Combined Inshore, Nearshore and Offshore Environmental Field Reports. Project No: 2015-001. Client Ref No: CELTIC-SUR1415-BEN-R01-V01 (BHM_2015-001). December 2015. Report prepared for EirGrid Plc and RTE by Bibby HydroMap and Benthic Solutions;
- Celtic Interconnector Project. Volume 2 - Combined Celtic Interconnector Habitat Assessment Survey and Environmental Baseline Report. Project No: 2015-001. Client Ref No: CELTIC-SUR1415-BEN-R02-V02 (BHM_2015-001). January 2016. Report prepared for EirGrid Plc and RTE by Bibby HydroMap and Benthic Solutions; and

- Celtic Interconnector Project. Benthic Survey Report. Final report. Ref No: 2018-0019-016-BNT, Revision C3. September 2018. Report prepared for EirGrid Plc and RTE by Next Geosolutions.

Detailed geophysical, geotechnical and benthic surveys were undertaken in Irish Territorial Waters in 2017 and 2018. From a marine sediments perspective, this included physico-chemical sampling, and subsequent analysis of particle size distribution, total organic carbon (TOC), total organic matter (TOM), heavy and trace metals, hydrocarbons and polycyclic aromatic hydrocarbons (PAH) in the surface layer. Samples were also collected in the intertidal zone.

10.2.4 Methodology for Assessment of Effects

Within this chapter a systematic approach to the assessment of effects has been followed where possible, which includes:

- A description of the relevant baseline conditions;
- A description of any proposed mitigation measures incorporated into the proposal;
- Identification and assessment of potential effects;
- Identification and assessment of cumulative effects (where appropriate); and
- Identification and assessment of residual effects remaining following the implementation of mitigation.

The assessment of effects on marine sediment quality broadly follows the methodology presented in Volume 3D Part 1 (Introductory Chapters) Chapter 4: EIAR Methodology. The evaluation and assessment within this chapter has been undertaken with reference to relevant parts of the 2017 Draft Guidelines on the information to be contained in Environmental Impact Assessment Reports (EIAR) issued by the Environmental Protection Agency (EPA), and 2018 Guidelines for Ecological Impact Assessment in the United Kingdom and Ireland developed by the Chartered Institute of Ecology and Environmental Management (CIEEM). This is recognised as current best practice for ecological assessment and provides guidance to practitioners for refining their own methodologies.

The assessment considers, as appropriate: direct, indirect, secondary and cumulative impacts and whether the impacts and their effects are short, medium, long-term, permanent, temporary, reversible, or irreversible. The assessment of impacts then takes into account the baseline conditions to describe:

- How the baseline conditions will change as a result of the project and associated activities; and
- Cumulative and in-combination impacts of the proposal and those arising from other developments.

The significance of a potential impact is defined by the sensitivity of the receiving environment and the character of the predicted impact (as outlined in Volume 3D Part 1 (Introductory Chapters) Chapter 4: EIAR Methodology). In some cases, magnitude or significance cannot be quantified with certainty; in these cases, professional judgement is used to identify the significance of an impact.

Despite it only being necessary to assess and report significant residual effects (those that remain after mitigation measures have been taken into account), it is good practice to make clear both the potential significant effects without mitigation and the residual significant effects following mitigation. This helps to identify necessary and relevant mitigation measures that are proportionate to the size, nature and scale of anticipated effects. Impacts are therefore considered initially in the absence of mitigation. After avoidance / mitigation measures and necessary compensation measures have been applied, and opportunities for enhancement incorporated, impacts are reassessed and residual impacts are identified.

In the Scoping Report for Foreshore Licence Application and Environmental Impact Assessment Report (Wood, 2020) produced for the Celtic Interconnector Project, three potential effects on marine sediment quality were identified. These were:

- Disturbance of seabed during cable installation and rock armour formation;
- Changes in sediment transport regime; and
- Changes in water quality through release of contaminants held in marine and coastal sediments.

While the baseline condition of marine sediments and sediment quality is covered in this chapter, assessment of the effects associated with changes in water quality through release of contaminants held in marine and coastal sediments is covered in Volume 3D Chapter 12: Marine Water Quality.

10.3 Receiving Environment

Data collected as part of surveys of the proposed cable route indicate that surficial sediments throughout the survey corridor are characterised by very fine to very coarse sands with occasional gravels and pebbles. The dominant sediment type present was gravelly muddy sand (as per Folk, 1954), with maximum levels of ~95% sand recorded in samples from Irish waters.

Intertidal surveys of Claycastle Beach indicate that the proposed landfall area is predominantly composed of sands with a band of mixed sediment in the mid shore zone.

In Irish waters, high (>30%) proportions of gravel were not recorded at any subtidal station. Percentages of fines (i.e. <63µm diameter sediments) were also generally low (<30%). The generally low percentage of fines recorded is consistent with shallow, high energy environments, where near-seabed stress is high and rates of sedimentation are low. Silts and clays often remain suspended due to high tidal currents and, in shallower waters, wave action.

The hydro-sedimentary study carried out for the Project indicated that, in Irish waters, wave-induced sediment mobility occurs only close to the shore, in depths of up to 20m (with a probability of occurrence in this zone of 20%), decreasing as water depth increases to 60m, beyond which waves have no influence on surficial sediments. At depths of >60m, current-induced sediment mobility dominates. In the offshore zone, the sediment thickness with the potential to be affected by wave- or current-induced mobility is generally less than 1m, but this could reach 1.5-2m in very localised areas.

Total organic matter (TOM) is made up from a mixture of different organic materials, but is predominantly naphthenic materials (such as carboxylic acids and humic substances), which play an important role within the benthic community as a potential food source to deposit-feeding organisms. Organic matter is an important scavenger of other chemical components, such as heavy metals and some hydrocarbon compounds (McDougall, 2000). Total organic carbon (TOC) represents the proportion of biological material and organic detritus within the substrate. Changes in TOC may reflect changes in both physical factors (eg addition of fines) and common co-varying environmental factors through greater sorption on increased sediment surface areas (Thompson and Lowe, 2004).

The levels of TOM in samples from both the 2015 and 2018 surveys were low and consistent throughout the Celtic Interconnector cable route. Percentage TOC was also consistent between surveys, ranging from below detection limit (<0.1%) to up to 0.36% in Irish waters. These low values are representative of an organically deprived environment. Higher levels of TOC were typically associated with higher proportions of fine sediments.

The total hydrocarbon content (THC) of the sediments sampled in both the 2015 and 2018 surveys were low throughout the interconnector cable route in Irish waters. The highest THC values were recorded at stations close to the Irish coastline and were associated with finer sediments (which provide an increased surface area for adsorption and retention of hydrocarbons) and higher TOC concentrations. The correlation between THC and TOC suggests that most of the THC is present in organic matter. The 2018 analysis recorded total polyaromatic hydrocarbon (PAH) concentrations in addition to THC; in all cases PAHs were below the analytical reporting limit in all samples (<1.28mg/kg). The results of the sample analyses indicated that there is no significant hydrocarbon contamination along the interconnector cable route.

Metals occur naturally in the marine environment and are widely distributed in both dissolved and sedimentary forms. Some are essential to marine life while others may be toxic to certain organisms (Paez-Osuna and Ruiz-Fernandez, 1995). Some, such as zinc, may be essential for normal metabolism but can become toxic above a critical threshold (Long *et al*., 1995). The bioavailability (and therefore toxicity) of individual metals to marine organisms is dependent on a number of factors, including sediment grain size, TOC content, and acid-volatile sulphide concentrations (Long *et al*., 1995).

Trace metals are present in sediments within the sediment particles themselves (as components of minerals), adsorbed to the surfaces of sediment particles, and on the surfaces of organic matter (by forming metal-organic ligand complexes). Trace metals that are intrinsic parts of sediment particles (residual) are not bioavailable. Trace metals that are associated with the surfaces of particles within the sediment (non-residual) may be bioavailable and can include trace metals originating from sources of pollution. The analytical method used to determine metal concentrations in marine sediments does not differentiate between non-residual and residual trace metal concentrations (as samples undergo mineral digestion by hydrofluoric acid before quantification of metal concentrations).

Therefore, if a metal is found in high concentrations it does not necessarily follow that this will have a detrimental effect on the environment. It is necessary to use other pieces of information (e.g. particle size and TOC results) to determine whether the concentrations found have the potential to be toxic to benthic marine life (Long *et al*., 1995).

Analysis of samples collected as part of the surveys of the interconnector cable route conducted in 2015 and 2018 indicate that concentrations of heavy and trace metals are generally low and consistent throughout the survey corridor in Irish waters.

Sediment concentrations of cadmium, chromium, copper and zinc were low throughout the interconnector cable route. All stations recorded these metals at concentrations below Cefas Action Level 1 values, Canadian Sediment Quality Guidelines threshold effect levels (TEL) and OSPAR BAC values. Copper and zinc concentrations were slightly higher in samples collected in 2018 than in 2015, however these values were associated with sediments containing higher proportions of fines and TOC, to which these metals readily adsorb. Tin concentrations were low throughout the cable route, with most results being below detection limits.

Nickel concentrations were relatively low and consistent throughout the interconnector cable route in both years, however one site in 2015 (035) recorded a nickel concentration of 25.7mg/kg, which is above the Cefas Action Level 1 value, the ERL (Long *et al*., 1995) and Canadian Sediment Quality Guidelines TEL. A single sample collected in 2018 (CL-BN03) also recorded nickel concentrations above the Canadian Sediment Quality Guidelines TEL (though below Cefas Action Levels and ERL). However, in both cases the values recorded fell below the OSPAR BAC level. The nickel concentrations at these sites were only slightly above the guideline thresholds, and it should be noted that the relationship between the incidence of adverse biological effects and concentrations of nickel is relatively poor (Long *et al*., 1995).

[**PLACEHOLDER – Map in preparation, showing sampling locations along the cable route, and cross-referenced in other chapters, as required**]

Mercury concentrations were generally low (frequently below the limit of detection, <0.01mg/kg) throughout the interconnector cable route in both years, with the exception of a single station (BB04) in 2015, where levels of 0.28mg/kg were recorded. This falls above the ERL value for mercury, however, significantly below the ERM value of 0.71 mg/kg (Long *et al*., 1995).

Lead concentrations were moderate and variable throughout the interconnector cable route in 2015, but were much lower and less variable in 2018, with all samples in 2018 being below all guideline values. The sample from station BB04 in 2015 recorded a lead concentration above Canadian Sediment Quality Guidelines TEL, though below all other guidelines and thresholds, including the ERL.

Samples taken in 2015 indicate that arsenic concentrations are highly variable throughout the interconnector cable route, with levels in Irish waters ranging from 2.8 – 47.5mg/kg. Several samples contained arsenic concentrations exceeding the ERL (Long *et al*., 1995), Cefas Action Level 1 and the Canadian Sediment Quality Guidelines TEL. The sample from station BB04 showed the highest concentration of arsenic (47.5mg/kg), which also exceeded the OSPAR BAC value and the Canadian Sediment Quality Guidelines probable effect level (PEL). The concentrations of arsenic in samples collected in 2018 were much lower and less variable than those recorded in 2015. However, one sample (CL-BN06) exceeded the ERL. This sample was also associated with a high iron content; arsenic is often associated to iron containing minerals, to which they adsorb. The high level of arsenic at this station therefore does not necessarily indicate contamination. All other samples in 2018 fell below all guideline values.

Throughout the interconnector cable route in Irish waters iron and aluminium concentrations in both years were similar in both range and variability, with the samples collected in 2018 generally having slightly higher concentrations. This likely reflects physical differences in the two sets of samples, with the 2018 samples collected closer to shore (iron and aluminium are abundant in crustal rocks), and were found to contain higher proportions of fines.

Barium concentrations were consistently low throughout the interconnector cable route in both 2015 and 2018, with average concentrations of 12.5mg/kg (2015) and 11.9mg/kg (2018). Barium is typically insoluble in the form of a non-toxic sulphate (Gerrard *et al*., 1999) and as such is generally not bioavailable to marine fauna. Barium sulphates are often associated with other heavy metals, such as cadmium, chromium, copper, lead, mercury and zinc, however no obvious geographical patterns or correlations with other metals were detected, although the highest concentrations of barium were found in samples containing relatively high concentrations of TOC.

Vanadium is often associated with the oil and gas industry as it is present in relatively high concentrations in most crude oils (Khalaf *et al*., 1982). Most vanadium enters seawater in suspension or colloidal form, passing quickly out of the water column and depositing in sediments (Cole *et al*., 1999), and as such could be considered as being relatively non-bioavailable. Vanadium concentrations were found to be low throughout the interconnector cable route.

In summary, the concentrations of heavy and trace metals in surficial sediments along the interconnector cable route have been found to be generally low and consistent throughout the survey corridor, with almost all concentrations below OSPAR BAC thresholds, suggesting that little anthropogenic contamination had occurred across the survey area. The exception to this was the sample taken at station BB04. As this station was relatively close to shore (being approximately 5km from the Irish coastline), it is possible that the elevated levels of mercury, lead and arsenic recorded are a result of anthropogenic contamination.

The baseline environment is not static and will exhibit some degree of natural change over time, with or without the Project in place, due to naturally occurring cycles and processes. Therefore, when undertaking impact assessments, it is necessary to place any potential impacts in the context of the envelope of change that might occur naturally over the timescale of the Project.

Further to potential change associated with existing cycles and processes, it is necessary to take account of the potential effects of climate change on the marine environment. Mean sea level is likely to rise during the 21st Century as a consequence of either vertical land (isostatic) movements or changes in eustatic sea level. A rise in sea level may allow larger waves, and therefore more wave energy, to reach the coast in certain conditions and consequently result in an increase in local rates or patterns of erosion and the equilibrium position of coastal features. It is however unlikely that significant changes in the level of contaminants in the benthic sediments of the western Celtic Sea will occur as a result. In addition, there is a high degree of uncertainty of how winter storm tracks over the North Atlantic Ocean may be altered due to climate change. Natural variability in wind speeds and hence wave heights is large and dominant and is projected to remain so for the century to come (Gallagher *et al*., 2016).

10.4 Characteristics of the Development

Volume 3D Part 2 EIAR for Ireland Offshore (Specialist Chapters) - Chapter 5: Description of Landfall and Chapter 6: Description of the Offshore Cable provide a detailed account of the Project for the landfall at Claycastle Beach, the foreshore, and works in the wider marine environment.

The installation of the Celtic Interconnector will cause disturbance to the seabed, with resulting effects on marine sediments and sediment quality in the immediate vicinity. The mechanisms by which this will occur are described in the following sections.

10.4.1 Landfall at Claycastle Beach

During Phase I of the Landfall installation, beach preparation works, including excavations, will take place. This will involve the following activities:

- Open cut trenching across Claycastle Beach;
- Installation of temporary causeway;
- Installation of cofferdam with sheet piling;
- Excavation of cofferdam and removal of sediment to installation compound;
- Installation of conduits into trench and replacement of spoil; and
- Installation of temporary winch platform and winch.

In Phase 2 of the Landfall installation, cable pull-in will take place, which will involve the following activities:

- Excavation of receiver pits;
- Arrival of submarine cables on cable lay vessel and transferral of messenger wire to cable laying vessel;
- Cable pull-in by winch, from cable laying vessel through conduit to the Transition Joint Bay;
- Commencement of offshore cable burial by cable laying vessel with plough; and
- Reinstatement of receiving pit and beach.

The disturbance of beach sediments during both Phase 1 and 2, particularly through trenching and excavation works, has the potential to cause changes in the sediment transport regime, and has the potential to cause changes in marine water quality through increases in turbidity and release of contaminants held in beach sediments. However, the disturbance will be temporary, and once works are complete the beach will be returned to its prior condition. The volume of sediments to be removed during excavation of the trench is estimated at approximately 4,000m^3. The spoil will be stored within the compound on hard standing. The stored spoil shall be adequately covered in order to prevent exposure to the elements, and hence prevent leaching of sediment (and any potential contaminants present therein) into the marine environment. Once landfall works are completed, the trench spoil will be returned to the trench to reinstate the beach to its prior condition. Results from benthic surveys of the cable route indicate that the beach sediments are not contaminated.

10.4.2 Cable Route

The installation of the submarine cable as part of the marine construction works will typically follow a sequence similar to the following:

- Contractor survey, route engineering and finalisation;
- UXO intervention campaign;
- Boulder clearance;
- Pre-lay grapnel runs;
- Construction of infrastructure crossings;
- Pre-lay route survey;
- Cable lay and post-lay survey; and
- Burial and post-burial survey.

Installation of the cable will be undertaken using methods including (as appropriate to local seabed conditions) ploughing and mechanical trenching. Optimum burial depths of 0.8m to 2.5m are sought for the cable; where this is not possible, appropriate external cable protection shall be installed.

During preparatory works, activities likely to cause disturbance of the seabed include boulder removal and sandwave sweeping. During construction works, pre-lay grapnel runs, construction of infrastructure crossings, cable lay and cable burial all are likely to cause seabed disturbance. Sediments and seabed features (such as sandwaves) have the potential to be permanently lost via these activities, and there may be localised changes in the sediment transport regime as a result.

Based on an assumption that a corridor of approximately 15m width will be disturbed by cable-laying equipment along a length of 151km (in Irish waters), an area of approximately 2.3km^2 will be directly disturbed by cable installation. Depending on the installation method used, the trench created by installation may be partly back-filled by the cable-laying equipment.

There is the potential for marine water quality to be impacted by any activity which causes disturbance of the seabed along the route through release of contaminants held in surficial sediments. However, changes in marine water quality arising from seabed disturbance is only a risk in heavily contaminated locations. Sediment samples collected as part of cable route surveys in 2015 and 2018 indicate that neither Claycastle Beach nor the seabed along the cable route in Irish waters is contaminated. Surveys of the cable route (ie pre-lay, post-lay and post-burial) will not cause significant resuspension of seabed sediments.

10.4.3 Cable Protection

Rock placement as a means of primary cable protection is not envisaged along the cable route in Irish waters. However, it is likely that some secondary rock protection may be required where the target depth of lowering (DOL) is not fully achieved. The primary external protection approach is through rock placement (see Volume 3D Part 2 EIAR for Ireland Offshore (Specialist Chapters) - Chapter 5: Description of Landfall and Chapter 6: Description of the Offshore Cable). However, a number of other options could be considered, notably concrete mattressing. Rock placement would be sourced from certified quarries, with well-developed infrastructure.

The requirement for external cable protection will be established during the detailed design phase. The exact length of the route which will need this additional protection is therefore not known at the time of writing. For the purposes of assessing potential effects, a precautionary approach has been employed and it has been assumed that the whole length of the cable route within Irish waters (i.e. 151km) will be protected. As a 'worst case scenario' it has been assumed that cable protection will be installed in a 15m wide corridor centred on the actual cable, resulting in an area of approximately 2.3km^2 covered by external protection. However, external protection will only be required in areas where trenching is not deemed feasible, through either the presence of other seabed assets or obstacles (such as at cable crossings), where ground conditions are too hard, or where secondary protection is required to achieve the required burial depth.

On areas of hard substrate, the deployment of external rock protection will result in the addition of hard material into areas where such conditions already exist, therefore there will be not be a significant change to the seabed types present and should not significantly affect the local sediment regime. Where external rock protection is installed over cable crossings, or as secondary protection, there is the potential for permanent loss of seabed features in sedimentary environments. However, this is anticipated to be over a small area compared to the wider route.

Introduction of hard material into an area which is predominantly sedimentary has the potential to result in localised changes to hydrographic conditions, and associated sediment dynamics. It is anticipated that some level of scour may occur where external cable protection is installed. However, due to the intrinsic purpose of the cable protection, the protection will be designed to minimise scour.

Scour of seabed sediments around the cable protection has the potential to cause changes in marine water quality through release of contaminants held in benthic sediments. However, changes in marine water quality arising from seabed disturbance is only a risk in heavily contaminated locations.

10.5 Likely Significant Impacts of the Development

10.5.1 Do Nothing

In the 'Do Nothing' alternative, there would be no landfall or marine construction works associated with the Celtic Interconnector, and therefore the existing baseline environment would be expected to remain unchanged, subject to natural variation. The evolution of the marine environment in the absence of the Project will depend on future levels of marine activity such as military operations and offshore developments, future resource exploitation such as fishing, and the effectiveness of protected site management, as well as variation due to climate change. Some of these possible changes may be planned, such as marine renewable energy developments and cables. Others, however, will be subject to change such as the evolution of commercial fishing activities as influenced by economic and resource availability factors, the evolution of maritime traffic as influenced by economic and port related factors, and the evolution of maritime fleets as influenced by on-board waste management practices.

10.5.2 Installation Phase

During the installation phase of the Celtic Interconnector, surficial sediments will be disturbed at both the Landfall at Claycastle Beach and along the marine cable route. Seabed sediments will be resuspended into the water column and will then settle out again, which can have an effect, either positive or negative, on benthic habitats and species (Dernie *et al*., 2003) (see Volume 3D Part 2 (Specialist Chapters), Chapter 13: Biodiversity).

Compared to other offshore activities such as bottom trawling, ship anchoring or large-scale dredging, seabed disturbance resulting from subsea cable activities is considered temporary and has a relatively limited extent (Carter *et al*., 2009; OSPAR, 2012), with the seabed usually returning to its original state (BERR, 2008). The disturbance itself is restricted to a narrow strip of seabed, normally limited to an area 2-3m either side of the cable (Bald *et al*., 2014; Carter *et al*., 2009), or in the order of 10m width if the cable has been ploughed into the seabed (OSPAR, 2009).

Installation tools may have a footprint up to 10m width depending on the burial method used (OSPAR, 2009; NIRAS, 2015). The level of seabed disturbance caused during clearance or installation also largely depends on the equipment being used, as well as on the sediment type (BERR, 2008). The level of disturbance caused by ploughs is considered to be lower compared to jetting techniques (OSPAR, 2012; NIRAS, 2015).

Dispersion of disturbed sediments is dictated by the local hydrodynamic regime, particularly near-bottom current speeds (BERR, 2008). Coarser sediments such as sand and gravel settle relatively close to the origin of disturbance, while finer sediments such as clay and silt can remain in suspension for a longer period of time creating a larger impact footprint. However, a greater dispersion also results in a smaller level of deposition at any given point. The majority of sediment deposition occurs within tens of meters of the cable route (OSPAR, 2009).

The cable burial technique used in Irish Territorial Waters and the Irish EEZ may vary depending on the geology of the seabed. However, assuming that a corridor of approximately 15m width will be disturbed by cable-laying equipment, along a length of 151km (in Irish waters), an area of approximately 2.3km^2 will be directly disturbed by cable installation. Depending on the installation method used, the trench created by installation may be partly back-filled by the cable-laying equipment.

Where external cable protection is not installed, trenches will be naturally infilled along the majority of the cable route through a combination of natural collapse of temporary trench walls, the resettling of disturbed suspended sedimentary material, and bioturbation. In these areas, effects on the seabed are considered to be temporary and, following natural infilling, the seabed will return to near pre-installation conditions.

During Landfall installation works at Claycastle Beach, a trench will be cut, removing approximately 4,000m^3 of beach sediment. This spoil shall be stored within the compound on the hard standing, to allow the site to be restored to its previous condition following installation of the conduits. The spoil shall be adequately covered in order to prevent exposure to the elements. This, combined with use of the cofferdam, will help to prevent disturbed sediment entering the marine environment. Even if sediment is resuspended during beach works, intertidal habitats such as sand and mudflats tend to display a low sensitivity to and high recoverability from temporary sediment displacement likely to occur from trenching. The recovery of these habitats is dependent on the hydrodynamics of the surrounding area, although sandy sediments are likely to recover in less than a year (Tillin and Budd, 2016).

The cable route does not pass through any habitats or areas of environmental sensitivity, therefore receptor value for sediment quality is considered to be low to negligible. As described above, the area of seabed with potential to be affected by temporary disturbance is small within the wider setting of Irish waters, resulting in a low magnitude of change. Effects as a result of disturbance to seabed sediments during the installation phase are therefore considered to be not significant.

The introduction of hard material in the form of external cable protection into the predominantly sedimentary environment of the interconnector cable route has the potential to cause localised changes to hydrographic conditions and associated sediment dynamics. The sediments along the cable route are primarily composed of mobile sands. It is therefore anticipated that some level of scour may occur where external cable protection is installed. However, due to the intrinsic purpose of the cable protection, the protection will be designed to minimise scour. Should scour occur, however, the sediment type present along the cable route (ie sands and gravels) means that sediment suspension will be temporary, with sediments expected to settle out within a single spring-neap tidal cycle. As receptor value is low to negligible, and low levels of scour are expected, effects on local sediment dynamics through the presence of external cable protection are considered to be not significant.

In addition to causing disturbance of seabed sediments, the installation phase has the potential to release / remobilise contaminants held within the sediment when the seabed is disturbed (BERR, 2008). The location and type of sediment will determine whether contaminants are likely to be held in the benthic environment.

Contaminants such as oil and heavy and trace metals are most likely found near the coastline, generally attached to fine sediments, although certain chemicals can persist in coarser sediments (BERR, 2008). Contaminant release is only a concern in heavily contaminated locations, such as major ports, oil and gas developments, historical industrial areas, and waste disposal or natural sinks, and is of less importance when considering offshore areas (OSPAR, 2009).

The majority of organic compounds present in the environment are either readily biodegradable or of low water solubility and hence of limited significance in terms of water contamination (Tran *et al*., 1996). However, some organic compounds can reach toxic concentrations in the dissolved phase, and/or bioaccumulate from the dissolved phase to toxic levels. These include organo-metallic compounds of lead, tin and mercury.

The release of contaminants usually occurs within a localized area for a short period of time during the installation (and potentially during any maintenance activities or decommissioning), and should only be of concern near industrialised areas (BERR, 2008). Sediment samples collected as part of the cable route surveys in 2015 and 2018 indicate that neither Claycastle Beach nor the seabed along the cable route in Irish waters is contaminated. Furthermore, bioavailable metals and hydrocarbons are generally associated with fine sediments (ie <63µm) and higher TOC content. As the surficial sediments along the interconnector cable route are predominantly sands with low associated TOC values, the risk of resuspension and subsequent desorption of contaminants is lower than in very muddy sediments.

Contamination arising from seabed disturbance is only a risk in heavily contaminated locations (OSPAR, 2009). Sediment samples collected as part of cable route surveys indicate that neither Claycastle Beach nor the seabed along the cable route in Irish waters is contaminated. Sediments which are suspended due to cable burial are not expected to settle out more than 10km away from the installation area, with the majority (>90%) being deposited within 1km (BERR, 2008; Aquind, 2019). The sediment is expected to settle out within a single spring-neap tidal cycle. As receptor value is low to negligible, and magnitude of change is expected to be low, changes in water quality through release of contaminants held in marine and coastal sediments are considered to be not significant.

The potential for indirect effects on ecological features arising from changes to sediment quality along the cable route is presented in Volume 3D Part 2 (Specialist Chapters), Chapter 13: Biodiversity.

10.5.3 Operational Phase

Once the cable and its associated infrastructure are installed and operating, it is anticipated that they will require minimal maintenance. However, in the event of the cable getting damaged or becoming faulty, operational maintenance activities would be required to repair the affected components. For offshore components, the cable may need to be cut at the appropriate location and brought to the surface for repair before being put back into place on the seabed or replaced. Operational maintenance activities would typically comprise similar vessels, activities and locations as the installation works.

Sediments are likely to be disturbed during cable maintenance activities, and effects are considered to be the same as for the installation phase.

The cable route does not pass through any habitats or areas of environmental sensitivity, therefore receptor value for sediment quality is considered to be low to negligible. As described above, the area of seabed with potential to be affected by temporary disturbance is small within the wider setting of Irish waters, resulting in a low magnitude of change. Effects as a result of disturbance to seabed sediments during the installation phase are therefore considered to be not significant.

The introduction of hard material in the form of external cable protection into the predominantly sedimentary environment of the interconnector cable route has the potential to cause localised changes to hydrographic conditions and associated sediment dynamics. The sediments along the cable route are primarily composed of mobile sands. It is therefore anticipated that some level of scour may occur where external cable protection is installed. However, due to the intrinsic purpose of the cable protection, the protection will be designed to minimise scour. Should scour occur, however, the sediment type present along the cable route (ie sands and gravels) means that sediment suspension will be temporary, with sediments expected to settle out within a single spring-neap tidal cycle. As receptor value is low to negligible, and low levels of scour are expected, effects on local sediment dynamics through the presence of external cable protection are considered to be not significant.

Contamination arising from seabed disturbance is only a risk in heavily contaminated locations (OSPAR, 2009). Sediment samples collected as part of cable route surveys indicate that neither Claycastle Beach nor the seabed along the cable route in Irish waters is contaminated. Sediments which are suspended due to cable burial are not expected to settle out more than 10km away from the installation area, with the majority (>90%) being deposited within 1km (BERR, 2008; Aquind, 2019). The sediment is expected to settle out within a single spring-neap tidal cycle. As receptor value is low to negligible, and magnitude of change is expected to be low, changes in water quality through release of contaminants held in marine and coastal sediments are considered to be not significant.

The potential for indirect effects on ecological features arising from changes to marine sediments and sediment quality along the cable route is presented in Volume 3D Part 2 (Specialist Chapters), Chapter 13: Biodiversity.

10.5.4 Decommissioning Phase

Commented [A18]: Placeholder: Decommissioning text remains under review / discussion, and will be finalized prior to submission of the final Application File.

The design lifespan of the Celtic Interconnector is approximately 40 years, although it should be noted that other interconnector projects have exceeded this, with cables remaining operational for up to 80 years in some cases. A decommissioning plan will be developed prior to the decommissioning phase of the Project. The decision on whether to recover the cable or not will be made at a future date and further details on this decision will be provided including the methodology to be adopted. It is currently anticipated that the cable will be left in-situ where deemed environmentally acceptable and with the understanding that this may require long term monitoring and maintenance. This current view assumes no legal requirement to recover the cable and associated infrastructure. However, should this be the case, the Project promoters (EirGrid and RTE) will take appropriate measures and act responsibly in line with their obligations.

The rationale for leaving the cable in-situ is that the health and safety risk and economic cost to remove the cable is likely to outweigh the economic value of the cable. Due to the high cost of cable vessels and personnel and the comparatively low value of the cable materials, it may not be considered economically viable to remove the cable for recycling.

It is also anticipated that the cable protection materials will be left in situ as the materials used are not considered economical to recover. In addition to the cost, across the lifespan of the Project, the cable protection may come to benefit the marine environment by providing localised reef features and increasing local biodiversity. Ecological surveys will be carried out before the decommissioning phase of the Project to determine whether the cable and its protection have become beneficial to marine fauna and whether leaving these structures in-situ is more environmentally acceptable overall than attempting to remove them.

If the cable were to be removed without moving the cable protection, the process would involve fluidising the seabed with a mass flow excavator and pulling the cable aboard a vessel with a winch. This activity would require approval under the relevant legislation in place at the time of decommissioning the Celtic Interconnector Project. However, the external cable protection would likely cause an obstruction to such activity, particularly for long lengths of cable protection therefore it is considered more environmentally and economically favourable to leave the cable and its protection in-situ.

If the cable and cable protection are left in place, there would be no likely effect on marine sediment quality arising as part of the decommissioning phase.

10.5.5 Cumulative Effects

There is one other proposed project in the marine environment in the proximity of the Celtic Interconnector Project that has the potential to impact marine sediments and sediment quality. DP Energy Ireland (DP Energy) is investigating the feasibility of developing an offshore floating wind energy prospect off the south coast of Ireland, the Inis Ealga Marine Energy Park (IEMEP). DP Energy intends to carry out site investigations within the prospect area, potential export cable corridors and landfall areas in order to assess the site and associated seabed. The results of these investigations will be used to select optimal cable route(s), landfall option(s), windfarm layout, and provide baseline data for EIAR.

The Inis Ealga Site is approximately 54km in width stretching from Dungarvan, Co. Waterford to Cork Harbour, Co. Cork. The Site occupies an area of 925km^2 and is located approximately 7.5km south of Power Head, Co. Cork and 26km south of Helvick Head, Co. Waterford.

As part of the IEMEP project, there are likely to be activities which will impact marine sediments and sediment quality, for example cable installation and construction of landfall infrastructure. However, given that the effects of the Celtic Interconnector Project on sediment quality are predicted to be both non-significant and temporary, no in-combination effects with the IEMEP project are expected.

10.6 Mitigation and Monitoring

Commented [A19]: Placeholder: Mitigation and monitoring plans remain under review / discussion, and will be finalized prior to submission of the final Application File.

10.6.1 Installation Phase

The seabed at the Claycastle Beach landfall consists of sandy sediments with depths in excess of 3.0m. This will allow trench and burial of the cable to the target depth (1.5m) using a plough launched from the beach. Coastal erosion studies have indicated the seabed is stable which will help limit the minimum burial depths for the cable.

When the trench is excavated, approximately 4,000m^3 of beach sediment will be removed. This spoil will be stored within the compound on the hard standing to allow the site to be restored to its previous conditions following the installation of the conduits. The stored spoil shall be adequately covered in order to prevent exposure to the elements, and hence prevent leaching of sediment (and any potential contaminants present therein) into the marine environment.

In line with guidelines outlined in BERR (2008) and OSPAR (2012), the cable route has been designed to avoid European designated sites including SACs and SPAs and thus minimise any potential effects to areas of conservation importance.

During the pre-construction engineering and design phase for the Celtic Interconnector, a detailed analysis of the seabed along the route of the Celtic Interconnector will be undertaken. From this, the most appropriate installation techniques will be established, as determined by seabed type, to minimize sediment disturbance and hence minimise effects on marine sediments and sediment quality. In addition, where external cable protection is required, this will be designed according to seabed type, again, minimizing sediment and seabed disturbance. Minimising seabed disturbance will minimise the potential resuspension of contaminants from seabed sediments to the water column.

Where the need for external rock protection is identified, this will be designed according to the receiving environment, based on seabed type, and the need to reduce seabed disturbance. Cable protection will be designed to minimise scour, and hence resuspension of sediments. Rock placement would be sourced from certified quarries, with inert natural stone material used to minimise the degree of impact.

10.6.2 Operational Phase

Throughout the Project's lifespan, periodic monitoring of the cable route will be undertaken; should such monitoring identify significant changes in the bathymetry or seabed features (ie sediment type) in the vicinity of the cable route, appropriate measures will be taken, including replacement or addition of further external cable protection, as necessary.

10.6.3 Residual Impacts

No significant residual effects on marine physical processes are anticipated.

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11 Marine physical processes

11.1 Introduction

This chapter considers the potential for effects to arise on physical coastal and sedimentary processes associated with the proposed Celtic Interconnector Project (the proposed development). Marine physical processes is a wide-ranging discipline, with the capacity to interact with a number of other disciplines. This chapter deals with potential effects of changes to coastal processes arising from the installation of the Celtic Interconnector cable, and cable protection as required. These changes may subsequently cause effects on receptors covered in other chapters. Due to these interactions, this chapter should therefore be read in conjunction with a number of other chapters in Volume 3D Part 2 EIAR for Ireland Offshore (Specialist Chapters), as follows:

- Chapter 10 – Sediment quality;
- Chapter 12 – Water quality; and
- Chapter 13 – Biodiversity.

11.2 Methodology and Limitations

11.2.1 Legislation and Guidance

There is no specific legislation or guidance directly associated with the assessment of effects on marine physical processes. As described above, the marine physical processes topic covers a range of aspects, with the potential to interact and affect other disciplines, including biodiversity and marine water and sediment quality. Assessment of effects addressed under those topics has been conducted in relation to the appropriate guidance.

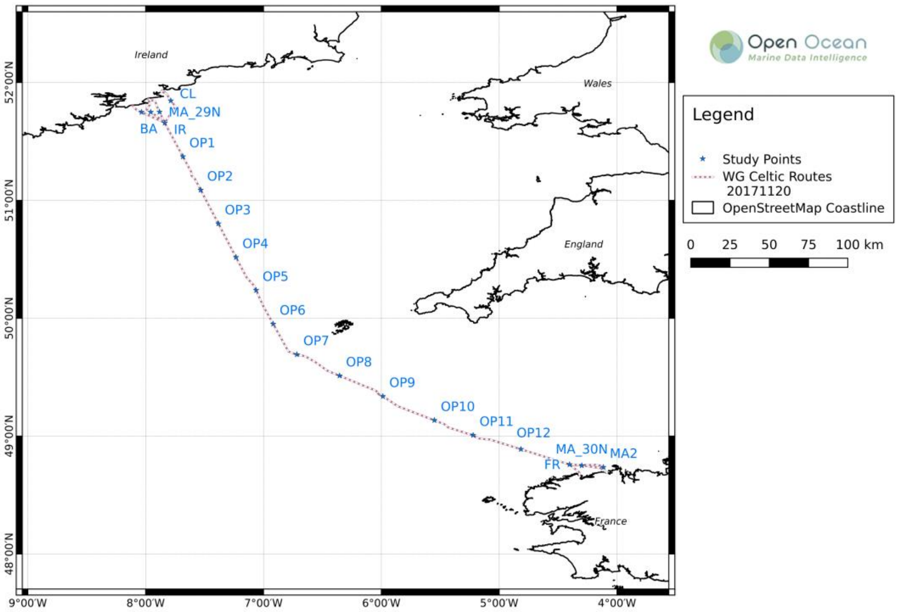
At a wider level, marine physical processes form part of the consideration for both the Water Framework Directive (WFD) 2000/60/EC and Marine Strategy Framework Directive (MSFD) 2008/56/EC. Elements directly associated with these directives (for example, *"Sea-floor Integrity"*, one of the eleven 'Qualitative Descriptors' for determining good environmental status outlined in the MSFD) have been considered where appropriate as potential effects within this assessment, with more detailed assessment from a Directive perspective in Volume 8B and Volume 8C, respectively.

11.2.2 Desktop Studies

Hydrographic parameters were derived from existing metocean databases (including the Climate Forecast System data base, produced by the National Center for Environmental Prediction, and the HOMERE wave database, developed under the Integrated Ocean Waves for Geophysical and other Applications (IOWAGA) framework), including wind speeds, significant wave heights and current speeds. A hydro-sedimentary assessment was also undertaken to assess the potential for sediment mobility induced by currents and waves along the whole cable route. Two metocean studies were produced, including detailed current modelling for the nearshore zone. This built on data calculated at 20 points along the cable route, identified to represent subareas along the cable route, of which five were within

Irish waters. The location of all study points along the cable route are presented in Figure 11.1.

Figure 11.1 Study points used to inform metocean study for the Project



Where appropriate, additional, third-party information (including from the ocean current database, CMEMS, and a general desk-based literature review) has been used to supplement the data gathered by site-specific field surveys.

11.2.3 Field Studies

A number of surveys were completed along the length of the cable route in Irish coastal and offshore waters, covering a 500m wide corridor, during 2017 and 2018. These include completion of:

- multibeam echo sounder survey, processed to provide a digital terrain model identifying major bathymetric features and bathymetric changes on the seabed, including mega-ripples and seabed infrastructure;
- side-scan sonar, run at both high and low frequency with digital rendering onto a seabed mosaic of the area, allowing inference of seabed type, hardness, and delineation of low-level relief features and discrete objects; and
- shallow sub-bottom profiling, used to clarify changes that might be seen in the sonar and surface bathymetry.

11.2.4 Methodology for Assessment of Effects

In broad terms, the assessment of effects on marine physical processes and sediments is aligned with that presented in Volume 3D Part 2 (Introductory Chapters) Chapter 4: EIAR Methodology.

Due to the nature of the receptors covered within this assessment (ie the seabed itself, and hydrodynamic conditions), the establishment of numerical scales for status of receptors in terms of importance and sensitivity, and for effects in terms of magnitude, are not appropriate. Instead, changes are described in a more qualitative manner, taking into consideration their role as pathways of effect. However, such scales are applied in, for example, Volume 3D Part 2 EIAR for Ireland Offshore (Specialist Chapters) - Chapter 13 – Biodiversity, when considering effects of changes in marine physical processes on biodiversity, and Volume 3D Part 2 EIAR for Ireland Offshore (Specialist Chapters) - Chapter 15: Archaeology and Cultural Heritage, for considering the potential effects of scour.

11.2.5 Difficulties Encountered

No notable difficulties were encountered in the development of this Chapter.

11.3 Receiving Environment

The field of marine physical processes considers the natural cycle of tides, currents, wave climate and the resulting sediment regime. Installation and placement of structures on the seabed has the potential to influence the flow of water and the associated characteristics of waves and currents, thus potentially altering the sedimentary regime. In general, as waters deepen, the proposed development is outside the influence of localised changes in coastal activities that might affect physical processes at the seabed.

11.3.1 Wind and wave conditions

Spatial variations in wind and wave conditions were recorded along the length of the cable route, with an average wind velocity greater than 8m/s along most of the route, reducing to around 6.5-7m/s close to the Irish coast. The wind strength weakens approximately 50-75km off the Irish coast, where the wind is less regular and affected by turbulence. Westerly and south-westerly winds are dominant along the length of the cable route. Maximum wind speeds (up to 31.1m/s in the nearshore zone) were recorded from December to February, with minimum speeds from June to August; peak wind speeds may increase by approximately 10m/s during the winter months.

Highly energetic swell coming westerly from the Atlantic Ocean results in harsh wave conditions, again, beginning to decrease around 70km from the Irish coast. Due to the prevailing wind conditions, the main direction of the overall sea state has a west-south-west incidence, with these winds tending to create higher wind sea waves than those towards the French coast.

Maximum significant wave heights of up to 7m were recorded within the nearshore zone in Irish Territorial Waters.

11.3.2 Sea level

The highest positive storm surges (where tides and waves combine to push water onshore) occur during winter, with stronger winds blowing in from the south-west, and lowest negative storm surges (where water is pushed away from the shore) occur during spring, when winds from the north-east / east-north-east become stronger. This shift in prevailing peak wind directions tends to accentuate ebb tides and attenuate flood tides, also contributing to overall lower negative storm surges.

11.3.3 Currents

Tidal currents are stronger during the equinoxes in spring and autumn. At the Irish end of the cable route, where tides are weaker, the strong winter winds have a greater impact on peak current speeds which contributes to a higher seasonal variability. In the northern half of the cable route, in the offshore zone, current velocities average less than 0.25m/s (approximately 0.5 miles/hr) and decrease inshore towards the Irish shoreline.

The main current directions are dictated by the ebb and flow tidal conditions and follow a west-south-west to east-north-east axis along most of the cable route.

11.3.4 Seabed conditions and depth

At a general level, the nature of the seabed sediment along the cable route is predominantly fine to coarse sands, with occasional gravel and pebbles, with the dominant sediment type represented by gravelly muddy sand, according to the Folk classification[41]. In Irish waters, mean particle size recorded was below 3mm diameter, with higher proportions of gravel (<35%) being recorded at only two stations, and the same for fine particles, although fine sediment was generally more prevalent within the Irish marine zone. Where finer sediments are present in this area, due to the comparatively high energy environment (in particular in shallower waters), silts and clays may often remain suspended, being prevented from settling by tidal currents and wave action. Overall, in Irish waters, seabed sediments are sand dominated, with maximum levels of approximately 90% recorded at some sampling stations.

The hydro-sedimentary study carried out for the proposed development assessed the potential for sediment mobility induced by currents and waves along the cable route. In Irish waters, wave-induced sediment mobility occurred close to the shore, in depths of up to 20m (with a probability of occurrence in this zone of 20%), decreasing as water depth increases to 60m, beyond which waves have no influence on surficial sediments. At depths of 80m and beyond, current-induced sediment mobility dominates. In the offshore zone, the sediment thickness with the potential to be affected by wave- or current-induced mobility is generally less than 1m, but can reach 1.5 - 2m in very localised areas.

In Irish waters, the seabed depth drops away steeply in the first 20km of the proposed cable route, with the majority of the Celtic Interconnector being located in waters with a water depth of 60m plus, reaching maximum depths of over 100m.

11.4 Characteristics of the Development

As outlined in Volume 3D Part 2 EIAR for Ireland Offshore (Specialist Chapters) - Chapter 5: Description of the Landfall and Chapter 6: Description of the Offshore Cable, the installation of the Celtic Interconnector and associated cable protection will inevitably result in a level of

[41] Folk, R.L. (1980) Petrology of Sedimentary Rocks. Austin, Tex: Hemphill Pub. Co. Print.

disturbance to the seabed, with resulting effects on marine physical processes in the immediate vicinity. During preparatory works, this may include removal of boulders found along the cable route, and sand wave sweeping.

Installation of the cable will be undertaken using methods including, as appropriate to local seabed conditions, ploughing, jetting and mechanical trenching. Within the nearshore zone, the need for rock trenching is not expected although approximately 33km of the route is underlain by chalk in the Irish EEZ potentially requiring specialist rock-cutting tools.

Optimum burial depths of 0.8-2.5m are sought for the cable; where this is not possible, external cable protection shall be installed. In Irish waters, the need for rock placement as external cable protection has been estimated as 5,100 tonnes (t) in Irish Territorial Waters, and approximately 42,500t within the Irish EEZ, along the total length within Irish waters of 151km.

11.5 Likely Significant Impacts of the Development

11.5.1 Do Nothing

In the Do Nothing alternative, there would be no subsea works along the proposed route of the Celtic Interconnector in relation to the proposed development. However, over the estimated lifetime of the proposed development, changes to marine hydrological changes would be expected as a result of climate change, with associated changes in the marine and coastal sedimentary processes. At this stage, the degree of predicted change cannot be quantified.

11.5.2 Installation Phase

Disturbance to, and loss of, seabed features during cable installation

During the installation phase of the Celtic Interconnector, the surficial sediments, and associated features such as sand waves or mega-ripples, along the cable route will be disturbed and may be permanently lost as a result of seabed preparation and the physical laying of the cable. Based on a worst case assumption that a corridor of approximately 15m (i.e. 0.015km) will be directly disturbed by cable-laying equipment (within the general indicative 500m installation corridor), along a length of 151km in Irish waters, an area of 2.265km^2 will be directly disturbed by cable installation. Depending on the installation method used, the trench created by installation may be partly or fully back-filled by the cable-laying equipment.

Where external cable protection is not installed, the trenches will be naturally infilled along the majority of the cable route, through a combination of natural collapse of temporary trench walls, the resettling of disturbed suspended sedimentary material and bioturbation (the natural movement / disturbance of sediment by organisms including, for example, burrowing worms). In such areas, effects on seabed features are considered to be temporary, and following natural infilling, the seabed will return to a similar condition as it was pre-installation.

The cable route does not pass through any important sedimentary or bathymetric features such as sandbanks, therefore receptor value for the seabed features is considered to be low. As described above, the area of seabed with potential to be affected by temporary disturbance is small within the wider setting of Irish waters (both coastal and offshore), resulting in a low magnitude of change. Effects as a result of disturbance to, and loss of, seabed features are therefore considered to be not significant.

The potential for indirect effects on ecological features arising from physical sediment disturbance along the cable route is presented in Volume 3D Part 2 EIAR for Ireland Offshore (Specialist Chapters) - Chapter 13:Biodiversity.

Disturbance to, and loss of, seabed features during installation of cable protection

For those areas where the optimum burial depth cannot be achieved, external cable protection will be installed using either rock protection or cable mattressing, as appropriate, as presented in Volume 3D Part 2 EIAR for Ireland Offshore (Specialist Chapters) - Chapter 6: Description of the Offshore Cable. The requirement for external cable protection will be established during the detailed design phase, therefore at the time of writing, the exact length of the route which will need this additional protection is not finally confirmed. For the purposes of assessing potential effects, the precautionary assumption that the whole length of the cable route within Irish waters (ie 151km) will be protected, has been made. As calculated above, as a worst case, it has been assumed that cable protection will be installed in a corridor 5m either side of the actual cable route, resulting in a 15m wide corridor (ie 0.015km), and an area of 2.265km^2 covered by external protection.

Installation of external rock protection has the potential to change the localised nature of the seabed through the introduction of a hard substrate. However, external protection will be minimised and will only be required in areas where trenching is not deemed feasible, through either the presence of other seabed assets / obstacles (such as at cable crossings), where ground conditions are too hard, or where secondary protection is required to achieve the required burial depth.

In the areas where ground conditions are too hard to trench, installation of external rock protection will result in addition of hard substrate into areas where such conditions already exist, therefore there will be no significant change to the seabed types present. Where external rock protection is installed over cable crossings, or as secondary protection, there is the potential for permanent loss of seabed features in sedimentary environments. However, as described above, this is anticipated to be over a small and localised area, a maximum of 2.265km^2 as a worst case, compared to the wider marine area.

The cable route does not pass through any important sedimentary or bathymetric features such as sandbanks (ridges of sand), therefore the receptor value for seabed features is considered to be low to negligible. The area of seabed permanently changed in nature will be small in magnitude, when compared to the wider marine area. Effects on seabed features as a result of installation of external rock protection are therefore considered to be not significant.

The potential for indirect effects on ecological features arising from physical sediment disturbance along the cable route is presented in Volume 3D Part 2 EIAR for Ireland Offshore (Specialist Chapters) - Chapter 13: Biodiversity.

Changes to coastal erosion patterns due to installation works at the cable landfall

Any works within the intertidal zone have the potential to affect existing patterns of erosion and/or accretion within the coastal zone. For this element of the EIAR, assessment has drawn on the Irish Coastal Protection Strategy Study (ICPSS)[42], which provides strategic coastal erosion maps for the Irish coastline, which are used to inform policy, planning and development of coastal areas. In the study, Youghal, adjacent to Claycastle, was noted as an area potentially vulnerable to wave over-topping during storms, and an area of potential flood risk.

At Claycastle Beach itself, the purpose of works during installation is to ensure that the infrastructure is installed in a manner which is safe to both the surrounding environment, and the cable itself, with a key consideration for the latter being ensuring the cable remains buried. Although trenching across the beach will result in disturbance of the existing sediment transport regime, this disturbance will be temporary in nature (estimated to be approximately 10 weeks, based on the worst case scenario), with the beach being restored to its original state following installation. Once installed, the cable will be buried at a sufficient depth (minimum 1m) that it will not interact with surface sediments, and so changes to existing coastal processes are not anticipated. Further, periodic surveys of the cable during its lifecycle will be undertaken to confirm that it is remaining at a suitable depth from both an engineering and environmental perspective. Should these surveys identify a need for any reburial, this work will be undertaken as described in Volume 3D Part 2 EIAR for Ireland Offshore (Specialist Chapters) - Chapter 5: Description of the Landfall and Chapter 6: Description of the Offshore Cable, with potential effects anticipated to be no greater in magnitude than those described here. Effects on coastal erosion patterns are therefore considered to be not significant.

Impacts of Unexploded Ordnance

Although surveys have suggested there is a low risk of encountering unexploded ordnance (UXO), as presented in Volume 3D Part 2 EIAR for Ireland Offshore (Specialist Chapters) - Chapter 6: Description of the Offshore Cable, if such a target is identified, the preference will be avoidance by localised re-routing. If this is not possible there are a number of options for its safe removal and/or detonation. In terms of potential effects on the seabed of the cable route, the worst case would be for the target to be detonated *in situ*, where it is found. Depending on the size of the target, this could result in damage to the surrounding marine environment, including loss of habitats and seabed features. However, at the time of writing, the presence of UXO along the route is not considered likely, and should any targets be identified, these would be reviewed and disposed of through liaison with the appropriate authorities, including, if required, completion of any additional impact assessment required at the time.

Commented [A20]: Placeholder: An appendix, considering and assessing the presence and handling of UXO, is currently in preparation, and will be ready for submission with the final Application File. Within the current EIAR, the approach has been to not include UXO within impact assessments, on the assumption that the chance of encountering them during works is low.

11.5.3 Operational Phase

[42] Irish Coastal Protection Strategy Study. Available online at: https://www.gov.ie/en/publication/eed0fb-irish-coastal-protection-strategy-study-icpss/. [Accessed 28 February 2021]

Changes to bathymetry through placement of external cable protection

Throughout the majority of the route, the cable will be buried at a minimum depth of 1m below the seabed surface, therefore is not anticipated to have any effect on local bathymetry in terms of seabed features or overall water depth.

External cable protection will be installed only in areas where optimum burial depth cannot be achieved, or where obstacles and/or cable crossings are required; this is not expected to be the case for the full length of the route. However, as above, for the assessment of effects, the precautionary assumption that rock protection will be required along the full cable route has been made. As a result, there may be the need to install external rock protection along the length of the cable, up to approximately 1m 'deep', and proud of the seabed surface. In Irish waters, the seabed displays a range of features, including ridges of up to 0.3m height, occasional depressions, and mobile sediment features such as sand ripples. As a result, the introduction of a feature up to 1m in height is unlikely to result in a significant change to the seabed.

Overall water depth is also not expected to be significantly affected due to the water depths recorded along the route (between 60m and 100m within the Irish EEZ). The change as a result of cable protection would be 1.6% in water depths of 60, and less in deeper waters. This degree of change is not likely to alter broad-scale hydrosedimentary processes or other concerns such as the draft depths required by vessels (Volume 3D Part 2 EIAR for Ireland Offshore (Specialist Chapters) - Chapter 18:Shipping and Navigation). In shallower waters, where any change in depth may be proportionally greater in relation to the existing water depth, for example on the approach to Claycastle Beach, it is anticipated that the cable would be buried, thereby avoiding the need for external cable protection. This will be confirmed prior to cable installation. No significant changes to water depth are therefore anticipated within Irish Territorial Water or the Irish EEZ.

Effects on bathymetry through placement of external cable protection are therefore considered to be not significant.

Changes to local sediment dynamics through the presence of external cable protection

Introduction of hard material into an area which is predominantly sedimentary has the potential to result in localised changes to hydrographic conditions, and associated sediment dynamics. As described above, the seabed along the route of the Celtic Interconnector exhibits a number of features, including mobile sand ripples and waves.

It is anticipated that a level of scour may occur where external cable protection is installed. However, due to the purpose of the cable protection, its will be designed to minimise this occurring, for example through the slope of the installed protection, minimising changes to micro-level water flows in the immediate vicinity. Further, due to the mobile nature of the seabed, should any temporary scouring occur, this is likely to be infilled in a short period of time. As noted above, no environmentally-sensitive habitats (ie those designated as being of conservation importance, or supporting qualifying features of designated sites) were recorded along the cable route, and low levels of scouring are anticipated. Effects on local sediment dynamics through the presence of external cable protection are therefore considered to be not significant.

Potential disturbance to subsurface peat in the intertidal zone

Surveys in the area have shown that there are areas of subsurface peat in the intertidal zone at Claycastle Beach, approximately 4m below the surface on the beach, reaching depths of approximately 8m moving into the subtidal zone.

[PLACEHOLDER – FIGURE TO BE INSERTED, SHOWING LOCATION OF SUBSURFACE PEAT IN THE VICINITY OF THE CABLE LANDFALL]

Trenching across the beach is anticipated to be at a depth of around 3m, and therefore should not interact with the subsurface peat. If, during the installation process at the landfall, any peat is cut away, the resulting pocket in the beach sediment will be filled with existing beach sediment, predominantly sand. It will not be feasible for the original peat to be returned to the location or in the same physical state, meaning that this will be permanently lost from the system. As a result, concerns have been raised through consultation with Cork County Council that this may result in dangerous conditions for bathers and other beach users, through changes to the beach profile, or the potential for holes to appear as a result of the works. However, the sedimentary nature of the intertidal zone at Claycastle, the approximate 4m of existing sedimentary deposits above the peat and in particular the density of sands and gravels which comprise the beach site, will mean that natural coastal processes within the zone will prevent such holes appearing as a result of the works, once they have been backfilled during the installation process. This will be subject to ongoing monitoring of the cable, to ensure that sufficient levels of burial are maintained, and that no damage to the beach occurs as a result of the works. The potential damage to the beach as a result of disturbing subsurface peat is therefore considered to be not significant.

11.5.4 Decommissioning Phase

A decommissioning plan will be prepared prior to the decommissioning phase of the proposed development, which is expected to be at least 40 years from the start of operation. It is currently anticipated that the cable and associated external cable protection will be left in-situ where this is deemed environmentally acceptable; this may require a level of long-term monitoring and maintenance. There are not expected to be any effects on marine physical processes and sediments as a result of this proposed course of action. However, any works required for decommissioning will be subject to future consent applications, and environmental assessments, as relevant.

11.5.5 Cumulative Effects

Volume 3D Part 2 EIAR for Ireland Offshore (Specialist Chapters) - Chapter 16: Material Assets, describes a number of projects or other developments within the vicinity of the Celtic Interconnector, including the Inis Ealga Marine Energy Park (currently at early concept / feasibilty stage), the site of which is intersected by the proposed cable route. Inis Ealga Marine Energy Park is a large proposed floating offshore wind park, with each turbine typically having between three and six mooring lines, depending on turbine design, as well as the need for inter-array and export cabling, which may result in a range of effects similar to those of the Celtic Interconnector. However, at the time of writing, project design details for this development, and other offshore wind farm sites, are not yet available, so it is not possible to quantify precise interactions between the projects. Given their early stage of planning, it is likely that the installation of the Celtic Interconnector will be complete by the time the Inis Ealga Marine Energy Park is under development. Therefore, any consideration of marine physical processes, and assessment of potential interactions, will be the responsibility of the offshore wind developers and decision-makers at that time.

11.6 Mitigation and Monitoring Measures

Commented [A21]: Placeholder: Mitigation and monitoring measures remain under review / discussion. These will be finalized prior to submission of the final Application File.

11.6.1 Construction Phase

During the pre-construction engineering and design phase for the Celtic Interconnector, detailed sub-bottom profiling and accompanying analysis of the seabed along the route of the Celtic Interconnector will be undertaken. From this, the most appropriate installation techniques will be established, as determined by seabed type, to minimise sediment disturbance.

Throughout the route, the most appropriate installation techniques shall be selected, to ensure external cable protection is only installed where necessary; in these situations, the rock protection this will be designed according to seabed type, again, minimising sediment and seabed disturbance.

11.6.2 Operational Phase

As outlined above, where the need for external rock protection is identified, this will be designed in accordance with CIRIA Rock Manual using EN13383:2002 standard armourstone according to the receiving environment, based on seabed type, and the need to reduce seabed disturbance. Throughout the Project's lifespan, periodic monitoring of the route will be undertaken; should such monitoring identify significant changes in the bathymetry or seabed features in the vicinity of the cable route, appropriate measures will be taken, including replacement or addition of further external cable protection, as necessary.

11.6.3 Residual Impacts

Subject to full implementation of mitigation, no significant residual effects on marine physical processes are anticipated.

12 Marine water quality

12.1 Introduction

This chapter provides an overview of the marine water quality likely to be present along and adjacent to the proposed Celtic Interconnector route and considers the potential significant impacts that the installation and operation of the Celtic Interconnector Project may have on marine water quality, as well as the mitigation measures to be implemented to avoid, reduce, and offset any potential impacts.

This chapter deals with potential effects of changes to marine water quality arising from the installation of the Celtic Interconnector cable, including landfall at Claycastle Beach, and cable protection as required. However, marine water quality has the potential to be influenced by other receptors, such as sediment quality, and changes to marine water quality may subsequently cause effects on receptors covered in other chapters. Due to these interactions, this chapter of the EIAR should be read in conjunction with a number of other Volume 3D Part 2 EIAR for Ireland Offshore (Specialist Chapters), including:

- Chapter 10: Marine Sediment Quality.
- Chapter 11: Marine Physical Processes.
- Chapter 13: Biodiversity.
- Chapter 19: Commercial Fisheries.

12.2 Methodology and Limitations

12.2.1 Legislation and Guidance

Key legislation relevant specifically to the assessment of potential effects on marine and coastal water quality includes:

- The Convention for the Protection of the Marine Environment of the North-East Atlantic (the “OSPAR convention”) 1992 including; (i) the OSPAR Hazardous Substances Strategy; and (ii) Strategy for a Joint Assessment and Monitoring Programme (JAMP);
- EC Directive 92/43/EEC on the conservation of natural habitats and of wild flora and fauna (the Habitats Directive);
- The Marine Strategy Framework Directive (MSFD) (2008/56/EC);
- The Water Framework Directive (WFD) 2000 (2000/60/EC);
- The Bathing Water Directive (BWD) 2006 (2006/7/EC);
- The Shellfish Waters Directive (SFWD) 2006 (2006/113/EC); and
- The Priority Substances Directive (2013/39/EU), amending the original Priority Substances Directive (2008/105/EC).

The WFD and MSFD seek to ensure, respectively, Good Ecological Status and Good Environmental Status (GES) within designated water bodies, with the MSFD covering waters beyond 1 nautical mile (nm) and the WFD covering freshwater, transitional and coastal waters up to 1nm. A Water Framework Directive Assessment has been carried out for the Project and is presented in in Volume 8C.

Broadly, GES for the marine environment means that marine waters are:

- Ecologically diverse;
- Clean, healthy and productive; and
- Used sustainably, so that the needs of current and future generations are safeguarded.

The WFD Assessment carried out as part of the Project identified, as part of the screening process, two WFD waterbodies which could be potentially be impacted by the Project. These are Youghal Bay (IE_SW_020_0000) and Western Celtic Sea (IE_SW_010_0000).

The BWD and the SFWD are only applicable at designated bathing waters and shellfisheries, respectively.

The Irish landfall for the Celtic Interconnector will be at Claycastle Beach near Youghal, County Cork. As this area is a designated bathing beach, the BWD is applicable. Effects on Bathing Waters are covered in the Water Framework Directive Assessment that has been carried out for the Project, presented in in Volume 8C.

The SFWD concerns the quality of shellfish waters and applies to both coastal and brackish waters. Annex I to the Directive sets out requirements for the physico-chemical parameters (oxygen content, temperature, salinity etc.) in the shellfish water, as well as requirements regarding the contaminants present. The SFWD is only applicable at designated shellfisheries, the nearest of which is 4km from the Celtic Interconnector cable route. The Project does not intersect with any designated shellfisheries.

The Priority Substances Directive aims to control pollution caused by certain dangerous substances discharged to the aquatic environment. Two lists of compounds have been established. List I contains substances regarded as being particularly dangerous because of their toxicity, persistence and bioaccumulation and the discharge of which must be eliminated. List II contains substances which are less dangerous, but which nevertheless have a deleterious effect on the aquatic environment and the discharge of which must be reduced.

12.2.2 Desktop Studies

A Water Framework Directive Assessment has been carried out for the Project and is presented in Volume 8C.

Sediment chemistry samples were collected as part of the benthic surveys conducted along the cable route. Where appropriate, additional third-party information has been used to supplement these data.

12.2.3 Field Studies

A number of marine and coastal surveys have been completed along the proposed cable route, with findings and wider reporting being provided by:

- CELTIC Interconnector Study Synthesis. Prepared by Wood Group for EirGrid & RTE. Doc Ref: 400584-PL-REP-001, Rev: H. July 2019.
- Celtic Interconnector Project. Volume 1 - Combined Inshore, Nearshore and Offshore Environmental Field Reports. Project No: 2015-001. Client Ref No: CELTIC-SUR1415-BEN-R01-V01 (BHM_2015-001). December 2015. Report prepared for EirGrid Plc and RTE by Bibby HydroMap and Benthic Solutions.
- Celtic Interconnector Project. Volume 2 - Combined Celtic Interconnector Habitat Assessment Survey and Environmental Baseline Report. Project No: 2015-001. Client Ref No: CELTIC-SUR1415-BEN-R02-V02 (BHM_2015-001). January 2016. Report prepared for EirGrid Plc and RTE by Bibby HydroMap and Benthic Solutions.
- Celtic Interconnector Project. Benthic Survey Report. Final report. Ref No: 2018-0019-016-BNT, Revision C3. September 2018. Report prepared for EirGrid Plc and RTE by Next Geosolutions.

With the exception of bathing and shellfish water areas, concentrations of contaminants in marine waters are not routinely measured under the existing monitoring programmes, and no water samples were taken as part of the route survey. However, benthic sediment samples were collected for chemical analysis.

12.2.4 Methodology for Assessment of Effects

Within this chapter a systematic approach to the assessment of effects has been followed where possible, which includes:

- A description of the relevant baseline conditions;
- A description of any proposed mitigation measures incorporated into the proposal;
- Identification and assessment of potential effects;
- Identification and assessment of cumulative effects (where appropriate); and
- Identification and assessment of residual effects remaining following the implementation of mitigation.

The assessment of effects on marine water quality broadly follows the methodology presented in Volume 3D Part 1 EIAR for Ireland Offshore (Introductory Chapters). The evaluation and assessment within this chapter has been undertaken with reference to relevant parts of the 2017 Draft Guidelines on the information to be contained in Environmental Impact Assessment Reports (EIAR) issued by the Environmental Protection Agency (EPA), and 2018 Guidelines for Ecological Impact Assessment in the United Kingdom and Ireland developed by the Chartered Institute of Ecology and Environmental Management (CIEEM). This is recognised as current best practice for ecological assessment and provides guidance to practitioners for refining their own methodologies.

The assessment considers, as appropriate: direct, indirect, secondary and cumulative impacts and whether the impacts and their effects are short, medium, long-term, permanent, temporary, reversible, or irreversible. The assessment of impacts then takes into account the baseline conditions to describe:

- How the baseline conditions will change as a result of the project and associated activities; and
- Cumulative and in-combination impacts of the proposal and those arising from other developments.

The significance of a potential impact is defined by the sensitivity of the receiving environment and the character of the predicted impact (as outlined in Volume 3D Part 1 EIAR for Ireland Offshore (Introductory Chapters)). In some cases, magnitude or significance cannot be quantified with certainty; in these cases, professional judgement is used to identify the significance of an impact.

Despite it only being necessary to assess and report significant residual effects (those that remain after mitigation measures have been taken into account), it is good practice to make clear both the potential significant effects without mitigation and the residual significant effects following mitigation. This helps to identify necessary and relevant mitigation measures that are proportionate to the size, nature and scale of anticipated effects. Impacts are therefore considered initially in the absence of mitigation. After avoidance / mitigation measures and necessary compensation measures have been applied, and opportunities for enhancement incorporated, impacts are reassessed and residual impacts are identified.

In the Scoping Report for Foreshore Licence Application and Environmental Impact Assessment Report (Wood, 2020) produced for the Celtic Interconnector Project, three potential effects on marine water quality were identified. These were:

- Release of hazardous substances through loss of chemicals/fuels from installation vessels;
- Discharge of wastewater and solid waste (including plastics) from installation vessels; and
- Changes in water quality through release of contaminants held in marine and coastal sediments.

Vessels will manage on-board waste streams including wastewater and sewage in line with international agreements such as the International Convention for the Prevention of Marine Pollution from Ships (the MARPOL convention), with Annex IV relating specifically to sewage management and Annex V relating to solid waste streams such as garbage. The potential effect ‘discharge of wastewater and solid waste (including plastics) from installation vessels’ has therefore been scoped out of this assessment.

12.3 Receiving Environment

With the exception of bathing and shellfish water areas, concentrations of contaminants in marine waters are not routinely measured under the existing monitoring programmes, and no water samples were taken as part of the route survey. Baseline information regarding marine water quality in the water column along the Project cable route has therefore been drawn from existing sources.

Water quality has the capacity to be affected through release of contaminants held in marine and coastal sediments when those sediments are disturbed. While water chemistry data are not available from the route surveys, detailed geophysical, geotechnical and benthic surveys were undertaken in Irish Territorial Waters and in the Irish EEZ along the proposed cable route. These surveys included physico-chemical sampling of surficial sediments for particle size analysis (PSA), total organic carbon (TOC), total organic matter (TOM), heavy and trace metals, hydrocarbons, and polycyclic aromatic hydrocarbons (PAH). The results of these surveys as they pertain to baseline sediment quality are presented in Volume 3D Part 2 EIAR for Ireland Offshore (Specialist Chapters) - Chapter 10: Marine Sediment Quality.

Marine water quality at any particular location on the Irish continental shelf is the result of a combination of source, transport and removal mechanisms for different individual chemical species. There are many routes by which substances with the potential to affect water quality enter the Celtic Sea, both through natural processes and as a result of anthropogenic activity, although there is evidence to suggest that anthropogenic inputs have reduced over the past few decades (UKMMAS, 2010).

Water quality monitoring is undertaken in coastal waters by the respective local authorities as part of the requirements of the EU WFD. River Basin Management Plans (RBMP) are being developed as a requirement of the WFD and report on the "ecological status" of surface and ground water in coastal waters (within 1nm and "chemical status" of surface and ground waters in territorial waters (out to 12nm).

The Irish landfall will be at Claycastle Beach near Youghal, County Cork. There is a designated bathing water area here ('Youghal, Claycastle'). Claycastle Beach is an approximately 500m long gently sloping sandy beach that holds Blue Flag Bathing Water Status, which demonstrates that the beach complies with the 'excellent' standard outlined in the BWD. This status also signals compliance with a specific set of criteria relating to water quality, information provision, environmental education, safety and environmental management. The bathing water quality at Claycastle was classified as 'excellent' in 2019. Prior to 2019, however, water quality status has shown some variability; water quality status was recorded as 'sufficient' in 2014 and 2015, and 'good' in 2016-2018. It has been noted, however, that these results were biased by the poor 2012 season (EPA, 2018).

The WFD Assessment carried out as part of the Project identified, as part of the screening process, two WFD waterbodies which could be potentially impacted by the Project. These are 'Youghal Bay' and 'Western Celtic Sea.'

Youghal Bay (part of the Lee, Cork Harbour and Youghal Bay catchment area) has an overall waterbody assessment status (2013-2018) of 'moderate' (with 'good' ecological status; 'moderate' chemical status; and 'high' nutrient conditions). Water quality at Youghal Bay is considered 'At Risk' due to the pressure of pastural agriculture. During the 2013-2015 monitoring period, increases in nitrogen loads and opportunistic macroalgae were recorded in Youghal Bay, although this improved in the 2013-2018 RBMP cycle. In the 2013-2018 RBMP cycle, Youghal Bay failed the environmental quality standard for dissolved oxygen but passed the environmental quality standard for dissolved inorganic nitrogen.

The Western Celtic Sea waterbody assessment status is currently 'unassigned' (2013-2018), however water quality in this area is considered 'Not At Risk'.

Limited seawater quality data are available from the OSPAR Quality Status Report 2000 for Region III (Celtic Seas), an update of which is due in 2023. In general, the report indicates that inputs of potential contaminants, including metals, nutrients, and polychlorinated biphenyls (PCBs), were stable throughout the 1990s. There were, however, indications of slight increases in nitrogen and phosphorous from the south and southeast coasts of Ireland, with both displaying high inter-annual variability.

With regard to metallic contaminants, lead (Pb) and mercury (Hg) are strongly associated with particulate material and therefore, except very close inshore and near to sources such as rivers, dissolved concentrations tend to be low. Copper (Cu), zinc (Zn) and cadmium (Cd) tend to stay in the dissolved phase, thus their concentrations tend to reflect much more closely mixing with oceanic seawater. The OSPAR report describes the concentrations of these dissolved metals in the Celtic Sea as being generally consistent with background levels, although in coastal areas (particularly estuaries) higher levels were recorded.

Turbidity provides a measure of Suspended Particulate Matter (SPM), both mineral and organic, in the water column. The organic fraction of SPM predominantly results from biological activity in the water column, and consists primarily of planktonic material and bacteria. This will not be influenced by any activities associated with cable installation and will not be discussed further in this Chapter. Inorganic SPM, which includes suspended sediments, results from inputs from rivers (derived both from erosion in the river catchments and from chemical reactions in the estuarine zone), fallout from the atmosphere, and coastal erosion combined with resuspension of existing sediments and chemical reactions in the water column. As a result, inorganic SPM loads vary widely, generally increasing with proximity to the coastline. SPM concentrations are highly variable, both spatially and temporally, depending on proximity to terrestrial sources, water depth, and weather conditions (UKMMAS 2010).

SPM loads are also highly dependent on near-bottom current speeds, with higher speeds resulting in more resuspension of sediments. As a result, SPM loads tend to be greater during spring tides than during neaps and can increase to very high levels during storm events (UKMMAS 2010). Satellite imagery data (Rivier *et al*., 2012; Cefas, 2016) indicate seasonality, with non-algal surface SPM concentrations in the western Celtic Sea being generally very low (< 1mg/l) except in winter, when monthly-averaged values of up to around 5mg/l have been observed.

As a general indication of naturally occurring SPM loads resulting from sediment resuspension, values in the order of 1,000mg/l have been measured in the surf zone of sandy beaches (Voulgaris and Collins, 2000), while surface inorganic SPM loads in water depths of over 70m in the central English Channel may exceed 6mg/l during the winter (Rivier *et al*., 2012).

The baseline environment is not static and will exhibit some degree of natural change over time, with or without the Project in place, due to naturally occurring cycles and processes. Therefore, when undertaking impact assessments, it is necessary to place any potential impacts in the context of the envelope of change that might occur naturally over the timescale of the Project.

Further to potential change associated with existing cycles and processes, it is necessary to take account of the potential effects of climate change on the marine environment. Mean sea level is likely to rise during the 21st Century as a consequence of either vertical land (isostatic) movements or changes in eustatic sea level. A rise in sea level may allow larger waves, and therefore more wave energy, to reach the coast in certain conditions and consequently result in an increase in local rates or patterns of erosion and the equilibrium position of coastal features. It is however unlikely that significant changes in the level of contaminants in the western Celtic Sea will occur as a result. In addition, there is a high degree of uncertainty of how winter storm tracks over the North Atlantic Ocean may be altered due to climate change. Natural variability in wind speeds and hence wave heights is large and dominant and is projected to remain so for the century to come (Gallagher *et al*., 2016).

12.4 Characteristics of the Development

Volume 3D Part 2 EIAR for Ireland Offshore (Specialist Chapters) - Chapter 5: Description of the Landfall and Chapter 6: Description of the Offshore Cable) provide a detailed account of the Project for the landfall at Claycastle Beach, the foreshore, and works in the wider marine environment.

The installation of the Celtic Interconnector cable will cause disturbance to the seabed, with resulting effects on marine water quality in the immediate vicinity. The mechanisms by which this will occur are described in the following sections.

12.4.1 Landfall at Claycastle Beach

During Phase I of the Landfall installation, beach preparation works, including excavations, will take place. This will involve the following activities:

- Open cut trenching across Claycastle Beach;
- Installation of temporary causeway;
- Installation of cofferdam with sheet piling;
- Excavation of cofferdam and removal of sediment to installation compound;
- Installation of conduits into trench and replacement of spoil; and
- Installation of temporary winch platform and winch.

In Phase 2 of the Landfall installation, cable pull-in will take place, which will involve the following activities:

- Excavation of receiver pits;
- Arrival of submarine cables on cable lay vessel and transferral of messenger wire to cable laying vessel;
- Cable pull-in by winch, from cable laying vessel through conduit to the Transition Joint Bay;

- Commencement of offshore cable burial by cable laying vessel with plough; and
- Reinstatement of receiving pit and beach.

The disruption to beach sediments during both Phase 1 and 2, particularly through trenching and excavation works, has the potential to cause changes in marine water quality through increases in turbidity and release of contaminants held in beach sediments. However, results from benthic surveys of the cable route indicate that the beach sediments are not contaminated (Volume 3D Part 2 EIAR for Ireland Offshore (Specialist Chapters) - Chapter 6: Marine Sediment Quality). The volume of sediments to be removed during excavation of the trench is estimated at approximately 4,000m^3. The spoil will be stored within the compound on hard standing. The stored spoil shall be adequately covered in order to prevent exposure to the elements, and hence prevent leaching of sediment (and any potential contaminants present therein) into the marine environment. Once landfall works are completed, the trench spoil will be returned to the trench to reinstate the beach to its prior condition.

The cable pull-in (Phase 2) does not interact with water quality so there is no credible pathway for impacts to water quality from this activity. However, the presence of installation vessels will marginally increase the risk of a pollution incident, which has the potential to negatively impact marine water quality. The running aground of a vessel or a collision could lead to a fuel spill. In addition, cleaning fluids, oils and hydraulic fluids used onboard cable laying vessels could be spilled overboard or unintentionally discharged. However, a pollution incident would only occur in case of an accident, and is therefore considered an unlikely effect.

12.4.2 Cable Route

The installation of the submarine cable as part of the marine construction works will typically follow a sequence similar to the following:

- Contractor survey, route engineering and finalisation;
- UXO intervention campaign;
- Boulder clearance;
- Pre-lay grapnel runs;
- Construction of infrastructure crossings;
- Pre-lay route survey;
- Cable lay and post-lay survey; and
- Burial and post-burial survey.

Installation of the cable will be undertaken using methods including (as appropriate to local seabed conditions) ploughing and mechanical trenching. Optimum burial depths of 0.8m to 2.5m are sought for the cable; where this is not possible, appropriate external cable protection shall be installed.

Commented [A22]: Placeholder: An appendix, considering and assessing the presence and handling of UXO, is currently in preparation, and will be ready for submission with the final Application File. Within the current EIAR, the approach has been to not include UXO within impact assessments, on the assumption that the chance of encountering them during works is low.

There is the potential for marine water quality to be impacted by any activity which causes disturbance of the seabed along the route through release of contaminants held in surficial sediments. However, changes in marine water quality arising from seabed disturbance is only a risk in heavily contaminated locations. Sediment samples collected as part of cable route surveys in 2015 and 2018 indicate that neither Claycastle Beach nor the seabed along the cable route in Irish waters is contaminated (see Volume 3D Part 2 EIAR for Ireland Offshore (Specialist Chapters) -, Chapter 10: Marine Sediment Quality). Surveys of the cable route (i.e. pre-lay, post-lay and post-burial) will not cause significant resuspension of seabed sediments.

During preparatory works, activities likely to cause disturbance of the seabed include boulder removal and sandwave sweeping. During construction works, pre-lay grapnel runs, construction of infrastructure crossings, cable lay and cable burial all are likely to cause seabed disturbance.

The presence of installation vessels during marine construction works and surveys will marginally increase the risk of a pollution incident, which has the potential to negatively impact marine water quality. The running aground of a vessel or a collision could lead to a fuel spill. In addition, cleaning fluids, oils and hydraulic fluids used onboard cable laying vessels could be spilled overboard or unintentionally discharged. However, a pollution incident would only occur in case of an accident, and is therefore considered an unlikely effect.

12.4.3 Cable Protection

Rock placement as a means of primary cable protection is not envisaged along the cable route in Irish waters. However, it is likely that some secondary rock protection may be required where the target depth of lowering (DOL) is not fully achieved. The primary external protection approach is through rock placement (Volume 3D Part 2 EIAR for Ireland Offshore (Specialist Chapters) - Chapter 5: Description of the Landfall and Chapter 6: Description of the Offshore Cable. However, a number of other options could be considered, notably concrete mattressing. Rock placement would be sourced from certified quarries, with well-developed infrastructure.

The requirement for external cable protection will be established during the detailed design phase. The exact length of the route which will need this additional protection is therefore not known at the time of writing. For the purposes of assessing potential effects, a precautionary approach has been employed and it has been assumed that the whole length of the cable route within Irish waters (i.e. 151km) will be protected. As a ‘worst case scenario’ it has been assumed that cable protection will be installed along a 15m wide corridor centred on the actual cable, resulting in an area of approximately 2.3km^2 covered by external protection. However, external protection will only be required in areas where trenching is not deemed feasible, through either the presence of other seabed assets or obstacles (such as at cable crossings), where ground conditions are too hard, or where secondary protection is required to achieve the required burial depth.

Introduction of hard material into an area which is predominantly sedimentary has the potential to result in localised changes to hydrographic conditions, and associated sediment dynamics. It is anticipated that some level of scour may occur where external cable protection is installed. However, due to the intrinsic purpose of the cable protection, the protection will be designed to minimise scour.

Scour of seabed sediments around the cable protection has the potential to cause changes in marine water quality through release of contaminants held in benthic sediments. In addition, the presence of installation vessels during marine construction works and surveys will marginally increase the risk of a pollution incident, which has the potential to negatively impact marine water quality. The running aground of a vessel or a collision could lead to a fuel spill. In addition, cleaning fluids, oils and hydraulic fluids used onboard cable laying vessels could be spilled overboard or unintentionally discharged. However, a pollution incident would only occur in case of an accident, and is therefore considered an unlikely effect.

12.5 Likely Significant Impacts of the Development

12.5.1 Do Nothing

In the ‘Do Nothing’ alternative, there would be no landfall or marine construction works associated with the Celtic Interconnector, and therefore the existing baseline environment would be expected to remain unchanged, subject to natural variation. The evolution of the marine environment in the absence of the Project will depend on future levels of marine activity such as military operations and offshore developments, future resource exploitation such as fishing, and the effectiveness of protected site management, as well as variation due to climate change. Some of these possible changes may be planned, such as marine renewable energy developments and cables. Others, however, will be subject to change, such as the evolution of commercial fishing activities as influenced by economic and resource availability factors, the evolution of maritime traffic as influenced by economic and port related factors, and the evolution of maritime fleets as influenced by on-board waste management practices.

12.5.2 Installation Phase

During the installation phase of the Celtic Interconnector, surficial sediments will be disturbed at both the landfall at Claycastle Beach and along the marine cable route. Seabed sediments will be resuspended into the water column increasing turbidity and creating sediment plumes that can have an effect, either positive or negative, on habitats and species (Dernie *et al*., 2003) (see Volume 3D Part 2 EIAR for Ireland Offshore (Specialist Chapters) - Chapter 13: Biodiversity).

Compared to other offshore activities such as bottom trawling, ship anchoring or large-scale dredging, seabed disturbance resulting from subsea cable activities is considered temporary and has a relatively limited extent (Carter *et al*., 2009; OSPAR, 2012), with the seabed usually returning to its original state (BERR, 2008). The disturbance itself is restricted to a narrow strip of seabed, normally limited to an area 2-3m either side of the cable (Bald *et al*., 2014; Carter *et al*., 2009), or in the order of 10m width if the cable has been ploughed into the seabed (OSPAR, 2009).

Installation tools may have a footprint up to 10m width depending on the burial method used (OSPAR, 2009; NIRAS, 2015). The level of seabed disturbance caused during clearance or installation also largely depends on the equipment being used, as well as on the sediment type (BERR, 2008). The level of disturbance caused by ploughs is considered to be lower compared to jetting techniques (OSPAR, 2012; NIRAS, 2015).

Dispersion of disturbed sediments is dictated by the local hydrodynamic regime, particularly near-bottom current speeds (BERR, 2008). Coarser sediments such as sand and gravel settle relatively close to the origin of disturbance, while finer sediments such as clay and silt can remain in suspension for a longer period of time creating a larger impact footprint. However, a greater dispersion also results in a smaller level of deposition at any given point. The majority of sediment deposition occurs within tens of meters of the cable route (OSPAR, 2009). Previous studies (e.g. Aquind, 2019) have stated that clays (i.e. sediments <3.9µm diameter) have the capacity to be transported distances of up to 10km, although at these distances it is unlikely that that increases in suspended sediment loads will be discernible above natural variation.

In addition to causing increases in turbidity, the installation phase has the potential to release / remobilise contaminants held within the sediment when the seabed is disturbed (BERR, 2008). The location and type of sediment will determine whether contaminants are likely to be held in the benthic environment.

Contaminants such as oil and heavy and trace metals are most likely found near the coastline, generally attached to fine sediments, although certain chemicals can persist in coarser sediments (BERR, 2008). Contaminant release is therefore only a concern in heavily contaminated locations, such as major ports, oil and gas developments, historical industrial areas, and waste disposal or natural sinks, and is of less importance when considering offshore areas (OSPAR, 2009).

The majority of organic compounds present in the environment are either readily biodegradable or of low water solubility and hence of limited significance in terms of water contamination (Tran *et al*., 1996). However, some organic compounds can reach toxic concentrations in the dissolved phase, and / or bioaccumulate from the dissolved phase to toxic levels. These include organo-metallic compounds of lead, tin and mercury.

The release of contaminants usually occurs within a localized area for a short period of time during the installation (and potentially during any maintenance activities or decommissioning), and should only be of concern near industrialised areas (BERR, 2008). Sediment samples collected as part of cable route surveys in 2015 and 2018 indicate that neither Claycastle Beach nor the seabed along the cable route in Irish waters is contaminated (see Volume 3D Part 2 EIAR for Ireland Offshore (Specialist Chapters) - Chapter 10: Marine Sediment Quality). Furthermore, bioavailable metals and hydrocarbons are generally associated with finer sediments (i.e. muds, <63µm) and higher organic carbon content. As the surficial sediments along the interconnector cable route are predominantly sands with low associated total organic carbon values, the risk of re-suspension and subsequent desorption of contaminants is lower than in very muddy sediments.

During Landfall installation works at Claycastle Beach, a trench will be cut, removing approximately 4,000m^3 of beach sediment. This spoil shall be stored within the compound on the hard standing, to allow the site to be restored to its previous condition following installation of the conduits. The spoil shall be adequately covered in order to prevent exposure to the elements. This, combined with use of the cofferdam, will help to prevent disturbed sediment entering the marine environment. Due to the highly mobile nature of the sediments at Claycastle Beach and in the local coastal waterbody, and the frequent disturbance of these sediments due to e.g. tidal currents and storms, it is considered likely that there is already high natural dispersion and diffusion of any low-level contaminants present.

The cable burial technique used in Irish territorial waters and the Irish EEZ may vary depending on the geology of the seabed. However, assuming that a corridor of approximately 15m width will be disturbed by cable-laying equipment along a length of 151km (in Irish waters) an area of approximately 2.3km^2 will be directly disturbed by cable installation.

The cable route does not pass through any habitats or areas of environmental sensitivity, therefore receptor value for water quality is considered to be low to negligible. The geographic extent of any increase in SPM concentrations due to cable burial is not expected to extend more than 10km away from the installation area, with the majority of particles (over 90%) being deposited within 1km. The area with the potential to be affected by increases in SPM is small within the wider setting of Irish waters, resulting in a low magnitude of change. Any elevation in suspended sediment concentrations once installation works are complete will be temporary, with levels expected to return to baseline within a single spring-neap tidal cycle. Effects on marine water quality due to changes in turbidity are therefore considered to be **not significant**.

Contamination arising from seabed disturbance is only a risk in heavily contaminated locations (OSPAR, 2009). Sediment samples collected as part of cable route surveys indicate that neither Claycastle Beach nor the seabed along the cable route in Irish waters is contaminated. Sediments which are suspended due to cable burial are not expected to settle out more than 10km away from the installation area, with the majority (>90%) being deposited within 1km. The sediment is expected to settle out within a single spring-neap tidal cycle. As receptor value is low to negligible, and magnitude of change is expected to be low, changes in water quality through release of contaminants held in marine and coastal sediments are considered to be **not significant**.

Installation of cable protection has the potential to impact marine water quality via the release of hazardous substances through loss of chemicals/fuels from installation vessels. The marine environment is highly sensitive to hydrocarbon and chemical spills, which can have major ecological effects. The magnitude of the potential effect is low to high and is dependent on the nature and size of a spill. Mitigation measures are therefore required to remove the risk of accidental hydrocarbon or chemical spill. Overall, a hydrocarbon or chemical release is considered **unlikely** as the presence of cable installation vessels will only marginally increase the risk of a pollution incident. Effects on marine water quality due to loss of chemicals / fuels from installation vessels are therefore considered to be **not significant**.

The potential for indirect effects on ecological features arising from changes to water quality along the cable route is presented in Volume 3D Part 2 EIAR for Ireland Offshore (Specialist Chapters) - Chapter 13: Biodiversity.

12.5.3 Operational Phase

Once the cable and its associated infrastructure are installed and operating, it is anticipated that they will require minimal maintenance. However, in the event of the cable getting damaged or becoming faulty, operational maintenance activities would be required to repair the affected components. For offshore components, the cable may need to be cut at the appropriate location and brought to the surface for repair before being put back into place on the seabed or replaced. Operational maintenance activities would typically comprise similar vessels, activities and locations as the installation works.

Sediments are likely to be disturbed during cable maintenance activities, and effects are considered to be the same as for the installation phase.

The cable route does not pass through any habitats or areas of environmental sensitivity, therefore receptor value for water quality is considered to be low to negligible. The geographic extent of any increase in SPM concentrations due to cable burial is not expected to extend more than 10km away from the installation area, with the majority of particles (over 90%) being deposited within 1km. The area with the potential to be affected by increases in SPM is small within the wider setting of Irish waters, resulting in a low magnitude of change. Any elevation in suspended sediment concentrations once installation works are complete will be temporary, with levels expected to return to baseline within a single spring-neap tidal cycle. Effects on marine water quality due to changes in turbidity are therefore considered to be not significant.

Contamination arising from seabed disturbance is only a risk in heavily contaminated locations (OSPAR, 2009). Sediment samples collected as part of cable route surveys indicate that neither Claycastle Beach nor the seabed along the cable route in Irish waters is contaminated. Sediments which are suspended due to cable burial are not expected to settle out more than 10km away from the installation area, with the majority (>90%) being deposited within 1km. The sediment is expected to settle out within a single spring-neap tidal cycle. As receptor value is low to negligible, and magnitude of change is expected to be low, changes in water quality through release of contaminants held in marine and coastal sediments are considered to be not significant.

Use of vessels during maintenance works has the potential to impact marine water quality via the release of hazardous substances through loss of chemicals / fuels. The marine environment is highly sensitive to hydrocarbon and chemical spills, which can have major ecological effects. The magnitude of the potential effect is low to high and is dependent on the nature and size of a spill. Mitigation measures are therefore required to remove the risk of accidental hydrocarbon or chemical spill. Overall, a hydrocarbon or chemical release is considered unlikely as the presence of cable maintenance vessels will only marginally increase the risk of a pollution incident. Effects on marine water quality due to loss of chemicals / fuels from vessels are therefore considered to be not significant.

The potential for indirect effects on ecological features arising from changes to water quality along the cable route is presented in Volume 3D Part 2 EIAR for Ireland Offshore (Specialist Chapters) - Chapter 13: Biodiversity.

12.5.4 Decommissioning Phase

The design lifespan of the Celtic Interconnector is approximately 40 years, although it should be noted that other interconnector projects have exceeded this, with cables remaining operational for up to 80 years in some cases. A decommissioning plan will be developed prior to the decommissioning phase of the Project. The decision on whether to recover the cable or not will be made at a future date and further details on this decision will be provided including the methodology to be adopted. However, it is currently anticipated that the cable will be left in-situ where this is deemed environmentally acceptable, and with the understanding that this may require long term monitoring and maintenance. This current view assumes no legal requirement to recover the cable and associated infrastructure. However, should this be the case, the Project promoters (EirGrid and RTE) will take appropriate measures and act responsibly in line with their obligations.

The rationale for leaving the cable in-situ is that the health and safety risk and economic cost to remove the cable is likely to outweigh the economic value of the cable. Due to the high cost of cable vessels and personnel and the comparatively low value of the cable materials, it may not be considered economically viable to remove the cable for recycling.

It is also anticipated that the cable protection materials will be left in situ as the materials used are not considered economical to recover. In addition to the cost, across the lifespan of the Project, the cable protection may come to benefit the marine environment by providing localised reef features and increasing local biodiversity. Ecological surveys will be carried out before the decommissioning phase of the Project to determine whether the cable and its protection have become beneficial to marine fauna and whether leaving these structures in-situ is more environmentally acceptable overall than attempting to remove them.

If the cable were to be removed without moving the cable protection, the process would involve fluidising the seabed with a mass flow excavator and pulling the cable aboard a vessel with a winch. This activity would require approval under the relevant legislation in place at the time of decommissioning the Celtic Interconnector Project. However, the external cable protection would likely cause an obstruction to such activity, particularly for long lengths of cable protection therefore it is considered more environmentally and economically favourable to leave the cable and its protection in-situ.

If the cable and cable protection are left in place, there would be no likely effect on marine water quality arising as part of the decommissioning phase.

If the cable and cable protection are removed as part of the decommissioning phase, there is the potential for water quality to be impacted through increases in turbidity and release of contaminants held in seabed sediments. The effects of this are considered likely to be the same as for the installation phase.

Use of vessels during decommissioning works has the potential to impact marine water quality via the release of hazardous substances through loss of chemicals / fuels. The marine environment is highly sensitive to hydrocarbon and chemical spills, which can have major ecological effects. The magnitude of the potential effect is low to high and is dependent on the nature and size of a spill. Mitigation measures are therefore required to remove the risk of accidental hydrocarbon or chemical spill. Overall, a hydrocarbon or chemical release is considered unlikely as the presence of decommissioning vessels will only marginally increase the risk of a pollution incident. Effects on marine water quality due to loss of chemicals / fuels from vessels are therefore considered to be not significant.

12.5.5 Cumulative Effects

There is one other proposed project in the marine environment in the proximity of the Celtic Interconnector Project that has the potential to impact marine water quality. DP Energy Ireland (DP Energy) is investigating the feasibility of developing an offshore floating wind energy prospect off the south coast of Ireland, the Inis Ealga Marine Energy Park (IEMEP). DP Energy intend to carry out site investigations within the prospect area, potential export cable corridors and landfall areas in order to assess the site and associated seabed. The results of these investigations will be used to select optimal cable route(s), landfall option(s), windfarm layout, and provide baseline data for EIAR.

The Inis Ealga Site is approximately 54km in width stretching from Dungarvan, Co. Waterford to Cork Harbour, Co. Cork. The Site occupies an area of 925km^2 and is located approximately 7.5km south of Power Head, Co. Cork and 26km south of Helvick Head, Co. Waterford.

As part of the IEMEP project, there are likely to be activities which will impact marine water quality, for example cable installation and construction of landfall infrastructure. However, given that the effects of the Celtic Interconnector Project on marine water quality are predicted to be both non-significant and temporary with the cable in place by the time of the wind farm’s development, no in-combination effects with the IEMEP project are expected.

12.6 Mitigation and Monitoring

Commented [A23]: Placeholder: Mitigation and monitoring measures remain under review / discussion. These will be finalized prior to submission of the final Application File.

12.6.1 Installation Phase

The seabed at the Claycastle Beach landfall consists of sandy sediments with depths in excess of 3m. This will allow trench and burial of the cable to the target depth (1.5m) using a plough launched from the beach. Coastal erosion studies have indicated the seabed is stable which will help limit the minimum burial depths for the cable.

When the trench is excavated, approximately 4,000m^3 of beach sediment will be removed. This spoil will be stored within the compound on the hard standing to allow the site to be restored to its previous conditions following the installation of the conduits. The stored spoil shall be adequately covered in order to prevent exposure to the elements, and hence prevent leaching of sediment (and any potential contaminants present therein) into the marine environment.

In line with guidelines outlined in BERR (2008) and OSPAR (2012), the cable route has been designed to avoid European designated sites including Special Areas of Conservation

(SACs) and Special Protection Areas (SPAs) and thus minimise any potential effects to areas of conservation importance.

During the pre-construction engineering and design phase for the Celtic Interconnector, a detailed analysis of the seabed along the route of the Celtic Interconnector will be undertaken. From this, the most appropriate installation techniques will be established, as determined by seabed type, to minimise sediment disturbance and hence minimise effects on marine water quality. In addition, where external cable protection is required, this will be designed according to seabed type, again, minimizing sediment and seabed disturbance. Minimising seabed disturbance will minimise the potential resuspension of contaminants from seabed sediments to the water column.

Where the need for external rock protection is identified, this will be designed according to the receiving environment, based on seabed type, and the need to reduce seabed disturbance. Cable protection will be designed to minimise scour, and hence resuspension of sediments. Rock placement would be sourced from certified quarries, with inert natural stone material used to minimise the degree of impact.

Vessels used for installation will be expected to be compliant with MARPOL regulations. These regulations cover the prevention of pollution from accidents and routine operations. In addition, mitigation measures will be taken to minimise the risk of collision between installation vessels and other vessels. All vessels will have shipboard oil pollution emergency plans (SOPEP) in operation.

12.6.2 Operational Phase

Throughout the Project’s lifespan, periodic monitoring of the cable route will be undertaken; should such monitoring identify significant changes in the bathymetry or seabed features (i.e. sediment type) in the vicinity of the cable route, appropriate measures will be taken, including replacement or addition of further external cable protection, as necessary.

Vessels used for any monitoring or maintenance activities during the operation phase of the Project will be expected to be compliant with MARPOL regulations. These regulations cover the prevention of pollution from accidents and routine operations. In addition, mitigation measures will be taken to minimise the risk of collision between installation vessels and other vessels. All vessels will have shipboard oil pollution emergency plans (SOPEP) in operation.

12.6.3 Residual Impacts

No significant residual effects on marine physical processes are anticipated.

12.7 Bibliography

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13 Biodiversity

Commented [A24]: Placeholder: The Biodiversity chapter is still under discussion, with a number of elements still to be finalized. All aspects will be finalized prior to submission of the final Application File.

13.1 Introduction

This chapter of the EIAR assesses the likely significant effects[43] of the Project with respect to biodiversity, including intertidal and benthic habitats and ecology, natural fish ecology, ornithology, marine mammals and reptiles. The chapter should be read in conjunction with Volume 3D Part 2 EIAR for Ireland Offshore (Specialist Chapters) - Chapter 5: Description of the Landfall and Chapter 6: Description of the Offshore Cable and with respect to relevant parts of other chapters (including Volume 3D Part 2 EIAR for Ireland Offshore (Specialist Chapters) – Chapter 17: Noise and Vibration), where common receptors have been considered and where there is an overlap or relationship between the assessments of effects. In this chapter, receptors are referred to as ecological features, to accord with the Chartered Institute of Ecology and Environmental Management (CIEEM 2018) 'Guidelines for Ecological Impact Assessment in the UK and Ireland: Terrestrial, Freshwater, Coastal and Marine'. The term ecological feature is defined in the guidance as pertaining to habitats, species and ecosystems.

Information to inform appropriate assessment, as required by the European Communities (Birds and Natural Habitats) Regulations 2011 S.I. 477/2011 (as amended) is provided in Volumes 6B and 11, for Irish and UK EEZ, respectively.

13.2 Methodology and Limitations

13.2.1 Legislation and Guidance

The legislation relevant to this assessment is:

- European Communities (Birds and Natural Habitats) Regulations 2011 S.I. 477/2011 (as amended);
- Wildlife Act 1976 S.I. No. 39/1976 (as amended) (hereafter 'The Wildlife Acts); and,
- Planning and Development Act 2000 S.I. 30/2000 (as amended) and Planning and Development Regulations 2001 (as amended).

The key planning policy relevant to this assessment is:

Commented [A25]: Placeholder: A full review of all planning policies listed will be undertaken prior to submission of the final Application File.

- County Cork Development Plan 2014 (Natural Heritage objectives HE2-3, HE2-5, HE4-6, HE6-1); and
- County Cork Biodiversity Action Plan 2009-2014 [which had not been updated at the time of writing]
- East Cork Municipal District Local Area Plan 2017(Local Area Plan objective - LAS-01).

[43] In the Biodiversity chapter, the term 'potentially significant effects' is used in the sections prior to the 'scope of the assessment' (Section 6.7) being determined, as it accords with CIEEM guidance. The term 'likely significant effects' is used once the scope of the assessment has been determined. The use of this term is not to be confused with Likely Significant Effects (LSEs) as used in the context of the Natura Impact Statement.

The key guidance relevant to this assessment is:

- Chartered Institute of Ecology and Environmental Management (CIEEM 2018) 'Guidelines for Ecological Impact Assessment in the UK and Ireland: Terrestrial, Freshwater, Coastal and Marine'.
- Environmental Protection Agency (EPA, 2017) Guidelines on the information to be contained in Environmental Impact Assessment Reports (Draft August 2017).
- Assessment of the environmental impacts of cables (OSPAR, 2009).
- Guidance to Manage the Risk to Marine Mammals from Man-made Sound Sources in Irish Waters (Department of Arts, Heritage and the Gaeltacht, 2014).

For marine faunal groups a qualitative assessment has been undertaken on the basis of the noise criteria presented in Volume 3D Part 2 EIAR for Ireland Offshore (Specialist Chapters) – Chapter 17: Noise and Vibration and the sensitivity of the species concerned.

Additional legislation, conventions and other protection afforded to marine mammals and reptiles in Ireland is summarised in **Table 13.1**.

Table 13.1 Additional legal protection and conservation status classifications afforded to marine mammals and reptiles in Irish waters

Species	**Legislative context (additional conservation status classifications included where relevant)**
Harbour porpoise (*Phocoena phocoena*)	Annex II of EC Council Directive 92/43/EEC on the conservation of natural habitats and of wild fauna and flora (the 'Habitats Directive') Annex IV of EC Habitats Directive. OSPAR List of Threatened and Declining Species and Habitats.
Bottlenose dolphin (*Tursiops trunactus*)	Annex II and IV of EC Habitats Directive
All cetacea	Annex IV of EC Habitats Directive
Grey seal (*Halichoerus grypus*) **/harbour seal** (*Phoca vitulina*)	Annex II of EC Habitats Directive
Green Turtle *(Chelonia mydas)*	Convention of the Conservation of Migratory Species of Wild Animals Appendix I. Convention on the Conservation of European Wildlife and Natural Habitats (Bern Convention) Appendix II.

Commented [A26]: Placeholder: All table and figure numbering to be checked and amended prior to submission of final Application File.

Species	Legislative context (additional conservation status classifications included where relevant)
	NB: green turtle are not protected under the Wildlife Acts
Hawksbill Turtle (*Eretmochelys imbricata*)	Annex IV of EC Habitats Directive. Convention of the Conservation of Migratory Species of Wild Animals Appendix I. Convention on the Conservation of European Wildlife and Natural Habitats (Bern Convention) Appendix II.
Kemp's Ridley *(Lepidochelys kempii)*	Annex IV of EC Habitats Directive. Convention of the Conservation of Migratory Species of Wild Animals Appendix I. Convention on the Conservation of European Wildlife and Natural Habitats (Bern Convention) Appendix II.
Leatherback Turtle *(Dermochelys coriacea)*	Annex II and Annex IV of EC Habitats Directive. Convention on the International Trade in Endangered Species of Flora and Fauna Appendix I. Convention of the Conservation of Migratory Species of Wild Animals Appendix I. The Convention for the Protection of the marine Environment of the North-East Atlantic (OSPAR Convention).
Loggerhead Turtle *(Caretta caretta)*	Annex II and Annex IV of EC Habitats Directive. Convention of the Conservation of Migratory Species of Wild Animals Appendix I. Convention on the Conservation of European Wildlife and Natural Habitats (Bern Convention) Appendix II. The Convention for the Protection of the marine Environment of the North-East Atlantic (OSPAR Convention).

Guidance to manage the risk to marine mammals from man-made sound sources in Irish Waters, is a guidance document prepared by the National Parks and Wildlife Service (NPWS), formerly within the Department of Arts, Heritage and Gaeltacht (DAHG) in 2014[44].

[44] Management and responsibility for the NPWS was transferred in 2020 to the Department of Housing, Local Government and Heritage.

It describes the legal context of the consideration of underwater sound in relation to marine mammals, the use of sound by different marine mammal species, and methods for characterising and managing risks to these species from anthropogenic sound sources.

For marine turtles, the Joint Nature Conservation Committee (JNCC), a nature conservation agency in the UK, suggests that their guidelines and protocols for marine mammals could be adapted to help reduce the risk of deliberate injury to other marine species (JNCC 2017), if deemed appropriate by the relevant Regulator, in this case, the Foreshore Unit.

13.2.2 Desktop Studies

A desk-study has been undertaken to inform the assessment presented within this chapter. This has included a systematic gathering and review of grey and peer-reviewed literature that included *inter alia*:

- NPWS website (National Parks and Wildlife Service, 2021) for information on protected sites;
- National Biodiversity Data Centre website (National Biodiversity Data Centre, 2021) for information on protected species;
- Birds of Conservation Concern in Ireland 2014 – 2019 (Colhoun and Cummings (2013);
- European Seabirds at Sea (ESAS) database (maintained by the JNCC, also covering marine mammals);
- Inland Fisheries Ireland: Water Framework Directive Fish Stock Survey of Rivers and Transitional Waters in the South Western River Basin District;
- Publications by Bord Iascaigh Mhara (Irish Sea Fisheries Board);
- Marine Institute fisheries surveys and data, including shellfish;
- Sea-Fisheries Protection Authority: Data and statistics from the Irish sea-fisheries industry, including landing numbers and quotas;
- International Council for the Exploration of the Seas (ICES) Fisheries Overview: Celtic Seas Ecoregion;
- ICES fisheries catch and survey data;
- FAO Fishery and Aquaculture Statistics;
- Eastern Regional Fisheries Board: fisheries reports;
- All Ireland Cetacean Sighting and Stranding Scheme (implemented by the Ireland Whale and Dolphin Group);
- Small Cetaceans in European Atlantic Waters and the North Sea (SCANS) (coordinated by Sea Mammal Research Unit of University of St Andrews);
- Irish Basking Shark Study Group Sightings (implemented by the Irish Basking Shark Study Group); and
- NPWS Seal database (coordinated by NPWS).

Designated Sites

In Irish Waters, designated sites associated with coastal (below Mean High Water Mark (MHWM)) and marine environments comprise Special Areas of Conservation (SACs; and candidate SACs), and Special Protection Areas (SPAs). These have been identified within 5km of the Project site for habitat features and within species-specific search areas associated with different mobile features. These search areas for mobile features were as follows:

- Homing migratory fish show considerable spatial mixing around the coast as they return to their natal waters to spawn and the project has the potential to affect both local and more distant migratory fish populations. The Project has considered principal migratory fish rivers both within the locale and to the east of the proposed project up to c.125km, the principal direction of migratory fish movements;
- SPAs that are designated in full or in part by supporting seabird species that could interact with the Project were identified using the mean max foraging ranges published in Woodward et al. 2019;
- For seal species, search areas were focused on foraging ranges, using typical distances of 120km for common seal, and 145km for grey seal (SMRU, 2011 and Thompson et al 1996, respectively);
- For cetaceans, consideration was given to Marine Mammal Management Units (MU), primarily defined as being used in UK waters, but which also cover the Irish marine environment. MUs were established by the JNCC (JNCC, 2015), with the aim of enabling identification of plans and projects, which should be considered in impact assessments for key cetacean species within and adjacent to UK waters. MUs are established for individual species, then broken down geographically. For example, for harbour porpoise, the relevant MU is CIS, or Celtic and Irish Seas, and for bottlenose dolphin, two MU are applicable: Offshore Channel, Celtic Sea & South West England, and Irish Sea.

Table 13.2 provides a summary of the species-specific search radii applied, listing the relevant source.

Commented [A27]: Placeholder: National Heritage Areas to be included in document prior to submission of final Application File.

Table 13.2 Summary of species-specific search distances and source information used to identify European Sites with mobile features

Species	Approximate search distance	Source
Black-headed gull	19km	Woodward et al (2019), 'Desk-based revision of seabird foraging ranges used for HRA screening', BTO research report no.724, BTO
Common gull	50km	
Lesser Black backed	127km	
Herring Gull	59km	
Cormorant	26km	
Manx Shearwater	1,387km	
Kittiwake	156km	
Fulmar	542km	
Gannet	315km	
Puffin	137km	
Storm Petrel	336km	
Leach's Storm Petrel	657km*	
Non-breeding water birds	5km	Chapman, C. & Tyldesley, D. (2016).Functional linkage: How areas that are functionally linked to European sites have been considered when they may be affected by plans and projects - a review of authoritative decisions. Natural England Commissioned Reports, Number207
Grey Seal	145km	Sea Mammal Research Unit (SMRU) (2011) Scientific Committee On Seals (SCOS) Scientific advice on matters related to the management of seal populations: 2011. Thompson, P. M., McConnell, B. J., Tollit, D. J., MacKay, A., Hunter C., and Racey. P. A. (1996) Comparative distribution, movements and diet of harbour and grey seals from
Common Seal	120km	

Species	Approximate search distance	Source
		Moray Firth, NE Scotland. Journal of Applied Ecology, 33(6):1572-1584.
Harbour Porpoise	All sites which include Harbour Porpoise within the Celtic Sea Management Unit for Cetaceans	IAMMWG, (2015), Management Units for cetaceans in UK waters (January 2015), JNCC Report No. 547, JNCC, Peterborough, ISSN 0963-8091.
Bottlenose Dolphin	All sites which include Bottlenose dolphin within the Offshore Channel, Celtic Sea and South West England Management Unit for Cetaceans	IAMMWG, (2015), Management Units for cetaceans in UK waters (January 2015), JNCC Report No. 547, JNCC, Peterborough, ISSN 0963-8091.
Migratory Fish species	100km	**TBC**

*Only a mean figure is available for Leach's Storm Petrel based on a single study.

Commented [A28]: Placeholder: References to be included here

13.2.3 Field Studies

Intertidal and Benthic Habitats and Ecology

Data on benthic habitats and fauna was gathered along the proposed route of the Celtic Interconnector in two campaigns carried out in 2015 and 2018 respectively. Seabed acoustic surveys and geophysical surveys were undertaken, bathymetry was measured, and samples of benthos and sediment were taken both using a Hamon grab and seabed photography (stills and video). Over the course of the survey campaigns, data was collected from locations that are no longer under consideration (that is, data gathered to inform the optioneering stage), although the wider dataset is considered appropriate to inform the EIAR through the provision of additional, contextual data and information. Sediment composition was identified as the greatest factor influencing diversity of macrofaunal communities along the route.

Fish Ecology

No targeted fish ecology or fisheries surveys have been undertaken within coastal waters or along the wider marine route of the Celtic Interconnector, with no dedicated survey effort planned prior to the submission of the EIAR. The composition of fish populations in Irish intertidal, territorial and EEZ waters have been drawn from Inland Fisheries Ireland transitional waters fish surveys for the Blackwater (Munster) estuary and sources referenced in Section 13.2.2 (Desktop Studies) and 13.9 (References).

Ornithology

Ornithological surveys of the intertidal and nearshore environments have been carried out within the Zone of Influence of the proposed landfall location at Claycastle Beach[45]. Surveys took place over three seasons to capture wintering bird activity in February and March 2019, and again monthly between November 2019 and March 2020, and from X 2020 to Y 2021. with breeding bird activity recorded between April and June 2019. These surveys provide an understanding of the occurrence of waders, wildfowl and seabirds using the intertidal, nearshore, and coastal inshore areas across the year. The field reports, including the methodology employed and the timing of surveys are provided in Appendix 9A.

Commented [A29]: Placeholder: Additional information from these surveys will be incorporated into the assessment prior to submission of the final Application File.
This comment applies to all references to ornithology survey data throughout the EIAR.

Commented [A30]: Placeholder: Appendices in preparation / under review, and will be incorporated into EIAR prior to submission of final Application File.

At sea, no targeted surveys have been undertaken to identify seabirds commuting or foraging along the route of the Celtic Interconnector. Given the largely sub-surface nature of the Project and the third-party data available, no dedicated survey effort was considered necessary to inform this assessment.

The data gathered represents a snapshot of the bird populations present within the area throughout the non-breeding period with, the repeat visits providing for a robust assessment with regard to ornithology. Whilst data on wintering birds is unavailable for the months of September and October this is not considered to be a limitation given that the usual peaks in bird numbers usually occur later in the non-breeding winter period, often in January (see for instance data in Crowe and Boland, 2004; Boland et al., 2009; Crowe et al., 2016; Lewis et al., 2016).

Marine Mammals and Reptiles

Marine mammal observers (MMOs) were operational onboard the 2014 and 2017 geophysical survey vessels. Whilst focusing on marine mammals, the survey methodology dictates that surveyors are also instructed to record any sightings of marine reptiles. Throughout all works, suitably qualified MMOs followed the DAHG guidelines established by the NPWS, recording continuously as appropriate. The findings from this work have been incorporated into the baseline description below.

Commented [A31]: Placeholder: SQEP information for the project MMOs shall be included prior to submission of the final Application File. Similar information as appropriate will be included for other key survey leads.

13.2.4 Methodology for Assessment of Effects

Scope of the Assessment

The method for determining the scope of the assessment within the biodiversity chapter differs from that used in other technical chapters within this EIAR in order to correspond with topic specific guidance (i.e. CIEEM, 2018). However, the relevant receptors (ie ecological features), the spatial and the temporal scope are all defined in Sections 13.4 – 13.6. The method has multiple stages enabling the scope of the assessment to be progressively refined.

[45] Surveys were also carried out at Redbarn and Ballinwilling, to inform optioneering under Step 4 of EirGrid's Framework – see Srep 4 reporting online at https://www.eirgridgroup.com/the-grid/projects/celtic-interconnector/related-documents/index.xml

Scoping – Determining Importance of Ecological Features

For this biodiversity assessment, the first stage in determining the scope of the assessment is to identify which ecological features identified through the desk study and field surveys are 'important'[46] in the context of the Project. Following CIEEM (2018) guidance, the importance of ecological features is first determined with reference to legislation and policy and then with regard to the extent of habitat or size of population that may be affected by the Project.

As the importance of ecological features is determined with regard to the extent of habitat or size of population that may be affected by the Project, each status can differ from that which would be conferred by legislative protection or a species' level of conservation significance.

Where information is available, information regarding the extent and population size, population trends and distribution of the ecological features has been used, to inform the categorisation of importance at the Project level. Where detailed criteria or contextual data are not available, professional judgement was used to determine importance applying a precautionary approach.

The following geographical scale has been used within the assessment:

- **European** – e.g. Natura 2000 sites, areas that support habitats or species great enough in extent/number to qualify as Natura 2000 sites even if not designated;
- **National** – e.g. Natural Heritage Areas (NHA), areas that support habitats or species great enough in extent/number to qualify as NHA even if not designated or contribute significantly to the objectives in the national Biodiversity Action Plan 2017 – 2021;
- **County** – e.g. habitats or species present that may contribute significantly to the objectives in the Cork County Biodiversity Action Plan 2009 – 2014;
- **Local** – e.g. habitats, red listed flora and fauna and legally protected species that based on their extent, population size, quality etc are determined to be at a lesser level of importance than the geographic contexts above; and
- **Negligible** – e.g. common and widespread semi-natural habitats and species that do not occur in levels elevated above those of the surrounding area and areas of heavily modified or managed land uses (e.g. hard standing used for car parking, as roads etc.).

A justification of all determinations of importance are provided in Table 13.3.

Where protected species are present and there is the potential for a breach of the legislation, those species should always be considered as 'important' features. With the exception of such species receiving specific legal protection, or those subject to legal control (eg invasive species), all ecological features that were determined to be important at a negligible level have been scoped out of the assessment at this stage. Further, ecological features of local importance, where there was a specific technical justification, were also scoped out at this stage. This is because effects on them would not influence the decision-making about

Commented [A32]: Placeholder: Where applicable, this shall be reviewed and considered in line with NRA (2009) as standard in Ireland, and as per onshore chapter, in NRA Guidelines for Ecological Assessment of National Road Schemes https://www.tii.ie/technical-services/environment/planning/Guidelines-for-Assessment-of-Ecological-Impacts-of-National-Road-Schemes.pdf

Commented [A33]: Placeholder: Additional definition to be included here, for clarity, prior to submission of final Application Form.

[46] Importance relates to the quality and extent of designated sites and habitats, habitat/species rarity and its rate of decline. Ecological features that are not considered to be important are those that are sufficiently widespread, unthreatened and resilient and with populations that will remain viable and sustainable irrespective of the Project.

whether or not consent should be granted for the Project (in other words a significant effect in EIA terms could not occur). This approach is consistent with that described in CIEEM (2018). Specific justification for exclusion of each of these ecological features is provided in Table 13.3.

Commented [A34]: Placeholder: Additional information will be included on this point prior to submission of the final Application File.

All legally protected species and ecological features that are considered to be of conservation importance (based on the definitions above) were then taken through to the next stage of the assessment.

Spatial Scope

The installation and operation phases of the Project may result in the following environmental changes that could significantly affect ecological features/receptors:

- Habitat loss or degradation;
- Increased suspended sediment concentrations;
- Deposition of sediments (smothering);
- Accidental loss of pollutants or disturbance of pollutants already present;
- Increased light, noise and vibration (disturbances);
- Increased vessel movement; and
- Creation of electro-magnetic fields.

The key to establishing which environmental changes may result in likely significant effects, is the determination of a Zone of Influence (ZoI) for each important ecological feature identified. ZoIs differ depending on the type of environmental change (i.e. the change from the existing baseline) as a result of the Project and the ecological feature being considered.

The most straightforward ZoI to define is the area affected by land-take and direct land-cover changes associated with the Project. This ZoI is the same for all affected ecological features.

By contrast, for each environmental change that can extend beyond the area affected by land-take and land-cover change (e.g. increased noise associated with installation activities within the land-take area), the ZoI may vary between ecological features, dependent upon their sensitivity to the change and the precise nature of the change. For example, while a harbour porpoise might be disturbed by noise generated during the installation at a distance of XX, species groups such as many invertebrates may be unaffected by changes in noise. In view of these complexities, the definition of the ZoI that extends beyond the land-take area was based upon professional judgement informed (as far as possible) by a review of best available published evidence (e.g. disturbance criteria for various species) and discussions with the technical specialists who are working on other chapters of the EIAR.

Commented [A35]: Placeholder: Additional information to be inserted here regarding ZOIs, including supporting information from the NIS.

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It should be noted that the avoidance of potentially significant effects through the design process was taken into account through the consideration of each ZoI, as were standard installation practices that are commonplace. When scoping in or out ecological features from further assessment, contractual commitments to environmental measures (see Section 13.4) associated with the Code of Installation Practice have been taken into account (e.g. pollution controls).

[Decommissioning text to be added here, once finalised]

Commented [A37]: Placeholder: Decommissioning text to be added prior to submission of final Application File.

Temporal Scope

The temporal scope of the assessment of the biodiversity assessment is consistent with the period over which the development would be carried out. Namely, installation of the offshore cable route commencing in 2024 and fully operational in 2027 for an estimated duration of 40 years prior to decommissioning.

Significance Evaluation Methodology

CIEEM (2018) defines a significant effect as one *"that either supports or undermines biodiversity conservation objectives for 'important ecological features' or for biodiversity in general*".

When considering potentially significant effects on ecological features, whether these be adverse or beneficial, the following characteristics of environmental change are taken into account[47]:

- **Extent** – the spatial or geographical area over which the environmental change may occur;
- **Magnitude** – the size, amount, intensity or volume of the environmental change;
- **Duration** – the length of time over which the environmental change may occur;
- **Frequency** – the number of times the environmental change may occur;
- **Timing** – the periods of the day/year etc. during which an environmental change may occur; and
- **Reversibility** – whether the environmental change can be reversed through restoration actions.

Magnitude of Change

The approach for defining a scale for the magnitude of the environmental change, on habitats or species, as a result of the Project is described in Table 13.3. This provides an understanding of the relative change from the baseline position, be that adverse or beneficial changes.

[47] The definitions of the characteristics of environmental change are based on the descriptions provided in CIEEM 2018. Other chapters in this EIAR may use some of the same terms albeit with a different definition.

Table 13.3 Guidelines for the assessment of the scale of magnitude – based on CIEEM (2018)

Scale of change	Criteria and resultant effect
High	The change permanently (or over the long-term) affects the conservation status of a habitat/species, reducing or increasing the ability to sustain the habitat or the population level of the species within a given geographic area. Relative to the wider habitat resource/species population, a large area of habitat or large proportion of the wider species population is affected. For designated sites, integrity is compromised. There may be a change in the level of importance of the receptor in the context of the Project.
Medium	The change permanently (or over the long term) affects the conservation status of a habitat/species reducing or increasing the ability to sustain the habitat or the population level of the species within a given geographic area. Relative to the wider habitat resource/species population, a small-medium area of habitat or small-medium proportion of the wider species population is affected. There may be a change in the level of importance of this receptor in the context of the Project.
Low	The quality or extent of designated sites or habitats or the sizes of species' populations, experience some small-scale reduction or increase. These changes are likely to be within the range of natural variability and they are not expected to result in any permanent change in the conservation status of the species/habitat or integrity of the designated site. The change is unlikely to modify the evaluation of the receptor in terms of its importance.
Very Low	Although there may be some effects on individuals or parts of a habitat area or designated site, the quality or extent of sites and habitats, or the size of species populations, means that they would experience little or no change. Any changes are also likely to be within the range of natural variability and there would be no short-term or long-term change to conservation status of habitats/species receptors or the integrity of designated sites.
Negligible	A change, the level of which is so low, that it is not discernible on designated sites or habitats or the size of species' populations, or changes that balance each other out over the lifespan of a Project and result in a neutral position.

13.2.5 Determining Significance – Adverse and Beneficial Effects

Adverse effects are assessed as being significant if the favourable conservation status of an ecological feature would be lost as a result of the Project. Beneficial effects are assessed as those where a resulting change from baseline improves the quality of the environment (e.g.

increases species diversity, increases the extent of a particular habitat etc., or halts or slows down an existing decline). For a beneficial effect to be considered significant, the conservation status would need to positively increase in line with a magnitude of change of 'high' as described in Table 13.3.

Conservation status is defined as follows (as per CIEEM, 2018):

- "*For habitats, conservation status is determined by the sum of the influences acting on the habitat that may affect its extent, structure and functions as well as its distribution and typical species within a given geographical area; and*
- *For species, conservation status is determined by the sum of influences acting on the species concerned that may affect its abundance and distribution within a given geographical area*".

The decision as to whether the conservation status of an ecological feature would alter has been made using professional judgement, drawing upon the information produced through the desk study (ie review of third-party, publicly-available sources), field survey (targeted, site-specific data gathering) and assessment of how each feature is likely to be affected by the Project.

A similar procedure is used where designated sites may be affected by the Project, except that the focus is on the effects on the integrity of each site; defined (in CIEEM, 2018) as:

- "*The coherence of its ecological structure and function, across its whole area, that enables it to sustain the habitat, complex of habitats and/or the levels of populations of the species for which it was classified*".

The assessment of effects on integrity draws upon the assessment of effects on the conservation status of the features for which the site has been designated.

13.2.6 Difficulties Encountered

There were no difficulties encountered in the preparation of this assessment.

Commented [A38]: Placeholder: To be amended in line with specific comments on section, prior to submission of final Application File.

13.3 Receiving Environment

13.3.1 Designated Sites

A number of European and/or national sites that support mobile species that could interact with the Celtic Interconnector Project have been identified. Full details of these sites and designated features are provided in Appendix 13B.

There are four European sites within 5km of the Project, where direct or indirect effects on the designated and supporting habitats have been considered:

- Blackwater River (Cork/Waterford) SAC (Site Code 002170) /proposed Natural Heritage Area;
- Blackwater Estuary SPA (Site Code 004028);
- Ballymacoda (Clonpriest and Pillmore) SAC (Site Code 000077)/pNHA; and
- Ballymacoda Bay SPA (Site Code 004023).

The following sites are designated for populations of fish, and could potentially interact with the Celtic Interconnector Project as the potential ranges of the various migratory fish species, which are designated features intersect with the Project:

- Blackwater River (Cork/Waterford) SAC (Site Code 002170)/pNHA;
- River Barrow and River Nore SAC (Site Code 002162)/pNHA;
- Lower River Suir SAC (Site Code 002137); and
- Slaney River Valley SAC (Site Code 000781) /pNHA.

The following SPAs are designated for populations of birds that could potentially interact with the Celtic Interconnector Project. The following 24 sites have been identified, with the designated interest features that could interact with the Project shown in brackets:

- Blackwater Estuary SPA (Site Code 004028) - all designated features;
- Ballycotton Bay SPA (Site Code 004022) - common gull *Larus canus*, lesser black-backed gull *Larus fuscus*;
- Ballymacoda Bay SPA (Site code 004023) - all designated features;
- Beara Peninsular (Site Code 004155) - Northern fulmar *Fulmarus glacialis*;
- Blasket Islands SPA (Site Code 004008) - Northern fulmar, European storm petrel *Hydrbates pelagicus*, Manx shearwater *Puffinus puffinus*;
- Clare Island SPA (Site Code 004136) - Norther fulmar;
- Cliffs of Moher SPA (Site Code 004005) - Northern fulmar;
- Cork Harbour SPA (Site Code 004030) - common gull, lesser black-backed gull and cormorant *Phalacrocorax carbo*;
- Cruagh Island SPA (Site Code 004170) - Manx shearwater;
- Deenish Island and Scariff Island SPA (Site Code 004175) - Northern fulmar, Manx shearwater;
- Duvillaun Islands SPA (Site Code 004111) - Northern fulmar;
- Helvick Head to Ballyquin SPA (Site Code 004192) - herring gull *Larus argentatus*, cormorant, black-legged kittiwake *Rissa tridactyla*;
- High Island, Inishshark and Davillaun SPA (Site Code 004144) - Northern fulmar;
- Iveragh Peninsula SPA (Site Code 004154) - Northern fulmar;
- Kerry Head SPA (Site Code 004189) - Northern fulmar;
- Lambay Island SPA (Site Code 004069) - Northern fulmar;
- Magharee Islands SPA (Site Code 004125) - European storm petrel;
- Mid-Waterford Coast SPA (Site Code 004193) - herring gull;
- Puffin Island SPA (Site Code 004003) - Northern fulmar, European storm petrel, Manx shearwater;

- Saltee Islands SPA (Site Code 004002) - Atlantic puffin *Fratercula arctica*, Northern fulmar, lesser black-backed gull, Northern gannet, black-legged kittiwake;
- Skelligs SPA (Site Code 004007) - Northern fulmar, European storm petrel, Northern gannet, Manx shearwater;
- Stags of Broad Haven SPA (Site Code 004072) - Leach's storm petrel *Oceanodroma leucorhoa*;
- The Bull and The Cow Rocks SPA (Site Code 004066) - European storm petrel, Northern gannet; and
- Wexford Harbour and Slobs SPA (Site Code 004076) - lesser black-backed gull.

The following SACs are designated for populations of marine mammals in Ireland and could potentially interact with the proposed offshore development. These include all SACs supporting bottlenose dolphin and harbour porpoise, and those supporting common and grey seals on the east coast (excludes 11 sites for common seal and six for grey seal located on the west coast of Ireland), taking into account the MUs for these species, as highlighted above:

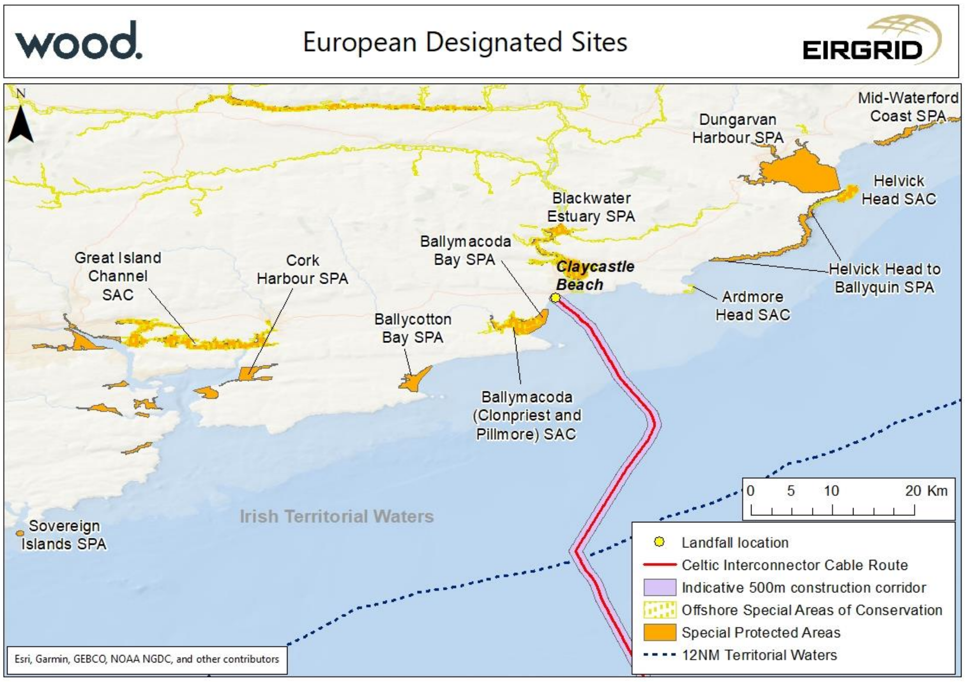
- Lower River Shannon SAC (Site Code 002165) - bottlenose dolphin;
- West Connacht Coast SAC (Site Code 002998) - bottlenose dolphin;
- Roaringwater Bay and Islands SAC (Site Code 000101) - harbour porpoise and grey seal;
- Blasket Islands SAC (Site Code 002172) - harbour porpoise and grey seal;
- Rockabill to Dalkey Island SAC (Site Code 003000) - harbour porpoise;
- Lambay Island SAC (Site Code 000204) - common seal and grey seal;
- Slaney River Valley SAC (Site Code 000781) - common seal; and
- Saltee Islands SAC (Site Code 000707) - grey seal.

SACs located on the west coast of Ireland, that are designated for seals (but not for cetaceans), have not been listed and are not included in the assessment. This is because the distances between the designated sites and the Celtic Interconnector route are in excess of commonly recorded movement patterns for grey seal (145km – Thompson et al., 1996) and common seal (120km – SMRU, 2011).

Figure 13.1 below illustrates the European designated sites within the study area.

Figure 13.1 European Designated Sites within the Study Area

Commented [A39]: Placeholder: Revised figure in preparation, will be included prior to submission of final Application File.



13.3.2 Intertidal and Benthic Habitats and Ecology

In 2018, detailed intertidal surveys were undertaken of the three potential Irish landfall sites being considered at that stage (Ballinwilling Strand, Redbarn Beach and Claycastle Beach). Habitats were classified based on the European EUNIS classification, combining the general environment, nature of sub-strata, littoral zonation, and flora/fauna species present at the site being assessed.

The broad categories, and associated sub-categories of habitat, recorded at Claycastle Beach were as follows:

- A1.2 – Moderate energy littoral rock:
  - A1.212: Fucus spiralis on full salinity exposed to moderately exposed upper eulittoral rock. This sub-habitat was identified on the existing pipe outfall at Claycastle Beach, with species present including limpets, winkles and barnacles. Ephemeral green seaweed is often common during summer months and was recorded during the Project-specific surveys;
- A1.4 – Feature of littoral rock for example, ephemeral algae in the intertidal zone:
  - A1.45: Ephemeral green or red seaweeds (freshwater of sand-influenced) on non-mobile substrata. Although ephemeral green seaweeds were recorded at

Claycastle Beach, the littoral rockpool communities which can be a feature of the habitat were mainly absent;

- A2.2 – Littoral sand and muddy sand: In general, across all sand sub-habitats, limited shell debris was recorded on the sediment surface, with slight rippled patterns as a result of wave action and tidal currents. Species present included communities of amphipods and polychaetes, as well as some barren areas at Claycastle Beach. Sand mason worms were recorded in the lower littoral zones:
  - A2.22: Barren or amphipod-dominated mobile sand shores;
  - A2.23: Polychaete / amphipod-dominated fine sand shores;
  - A2.245: Lanice conchilega in littoral sand;
- A2.4 – Littoral mixed sediment: Areas of A2.43 were observed beneath the drift line at Claycastle Beach, with areas of A2.431 in the midlittoral zone. The underlying substratum for both comprised rock and boulders, with coarse sand also present:
  - A2.43: Species-poor mixed sediment shores;
  - A2.431: Barnacles and Littorina spp. on unstable eulittoral rock;
- B1 – Coastal dunes and sandy shores:
  - B1.2: Sand beaches above the driftline. This was recorded at Claycastle Beach, above the high water mark, formed as a result of sands brought up the beach by wave and wind action; and
- B2 – Coastal shingle:
  - B2.1: Shingle beach driftlines.

In addition, clay outcrops were observed at all three intertidal locations surveyed, with fossilised wood at two sites and peat outcrops at one.

Further offshore, detailed surveys conducted in both Irish Territorial Waters and the Irish Exclusive Economic Zone (EEZ) during 2015 identified a range of habitats along the cable corridor, as presented in Figure 13.2.

Table 13.2 presents the habitats that were recorded along the route of the Celtic Interconnector in Irish Waters.

Table 13.2 Habitats along the route of the Celtic Interconnector in Irish waters

Commented [A40]: Placeholder: Reference, where applicable, to Annex I habitats, to be included prior to submission of final Application File.

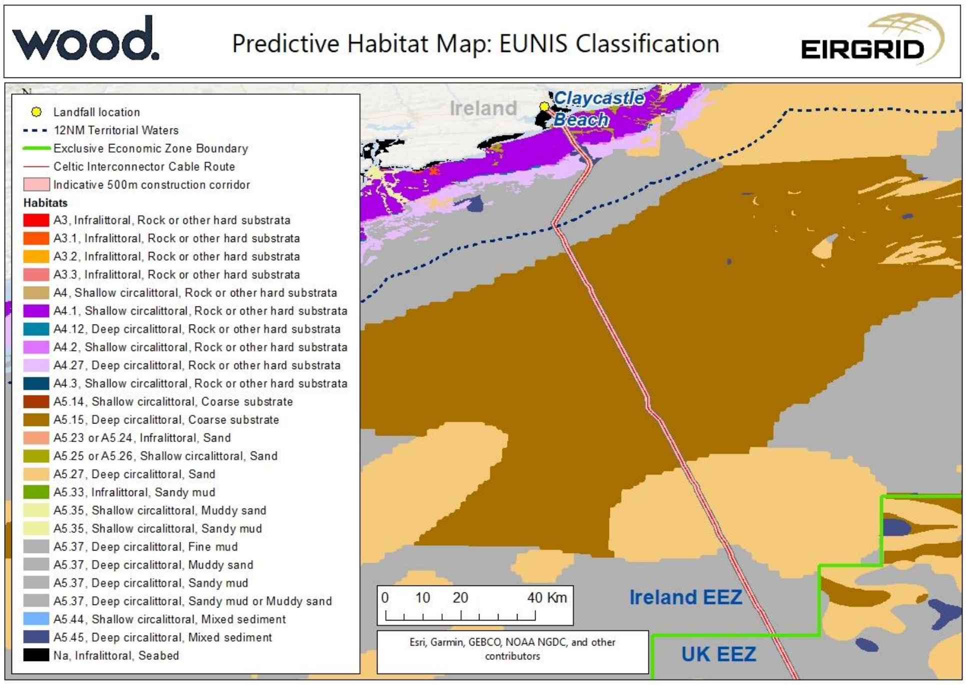
EUNIS Code	Biozone	Substrate	Length present along cable route (km)
A5.15	Deep circalittoral	Coarse substrate	61.1
A5.37	Deep circalittoral	Fine mud	24.9
A5.45	Deep circalittoral	Mixed sediment	5.5
A5.44	Shallow circalittoral	Mixed sediment	1.1

EUNIS Code	Biozone	Substrate	Length present along cable route (km)
A5.37	Deep circalittoral	Muddy sand	22.3
A4.27	Deep circalittoral	Rock or other hard substrata	1.1
A5.27	Deep circalittoral	Sand	22.7
A5.25 / A5.26	Shallow circalittoral	Sand	6.8
A5.37	Deep circalittoral	Sandy mud	1.4
N/A	Infralittoral	Seabed	1.9
N/A	Shallow circalittoral	Seabed	1.9

The distribution of these, and other habitats in the vicinity of the Celtic Interconnector, is shown in Figure 13.2.

Figure 13.2 Predictive Habitat Map of EUNIS Classifications

Commented [A41]: Placeholder: Additional map to be created and inserted here, showing detail of the approach to Claycastle.



The sediment type observed during survey within the Irish Territorial Waters and Irish EEZ showed substrate was variable, ranging from areas of soft rippled sand to large rocks and cobbles. Epifauna was also relatively variable reflecting substrate type with reasonably low abundance in the sandy regions, increasing in areas of cobbles and boulders where a hard substrate was present for encrusting fauna.

The habitats identified through detailed surveys of the cable route are associated with a number of intertidal and subtidal communities.

Along the cable route on the approach to Claycastle Beach, the benthic community is characterised by the presence of species groups including cnidaria, nemertea, annelida, arthropoda, mollusca, phoronida, and echinodermata. These form important elements of complex marine and coastal foodwebs, providing prey species for fish populations, and subsequently birds and marine mammals. Surveys along the route's entirety did not identify any environmental sensitive habitats or benthic communities, or the presence of confirmed or potential areas of Annex I habitats, as listed under the EC Habitats Directive (such as biogenic reefs, or subtidal pockmark features). However, one area of medium-stony 'reefiness' (the extent to which the worms create a reef) was identified on the approach to Claycastle Beach; such reefs can form key habitats for other species, and may develop in importance over time, but in this case, the area is not of priority, Annex I status or importance.

13.3.3 Natural Fish Ecology (including basking shark)

Characterisation of fish stocks within the near shore and intertidal zone has been drawn from the IFI Blackwater (Munster) Estuary fish surveys (IFI, 2008). A total of 24 species were recorded in the lower estuary around Youghal, ranging from adventitious freshwater species, e.g. dace (*Leuciscus leuciscus*) to fully marine species, e.g. cod (*Gadus morhua*). A number of diadromous species (fish that migrate between river and sea to complete their lifecycle) such as Atlantic salmon (*Salmo salar*), sea tout (*Salmo trutta*), European eel (*Anguilla anguilla*),and smelt (*Osmerus eperlanus*). The most commonly occurring species in the lower estuary were common goby (*Pomatoschistus microps*), which were recorded at 11 sites throughout the estuary and flounder (*Platichthys flesus*), recorded at eight sites. The most abundant species were common goby, sprat (*Sprattus sprattus*), flounder and European smelt (*Osmerus eperlanus*). Two migratory species known to frequent the Blackwater River were not recorded in the transitional and intertidal surveys including sea lamprey (*Petromyzon marinus*) and Twaite shad (*Alosa fallax*). Elliott and Taylor (1989) and UK TAG (2012) define a number of ecological guilds that can be used to describe how different species use an estuary (Table 13.3). Details of the species commonly occurring in the intertidal areas of Youghal Bay are listed in Table 13.4.

Table 13.3 List of ecological guilds, their abbreviated forms and notes on estuarine use (Elliott and Taylor, 1989)

Number	Ecological Guild (abbreviated form)	Use of Estuary
1	Adventitious freshwater species (FW)	Freshwater species with no estuarine requirement
2	Estuarine residents (ER)	Spend whole life in estuary
3	Adventitious marine species (MA)	Marine species with no estuarine requirement
4	Marine seasonal (MS)	Marine species with seasonal migrations to the estuary as adults
5	Marine juvenile (MJ)	Marine species using the estuary as a nursery area
6	Diadromous species (DA)	Species that use estuaries during migrations between marine and freshwater habitats

Table 13.4 Fish species recorded in the Lower Blackwater Estuary and their Ecological Guilds (source, IFI 2008).

IRL 2011 - Red list status for Ireland based on this assessment; CR - Critically Endangered, VU – Vulnerable, NT - Near Threatened, dd - data deficient, lc – least concern; na– not assessed.

Species	***Scientific Name***	**Conservation Status IRL 2011 (King et al., 2011)**	**EU HD Protection**	**Functional Guild**
2-spotted goby	*Gobiusculus flavescens*	na	-	MA
3-spined stickleback	*Gasterosteus aculeatus*	lc	-	DA
5-bearded rockling	*Ciliata mustela*	xx	-	MS
Atlantic salmon	*Salmo salar*	VU	Annex II & V	DA
Brown trout	*Salmo trutta*	lc	-	DA
Cod	*Gadus morhua*	na	-	MJ
Common goby	*Pomatoschistus microps*	na	-	ER
Dab	*Limanda limanda*	na	-	MJ
European eel	*Anguilla anguilla*	CR	Annex II	DA
European sea bass	*Dicentrarchus labrax*	na	-	MJ
Flounder	*Platichthys flesus*	lc	-	ER
Golden-grey mullet	*Liza aurata*	na	-	MS
Greater pipefish	*Syngnathus acus*	na	-	ER
Lesser sandeel	*Ammodytes tobianus*	na	-	ER
Plaice	*Pleuronectes platessa*	na	-	MJ
Pollock	*Pollachius pollachius*	na	-	MJ

Species	*Scientific Name*	Conservation Status IRL 2011 (King et al., 2011)	EU HD Protection	Functional Guild
River lamprey*	*Lampetra fluviatilis*	lc	Annex II & V	DA
Sea lamprey*	*Petromyzon marinus*	NT	Annex II.	DA
Smelt	*Osmerus eperlanus*	lc	-	DA
Sprat	*Sprattus sprattus*	na	-	MJ
Thick lipped grey mullet	*Chelon labrosus*	na	-	MS
Twaite shad*	*Alosa fallax*	VU	Annex II & V.	DA
Whiting	*Merlangus merlangus*	na	-	MJ

* Species known to frequent the tideway but not recorded by IFI (2008)

A number of commercial species of fish use areas of Irish Territorial Waters occupied by the proposed interconnector cable route for both spawning and nursery grounds (see Volume 3D Part 2 EIAR for Ireland Offshore (Specialist Chapters) – Chapter 19: Commercial Fisheries). Atlantic herring (*Clupea harengus*) and whiting (*Merlangius merlangus*) both spawn in shallow, nearshore waters. Atlantic herring spawn between September and February and within typically patchy historic spawning sites. Whiting spawn between January and July in shallow water less than 30m deep. Juveniles of both species utilise coastal waters for nursery habitat (Coull 1998; Ellis et al., 2012). Haddock (*Melanogrammus aeglefinus*) also spawn within coastal waters to the west of the cable route, with juveniles remaining in the coastal waters adjacent to the cable route throughout the year (Connolly, 2009; Marine Institute 2020).

Atlantic cod are pelagic spawners and show a high fidelity to defined spawning grounds, spawning between May and December around Ireland and the UK. Their larvae drift close inshore to the shallow waters and estuaries of the Irish coast which provide suitable nursery grounds, moving into deeper water as size increases (Bastrikin et al. 2014). The proposed interconnector cable route will bisect spawning grounds for this species located off the coast near Waterford.

Both Atlantic mackerel (*Scomber scombrus*) and horse mackerel (*Trachurus trachurus*) spawn extensively offshore, to the southwest of Ireland in May with eggs and larvae drifting east with the young-of-year moving inshore to nursery grounds throughout coastal waters along the south east coast (Marine institute, 2020). Hake (*Merluccius merluccius*) and megrim (*Lepidorhombus whiffiagonis*) spawn off the south and southwest of Ireland with juveniles moving inshore to nursery grounds along the length of the Irish southern coastline(Connolly et al 2009; Ellis et al., 2012; Marine Institute, 2020).

Ireland has designated a series of (predominantly) freshwater SACs for habitats of the fish species listed under Annex II of the Habitats Directive (*inter alia* Atlantic salmon, twaite shad, and the three lamprey species). The purpose of the designated sites is to maintain or, where appropriate, restore populations to a favourable conservation status in their natural range (NPWS, 2012).

The Project does not intersect with these SACs. However, four of the above Annex II fish species do frequent the waters in the vicinity of the proposed cable route, namely: sea lamprey, river lamprey (*Lampetra fluviatilis*), twaite shad and Atlantic salmon (King and Linnane 2004; IFI 2008; NPWS, 2012).

The cable landfall at Claycastle Beach lies adjacent to the Blackwater River (Cork/Waterford) SAC designated for migratory fish (NPWS, 2021b). Catchments to the east and west of Youghal Bay also support populations of migratory fish that are qualifying features of these waters' conservation designations (NPWS 2021). These diadromous species of fish forage in coastal and offshore waters returning to freshwater to spawn. The proposed cable route will intersect the migratory pathways of these fish as the move to and from their natal waters.

The following Irish SACs are designated for populations of migratory fish, that could potentially interact with the Celtic Interconnector Project:

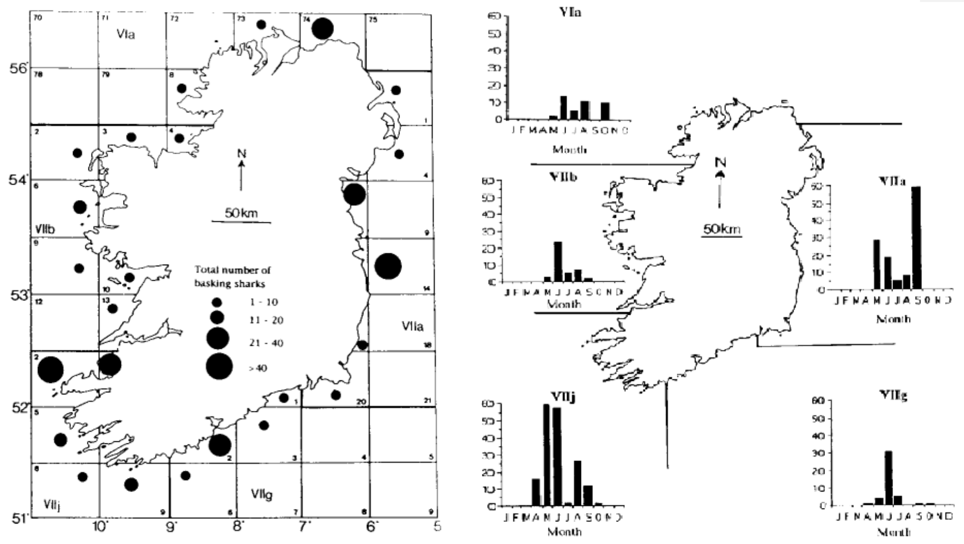
- Blackwater River (Cork/Waterford) SAC (Site code: IE002170). The Blackwater River is located approximately 1.75 km to the east of the Claycastle Beach landfall site;
- River Barrow and River Nore SAC (Site code: IE002162). The mouth of the River Barrow lies approximately 65 km to the east of the Claycastle Beach landfall site;
- Lower River Suir SAC (Site code: IE 002137). The River Suir is a principal tributary of the River Barrow, with their confluence in the tidal reach. The mouth of the River Barrow lies approximately 65 km to the east of the Claycastle Beach landfall site; and
- Slaney River Valley SAC (Site code: IE000781) The mouth of the Slaney River lies approximately 110 km to the east of the Claycastle Beach landfall site.

The European eel is listed by the International Union for Conservation of Nature (IUCN) as a Critically Endangered species, and is assessed as such in the Irish Red List (King et al., 2011). The fish frequents coastal waters and freshwater system around Ireland and could interact with the Celtic Interconnector Project (Moriarty, 1975; IFI, 2008).

Basking shark (*Cetorhinus maximus*) is classified as of Vulnerable status in the Global IUCN Red List status, and is Endangered in Irish waters (Clarke et al., 2016). Basking Shark is known to frequent the waters off the south coast of Ireland (Berrow and Heardman, 1994). These fish move eastwards into coastal waters from the deeper waters of the Atlantic in the spring (April) where they remain until as late as October before moving back offshore. During the summer months these fish may a significant amount of their time feeding on the surface, although feeding also takes place subsurface. There is a paucity of data regarding basking shark population estimates in Ireland, and little is known of their behavioural and feeding habits within near shore environments (IBSG, 2019).

Figure 13.3 illustrates seasonal distribution and abundance of basking shark by ICES rectangle for the period 1993.

Figure 13.3 Seasonal distribution and abundance of basking shark by ICES rectangle for the period 1993 – (source Berrow and Heardman, 1994)



13.3.4 Ornithology

Wetland bird surveys undertaken in 2019 and 2020 within the intertidal areas and adjoining fields at Redbarn – Claycastle Beach (covering approximately 2.1km of the beach and 9ha of agricultural fields) identified a total of 22 species. The working area at the landfall point at Claycastle is approximately 20m wide, and therefore occupies only a small proportion of the survey area. The survey area was split into five count sectors (plus some fields behind the beach), with the proposed landfall area being on the boundary between count sections three and four.

Initial surveys were completed in February and March 2019 at high tide and low tide, following a methodologies based on the Irish Wetland Bird Survey (I-WeBS) methodology (Boland and Crowe, 2012) (for high tide counts) and similar methods for low tide counts (Lewis and Tierney, 2014). The high-tide counts used a ‘snapshot’ approach, recording the number of birds present over high tide only whilst the low tide counts used a four-hour observation period, centred on low tide.

Between November 2019 and March 2020 the same area was surveyed using similar methods though the high tide counts were extended to four hours of observation, centred on high tide (as per the low tide methodology. Each month four hours of observation were completed around low tide (20 hours in total), and high tide (20 hours in total). Tables 13.5 and 13.6 provides a summary of the survey results across all five count sectors for context with data from sectors three and four highlighted; the full survey reports are provided at Appendix 13A.

Commented [A42]: Placeholder: All appendices currently in prep / under review, and will be provided with the final Application File.

Table 13.5 A summary of wintering bird survey information gathered at Redbarn – Claycastle Beach between February and March 2019

Species	High Tide Peak (sectors three and four only in parentheses)	Low Tide Peak (sectors three and four only in parentheses)	Birds of Conservation Concern (BoCC) in Ireland	All Ireland Population[48]	Peak % of all-Ireland non-breeding population recorded in survey area
Grey Heron *(Ardea cinerea)*	0 (0)	1 (0)	Green	2,610	<0.1
Cormorant (*Phalacrocoracidae*)	1 (0)	0 (0)	Amber – B&W	10,870	<0.1
Oystercatcher (*Haematopus Ostralegus)*	14 (0)	29 (14)	Amber – B&W	60,540	<0.1
Curlew (*Numenius)*	57 (0)	16 (0)	Red – B&W	35,240	0.16
Bar-tailed godwit (*Limosa Lapponica*)	0 (0)	6 (0)	Amber - W	16,530	<0.1
Sanderling (*Calidris alba)*	0 (0)	88 (25)	Green	8,420	1.04
Redshank (*Tringa totanus*)	0 (0)	1 (0)	Red – B&W	23,800	<0.1
Black-headed gull (*Chroicocephalus ridibundus*)	4 (0)	22 (9)	Red - B	13,983*	N/A
Common gull (*Larus canus*)	14 (4)	15 (1)	Amber - B	1,617*	N/A
Great black-backed gull (*Larus marinus)*	0 (0)	8 (0)	Amber - B	2,319*	N/A
Herring gull (*Larus argentatus*)	0 (0)	23 (4)	Red - B	6,235*	N/A

[48] All entries not marked with an * are expressed as the number of non-breeding individuals taken from Burke et al. 2019. In the absence of accurate non-breeding population estimates for gull species, those with an * are numbers of apparently occupied nests (AON) from the Seabird Monitoring Report 1986 – 2018 and are likely to represent a significant underestimate of the non-breeding population.

Species	High Tide Peak (sectors three and four only in parentheses)	Low Tide Peak (sectors three and four only in parentheses)	Birds of Conservation Concern (BoCC) in Ireland	All Ireland Population[48]	Peak % of all-Ireland non-breeding population recorded in survey area
Lesser black-backed gull (*Larus fuscusl*)	0 (0)	4 (4)	Amber - B	4,849*	N/A

Table 13.6 A summary of the wintering bird survey information gathered at Redbarn – Claycastle Beach between November 2019 and March 2020

Species	High Tide Peak (sectors three and four only in parentheses)	Low Tide Peak (sectors three and four only in parentheses)	Birds of Conservation Concern (BoCC) in Ireland	All Ireland Population[49]	Peak % of all-Ireland population recorded in survey area
Mute swan (*Cygnus olor*)	0 (0)	5 (0)	Green	9,130	<0.1
Mallard (*Anas platyrhynchos*)	0 (0)	2 (0)	Green	28,230	<0.1
Teal (*Anas crecca*)	26 (0)	15 (0)	Amber – B&W	35,740	<0.1
Eider **(***Somateria*)	2 (0)	0 (0)	Amber – B&W	5,660	<0.1
Cormorant (*Phalacrocorax carbo*)	1 (1)	3 (0)	Amber – B&W	10,870	<0.1
Shag (*Phalacrocorax aristotelis)*	17 (0)	5 (0)	Amber – B	Not available	-
Little egret (*Egretta garzetta*)	3 (0)	3 (0)	Green	1,390	0.2

[49] All entries not marked with an * are expressed as the number of non-breeding individuals taken from Burke et al. 2019, those with an * are numbers of apparently occupied nests (AON) from the Seabird Monitoring Report 1986 – 2018

Species	High Tide Peak (sectors three and four only in parentheses)	Low Tide Peak (sectors three and four only in parentheses)	Birds of Conservation Concern (BoCC) in Ireland	All Ireland Population[49]	Peak % of all-Ireland population recorded in survey area
Grey heron (*Ardea cinerea*)	1 (0)	0 (0)	Green	2,610	<0.1
Water rail (*rallus aquaticus*)	0 (0)	1 (0)	Green	Not available	-
Oystercatcher (Haematopus Ostralegus)	42 (38)	13 (8)	Amber – B&W	60,540	<0.1
Grey plover (*Pluvialis squatarola*)	0 (0)	1 (0)	Amber - W	2,940	<0.1
Ringed plover (*Charadrius hiaticula*)	20 (20)	0 (0)	Green	11,660	0.17
Sanderling (*Calidris alba*)	50 (50)	84 (38)	Green	8,420	0.99
Turnstone (*Arenaria)*	1 (0)	0 (0)	Green	9,480	<0.1
Dunlin (*Calidris alpine*)	1 (0)	0 (0)	Red – B&W	45,760	<0.1
Redshank (Tringa totanus)	1 (0)	2 (0)	Red – B&W	23,800	<0.1
Bar-tailed godwit (*Limosa lapponica*)	0 (0)	152 (0)	Amber - W	16,530	0.9
Curlew (*Numenius*)	76 (0)	85 (0)	Red – B&W	35,240	0.24
Black-headed gull (*Chroicocephalus ridibundus*)	4 (2)	18 (5)	Red - B	13,983*	0.12
Common gull (*Larus canus*)	15 (12)	31 (3)	Amber - B	1,617*	N/A
Herring gull (*Larus argentatus*)	9 (4)	52 (9)	Red - B	6,235*	N/A
Great black-backed gull (*Larus marinus)*	6 (4)	6 (0)	Amber - B	2,319*	N/A

Numbers of non-breeding water birds recorded during the surveys between Redbarn / Claycastle were generally low, particularly at high tide where there is little habitat available as the high-water level typically reaches the foot of the sand dunes and coastal walkway. The walkway is also popular with walkers and dog walkers meaning that levels of human disturbance are quite high which further discourages birds from roosting in this area. A total of 22 different species were recorded across the low and high tide surveys and featured a range of coastal bird species.

Of the species recorded, only bar-tailed godwit and sanderling occurred in notable numbers. 152 Bar-tailed godwit were recorded in January 2020 representing 0.9% of the all-Ireland population of this species. Sanderling also occurred in notable numbers with a peak count of 159 individuals recorded in March 2020 representing 1.88% of the all-Ireland population of this species.

The proposed working area required for the landfall point at Claycastle Beach is approximately 14m wide, and therefore occupies only a small proportion of the survey area centred approximately on the boundary between count sectors 3 and 4. Based on this, birds which were recorded in count sectors 3 and 4 would represent those most at risk of being affected by the project. The only records of bar-tailed godwit from January 2020 and February 2020 both occurred in count sector 1 which is between 700m and 1,200m south-west of the proposed landfall location. Curlew were recorded during surveys, with peak counts of up to 85 individuals, however these records were all restricted to inshore agricultural fields located behind the beach.

Only eight of the 22 species were recorded in count sectors 3 and 4. Of the eight species recorded close to the proposed landfall point cormorant and ringed plover were noted on a single occasion across count sectors three and four only (both in November 2019). Sanderling and oystercatcher were the only wading birds noted occurring with any frequency in either count sector and therefore within 300m of the landfall point.

A peak count of 159 Sanderling was recorded during a nearshore survey in March 2020 with a foraging flock recorded in the centre of count sector 3. Sanderling were also noted at high tide on a single occasion (50 birds November 2019), with low tide surveys recording 25 birds in February 2019, two birds in November 2019 and 38 in December 2019. This suggest that their usage of the area is sporadic. Oystercatcher were noted at high tide on a single occasion, November 2019, when 38 individuals were recorded. Small numbers (<5) were also noted at low tide in February and March 2019 and between November 2019 and January 2020.

Of the other four species noted in count sector three and four, all were gull species (Black-headed Gull, Herring Gull, Lesser Black-backed Gull, Great Black-backed Gull) with peak counts recorded at low tide.

All of the other species were; recorded on a single occasion; only in very small numbers (<0.5% of all-Ireland population) within the survey area; or were only recorded in fields behind the beach.

The count data collected in February and March 2019 shows no obvious differences with the data collected between November 2019 and March 2020 with a similar species composition and peak counts recorded.

Surveys for birds using the nearshore environment (comprising the intertidal area and marine habitats visible from the vantage point) were undertaken for three hours per month (total of 15 hours) between November 2019 and March 2020 with counts at high, mid and low tides. The area counted was centred on the potential landfall location, with fifteen species were recorded, as presented in Table 13.7.

Table 13.7 A summary of the nearshore bird survey information gathered at Claycastle Beach between November 2019 and March 2020

Species	Peak count	Mean	BoCC in Ireland[7]	All Ireland Population[8]
Brent goose (*Branta bernicla*)	15	5.4	Amber - W	35,150
Common scoter (*Melanitta nigra*)	2	0.4	Red - B	10,640
Gannet (*Morus*)	5	1	Amber - B	47,946**
Cormorant (*Phalacrocorax carbo*)	13	6.2	Amber – B&W	10,870
Shag (*Phalacrocorax aristotelis*)	1	0.2	Amber – B	Not available
Oystercatcher (*Haematopus Ostralegus)*	36	9.4	Amber – B&W	60,540
Ringed plover (*Charadrius hiaticula*)	12	2.4	Green	11,660
Sanderling (*Calidris alba*)	159	40	Green	8,420
Dunlin (*Calidrus alpina*)	21	4.2	Red – B&W	45,760
Black-headed gull (*Chroicocephalus ridibundus*)	143	70.6	Red - B	13,983*
Common gull (*Larus canus*)	153	55.6	Amber - B	1,617*
Herring gull (Larus argentatus)	212	101.6	Red - B	6,235*
Great black-backed gull (*Larus marinus)*	54	28.4	Amber - B	2,319*
Lesser black-backed gull (*Larus fuscusl*)	34	6.8	Amber - B	4,849*
Kittiwake	18	3.6	Amber - B	49,160*

Species	Peak count	Mean	BoCC in Ireland[7]	All Ireland Population[8]
(*Rissa*)				

Of the 15 species recorded, seven were present in numbers representing less than 1% of the All Ireland population. The five species of gulls recorded were the most common type of bird noted, as would be expected in this type of area.

Considering the results of the wintering bird survey and the recording of birds in the nearshore environment, the species occurring in numbers in excess of 0.1% of the All-Ireland population (at peak) in either of the survey formats and being recorded on two or more occasions is presented below. Of these species, those highlighted in bold text, are those that were recorded within 300m of the proposed landfall point and those with an * are listed on the designations for the two closest SPAs (namely Ballymacoda Bay and the Blackwater Estuary). The following species are considered further in Section X

- Cormorant;
- Shag
- Little egret;
- Oystercatcher;
- **Ringed plover***;
- **Sanderling***;
- **Bar-tailed godwit***;
- **Curlew***;
- **Black-headed gull***;
- **Common gull***;
- Herring gull;
- Great black-backed gull; and
- **Lesser black-backed gull***.

Further from the coast, published data demonstrates that a wide range of seabirds are regularly recorded in the area including manx shearwater, Northern gannet, kittiwake, guillemot and razorbill. Sources include:

- Mackey, M., Ó Cadhla, O., Kelly, T.C., Aguilar de Soto, N. & Connolly, N. (2004). Cetaceans and Seabirds of Ireland's Atlantic Margin. Volume I – Seabird distribution, density & abundance. Report on research carried out under the Irish Infrastructure Programme (PIP): Rockall Studies Group (RSG) projects 98/6 and 00/13, Porcupine Studies Group project P00/15 and Offshore Support Group (OSG) project 99/38. 95pp; and
- European Seabirds at Sea (ESAS) database coordinated by the Joint Nature Conservation Committee (JNCC)**Error! Bookmark not defined.**.

No birds were recorded breeding below MHWM during breeding bird surveys completed in 2019, therefore, breeding birds are not considered further within this chapter. Potential effects on breeding birds as a result of terrestrial elements of the Project are considered in Volume 3C.

13.3.5 Marine Mammals and Reptiles

The Celtic and Irish Seas support a variety of marine mammals, including cetaceans and seals. A total of twenty-four[50] cetacean species have been recorded throughout Irish waters, with the most commonly recorded of these being common dolphin (*Delphinus delphis*), bottlenose dolphin (*Tursiops truncatus*) and harbour porpoise (*Phocoena phocoena*) with populations present year-round. Other species recorded include minke whale (*Balaena acutorostrata*) and humpback whale (*Megaptera novaeanglilae*). The Irish Whale and Dolphin Group (IWDG) collates records of sightings and strandings within Irish waters, as well as undertaking constant effort surveys at vantage points along the Irish coast. Recent (February 2021) coastal sightings have included a fin whale (*Balaenoptera physalus*) and a pod of 20 unidentified dolphins off Helvick Head, Co. Waterford.

Both grey and harbour seals are also present in Irish waters, with the majority of the populations being present along the western coast. Both species are present year-round, with individuals regularly passing between Irish and UK EEZ. The NPWS compiles a 'seal database', collating observations of both grey and common seals, from a range of sources and surveys. This holds a number of historic records (ranging from 1960 to 1981) within the Claycastle Beach area, for both grey and common seal. Grey seals resident off the Cork coast comprise part of the North-east Atlantic population of approximately 100,000 individuals, 80% of which are located around the shores of Ireland and Britain. For harbour seals, there are an estimated 30,000 in Irish and UK EEZ.

All marine mammals are afforded strict protection under the Habitats Directive against deliberate capture, killing, or disturbance as well as against the deterioration or destruction of breeding sites or resting places (i.e. even where not deliberate). All marine mammals are also protected in Ireland by the Wildlife Acts.

Ireland has designated a series of SACs for bottlenose dolphin, harbour porpoise, grey seal and harbour seal, whose Conservation Objectives protect the populations therein. Cetacean species recorded in Irish waters are also considered within the Conservation Plan for Cetaceans in Irish Waters (Department of the Environment, Heritage and Local Government ,2009).

A number of SACs are designated for populations of marine mammals in Ireland and their qualifying features/species could potentially interact with the Celtic Interconnector Project. These include all SACs supporting bottlenose dolphin and harbour porpoise, and those supporting common and grey seals on the east coast (eleven sites for common seal and six sites for grey seal located on the west coast of Ireland), as presented under 'Designated Sites' above.

[50] It should be noted that different sources quote either 24 or 25 species as having been recorded in Irish Waters. The record of 24 species is provided by the NPWS.

Throughout all relevant works undertaken to date for the Celtic Interconnector Project, including seabed surveys, MMOs have been present on the survey vessels. The role of an MMO is to monitor for the presence of marine mammals, and where noise-generating works are being completed (for example geophysical surveys), that direct and indirect impact risks (mortality, hearing loss and/or disturbance) are mitigated and operations are controlled when animals come within close proximity prior to the sound source being generated e.g. 500-1,000m.

During the MMO surveys from October-November 2017, a total effort of just under 136 hours of surveys was undertaken, recording 18 sightings of an estimated 92 individual animals, comprising four species: harbour porpoise, common dolphin, Atlantic white-sided dolphin (*Lagenorhynchus acutus*) and grey seal. A number of unidentified dolphins were also recorded. Across all MMO surveys along the route of the Celtic Interconnector, species were recorded in water depths ranging from 7.3m to 77.6m.

Due to their similar wide-ranging nature, sea turtles have been included within this section, although the likelihood of encountering them during works on the project are low, with only one sighting noted within 35km of the site, in 1983. The Irish Sea Leatherback Turtle Project (2003-2006) was established to increase knowledge of leatherback turtles in the waters around Wales and Ireland. Work included tracking of turtles to understand their movements, and aerial surveys of their primary food source: jellyfish. Individuals migrate to the waters off Western Europe to feed and are well-adapted for conditions within the Celtic Sea. Of a total of 682 records of leatherback turtles between 1960 and 2004 in Irish and UK EEZ, 161 were from Irish waters, with numbers highest along the south and west coasts, mostly during summer months (July to October), with a peak in August. Other turtle species recorded in Irish waters have included the green turtle, hawksbill turtle, Kemp's Ridley turtle and loggerhead turtle. From King, G.L. & Berrow, S.D. (2009) the number of records for each of these species and their proximity to the Project area are presented below:

- Green turtle - 1 record in 1995 - 133km to the south west of the Project area and off the coast near Cape Clear Island;
- Hawksbill turtle - 1 record in 1983 - 34km to the south west of the Project area and off the coast at Roches Point;
- Kemp's Ridley turtle - 10 records from 1921 to 1993 - closest >200km from the Project area on the west coast, near Whiddy Island, at the head of Bantry Bay; and
- Loggerhead turtle - 52 records from 1838 to 2005 - majority along the west coast of Ireland, but also records to the south west, within the Project area (off Youghal) and to the east/north east.

13.4 Mitigation / Embedded Measures Section

Throughout works to install both the cable itself, and associated external rock protection, a number of embedded mitigation works have been incorporated into project design. Mitigation specific to biodiversity aspects of the assessment includes:

- Project-related vessels to be operated in line with IMO Guidelines for the reduction of underwater noise to address adverse impacts on marine life;

Commented [A43]: Placeholder: To be reviewed in line with NPWS documentation prior to submission of final Application File.

Commented [A44]: Placeholder: To be reviewed and amended in line with any project amendments, and referencing the Rochdale Envelope, prior to submission of the final Application File.

Commented [A45]: Placeholder: All mitigation and monitoring measures remain under review / discussion, and will be confirmed prior to submission of the final Application File.

- Operations in the Irish marine environment will be undertaken in line with the 'Guidance to manage the risk to marine mammals from man-made sound sources in Irish waters', as published by the Department of Arts, Heritage and the Gaeltacht in 2014.;
- Works to be limited to daylight hours to reduce impact to birds and other receptors from increase noise and human presence during installation at sea and landfall;
- Seek to avoid noisiest works in January and February as these months typically coincide with peaks in bird numbers as reported on in the wintering and monthly bird surveys undertaken in 2019 and 2020, and as recorded at high and low tide at the landfall point, and elevated sensitivity due to heightened food scarcity and winter climatic conditions;
- Use of noise-attenuation fencing, solid hoarding or other acoustic barriers to reduce noise propagation and conceal human activity;
- Use of piling types and techniques that limit noise propagation such as vibratory sheet piling installation;
- Use soft start piling techniques to prevent birds, and other receptors from being startled;
- Project-related vessels will adhere to international best practise regarding pollution control, including the MARPOL convention;
- Use of appropriate installation equipment, determined by seabed type, will be used, indirectly minimising seabed disturbance, subsequent release of sediment into the water column, and indirect effects on benthic habitats and species; and
- Use of appropriate burial depths (0.8-2.5m) and heat shielding during cable installation will indirectly reduce effects from heat emissions and electro-magnetic fields (EMF).

Commented [A46]: Placeholder: Status of winter works to be confirmed prior to submission of final Application File.

13.5 Scope of the Assessment

Ecological features that are scoped into the assessment (i.e. those of conservation or ecological importance occurring within a relevant ZoI) are summarised in Table 13.8, along with a summary of the justification for inclusion. For each ecological feature presented in Table 13.8, the potential environmental changes and significant effects resulting from the Project are provided.

Table 13.8 Likely effects, ZoIs and justification for scoped-in ecological features

Ecological feature	Importance – legislation and policy	Importance – Project	Environmental changes and likely significant effects	Zone of influence	Relevant assessment criteria and scoped-in / out justification
European Sites (SPAs) that include bird species as a designated feature	European	European	Disturbance due to installation works Temporary habitat loss from installation works including due to increases in suspended sediment. Pollution events reducing habitat quality or having direct toxic effects	Variable dependent on species foraging range as identified in Woodward *et al* 2019	Scoped out – Assessment of potential impacts on European Sites is presented in Volumes 6B and 11, for Irish and UK EEZ, respectively, in full. Potential effects on designated features of Ballymacoda Bay SPA and Blackwater Estuary SPA, (i.e. European sites closest to proposed cable route), are considered through individual species accounts below.
Cormorant	European	Local	Disturbance due to installation works. Temporary habitat loss from installation works including due to increases in suspended sediment.	300m	Scoped out – seen regularly within the near-shore environment in small numbers. The species ranging nature ensures any temporary habitat loss (through disturbance or suspended sediment) would represent a fraction of available habitat. This species is not reliant on the intertidal habitats and is therefore mainly likely to fly past the working area reducing exposure to

Commented [A47]: Placeholder: Table to reviewed and updated subject to additional information, prior to submission of final Application File. This will include, as appropriate, consideration of the discussion of mitigation within the table.

Ecological feature	Importance – legislation and policy	Importance – Project	Environmental changes and likely significant effects	Zone of influence	Relevant assessment criteria and scoped-in / out justification
			Pollution events reducing habitat quality or having direct toxic effects.		human or construction disturbance. This species is also tolerant of human disturbance.
Shag	European	Local	Disturbance due to installation works. Temporary habitat loss from installation works including due to increases in suspended sediment. Pollution events reducing habitat quality or having direct toxic effects.	300m	Scoped out – seen regularly within the near-shore environment in small numbers. The species ranging nature ensures any temporary habitat loss (through disturbance or suspended sediment) would represent a fraction of available habitat. This species is not reliant on the intertidal habitats and is therefore mainly likely to fly past the working area reducing exposure to human or construction disturbance.
Little egret	European	Local	Disturbance due to installation works.	300m	Scoped out – whilst this species could be associated with intertidal habits this species was only recorded during surveys in association with Ballyvergen Marsh above MHWM and over 300m from the proposed landfall point.

Ecological feature	Importance – legislation and policy	Importance – Project	Environmental changes and likely significant effects	Zone of influence	Relevant assessment criteria and scoped-in / out justification
Oystercatcher	European	Local	Disturbance due to installation works. Temporary habitat loss from installation works including due to increases in suspended sediment. Pollution events reducing habitat quality or having direct toxic effects.	300m	Scoped out – although the area within which installation activity is proposed was used regularly by this species, numbers were not great enough for a detectable effect on local population to be observed. The installation works represent a temporary displacement from a small area, that is already prone to disturbance by beach users. At distances over 200m the potential for disturbing and displacing individual birds is low to negligible (Cutts, Phelps & Burdon 2009) meaning there are large areas of suitable habitat already in use by this species in the immediate vicinity. It is not expected that any behavioural changes by individual birds would be great enough to significantly reduce energy intake due to the availability of adjacent habitat already in use, and therefore over-winter survival and future productivity would not be affected.
Ringed plover	European	Local	Disturbance due to installation works. Temporary habitat loss from installation works including due to increases in	300m	Scoped out – this species was recorded on a single occasion in the intertidal (in numbers representing 0.17% of the All-Ireland wintering population) and the near shore environment respectively. This low level of usage suggests that the area that may be subject to the effects of landfall installation does not form a core resource used by this species. Therefore, any changes

Ecological feature	Importance – legislation and policy	Importance – Project	Environmental changes and likely significant effects	Zone of influence	Relevant assessment criteria and scoped-in / out justification
			suspended sediment. Accidental (minor) pollution events (eg fuel or chemical leaks from vessels associated with the project) reducing habitat quality or having direct toxic effects.		within this area would not unduly compromise the fitness of any individual birds or the local population.
Sanderling	European	National	Disturbance due to installation works. Temporary habitat loss from installation works including due to increases in suspended sediment. Pollution events reducing habitat	300m	Scoped in – peak numbers of sanderling (when commuting through the nearshore environment) equated to 1.9% of the national population. Sanderling have been recorded within the ZoI and other habitats within the intertidal zone. Works within the intertidal zone, although temporary in nature, will cause disturbance to, temporary loss of habitats for Sanderling. Scoped out – Embedded measures to avoid and minimise the risk of pollution events mean that potential

Ecological feature	Importance – legislation and policy	Importance – Project	Environmental changes and likely significant effects	Zone of influence	Relevant assessment criteria and scoped-in / out justification
			quality or having direct toxic effects		impacts are unlikely and therefore not considered further for assessment.
Bar-tailed godwit	European	Local	Disturbance due to installation works. Temporary habitat loss from installation works including due to increases in suspended sediment. Pollution events reducing habitat quality or having direct toxic effects.	200m	Scoped out – bar-tailed godwits were only recorded in areas more than 700m from the proposed landfall location (and associated installation areas) where potential effects of the development would not occur.
Curlew	European	Local	Disturbance due to installation works. Temporary habitat loss from installation works including due to increases in	300m	Scoped out – whilst this species could be associated with intertidal habitat curlew were predominantly recorded in association with Ballyvergen Marsh and adjacent agricultural lands above MHWM

Ecological feature	Importance – legislation and policy	Importance – Project	Environmental changes and likely significant effects	Zone of influence	Relevant assessment criteria and scoped-in / out justification
			suspended sediment. Pollution events reducing habitat quality or having direct toxic effects.		
Gulls – **Black-headed gull, common gull, herring gull, lesser black-backed gull and great black-backed gull**	European	National to Local	Disturbance due to installation works. Temporary habitat loss from installation works including due to increases in suspended sediment. Pollution events reducing habitat quality or having direct toxic effects.	100m	Scoped out – gulls are highly tolerant of human presence and are often attracted to vessels. Their ability to forage over large distances also ensures that any exclusion from the installation area would represent only a small fraction of their range. It would not be expected that any individual gull would suffer a loss of fitness associated with the proposed works.
Seabirds in the marine environment	European	Local	Disturbance due to installation works.	Variable dependent on species	Scoped out - The installation activities will be highly localized at any given point in time and occupy only a small fraction of the habitat available to seabirds for

Ecological feature	Importance – legislation and policy	Importance – Project	Environmental changes and likely significant effects	Zone of influence	Relevant assessment criteria and scoped-in / out justification
			Temporary habitat loss from installation works including due to increases in suspended sediment. Pollution events reducing habitat quality or having direct toxic effects.	foraging range as identified in Woodward *et al* 2019.	foraging. Levels of disturbance are akin to a very small increase in the usual vessel traffic encountered in the area.
Intertidal habitats and species communities, as described above	Local	Local	Disturbance to / loss of habitat as a result of installation works	500m	Scoped in – Works within the intertidal zone, although temporary in nature, will cause disturbance to, and potential loss of, habitats and species through their scale and nature.
Subtidal (benthic) habitats and species communities,	Local	Local	Disturbance to / loss of habitat as a result of installation works.	500m	Scoped in – Due to the nature of the project, disturbance of the seabed, and its associated habitats and species, is inevitable.

Ecological feature	Importance – legislation and policy	Importance – Project	Environmental changes and likely significant effects	Zone of influence	Relevant assessment criteria and scoped-in / out justification
as described above			Creation of new habitat in subtidal zone. Changes to water quality as a result of increased suspended sediment. Pollution events reducing habitat quality or having direct toxic effects.		
Marine mammals (seals) in the intertidal zone	European	Local	Underwater noise and disturbance to marine mammals (seals), due to sheet piling to create/remove a cofferdam and increased vessel movements in the	Variable with species, sound source, level of disturbance and receiving environment.	Scoped in – There are no actual records to indicate that Claycastle Beach is important to seal species, as a haul-out or breeding site. However, it is certain/near-certain that they will be present feeding in nearshore / offshore areas and Volume 3D Part 2 EIAR for Ireland Offshore (Specialist Chapters) - Chapter 17: Noise and Vibration presents approximate source levels for sheet piling the cofferdam, that is above the levels that would require mitigation (>180dB = 207dB).

Ecological feature	Importance – legislation and policy	Importance – Project	Environmental changes and likely significant effects	Zone of influence	Relevant assessment criteria and scoped-in / out justification
			intertidal zone (installation, phase).		Increased vessel movements may also cause seal injury from use of ducted propellers.
Marine mammals (all groups) in the subtidal zone	European	Local	Underwater noise and disturbance to marine mammals (all groups), due to support and installation vessel presence (installation, operation and decommissioning phases). Underwater noise and disturbance to marine mammals (all groups), due to installation activity (cable laying with trenching and install of external cable protection).	Variable with species, sound source, level of disturbance and receiving environment.	Scoped in - Underwater noise source levels from these vessels, in Volume 3D Part 2 EIAR for Ireland Offshore (Specialist Chapters) - Chapter 17: Noise and Vibration, indicate that their engines and dynamic positioning (DP), are below the levels that would require mitigation for marine mammals (180dB). Underwater noise source levels from, cable laying with trenching, and install of external cable, in Volume 3D Part 2 EIAR for Ireland Offshore (Specialist Chapters) - Chapter 17: Noise and Vibration, indicate that they are below the levels that would require mitigation for marine mammals (180dB). UXO targets were scoped out of the EIAR because they are not expected along the cable route, also there is a commitment to best practice mitigation in the unlikely event that any are discovered. However, underwater noise source levels, from subsea survey and monitoring equipment, in Volume 3D Part 2 EIAR for Ireland Offshore (Specialist Chapters) - Chapter 17: Noise and Vibration, indicate that they are above the

Commented [A49]: Placeholder: Reference to be included.

Ecological feature	Importance – legislation and policy	Importance – Project	Environmental changes and likely significant effects	Zone of influence	Relevant assessment criteria and scoped-in / out justification
			Underwater noise and disturbance to marine mammals (all groups), due to installation activity (unlikely need to detonate unexploded ordnance (UXO) during preparation for cable install). Underwater noise disturbance to marine mammals (all groups), due to subsea survey and monitoring equipment (installation, operation and decommissioning phases).		levels that would require mitigation for marine mammals (180dB). This would apply to installation, operation and decommissioning phases of the project also.

Commented [A50]: Placeholder: An appendix, considering and assessing the presence and handling of UXO, is currently in preparation, and will be ready for submission with the final Application File. Within the current EIAR, the approach has been to not include UXO within impact assessments, on the assumption that the chance of encountering them during works is low.

Commented [A48]: Placeholder: An appendix, considering and assessing the presence and handling of UXO, is currently in preparation, and will be ready for submission with the final Application File. Within the current EIAR, the approach has been to not include UXO within impact assessments, on the assumption that the chance of encountering them during works is low.

Ecological feature	Importance – legislation and policy	Importance – Project	Environmental changes and likely significant effects	Zone of influence	Relevant assessment criteria and scoped-in / out justification
Marine Reptiles (marine turtles – notably leatherback and loggerhead turtles)	European	County	Underwater noise and disturbance to marine turtles, due to sheet piling to create/remove a cofferdam and increased vessel movements in the intertidal zone (installation, phase). Underwater noise and disturbance to marine turtles, due to support and installation vessel presence (installation, operation and decommissioning phases). Underwater noise and disturbance to marine turtles, due	Variable with species, sound source, level of disturbance and receiving environment	Scoped in - Underwater noise source levels, from sheet piling the cofferdam, in Volume 3D Part 2 EIAR for Ireland Offshore (Specialist Chapters) - Chapter 17: Noise and Vibration, indicate that noise levels are above the level that is likely to trigger a behavioural response and agitate marine turtles (166 to 175 dB from MaCauley et al. (2000)). There are almost no data on the effects of intense sounds on marine turtles and, thus, it is difficult to predict the level of damage to hearing structures at the peak 207dB level. The likely frequency banding from the sheet piling the cofferdam, of 12Hz to 100kHz, is within the low/sensitive hearing range of marine turtles. Underwater noise source levels from the support and install vessels, in Volume 3D Part 2 EIAR for Ireland Offshore (Specialist Chapters) - Chapter 17: Noise and Vibration, indicate that their engines and dynamic positioning (DP), are at a level that is likely to trigger a behavioural response and may agitate marine turtles. The likely frequency banding from these vessels and the DPs, of 20Hz to 35kHz, is within the low/sensitive hearing range of marine turtles. Also, constant low frequency noises from vessels compound the potential

Ecological feature	Importance – legislation and policy	Importance – Project	Environmental changes and likely significant effects	Zone of influence	Relevant assessment criteria and scoped-in / out justification
			to installation activity (cable laying with trenching and install of external cable protection). Underwater noise and disturbance to marine turtles, due to installation activity (unlikely need to detonate UXO during preparation for cable install). Underwater noise disturbance to marine turtles, due to subsea survey and monitoring equipment (installation, operation and		for an acoustic impact, including low frequency masking e.g. acquisition of prey and avoidance of predators in Irish Waters. Underwater noise source levels from cable laying with trenching, and install of external cable, in Volume 3D Part 2 EIAR for Ireland Offshore (Specialist Chapters) - Chapter 17: Noise and Vibration, indicate that they are at a level that is likely to trigger a behavioural response and agitate marine turtles. The likely frequency banding of 40-50kHz is out with the low/sensitive hearing range of marine turtles. UXO targets were scoped out of the EIAR because they are not expected along the cable route, also there is a commitment to undertake appropriate assessment / licencing as required in the unlikely event that any are discovered. However, underwater noise source levels, from subsea survey and monitoring equipment, in Volume 3D Part 2 EIAR for Ireland Offshore (Specialist Chapters) - Chapter 17: Noise and Vibration, indicate that they are at a level that is likely to trigger a behavioural response and agitate marine turtles. There are almost no data on the effects of sudden, intense sounds on marine turtles and, thus, it is difficult to

Ecological feature	Importance – legislation and policy	Importance – Project	Environmental changes and likely significant effects	Zone of influence	Relevant assessment criteria and scoped-in / out justification
			decommissioning phases).		predict the level of damage to hearing structures at the associated peak 240dB level. The likely frequency banding from the subsea survey and monitoring equipment, of 300Hz to 500kHz, is within the low/sensitive hearing range of marine turtles. Also, constant low frequency noises from vessels and seismic survey activity compound the potential for an acoustic impact, including low frequency masking e.g. acquisition of prey and avoidance of predators in Irish Waters.

*The potential effects of pollution have been discounted for all ornithological features based on the pollution control measures described previously.

Commented [A51]: Placeholder: An appendix, considering and assessing the presence and handling of UXO, is currently in preparation, and will be ready for submission with the final Application File. Within the current EIAR, the approach has been to not include UXO within impact assessments, on the assumption that the chance of encountering them during works is low.

13.6 Characteristics of the Development

Refer to Volume 3D Part 2 EIAR for Ireland Offshore (Specialist Chapters) - Chapter 5: Description of the Landfall and Chapter 6: Description of the Offshore Cable, for the detailed project description of the intertidal and marine aspects, which informed this assessment.

13.7 Likely Significant Impacts of the Development

13.7.1 Assessment of Effects – Intertidal and Benthic Habitats and Ecology

Installation phase

Habitat loss – Sanderling

During phase one of installation approximately 6,220 m^2 of land take could be required including areas of the beach, car park and amenity grassland areas on the landward side of the beach. This also includes approximately 2,860m^2 of intertidal habitats which are required for the installation of the sheet pile cofferdam and temporary causeway.

The affected area would be returned to its current state following the end of phase one but it could still be unavailable for up to 10 weeks during the non-breeding period with installation planned for October-April (subject to confirmation). Whilst the installation area will be re-instated, it is likely that the prey resources upon which some wading birds are reliant will take longer to recolonise the substrate making it unsuitable for a longer period.

Records of birds from surveys completed in 2019/20 indicate that wading birds favour the south-western end of the beach between Redbarn and Claycastle beach. However, Sanderling were more widespread during the surveys with birds recorded in closer proximity to the proposed cable route. Records from count sectors one, two and three indicate that suitable habitat was present throughout much of the survey area.

The surveys completed in 2019/20 have shown that use of the intertidal areas is sporadic with numbers of Sanderling varying between months and not occurring in notable numbers for an extended part of the non-breeding period.

Given the short-term nature of the predicted effects (i.e disturbance during construction), the availability of other suitable habitat in the wider area, the observed distribution and counts of sanderling and the national and local trends (at nearby European sites), it is concluded that the magnitude of the effects Sanderling due to habitat loss are therefore considered to be **Low** and **Not Significant**.

Disturbance to Sanderling

During phase one (and to a lesser extent phase two) of installation, activities on the foreshore and presence of personnel have the potential to result in disturbance that would render the installation area and an additional buffer of 250m from disturbance sources (Cutts *et al* 2009) unsuitable for sanderling resulting in effective loss of habitat for a 10-week period during the installation phase. The peak of disturbance would be during the construction period of the cofferdam though human presence throughout could still result in disturbance within the defined ZoI.

As described above, the surveys completed in 2019/20 showed that birds generally favoured sections of the beach which are more than 200m from the proposed cable route with bar-tailed godwits in particular only occurring more than 700m away. Sanderling were recorded in closer proximity to proposed working areas but are less sensitive to human disturbance (Cutts et al., 2013) and were recorded throughout the survey area with suitable habitat available throughout.

The surveys completed in 2019/20 have shown that use of the intertidal areas is sporadic with numbers of sanderling varying between months and did not occur in notable numbers for an extended part of the non-breeding period.

Given the short-term nature of the predicted effects (i.e disturbance during construction), the availability of other suitable habitat in the wider area, the observed distribution and counts of sanderling and the national and local trends (at nearby European sites), it is concluded that the magnitude of the effects Sanderling due to disturbance during installation are therefore considered to be **Low** and **Not Significant**.

Release of hazardous substances through loss of chemicals / fuels from installation vessels

During all works at sea and in the intertidal zone, there is the potential for loss of chemicals, fuels, or other pollutants as a result of accidental spills from installation vessels and other associated heavy plant. This can result in both direct toxic effects on individuals in the water column and on the seabed, and subsequent effects on other species in the food-web, including predator species such as seabirds and marine mammals.

To minimize risks of pollution incidents international best practice will be followed, for example adherence to the International Convention for the Prevention of Pollution from Ships (the MARPOL Convention), the main convention covering pollution prevention in the marine environment, including from operational or accidental causes. Further, Project-specific requirements and procedures will be outlined in the Construction Environmental Management Plan (CEMP) and Pollution Prevention Plan (PPP).

Depending on the severity of any pollution incidents, the magnitude of change could be High. However, through the use of preventative measures and various control plans in place, the risk of occurrence of such incidents is Low and the magnitude of impact assessed as Low. Coupled with the high capacity of the marine environment for dilution of pollutants (see Volume 3D Part 2 EIAR for Ireland Offshore (Specialist Chapters) - Chapter 12: Marine Water Quality), the magnitude of the effect is assessed as Low and Not Significant.

Changes in water quality through release of contaminants held within the marine and coastal sediments

Through the installation of the cable route, the disturbance of sediment is inevitable. Depending on the quality of that sediment, there is the subsequent potential for contaminants to be released into the marine environment. This could potential cause both direct and indirect effects on benthic habitats, and the communities associated with them, as well as through consumption up the food chain to larger predators. Detailed analysis and assessment of marine sediment quality along the cable route is presented in Volume 3D Part 2 EIAR for Ireland Offshore (Specialist Chapters) - Chapter 10: Marine Sediment

Quality. Consideration of how water quality may be affected by the project disturbing marine sediment is outlined in Volume 3D Part 2 EIAR for Ireland Offshore (Specialist Chapters) - Chapter 12: Marine Water Quality. At a high level, data collected along the cable route found that the dominant seabed sediment type present was gravelly muddy sand, with the landfall predominantly composed of sands with a band of mixed sediment. From a contaminants perspective, there were low levels of hydrocarbons and trace metals present in the sediment samples, with the majority recorded at below Cefas Action Level 1, and Canadian Sediment Quality Guidelines threshold effect levels (TEL), standard guidelines for sediment quality. Slightly higher levels, above guideline levels, were recorded for some contaminants, including lead and arsenic. However, overall, the concentrations of heavy and trace metals were found to be **Low** and consistent along the survey corridor, suggesting little anthropogenic contamination in the area. The cable route does not pass through any habitats or areas of environmental sensitivity, which means the cable route exhibits low sensitivity. The presence of any contaminated sediment within the water column will be temporary, with material subsumed into natural sediment transport processes. The magnitude of the effects on water quality due to release of contaminated sediments during installation are therefore considered to be **Low** and **Not Significant**.

Commented [A52]: **Placeholder: References to be included prior to submission of final Application File.**

Disturbance to, and loss of, intertidal and benthic habitats during cable installation (including through smothering)

During installation of the Celtic Interconnector, disturbance of the seabed and intertidal zone and associated loss of habitats will be unavoidable. As presented in Volume 3D Part 2 EIAR for Ireland Offshore (Specialist Chapters) - Chapter 11: Marine Physical Processes, the assumption has been made that direct disturbance to the seabed will be limited to the immediate cable route, with an overall corridor of 15m. In addition to this, there is the potential for indirect effects over a wider area, including through increased levels of suspended sediment concentration (SSC) in the vicinity of the Project. Although the distance and duration that this material remains in the water column depends on a number of factors, including the particle size and water movement, the geographic extent of increase SSC is not expected to extend more than a worst case of 10km from the cable route (BERR, 2008), with the majority of material resettling within 1km, and within a few hours of disturbance. Additional evidence (Aquind, 2019) supports this, noting that smothering of habitats did not extend beyond 1km from the cable route.

Depending on the installation method used, the trench created for the cable's installation may be partly back-filled by the cable-laying equipment. However, some temporary disturbance to the local sediments is likely to remain once the cable is installed. As a worst case it is therefore assumed that all habitat will be permanently lost under the footprint of the cable route and within a total buffer of 15m width. Within Irish waters this would result in a worst-case direct habitat loss of 1.5km^2. Given the overall area of similar habitat type, and this small area in comparison to wider habitat types present, this assessed as a Low magnitude impact.

Commented [A53]: **Placeholder: All widths, areas and associated calculations will be reviewed in line with the final project description, and finalized prior to submission of the final Application File.**

The cable route does not pass through any environmentally-sensitive (ie designated or of conservation / ecological importance) habitats or features. For the majority of the route the habitats can be considered of Low value/importance, with the seabed comprising mobile sediments, including fine- and coarse-grained sand, with features including mobile sand ripples and waves. Based on these existing conditions, it is anticipated that trenches will be filled following installation partly via the installation equipment, and partly through natural processes, with the seabed being restored to pre-installation conditions shortly after installation through this infilling. As a result, effects arising from direct disturbance to intertidal and benthic habitats are considered to be of Low magnitude and **Not Significant**. Further, through the selection of appropriate installation methods, indirect effects on intertidal and benthic habitats as a result of increased suspended sediment levels are also considered to be **Not Significant**.

Within the intertidal zone, there will be additional disturbance through land-based works, and works within the immediate vicinity of the coastline, on and in front of the beach area. Installation at the landfall will take place over two phases, as outlined in Volume 3D Part 2 EIAR for Ireland Offshore (Specialist Chapters) - Chapter 5: Description of the Landfall and Chapter 6: Description of the Offshore Cable. Phase One is expected to take approximately ten weeks, and require land-take of approximately 3,360m^2 of land including the beach and landward areas. Additionally, 2,860m^2 within the intertidal zone will be required for installation of the cofferdam and temporary causeway for installation works. Due to the nature of the works, disturbance to the intertidal sediments and associated habitats / species is unavoidable. Further, when the trenches are back-filled, material will not be returned to the area in the same manner as it was originally found; i.e. previous surface sediments may be buried under around 3m of other sediment material. Phase Two of the works will take around four weeks and will involve limited additional land take in the intertidal zone. As a worst-case scenario, it has been assumed that all habitats and species present in this area will be permanently lost, with mixed sediment, and sand-based sediment habitats being those primarily affected.

Although colonization rates of sedimentary environments can vary widely, depending on the biodiversity of the adjacent areas, and the duration of disturbance, individuals can begin to move back into a previously disturbed area immediately once the works have finished. Further, the works area is surrounded by what will remain undisturbed intertidal zone, meaning existing biodiversity is immediately present to recolonize over time. With no habitats of particular environmental sensitivity or conservation importance, and considering the temporary nature of the works, effects as a result of installation in the intertidal zone are considered to be of **Low magnitude** and **Not Significant**.

Disturbance to, and loss of, intertidal and benthic habitats during installation of external cable protection

Following installation of the cable itself, along certain sections of the cable route, there may be the need for the installation of external cable protection, comprising either rock placement, or mattressing. This may occur in either sedimentary or hard substrate seabed conditions, depending on whether the requirement for external protection is based on ground conditions being unsuitable for cable burial, or where a cable-crossing needs to be undertaken.

Where cable protection is required, it has been assumed that this will be installed immediately, or shortly after, cable installation. Therefore, habitats initially disturbed by cable-laying equipment, and the installation of the cable itself, will not yet have had chance to recover from that initial disturbance. Installation of external cable protection is therefore not expected to have further effects on these habitats, and effects are considered to be of **Low magnitude** and **Not Significant**.

In addition to the above, there is potential for external rock protection to provide a degree of habitat creation in the marine environment. Rock placement, or installation of mattressing, may provide hard substrate on which species may settle out and colonise.

Operational phase

Following installation of the cable, and external cable protection as required, further effects on intertidal and subtidal communities are not anticipated during the operational phase.

Decommissioning phase

The Celtic Interconnector will be decommissioned once it ceases operation. The operational life is expected to be 40 years.

The submarine cables will either be left in place or will be removed for recycling in accordance with the relevant waste management regulations in place when decommissioning takes place. Any works required to remove infrastructure as part of the decommissioning phase, will be subject to the relevant consent applications, and associated environmental assessments, at the time of decommissioning. The nature of these consents will be determined by the prevailing legislative requirements at the time.

13.7.2 Assessment of effects – Natural Fish Ecology

The potential impacts to fish and shellfish from installation and operation of the marine cables is provided below.

Construction and Decommissioning phase

Disturbance to, and loss of intertidal habitat during cable installation

Loss or disturbance of intertidal habitat will occur as a result of the excavation of the open cut trench across the intertidal foreshore and placement of an adjacent temporary causeway for plant access. The trench will be excavated using land-based equipment (such as long arm excavators) with the aid of a temporary sheet piled cofferdam to ensure trench stability. The trench will be backfilled, and site reinstated to its original condition following installation of the pre-installed conduits.

It is anticipated that a temporary land take (October 2024 to April 2025) of approximately 2,860m^2 will be required into the intertidal zone for installation of the sheet pile cofferdam and temporary causeway (see Volume 3D Part 2 EIAR for Ireland Offshore (Specialist Chapters) - Chapter 5: Description of the Landfall and Chapter 6: Description of the Offshore Cable).

Fisheries composition within the near shore and intertidal habitats are often the most diverse and productive, providing important nursery and foraging grounds for species such as juvenile herring, bass, flatfish species (eg Soleidae and Bothidae) and Gobiidae (gobies).

Installation of the cofferdam and dewatering of the trench will result in the loss of any trapped fished and shellfish not displaced by site disruption and noise. Cryptic species such as juvenile flatfish and sessile species such razor shell (Ensis) species are more at risk than mobile and pelagic species of fish and crustacean, which have greater potential to relocate to alternative habitat nearby during installation and may return once the temporary works are complete. Additionally, mobile and pelagic species are likely to return during the works, when the water is turbid and food availability in the water column is higher eg as a result of seabed disturbance adding sediment plumes into the water column.

The loss or disturbance of intertidal habitat during the installation operation will be localised, representing only a very small footprint of the wider bay and coastal waters. Juvenile fish typically move offshore during the winter months to warmer waters, or on recruitment to the adult stock. The intertidal work is proposed to take place between the months of October and April minimising impact on summer nursery grounds.

The sensitivity of fish and shellfish to disturbance or habitat loss has been assessed as Low. The magnitude of this effect is considered to be Low due to any impacts being localised and temporary to fish and shellfish populations. The significance of the effect on fish and shellfish from loss or disturbance to intertidal habitat is therefore assessed as Minor and not significant.

<u>Disturbance to, and loss of seabed habitat during cable installation (including smothering)</u>

Loss or disturbance of seabed habitat will occur as a result of seabed preparation and cable lay.

Seabed surface sediments in the vicinity of the cable route within Irish Territorial Waters and EEZ comprise sandy gravel through to dense sand and high strength clay which are typical of the widespread sediment character of this part of the Celtic Sea (see Volume 3D Part 2 EIAR for Ireland Offshore (Specialist Chapters) - Chapter 11: Marine Physical Processes).

Dependent on the cable burial tool employed the footprint of the cable installation machinery will disturb a corridor along the path of the cable route of between 5 and 15m in width, with target depths of lowering between 0.8m and 2.5m dependent upon seabed geology and risk of subsequent third-party interactions e.g., demersal trawling (EirGrid 2020).

Mobile species along the proposed marine cable route corridor will be able to relocate to alternative habitat nearby during installation and return once the cable has been buried. Sessile species will be lost, buried or displaced.

Sensitive inshore species include inter alia the razor clams (*Ensis siliqua*) which occurs in mud and muddy sand and *Ensis arcuatus,* which occurs in sandy substrate. Further offshore both Nephrops (*Nephrops norvegicus*) and scallops (*Pecten maximus*) are also considered vulnerable.

Razor clams live buried in sand, and direct interaction with cable laying machinery will likely result in injury or mortality. The direct path of cable lay is however localised and razor clams are considered tolerant of disturbance and smothering to c. 5 cm and of displacement, rapidly reborrowing in suitable adjacent substratum. Razor clams have pelagic larva and the resultant annual spatfall aids rapid recovery where the seabed is reinstated to its original condition post cable lay. The loss or disturbance of habitat during the installation operation will be localised, representing only a small footprint of the wider region (approximately 0.76km^2 to 2.2 km^2).

Nephrops lives in burrows in sandy mud habitats where burrows can large, extending to over one metre in length and penetrate up to 30cm into the sediment. Due to their burrowing ability in these habitats, Sabatini and Hill (2008) considered Nephrops to be tolerant of temporary increased levels of suspended solids and resultant smothering by fines up to a depth of 5 cm. Where individuals are not killed or damaged by direct interaction with cable installation machinery, they are likely to immediately commence burrowing in adjacent ground to which they have been displaced. Their intolerance to disturbance is therefore assessed to be low with a very high recoverability (*ibid.*).

Scallops not directly lost through direct interaction within the seabed clearance and cable lay machinery are tolerant of displacement and can re-settle, although vulnerable to predation until recessed (Marshall & Wilson, 2008). Cable laying is not thought to have a particularly adverse effect on the scallops which are considered tolerant of physical disturbance and smothering by up to 5cm of fine silts.

Demersal species of fish, which live in close proximity to the substrate are considered most at risk of injury during cable lay however these species are often highly mobile and may easily avoid interaction with the ground preparation and cable lay machinery. Sandeels, such as the lesser sandeel (*Ammodytes tobianus*) are widespread throughout the Celtic and Irish Sea and Rowley (2008) notes their presence along the route of the cable corridor although they are notably absent in Coull (1998), Lynam et al. (2013) and Ellis et al. (2012), leading to the assumption that population densities are low along the cable route. Sandeel overwinter in sandy substrate, this typically occurs between autumn and winter, during this period they burrow into the sediment when they are potentially susceptible to injury and loss through interaction with cable lay machinery. There is some evidence that scallop dredges kill sandeels buried in sediment during this period (NatureScot, 2020). Works scheduled between April and October would largely avoid the period in which they are most at risk. Sandeels are considered tolerant of disturbance and displacement with uninjured specimens able to rapidly reborrow in suitable adjacent substratum. Their intolerance to disturbance is therefore assessed to be low with a very high recoverability. The sensitivity of sandeel is assessed as **Low**.

Sandeel are considered an important keystone species and of local importance, forming a critical component of the local food web for both piscivorous fish and avian predators. The magnitude of this effect is considered to be Low due to any impacts being localised within the wider setting of Irish waters and the populations along the cable route corridor being of low intensity. The significance of effect to sandeel is assessed as **Negligible**.

Other mobile species of benthic fish are tolerant of localised displacement resulting from temporary habitat and physical disturbance arising from cable lay and the magnitude of the impact to these species is considered **Negligible**.

By its very nature, the installation of the Celtic Interconnector will cause disturbance to the seabed in the immediate vicinity. The seabed sediments in Irish territorial waters and EEZ are sand dominated, with maximum levels of ~90% recorded at some sampling stations. Sand particles suspended by the installation process typically settle quickly, however the finer silt and clay component may remain suspended being prevented from settling by tidal currents and/or wave action. Any sediment plume resulting from the cable lay may temporally impair foraging of some species within the immediate footprint of the mobile operation however both juvenile and adult fish may readily disperse and relocate when sediment load is increased (Henley *et al*., 2000) and the sensitivity of these fish to disturbance is assessed as **Negligible**.

The loss or disturbance of foraging habitat during the installation operation will be temporary, mobile and localised, representing only a small footprint of the wider region. The magnitude has been assessed as Low. Fish, which are considered highly mobile species are considered tolerant of temporary disturbance with high and rapid recoverability, readily returning to the pressure has lowered or ceases (NE, 2016). The magnitude of this effect on fish is considered Negligible or Minor and not significant.

<u>Disturbance to, and loss of habitats during installation of external cable protection</u>

In areas of third-party cable crossings (i.e. the six in-service telecommunication cable crossings identified along the cable route in Irish EEZ waters), or where target burial cannot be achieved it will be necessary to protect the cable by placement of rock armouring or concrete mattressing.

The potential risk to benthic fish and shellfish communities will be from direct smothering from the cable protection, but also potentially from suspension and subsequent settlement of sediments disturbed when the cable protection is installed.

Whilst rock placement as a means of primary cable protection is not envisaged with Irish territorial waters it is possible that some secondary rock protection may be required where the target depth of lay is not fully achieved. The probability is estimated at 5% based on the seabed conditions and if required the rock quantity has been estimated as 5,100 tonnes (t). Within the Irish EEZ secondary rock protection may be required where the target depth of lay is not fully achieved and is estimated at no more than 42,500t.

Placement of rock armouring and concrete mattressing will result in mortality of sessile species within the footprint of the armouring whilst more mobile species (fish and crustaceans) may be able to avoid smothering by moving away from the area (NE, 2016). Placement of rock or concrete mattressing will result in the long-term loss of smothered habitat although the footprint lost will be small within the wider setting of Irish waters.

Whilst high levels of suspended solids can result in injury and mortality to some fish larvae and impair foraging of both fish and shellfish, the sediment plumes associated with the placement of cable protection will be both localised and short-term in duration (see Volume

3D Part 2 EIAR for Ireland Offshore (Specialist Chapters) - Chapter 11: Marine Physical Processes). Disturbance may result in feeding opportunities for some species of benthic fish which may predate upon displaced macroinvertebrates and crustacea before they have opportunity to re-establish themselves within the adjacent habitat (Henley et al., 2000).

The placement of cable protection structures such as rock armouring and concrete mattresses along the cable route will introduce habitat heterogeneity where seabed surface sediments comprises mainly of sand, gravels and clays. The introduction of rock substrates may provide reef habitat that may be colonised by a range fish, crustacea and fouling species, and may act to cause localised increases in biodiversity which may lead to a change in the natural benthic community at these sites. Where the substrate comprises soft sediments frond mattressing, where the individual concrete components tessellate more closely than rock typically encourages the accumulation of sediment is likely to be acceptable as it is more in keeping with the natural environment.

Once macrobenthic communities begin to establish the reefs have the potential to an increase diversity and abundance of fish and shellfish species (Inger et al., 2009). Leonhard et al. (2011) have shown that the introduction of hard substrates to homogenous sand banks associated to renewable energy developments can result in a net gain for marine fish biodiversity. Species such as cod have shown a behavioural response to the introduction of artificial reefs (Jensen, 2002), that provide refuge and potential foraging opportunities. Lithophilic spawners such as herring by utilise the reef for spawning.

The sensitivity of fish has been assessed as **Low**. Fish are considered tolerant of the potential impacts without detriment to character or composition of stocks. Whilst the loss of habitat resulting from the placement of cable protection is long lasting the impact is localised and the area lost represents only a small footprint of the wider region. Fish species that frequent habitats adjacent to the cable routes are mobile and widely distributed within the Southern Celtic and Irish Sea and as such the magnitude of any impact arising from the placement of external cable protection has been assessed a Negligible. The magnitude of the resultant effect is assessed as **Negligible** and **Not Significant**.

Commented [A54]: Placeholder: Text around habitat loss / habitat creation to be reviewed and aligned prior to submission of final Application File.

Disturbance to spawning and nursery grounds from cable installation

During the construction phase, temporary habitat modification will occur as a result of the placement of a cofferdam and trenching within the intertidal foreshore and offshore ground preparation and cable installation. These works have the potential to impact upon the spawning and nursery grounds of fish.

In 2003 the EU Commission established a ‘Biologically Sensitive Area’ off the south and south west coast of Ireland (Council Regulation (EC) No 1954/2003). These waters through which the cable corridor will pass are considered to contain some of the most important fish spawning and nursery areas in the North Atlantic (Marine Institute, 2006).

Spawning Grounds

Given the potential for impact of cable laying operations to spawning fish, either direct through disturbance and/or smothering of eggs or indirect through vessel disturbance (and associated noise) resulting in displacement of fercund adult fish within the water column from the vicinity of operations Good Practice guidance recommends that construction on or in the seabed should be carried out outside of the spawning season, particularly for substrate spawners e.g. herring.

Fisheries sensitivity maps (Coull et al., 1998; Dransfeld et al., 2004; Ellis et al.; 2012, Marine Institute 2020) provide information on spawning and nursery areas and timings within the southern Celtic Sea. This data indicates that the proposed marine cable route passes within or close to the spawning grounds of nine principal fish species including cod, haddock, hake, herring, lemon sole, ling, megrim, mackerel, pollock, sprat and whiting (see Table 13.9).

Majority of species move offshore prior to spawning to release their eggs in deeper waters however cod, whiting and herring are reported to spawn in the shallow coastal waters, with both herring and cod showing a high fidelity to defined spawning grounds.

Table 13.9 Summary of spawning and nursery areas for the main commercial species[51]

Species	**Jan**	**Feb**	**Mar**	**Apr**	**May**	**Jun**	**Jul**	**Aug**	**Sep**	**Oct**	**Nov**	**Dec**
Atlantic cod		*	*									
Haddock												
Hake		*	*									
Herring	*	*								*	*	*
Lemon Sole					*							
Ling												
Megrim												
Mackerel					*	*						
Pollack												
Sprat												
Whiting												

Most species of fish are broadcast spawners and with the exception of herring, spawn in the water column where they release numerous buoyant eggs that drift with the prevailing currents following release. Whilst adults in spawning condition may be temporarily disturbed and displaced from the immediate area of cable installation operations the spawning areas through which the proposed marine cable route corridor passes are extensive, covering a wide area of the Celtic Sea. The impact of ground preparation and cable installation to the spawning habitat of these pelagic spawners is considered to be **Negligible**.

[51] Sources Coull et al., 1998; Dransfeld et al., 2004; Ellis et al.; 2012, Marine Institute 2020.

Herring are demersal spawners releasing ribbons of sticky eggs on to hard substrate such as gravel banks, stones, broken mussel shell or where coarse sand predominates (Ellis et al., 2012; Froese and Pauly, 2019; INFOMAR, 2020). Potential herring spawning habitat exists inshore around Knockadoon and Ram Head, the headlands that bound Youghal Bay (INFOMAR, 2020) (Figure 13.4). Spawning may occur from September through until February each year although the intensity of spawning on these historic spawning grounds characteristically varies considerably between year. Adult herrings typically move offshore shortly after spawning takes place.

The proposed cable route from Claycastle Beach follows a channel that avoids outcropping rocks with surface sediments predominantly formed of sandy mud, with patches of sand appearing from KP 3.2 and although boulders (classified as 'boulder area') are present throughout the near coast environment the habitat along the cable corridor is not considered optimal herring spawning habitat.

The Marine Institute (2018) however identify a broader spawning area for herring that incorporates much of Youghal Bay and coastal waters to the west. Herring aggregate in large shoals near shore prior to spawning and the areas frequented by these shoals include areas of suboptimal spawning habitat. As fish become 'ripe' smaller shoals break from the main shoal to shed their eggs over the spawning grounds located within the wider spawning area before re-joining the main shoal, thus spawning events may take place over prolonged periods.

Cofferdam installation, trenching and placement of conduits within the intertidal zone will be undertaken during the winter months (October 2024 to April 2025), to avoid the bathing season at Claycastle Beach. This period coincides with the movement on shore of spawning herring and subsequent spawning events. The cofferdam will extend approximately 150m into the intertidal zone to a point approximately 50m shoreside of Lowest Astronomical Tide (LAT).

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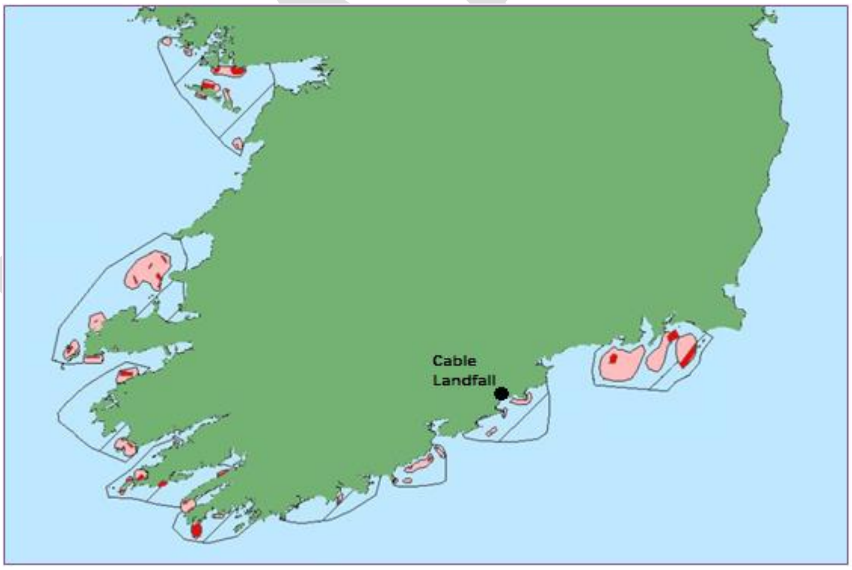
The intertidal region is approximately 200m long with a gentle sloping gradient. Beyond the intertidal zone the seabed profile is relatively flat with gentle gradients leading to an uninterrupted smooth progression to the 10m water depth at approximately KP 2.9. The offshore cable route follows a sediment channel identified within the band of bedrock present along this coastline providing ease of burial to the required target depths. Benthic surveys undertaken along the cable corridor within Youghal Bay did not identify any pockmark features, biogenic or geological reefs or significant substrate that may provide habitat for herring spawning.

Whilst fish may occasionally spawn on features within the intertidal zone these eggs may become desiccated or predated during low water periods and are not considered to contribute to recruitment. The footprint of the cable corridor through the nearshore environment is considered to be localised and whilst work within the intertidal zone will take place during the herring spawning season both the sensitivity and magnitude of the impacts on herring spawning is considered to be **Negligible**. The HVDC cable will be pulled through the conduit by the cable lay vessel. The nearshore disturbance from vessel activity associated with cable installation occurs over relatively short time periods and is a singular event that will occur outside of the main herring spawning period. Inshore vessel activity may not occur again over the project's life cycle, unless maintenance work is required, and both the sensitivity and magnitude of the impacts on herring spawning arising from vessel activity is considered to be **Negligible**.

The magnitude of effects on herring spawning grounds is therefore considered to be **Negligible** and **Not Significant**.

The sensitivity of spawning habitat has been assessed as **Low**, as although eggs present on the seabed at the time of ground preparation and cable installation would be removed or destroyed the population is considered tolerant of this singular, localised event that will not result in a significant effect to the spawning stock biomass. The magnitude of this impact has therefore been assessed as **Negligible** due to the very small spatial extent of the impact within the Irish territorial waters and EEZ, the single occurrence of the impact and the predicted level of change to the baseline. The magnitude of the effect arising from the disturbance on fish spawning arising from ground preparations and cable lay has been assessed as **Minor** and **Not Significant**.

Figure 13.4 The location of herring spawning beds (red), grounds (pink) and areas (hatched) identified by INFOMAR, 2020 (modified from Marine Institute, 2018).



Nursery Grounds

Whilst the potential impact of the proposed project to pelagic spawners has been assessed as **Negligible**, tidal currents may carry fertilised eggs and tiny juvenile fish species within the plankton to coastal nursery areas. These are areas that provide plentiful food and shelter for young fish species.

Nursery grounds for 12 species along the proposed cable corridor are described by Coull et al. (1998), Dransfeld et al. (2004), Ellis et al. (2012) and the Marine Institute 2020.

Nominal high-density nursery grounds are described for anglerfish by Ellis et al (2012), as indicated by the presence of juveniles (<28 cm total length) along the cable route within the Irish EEZ. Anglerfish spawn offshore in deep water and their post-larval life stage undergoes a prolonged pelagic lifestage during which time they are subject to advection by surface currents. Ellis et al (2012) describes low intensity nursery grounds along the entire cable corridor within Irish territorial waters and EEZ.

Coull et al. (1998) describe nominal nursery grounds for both cod and whiting inshore within Irish territorial waters along the proposed cable route as indicated by the presence of juveniles (<23 and 20 cm total length respectively) in groundfish survey although subsequent studies (Ellis et al., 2012) suggest theses nursery grounds are of low intensity. The larvae of cod drift inshore to suitable nursery grounds along the Irish coast from known spawning grounds to both the east and west of the cable route. The young remain inshore for 3 to 4 years until they mature and move offshore.

Ireland's Marine Atlas (Marine Institute, 2016) describes Atlantic haddock nursery grounds within the Irish EEZ along the proposed length of the cable route, however Dransfeld et al. (2004) recorded low occurrence of haddock larvae in a survey of spawning grounds and larval distribution in May 2000 and the species was not recorded by Coull et al (1998). Post larval fish are pelagic until they reach a length of c. 70 mm when they become a demersal.

Ellis et al (2012) report the entire Celtic Sea as a low intensity hake nursery. Dransfeld et al. (2004) did not recorded larval hake along the route of the proposed cable corridor with the principal nursery area for the species to the south west of Ireland however the Marine Institute (2006) highlight the importance of waters off the south coast of Ireland, through which the cable route will pass as important hake nursery grounds.

Nursey grounds for lemon sole are described throughout the Irish EEZ along the west and south coast of Ireland and along the length of the cable route (Coull et al., 1998). Megrim larvae are predominantly recorded off the southwest coast, with very low numbers recorded in the locale of the proposed cable corridor (Dransfeld et al. 2004).

Both sprat and mackerel larvae are common and widely distributed throughout the southern Celtic Sea ecoregion. Herring larvae are recorded closer inshore in protected bays along the south coast. Pollock larvae are reported at low intensity throughout the southern Celtic Sea at similar inshore sampling stations to cod.

The lack of historical commercial interest in ling has resulted in a paucity of data regards their distribution however Ellis et al. (2012) describes low intensity nursery areas throughout the Celtic Sea.

The cable route corridor passes through expansive nursery areas covering a wide area of the southern Celtic Sea.

The sensitivity of nursery habitat has been assessed as low as although larvae present on the seabed at the time of cable installation may be displaced or destroyed the nursery grounds are considered of low intensity and the stocks of fish are considered tolerant of this singular, localised event that will not result in a significant population affect. The magnitude of this impact has been assessed as Negligible due to the very small spatial extent of the cable route corridor (2.27 km^2) within the Irish territorial waters and EEZ, the single occurrence of the impact and the predicted level of change to the baseline. The magnitude of the effect arising from disturbance on fish nursery grounds, caused by ground preparation and cable installation, has been assessed as Minor and **Not Significant**.

Diadromous species

The spawning and early lifestages of shads, lampreys (sea lamprey and river lamprey), sea trout and Atlantic salmon occur only in rivers, and will not be directly affected by potential impacts arising from ground preparation, clearance and cable lay. European eel is catadromous, living most of their lives in freshwater returning to the marine environment to spawn. Spawning is believed to occur in the Sargasso Sea where spawning events will not be affected from disturbance arising from the project.

<u>Loss or disturbance of spawning and nursery grounds from cable protection</u>

Where the target depth of lay cannot be achieved or where the cable crosses existing cables or pipelines the cable route will be protected using rock placement or concrete mattresses/sleepers. Six in-service telecommunication cable crossings have been identified along the cable route in Irish EEZ waters. The level of potential rock protection in Irish territorial waters is between 0km and 3km in the worst case, or 0t to 10t. The level of potential rock protection in Irish EEZ is between 0km and 30km in the worst case, or 0t to 80t although the level of rock protection shall be minimised as much as possible through the best endeavours of the installation contractor to achieve the required level of protection through burial (EirGrid, 2020).

The placement of rock and the plume of fine sediment that may be deposited when the rocks are positioned may smother fish eggs and immobile juveniles on the seabed. The extent of rock placement within the spawning grounds, and the more extensive nursery grounds which cover relatively large areas of the southern Celtic Sea is very small, c. 0 – 0.015km^2 within Irish territorial waters and c. 0 – 0.15km^2 within in Irish EEZ waters. Impacts from rock placement are unlikely to adversely affect recruitment or the overall population size of fish (broadcast spawning marine species such as clupeids and gadoids) as the equivalent adult values of the eggs and larval fish lost will be negligible in comparison to the spawning stock biomass.

Where rock protection protrudes above the surrounding seabed, it may provide a new habitat for colonisation such as a stable reef type substrate on which organisms may attach subsequently attracting more diverse fish species which may take refuge within or forage around the modified substrate. The artificial reef also has the potential to provide additional and beneficial spawning habitat to herring. The introduction of artificial reefs along the cable corridor therefore may have positive benefits to the localised marine environment.

The sensitivity of spawning and nursery habitat has been assessed as low as although eggs or larvae present on the seabed at the time of cable protection installation would be removed or destroyed the local stock is considered tolerant of this singular, localised event that will not result in a significant population affect. The magnitude of this impact has been assessed as **Negligible** due to the very small spatial extent of the impact within the Irish territorial waters and EEZ, the single occurrence of the impact and the predicted level of change to the baseline. The magnitude of the effect of disturbance to fish spawning and nursery grounds from rock placement has been assessed as **Negligible or Minor** and **Not Significant**.

Operational phase

Creation of Electromagnetic fields (EMF)

The localised electromagnetic field (EMF) created by electric current passing through the cables has the potential to disrupt electrosensitive and magneto sensitive fish; these include elasmobranchs, lamprey, eel and salmonids (Gill et al., 2005).

The EMF is composed of both an electric (E) and an induced magnetic (B) field (Cada et al. 2011). The E field is normally fully contained within the cable by the insulation that surrounds the conductor however the B field may propagate outside the cable and can be sensed by magneto-sensitive species. Where a fish or tidal movement occurs through a B field, a further induced electric (iE) field can be created (Gill & Bartlett, 2010).

Potential impacts of any electric field may include disrupting sensory feeding cues of predominantly elasmobranchs e.g., thornback rays *Raja clavata* which employ electroreceptive foraging behaviour. Magnetic fields may impact upon the navigational cues to diadromous species such as salmon, sea trout and eel as well as elasmobranchs, impairing orientation which may subsequently influence migratory behaviour.

The River Blackwater, located approximately 2km to the east of the Claycastle Beach land fall is a noted Atlantic salmon and sea trout fishery. Both Atlantic salmon and sea trout are anadromous, living much of their adult lives in the marine environment, returning to freshwater to spawn in their natal river. Both species will require to cross the route of the proposed cable corridor on at least two occasions during their life history, once as a smolt emigrating from freshwater and a second time as a sexually mature adult as they return to the river to spawn. Sea trout do not undertake such an extensive open ocean migration as that observed in salmon, remaining closer to the coast where they feed on fish and crustaceans in estuaries and coastal waters. They may thus encounter the cable corridor on numerous occasions whilst foraging. The magnetic fields generated around the cable are a potential source of disruption to the migration of fish to and from this river and to sea trout foraging along the cable corridor.

As well as being a recreationally important species, salmon are assessed by the Irish Red List of species as Vulnerable (King et al., 2011) and Atlantic salmon is a qualifying interest of Special Areas of Conservation.

Returning adult Atlantic salmon migrating through coastal waters are typically found near the surface (although deeper dives are observed), at depths of between 0.5–5m (Davidsen, 2013; Godfrey et al., 2015), where they will not encounter the strongest magnetic flux densities at the substrate surface directly above the cable. While salmon are believed to utilise the earth's magnetic field to aid navigation in open oceans, in shallow coastal waters their surface migratory behaviour may indicate that olfactory cues contained within the buoyant freshwater plumes that emanate from estuaries override the weaker magnetic cues, a theory supported by the increase in near shore migration speeds observed with increasing river discharge, that may serve to ease river recognition (Davidsen, 2013).

A study undertaken by Armstrong et al. (2015) observed the response of captive Atlantic salmon to activated Helmholtz coils. The study demonstrated that neither large salmon (62-85cm) or smaller post-smolts (24-41cm) showed a significant response (alarm behaviour, avoidance, accelerated or decelerated swimming) when passing through a magnetic field of up to 95 microtesla (µT) (Values measured on the HVDC EWIC Interconnector cable, a 500MW 400kV AC (DC ±200 kV) submarine cable, indicate that the magnetic field strength was approximately 44 µT at xxm (Brian O'Keeffe pers. comm.))

Commented [A56]: Placeholder: Data to be confirmed prior to submission of final Application File.

Whilst there is generally a paucity of studies that observe the effect of subsea cables on Atlantic salmon migration (Gill and Bartlett, 2010). Gill et al. 2005 cites observations from the Dee estuary where there are several buried cables in existence considered not to have affected salmonid and eel migrations historically. Sigray and Westerberg (2008) cite an earlier study by Yano et al. (1997) who were similarly unable to demonstrate that the orientation of chum salmon (*Oncorhynchus keta)* was altered when the magnetic field was increased by two orders of magnitude in relation to the Earth's geomagnetic field.

European eel is similarly sensitivity to magnetic fields (Durif et al., 2013; Gill et al., 2005). Eel are considered a 'Critically Endangered' species (King et al., 2011) following significant declines in numbers in both Ireland and throughout Europe. They are catadromous, living most of their life in freshwater, returning to the sea to spawn. Eel are known to frequent the River Blackwater and all waters draining into the southern Celtic and Irish Sea.

Studies tracking eels in the southern Baltic Sea suggested that migratory eels may be deviated from a straight course as a result of the magnetic anomaly caused by a subsea cable although the spatial resolution of the study was too low to draw a firm conclusion about the effect (Öhman et al, 2007). Swedish studies have also shown small delays to eel migration resulting in passage across subsea cables (Sigray and Westerberg, 2008) and Gill and Bartlett (2010) describe trivial and temporary change in eel swimming direction that encounter the confounding magnetic field around HVDC cable. Orpwodd (2015) observed the response of European eels at the silver eel stage to an AC magnetic field of approximately 9.6µT within a controlled laboratory setting. There was no evidence of a difference in movement due to the magnetic field nor observations of startle or other obvious behavioural changes.

Elasmobranchs such as the small-spotted catshark (*Scyliorhinus canicular*) and the thornback ray are both common around the Irish coast and known to be sensitive (i.e. electroreceptive) to the iE-fields generated around subsea cables. These emissions may influence fish behaviour, as some species have been shown to detect very weak voltage gradients (down to 0.5µV m-1) in the environment around them. Gill et al. (2005) noted that the ability to detect iE-fields is likely to vary between individuals of the same species dependent on the sex, life stage and size of individual, with larger fish becoming more sensitive. In addition, Normandeau et al. (2011) noted that submarine power cables have the potential to temporarily affect the seasonal or diel migration pathways of elasmobranchs over short distances, although this might not necessarily be adverse as it may subsequently act as a recognizable waypoint.

Laboratory based studies by Gill & Taylor (2001) suggested small-spotted catsharks avoided DC E-fields at emission intensities similar to those predicted from offshore wind farm AC cables whilst being attracted to DC emissions at levels predicted to emanate from their prey. Resident populations that inhabit areas near cable routes may therefore be attracted, repelled or unaffected by the presence of power cables (Normandeau et al., 2011).

Despite the potential for sensory overlap with expected E-field levels from undersea power cables, there is little evidence to determine whether these currently speculative consequences may occur in the field. In a strategic review of offshore wind farm monitoring data, Cefas (2009) cited post construction monitoring of the Kentish Flats windfarm that showed no discernible difference between elasmobranch populations at control or reference sites. In addition, in response to the development of the Thanet offshore wind farm site, Natural England stated at the time that "*(given the current levels of ecological understanding) there will not be a significant impact to the populations of elasmobranchii that are resident within the wind farm footprint and cable export route, but English Nature's advice is provided in the light of current information that is available*" (BERR, 2008).

Locations and temporal stability of specific parturition or spawning grounds are not well delineated however it is considered these should broadly overlap with the nursery grounds. The proposed cable route does not pass through high intensity nursery grounds for the elasmobranchii mapped by Ellis et al. (2012).

Both river lamprey and sea lamprey are diadromous species known to frequent rivers adjacent to the Claycastle Beach landing site (King and Linnane, 2004). Although at the lower end of the electroreceptive spectrum (*P. marinus* behavioural response of 10µV m-1), E-fields have the potential to influence the movements of lamprey. Again, the ability to sense E-fields may not necessarily elicit a negative response. Studies carried out on a 33kV cable crossing the Clwyd estuary in North Wales have indicated elevated E-fields (> 70µV m-1) and B-fields (50µT) (CMACS (2003) with both values well within the sensory range of both lamprey and salmonids. Notwithstanding, the Clwyd is well known for its population of lamprey (Kelly & King, 2001) and salmonids, suggesting that the effect of the cables on these species is restricted.

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The cable will be buried to a depth of >1.8m across the intertidal zone to a distance approximately 50m shoreside of the lowest astronomical tide. Offshore the cables shall be buried beneath the seabed varying in depth between 0.8m and 2.5m dependent on risk of third-party interactions and seabed conditions.

Both iE- and B-fields dimmish rapidly with increasing distance from the cable. Burial of the cable along the cable corridor is likely to provide some mitigation for the possible impacts of the strongest B- and iE-fields that exist close to the surface of the cable, owing to the physical barrier of the substratum. Whilst B-fields decrease exponentially with distance from the cable iE-fields may remain detectable by electrosensitive species for tens of meters from the cable. Whilst burying the cable will not fully mitigate the potential impact resulting from the propagation of EMFs, it will prevent fish encountering the strongest magnetic flux densities at the surface of the cable (Cada et al., 2011).

Whilst there remain potential effects to fisheries resulting from EMF emissions from the cables to date there has been no evidence to indicate that the sensitivity and/or magnitude of these impacts are sufficient to significantly impact fisheries resources (Gill et al., 2005).

The impact is predicted to be of local spatial extent (the order of 10 m each side of the cable), continuous and irreversible (during the lifetime of the project). Whilst B and iE-fields may be detected by both elasmobranchs and salmonids detection of stimuli does not necessarily lead to a response in behaviour (Öhman et al., 2007). Studies to date have not determined any significantly adverse impacts resulting from submarine cables. The magnitude is therefore, considered to be **Low**.

Elasmobranch species are common throughout Irish waters and present within the study area, although some species such as the porbeagle shark (*Lamna nasus*) and basking shark (*Cetorhinus maximus*) are Critically Endangered and Vulnerable respectively within the NE Atlantic (Clarke, 2016). Whilst elasmobranchs are both electro- and magneto-sensitive observations and evidence from post construction surveys e.g., Kentish Flats show no significant effects to fish populations as a result of EMF. The sensitivity of elasmobranchs is assessed as **Low**.

Diadromous species (Atlantic salmon, sea lamprey, river lamprey and twaite shad) are nationally and regionally important species and are Annex II qualifying species of the adjacent Blackwater River (Cork/Waterford) SAC (Site code 002170) which discharges into Youghal Bay, River Barrow and River Nore SAC (002162), Lower River Suir SAC (002137) and Slaney River Valley SAC (000781). These species are common throughout Irish waters and present within the study area with primary spawning areas in the adjacent freshwaters. The sensitivity of diadromous species is assessed as **High**.

There is currently a paucity of data concerning the sensitivity of basking sharks to EMF, therefore the assessment presented here is precautionary in nature. Drewery (2012) noted basking shark are related to paddlefish (*Polyodon spathula*), a freshwater species found in the USA and a species to which they are anatomically similar with comparable feeding behaviour. Paddlefish are able to detect the tiny electric fields from plankton which induce small E fields through their swimming and interaction with the geomagnetic field. Basking sharks have a similar ability to detect minute electric fields and therefore may detect submarine cables. Newton et al. (2019) however notes that the location and relatively low number of electroreceptive dermal pores corresponds to a species that feed with an indiscriminate suction or ram-feeding method of prey capture with low electro-sensory resolution. The sensitivity of basking shark to potential impacts has been assessed as **High**, and takes into account their Endangered status within Irish waters and their unknown population status following years of exploitation. The impact is predicted to be of a local spatial extent with minimal impact to feeding grounds, with hotspots concentrated further to the west. The magnitude has been assessed as **Negligible**.

Whilst it is likely that a number of marine fish species including gadoids and clupeids may detect induced electric fields there is no evidence of a behavioural response having been observed and these species fish which are common throughout Irish waters and present within the study area are considered to have low sensitivity to EMF's. These species are assessed as being of Local to Regional importance in the southern Celtic Sea fish study area and the sensitivity of these receptors is therefore, considered to be **Low**.

The magnitude of effect to elasmobranchs is assessed as **Negligible** and **Not Significant**.

The magnitude of effect to diadromous fish is assessed as **Minor adverse** and **Not Significant**.

The magnitude of effects to basking shark is assessed as **Minor adverse** and **Not Significant**.

The magnitude of effect to other species of marine fish is assessed as **Negligible** and **Not Significant**.

Heating

The transfer of electrical energy through high voltage submarine cables produces heat as a result of the Joule effect (Ohmic heating), which increases the temperature at the cable surface (OSPAR 2009). Where a cable is laid on a seabed the constant flow of water over the cable tends to rapidly dissipate the thermal energy and confines the elevated temperatures to the cable surface (Taormina et al., 2018). However, where the cable is buried radiation of heat can warm the surrounding sediment which has the potential to influence marine biota. The degree of thermal radiation from a buried cable is dependent on both laying depth and the thermal conductivity of the substrate (Taormina et al., 2018; Zang et al., 2020). Emeana et al. (2016) undertook a series of laboratory experiments and determined that heat transfer through coarse silts form a heat source designed as a proxy to a buried subseafloor HV cable is predominantly conductive producing temperature increases of >10°C up to 40 cm from a cable heated to 60°C above ambient. Coarse sands were however more permeable and exhibited predominantly convective heat transfer with significantly higher temperatures recorded in sediments at distances of a metre from the source.

Whilst the surface sediments along the cable route through the Irish Territorial Waters and EEZ comprise predominantly of dense sand, sandy gravel and high strength clay with a stratum of underling chalk further offshore, (KP 57.5 to KP 90.7), the geotechnical properties of the substrate will be significantly disturbance along the cable corridor during installation that may alter the permeability of the surface substrate which may result in elevated temperatures of surface substrates. The thermal radiation will vary along the course of the cable route.

Whilst there is a general paucity of field studies concerning thermal radiation from subsea cables, Taormina et al. (2018) cite a study from the offshore wind array at Nysted, Denmark, in the proximity of two AC cables of 33 and 132kV buried in a medium sand area, approximately 1m deep. Results showed maximal temperature increase of about 2.5ºC at 50cm directly below the cable. A further study of the BritNed interconnector, a 1,000MW high-voltage (450kV) direct-current submarine power cable between the Isle of Grain in Kent, and Maasvlakte in Rotterdam, the Netherlands recorded summer temperature elevations in the immediate sediment of between 0.5°C and 5.5°C where the cable was buried to a depth of lay of 1m. Where burial depth increased to 3 m the temperature rise was calculated to be between less than 0.5°C to 1.8°C above ambient (NIRAS, 2015). A study of a high voltage DC buried cable system between New England and Long Island New York (Cross Sound Cable Interconnector), estimated a rise in temperature at the seabed immediately above the buried cable of 0.19°C and an associated increase in seawater temperature of 0.s°C.

The only species likely to be impacted directly by the effects of a warming seabed are burrowing species, such as sand eels as well as adult flat fish and rays who bury themselves or live-in contact with the seabed. Although Rowley (2008) notes the presence of adults within waters adjacent to the cable corridor, the proposed cable route does not pass-through known spawning or nursery grounds for sandeels (Ammodytidae), (Coull, 1998; Lynam et al., 2013; Ellis et al 2012) with populations predominantly located to the east, in the Irish Sea

Indirectly, however elevated substrate temperatures may result in an alteration of the benthic macroinvertebrate species on which these fish feed. Fish are however highly mobile and will readily relocate to adjacent foraging grounds.

Whilst the heat emissions will be relatively localised the thermal radiation from the cable operation would be constantly emitted. To mitigate for a temperature rise OSPAR (2009) recommend an appropriate burial depth should be applied where practical. The target depths of lowering (DOL) of the cable into the seabed along the cable route is between 0.8 and 2.5m (see Volume 3D Part 2 EIAR for Ireland Offshore (Specialist Chapters) - Chapter 5: Description of the Landfall and Chapter 6: Description of the Offshore Cable). The target DOL will vary depending upon seabed geology and with the variable risk profile.

Despite the long-lasting thermal radiation, authors such as Taormina et al. (2018), BERR (2008) and NIRAS (2015) conclude that both the narrowness of cable corridors and the expected weakness of thermal radiation (it is considered that seawater would remain at background temperatures very close to the seabed surface), impacts to fish are not considered to be significant. The sensitivity of fish to the localised heat emissions is considered **Low**.

The magnitude of the environmental change, as a result of heat emissions produced by the subsea cable has been assessed as Medium.

The significance of this effect has been assessed as Minor and **Not Significant**.

13.7.3 Assessment of Effects - Marine Mammals and Reptiles

Installation phase

<u>Underwater noise and disturbance to marine mammals in the intertidal and subtidal zones</u>

Underwater noise and disturbance effects on marine mammals in the intertidal zone (seals) and subtidal zone (all groups) are possible during the installation, operational and decommissioning phases. Particularly, as a result of underwater noise from sheet piling, to create and remove the cofferdam (causing potential disturbance, hearing loss/injury and/or direct mortality), subsea survey and monitoring equipment (causing potential disturbance, hearing loss/injury and/or direct mortality) and increased vessel movements (causing seal injury from ducted propellers).

For underwater noise from sheet piling, to create and remove the cofferdam (causing disturbance, hearing loss/injury and direct mortality) this is a Negative, Short-term, Permanent impact, which is Certain/near-certain to occur for a receptor of County ecological value. This is considered to be a **Low** magnitude impact (leading to the loss of <1% of a defined population) that requires mitigation so that impacts on the integrity of the receptor , are avoided and/or controlled. Without mitigation this impact would be considered to be **Significant** in the context of the integrity of this ecological resource.

For underwater noise from the subsea survey and monitoring equipment (causing potential disturbance, hearing loss/injury and/or direct mortality) this is a Negative, Short-term, Permanent impact, which is Certain/near-certain to occur for receptors of Local and Regional ecological value. This is considered to be a **Low** magnitude impact (lead to the loss of <1% of a defined population) that requires mitigation so that impacts on the integrity of these receptors, are avoided and/or controlled. Without mitigation this impact would be considered to be **Significant** in the context of the integrity of these ecological resources.

For increased vessel movements (including seal / cetacean injury from ducted propellers) this is a Negative, Permanent impact, which is Unlikely to occur for a receptor of County ecological value. This is considered to be a **Negligible** magnitude impact (less than <1% of the population) and is not considered to have an impact on the integrity of the receptor. This is therefore considered **Not Significant** impact in the context of the integrity of this ecological resource.

Operational phase

<u>Underwater noise and disturbance to marine mammals in the intertidal and subtidal zones</u>

Underwater noise and disturbance effects on marine mammals in the intertidal zone (seals) and subtidal zone (all groups) are possible during the operational phase. Particularly, as a result of underwater noise from subsea survey and monitoring equipment (causing potential disturbance, hearing loss / injury and/or direct mortality) and increased vessel movements (causing seal injury from ducted propellers).

For underwater noise from the subsea survey and monitoring equipment (causing potential disturbance, hearing loss/injury and/or direct mortality) this is a Negative, Long-term, Permanent impact, which is Certain/near-certain to occur for receptors of Local and Regional ecological value. This is considered to be a Low magnitude impact (lead to the loss of <1% of a defined population) that requires mitigation so that impacts on the integrity of these receptors, which are of Local and Regional importance, are avoided and/or controlled.

Without mitigation this impact would be considered to be Significant in the context of the integrity of these ecological resources.

For increased vessel movements (seal injury from ducted propellers) this is a Negative, Permanent impact, which is Probable to occur for a receptor of County ecological value. This is considered to be a Negligible magnitude impact (less than <1% of the population) and is not considered to have an impact on the integrity of the receptor, which is of County importance. This is therefore considered to be a Not Significant impact in the context of the integrity of this ecological resource.

Decommissioning phase

Underwater noise and disturbance to marine mammals in the intertidal and subtidal zones

Underwater noise and disturbance effects on marine mammals in the intertidal zone (seals) and subtidal zone (all groups) are possible during the decommissioning phase. Particularly, as a result of underwater noise from subsea survey and monitoring equipment (causing potential disturbance, hearing loss / injury and/or direct mortality) and increased vessel movements (causing seal injury from ducted propellers).

For underwater noise from the subsea survey and monitoring equipment (causing potential disturbance, hearing loss/injury and/or direct mortality) this is a Negative, Short-term, Permanent impact, which is Certain / near-certain to occur for receptors of Local and Regional ecological value. This is considered to be a Low magnitude impact (lead to the loss of <1% of a defined population) that requires mitigation so that impacts on the integrity of these receptors, which are of Local and Regional importance, are avoided and/or controlled. Without mitigation this impact would be considered to be Significant in the context of the integrity of these ecological resources.

For increased vessel movements (seal injury from ducted propellers) this is a Negative, Permanent impact, which is Unlikely to occur for a receptor of County ecological value. This is considered to be a Negligible magnitude impact (less than <1% of the population) and is not considered to have an impact on the integrity of the receptor, which is of County importance. This is therefore considered to be a Not Significant impact in the context of the integrity of this ecological resource.

13.7.4 Assessment of Effects - Marine Reptiles

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Installation phase

Underwater noise and disturbance to marine turtles

Underwater noise and disturbance effects on marine turtles are possible during the installation, phase. Particularly, as a result of underwater noise from sheet piling, to create and remove the cofferdam, support and installation vessel presence (engines and DPs), cable laying with trenching and install of external cable, subsea survey and monitoring equipment, installation of external cable protection/rock deployment (causing potential disturbance, low frequency masking, possible hearing loss/injury and/or direct mortality).

For underwater noise from sheet piling, to create and remove the cofferdam (causing disturbance, low frequency masking, possible hearing loss / injury and/or direct mortality) this is a Negative, Short-term, Temporary and Permanent impact, which is Unlikely to occur for a receptor of County ecological value. This is considered to be a **Low** magnitude impact (lead to the loss of <1% of a defined population) that requires mitigation so that impacts on the integrity of the receptor, are avoided and/or controlled. Without mitigation this impact would be considered to be **Significant** in the context of the integrity of the ecological resource.

For underwater noise from support and installation vessels (causing disturbance and low frequency masking) this is a Negative, Short-term, Temporary impact, which is Probable to occur for a receptor of County ecological value. This is considered to be a **Low** magnitude impact (lead to the loss of <1% of a defined population) that requires mitigation so that impacts on the integrity of the receptor, which is of County importance, are avoided and/or controlled. Without mitigation this impact would be considered to be Significant in the context of the integrity of the ecological resource.

For underwater noise from cable laying with trenching and install of external cable (causing disturbance) this is a Negative, Short-term, Temporary impact, which is Unlikely to occur for a receptor of County ecological value. This is considered to be a Low magnitude impact (lead to the loss of <1% of a defined population) that requires mitigation so that impacts on the integrity of the receptor, which is of County importance, are avoided and/or controlled. This is therefore considered **Not Significant** in the context of the integrity of the ecological resource.

For underwater noise from subsea survey and monitoring equipment (causing disturbance, low frequency masking, possible hearing loss/injury and/or direct mortality) this is a Negative, Short-term, Temporary and Permanent impact, which is Probable to occur for a receptor of County ecological value. This is considered to be a Low magnitude impact (lead to the loss of <1% of a defined population) that requires mitigation so that impacts on the integrity of the receptor, are avoided and/or controlled. Without mitigation this impact would be considered to be **Significant** in the context of the integrity of the ecological resource.

Operational phase

<u>Underwater noise and disturbance to marine turtles</u>

Underwater noise and disturbance effects on marine turtles are possible during the operational phase. Particularly, as a result of subsea survey and monitoring equipment (causing disturbance, low frequency masking, possible hearing loss/injury and direct mortality).

For underwater noise from subsea survey and monitoring equipment (causing disturbance, low frequency masking, possible hearing loss/injury and/or direct mortality) this is a Negative, Short-term, Temporary and Permanent impact, which is Probable to occur for a receptor of County ecological value. This is considered to be a **Low** magnitude impact (lead to the loss of <1% of a defined population) that requires mitigation so that impacts on the integrity of the receptor, which is of County importance, are avoided and/or controlled. Without mitigation this impact would be considered to be **Significant** in the context of the integrity of the ecological resource.

Decommissioning phase

<u>Underwater noise and disturbance to marine turtles</u>

Underwater noise and disturbance effects on marine turtles are possible during the decommissioning phase. Particularly, as a result of subsea survey and monitoring equipment (causing disturbance, low frequency masking, possible hearing loss/injury and/direct mortality).

For underwater noise from subsea survey and monitoring equipment (causing disturbance, low frequency masking, possible hearing loss/injury and/or direct mortality) this is a Negative, Short-term, Temporary and Permanent impact, which is Probable to occur for a receptor of County ecological value. This is considered to be a Low magnitude impact (lead to the loss of <1% of a defined population) that requires mitigation so that impacts on the integrity of the receptor, which is of County importance, are avoided and/or controlled. Without mitigation this impact would be considered to be Significant in the context of the integrity of the ecological resource.

13.7.5 Cumulative Effects

As outlined in Section 4.8, consideration has been given as to whether any of the ecological features that have been taken forward for assessment in this chapter are likely to be subject to cumulative effects on ecological features because of the effects generated by other developments.

13.8 Mitigation

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14 Seascape and Landscape

14.1 Introduction

This chapter assess the likely significant effects of the Celtic Interconnector Project within Irish Territorial Waters and the Irish Exclusive Economic Zone (EEZ) with regard to the seascape and landscape.

14.1.1 Definition of landscape and seascape

Landscape is defined by the European Landscape Convention (ELC) as "*an area, as perceived by people, whose character is the result of the action and interaction of natural and/or human factors*"[52]. The ELC definition of landscape is inclusive and Article 2 of the ELC states that "*Subject to the provisions contained in Article 15, this Convention applies to the entire territory of the Parties and covers natural, rural, urban and peri-urban areas. It includes land, inland water and marine areas. It concerns landscapes that might be considered outstanding as well as every day or degraded landscapes*."

The National Marine Planning Framework Consultation Draft[53] (Government of Ireland / Rhialtas na hÉireann) states that, "*Seascape refers to landscapes with views of the coast or seas, and coastal areas and the adjacent marine environment with cultural, historical and archaeological links with each other. Seascape can be broken down into its constituent parts of visual resource and marine character. Visual resource refers to views of the coast and sea from land, views from the sea to land, and views from sea to sea. Character is the perception of an area, the combination of characteristics at the surface, within the water column and on the seabed*."

Landscape and seascape effects relate to changes to the landscape or seascape as resources in their own right. Visual effects are a closely linked set of effects on specific views and on the general visual amenity experienced by people.

14.2 Methodology and Limitations

14.2.1 Legislation and Guidance

Legislation

Planning Policies set out in the National Marine Planning Framework Consultation Draft with regard to seascape state that, "*Proposals should demonstrate how the impacts of a development on the seascape and landscape of an area have been considered. The proposal will only be supported if they demonstrate that they will, in order of preference: a) avoid, b) minimise, or c) mitigate significant adverse impacts on the seascape and landscape of the area.*" It continues, "*If it is not possible to mitigate significant adverse impacts, the public benefits for proceeding with the proposal that outweigh significant*

[52] Council of Europe, (2000). *European Landscape Convention Statutory Instrument 2018 No. 834*.
[53] Rhialtas na hÉireann/Government of Ireland, (2019). *National Marine Planning Framework Consultation Draft*. [online]. Available at: https://www.housing.gov.ie/sites/default/files/public-consultation/files/draft_national_marine_planning_framework_final.pdf

adverse impacts on the seascape and landscape of the area and its significance must be demonstrated."

Technical Guidance

The data gathering and scoping exercise has been undertaken in accordance with the third edition of the Guidelines for Landscape and Visual Impact Assessment (GLVIA3) produced by the Landscape Institute and the Institute of Environmental Management and Assessment[54], together with best practice and professional experience. GLVIA3 is widely regarded by landscape and planning professionals in Ireland and the UK as the 'industry standard'.

14.2.2 Desktop Studies

The scope of this chapter was defined in the Scoping Report for Foreshore Licence Application and Environmental Impact Assessment Report that was submitted to the Foreshore Unit within the Department of Housing Local Government and Heritage (DHLGH) for review and comment in October 2020. The scope definition was based upon a desktop review of legislation, guidance documents, and current best practices in EIA. The principal data sources used to inform the assessment of potential landscape, seascape and visual effects comprises the following:

- Cork County Draft Landscape Strategy[55];
- Regional Seascape Character Assessment for Ireland 2020 Draft Consultation Report[56] (The Marine Institute, 2020); and
- Aerial Photography (Google Earth Pro – imagery date March 2020).

14.2.3 Field Studies

Surveys of Claycastle Beach and its environs were carried out between 2017 - 2018. A follow-up walkover survey was carried out at Claycastle Beach in late 2020. The walkover survey did not note any changes to the general beach environment since the initial survey conducted in 2018, with the exception of the introduction of a boardwalk structure that was under construction at the time of the survey. Once completed the wooden boardwalk will connect the eastern end of the car park with Beach Promenade and the western end of the car pack to Redbarn Beach. The boardwalk structure is a raised platform walkway approximately 2m wide.

14.2.4 Methodology for Assessment of Effects

The visual effects of temporary landfall works on the beach and above the MHWM on human receptors will be covered in Volume 3C EIAR Ireland Onshore. An assessment on landscape / seascape character and visual receptors as a consequence of the offshore

[54] Landscape Institute and the Institute of Environmental Management and Assessment, (2013). *Guidelines for Landscape and Visual Impact Assessment. 3rd edition*. London. Routledge.
[55] Cork County Council, (2007). *Cork County Draft Landscape Strategy*. [online]. Available at: http://corkcocoplans.ie/wp-content/uploads/bsk-pdf-manager/2016/07/Draft-Landscape-Strategy-2007.pdf
[56] The Marine Institute, (2020). *Definition and Classification of Ireland's Seascapes*. Minogue, R, Foley, K, Collins, T, Hennessy, R, Doherty, P, Vaughan, E and Black, D. [online]. Available at: https://emff.marine.ie/blue-growth/project-13-definition-and-classification-ireland%E2%80%99s-seascapes

components of the project (up to MHWM) has been scoped out of the EIAR because they are not likely to be significant. Therefore, no assessment methodology including significance evaluation criteria is required.

14.3 Receiving Environment

14.3.1 Irish Territorial Waters

Landscape character

The Cork County Draft Landscape Strategy identifies the Irish landfall site at Claycastle Beach as being within Landscape Character Type (LCT) 2: Broad Bay Coast and more specifically with Landscape Character Area (LCA) 35 - Youghal Bay. This LCT "*stretches along the coast from the mouth of Cork Harbour in the west to the eastern boundary of County Cork at Youghal*" and features the following key characteristics:

- "Land use, field, boundaries, trees and wildlife:
  - *The coastline sweeps in broad bays flanked by low promontories, terminating along the shore with low cliffs, and a combination of rocky shores and long crescent shaped bays, such as Ballycotton Bay and Youghal Bay.*
  - *Inland, moderately sized fertile fields bounded by low broadleaf hedgerows, are used mostly for dairy pasture but also some tillage.*
- Built Environment:
  - *Isolated cottages, two-storey houses and farmsteads are scattered across the landscape.*
- Socio Economic:
  - *Towns and villages include Youghal, Shanagarry and Ballycotton.*
- Ecology:
  - *The freshwater marsh at Ballyvergan is Irelands largest coastal freshwater marsh and is important for a number of breeding bird species including the Reed Warbler.*
  - *Cliffs and offshore islands are important for breeding seabirds including cormorants, black guillemots, gulls and fulmar. Other coastal and estuarine habitats are important and support significant numbers of wintering birds.*
  - *The Blackwater River and its associated woodlands and other habitats are the most noteworthy inland habitats within this area."*

The Cork County Draft Landscape Strategy also provides an evaluation of each LCT in terms of the following:

- Landscape Value defined in the draft Landscape Strategy as "the environmental or cultural benefits, including services and functions, which are derived from various landscape attributes".
- Landscape Sensitivity defined as "the measure of a landscape's ability to accommodate change or intervention without suffering unacceptable effects to its character and values."

- Landscape Importance considered to be the "importance of a landscape rated as Local, County, or National".

LCT 2: Broad Bay Coast is identified as being of very high landscape value and sensitivity, and of County importance.

There are no further landscape character types described in the *Cork County Draft Landscape Strategy* for 35 - Youghal Bay[4].

Seascape character

The Regional Seascape Character Assessment for Ireland 2020 (Draft Consultation Report) identifies Claycastle beach within the Atlantic Celtic Bays and Estuaries Seascape Character Area (SCA 10). This large SCA comprises a stretch of Cork and Waterford coastline and bays from Cape Clear to Helvick Head, Co. Waterford. The SCA is predominantly influenced by the Celtic Sea but the Atlantic continues to exert an influence particularly at the western end. The key characteristics of the SCA10 are:

- "A complex and extensive SCA; that is subject to influence of both Atlantic Ocean and Celtic Seas.
- A series of estuaries, bays, headlands, low cliffs and beaches with a broadly consistent coastal form.
- Key seascape features relate to the series of headlands including Seven Head, Old Head of Kinsale, Ardmore and Helvick Head.
- Protruding Old Red Sandstone Peninsulas more pronounced in the western part of this SCA are accompanied by cliffs usually between 40 - 60m AOD (Above Ordnance Datum)
- Three important historic towns are located in this SCA: Rosscarbery, Kinsale and Youghal. Kinsale and Youghal were both enclosed with towns walls and defences and Rosscarbery may have been walled. All three towns have long associations with the sea throughout their histories.
- The vertical scale of the cliffs and headlands create a more dramatic character and present closer dramatic views to the sea and along the series of headlands in good visibility.
- Popular for recreation, tourism, sailing, fishing, arts and food production, this is an active and busy SCA, contrasting with a more remote character associated with the headlands.
- Strong connections to the sea remain with clear maritime character; the estuaries offer a sense of shelter and haven; the presence and influence of the Atlantic Ocean and Celtic Sea is constant."

No Seascape or Marine Character Assessment has been prepared for the Celtic Sea between the Irish Territorial Waters and the EEZ boundary between Ireland and the UK. The seascape is open sea with daily commercial shipping present.

Local landscape and visual context

Few of the key characteristics cited for LCT 2 are overtly present at Claycastle Beach, which comprises a sandy foreshore backed by a long, narrow public car park to the north. The car park is separated from the Summerfield Holiday Park by a strip of grassed dunes. A second, smaller caravan park is located to the northeast of the car park opposite the Claycastle Pitch and Putt club and Youghal Leisure Centre, both sited on the northern side of Front Strand. A raised wooden boardwalk (the Youghal Boardwalk) on piled foundations connects the eastern end of the car park with Beach Promenade, whilst further footpaths are provided across the raised area of amenity grassland which separates the beach and Front Strand, and which provides opportunities for elevated sea views towards Capel Island and Knockadoon Head. In 2020, construction was undertaken on the boardwalk to extend it from the western end of the car park towards Redbarn Beach as shown in Figure 14.1.

Figure 14.1 Boardwalk – Claycastle Beach

An arial image of the beach is shown in Figure 14.2 with the locations of the photographs shown in Figure 14.3 marked on it. Photographs one, three and five were taken on top of the embankment that lies between the carpark and the beach. Photographs two and four were taken from the beach itself between the high and low water mark. Photograph six shows an outfall of stream as noted in the 2017 - 2018 surveys. In the background of photo six, the boardwalk construction to the west of the carpark is shown.

Figure 14.2 Claycastle Walkover – Photograph Locations

Figure 14.3 Claycastle Walkover Survey – Pictures

14.4 Characteristics of the Development

14.4.1 Landfall at Claycastle Beach

A description of the landfall development at Claycastle Beach is set out in Volume 3D Part 2 EIAR for Ireland Offshore (Specialist Chapters) - Chapter 5: Description of the Landfall.

14.4.2 Cable Route

The Celtic Interconnector cable route within Irish Territorial Waters and Irish EEZ is described in Volume 3D Part 2 EIAR for Ireland Offshore (Specialist Chapters) - Chapter 6: Description of the Offshore Cable.

14.5 Likely Significant Impacts of the Development

As noted at the start of this chapter, an assessment of landscape and seascape effects has been scoped out of the EIAR on the basis that significant effects are considered unlikely to occur. The rationale behind this conclusion, as reported as part of the Scoping Report for Foreshore Licence Application and EIAR is set out in Table 14.1.

Table 14.1 Seascape and Landscape – Likely Significant Impacts of the Development

Potential impact	**Rationale**	**Potential mitigation**
Installation phase		
Changes to landscape / seascape character at the landfall site (up to MHWM) during the installation phase.	Changes to landscape / seascape character would include the presence of installation machinery and disturbance along a highly localised corridor within LCT 2 (and LCA 35) which both cover relatively large areas. Installation works across Claycastle Beach (to MHWM) are scheduled to take place over a 10-week period and within an installation corridor (incorporating the cofferdam and raised causeway) that extends to less than 25m in width. The key characteristics noted in the extant assessment would remain unchanged. Whilst noted as being of very high value and sensitivity, the localised nature of the effects and their brevity (approximately 10 weeks) means that significant landscape and seascape upon LCT 2 (and LCA 35) effects are unlikely to occur.	Not applicable
Changes to visual receptors' views close to the landfall site during the installation phase	Visual receptors are primarily recreational receptors visiting the Claycastle Beach and Youghal Boardwalk. These are likely to be of high visual sensitivity, but the brevity of the works (a 10-week period) and localised nature of the installation corridor (less than 25m wide) means that significant visual effects are unlikely to occur. Nevertheless, visual effects of work on the beach below MHWM will be addressed in the onshore volume of the EIAR as it is a common set of	Not applicable

Potential impact	Rationale	Potential mitigation
	visual receptors to those affected by true onshore works.	
Changes to seascape character within Irish Territorial Waters and Irish EEZ during the installation phase.	Changes to seascape character within the Irish Territorial Waters and EEZ during the installation phase will be associated with the presence of cable-laying vessels. The presence of vessels is not an uncommon characteristic of the baseline seascape character with SCA 10 citing an area which is "*Popular for recreation, tourism, sailing, fishing, arts and food production, this is an active and busy SCA*" as one of the key characteristics. As a consequence, the cable-laying vessels will be incremental to those which are already present within SCA 10 and consequently significant effects are unlikely to occur.	Not applicable
Operation phase		
Changes to landscape / seascape character at the landfall site (up to MHWM) during the operational phase	The mitigation measures deployed would ensure that there would be no long-term direct or indirect changes to landscape / seascape character within the intertidal area (up to MHWM) (i.e. within LCT 2: Broad Bay Coast or LCA 35 - Youghal Bay).	Following completion of the installation works across Claycastle Beach to MHWM, the installation corridor (incorporating the cofferdam and raised causeway) would be reinstated using native materials previously excavated from the beach to original beach levels and gradients.
Changes to visual receptors' views close to the landfall site (up to MHWM)	There would be no long-term changes to visual receptors' views (that is, recreational users of Claycastle Beach) during the operational phase.	The mitigation measures described for the changes to

Potential impact	Rationale	Potential mitigation
during the operational phase		landscape / seascape character at the landfall site are applicable to the visual effects.
Changes to seascape character within Irish Territorial Waters and the Irish EEZ during the operational phase	There would be no above surface changes to seascape character during the operational phase. The presence of any operational maintenance or survey vessels would be occasional and in keeping with the existing seascape character as described for SCA 10.	Not applicable

14.5.1 Decommissioning Phase

The developers of the Celtic Interconnector will prepare a decommissioning plan prior to the decommissioning phase of the Project, which is expected to be at least 40 years from the start of operation. It is currently anticipated that the cable and associated external cable protection will be left in-situ where this is deemed environmentally acceptable. Monitoring and maintenance may be required by the regulators and this would be agreed upon preparation of the decommissioning plan. Based on the findings of this assessment for the construction and operational phases of the Project, there are not expected to be any significant effects on the landscape or seascape character as a result of this proposed course of action.

14.5.2 Cumulative Impact

Landscape and seascape characteristics are not anticipated to be affected by other developments such that any cumulative effect might arise.

14.5.3 Mitigation and Monitoring

As noted at the start of this chapter, an assessment of landscape and seascape effects has been scoped out of the EIAR on the basis that significant effects are considered unlikely to occur. Following completion of the installation works across Claycastle Beach to MHWM, the installation corridor (incorporating the cofferdam and raised causeway) would be reinstated using native materials previously excavated from the beach to original beach levels and gradients. These measures are considered to be likely to be effective and deliverable and no additional mitigation measures are proposed to further reduce the landscape and seascape effects.

14.5.4 Residual Impact

No significant residual effects on landscape or seascape character are predicted to occur.

15 Archaeology and cultural heritage

15.1 Introduction

This chapter of the EIAR assesses the likely significant effects of the Project with respect to the marine historic environment within Irish Territorial Waters and the Irish Exclusive Economic Zone (EEZ). This chapter should be read in conjunction with the development description provided in Volume 3D Part 2 EIAR for Ireland Offshore (Specialist Chapters) - Chapter 5: Description of the Landfall and Chapter 6: Description of the Offshore Cable.

The Framework and Principles for the Protection of the Archaeological Heritage (Department of Culture, Heritage and the Gaeltacht 1999) sets out that the archaeological heritage of an area is a non-renewable resource that requires careful and responsible management, taking account of:

- The need to examine and re-assess conclusions reached by present day study;
- The necessity to provide for long term curation and conservation of archaeological material;
- The ability to process, analyse, and disseminate the results of archaeological excavations; and
- The benefit of archaeological remains to the public in terms of promoting knowledge and understanding of the past.

In this case, potential receptors of effects arising from the Project fall into two categories; archaeological remains (primarily remains of vessels lost at sea or other marine wreckage); and deposits of archaeological interest, comprising sediments of potentially terrestrial origin that have been inundated by rising sea levels.

15.2 Methodology and Limitations

15.2.1 Legislation, Policy and Guidance

This chapter is concerned with the effects arising on the marine historic environment within the Territorial Waters and the EEZ of the Republic of Ireland. Consequently, the relevant legislative framework is set by:

- National Monuments Acts (1930-2004);
    - The National Monuments (Amendments) Act 1987 sets out protections for wrecks over 100 years old, archaeological objects underwater irrespective of age, wrecks that are less than 100 years old and archaeological objects, or the potential location of such a wreck or archaeological object. An Underwater Heritage Order (UHO) can be placed on a wreck or object if it is considered to be of sufficient historical, archaeological or artistic importance to merit such protection.

- Interference with any wreck which is more than one hundred years old or an archaeological object which is lying on, in, or under the sea bed or on or in land covered by water is prohibited except in accordance with a licence issued by the Minister for Culture, Heritage and the Gaeltacht.
- Heritage Act (Ireland, 1995);
  - This act sets out the powers of An Chomhairle Oidhreachta (The Heritage Council) to propose policies and priorities for (inter alia) the identification, protection, preservation and enhancement of the national heritage, including, archaeological objects, heritage objects, seascapes and wrecks.

The potential for activities to give rise to disturbance of the marine historic environment is recognised in the inclusion of the Minister for Culture, Heritage and the Gaeltacht as a consultee in proposals in other Acts, including the Foreshore Act 1933 (as amended).

The National Marine Planning Framework (NMPF) is presently in progress at Stage 3 of a four-stage process, comprising preparation of a finalised NMPF, planned for adoption before March 2021. In addition to consultation questions, the NMPF Baseline Report (2018) sets out:

- The policy, legislative and regulatory context for marine spatial planning and the development of Ireland’s first plan;
- A description of the “as is” situation in terms of existing sectoral development and activities in Ireland’s maritime area, including an identification of the future opportunities and constraints for each; and
- An initial elaboration of potential high-level objectives for Ireland’s first National Marine Planning Framework.

The draft NMPF sets out that a process of assessment of the potential effects of development and mitigation of disturbance will be required.

Guidance on the treatment of the historic environment in planning is set out in the Framework and Principles for the Protection of the Archaeological Heritage (Department of Culture, Heritage and the Gaeltacht 1999), which sets out the archaeological heritage is a non-renewable resource which requires careful and responsible management. This guidance also identifies processes for the management of the archaeological heritage within planning and other consent applications.

Where relevant, archaeological fieldwork was carried out in line with the ‘Institute of Archaeologists of Ireland code of conduct for archaeological assessment excavation (2006).

International Guidance and policy on the treatment of the marine historic environment is also set out in:

- European Convention on the Protection of the Archaeological Heritage (The Valetta Convention) 1992;
- UNESCO Convention on the Protection of the Underwater Cultural Heritage (2001);

- International Council of Monuments and Sites (ICOMOS) Charter on the Protection and Management of Underwater Cultural Heritage (1996) (the Sofia Charter); and
- United Nations Convention on the Law of the Sea (UNCLOS) 1982.

EirGrid has published guidance on Cultural Heritage Guidelines for Electricity Transmission Projects A Standard Approach to Archaeological, Architectural and Cultural Heritage Impact Assessment of High Voltage Transmission Projects (2015). This summarises existing legislation and guidance, describing how EirGrid will respond to those requirements and sets out a staged process to ensure that archaeology and cultural heritage issues are considered at each stage of the development process.

15.2.2 Supporting Baseline Surveys

Archaeological assessments of the entire route were undertaken by Headland Archaeology (2014; 2015) including a desk-based assessment (DBA), and assessment of marine geophysical survey data for the entire route and two landfall location options in Ireland. A geoarchaeological assessment of vibrocore logs was also conducted (by Wessex Archaeology 2016). In addition to full coverage of the present route, these assessments include sectors of the route that are no longer under consideration.

Cotswold Archaeology was commissioned by EirGrid plc in 2017 to undertake further archaeological assessments on the new / revised routes. These included a DBA, assessment of marine geophysical survey data, non-intrusive foreshore surveys including walkover, hand-held metal detector, and geophysical (electrical conductivity) surveys at two new locations (Claycastle and Redbarn), and a walkover survey at Ballinwilling Strand that had been assessed previously (Headland Archaeology 2015). The aim of this work was to assess and map the extent of archaeological remains at the three potential landfall locations being considered at that time.

The archaeological assessment of marine geophysical data for the revised routes in Irish Territorial Waters was undertaken for Cotswold Archaeology by Coastal and Offshore Archaeological Research Services (COARS), University of Southampton, in 2018. The aim was to identify, locate and characterise features with possible archaeological potential, and to assess the sub-bottom profiler (SBP) data in order to establish the archaeological and palaeo-environmental potential of the subsurface sediments that may be encountered (Cotswold Archaeology 2018a).

In advance of geotechnical site investigations, which used intrusive techniques such as vibrocores, boreholes and test pits, an underwater archaeology impact assessment was undertaken at the landfall locations. This mapped features of archaeological potential at each of the landfall locations, including the exposed peat deposits at Claycastle beach, highlighting their palaeo-environmental potential. It then suggested mitigation in the form of archaeological exclusion zones to avoid any impact to these sites (Cotswold Archaeology 2018b). The impact assessment has not been included in this report as relevant details contained therein are addressed in reporting included at Appendices 11D, 11E, 11F and 11G.

Commented [A60]: Placeholder: Appendices currently in preparation; these will be incorporated into the EIAR documentation prior to submission of the final Application File.

In addition to the original site investigations along the original proposed cable route (Wessex Archaeology 2016), further site investigations were undertaken in 2018 along the revised routes in Irish Territorial Waters. These comprised test pits and boreholes on the landfall and nearshore locations, and vibrocores in deeper water (Cotswold Archaeology 2019a). A watching brief (or 'archaeological monitoring') was conducted during the site investigations on the foreshore and in the intertidal zone (IAC Archaeology 2018).

The peat deposits found in the intertidal zone at Claycastle Beach[57] were further investigated using a hand auger and hand-dug test pits. A geoarchaeological assessment was then undertaken of the results of these investigations. This assessment was undertaken to understand the nature and extent of the buried peat deposits, to recover any material that might be of archaeological significance, and to enhance our understanding of the nature of the deposit (Cotswold Archaeology 2019).

Desk-based studies which have informed the development of the scope and baseline of this assessment are set out at Table 15.1.

Table 15.1 Desk-based studies

Study	Scope and Key Findings	Appended as
Ireland-France Celtic Interconnector, Marine archaeology desk-based assessment. **(Headland Archaeology 2014)**	Marine Archaeology baseline study aiming to: • Assess the nature of the cultural resource in this area; • Outline the archaeological potential of the marine environment; • Aid in the identification of seabed anomalies that may be discovered during the proposed • Complete a geophysical survey; and, • Inform and propose mitigation for sites that may be impacted by the proposed geotechnical survey. Results: • Identification of recorded potential wrecks and obstructions; and, • Identification of potential for survival of deposits of geoarchaeological interest within the intertidal and marine zones.	n/a
Celtic Interconnector Project Marine archaeology desk-based assessment **(Cotswold Archaeology 2017)**	Marine archaeology baseline survey of the revised offshore routes related to the Ballinwinning, Claycastle and Redbarn landfalls identified one potential wreck within the Cable Study Corridor (CSC) and areas of geoarchaeological interest.	n/a
Celtic Interconnector Project, Marine	Consolidates previous reporting, focusing on the final agreed route. Sets out archaeological baseline for the entire route between Irish and French	Appendix 11A

[57] These deposits are noted as area of archaeological potential CH138 in the onshore historic environment chapter.

Study	Scope and Key Findings	Appended as
***Archaeology and Cultural Heritage Report.* (Cotswold Archaeology 2019)**	landfalls, identifying areas of geoarchaeological and archaeological interest.	

Field studies that have influenced the scope and baseline of this assessment are set out at Table 15.2.

Table 15.2 Field studies

Study	Scope and Key Findings	Appended as
Ireland-France Celtic Interconnector: Archaeological Review of Geophysical Survey Data (Headland Archaeology 2015)	Review of geophysical (side scan, seismic pinger and magnetometer) and bathymetric (multi-beam echo sounder, or MBES) data, in order to identify sites or features of archaeological potential and to characterise the marine environment in terms of prehistoric landscape potential and significance. Identified three medium potential anomalies and 40 low potential anomalies in proximity of the CSC.	Appendix 11B
Celtic Interconnector – Feasibility Study, Stage 1 Geoarchaeological Assessment of Vibrocore Logs. (Wessex Archaeology 2016)	Geoarchaeological assessment of vibrocore logs from Irish Territorial Waters and EEZ. Identified locations where deposits of geoarchaeological interest survive.	Appendix 11C
Archaeological review of foreshore walkover, and foreshore and offshore geophysical survey data. (Cotswold Archaeology 2018)	Walkover and geophysical surveys of potential landfalls at Claycastle and Redbarn and associated cable routes, with a further walkover survey at a potential landfall at Ballinwinning. Identified potential archaeological features within the foreshore at Claycastle and Redbarn and potential features of geoarchaeological interest and one potential wreck within the marine zone.	Appendix 11D
Celtic Interconnector Project Marine archaeological impact assessment for proposed ground investigation surveys. (Cotswold Archaeology 2018)	Assessment of the potential effects of proposed ground investigation works at Ballinwinning, Redbarn and Claycastle and within Irish Territorial Waters.	n/a
Celtic Interconnector Project	Assessment of samples recovered from Claycastle and Redbarn beaches identified estuarine deposits and a potential submerged	Appendix 11E

Study	Scope and Key Findings	Appended as
Geoarchaeological Assessment. (Cotswold Archaeology 2019)	forest in nearshore and intertidal areas of Claycastle Beach.	
Archaeological monitoring as part of the Celtic Interconnector Project, Claycastle & Summerfield/ Clonard East/ Ballycrenane, County Cork. (IAC Archaeology 2018)	Archaeological monitoring of ground investigation at Claycastle, Ballinwinning and Ballycroneen. No archaeological remains were observed at Ballinwinning or Ballycroneen, but buried peats were observed at Claycastle.	Appendix 11F
Celtic Interconnector Project Claycastle Beach, Youghal, Co. Cork, Ireland Geoarchaeological assessment of auger and test pit logs. (Cotswold Archaeology 2019)	Report on augering and test pitting at Claycastle beach. Identified buried peats within the proposed cable route.	Appendix 11G

15.2.3 Methodology for Assessment of Effects

Effect Categorisation

The likely effects anticipated to arise on the marine historic environment are, in this case, considered to be primarily direct effects in that disturbance of archaeological remains and deposits of geoarchaeological interest would arise only through direct disturbance caused by site clearance, cabling or cable protection operations. The Project would not give rise to change in processes such as scour or accretion that are likely to give rise to indirect disturbance of archaeological remains or deposits (see Volume 3D Part 2 EIAR for Ireland Offshore (Specialist Chapters) – Chapter 11: Marine Physical Processes). There is a potential that remains on the seabed may be indirectly affected by scour caused by the placement of cable protection in areas that experience more dynamic tidal currents, typically at depths of less than 20m.

Assignment of receptor value

Identified receptors have been assigned on the basis of professional judgement to the following classes of value as set out at Table 15.3.

Table 15.3 Receptor value

Value	Rationale
High	Features of high value are typically those of international / national importance recognised by designation (e.g. World Heritage Sites, Recorded Monuments and wrecks protected by Underwater Heritage Orders). High value features may also include those which are not at present designated, but which appear likely to meet any relevant criteria for designation by virtue of particularly good preservation, completeness or rarity.
Medium	Features of medium value are not normally designated but have value on a regional level. These features typically hold evidential or historical value on a regional level as relatively complete or well-preserved examples of common feature types or represent less well-preserved elements of more unusual features.
Low	Features of low value would not be designated and would generally represent less well-preserved examples of common features of which more representative and better-preserved examples exist, or which hold value on a local level.
Negligible	Features of negligible value are typically very poorly preserved and have little or no value but may be worthy of note.

Magnitude of Effect

Magnitude of effect has been classified by professional judgement into the following classes of magnitude set out in Table 15.4.

Table 15.4 Magnitude of Change

Value	Rationale – Adverse	Rationale - Positive
High	Total loss of an archaeological site or feature.	Removal of urgent risks to a site or feature and provision of significant enhancements to management, understanding and access/interpretation.
Medium	Disturbance of key elements of an archaeological site or feature, leaving the feature legible but discernibly disturbed.	Discernible enhancements to a site or feature, for example preventing a gradual declining trend in preservation, or enhancing public understanding.
Low	Minor disturbance of minor elements of an archaeological site or feature, leaving any remains or deposits largely legible or otherwise undamaged.	Minor enhancements to management of a feature or site.
Negligible	Very minor or superficial disturbance of a site or feature leaving all key elements readily legible.	Very minor or superficial enhancements to a site or feature.

Identification of Receptors

Potential receptors have been identified with reference to previous studies of the cable route. These have been verified by searches of known wrecks and obstructions records within a 500m Cable Study Corridor (CSC), defined as an area 250m to either side of the proposed cable route, and a wider study area of 2.5km to either side of the proposed cable route, i.e. 5km width in total.

Difficulties Encountered

The works carried out at Claycastle Beach have provided a clear understanding of the importance, nature and distribution of archaeological remains within the Project and the evidence base is considered robust.

The marine geophysical survey and vibrocoring was carried out primarily for engineering purposes and consequently the correlation of the archaeological deposit sequence with the subsea features is not tailored for predicting the survival of deposits of geoarchaeological interest or their distribution. This information is however sufficient to understand the value of these deposits, the nature and magnitude of any effect and the nature of proposed mitigation. Consequently, the evidence base for the EIAR is considered robust.

The evidence base for the presence of marine archaeological remains is generally predictive. Records of losses and study of geophysical surveys provide a comprehensive understanding of potential concerns, and identify features that should be avoided by design, but mitigation proposals have been developed to ensure that any limitations to these surveys can be adequately mitigated.

15.3 Receiving Environment

Detailed baseline information is contained within the suite of reports noted at Table 15.1 and is not reproduced in full below. The following description of the baseline receiving environment identifies the key historic trends and process that bear on the baseline environment and sets out the relevant potential receptors of adverse effects.

Figure 15.1 illustrates the locations of vibrocores and recorded and potential wrecks corresponding to the references used in Tables 15.5 and 15.6.

Figure 15.1 Location of vibrocores, recorded and potential wrecks containing archaeological material

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Near-Shore Peat Deposits

Test pitting on the beach and foreshore at Claycastle was carried out to investigate the full extent of peat deposits which visibly outcrop on Claycastle Beach and which geophysical survey suggested extended landward and seaward. This survey confirmed the presence of substantial silt and peat deposits buried below beach sands between high water and low water (Cotswold Archaeology 2019). These peat deposits were observed in augering to be between 0.85m to 1.2m thick and to be overlain by between 0.9m and 4.5m of beach sand within the cable route, but are significantly less deeply buried in other parts of the beach; cover was deepest at the landward side of the beach, with cover becoming shallower further down the beach. Previous archaeological investigation has suggested that the peats in this sequence were deposited from the early Neolithic period to the later Iron Age (approximately 3000 BC to AD 500). This duration of deposition means that the deposits potentially hold important information for informing understanding of the development of the past environment, particularly with regard to the rise in sea levels that occurred at this time. There is also a potential for anthropogenic material to survive within the peats, which offer suitable conditions for preservation of organic remains. These deposits are considered as a receptor of high value for their informative potential.

Walkover surveys have identified potential archaeological features, comprising a possible metal bowl (CA3001) and a rectilinear cut suggestive of a fulacht fia (CA 3007) close to the proposed landfall. These remains are important of themselves, but also indicate the potential for related archaeological remains to be present within the peat deposits.

Commented [A62]: Placeholder: Plan showing features on the beach to be added here prior to submission of final Application File.

Marine deposits of geoarchaeological interest

The Celtic Sea in its present state was formed after the end of the last glacial episode, with sea levels around 60-70m below modern sea level at around 20,000 years before present (bp) rising to approximately modern sea level by around 3,500 years bp, although there is significant uncertainty over the detailed progress and chronology of that sea level rise. The rising sea levels covered former land surfaces; in most cases causing erosion, which has removed those submerged land surfaces and exposed underlying bedrock, but in some cases leaving these former land surfaces in-situ and offering favourable conditions for the survival of organic remains. These are primarily of importance for providing information about the past environment at different periods, but which may also contain preserved remains of past human activity. These deposits have been identified surviving within the foreshore and near-shore environments as coherent and extensive deposit sequences. Within the marine zone, scour from rising sea levels has largely eroded these deposits such that they survive primarily in incised features such as former river valleys.

In deeper waters, specific areas of interest have been identified through marine geophysical survey and vibrocoring (Wessex Archaeology 2016). Sub-bottom profiling identified seven potential infilled channels, and geoarchaeological assessment of these sources identified four principal stratigraphic units:

- Unit 1 Bedrock: Chalk bedrock of no archaeological interest.

- Unit 2 Quaternary glacial / glacio-marine sediments: Primarily Diamacton, sands, gravels and clays of the Caernarfon Bay Formation and Western Irish Sea Formation. These deposits hold limited archaeological interest, having a low potential to contain redeposited archaeological material and in some cases forming land surfaces on which Unit 3 deposits formed.
- Unit 3 Estuarine and terrestrial sediments: Primarily laminae of peat in gravelly clay deposits. These deposits are of archaeological interest, with peat offering opportunities for preservation of organic remains which could inform understanding of past environments that pre-date inundation of the Celtic Sea area.
- Unit 4 Seabed sediments: Unconsolidated sands and gravels with frequent bivalve and gastropod shell surviving in various thicknesses up to 2.5m. These deposits have little or no archaeological interest.

The vibrocore locations where potentially archaeologically significant deposits were observed are set out at Table 15.5. These locations are not clearly correlated to the subsea features identified in the marine geophysical survey. The observed extent of these remains is over a 54km length of the proposed cable route, extending approximately 49km within the Irish EEZ, although the presence of intervening boreholes which did not contain archaeologically significant deposits demonstrates that these deposits are not continuous and appear to represent isolated survivals of deposits. Following initial assessment of nine core samples, six sample locations from five cores have been identified as potentially suitable for further investigation.

Table 15.5 Vibrocore locations where deposits of potential archaeological significance have been observed

ID	Depth From	Depth to	Rationale	Research Potential	Suitable for further investigation
VC-053A	0.29	0.46	Firm friable amorphous black Peat (H8)	Palaeoenvironmental Interest Sea level minima reference points	No
VC-065A	0.56	1.08	Occasional black organic pockets up to 7mm	Palaeoenvironmental Interest Sea level minima reference points	No
VC-071	0.36	1.12	Occasional black organic pockets up to 12mm	Palaeoenvironmental Interest Sea level minima reference points	No
VC-072	0.18	2.1	Occasional black organic and peaty pockets up to 12mm, between 1.6 - 2.1m many black organic/peaty laminae	Palaeoenvironmental Interest Sea level minima reference points	Yes

ID	Depth From	Depth to	Rationale	Research Potential	Suitable for further investigation
VC-073	0.24	0.3	Occasional small black organic / peaty pockets up to 6mm	Palaeoenvironmental Interest Sea level minima reference points	No
VC-075	0.1	1.4	Black organic/peaty pockets and laminae up to 12mm, between 0.9 - 0.95m black organic peaty band	Palaeoenvironmental Interest Sea level minima reference points	Yes
VC-075A	0.2	2.72	Small bands of organic/peaty pockets and laminae up to 7mm	Palaeoenvironmental Interest Sea level minima reference points	No
VC-077A	0.45	1.01	Dark grey slightly silty fine to medium sand with many thick laminae (up to 8mm thick) of firm clay	Palaeoenvironmental Interest Sea level minima reference points	Yes
VC-079A	0.3	1.13	Dark grey silty gravelly fine, medium and occasionally coarse sand with many thick laminae (up to 8mm thick) of firm sandy clay. Gravel is angular fine to coarse of sandstone. Rare pockets of fine to coarse sand. Slight organic odour	Palaeoenvironmental Interest Sea level minima reference points	Yes
VC-082	0.7	0.96	Dark brown / black slightly sandy silt	Palaeoenvironmental Interest Sea level minima reference points	No
VC-084*	0.42	1.25	Slightly peaty slightly sandy clayey silt	Palaeoenvironmental Interest Sea level minima reference points	Yes
Note: *VC-084 is located within the UK EEZ but appears to represent a continuation of the same deposit sequence observed within the Irish EEZ.					

These deposits are of particular significance as the first evidence for the survival of stratified deposit sequences relating to a pre-inundation archaeological landscape within the Celtic Sea area, and at depths of 96-104m below lowest astronomical tide are among the deepest marine peat deposits observed to date. While previous studies (e.g. Farr et al. 2017) had suggested that these deposit sequences might survive, recent research project have not identified these deposits. These deposits have the potential to complement understanding of the past human occupation of the Celtic Sea region and the wider European continental shelf during the last glacial period. They are certainly of national importance and have the potential to contribute to international research and understanding. These deposits are collectively considered as a receptor of high value.

Potential Archaeological Remains

There is a potential for remains of archaeological interest associated with terrestrial human activity within the near-shore peats, though no such remains have been observed to date. While no adverse effects are predicted, mitigation design will allow for the recovery of any archaeological material

The estuary of the River Blackwater forms a natural harbour at Youghal, which is recorded as having been formed by exceptional tidal conditions in the early 9th century AD, and which has been in use throughout the historic period. The approach to the harbour appears to be marked by a concentration of recorded losses and obstructions, and while the cable route passes to the south and west of the principal concentration of recorded wrecks, desk-based assessment has noted the presence of a number of recorded and potential wreck sites. The proposed cable route passes through an area to the south-west of the principal routes into and out of the harbour. As the route moves further into the Celtic Sea, it enters an area historically used for access to the Atlantic ports of Ireland, England, Wales and France and for access to the English Channel, and while recorded and potential wrecks and obstructions become more sparsely distributed, the potential that such features may be affected will remain.

Initial studies by Headland Archaeology (Headland Archaeology 2014) identified a number of recorded losses within the CSC, and subsequent analysis of marine geophysical survey identified further potential wrecks. These potential wrecks were classified as Low, Medium and High Potential. A renewed search was made of the NMS wreck data in the preparation of this EIAR.

The varied dates, sources and survey techniques used to identify and locate wrecks means that the locations cited by official records may not accurately reflect the true location of wrecks. Wreck W11319, recorded in desk studies by Headland Archaeology as HA 13 and by Cotswold Archaeology as CA8 is important in this respect. The true location of this wreck appears to be more accurately recorded as CA1001, an observation from the marine geophysical survey. This survey did not identify any anomalies at the recorded location of the wreck, and the distance between the recorded and observed locations is well within the tolerances anticipated for different generations of positioning systems.

There are no formally designated wrecks within the CSC or wider study area, although wider statutory protections of undated wrecks and wrecks over 100 years old under the National Monuments Act 1987 will still apply. Previously recorded losses and geophysical anomalies assessed as of medium archaeological potential are summarised at Table 15.6 and within the Wider Study Area are summarised at Table 15.7.

Table 15.6 Recorded losses, obstructions and potential wrecks within the CSC

ID	Name	Classification	Place of Loss	Date of Loss	Lat	Long	Source
W10966	Unknown (HA 16)	Unknown; identified as demasted brig of unknown date (Cotswold Archaeology 2019)	Unknown	Unknown	50.74167	-7.35833	UKHO
W11319	Unknown (HA 13/CA8/CA1 001)	Unknown	Celtic Sea	Unknown	51.6625	-7.82817	UKHO Eoghan Kieron
HA2041	Unknown	Medium potential magnetic and sidescan anomaly	Unknown	Unknown	51.40426	-7.69868	Headland Archaeology 2015
HA2051	Unknown	Medium potential magnetic and bathymetric anomaly	Unknown	Unknown	51.4032	-7.70485	Headland Archaeology 2015 (also recorded by Osiris as M61)
HA2052	Unknown	Medium potential sidescan anomaly	Unknown	Unknown	51.40356	-7.70513	Headland Archaeology 2015
HA2067	Unknown	Medium potential sidescan anomaly	Unknown	Unknown	50.85182	-7.40951	Headland Archaeology 2015
HA2082	Unknown	Medium potential sidescan anomaly	Unknown	Unknown	51.21056	-7.61294	Headland Archaeology 2015
HA5000	Unknown	Medium potential magnetic anomaly	Unknown	Unknown	51.68806	-7.84895	Headland Archaeology 2015 (also recorded by Osiris as M37)
CA8	same as W11319	Unknown	Unknown	Unknown	51.66145	-7.827655	Cotswold Archaeology 2019

ID	Name	Classification	Place of Loss	Date of Loss	Lat Easting	Long Northing	Source
CA1001	confirmed location of CA8/W11319	High potential bathymetric and magnetic anomaly. Probable wreck site measuring 91.4m long by 7.3m high	Unknown	Unknown	580911	5724197	Cotswold Archaeology 2019
CA1002	Unknown	Medium potential magnetic anomaly – probable metallic debris. No indication of substantial sub-bottom remains.	Unknown	Unknown	580878	5750872	Cotswold Archaeology 2019
CA1003	Unknown	Medium potential – magnetic anomaly and small rounded reflector. No indication of substantial sub-bottom remains.	Unknown	Unknown	586418	5738751	Cotswold Archaeology 2019
CA1005	Unknown	Medium potential anomaly. Bathymetric high close to two magnetic anomalies. No indication of substantial sub-bottom remains.	Unknown	Unknown	580536	5723787	Cotswold Archaeology 2019
CA1011	Unknown	Medium potential magnetic anomaly with associated small reflector probable metallic debris. No	Unknown	Unknown	580567	5723726	Cotswold Archaeology 2019

ID	Name	Classification	Place of Loss	Date of Loss	Lat	Long	Source
		indication of substantial sub-bottom remains.					
CA1012	Unknown	Low potential magnetic anomaly – single magnetic anomaly. No indication of substantial sub-bottom remains.	Unknown	Unknown	581200	5750884	Cotswold Archaeology 2019

Table 15.7 Recorded losses, obstructions and medium potential anomalies within the WSA

ID	Name	Classification	Place of Loss	Date of Loss	Lat	Long	Source
W02746	U-27 (HA 27)	Submarine	Wicklow, Arklow Bank	19/08/1915	50.71667	-7.36667	UKHO
W05360	William Martin	Schooner	Waterford, Rams Head, Ardmore, 9 miles SW by W of.	16/03/1917	51.79833	-7.77	UKHO
W10728	Unknown (HA 105)	Unknown	Unknown	Unknown	51.6	-7.78333	UKHO
W10751	Unknown	Unknown	Unknown	Unknown	51.77222	-7.725	UKHO
W10758	Unknown	Unknown	Unknown	Unknown	51.79	-7.72889	UKHO
W10766	Unknown	Unknown	Unknown	Unknown	51.81695	-7.80305	UKHO
W10839	Unknown (appears to be the same record as HA86 and HA113)	Unknown	Unknown	Unknown	51.54537	-7.74958	UKHO
W11037	Unknown	Unknown	Ballycotton, Co. Cork 17.6km SE	Unknown	51.7079	-7.82833	INFOMAR Wreck Data; GSI Wreck No_333
W11552	Unknown	Unknown	Unknown	Unknown	50.74333	-7.36767	John O'Connor
W11707	Zane Spray (HA 10)	Yacht	Unknown	04/07/1995	51.31667	-7.645	UKHO

ID	Name	Classification	Place of Loss	Date of Loss	Lat	Long	Source
HA2023	Unknown	Medium potential magnetic anomaly	Unknown	Unknown	51.6880606	-7.8489524	Headland Archaeology 2015
CA1004	Unknown	Medium potential magnetic anomaly	Unknown	Unknown	579159	5725278	Cotswold Archaeology 2019

The valuation of individual wrecks, obstructions and geophysical anomalies of archaeological potential is a matter for professional judgement based on an understanding of those remains. Wrecks that are substantially intact or undisturbed are generally likely to be of high value, though some particularly recent wrecks may be considered to be of lower value. Similarly, wrecks that have previously been disturbed or that comprise less coherent scatters of wreckage are more likely to be of lower value. Where the exact nature and circumstances of a wreck are not known, a precautionary assessment of high value has been applied.

15.4 Characteristics of the Development

The Project requires the burial of the subsea interconnector cable and the placement of cable protection.

Within the intertidal zone, the cable would be installed either within ducts laid in an open cut or ploughed into the sands at the Claycastle landfall site. The EIAR considers open cut cabling as the most intrusive option to provide a 'worst case' scenario. The effects of works above high water are considered in Volume 3C (Ireland Onshore) of the EIAR.

Marine cabling would involve three stages:

- Preparation for cable laying:
  - Survey prior to work;
  - Clearance of obstacles;
  - Clearance of the sea floor along the corridor; and
  - Levelling of sand waves.
- Installation of marine cabling by:
  - Jetting;
  - Ploughing; and
  - Rock-cutting (where necessary).
- Installation of cable protection.

Preparation and clearance of the proposed route has the potential to give rise to disturbance of archaeological material on the seabed, while cable installation would primarily affect material buried under marine sediments. Given the extent of preparation required in advance of cabling and disturbance arising from cabling, it is not considered that placement of cable protection would give rise to disturbance of archaeological remains.

15.5 Likely Significant Impacts of the Development

15.5.1 Do Nothing

In the Do Nothing scenario, no significant change is anticipated to the baseline.

The exposed peats in the foreshore at Claycastle may be subject to a degree of adverse change through erosion and periodic drying, and depth of deposition of beach sand over these deposits is likely to continue to fluctuate although any change to the deposits themselves would be very gradual, and the much larger expanse of buried peats is likely to remain largely unaffected.

Buried marine deposits of geoarchaeological interest are similarly unlikely to experience significant change, although depth of cover by what appear to be relatively mobile marine sediments and potential erosion may present very minor change to the observed baseline.

Similarly, any wrecks present within the CSC would be subject to continuing natural decay resulting from the natural degradation of their construction materials and the action of sedimentation and erosion. Again, these processes would be very gradual and unlikely to present discernible change in the baseline in the duration of the Project lifespan.

15.5.2 Installation Phase

Effects on archaeological remains would be experienced during the installation phase. Any direct disturbance would arise from installation activities as set out above.

Near-shore Peat deposits

Near-shore peat deposits would be directly disturbed by the installation of the cable ducts through the intertidal zone, whether by open cut or ploughing.

The maximum depth of burial is sufficient to give rise to a degree of disturbance to the preserved silt and peat deposits across part of their extent, regardless of which method of installation is used. Adverse effects would arise through permanent and irreversible physical disturbance and removal of remains of geoarchaeological interest and through the disruption of a single stratigraphic sequence, resulting in the loss of informative value. Disturbance would be discernibly reduced as the depth of beach sand over the peats increases towards MHWS, but this depth of cover may vary with different weather and tidal conditions. This effect would, however, affect a relatively small part of a much larger heritage asset, the majority of which would remain undisturbed. Consequently, in the absence of any mitigation this direct effect on a receptor of high value is assessed as of low magnitude, which would result in a moderate adverse direct effect. Mitigation measures have therefore been considered.

The possible fulacht fia (CA 3007) and possible bowl (CA 3001) are within the foreshore licence area but outwith the indicative landtake of the landfall cabling and excavations. While no direct effect is anticipated on these features, mitigation comprising protective measure and provision for recording of at-risk archaeological remains has been considered.

Offshore deposits of geoarchaeological interest

Offshore deposits of geoarchaeological interest would be directly disturbed during the insertion of the marine cable where the cable is installed by jetting or ploughing. These deposits are not present in areas where rock-cutting would be used.

The anticipated depth of burial of the cable would be sufficient to remove or disturb deposits of geoarchaeological interest in all areas of the cable route where these remains have been observed to survive. However, these deposits also appear to be relatively extensive features and potential disturbance would be limited to small areas of these wider deposit sequences.

Consequently, in the absence of any mitigation this direct effect on a receptor of high value is assessed as of low magnitude, which would result in a moderate adverse effect. Mitigation measures have therefore been considered.

Archaeological Remains

The route of the proposed cabling has been designed to avoid disturbance of known or potential wreck sites.

Archaeological interpretation of marine geophysics has been undertaken, and there is therefore a low potential that remains of previously unrecorded wrecks or other archaeological material that have neither been recorded nor identified during geophysical survey may be present within the working area. Consequently, it is not anticipated that any necessary disturbance of such remains would occur, either during cabling or installation of cable protection, but there is a limited potential for inadvertent disturbance of remains that have not yet been identified during installation of cabling and installation of cable protection.

While it is not anticipated that any significant adverse effect would arise, mitigation measures have been set out to minimize the potential for disturbance and to ensure that statutory requirements to avoid disturbance of wrecks can be met.

15.5.3 Operational Phase

Adverse effects would only arise during the operational phase of the Project where the installed cable protection alters local marine and coastal processes to induce or accelerate scour or differential deposition of marine sediments, affecting archaeological remains on the seabed. This would be anticipated in more dynamic environments, primarily in shallow water near shore where localised high points caused by installation of cable protection interact with tidal currents, and would be a relatively localised effect, which could in the worst-case, give rise to an adverse change through disturbance of marine archaeological remains. However, a requirement for cable protection is not anticipated in the shallow nearshore environment due to the soft nature of the sediment in this area. Any cable protection would be designed to have regard to the need to minimise change to soils and processes and as a result, no significant adverse effect is anticipated. Details of the assessment of potential change to marine and physical processes are set out in Volume 3D Part 2 EIAR for Ireland Offshore (Specialist Chapters) – Chapter 11: Marine Physical Processes

15.5.4 Decommissioning Phase

No adverse effects are anticipated to arise during the operational phase of the Project. Any disturbance caused by decommissioning would affect only archaeological remains which have previously been disturbed during the installation phase.

15.5.5 Cumulative Effects

No other developments are currently planned at the foreshore of Claycastle so the near-shore peat deposits at Claycastle are not anticipated to be affected by other developments such that any cumulative effect might arise. Similarly, the relatively limited spatial extent of marine archaeological remains means that cumulative effects are not anticipated to arise.

The deposit sequences of geoarchaeological interest are present over an extensive area, and could potentially be affected by other developments, which presents a potential for cumulative effects. These deposits also extend into the UK EEZ, although it is not considered that a transboundary effect would arise as disturbance of these deposits in the UK EEZ would be caused only by works carried out within the UK EEZ, which are assessed in their own right in Volume 4 UK ER.

As noted above, no adverse cumulative effects are anticipated to arise on nearshore peats or on archaeological remains and cumulative effects would be restricted to offshore deposits of geoarchaeological interest.

15.6 Mitigation and Monitoring Measures

Commented [A63]: Placeholder: Mitigation measures remain under review / discussion, and will be confirmed prior to submission of the final Application File.

15.6.1 Construction Phase

Near-shore Peat deposits

Mitigation of the disturbance of the near-shore peat deposits would be achieved by the implementation of an of archaeological work aimed at identifying and recording deposits of archaeological interest, retrieving and analysing archaeological material that would allow for these deposits to be adequately understood and providing for the appropriate dissemination of the results of the work. This agreed scheme of work would provide for targeted archaeological excavation and monitoring of installation activities. The date, character and nature of these peats is most comparable with deposits of similar age and character observed elsewhere within the terrestrial zone and it will be important to ensure that recording and analysis of these remains is carried out in liaison with the onshore archaeological mitigation programme.

- Any archaeological mitigation should be planned and implemented in line with the onshore works.
- A suitably qualified and experienced Project Environmental Specialist will be appointed to develop a Project Environmental Remains Strategy in relation to the investigation and sampling of the submerged landscape and peat deposits along the cable route at Claycastle Beach (CH138). It will be prepared in accordance with the *TII Palaeo-environmental Sampling Guidelines*. This strategy will have regard to selected cabling methodology in selecting appropriate opportunities and techniques for sampling.
- Test trenching should be carried out in advance of works to allow for a more detailed understanding of the character of the peats and to inform the process of further developing the Project Environmental Remains Strategy. This advance prospection should:
    - Be carried out by a suitably qualified archaeologist under licence;
    - Include targeted trenches to assess the metal object (CA3001) and the character of the peat deposits;
    - Result in a detailed report setting out any findings and outlining any further mitigation measures that should be employed in relation to the proposed

development. This report should be submitted to the National Monuments Service (DHLGH).

- Exposed peat deposits to the SW of the cable route at Claycastle Beach (CH138) which include the site of a possible fulacht fiadh trough (CA3007) should be fenced off from the construction works for their duration with a minimum exclusion zone of 15m.
- Where possible, the site of the possible bowl (CA3001) and any related archaeological remains identified during testing should be fenced off from the construction works for their duration with a minimum exclusion zone of 15m. However, if this is not possible to protect the site then a full archaeological excavation of this feature should be carried out to preserve this feature by record and to record its relationship to the peat deposits within the construction area.

While the preparation of an archaeological record is not a complete mitigation of loss of informative value, this mitigation would discernibly reduce the potential effect of the scheme and would provide information that would allow greater understanding and more effective management of the archaeological resource in this area. Consequently, following the implementation of an agreed scheme of archaeological work, the magnitude of any change would be reduced to very low, resulting in a slight adverse effect.

Offshore deposits of geoarchaeological interest

Mitigation of the disturbance of offshore deposits of geoarchaeological interest would be achieved by an agreed programme of further archaeological investigation and recordings, in line with the findings of analysis of samples collected during the offshore SI works.

- A suitably qualified and experienced Project Environmental Specialist will be appointed to develop an Offshore Project Environmental Remains Strategy in relation to the investigation and sampling of the offshore deposits of archaeological interest. It will be prepared in accordance with the *TII Palaeo-environmental Sampling Guidelines*.
- Where appropriate, this strategy will have regard to opportunities for archaeological analysis of material recovered during engineering site investigation in addition to any planned archaeological investigation.
- Due regard will be had in preparing any investigative methodology to the need to enable valid and robust comparison of results of analyses between samples recovered from the UK and Irish EEZ.

While the preparation of an archaeological record is not a complete mitigation of loss of informative value, this mitigation would discernibly reduce the potential effect of the scheme and would provide information that would provide a clearer understanding of the importance of the archaeological resource informing its management in the future. Consequently, the magnitude of any change would be reduced to very low, resulting in a slight adverse effect.

Recorded and Potential Wrecks

Archaeological exclusion zones will be established round the sites of known and potential wrecks. These exclusion zones would be 100m from the nearest element of any wreck observed within surveys, of any recorded wreck that has not been located or location of any high potential sites, and 50m from the location of any medium potential geophysical anomalies, and would be used to minimise the potential for inadvertent disturbance of wreck sites and to ensure their avoidance where the cable route is micro-sited. Draft proposals for further interpretation of marine geophysical survey, further archaeological survey, input into further site investigation and design and monitoring of construction works will set out measures describing how initial pre-installation surveys would be used to ensure that detailed design could reflect the known presence of potential archaeological remains, and to avoid or minimise disturbance of wreck sites, and ensure that unavoidable disturbance could be adequately mitigated. Where these mitigation measures are in place, the worst-case magnitude of any change would be reduced to very low, a slight adverse effect. A Protocol for Archaeological Discoveries (PAD) is included within these proposals, setting out actions to be carried out in respect of identification or recovery of archaeological material during the construction phase.

Commented [A64]: Placeholder:
1) INITIAL MAP OF AEZ TO BE PROVIDED
2)PROPOSALS FOR MITIGATION AVAILABLE IN DRAFT PENDING INTERNAL AND CLIENT REVIEW

15.6.2 Operational Phase

Given the limited potential for scour and the agreement of AEZs with a clear buffer from archaeological remains, mitigation of disturbance caused by potential scour would be achieved through the recording and avoidance measures set out for works during installation. Where an effect is anticipated and could not be avoided, this mitigation would reduce the magnitude of the effect to very low, a slight adverse effect.

15.6.3 Residual Impacts

Table 15.8 Summary of Residual Impacts

Receptor	Value	Effect	Magnitude pre-mitigation	Mitigation	Magnitude post-mitigation	Residual effect
Construction						
Near-shore peat deposits	High	Disturbance of archaeologically significant deposits	Medium	Agreed scheme of archaeological investigation	Very Low	Slight
Offshore deposits of geoarchaeological interest	High	Disturbance of archaeologically significant deposits	Low	Agreed scheme of archaeological investigation	Very Low	Slight
Operation						
Near-shore peat deposits	High	None anticipated	n/a	n/a	n/a	No Effect
Offshore deposits of geoarchaeological interest	High	None anticipated	n/a	n/a	n/a	No Effect
Archaeological remains	High	Low potential for disturbance of wreck sites	High	Agreed scheme of archaeological investigation	Very Low	Slight-No Effect
Decommissioning						
Near-shore peat deposits	High	None anticipated	n/a	n/a	n/a	No Effect
Offshore deposits of geoarchaeological interest	High	None anticipated	n/a	n/a	n/a	No Effect
Archaeological remains	High	None anticipated	n/a	n/a	n/a	No Effect

15.7 References

Cotswold Archaeology 2017 *Celtic Interconnector Project Marine archaeology desk-based assessment.*

Cotswold Archaeology 2018 *Archaeological review of foreshore walkover, and foreshore and offshore geophysical survey data.*

Cotswold Archaeology 2018 *Celtic Interconnector Project Marine archaeological impact assessment for proposed ground investigation surveys.*

Cotswold Archaeology 2019 *Celtic Interconnector Project, Marine Archaeology and Cultural Heritage Report.*

Cotswold Archaeology 2019 *Celtic Interconnector Project Claycastle Beach, Youghal, Co. Cork, Ireland Geoarchaeological assessment of auger and test pit logs.*

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EirGrid (2015) *Cultural Heritage Guidelines for Electricity Transmission Projects A Standard Approach to Archaeological, Architectural and Cultural Heritage Impact Assessment of High Voltage Transmission Projects* (2015).

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Headland Archaeology 2014 *Ireland-France Celtic Interconnector, Marine archaeology desk-based assessment.*

Headland Archaeology 2015 *Ireland-France Celtic Interconnector: Archaeological Review of Geophysical Survey Data*

IAC Archaeology 2018 *Archaeological monitoring as part of the Celtic Interconnector Project, Claycastle & Summerfield/ Clonard East/ Ballycrenane, County Cork.*

Institute of Archaeologists of Ireland 2006 *Code of Conduct for Archaeological Assessment Excavation.*

Rhialtas na hÉireann/Government of Ireland 2018 *National Marine Planning Framework Baseline Report.*

Transport Infrastructure Ireland 2015 *NRA Palaeo-environmental Sampling Guidelines Retrieval, analysis and reporting of plant macro-remains, wood, charcoal, insects and pollen from archaeological excavations*

Wessex Archaeology 2016 *Celtic Interconnector – Feasibility Study, Stage 1 Geoarchaeological Assessment of Vibrocore Logs.*

16 Material assets

16.1 Introduction

This chapter presents an evaluation of the Celtic Interconnector project in so far as it relates to or potentially interacts with material assets in Irish waters.

Material assets are described in the 'Draft 'Guidelines on the information to be included in Environmental Impact Assessment Reports' (Environmental Protection Agency, 2017) as 'built services and infrastructure'. The EPA guidelines are largely focused on the terrestrial environment, with reference to transport and waste management infrastructure. In the marine environment, material assets take a number of forms including power and telecommunication cables, pipelines, renewable energy projects, marine aggregate resources, oil and gas assets, and communication structures. Waste management in the marine environment is also considered.

For the purposes of this chapter, material assets are defined as built services and infrastructure that have an economic or otherwise material value. These include those that may be operational or out of service.

This chapter describes the material assets that exist in the receiving environment and assesses the likely significance of effects of the Project on those assets. The objective of the assessment is to determine the potential for the Project to interact with or otherwise affect material assets identified within the area of search. The potential for likely significant effects during the installation, operation and decommissioning of the Project is considered. Any mitigation measures that are embedded into project design are noted and further mitigation measures are suggested where necessary in order to protect material assets and reduce any residual adverse impacts.

16.2 Methodology and Limitations

16.2.1 Legislation and Guidance

This chapter has been prepared with reference to relevant EU and Irish legislation and guidance, notably the Environmental Impact Assessment (EIA) Directive 2014/52/EU and the Draft EPA Guidelines 2017. At the time of writing, these guidelines are available in draft form and are not yet available in final form.

Article 3(1) of the amended EIA Directive 2014 specifies that material assets should be identified, described and assessed in an Environmental Impact Assessment Report (EIAR).

16.2.2 Dumping at Sea Act 1996

The Dumping at Sea Act 1996 (as amended) prohibits the dumping at sea from vessels, aircraft or offshore installation of a substance or material unless permitted by the EPA. The Act requires a Dumping at Sea permit for certain activities involving the disposal of material at sea. The relevance of the Dumping at Sea Act 1996 (as amended) to the Celtic Interconnector Project has been considered in consultation with the Environmental

Protection Agency (EPA). The EPA holds the decision power in the permit application process as outlined in the Foreshore and Dumping at Sea (Amendment) Act 2009 (as amended). The Project promoters sought the advice of the EPA regarding the applicability of this legislation in relation to its proposed activities during the cable laying phase of the Celtic Interconnector Project. The feedback from the EPA regarding this consultation is contained within the Minutes of EPA Meeting held on 14 Oct 2020 regarding the Dumping at Sea Permit Requirement (Volume 8A – Planning and Consultation Report).

The cable laying process in Irish waters involves the movement of sediment. Volume 3D Part 2 EIAR for Ireland Offshore (Specialist Chapters) - Chapter 6: Description of the Offshore Cable, describes the cable laying and burial tools and techniques available, which include ploughing and jetting. These methods involve the movement of sediment to allow the cable to be positioned within the seabed, with the displaced sediment replaced back to its original position once the cable is installed. In the case of non-displacement ploughing or jetting, the sediment will settle naturally immediately after cable laying, whereas displacement ploughing requires a back-filling pass to be employed post lay to close the trench back over the cable.

The back-filling of the trench, whether immediately after cable laying or as a secondary pass does not introduce any new material to the marine environment, nor does it result in the displacement of material from one location to another. Use of a standard plough and subsequent berm formation would not be considered dumping as the spoil is used to backfill the trench. It is therefore the view of the Project promoters, having regard to the advice of the EPA that the techniques described involve minimal disruption to the seabed and would not constitute deliberate disposal of material as described by the Dumping at Sea Act 1996. There are currently no cable or pipeline requirements that trigger Dumping at Sea permits in the Register of Dumping at Sea permits, so it is the view of the Project promoters that a Dumping at Sea Permit is not required for the works described.

16.2.3 Continental Shelf Act 1968 (as amended)

The Continental Shelf Act 1968 (as amended) has also been considered in consultation with the Department of the Environment, Climate, and Communications (DECC). The following sections of the Continental Shelf Act 1968 were given particular consideration:

- Section 2: “Any rights of the State outside territorial waters over the sea bed and subsoil for the purpose of exploring such sea bed and subsoil and exploiting their natural resources are, subject to subsection (2) of this section, hereby vested in the Minister and shall be exercisable by the Minister”;
- Section 5 (1): “A person shall not construct, alter or improve any structure or works in or remove any object or material from a designated area without the consent of the Minister for Transport and Power”; and
- Section 8: The Continental Shelf Act 1968 Act “shall apply in relation to all submarine cables and pipe-lines under the high seas…(b) in relation to pipe-lines and electricity cables…”.

DECC confirmed in writing on 7 December 2020 (Volume 8A – Planning and Consultation Report) that the development of the Celtic Interconnector does not require a Ministerial Consent under Section 5 of the Continental Shelf Act 1968. As such, this legislation is not considered further.

This chapter does consider however, the potential for the Project to impact upon those assets that are served by the Continental Shelf Act 1968 such as natural resource areas and hydrocarbon exploration.

Commented [A65]: Placeholder: Additional information regarding consultation with the Petroleum Affairs Division – Ref. email dated 6th Jan 2021 – to be added here.

16.2.4 Desktop Studies

The scope of this chapter was defined in the 'Scoping Report for Foreshore Licence Application and Environmental Impact Assessment Report' that was submitted to the Foreshore Unit Division of the Department of Housing, Local Government and Heritage for review and comment in October 2020. The scope definition was based upon a desktop review of legislation, guidance documents, and current best practices in EIA, and informed by a review of datasets that identify material assets in the vicinity of the proposed interconnector route. A threshold of 500m on either side of the cable was used as a study area for the determination of potential impacts of the Project on material assets. This corresponds to the 500m indicative installation corridor within which Project activities on the seabed will occur.

The data used to inform the assessment of material assets are:

- Irish Marine Institute Data Catalogue (Marine Institute, 2020);
- The Kingfisher Information Service – Offshore Renewable and Cable Awareness project (KISORCA, 2020);
- Department of Communications, Climate Action and Environment (DECC) - Current Applications for Statutory Consents (DECC 2020a);
- EMODnet Central Portal for marine data in Europe (EMODnet, 2019); and
- Irish Geological Survey Database (Geological Survey, 2020).

16.2.5 Field Studies

Magnetometer surveys were completed along the length of the cable route in Irish coastal and offshore waters, which have informed this chapter notably through the identification of existing subsea cable. These surveys are described in the following reports:

- EirGrid and RTE, 2016a. Geophysical Survey Results Report.
- EirGrid and RTE, 2016b. Marine Integrated Geophysical/Geotechnical Results Report.

16.2.6 Methodology for Assessment of Effects

The methodology used for the assessment of material assets is as described in Volume 3D Part 2 EIAR for Ireland Offshore (Specialist Chapters) - Chapter 5: Description of the Landfall and Chapter 6: Description of the Offshore Cable. The evaluation of potential impacts has been undertaken in line with the Draft EPA Guidelines 2017. The criteria used for the determining impact magnitude and receptor sensitivity in relation to material assets are defined in Table 16.1.

Table 16.1 Impact magnitude and receptor sensitivity for material assets

Error! Reference source not found.Error! No text of specified style in document.**1**	**High**	**Medium**	**Low**	**Negligible**
Receptor sensitivity	Receptor has little to no capacity to retain material asset value as a result of change to baseline conditions; damage to material assets results in major financial consequences; or assets of particularly high economic value.	Receptor has some tolerance to change by retaining some material asset value in view of the change; damage to material assets results in minor financial consequences; or assets are of some economic value.	Receptor has high tolerance to change by retaining full material asset value in view of the change; damage to material assets results in no financial consequences; or assets of low economic value.	Change to material asset value is undetectable in view of the change; damage to material assets cannot occur; or assets have negligible economic value.
Impact Magnitude	Long term (15-60 years) changes to material assets; a regional loss asset value; or other fundamental change to the baseline quality of available material assets	Medium term (7-15 years) changes to material assets; a local loss of asset value; or other material change to the baseline quality of available material assets	Short term (1-7 years) changes to material assets; a site-specific loss of asset value; changes are detectable but not material to the baseline quality of	Effects lasting less than a year; Very little to no change from baseline conditions; or change is not detectable in relation to the overall quality

			available material assets	of available material assets

16.2.7 Difficulties Encountered

The availability of data or information regarding the offshore windfarm sites which may be taken forward through the planning and consenting stage into operational sites is currently commercially sensitive and therefore unavailable.

The Project has identified operational and decommissioned subsea cables that will be crossed along the interconnector route in Irish waters and in the UK and French jurisdictions. It is possible that additional cables exist in the marine environment that have not yet been identified. Some cables are particularly old with the earliest cables dating back to the 19th century, so mapping is consequently unreliable. Others may have become buried, be very small, and have been overlooked by the survey work undertaken.

Consultation with the European Subsea Cable Association (ESCA) and the owners or operators or existing cables may provide additional information that will inform operations during the installation phase on the Project. Pre-installation surveys will also be undertaken to further define the presence of subsea cables, so while it is possible that there are cables that have not been specifically identified at the time of writing, the approach to mitigating any effects of crossing such cables is defined in this chapter and would be applicable to any cables identified at a later time. This possible data gap is therefore not likely to materially influence the outcome of this assessment.

A communication from the US Navy in Washington was received by the Project noting its interest in the Project. It is possible that the US Navy owns defence system assets in Irish waters but due to reasons of US national security, the type and location of these is not available and consequently cannot be assessed in this chapter. The Project continues its liaison with the defence departments of Ireland, UK, France, the US, and other countries as required to reduce risk to the Project and to any relevant defence systems.

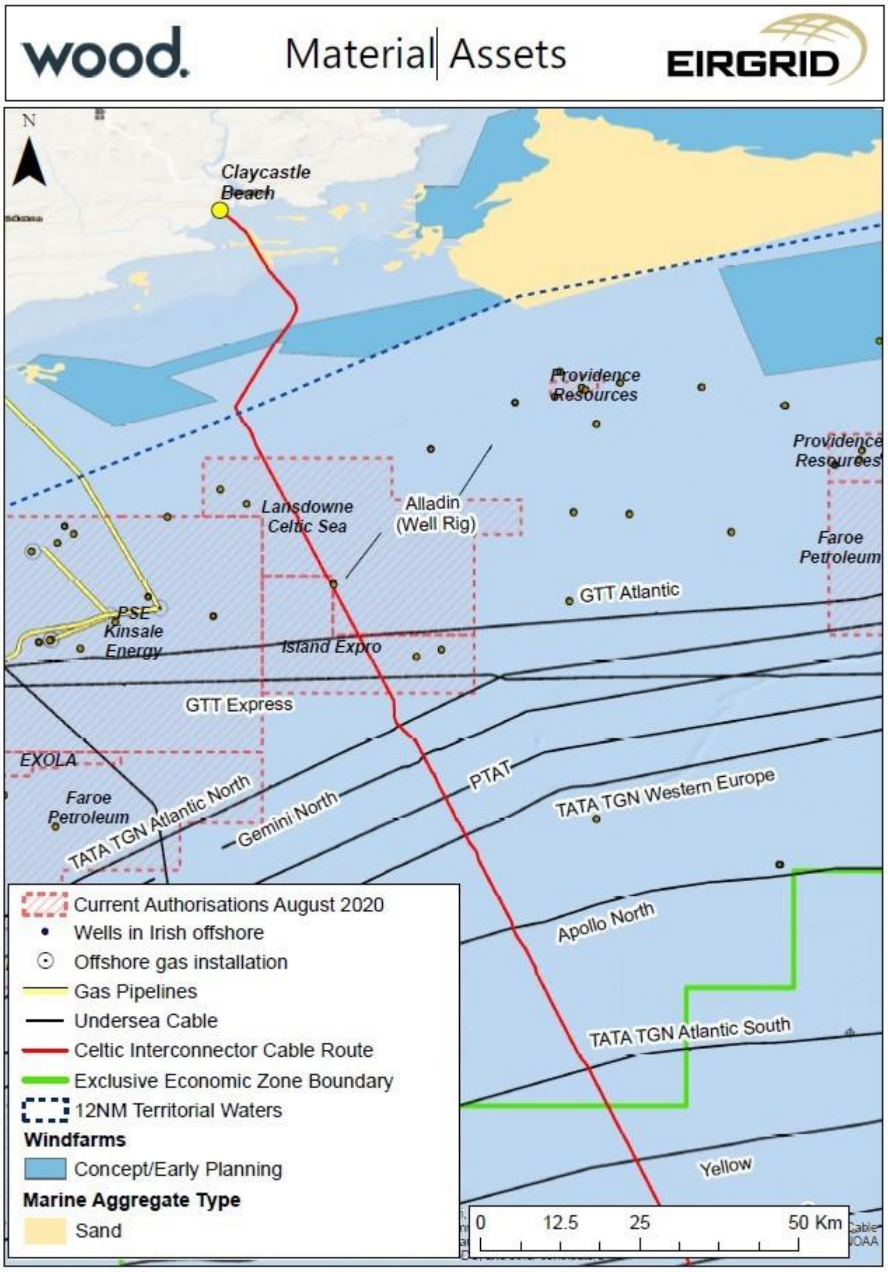
16.3 Receiving Environment

The review of datasets identified several offshore material assets in the vicinity of the Celtic Interconnector cable route, both within Irish Territorial Waters and out to the limit of the Irish EEZ. Namely, the review identified:

- Numerous operational and out-of-service cables;
- A decommissioned wellhead;
- The site of a proposed offshore floating windfarm (in concept / early planning); and,

An area of sand identified as having potential for marine aggregate extraction. Figure 16.1 illustrates the locations of material assets that are near to or intersect with the Project. Additional details describing the current status of these material assets are described below.

Figure 16.1 Material Assets in Irish Waters



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16.3.1 Proposed Offshore Renewable Power Sites

In Irish Territorial Waters, 3.1km of the proposed cable route intersects an area identified as a concept or early planning area for the Inis Ealga Marine Energy Park. DP Energy Ireland (DP Energy) is currently undertaking site feasibility studies for the potential development of the site. The proposal is for 700 MW or more, of offshore floating wind energy development as part of a wider portfolio of offshore renewable power developments in Ireland.

The Inis Ealga Marine Energy Park site occupies 925km^2 of seabed, located approximately 7.5km south of Power Head in County Cork and approximately 26km south of Helvick Head, County Waterford. DP Energy has identified three areas of search for the optioneering and site selection phase of the export cable route and landfall for the Inis Ealga Marine Energy Park, none of which include the landfall location of the Celtic Interconnector project at Claycastle Beach. The Inis Ealga Marine Energy Park project is described by DP Energy as "devices that will be connected via subsea inter-array cables that are in turn connected to an offshore platform with associated switchgear and protection systems that convert the voltage of the power ready for export".[58] No substation has been identified or confirmed to EirGrid at the time of writing this document given that the Inis Ealga Marine Energy Park is currently in the project feasibility stage.

The project website states that a Foreshore Site Investigation Application has been submitted and queries were raised by the Department of Housing, Planning, and Local Government (DHPLG) and responded to by the applicant in December 2019.

16.3.2 Hydrocarbon Assets

The Minister for the Environment, Climate and Communications (DECC) is responsible for all oil and gas-related activity in Ireland. Under the Petroleum and Other Minerals Development Act 1960, oil and gas developers need to be issued an authorisation by the Minister for DECC in order to carry out any oil and gas exploration or productions activities in the Irish marine environment. Figure 16.1 shows the locations of 'Current Authorisations' for hydrocarbons operations, as leased and regulated by DECC. Authorisations typically cover a large area within which the authorised developer can operate, subject to the approval of leases to undertake the proposed operations, which may include activities such as site surveys or the installation of infrastructure.
During consultation for the Celtic Interconnector Project, the Petroleum Affairs Division (PAD) of DECC provided the following information:

- The Celtic Interconnector cable route does not cross any currently licenced areas;
- The closest well approach to the Celtic Interconnector cable route is 49/17-1 – this well was plugged and abandoned in 1979. As with all wells that have been plugged and abandoned, no equipment is remaining on or above the seabed.

[58] Inis Ealga Marine Energy Park. Online [Accessed November 2020] http://dpenergy.info/inisealga/the-project

- The PAD calculated that the closest suspended wellhead to the Celtic Interconnector cable route is 49/23-2, located 4.3km from the proposed route at its closest approach.
- Marine Notice links were provided by the PAD, which included a request that suspended wellhead locations are given a wide berth of 500m by other marine activities.

Approximately 12km of the Celtic Interconnector cable route crosses a petroleum lease block classified as ‘lease undertaking’, entitled ‘Old Head of Kinsale’. The acreage report published by Petroleum Exploration and Development Offshore Ireland in September 2020 (DECC, 2020b) lists the Old Head of Kinsale block as covering 40.14km^2. The block is currently in an exploration phase, with no operational assets. A concession map from DECC and dated September 2020 shows that Petroleum Lease Undertaking has been confirmed within the south-eastern corner of the ‘Old Head of Kinsale’ block. The Celtic Interconnector including the indicative 500m cable installation corridor does not intersect with the confirmed lease part of the Old Head of Kinsale block.

Approximately 12km of the Celtic Interconnector cable route crosses a petroleum lease block classified as ‘lease undertaking’, entitled ‘Old Head of Kinsale’. The acreage report published by Petroleum Exploration and Development Offshore Ireland in September 2020 (DECC, 2020b) lists the Old Head of Kinsale block as covering 40.14km^2. The block is currently in an exploration phase, with no operational assets. A concession map from DECC and dated September 2020 shows that Petroleum Lease Undertaking has been confirmed within the south-eastern corner of the ‘Old Head of Kinsale’ block. The Celtic Interconnector including the indicative 500m cable installation corridor does not intersect with the confirmed lease part of the Old Head of Kinsale block.

As the Old Head of Kinsale gas field is in an exploration phase without operational assets, and since the cable route does not intersect with the area identified for Lease Undertaking, there is no potential for the cable route to adversely affect gas production operations in this block. Exploration activities will be able to continue unaffected by the interconnector; there is therefore no pathway for effects to this material asset predicted and this receptor is scoped out of further assessment.

Approximately 30km of the cable route also crosses the ‘Celtic Sea’ block. This block is not indicated in any of the concession maps or acreage reports from 2016 to 2020 and is therefore non-operational for exploration or production. As such, there is no pathway for effects on this receptor and it is scoped out of further assessment.

The Kinsale Gas Field is located approximately 25km to the west of the Project. It ceased production in 2020 and is planned for decommissioning. The Kinsale Energy gas export pipeline makes landfall at Inch Beach and was one of the key constraints identified during the consideration of alternate landfall locations that reduced the performance of Inch Beach and resulted in Claycastle emerging as the best performing option.

The Kinsale Gas Field ceased production in July 2020. The wells are now permanently plugged and the associated facilities (including platforms, pipelines, cables, subsea structures and an onshore terminal) are planned for decommissioning. The offshore decommissioning works are reported to be planned over a period of two to three years (from July 2020) (Kinsale Energy, 2020) and are therefore expected to be largely complete when installation of the Celtic Interconnector commences in 2023.

During the previously noted consultation with the Petroleum Division of DECC, Marine Notices were provided in relation to the suspended wellheads in the North Celtic Sea area. These notably request that a wide berth of at least 500m be given to the wellhead locations. Of particular relevance are:

- S.I. No. 285/1977 - Continental Shelf (Protection of Installations) Kinsale Head Field Order, 1977. This order establishes a 500m safety zone around offshore installations attached to the Kinsale Head Gasfield and prohibits ships from entering the zone, except with the consent of the Minister or under certain conditions (e.g. emergencies).
- S.I. No. 6/2003 - Continental Shelf (Protection of Installations) (South West Kinsale Gas Field) Order, 2003. This order establishes a larger safety zone encompassing two 500m radius circles connected by straight parallel lines tangent to and between the circles. Unauthorised ships are prohibited from entering this area. This area is >25km from the Celtic Interconnector cable route at its nearest point.

The Aladdin well head is located 240m to the east of the cable route at KP 63.8, and approximately 51km from the Irish coast. This well was drilled and abandoned in 1979. It is located within the indicative 500m installation corridor but as it is abandoned, it is unlikely to impact the Project or to be impacted by the Project. In 2019, DECC committed to no longer accept any new applications for exploration licences for natural gas or oil in Irish waters (DECC, 2020c).

No impacts from the Project on material assets relating to the hydrocarbons industry are likely so they have been scoped out of further assessment.

16.3.3 Cables

The routes of existing subsea cables have been identified from subsea surveys undertaken for the Celtic Interconnector Project. There are no existing cables within Irish Territorial Waters. Within the Irish EEZ, the Project intersects with six existing operational (live) subsea cables and two that have been decommissioned, as described in Table 16.2.

Table 16.2 Subsea Cables

Cable name	Description	KP crossing point	Status
GTT Atlantic subsea cable	12,200km trans-Atlantic fibre optic telecommunications cable connecting the	KP 72.2	Operational

Cable name	Description	KP crossing point	Status
	UK, Ireland, the United States of America (USA) and Canada		
GTT Express subsea cable	4,600km trans-Atlantic fibre optic telecommunications cable, connecting the UK, Ireland and Canada	KP 79.1	Operational
TATA TGN Atlantic North	13,000km trans-Atlantic pair of fibre optic telecommunications cables connecting the UK and the USA	KP 87.0	Operational
Gemini North subsea cable	12,600km trans-Atlantic fibre optic telecommunications cable connecting the UK and the USA	KP 92.4	Withdrawn from service in 2004
PTAT subsea cable	7,552km trans-Atlantic fibre optic telecommunications cables connecting the UK and the USA	KP 99.2	Withdrawn from service in 2004
TATA TGN Western Europe subsea cable	3,578km fibre optic telecommunications cables connecting the UK, Spain and Portugal	KP 105.5	Operational
Apollo North subsea cable	13,000km trans-Atlantic fibre optic telecommunications cables connecting the UK, France and the USA	KP 120.9	Operational
TATA TGN Atlantic South subsea cables	13,000km trans-Atlantic pair of fibre optic telecommunications cables connecting the UK and the USA	KP 144.4	Operational

16.3.4 Marine Aggregate Resources

In 2008, the Irish Sea Marine Aggregate Initiative (IMAGIN) undertook an analysis of marine aggregate extraction potential in the Irish Sea, that included waters between 20-60nm from the coast at Claycastle Beach (Sutton, 2008a). The study concluded that the marine aggregate resources in the Irish Sea identified represent "*a future alternative contribution to aggregate supply for the region, and in particular the Greater Dublin Area"* and that *"these resources would supplement the existing land-based aggregate supply, particularly sand products"*.

Approximately 8km of the Celtic Interconnector cable route within Irish Territorial Waters intersects an area identified as having potential for the extraction of sand (as reported in the draft National Marine Planning Framework (DHPLG, 2020). This potential was determined via data derived from EMODnet (2019), the IMAGIN project (Sutton, 2008a), and INFOMAR

(INFOMAR, 2019), a joint seabed mapping programme between the Geological Survey Ireland and the Marine Institute.

The IMAGIN study made recommendations including that the DEHLG should develop *"a strategic policy framework and regulatory processes to enable the successful management of marine aggregate extraction in Ireland"* (Sutton et al., 2008b). The subsequent draft National Marine Planning Framework supports sustainable marine mineral exploration (DHLGH, 2020) in Ireland but there are as yet no areas licenced or proposed for extraction.

While the available data suggest that the sand deposit indicated has potential to be suitable for aggregate extraction, this is not an area currently licenced for this activity. There are additional, larger areas of similar deposit in the wider area, so the installation of the Project is unlikely to restrict any future licensing of marine aggregate extraction. Therefore, no likely significant effect has been identified in relation to this receptor, and it is therefore scoped out of further assessment.

16.3.5 Practice and Exercise Areas

The following Navy and Air force Practice and Exercise Areas (PEXAs) are located within the Irish EEZ in the vicinity of the cable route:

- A UK Navy department PEXA that extends over approximately 500km^2 from east of the Isle of Wight to approximately 50km west of the boundary between the Irish and UK EEZ.
- The Southern Fleet Exercise Area extends into Irish waters and is defined as "Aircraft general, general practice, submarine general (non-firing exercises, practices and trials)".
- The South West MDA is a UK Air Force department PEXA that extends from the north Cornwall coast near Bude out across the UK EEZ and over Irish EEZ waters approximately 80km east of Cork (areas A, B and C). It covers a sea area of approximately 150km^2.

It is possible to view GIS data layers for these PEXA through the Admiralty website, but the terms and conditions of use do not permit the data to be downloaded or reproduced.

The Celtic Interconnector is routed through the three PEXAs identified above, but each of these covers a substantial sea area and they are not in constant use by the navy or air force. Given the nature of the Project, with short-term installation followed by the long-term presence of the subsea interconnector cable, there is little potential for the Project to interact with navy or air force PEXA operations. Consultation has been undertaken with the Irish Department of Defence (DoD) and also with the UK Ministry of Defence (MoD) in order to avoid any potential conflicts with any existing subsea defence or security equipment during Project design. There is therefore negligible potential for the Project to impact upon PEXAs and these are scoped out of further assessment.

16.3.6 Disposal Grounds

There are no dredge or military disposal sites in the vicinity of the proposed cable route. There is therefore no likely pathway for effects to these receptors and they are not considered further in the assessment.

16.4 Characteristics of the Development

16.4.1 Waste Generation

The EPA guidelines on the information to be included in Environmental Impact Assessment Reports' (Environmental Protection Agency, 2017) refer to waste management infrastructure in relation to material assets. The installation of the Celtic Interconnector will produce the waste streams defined in Volume 3D Part 2 EIAR for Ireland Offshore (Specialist Chapters) - Chapter 5: Description of the Landfall and Chapter 6: Description of the Offshore Cable.Waste streams produced at the landfall and during the offshore installation of the cable are likely to include waste-water including sewage, small quantities of general garbage comprising mixed food waste and food packaging, wider plastic and packaging waste such as polystyrene and cardboard, metals such as canisters, waste oils and lubricants, and electrical waste such as used batteries. These will require delivery to an appropriate licenced waste handling facility for recycling or disposal.

16.4.2 Landfall at Claycastle

The landfall at Claycastle Beach does not intersect or otherwise interact with any of the material assets identified.

16.4.3 Installation of Cable Route

The Celtic Interconnector cable route and indicative installation corridor intersects with the Inis Ealga Marine Energy Park site. Based on previous project experience within the Project design team, a distance of 300m is typically necessary for exclusion zones around floating turbine mooring lines. However, the Project assumes a 500m indicative cable installation route so 500m is therefore used as a worst case in relation to offshore wind exclusion.

16.4.4 Installation of Cable Protection

The cable route also intersects with some existing subsea cables. Given that the Inis Ealga Marine Energy Park is in the early design phase, it is likely that the Celtic Interconnector will be installed and operational by the time the Inis Ealga Marine Energy Park reaches its detailed design stage. The Celtic Interconnector will therefore be part of the future baseline that will need to be considered by the Inis Ealga Marine Energy Park, should the project proceed to the consenting and construction phases.

Operational maintenance of the cable protection and cable crossings will be required where these occur in UK waters, with repairs undertaken where necessary to ensure the adequate protection of the Celtic Interconnector cable as well as of the cable crossed by the Project. Survey work using methods such as sub-bottom profiling is typically non-intrusive.

16.5 Likely Significant Impacts of the Development

The scope of the assessment is limited to potential impacts on existing cables during installation, the potential for waste streams created during offshore works to impact upon onshore waste handling facilities and impacts on proposed offshore wind projects during operation. Impacts to hydrocarbons assets, marine aggregate resources, PEXA and disposal grounds were scoped out of the assessment in Section 16.3.

16.5.1 Do Nothing

In the absence of the Project, material assets will continue to be used throughout their operational lifetime and brought out of service at the appropriate time. Some decommissioned material assets will be removed from the marine environment while others will be left in-situ depending on current legislative requirements, economic drivers, and industry best practice.

In the 'Do Nothing' scenario, material assets that are intersected by the Project such as existing cable routes will remain subject to risk in the existing marine environment from accidental damage by fishing gear, anchoring or foundering, or force majeure such as storm events. The likelihood of such events would not be impacted.

The Inis Ealga Marine Energy Park would not have to consider the Project during its own design and consenting process if the Celtic Interconnector Project did not go ahead.

16.6 Construction Phase

16.6.1 Waste Generation

The waste streams produced during the installation of the Project will be transported to and processed by an appropriate licenced waste handling facility. The volume of waste likely to be produced can be attributed in part to the number of personnel involved in the installation phase of the Project. Assuming a worst-case of shift work seven days a week, 24 hours a day, this is estimated as a maximum of 7,660 person-days for the installation of the landfall and offshore works combined (Table 16.4).

Table 16.4 Estimated waste production based on person-days during installation phase

Installation activity	Maximum personnel / day	Days of operation	Person-days
Landfall installation	10	70	700
Pre-installation survey vessel	15	28	420
Preparatory works vessel	40	30	1,200
Cable lay vessel	90	60	5,400
Rock protection vessel	40	16	640
Total			8,360

Based on data estimates for the volume of waste generated on board commercial ships (Delft, 2017) including plastics, food waste, and domestic waste, it is estimated that the per person/per day volume is in the region of $0.013m^3$. Multiplied by 8,360 person-days, this amounts to a maximum volume of solid waste in the region of $108.68m^3$. Using a conversion factor of 0.27 for household waste (EAUC, 2020) as a proxy for the waste streams likely to be produced, this equates to a worst case of 29.34 tonnes.

There will be no marine discharges of waste or wastewater from Project vessels as these will be equipped with on-board waste storage and wastewater treatment facilities in line with IMO MARPOL Annex IV Prevention of Pollution from ships.

Waste will be delivered to a waste handling facility in phases (i.e. shortly following the landfall installation phase, and when vessels return to port). This is expected to have a slight and temporary effect on the overall volumes of waste handled by the waste facility at that time, resulting in a low impact magnitude. The sensitivity of the waste handling facility is expected to be low as the waste stream volumes and types are expected to be within the normal operating capacity and capability of a licenced facility.

The impact magnitude from waste generation is assessed as low due to the types and volumes of waste expected and the mitigation in place to ensure its correct handling. The sensitivity of the waste handling facility (i.e. receptor to this impact) is assessed as negligible as the types and volumes of waste expected will be within its capacity and capability. The residual impact of waste generation is therefore assessed as not significant.

16.6.2 Existing Cables

The construction of the Project has the potential to result in damage to existing cable infrastructure where these occur within the Irish EEZ, as a result of cable snagging during seabed preparation or installation works. It is also possible for the routing of the Project to compromise maintenance access for the owner or operator if the Project routing ran parallel or near-parallel to an existing operational cable, but the Project was designed to avoid this and to approach existing cables from a perpendicular direction.

Where this relates to live or operational cables, this could result in financial consequences for the cable owner or operator or for the promoters of the Celtic Interconnector Project. Where this relates to out-of-service cables and the damage was not pre-agreed through a Crossing Agreement, this could also result in a financial liability.

The sensitivity of existing cables is high due to their economic value and their importance for global communications. The magnitude of the effect for a damaged cable is low. The effect would be temporary until repairs could be undertaken. All subsea cables can be expected to require repair during their operational lifetime and cable operators are typically prepared to mobilise repairs quickly to minimise outage time. This would be likely to be undertaken within a year of damage occurring. The likelihood of damage to any given cable as a direct result of the Celtic Interconnector Project is also low as it has been designed to limit the potential for interactions with existing cables (please refer to Section 16.8.2 for more details).

16.7 Operational Phase

16.7.1 Proposed Offshore Renewables Projects

Survey work required to establish any possible need for operational maintenance of the cable protection and cable crossings in UK waters would use non-intrusive methods such as sub-bottom profiling, and as such would not impact upon existing subsea cables. Any necessary operational maintenance of the cable protection and cable crossings in UK waters will be undertaken in line with the relevant cable crossing agreements, so any consequential risk to existing subsea cables is anticipated to be low.

The intersection of the Celtic Interconnector cable route and indicative installation corridor with the Inis Ealga Marine Park site has the potential to sterilise the area concerned for offshore wind development as penetrative construction methods will not be permitted to occur over or in proximity to the Celtic Interconnector. As the Inis Ealga Marine Energy Park is a floating wind proposal, it can be anticipated that a large number of floating turbine mooring lines will need to be positioned across the site. These are typically anchored via a variety of possible engineering solutions depending on the local seabed geology. These typically penetrate the seabed to variable depths.

The length of cable that intersects the Inis Ealga Marine Energy Park is 3.1km. Assuming a worst-case whereby the 500m indicative cable corridor is maintained during the operational phase of the Celtic Interconnector project as an exclusion zone to further development, this would result in the sterilisation of 1.55km^2 or 0.17% of the 925km^2 of seabed available for the Inis Ealga Marine Energy Park. Given the overall size of the Inis Ealga Marine Energy Park, the magnitude of this impact as a restriction to development is low – there will be a detectable site-specific loss of seabed but this will not result in a material change to the baseline quality of the remaining asset. The sensitivity of the Inis Ealga Marine Energy Park is negligible as the change will not result in a detectable change to the material asset's value. It is currently in the early design so it is possible for the project design to be optimised whilst taking the Celtic Interconnector into account as a design constraint.

Decommissioning Phase

Decommissioning is anticipated to occur no sooner than 40 years from the start of operation.

It is currently anticipated that the Celtic Interconnector cable and cable protection will be left in-situ upon decommissioning. Where decommissioning works are required to remove infrastructure, these will be the subject of future consent applications as appropriate, to include relevant environmental assessments.

Routine surveys would be undertaken to assess the status and safety of the decommissioned infrastructure. In this scenario, there would be no impacts to material assets from decommissioning.

In the event that any part of the Project is removed from the foreshore or offshore environment upon decommissioning, any associated risk to material assets and any potential impacts associated with waste streams are anticipated to be of lower magnitude (or lower volume in the case of waste streams) than during the installation phase. These would also be of short-duration and would be managed through a Waste Management Plan (WMP) by the EPC contractor in line with relevant legislation and guidance at that time.

16.7.2 Cumulative Effects

The Inis Ealga Marine Energy Park is the only project identified as relevant to the cumulative assessment. Given that this project assessed in this chapter as a material asset in its own right, there is no further assessment presented in relation to this project.

The Inis Ealga Marine Energy Park does not intersect with the existing subsea cables considered in this chapter as those crossed by the Celtic Interconnector are all located further offshore. There is therefore no potential for cumulative impacts in relation to these receptors.

The Inis Ealga Marine Energy Park is also located inshore of the oil and gas assets identified, and further offshore than the marine aggregate resources.

Therefore, no cumulative impacts are identified in relation to material assets.

16.8 Mitigation and Monitoring Measures

Commented [A67]: Placeholder: All mitigation and monitoring measures remain under review / discussion, and will be confirmed prior to submission of the final Application File.

16.8.1 Construction Phase – Waste generation

The appointed EPC contractor will be required to prepare a WMP prior to commencing work. This will detail all the measures in place for the management of waste streams at the foreshore and in the offshore environment. The objective of the WMP will be to minimise the impact of the Project on the environment from waste at source and ensure effective environmental management throughout the development of the Project.

The installation of the Celtic Interconnector will be undertaken in line with Irish law and international best practice. The EPC contractor will be required to prepare and work in accordance with a WMP that will include waste stream management procedures including protocols for the correct handling, segregation, and disposal of waste in accordance with the Best Practice Guidelines on the Preparation of Waste Management Plans for Construction and Demolition Projects, Department of the Environment (DECC, 2006), as well as in accordance with Annexes IV and V of the International Convention for the Prevention of Pollution from Ships (the MARPOL Convention).

In line with the revised 2011 EU (Waste Directive) Regulations 2011 [S.I. No. 126/20011], waste will be managed in accordance with the waste hierarchy as defined by the EU Directive 2008/98/EC on Waste. This means that waste will be reduced, reused, recovered and recycled as far as reasonably practicable.

All waste streams arising during the installation phase of the Project will be managed and disposed of in accordance with European and Irish law and guidance including:

- Directive 2008/98/EC on Waste;
- EU (Waste Directive) Regulations 2011 [S.I. No. 126/20011];
- Waste Management Act 1996 (as amended);

- Waste Management (Amendment) Act 2001 [S.I. No. 36/2001];
- Protection of the Environment Act 2003 [S.I. No. 27/2003] as amended;
- Environment (Miscellaneous Provisions) Act 2011 [S.I. No. 20/2011] as amended; and
- Designing out waste – A design team guide to waste reduction in construction and demolition projects (EPA, 2013).

Temporary facilities for installation works will be provided in the hard standing car park area at the foreshore, including chemical toilets and additional wastewater holding capacity. These will be regularly serviced by a licensed wastewater treatment contractor, with effluents removed for discharge to a sewage treatment plant. The nearest wastewater treatment plant to the Project landfall site at Claycastle Beach is located less than 5km away, to the north of Youghal. Having been upgraded in 2018 (Irish Water, 2020), the Youghal wastewater treatment plant is anticipated to have the necessary equipment and capacity for treating wastewater from site.

Vessels will manage on-board waste streams including wastewater and sewage in line with international agreements such as the International Convention for the Prevention of Pollution from Ships (the MARPOL convention), with Annex IV relating specifically to sewage management and Annex V relating to solid waste streams such as garbage.

Waste produced offshore will be stored in designated containers and returned to port by the EPC contractor. Onshore, waste will be segregated into designated containers that are made of materials appropriate to the content. Waste will be collected and disposed of by a licensed waste contractor.

16.8.2 Installation Phase - Existing cables

Cable crossings are commonplace in the engineering design of interconnector cables and the risk posed to existing cables is mitigated through design using cable protection and through early consultation with the cable owners and operators.

The Celtic Interconnector Project has been designed to be protected and to offer protection to cables that it must cross. This has been achieved through subsea surveys to identify the location and status of the cables, which resulted in the cable route design maintaining appropriate distances from existing cables and optimising crossing angles as close to 90° as possible.

Prior to seabed preparation and cable installation activities, all existing cables will be identified within 100 m either side of the crossing point. The design of crossings is dependent on the configuration of each existing cable, as the amount and type of cable protection already employed will vary between cables. As described in Volume 3D Part 2 EIAR for Ireland Offshore (Specialist Chapters) - Chapter 6: Description of the Offshore Cable, cable burial is the preferred method of cable protection in so far as the underlying seabed geological conditions allow. At the crossings with existing operational cables, cable burial may not be possible if the existing cable is already buried within the target depth of lowering for the Celtic Interconnector Project. In order to protect both cables in this instance, it is necessary to lay the cable without burial. Where the existing cable's depth of burial is sufficiently deep, the Celtic Interconnector cable will be laid directly on the seabed. Where the existing cable's depth of burial is shallow, the Celtic Interconnector cable will be laid on pre-lay concrete mattresses or rock to achieve adequate separation between the two cables. In either case, cable protection in the form of concrete mattresses or a rock berm will be installed over the Celtic Interconnector cable to protect it from risk of damage via fishing gear snagging or anchorage.

Consultation with relevant asset owners or operators (notably those pertaining to the existing cables detailed in Table 16.2) provides accurate data and information concerning the current status of the identified cables that has been used to inform design decisions. Initial contact has been made with all live cable owners and operators to establish the correct point of contact. An Information Pack has been prepared and will be shared with these consultees in 2021. It will contain a presentation, route drawing, GIS route data, and typical crossing drawings. Further stages of consultation will include a request for accurate cable data from the owners or operators.

A draft Crossing Agreement template has been prepared based on industry standard as specified by the European Subsea Cables Association (ESCA) (previously the United Kingdom Cable Protection Committee, or UKCPC). It will be modified and tailored to the requirements of each specific cable crossing along the route. Each will include the following minimum content:

- Procedures for the work to be prepared;
- The approach to defining cable crossing locations, safety zones and notification areas;
- Notification periods including for before, during and after all pre-lay, installation and post-lay activities; and
- Details concerning the parties involves, liabilities, costs, duration and waivers.

Cable Crossing Agreements between the project promoters and third-party cable owners or operators will be in place prior to commencement of works. These will be subject to negotiation with each individual cable owner or operator and customised accordingly. Agreements will include the design and installation methods of the relevant cable crossing, which may vary in each case.

Out-of-service cables will be identified and cleared as follows:

- Cables will be located by survey instrumentation or mechanical equipment such as a grapnel;
- Cables will be cut a minimum of 50m either side of the Crossing Point with the Celtic Interconnector;
- Cables ends will be secured by dead-weights or burial;

- Information to be recorded for out-of-service cable crossings will be:
- Coordinates of cutting and cable ends;
- Details of dead-weights; and
- Length of cable recovered or moved, including disposal method.

Details will be sought from the owners or operators of existing cables that must be crossed. Information will include (but not be limited to):

- Route position list to confirm crossing angle and date of the most recent survey;
- Water depth and condition of the existing cable including depth of burial and the extent of any seabed surface exposure;
- Physical specifications of the existing cable including diameter and type; and
- Location of any repeaters or other associated equipment.

16.8.3 Proposed Offshore Renewable Power Projects - Operational Phase

Mooring line infrastructure for the Inis Ealga Marine Energy Park will need to be micro-sited to avoid the Celtic Interconnector project, and Cable Crossing Agreements will need to be put in place with the project Promoters where necessary.

The Project promoters will maintain communication and consultation with windfarm developers and other offshore developers as the Project develops, to determine the likelihood of the Inis Ealga Marine Energy Park proceeding in this location and to understand the level of risk associated with the cable location.

16.9 Residual Impacts

The impact was assessed as not significant due to the low impact magnitude and the negligible receptor sensitivity. The residual impact of waste generation is also therefore assessed as not significant.

Existing cables as material assets have been assessed as having a high sensitivity to damage due to their high economic value and importance for global communications. The impact magnitude has been assessed as low however, due to the temporary duration of the effect (1-7 years) and the low likelihood of occurrence. Given the mitigations described, the residual impact to existing cables is assessed as slight.

Commented [A68]: Placeholder: All references to project timings will be reviewed and confirmed prior to submission of final Application File.

The impact magnitude relating to the reduction in seabed availability for the Inis Ealga Marine Park has been assessed as low due to the scale of the seabed sterilisation in relation to the overall seabed area available for the Inis Ealga Marine Park. The sensitivity of the receptor has been assessed as negligible as the Inis Ealga Marine Park can be designed to account for any loss of seabed availability resulting from the Celtic Interconnector Project without a reduction in operational offshore wind power output. Therefore, the residual impact is assessed as not significant.

A summary of the assessment conclusions for material assets is provided in Table 16.5.

Table 16.5 Material Assets – Residual impacts summary

Potential impact	Impact magnitude	Receptor Sensitivity	Embedded mitigation	Residual impact
Waste generation	Low	Negligible	International best practice waste handling and use of licenced waste handling facilities	Not significant
Risk of damage to existing subsea cables at cable crossings intersected by the Project	Low	High	Consultation with existing cable operators, use of crossing-specific cable protection specifications, and approval of Cable Crossing Agreements prior to works	Slight
Project intersecting with concept or early planning area for an offshore windfarm	Low	Negligible	Consultation with windfarm developers to determine the likelihood of the offshore windfarm proceeding in this location, the level of risk associated with the cable location and the cable installation methods including cable protection.	Not significant

16.10 Conclusions

The assessment of material assets has considered the potential for the Project to impact upon proposed offshore renewable power sites, hydrocarbons assets, existing subsea cables, marine aggregate resources, PEXA, disposal grounds, and licenced waste handling facilities. Hydrocarbons assets, marine aggregate resources, PEXA, and disposal grounds were all scoped out of the assessment due to their absence in the vicinity of the Project or their operational status, or due to the low likelihood of a pathway(s) for significant effects.

The potential for the Project to impact upon licensed waste handling facilities, numerous existing subsea cables, and a proposed floating offshore wind development (the Inis Ealga Marine Park) were all assessed. The Celtic Interconnector Project does not pose a significant impact to onshore waste handling facilities due to the type and volumes of waste expected. Waste management will be undertaken in line with Irish law and international regulation and best practice in the foreshore and offshore environment. The necessary measures will be specified in the WMP including reference to roles and responsibilities and adherence to the WMP will be a contractual requirement for the EPC contractor.

No significant impact was predicted to the proposed Inis Ealga Marine Park site due to the scale of the interaction and therefore the low magnitude of the potential impact. A slight adverse impact has been identified in relation to existing cables due to the high economic value of these material assets. However, the mitigation inherent and embedded into the Project through the design of each cable crossing and the Cable Crossing Agreements prior to commencement of works ensures that this is limited to as low as reasonably practicable.

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17 Noise and vibration

17.1 Introduction

Certain marine species use sound for communication, navigation, and the identification of prey, (further information on this is provided in Volume 3D Part 2 EIAR for Ireland Offshore (Specialist Chapters) - Chapter 13: Biodiversity). Sound sources exist naturally in the marine environment, and marine fauna are typically adapted to these. The installation of the Celtic Interconnector Project has the potential to introduce anthropogenic sound sources to the marine environment that could be above the ambient sound levels of the receiving environment in terms of sound source level as measured in decibels (dB) or that are within frequency ranges that coincide with those used by marine fauna. This can impact upon the ability of marine fauna to use sound for the aforementioned purposes, and in extreme cases can cause physical injury to the auditory mechanisms of affected animals or mortality.

The EIAR for the Celtic Interconnector largely takes a receptor-led approach, meaning that the technical chapters assess potential impacts to specific receptors or receptor groups from Project activities. The introduction of Project-related noise and vibration to the environment has the potential to interact with and impact upon certain receptors that are defined in other chapters. The purpose of this chapter is to provide contextual information specific to the field of underwater noise that is used to inform the receptor-led assessment. This chapter characterises the baseline receiving environment for underwater noise and vibration in the vicinity of the cable route and defines the likely sound source levels and frequency ranges of the proposed works in the marine environment.

By way of general context, it is informative to note that, according to the Oslo / Paris convention for the Protection of the Marine Environment of the North-East Atlantic (OSPAR), sound emissions associated with the installation, removal or operation of submarine cables are considered as less harmful compared to activities such as seismic surveys, military activities or construction work involving pile driving (OSPAR Commission, 2012).

The assessment of noise and vibration is relevant where a receptor that is sensitive to the sound source exists. Sensitive marine fauna and the assessment of underwater noise and vibration on relevant species that have potential to occur in the vicinity of the Project are described in Volume 3D Part 2 EIAR for Ireland Offshore (Specialist Chapters) - Chapter 13: Biodiversity.

Human activities upon and behind the foreshore such as the car parks and holiday parks behind the Redbarn and Youghal sections of the Claycastle Beach are unlikely to propagate significant levels sound into the marine environment and are not considered further. Within the marine environment, the subsea cable installation is not anticipated to be audible to land-based receptors. Impacts to human receptors are scoped out of Volume 3D Ireland Offshore and are discussed in Chapter 13 of Volume 3C - Ireland Onshore.

17.2 Methodology and Limitations

17.2.1 Legislation and Guidance

Directive 2008/56/EC of the European Parliament and of the Council of 17 June 2008 establishing a framework for community action in the field of marine environmental policy (Marine Strategy Framework Directive, or MSFD) sets descriptors for the achievement of Good Environmental Status (GES). Under the MSFD, GES Descriptor 11 requires that, the *"introduction of energy (including underwater noise) does not adversely affect the ecosystem"*. This is applicable to the marine waters of the Irish EEZ UK EEZ including waters in the vicinity of the Project. Further information is included in Volume 8B MSFD Assessment.

In relation to marine fauna as receptors to underwater noise, marine fauna is afforded protection in the Irish EEZ through the EC Directive 92/43/EEC, known as the Habitats Directive. European Protected Species protected by the Habitats Directive include all species of dolphins, porpoises and whales. In the marine environment, the Habitats Directive is transposed in Ireland through the European Communities (Birds and Natural Habitats Regulations 2011 (S. I. No. 477 of 2011) as amended. Volume 3D EIAR Ireland Offshore provides further detail on marine fauna including the sensitivity of relevant species to underwater noise.

The Environmental Protection Agency (EPA) in Ireland has published the *Guidance Note for Noise: Licence Applications, Surveys and Assessments in Relation to Scheduled Activities* (NG4) (EPA, 2016). It is designed to provide acoustic guidelines to operators of activities in the First Schedule of the Environmental Protection Agency Act 1992 (as amended), which is not directly relevant to the works proposed by the Celtic Interconnector project. However, the note provides guidance to developers in relation to basic theory of environmental noise, Best Available Techniques (BAT), and noise reduction measures that may be considered during project development, all of which is relevant for informing best practice by the Project.

In 2012, The OSPAR Commission produced *Guidelines on Best Environmental Practice (BEP) in Cable Laying and Operation* (OSPAR Commission, 2012). The guidance differentiated the various types of sea cables and installation techniques, compiled mitigation measures to avoid and mitigate potential ecological impacts arising and identified knowledge gaps. Noise was not identified in this guidance as one of the primary sources of ecological impact requiring mitigation. The guidance stated that generally, maximum sound pressure levels related to the installation or operation of cables was *"moderate to low"*. However, only one publication of recordings of noise emissions during cable laying was identified by the authors (Nedwell et al. 2003; of a UK windfarm, which measured noise from cable trenching). The guidance acknowledged and highlighted such knowledge gaps at that time, and the need to determine noise generated from different burial techniques in different sediment types.

In 2014, the Department of Arts, Heritage and the Gaeltacht published *Guidance to manage the risk to marine mammals from man-made sound sources in Irish waters* (DAHG, 2014).

This guidance document describes the legal context of the consideration of underwater sound in relation to marine mammals, the use of sound by different marine mammal species, and methods for characterising and managing risks to these species from anthropogenic sound sources. Additional legislation and guidance of specific relevance to faunal receptor groups is described in Volume 3D Part 2 EIAR for Ireland Offshore (Specialist Chapters) - Chapter 13 – Biodiversity.

17.2.2 Desktop Studies

In 2014 as part of the Science, Technology, Research and Innovation for the Environment (STRIVE) Programme 2007-2013, the EPA published the findings of a study into the spatio-temporal distribution of underwater noise in Irish waters (Sutton et al., 2014). This study has been reviewed to inform the EIAR and further information is provided in Section 17.4.

Noise in water can propagate over wide areas and beyond international boundaries, so data sources in UK have also been reviewed. Anthropogenic noise has been monitored around the UK including in the Celtic Sea by Cefas (Merchant et al., 2016) and modelled mapping has been developed by the Marine Management Organisation (MMO) (MMO Project No. 1097) (MMO, 2015). While these publicly available datasets do not extend into the Irish jurisdiction, they are useful indicative sources that have been used to inform and characterise the noise and vibration baseline in this chapter of the EIAR.

A review of documents available from the Government of Ireland in relation to its approach to the MSFD has been undertaken. This includes the initial assessment of Irish marine waters and the establishment of environmental targets and indicators in relation to underwater noise, as well as reporting on the programme of measures put in place to achieve GES in Irish waters. A review of UK-based documents was also undertaken to inform the environmental assessments for the wider Project. In 2019, the Department for Environment Food and Rural Affairs (DEFRA) published a Marine Strategy Part One consultation document (DEFRA, 2019) on the UK's progress towards achievement of GES and the UK government's proposals for updating the UK Marine Strategy published in 2012.

Part of the measures taken since 2012 was the establishment of a noise registry that records impulsive noise in the marine environment and a monitoring programme designed to monitor trends in ambient noise levels in the sea. This nationally coordinated approach to quantifying underwater noise in UK waters involved monitoring at 12 sites around the UK, including one in the Celtic Sea. The findings of this work have been published (Merchant et al., 2016) and modelled mapping has been developed by the MMO Project No. 1097) (MMO, 2015). These data sources that have been used to inform and characterise the noise and vibration baseline in this chapter of the Ireland Offshore EIAR. Further information is included in Volume 8B MSFD Assessment.

17.3 Field Studies

Given the temporally transient nature of sound, there was determined to be no value in undertaking project-specific surveys of in-air or underwater ambient noise conditions during the planning and design phases of the Celtic Interconnector Project. However, the potential for noise generation was included as an environmental constraint in the development of alternatives when assessing the individual route options. Environmental input to optioneering noted that there was potential for higher levels of underwater noise where rock-cutting would be required, compared to standard trenching or cutting installation methods. This is not a particular concern for the Project in Irish waters due to the relatively soft nature of the substrate as described in the project description Volume 3D Part 2 EIAR for Ireland Offshore (Specialist Chapters) - Chapter 5: Description of the Landfall and Chapter 6: Description of the Offshore Cable.).

17.3.1 Methodology for Assessment of Effects

The methodology for assessing the effects of underwater noise on faunal receptors is presented in Volume 3D Part 2 EIAR for Ireland Offshore (Specialist Chapters) - (Chapter 13 – Biodiversity).

17.3.2 Limitations

No notable difficulties were encountered in the development of this chapter.

17.4 Receiving Environment

Underwater noise and vibration can arise from natural and anthropogenic sources and has the potential to affect acoustically sensitive species, and through this, the overall functioning of marine ecosystems. The capacity of water to readily transmit noise and vibration means that there is potential for sensitive receptors at many kilometres from the source to be affected by noise and vibration, primarily during the installation phase of the Project. Sensitive species are typically marine mammals that use high-frequency sound for communication such as harbour porpoise (*Phocoena phocoena*), and certain fish species in some cases. Further information on sensitive species is presented in Volume 3D Part 2 EIAR for Ireland Offshore (Specialist Chapters) - Chapter 13 – Biodiversity.

The findings of the study published as part of the STRIVE programme (Sutton et al., 2014) are presented as modelled seasonal soundscapes for continuous underwater noise linked to shipping activity. The soundscapes are modelled noise maps that present a ‘snapshot’ of likely sound propagation based on the probability of certain noise levels occurring in any given area. The STRIVE programme presents modelled data concerning the sea area in the vicinity of the Celtic Interconnector cable route as typically having maximum underwater noise levels between 100-120dB re 1µPa, with the higher end of the range modelled between spring and autumn and the lower end of the ranges modelled for winter months of January to March. Additional measured data was collected for the purposes of ground-truthing the model at a location outside Cork Harbour. A high-resolution underwater sound recording device was deployed at a water depth of 15m and 0.4m above the seabed for 16 days between 20 April and 4 August 2012. The site is approximately 30km west of the proposed cable route within Irish Territorial Waters. The recorded power spectral density in the one-third octave band at 125Hz (where the one-third octave 125Hz is equal to all the acoustic energy between the two frequencies 110Hz and 140Hz). The geometric mean value (i.e. the sound level that, for a given period of time, half the measured data was greater than this level and half the data was less) was 78 dB re 1µPa. The majority of the data ranged between approximately 60-100 dB re 1µPa, with 2-3% of the counts returning more intensely peaked data over 100 dB re 1µPa. The study identified fluctuating background noise signals resulting from environmental variables such as winds and waves as well as less dense but more intensely peaked data that corresponds to anthropogenic sound including the passage of vessels.

Merchant et al (2016) reported field measurements of underwater noise at 12 sites around the UK, with data for the Celtic Sea monitored at a site located off the south-western tip of Cornwall. While not located within Irish waters, the Celtic Sea monitoring location is the closest to the Celtic Interconnector Project and is taken to be broadly indicative of underwater sound levels that can be expected within the receiving environment in Irish waters. The study identified the Celtic Sea monitoring site dataset as being the least affected by anthropogenic sound of all the monitored sites. The Celtic Sea monitoring site was located 15km east of a convergence of shipping lanes, but the site was characterised predominantly by sound levels below 125Hz with a median sound pressure level of 83.2dB re 1µPa and a 90th percentile of 93.3dB re 1µPa. Higher frequency ranges were detected at 250Hz and 500Hz with median sound pressure levels of 87.1 and 89.7dB re 1µPa respectively, but these readings were infrequent. The data identified wind-generated noise as the primary driver of variability, with peaks of heightened noise levels above 100Hz. This indicates that there was little acoustic influence of shipping or other anthropogenic activities at this monitoring site, with natural sound sources being dominant.

In line with the data described by Sutton et al (2014) and Merchant et al (2016), the underwater noise and vibration environment along the cable route is dominated by natural sound sources such as wind and wave action. The vocalisations of marine fauna including birds and marine mammals in air and underwater are present and occasional continuous anthropogenic sound sources such as vessel engines and helicopters may be detectable periodically. This includes the movements of commercial and recreational vessels Volume 3D Part 2 EIAR for Ireland Offshore (Specialist Chapters) - Chapter 18 – Shipping and Navigation) as well as vessels and helicopters operated by the Irish Coast Guard and the ferry services that operate from Cork and Rosslare.

The open ocean environment of Irish EEZ waters is similarly characterised in terms of underwater noise and vibration by natural sound sources such as wave action and faunal vocalisations and by anthropogenic sources such as vessel engines. In the Irish EEZ, these are typically larger vessels than in Territorial Waters and may include fishing vessels, ferries, and cargo vessels of varying sizes such as container ships, tankers, and dry bulk carriers. The use of sonar in navigation and by fishing vessels for targeting shoals also propagates sound into the marine environment.

17.5 Characteristics of the Development

Underwater sound will be produced during the installation of the cable as a result of vessels, ancillary equipment and machinery, seabed preparation activities, cable laying, and the installation of cable protection. Sound and vibration will also be produced at the foreshore as a result of sheet piling during the installation of the cofferdam. The vessel types that will be used during the installation phase are described in Volume 3D Part 2 EIAR for Ireland Offshore (Specialist Chapters) - Chapter 5: Description of the Landfall and Chapter 6: Description of the Offshore Cable. Source terms for vessels and cable installation techniques have been published in numerous studies, often in relation to offshore wind developments. Within Irish waters, the principal noise sources of the Project and the noise levels likely to be propagated during the relevant activities are presented in Table 17.2:

Table 17.2 Noise and Vibration Characteristics of the Project

Noise and vibration source	Source term description	Approximate unweighted source levels	Likely frequency banding	Data source
Support vessel engines	Continuous broadband noise from gearbox, propeller resonance and propeller cavitation – data refers to small to mid-sized vessels between 50-100m in length, with source levels and frequencies varying relative to hull dimensions, speed and engine power.	155 to 180dB re 1µPa @ 1m depending on vessel type, with guard vessels typically at the lower end of the range	20 Hz to >10kHz	OSPAR Commission, 2009; Sutton et al, 2014
Cable lay vessel engines	Continuous broadband noise from gearbox, propeller resonance and propeller cavitation – data refers to vessels 50-100m in length with source levels and frequencies varying as stated above.	155 to 180dB re 1µPa @ 1m depending on vessel type, with the cable lay vessel expected to be at the higher end of the range	Up to 1kHz	OSPAR Commission, 2009
Cable protection installation vessel using Dynamic	Continuous broadband noise whilst operational. A previous study of rock deployment within the Yell Sound (Nedwell, 2004), Shetland found that the noise of rock placement from	121 to 148dB re 1µPa @ 1m	Broadband up to 35kHz	Nedwell and Edwards, 2004; Fischer, 2000; Prideaux,

Noise and vibration source	Source term description	Approximate unweighted source levels	Likely frequency banding	Data source
Positioning (DP)	vessels could not be detected by monitoring equipment above the levels of vessel noise recorded, with no notable difference between the vessel's noise levels when placing and not placing rock protection. Therefore, noise associated with placement of cable protection is accounted for under the assessment of the cable protection installation vessel noise.			2017; Wyatt, 2008
Subsea survey and monitoring equipment	Impulsive sound from equipment such as chirp sub bottom profiler	213-228 dB re 1µPa @ 1m	1.8 to 5.3kHz	Le Gall et al, 2016
Sheet piling on the foreshore	Pulsed broadband sound in water at high tide	81 to 84Leq dBA at 6 m (measured)	12 Hz to 100 kHz	Subacoustech, 2018; Paulus et al, 2008
Sheet piling on the foreshore	Predicted typical and highest construction noise level (in air) dB(A) at onshore locations (NSL1, NSL2, and NSL3) adjacent to the Landfall Interface Area	NSL1 62/70 NSL2 63/68 NSL3 50/52	N/A	Mott MacDonald, 2020
Cable laying with trenching	Continuous broadband noise, tonal machinery noise and transients with source term characteristics determined by the physical properties of the substrate	178dB re 1µPa @ 1m	Broadband with peaks around 40-50 kHz	Nedwell et al, 2003

17.6 Likely Significant Impacts of the Development

17.6.1 Do Nothing

Given that the baseline environment is characterised largely by natural sound sources and shipping, the baseline ambient noise levels could be expected to gradually increase over time as a result of climate change leading to an associated increased frequency of storm events, and as a result of increasing shipping in line with economic drivers and demand.

Given the ambition of the government to expand Ireland's offshore wind capacity, the future baseline is also likely to include underwater sound and vibration sources from the construction of offshore wind farms and associated marine surveys and shipping.

None of these longer-term baseline scenarios for underwater noise are influenced by the Project under the do nothing alternative.

17.6.2 Installation Phase

Vessel noise during installation

Installation vessels primarily generate underwater noise from their engines, propellers, navigation systems, dynamic positioning (DP) systems, and on-board machinery. These types of sounds will be propagated during the installation of the cable and cable protection as well as during later maintenance activities during the operational phase. There is potential for these sound sources to influence the behaviour of cetaceans and pinnipeds and their use of sound for navigation, communication and for the identification of prey. The potential for behavioural changes and other non-lethal effects on these receptors is assessed in Volume 3D Part 2 EIAR for Ireland Offshore (Specialist Chapters) - Chapter 13 -Biodiversity.

Noise and vibration through use of subsea survey and monitoring equipment (installation phase)

Similarly to the effect described above, the source levels and frequencies propagated by subsea survey and monitoring equipment such as sub bottom profiling have potential to influence the behaviour of certain sensitive marine fauna, and cause injury or mortality in extreme cases. This is assessed in Volume 3D Part 2 EIAR for Ireland Offshore (Specialist Chapters) - Chapter 13 -Biodiversity).

Noise and vibration as a result of cable installation activities including sheet piling at the Landfall Interface Area

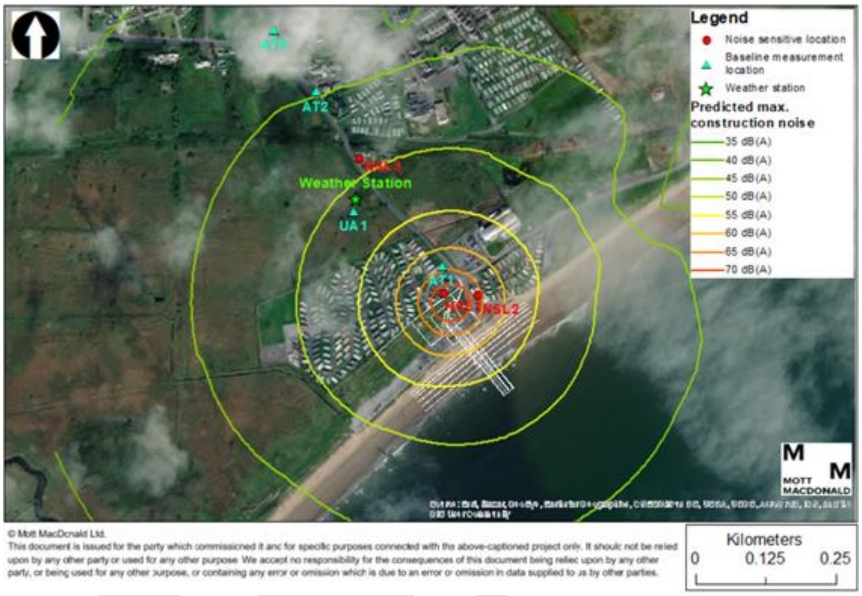
Cable installation in the marine environment and across the foreshore is likely to result in temporary and localised noise and vibration. The worst case for noise and vibration at the Landfall Interface Area is Option 1 as this uses sheet piling for the installation of a cofferdam. The source levels and frequencies propagated by cable installation and burial processes, particularly from the installation of steel sheet piles to create a cofferdam has potential to influence the behaviour of certain sensitive marine fauna where present, or to cause injury or mortality in a worst-case situation. This is assessed in Volume 3D Part 2 EIAR for Ireland Offshore (Specialist Chapters) - Chapter 13: Biodiversity.

In-air noise from sheet piling is likely to be perceptible by beach users and residents at Summerfield Holiday Park immediately behind the foreshore at Claycastle Beach. These in-air noise sources and any stakeholder concerns regarding the foreshore installation activities and its proximity to sensitive receptors are considered in Volume 3C – Ireland Onshore.

Commented [A69]: Placeholder: Confirm chapter number

The propagation of the predicted noise from sheet piling at the Landfall Interface Area is graphically illustrated in Figure 17.1.

Figure 17.1 Noise contours for the predicted level of construction noise



The sound source level from sheet piling within 6m from the source if used for the installation of a cofferdam at high tide is predicted to not exceed a worst case of 84dB(A) in line with published data (Subacoustech, 2018; Paulus et al, 2008). The source level of land is predicted to be lower due the acoustic properties of sound in air. While sound travels further in water than in air, taking into account the attenuation of sound over distance from the source and the predicted source level in water, the sound is predicted to decrease to well below 84dB(A) within 1km of the Landfall Interface Area.

Noise and vibration through installation of external cable protection

Previous studies of rock deployment within the Yell Sound, Shetland found that the noise of rock placement from vessels could not be detected by monitoring equipment above the vessel noise, with no clear difference between the vessel's noise levels when placing and not placing rock protection (Nedwell, 2004). The measurements were taken using a hydrophone at distances ranging from 200m to 10km from the sound sources and at depths varying between 1m to 200m. Therefore, noise associated with placement of cable protection is accounted for under the assessment of vessel noise in Volume 3D Part 2 EIAR for Ireland Offshore (Specialist Chapters) - Chapter 13: Biodiversity and is not assessed separately.

Noise and vibration through detonation of UXO during preparation for cable installation

Magnetometer surveys undertaken to date (in 2015 and 2018) have not identified a high potential for UXO targets along the cable route in Irish waters. Pre-installation surveys of the cable route will further determine the presence of any UXO. In the unlikely event that the pre-installation survey does identify UXO, these will subsequently be either detonated in situ, or removed to be detonated elsewhere. Any such works to UXOs will be carried out under licence held by the EPC contractor, informed by relevant environmental assessments, guidance and in line with the '*Guidance to manage the risk to marine mammals from man-made sound sources in Irish waters*' (DAHG, 2014). As UXO targets are not expected along the cable route in Irish waters and that there is a commitment to best practice mitigation in the unlikely event that any are discovered, the likelihood of any significant effects is negligible so this has been scoped out of the Offshore EIAR and is not considered further.

Commented [A70]: Placeholder: An appendix, considering and assessing the presence and handling of UXO, is currently in preparation, and will be ready for submission with the final Application File. Within the current EIAR, the approach has been to not include UXO within impact assessments, on the assumption that the chance of encountering them during works is low.

17.6.3 Operational Phase

Noise and vibration through use of subsea survey and monitoring equipment during the operational phase

The use of vessels deploying subsea survey and monitoring equipment such as a sub bottom profiler for completion of periodic operational maintenance surveys will use similar equipment and methods to those described during installation. During the operational phase, this will typically occur over more limited and focused areas than during installation. The potential for noise associated with these activities to impact fauna is assessed in Volume 3D Part 2 EIAR for Ireland Offshore (Specialist Chapters) - Chapter 13: Biodiversity.

No further noise sources are anticipated during the operational phase of the Project.

17.6.4 Decommissioning Phase

Decommissioning is anticipated to occur no sooner than 40 years from the start of operation. Where decommissioning works are required to remove infrastructure, these will be the subject of future consent applications as appropriate, to include relevant environmental assessments.

It is currently anticipated that the cable will be left in-situ where deemed environmentally acceptable and with the understanding that this may require long term monitoring and maintenance. Under this scenario, underwater noise sources during decommissioning would be limited to subsea survey and monitoring work to establish the integrity of the cable and the cable protection. The potential for effects on marine fauna is expected to be in line with those described for subsea surveys and monitoring during installation and operational maintenance, as assessed in Volume 3D Part 2 EIAR for Ireland Offshore (Specialist Chapters) - Chapter 13: Biodiversity.

17.6.5 Cumulative Effects

Volume 3D Part 2 EIAR for Ireland Offshore (Specialist Chapters) -.Chapter 16: Material Assets describes the Inis Ealga Marine Energy Park, which is intersected by the proposed cable route. This a large proposed floating offshore wind park off the coast of County Cork (further information in Volume 3D Part 2 EIAR for Ireland Offshore (Specialist Chapters) -.Chapter 16: Material Assets An indicative programme for this development is understood through consultation with the developer to be as follows (although dates are likely to be subject to change and beyond the control of EirGrid):

- Foreshore Site Investigation Application submitted to DoHPLG 4 Dec 2019;
- Public consultation concluded 4 June 2020;
- Foreshore Licence not yet issued by DHLGH in March 2021;
- Scoping exercise is ongoing and due to conclude in March 2021; and
- Marine ecology survey due to commence in Spring 2021, with a duration of two years.

Commented [A71]: To be updated prior to issue of Final Application File

EIAR finalisation expected in Q2 2023 with planning application submission to the Consenting Authority in Q3 2023.The construction of offshore wind developments typically involves significant changes to ambient underwater noise levels, from activities including seabed preparation, piling, cable and cable protection installation, and the movements of vessels and helicopters over prolonged periods. As the Inis Ealga Marine Park is a floating wind proposal, it is likely that the Project will propagate underwater noise and vibration over an as yet undetermined period of time during the installation of mooring lines for each floating turbine. Each turbine typically has between three and six mooring lines, depending on the turbine design. Project design details for these possible future offshore wind development sites or indeed others in wider Irish Territorial Waters are not yet available so it is therefore not possible to determine or quantify the installation techniques that are likely to be used. While the likely installation programme is not yet published, given their early stage of planning, it is likely that the installation of the Celtic Interconnector will be complete by the time these possible offshore wind sites are under development. Therefore, any underwater noise considerations and assessments will be responsibility of the offshore wind developers and decision-makers at that time.

There are no further developments in the vicinity of the landfall or interconnector cable route in Irish waters (either in construction or in planning) that have the potential to give rise to significant cumulative effects in terms of noise.

17.7 Mitigation and Monitoring Measures

Commented [A72]: Placeholder: All mitigation and monitoring measures remain in review, and will be confirmed prior to submission of the final Application File.

17.7.1 Installation Phase

The implementation of installation phase mitigation relating to underwater noise sources is detailed in Volume 3D Part 2 EIAR for Ireland Offshore (Specialist Chapters) -.Chapter 13: Biodiversity.

Vessels used by the Project will be operated and maintained in line with International Maritime Organisation (IMO) Guidelines for the reduction of underwater noise from commercial shipping to address adverse impacts on marine life (MEPC.1/Circ.833) (IMO, 2014). Relevant design considerations from these guidelines may include:

- Propeller design to reduce cavitation (i.e. the formation and implosion of water vapour cavities caused by the decrease and increase in pressure as water moves across the propeller blade);
- Selection of onboard machinery and engines with in-built noise reduction technology and/or appropriate vibration control measures;
- Proper location of equipment in the hull;
- Optimisation of foundation structures such as vibration isolation mounts that may contribute to reducing underwater radiated noise; and
- Effective maintenance to reduce noise and vibration.

Operations in the Irish marine environment will be undertaken in line with the '*Guidance to manage the risk to marine mammals from man-made sound sources in Irish waters*' (DAHG, 2014).

17.7.2 Operational Phase

The implementation of operational phase mitigation relating to underwater noise sources is detailed in Volume 3D Part 2 EIAR for Ireland Offshore (Specialist Chapters) -.Chapter 13: Biodiversity. Vessels will be operated and maintained in line with IMO Guidelines for the reduction of underwater noise from commercial shipping to address adverse impacts on marine life (IMO, 2014) as previously stated.

17.7.3 Residual Impacts

Residual impacts relate to marine fauna and are therefore described in Volume 3D Part 2 EIAR for Ireland Offshore (Specialist Chapters) - Chapter 13: Biodiversity.

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18 Shipping and navigation

18.1 Introduction

This chapter considers the potential for effects to arise on the navigation of vessels within Irish Territorial Waters or the Irish Exclusive Economic Zone (EEZ), as a result of installation and subsequence presence of the proposed Celtic Interconnector.

Vessel operation may also present risks to the interconnector cables, for example through damage from ships' anchors, ships grounding or foundering or interaction with fishing gear. These risks have been taken into account in the design process and appropriate mitigation measures (cable routeing, cable burial and cable protection) have been incorporated into project design. Such risks to the cables are not the subject of EIA and are not considered in this chapter, although some information on such aspects is included in the navigation risk assessment attached at Appendix 18A to this Volume 3D Part 2 of the EIAR, which also provides supporting information for the EIA aspects.

Commented [A73]: Placeholder: Navigational Risk Assessment currently in preparation, and will be finalized and included prior to submission of the final Application File.

This chapter focusses on effects of the interconnector project on navigation of vessels. In addition, construction activity and subsequent presence of the cables may have an effect on the ability of commercial fishing vessels to access their normal fishing areas during construction or to deploy certain types of bottom gear (for example trawls and dredges) subsequently. The effects of the project on fishing activity specifically are covered in Volume 3D Part 2 EIAR for Ireland Offshore (Specialist Chapters):

- Chapter 8 – Population and human health; and
- Chapter 19 – Commercial fisheries.

Consideration of fishing vessels in this chapter relates solely to effects on navigation, which apply to all types of vessel.

18.2 Methodology and Limitations

18.2.1 Legislation and Guidance

The wider legislative and policy context is set out in Volume 3D Part 1 (Introductory Chapters). The principal additional legislation relevant to this chapter is that relating to safe navigation of vessels, as set out below.

UNCLOS

The United Nations Convention on the Law of the Sea 1982 (UNCLOS) defines the rights and responsibilities of nations with respect to their use of the world's oceans, establishing guidelines for businesses, the environment, and the management of marine natural resources and establishing the right of innocent passage for vessels of one state passing through the territorial waters of another state.

COLREGS

The International Regulations for Preventing Collision at Sea 1972 (COLREGS) set out the navigation rules to be followed by ships and other vessels at sea to prevent collision between two or more vessels. The international regulations are transposed into Irish law through the Merchant Shipping (Collision Regulations) (Ships and Water Craft on the Water) Order 2012 (S.I. No. 507/2012).

SOLAS

Chapter V, Safety of Navigation, of the Annex to the International Convention for the Safety of Life at Sea (SOLAS) sets out the navigational equipment to be carried on board ships. This includes a requirement for all ships of 300 gross tonnage (GT) and upwards engaged on international voyages, cargo ships of 500GT and upwards not engaged on international voyages, passenger ships irrespective of size and fishing vessels exceeding 15m in length to carry Automatic Identification System (AIS) equipment. AIS is a system which allows the position of each vessel to be transmitted at frequent intervals to other vessels and shore stations / marine authorities. Ships fitted with AIS must maintain AIS in operation at all times while on passage, except where international agreements, rules or standards provide for the protection of navigational information.

A proportion of smaller fishing vessels and recreational craft carry AIS but this is voluntary and they may not broadcast continuously.

The international rules are transposed into Irish law through the European Communities (Vessel Traffic Monitoring and Information System) Regulations 2010 (S.I. No. 573/2010) (as amended).

Marine notices

Marine notices are information notices issued by An Roinn Iompair (Department of Transport) to publicise important safety, regulatory and other information relating to the maritime sector in Ireland. This system will be used to advise shipping of vessel activity and any exclusion zone established in connection with installation arrangements for the cable.

18.2.2 Desktop Studies

In 2013 Intertek commissioned Anatec to prepare a brief 'High-level review of shipping and navigational features' in the vicinity of four potential cable routes being examined between Ireland and France, to aid in cable routeing. Subsequently EirGrid and RTE commissioned a more detailed 'Shipping and fishing - cable risk assessment' for the preferred cable route west of the Isles of Scilly, reported in 2016. These reports are attached as Appendix 18B to this Volume 3D, Part 2 of the EIAR.

Commented [A74]: Placeholder: Appendix 18B is currently in preparation, and will finalized / included prior to submission of the final Application File.

Review of available project reports identified that data relevant to the assessment of effects of the Celtic Interconnector (Irish EEZ and Irish territorial waters sections) on shipping, fishing and recreational vessels are available in the following project reports.

- Celtic Interconnector Study Synthesis. Prepared by Wood Group for EirGrid and RTE. Doc Ref: 400584-PL-REP-001, Rev: H. July 2019.

- Ireland to France Cable Route. Shipping and Navigational Features. High Level Review (Technical Note). Ref. no. A3225-INT-TN-0. December 2013. Prepared for Intertek by Anatec Limited.
- Celtic Interconnector. Shipping and Fishing - Cable Risk Assessment. Ref. no. A3728-RTE-RA-2, Rev. 4. April 2016. Report prepared for EirGrid and RTE by Anatec Limited (Appendix 14B to this EIAR volume).
- Celtic Interconnector. Shipping and Fishing - Cable Risk Assessment. Appendix A – Data validation. Ref. no. A3728-RTE-AP-1, Rev. 1. January 2016. Report prepared for EirGrid and RTE by Anatec Limited.
- Celtic Interconnector. Shipping and Fishing - Cable Risk Assessment. Appendix B – VMS Fishing analysis. Ref. no. A3728-RTE-AP-2, Rev. 1. January 2016. Report prepared for EirGrid and RTE by Anatec Limited.

Although principally undertaken to provide an assessment of potential risks to the cable and to guide engineering design and routeing of the cable, these reports provide information on shipping activity, based on records from AIS, along with information on vessel sizes, anchoring requirements and anchor dragging risks along the cable route within the Irish EEZ and Irish territorial waters. This includes records of activity of fishing vessels fitted with AIS and records from Vessel Monitoring Service (VMS) satellite fishing data. Additional information is provided on recreational vessels, most of which do not have AIS.

The data are based on 12 months of AIS records, covering two separate 6-month periods in 2014 and 2015 but, as there have been no significant developments at local ports since then that would result in significant changes to vessel routeing, the data are considered still to provide a valid baseline for the current impact assessment. The reports also present data collated by the UK Marine Accident Investigation Board (MAIB) on ship foundering within 50 nautical miles (nm) of the cable route (including incidents affecting UK vessels in Irish waters).

Note also that the Anatec reports referenced consider two potential cable landfall sites, at Ballycroneen and Ballinwilling. The selected landfall site now being progressed is at Claycastle, immediately to the west of Youghal and the Blackwater Estuary, resulting in a cable route on the approach to the Irish shore up to 10km east of the Ballinwilling route option. As the chosen study area comprised a 5nm buffer of the cable routes considered, extended to 10nm (18.6km) at the landfalls to ensure anchoring activity was comprehensively identified within the analysis, the study includes the current cable route and the reports provide all the data required to assess the impacts of the Celtic Interconnector project on navigation.

As small recreational vessels and small fishing craft are not required to carry AIS equipment, qualitative data were obtained from publicly available information from local harbours. A more detailed description of the activity of small fishing vessels is included in Volume 3D Part 2 EIAR for Ireland Offshore (Specialist Chapters) - Chapter 19: Commercial Fisheries. As these are shallow draughted vessels and there is no expectation that cable protection protruding above the seabed will be installed in the nearshore shallower waters (Volume 3D Part 2 EIAR for Ireland Offshore (Specialist Chapters) - Chapter 5: Description of the Landfall and Chapter 6: Description of the Offshore Cable)the effects on navigation of such vessels will be confined to temporary interference with passage due to presence of work vessels and potentially an exclusion zone during cable installation. It was therefore not considered necessary to obtain detailed information on levels of activity of such vessels.

Other sources of data used were:

- Admiralty Sailing Directions, Irish Coast Pilot, NP40. 21st Edition, UKHO, 2019.
- UK Admiralty Charts 2049 Old Head of Kinsale to Tuskar Rock and 2071 Youghal.

18.2.3 Field Studies

As all larger vessels are now obliged to carry AIS equipment and to operate it when under way or fishing, field observations of such vessels was not required, as full details of vessel movements are available from AIS records, supplemented by radar data.

It was not deemed necessary to undertake field studies to obtain quantitative data on small inshore fishing vessel and recreational vessel activity for the purposes of the EIA. Qualitative data obtained from desk studies, as described above, were considered sufficient. However, direct discussion will be instigated with local fishing interests and recreational boat clubs once the precise nature and timing of the cable installation activities has been determined, to that ensure all local sea users are fully informed and thus risks to navigation are minimized.

18.2.4 Methodology for Assessment of Effects

The generic project-wide approach to EIA is set out in Volume 3D, Part 1 (Introductory Chapters) Chapter 4: EIAR Methodology, of this EIAR.

In terms of assessment of effects on navigation, the process has involved the following steps:

- Definition of the baseline navigation activity (including passage and anchoring) across the proposed cable route (receptors of potential effects);
- Identification of potential effects of cable installation and presence of the cable on navigation activity (as distinct from risks to the cable from shipping, which is relevant to the project design process but not the EIA process);
- Identification of magnitude of effects (degree of disruption or hazard), spatial scale and duration of effects, including identification of where the design of the development avoids or minimises adverse effects;
- Assessment of significance of effects;
- Identification and assessment of any cumulative effects; and
- Identification of any proposed mitigation and monitoring.

This Chapter is concerned with the effects of cable installation works and subsequent presence of the cable on navigation activities, such as normal navigation in Irish waters, access to ports, anchoring and any potential restrictions on these activities caused by the Celtic Interconnector project. It should be noted that ship anchoring (including in an emergency), anchor dragging and foundering of vessels can present risks to the cable and these are addressed in the Anatec reports attached as Appendix 18B to this volume of the EIAR. However, these aspects are not the subject of this EIAR chapter.

18.2.5 Difficulties Encountered

AIS equipment carriage is not mandatory for all vessels. Military vessels and small craft such as fishing vessels below 15m in length and recreational craft are not required to carry AIS and are therefore not included in the plots showing AIS data. Similarly, fishing vessels below 15m in length are not recorded in Vessel Monitoring Service (VMS) satellite fishing data, as described in Anatec report A3728, Appendix B (Appendix 18B of this Volume 3D of the EIAR).

Quantitative data on navigation of small fishing vessels in the vicinity of the cable route is therefore not available, although a general description of activity is available in Volume 3D Part 2 EIAR for Ireland Offshore (Specialist Chapters) - Chapter 19: Commercial Fisheries of this volume of the EIAR and this is regarded as adequate for the overall assessment. However, while consultation took place with the Ballycotton Fisherman’s Association and the Youghal Fisherman’s Association in 2017 and 2018, further consultation will be undertaken as part of the process of communicating detailed proposals for construction activity, when these are available.

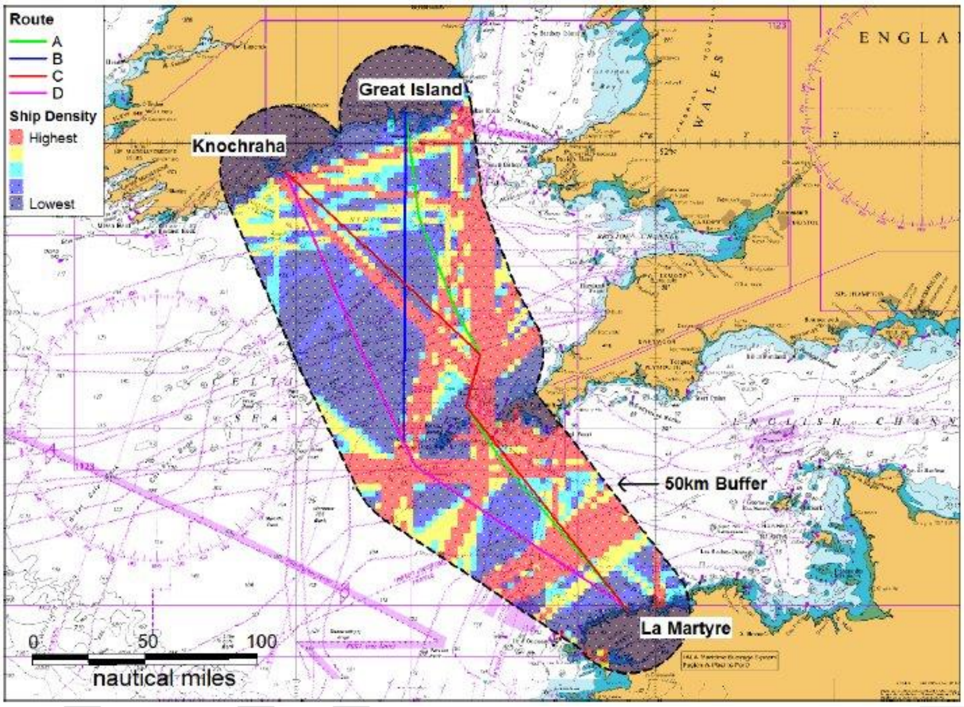
18.3 Receiving Environment

18.3.1 Vessel traffic

Shipping traffic density for vessels carrying AIS is indicated in Figure 18.1. (Note this is based on the Anatec high-level study report A3225-INT-TN-0 produced in 2013, as this gives a broader picture, but shipping data are entirely consistent with the 2014 and 2015 data presented in Anatec report A3728-RTE-RA-2. Note also that the adopted cable route approximates to option B in these drawings but with a landfall now located at Claycastle, the adopted route is well within the 50km buffer shown.) This figure shows that the principal concentrations of shipping traffic crossing the overall cable route relate to vessels passing between the Celtic Sea and the English Channel, the Bristol Channel and the Irish Sea (via St George’s Channel). However, the principal routeings for all of these shipping connections cross the cable route outside (seaward of) the Irish EEZ.

The principal shipping activity crossing or approaching the cable route in Irish waters is highlighted in Figure 18.2 and comprises principally shipping between Cork Harbour and the English Channel, the Bristol Channel and the Irish Sea, whose routes show up as three distinct corridors. In addition, there are lower levels of shipping following the Irish south coast to and from the west, destined for Waterford, the Irish Sea and Bristol Channel.

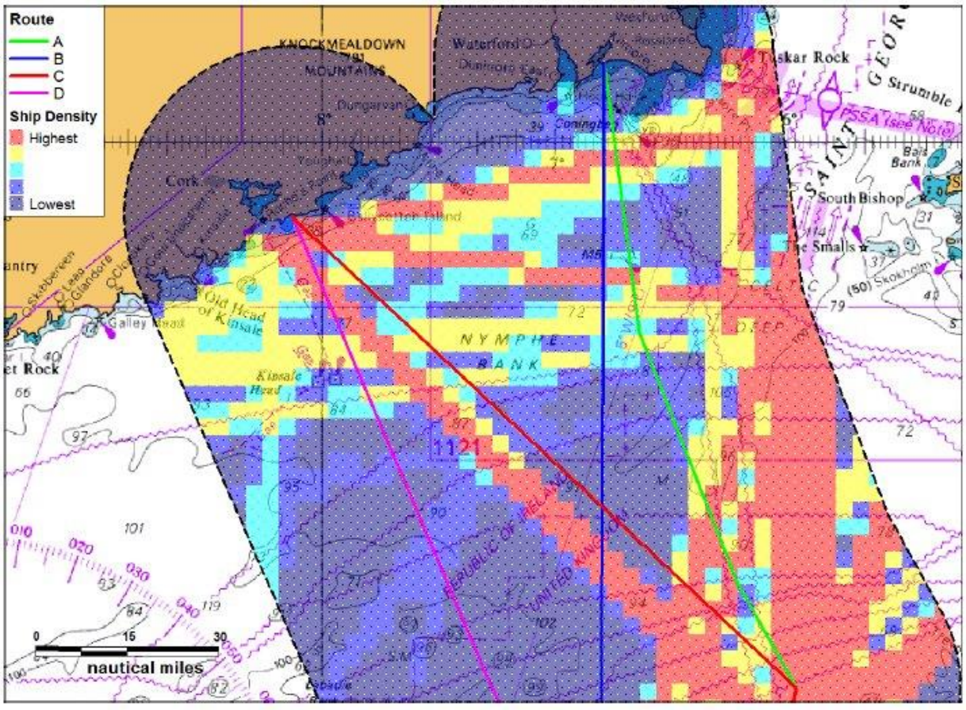
Figure 18.1 Marine traffic density along the whole of the proposed cable route (derived from Anatec report A3225-INT-TN-0)



A more detailed breakdown of traffic crossing the proposed cable route by type of vessel, vessel length, vessel draught, vessel deadweight tonnage (dwt) and vessel speed is given in Anatec report A3728-RTE-RA-2, reproduced in Appendix 18B of this EIAR volume. The data shows that over the cable route as a whole, 67% of vessels were cargo carrying (including tankers), 17% were fishing vessels, 6% recreational craft (carrying AIS) and the balance comprised a mixture of military, passenger and service vessels. The pattern within Irish waters appears from the plots to show a similar balance of uses. Over 25% of vessels were under 50m in length, with longer vessels apparent on routes to larger ports, such as Cork Harbour, which is recorded as receiving some vessels exceeding 200m in length. Similarly, vessel draughts were mainly less than 8m, with 22% recording <5m draught. Deeper draughted vessels were also recorded in Irish Waters accessing Cork Harbour, with maximum draught >10m and capacity >40,000 dwt. Figure 18.2 shows that highest densities of vessels crossing the cable route in Irish waters occur largely within the first 70km from its landfall at Claycastle and are principally associated with vessels sailing to or from Cork Harbour.

Analysis of data for ship deadweight for the first 100km of the cable route from the Irish coast shows that 51% of vessels fell within the <1,500 dwt category (which will include most fishing and recreational vessels).

Figure 18.2 Marine traffic density in the vicinity of the Irish Coast (derived from Anatec report A3225-INT-TN-0)



18.3.2 Route features

International Maritime Organisation (IMO) routeing measures are in place in the form of Traffic Separation Schemes (TSSs) affecting vessels passing through St George's Channel between the Irish Sea and the Celtic Sea, off the Irish Coast near Rosslare (TSS off Tuskar Rock) and off the south west Wales coast in UK waters (TSS off Smalls). Both of these are over 100km from the cable route, towards the east north east. A TSS is also in place off the southernmost extent of Ireland (TSS off Fastnet Rock), situated over 100km to the west south west of the cable landfall. These are too far away to affect the routeing of vessels in the vicinity of the cable route.

There are no offshore energy developments (windfarms, oil and gas platforms) at the water surface within the vicinity of the cable route in Irish Territorial Waters that would affect ship routeing. In the Irish EEZ, Kinsale A-East and Kinsale B-West gas platforms are approximately 10km west of the cable route and each is surrounded by a 500m navigation exclusion zone. These structures are approximately 50km offshore, in over 80m of water depth, thus avoidance by shipping is straightforward and has negligible impact on the routeing of shipping crossing the cable route.

The proposed cable route also crosses five active subsea cables and one redundant subsea cable within Irish waters. The crossings may involve additional protection protruding above the seabed but the crossings are in a minimum water depth of approximately 90m, so greatly in excess of the draught of any ship.

18.3.3 Ports

Local ports in Ireland (see Figure 18.3) contribute vessel traffic to the area, including:

- Kinsale, a small commercial, fishing and recreational port, located on the Bandon River, approximately 60km (by sea) west of Claycastle;
- Cork Harbour, comprising a number of ports within a natural estuarine complex around the River Lee estuary, approximately 37km (by sea) to the west of Claycastle, with port limits encompassing ports of Cork, Cobh, Passage West, Ringaskiddy and Whitegate, an important deep water harbour which accommodates both large commercial and passenger vessels, as well as a limited number of fishing vessels;
- Youghal in the Blackwater Estuary, which is approximately 1.75km north east of Claycastle and accommodates occasional visits to Greens Quay by commercial vessels up to around 4,000 dwt, as well as for small commercial fishing and recreational vessels;
- Dungarvan and Helvic, approximately 30km (by sea) east of Claycastle, small harbours that cater principally for recreational vessels; and
- Waterford, on the River Suir, off the River Barrow estuary, approximately 60km (by sea) east of Claycastle, which is a significant commercial freight port, while smaller harbours within the Barrow Estuary accommodate commercial fishing and recreational vessels.

18.3.4 Anchorages

Coastal anchorages identified in the Pilot Book for the area (Admiralty Sailing Directions, Irish Coast Pilot, NP40, 21st Edition, UKHO, 2019) are present off Cork Harbour, in Ballycotton Bay, off Youghal, in Whiting Bay and in the Barrow Estuary off Waterford, as shown on Figure 18.3. Neither Youghal nor Whiting anchorage is suitable for use in adverse weather conditions. Anchorages within estuaries are not shown as these are not relevant to the assessment.

Figure 18.3 Ports (yellow dots) and anchorages (orange dots) near the cable route landfall at Claycastle (mauve triangle)

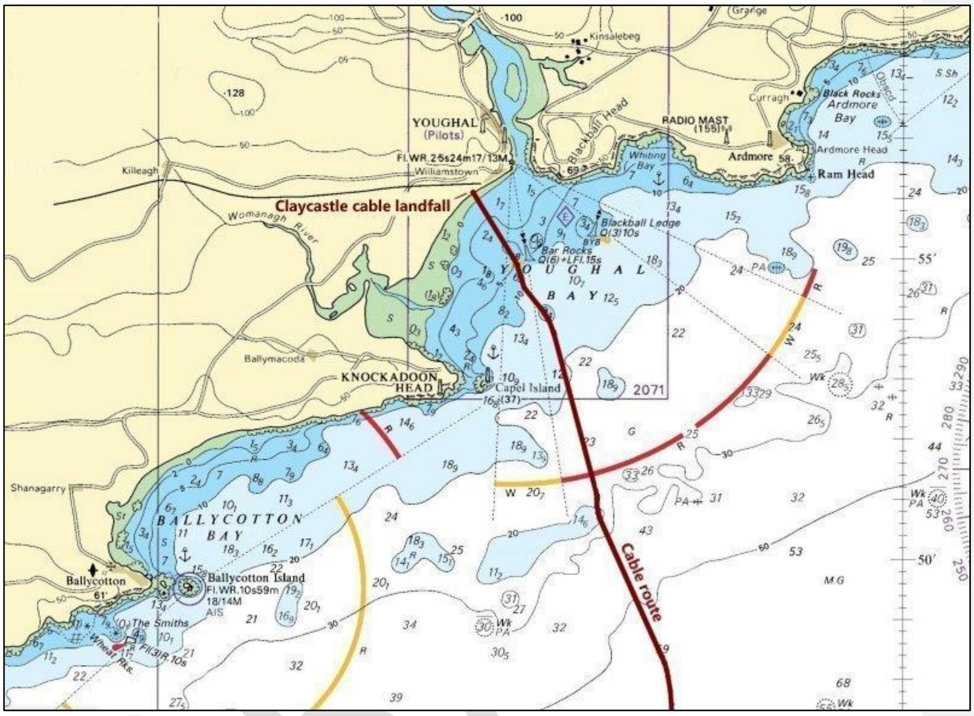
Anatec examined use of these anchorages based on AIS data. The majority of anchoring activity by vessels fitted with AIS was in the Cork Outer anchorage with a high proportion of tankers. Limited use of Ballycotton Bay, 10km west of the cable route, by cargo vessels is also recorded. In the vicinity of Youghal and the cable landfall, a few cargo vessels are recorded using the Youghal and Whiting Bay anchorages but the majority of anchoring is by cargo vessels within the main eastern approach channel. These are assumed to be vessels waiting for tidal conditions to allow entry, as access to the harbour is limited by the state of the tide. Only one vessel is recorded as anchoring close to the cable route.

It is worth noting that the AIS data do not provide information on anchoring by recreational vessels; however, these are of less concern in practice as their anchors are unlikely to penetrate to the cable burial depth.

18.3.5 Landfall area

The approaches to Youghal Harbour are shown in Figure 18.4 and comprise alternative east and west channels, identified by white sectors in the light from Youghal Lighthouse. The east channel is deeper, with a minimum depth of 2.8m below chart datum (BCD) and is the channel used by larger vessels. Further aids to navigation are present in the form of cardinal buoys (Bar Rocks and Blackball Ledge) marking eponymous hazards between the two channels. Locations of the Youghal and Whiting Bay anchorages, west of the west channel and north of the east channel respectively, are shown. The proposed cable landfall is at Claycastle, 1.8km southwest of the entrance to Youghal Harbour. The cable route proceeds in a generally south south west direction across the west approach channel and then between the channels, away from the anchorages.

Figure 18.4 Navigation channels and anchorages in the vicinity of the cable landfall at Claycastle



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18.4 Characteristics of the Development

A detailed project description, including both installation and operation phases, is detailed in

Volume 3D Part 2 EIAR for Ireland Offshore (Specialist Chapters) - Chapter 5: Description of the Landfall and Chapter 6: Description of the Offshore Cable. This section simply aims to highlight aspects that are particularly relevant to the navigation assessment.

18.4.1 Installation

There are two possible methodologies by which the proposed installation of the cable at the landfall at Claycastle will be undertaken. For the purposes of this EIAR, we have assessed both options including the worst case scenario i.e. Option 2 in addition to Option 1 which is the more likely methodology that would be preferred by the contractor. Option 1 would involve construction of a temporary cofferdam and causeway down the beach extending from above the level of highest astronomical tide (HAT) to a point on the beach approximately 50m above the level of lowest astronomical tide (LAT). This would involve only land-based equipment and its location means that the only potential interaction with navigation activity would be a temporary restriction on use of part of the beach which might affect users of beach-launched craft, such as personal watercraft, kite surf boards, etc. The cofferdam would be used to lay conduits through which the cables will be pulled by shore-based winches from a cable-laying vessel anchored near to the shore. If this option were adopted, the principal works affecting the beach would be proposed to occur during winter to minimize effects on beach users and would be estimated to take approximately 10 weeks to be completed, including removal of the cofferdam and causeway and re-instatement of the beach to its prior condition.

During a second phase of work in the summer months, the cables would then be pulled through the conduits from a cable-laying vessel using onshore winches at the head of the beach. This would involve access by land-based plant to excavate the receiver pits at the end of the previously installed conduits, requiring a second period of temporary restrictions on access to a small area of the beach near LAT for a period of approximately 4 weeks. Again, the only potential interaction with navigation activity would be a temporary restriction on use of a small part of the beach which might affect users of beach-launched craft, such as personal watercraft, kite surf boards, etc.

Option 2 would involve installation of conduits only to landward of the top of the beach, so no cofferdam or causeway would be required. Again this would be undertaken during winter months but would have no impact on navigation, as access to the majority of the beach would not be restricted. This phase of the works would take approximately 8 weeks to be completed.

The second phase of works would take place during the summer months and would again involve pulling cables through the conduits from a cable-laying vessel. However, in this option the cables would then need to be buried across the beach using a plough, which would require restriction of access to a strip of beach from the conduit receiver pits at the head of the beach to the level of LAT. The burying operation is estimated to take approximately 24 hours for each of the three cables but access to the strip running down the beach may be restricted for up to 4 weeks. Again, the only potential interaction with navigation activity would be a temporary restriction on use of a small part of the beach which might affect users of beach-launched craft, such as personal watercraft, kite surf boards, etc.

Once the cables have been pulled through the conduits to the transition joint bays, the cable laying vessel will proceed seaward laying the cable, following previous UXO and boulder clearance along the route (if required) and grapnel runs to clear debris. Cable laying will proceed seaward, most likely using a plough or mechanical trenching tool, depending on seabed conditions.

If the target burial depth cannot be achieved, protection using rock armour (or possibly concrete mattressing) may be required. It is estimated that this will apply to a maximum of 3km of cable route in Irish Territorial Waters and a maximum of 10km in the Irish EEZ.

The cable laying works below seaward of low water mark will involve the operation of various vessels, including the following in a worst case scenario:

- Survey vessels (route finalisation, pre-lay survey, post lay survey, post burial survey);
- Vessels for unexploded ordnance (UXO) survey and response if required;
- Vessels for boulder clearance and sandwave pre-sweeping in the Irish EEZ if required;
- Vessels carrying out pre-lay grapnel runs;
- Cable laying and burial vessel or vessels;
- Specialist vessel for rock trenching (potential requirement envisaged over a 33km section in the Irish EEZ);
- Vessels involved in installation of cable protection (e.g. rock armour); and,
- General supply vessels and rock supply vessel(s) if rock armour is required.

Some of these, for example the cable laying vessel, will be categorized as vessels of restricted manoeuvrability while operating and will require other, non-project related vessels to take appropriate avoidance measures as stipulated in the COLREGS. Vessels may require access to Cork Harbour, creating a low level of additional coastwise traffic.

Within Irish waters, indicative durations are that preparatory works are anticipated to last for approximately 30 days, cable laying for approximately 60 days and rock armouring for up to 16 days. As the first section of the cable from Claycastle will follow an existing sediment channel, no rock armouring is expected to be required within at least the first 18km, beyond which point water depth is over 60m BCD.

18.4.2 Operation

Where the cable is successfully buried to the target depth, the trench will be infilled and the character and bathymetry of the seabed will be unchanged, resulting in no new hazard to passing vessels. Where rock armour is required, this may protrude up to 2m above the seabed resulting in a reduction in available depth.

18.4.3 Potential effects on navigation

Principal characteristics of the development in relation to potential effects on navigation are:

- Temporary presence of work vessels with limited ability to manoeuvre during the construction phase and potentially an associated temporary exclusion zone, requiring avoidance by passing vessels;
- Presence of rock armour above the previous seabed level, resulting in localised reduction in water depth available for navigation; and
- Presence of cables within anchor burial depth of the seabed, imposing restrictions on where vessels may anchor.

18.5 Likely Significant Impacts of the Development

18.5.1 Do Nothing

Without the implementation of the Celtic Interconnector Project, shipping within Irish waters would continue to show largely the same pattern as at present, although there may be a slight shift to greater use of the deep-water routes as vessels become larger. In particular, growth of traffic at the recently built Riverside Quay in Liverpool, which allows larger container ships to access the port, will result in passage of deeper draught ships, although most of these will not enter Irish waters.

18.5.2 Construction Phase

Potential effects during construction are:

- Obstruction of normal navigation by vessels involved in cable installation activity; and
- Restriction of access for beach-launched craft on part of Claycastle Beach.

The cable installation process will involve one or more vessels classed as restricted in their ability to manoeuvre while cable laying or operating other underwater equipment. As required by the COLREGS, these vessels will display appropriate lights and shapes to indicate this status and, in restricted visibility, emit the required sound signals. Other vessels will have a duty to keep out of the way. It may be that an exclusion zone will be established, requiring avoidance of the work vessel by a minimum specified distance. As the cable laying progresses the area affected will move but at any one time it will be a small area (depending on any exclusion zone) and the obstruction will not be situated at any time in a narrow channel or fairway. Thus avoidance of such vessels will cause minimal interference or delay to passing vessels, particularly if they are advised in advance and can adjust their course in good time.

Compliance with the COLREGS by all vessels, including those involved in the Celtic Interconnector project and those passing through the area, should be sufficient to ensure vessel safety. However, further steps will be taken by EirGrid to ensure that mariners are warned in advance of the presence of the cable laying operations, including circulation of information via Marine Notices and radio navigational warnings, in advance of and during the works, allowing advanced passage planning, thereby reducing disruption to routeing and risk of inappropriate interaction. It is proposed to make direct contact with local commercial fishing interests and clubs representing local recreational vessel users once the precise nature and timing of the cable installation activities has been determined, in order to that ensure all local sea users are fully informed and thus risks to navigation are minimized as far as practicable.

Commented [A75]: Placeholder: Reference to KISORKA to be considered here

Other than during periods of repair / maintenance, no further exclusion zones are anticipated once the Celtic Interconnector is operational. This is consistent with the specified requirements of the Department of Agriculture, Food and the Marine, as advised by the Aquaculture and Foreshore Management Division via an EIAR Scoping Response to the Department of Housing, Local Government and Heritage (Foreshore Unit) on 12 February 2021.

On the basis that adequate information will be promulgated to mariners, the short duration of the works and the reasonable expectation that mariners are familiar with and comply with the COLREGS, the adverse effects of cable installation operations on existing navigation activity in the vicinity are assessed as minor and not significant. (It is noted again that effects on commercial fishing itself are not considered here but in Volume 3D Part 2 EIAR for Ireland Offshore (Specialist Chapters) - Chapter 19: Commercial Fisheries).

In terms of obstruction of part of the Claycastle Beach for around 10 weeks in winter months and up to 4 weeks in summer, thus limiting access to launch small vessels such a personal watercraft, kite surf boards, etc, most of the restrictions will take place in winter months, outside the official bathing season, at a time of year when demand for access is lowest. Restrictions in the summer will be minimised and will affect only a small part of the beach, whichever construction option is adopted. Signage will be provided to inform potential users of the restrictions. Due to the temporary nature of the restrictions, the continued availability of most of the beach for launching of small craft, the fact that the beach will be restored immediately and that the greatest period of restriction is outside the main recreation season, the adverse effects are assessed as minor and not significant.

18.5.3 Operational Phase

Potential effects during operation are:

- Grounding or damage to stern gear where rock armour is present; and,
- Restriction of anchoring in vicinity of cable reducing the scope for anchoring.

For most of the cable route, the cable will be buried to the target depth and the seabed restored to its original profile, resulting in no change to the bathymetry. However, a potential need has been identified to install rock armouring along up to 3km of the cable route in Irish Territorial Waters and up to 30km of the route in the Irish EEZ. A requirement for rock armouring is not envisaged for the first 18km of the cable from the landfall at Claycastle Beach, which means that all rock armouring will be in a water depth exceeding 60m BCD. Rock armour or concrete mattresses will also be used to protect cable crossings but, again, within Irish waters these are all in water depths exceeding 85m BCD.

As the need for rock armouring is only anticipated in water depths exceeding 60m BCD, well in excess of the draught of any ship, the presence of the cable will present no risk of grounding; therefore, the adverse effects are assessed as negligible and not significant.

The cable route does not pass through any designated anchorage areas and the only place where it approaches areas used for anchoring of cargo vessels or other large craft is in Youghal Bay. Within the bay the cable route runs from the landfall at Claycastle Beach, across the west approach channel then southwards between the approach channels, on the opposite sides to the anchorages, so access to the anchorages will be unaffected (see Figure 18.4). As described earlier, cargo vessels typically anchor in the east approach channel while awaiting the tide to allow them to enter the port but this does not take place in the west channel which is shallower. The cable route does not impinge at all on the east channel. Thus the effects of the presence of the cable on availability of anchorages are assessed as negligible and not significant.

18.5.4 Decommissioning Phase

Effects relating to the decommissioning phase, anticipated to be at least 40 years after installation, will depend on whether the cable is left *in situ*, in which case effects will remain as described above for the operation phase. Alternatively, if the cable is removed, effects will be similar to those described above for the construction phase.

18.5.5 Cumulative Effects

No other projects have been identified involving construction activity or new seabed installations on the open coast in the vicinity in the cable route, so no potential cumulative effects are predicted.

18.5.6 Transboundary effects

Although much shipping is transboundary in nature, effects of the cable on navigation during both installation and operational phases have been shown to be:

- Local to the cable within waters under Irish jurisdiction; and
- Not significant.

No significant effects have been identified in Irish waters which would result in transfer of marine traffic from Irish waters to those of another state (notably the UK) or an increase in hazards to shipping in another state. Transboundary effects are therefore determined to be negligible.

18.6 Mitigation and Monitoring Measures

Commented [A76]: Placeholder: Al mitigation measures remain under review / discussion, and will be confirmed prior to submission of the final Application File.

18.6.1 Construction Phase

During the construction phase, the key to vessel safety is compliance by both work and passing vessels with the COLREGS. This will be encouraged and facilitated by keeping all sea users fully informed of plans and progress regarding the cable installation and procedures in place to ensure their safety when navigating in the vicinity. This will be achieved through:

- The issuing of Marine Notices;
- Radio navigational warnings by local ports and coastguards;
- Radio communication between work vessels and passing vessels;
- Direct contact with local commercial fishing organisations;
- Direct contact with clubs representing local recreational boat users; and
- Notices on the beach regarding landfall works and launching of personal watercraft or kite surf boards.

It is recommended that the cable contractor monitors and maintains records of radio communications with passing craft and reviews these at intervals to ascertain whether any changes or improvements to information dissemination would be appropriate.

18.6.2 Operational Phase

The principal measure to minimize risks of adverse interaction between vessels and the cable is to ensure that information is supplied to appropriate authorities to enable marine charts and sailing directions to be updated to show the cable route.

18.6.3 Residual Impacts

No residual significant effects have been identified.

18.7 References

Anatec, 2013. Ireland to France Cable Route. Shipping and Navigational Features. High Level Review (Technical Note).

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19 Commercial fisheries

19.1 Introduction

This chapter of the EIAR assesses the likely significant effects that the installation and operation of the proposed marine cable may have on commercial fisheries. It considers the potential impacts and identifies appropriate mitigation measures to avoid, reduce, or offset potential adverse impacts.

The Commercial Fisheries chapter should be read in conjunction with the development description provided in Volume 3D Part 2 EIAR for Ireland Offshore (Specialist Chapters) - Chapter 5: Description of the Landfall and Chapter 6: Description of the Offshore Cable,and with respect to relevant parts of other chapters (namely Volume 3D Part 2 EIAR for Ireland Offshore (Specialist Chapters) - Chapter 17: Noise and Vibration, Chapter 11: Marine Physical Processes, Chapter 13: Biodiversity and Chapter 18: Shipping and Navigation) where common receptors have been considered and where there is an overlap or relationship between the assessments of effects.

19.2 Data Sources

The primary data sources used in the assessment of impacts on commercial fisheries include the following:

Project-specific studies undertaken with regards to vessel activity along the proposed route of the Celtic Interconnector that include:

- Celtic Interconnector Study Synthesis. Prepared by Wood Group for EirGrid & RTE. Doc Ref: 400584-PL-REP-001, Rev: H. July 2019;
- Celtic Interconnector Project. Fishing Activity Report. November 2013. Report for EirGrid and RTE by NetWork Services;
- Celtic Interconnector. Shipping and Fishing - Cable Risk Assessment. Ref. no. A3728-RTE-RA-2, Rev. 4. April 2016. Report prepared for EirGrid and RTE by Anatec Limited; and
- Celtic Interconnector. Shipping and Fishing - Cable Risk Assessment. Appendix B – VMS Fishing analysis. Ref. no. A3728-RTE-AP-2, Rev. 1. January 2016. Report prepared for EirGrid and RTE by Anatec Limited.

These reports provide information on fishing activity within the Irish EEZ and Irish Territorial Waters. Additional information has been acquired through liaison work undertaken by the Project's Fisheries Liaison Officer (FLO), who has led consultation with fishing interests and their representative organisations as appropriate.

In addition to the above, a review of both peer-reviewed and grey literature was undertaken supported by a data request to An t-Údarás um Chosaint Iascaigh Mhara (Sea Fisheries

Protection Authority) to inform the assessment presented within this chapter. Principal reports have included:

- Publications by Bord Iascaigh Mhara (Irish Sea Fisheries Board);
- Marine Institute: Irish Groundfish Surveys and Fisheries Resource Maps;
- Marine Institute: Atlas: Commercial Fisheries for Shellfish around Ireland;
- Marine Institute: Ireland's Marine Atlas;
- Sea-Fisheries Protection Authority: Data and statistics from the Irish sea-fisheries industry, including landing numbers and quotas;
- International Council for the Exploration of the Sea (ICES) subdivision VII fisheries catch statistics;
- ICES Fish Trawl Surveys, Pelagic and bottom fish trawl surveys, Database of Trawl Surveys (DATRAS);
- Food and Agriculture Organisation (FAO) Yearbook. Fishery and Aquaculture Statistics;
- Ellis et al 2012. Spawning and nursery grounds of selected fish species in UK waters; and
- Dransfeld et al 2000. Larval distribution of commercial fish species in waters around Ireland.

19.3 Commercial Fisheries Assessment Overview

The potential impacts of the installation and operation of the proposed marine cable on commercial fisheries interests have been assessed, using the methodology broadly described in Volume 3D Part 2 (Introductory Chapters) Chapter 4: EIAR Methodology. In order to assess the overall significance of an impact it was necessary to establish:

- The receptors that could be affected by the proposed development;
- Possible impacts arising from renewable projects on commercial fisheries;
- The magnitude of the potential impact incorporating likelihood, level of change, geographic extent and duration; and
- The sensitivity and/or importance of the receiving environment or receptor.

19.3.1 Identification of Receptors

The following principal receptors have been identified for commercial fisheries:

- Local inshore fisheries primarily comprising vessels <8m in length with a single crew member fishing static gear targeting *inter alia* lobster (*Homarus gammarus*), browncrab (*Cancer pagurus*), shrimp (*Palaemon serratus*) and trawls for clams (*Spisula solida*) and oyster *(Crassostrea gigas)* to around 6nm offshore.

- Local inshore trawlers (<10m) fishing within the 12nm territorial waters targeting *Nephrops* (*Nephrops norvegicus*) with demersal otter trawls all year. Single, twin or quad trawl rigs employed over soft ground for *Nephrops* with whitefish targeted over hard ground.
- Scallop *(Pecten maximus)* dredgers fishing within the Irish EEZ beyond the 12nm territorial waters.
- Offshore demersal trawls, vessels (12–25m length), include both otter and beam trawls, targeting Nephrops, benthic species and gadoids.
- Offshore pelagic trawls and seine nets.
- Shoreline harvesting. Hand gathering of periwinkles (*Littorina littorea*) occurs on rocky outcrops around the Irish landfall at Youghal Bay.

19.3.2 Magnitude of Impact

The magnitude of an impact considers the scale of the predicted change to baseline conditions resulting from a given potential impact and takes into account the likelihood of the impact occurring, the spatial extent over which it occurs, the level of change with respect to baseline conditions and the duration of the impact prior to recovery.

The magnitude of change affecting a receptor is identified on a scale ranging from 'neutral' to 'high'. Criteria for describing the magnitude of impact are described in Table 19.1.

Table 19.1 Definition of Terms Relating to the Magnitude of an Impact.

Potential consequence of impact on VER	Magnitude
Commercial fishing activity on traditional fishing grounds will be severely affected by the project and/or associated construction activities. Permanent (greater than three years) interference to fishing grounds will occur.	High
Commercial fishing activity on traditional fishing grounds will be significantly affected by the project and/or associated construction activities. Long term (six months to three years) interference to fishing grounds will occur.	Medium
Commercial fishing activity on traditional fishing grounds will be affected by the project and/or associated construction activities. Medium term (one to six months) interference to fishing grounds will occur.	Low
Commercial fishing activity on traditional fishing grounds will remain largely unaffected by the Project and/or associated construction activity. Intermittent and temporary (< one month) interference to fishing grounds will occur.	Negligible

Potential consequence of impact on VER	Magnitude
Although it is not always possible to state categorically that there will be no impact on a receptor, the term neutral will be used where the level of exposure is considered to be analogous to natural variation.	Neutral

19.3.3 Sensitivity and Importance of Receptor

The sensitivity of the baseline conditions has been assessed according to the relative importance of existing fisheries interests on or near to the proposed marine cable route corridor (e.g. whether it is of national, regional, or local importance), or by the sensitivity of receptors which would potentially be affected by marine cables installation and operation.

The sensitivity of commercial fisheries has been assessed in accordance with the criteria outlined in Table 19.2.

Table 19.2 Definition of Terms Relating to the Sensitivity and Importance of the Receptor

Sensitivity	Description
Very high	The receptor has little or no capacity to absorb change without fundamentally altering its present character, is of very high fisheries interest, or of national importance
High	The receptor has low capacity to absorb change without fundamentally altering its present character, has some fisheries interest, or is of national importance.
Medium	The receptor has moderate capacity to absorb change without significantly altering its present character, has some fisheries interest, or is of national importance.
Low	The receptor is tolerant of change without detriment to its character, is low fisheries interest, or local importance.
Negligible	The receptor is resistant to change and/or is of little fisheries interest.

19.3.4 Determination of Significance

A qualitative approach has been taken to determining the significance of the potential effects to commercial fisheries broadly following the approach illustrated in Table X.3 and also using professional judgement. The significance of a given effect is based on a combination of the magnitude (Table 19.1) of a potential impact and the sensitivity and importance of the receptor (Table 19.2). The magnitude of effects is identified as ranging between Negligible to Substantial. Effects identified as ‘moderate’, ‘major’ or ‘substantial’ are considered ‘significant’. Professional judgement will be used to determine if effects identified in the ‘minor or moderate’ category are either ‘not significant’ or ‘significant’.

Table 19.3 Matrix Used for the Assessment of the Significance of the Effect

		Magnitude of Impact				
		No Change	**Negligible**	**Low**	**Medium**	**High**
Sensitivity of receptor	**Negligible**	Negligible	Negligible	Negligible or minor	Negligible or minor	Minor
	Low	Negligible	Negligible or minor	Negligible or minor	Minor	Minor or moderate
	Medium	Negligible	Negligible or minor	Minor	Moderate	Moderate or major
	High	Negligible	Minor	Minor or moderate	Moderate or major	Major or substantial
	Very high	Negligible	Minor	Moderate or major	Major or substantial	Substantial

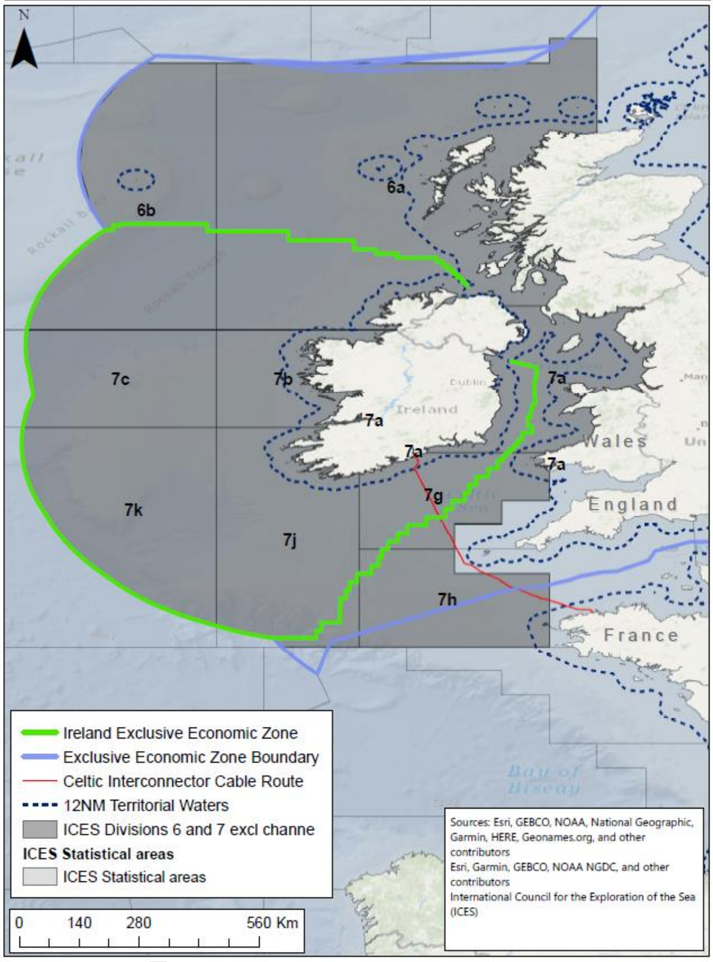
The results of this impact assessment are presented as residual effects in Table 19.3. Residual effects take into account design mitigation incorporated into the proposed marine cable route design or implemented during installation and operation.

19.4 Commercial Fisheries Baseline Characterisation

The geographic scope of the appraisal includes the area along and adjacent to the proposed marine cable route corridor as illustrated in Figure 19.1

The overview covers commercial fishing interests along the length of the proposed cable route within Irish territorial waters (ITW) (waters within 12nm of the coast in which Ireland exercise exclusivity to fisheries with a few exception) and the Irish EEZ (demarcated by a boundary 200nm seaward from the Irish coast or where EEZs overlap a boundary equidistant between neighbouring states) which fall predominantly within ICES sub-area 27.7g, Celtic Sea North (Division VIIg) as depicted in Figure 19.1. The ICES Divisions and Sub-divisions are used to geo-reference the boundaries of fish stocks and fisheries management areas.

Figure 19.1 Boundaries of the Irish Exclusive Economic Zone, Territorial Waters and ICES Subareas around the Irish Coast



Fishing within the Irish Territorial Waters and EEZ is predominantly undertaken by Irish vessels (Figure 19.1) using a diverse array of gear. Hand gathering of periwinkles occurs along on rocky shores adjacent to the proposed landfall, whilst small vessels (< 10m) operate inshore, typically targeting shellfish with static gear or demersal fish with trawls.

Vessels ≥ 10m target *Nephrops* using trawls whilst both trawls and seine nets are used to harvest gadoids and benthic species such as megrim (*Lepidorhombus whiffiagonis*), anglerfish (*Lophius piscatorius*), flatfish, and rays. Gill nets are employed to target pollack, monkfish, and cod inshore and hake further offshore. Dredge fishing gear is employed to fish for scallops in both inshore and offshore areas. Pelagic trawls mackerel (*Scomber scombrus*), horse mackerel (*Trachurus trachurus*) and herring (*Clupea harengus*) take place throughout the area of assessment.

In addition to the Irish fleet, commercial fishing within ICES division VIIg (Celtic Sea North) comprises vessels from the following countries:

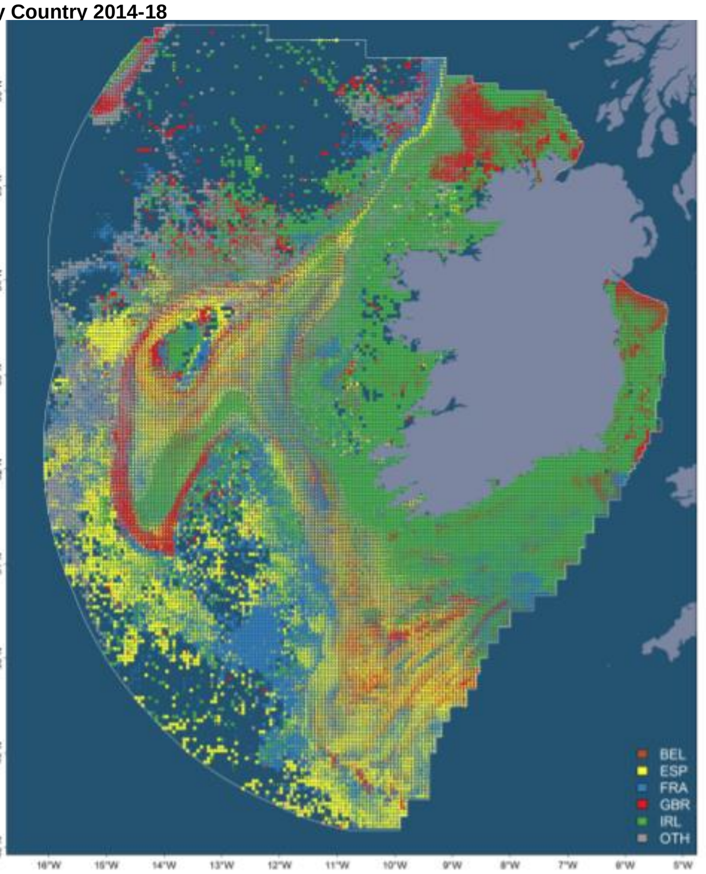
- Belgium – employing beam trawls and otter trawls to target rays, plaice (*Pleuronectes platessa)*, sole (*Solea solea*), and anglerfish *(Lophius piscatorius);*
- Spain – targeting hake (*Merluccius merluccius*), monkfish and megrim sole with long lines, gill nets and demersal otter trawls;
- France – mostly composed of bottom trawlers (18–35m) targeting gadoids, *Nephrops*, anglerfish, megrim, and rays;
- United Kingdom – targeting whitefish, *Nephrops*, whelk (*Buccinum undatum*) and crab;
- Netherlands - targeting pelagic species such as horse mackerel, mackerel and herring; and
- Portugal – targeting shark (*Prionace glauca*) with long lines.

The use of various fishing gears reflects the distribution of target species, regulations, and bottom characteristics. A comprehensive description of fishing methods is provided by Richards (2013), however, a summary of the principal methods employed within the Irish territorial waters and EEZ are provided below.

Three main categories of fishing gear fished within the waters adjacent to the proposed cable route:

- Static gear (pots, lines and gill nets);
- Demersal (bottom) trawl gear; and
- Pelagic (mid-Water) trawl gear.

Figure 19.2 Distribution of International Fishing Effort in the Irish EEZ by Country 2014-18



19.4.1 Static Gear

Static gear comprising gill nets, traps and pots set in a fixed location and periodically serviced. These methods are designed to intercept fish or to attract fish by bait, that has consequently become caught in the gear.

Gill nets comprise a panel of netting suspended vertically in the water by floats along the head rope and a weighted lead line or footrope. Panels are stitched together to create nets that can extend for several kilometres in length. Fish unable to detect the net swim into it and become entangled, often by their gill cover. There are two main types of gillnets in use: bottom gillnets and mid-water gillnets, the fisheries typically target cod (*Gadus morhua*), hake, sole and monkfish.

Pots or traps comprise baited pots often connected by a common line that can extend for many hundreds of metres. Once set, pots can be left on the seabed for several days before recovery. Pots can be deployed at a variety of depths from close in shore to many hundreds of metres in depth. Potting for crab is carried out in inshore waters over sandy ground. Prawns are targeted on the muddy, clay grounds along the coast and out to around 6nm offshore.

Static gear is not considered to pose a significant risk to subsea cables. However, disruption can be caused to static gear fisheries during the construction phase of a subsea cable system as a result of exclusion from short-term safety zone from fishing resulting in displacement of excluded vessels to other fishing grounds. This may result in short-term increase in steaming times and associated fuel costs and additional time spent at sea. Following construction period, static gear fishing can resume in the vicinity of the pipeline corridor.

19.5 Demersal (Bottom) Trawl

19.5.1 Otter Trawls

Otter trawls consist of a cone-shaped net or trawl with a wide mouth narrowing to the 'cod-end'. The net is towed through the water typically along or close to the seabed targeting *Nephrops*, and gadoids. The mouth of the net is kept open by the force of water acting against two 'otter boards', constructed of either steel or wood and attached to each side of the net by a bridle which draws the mouth of the net open. The top of the net is buoyed up by floats attached to the headline. The bottom of the mouth of the net is weighted down by a wire or footrope fitted with round rubber or steel rockhopper discs to enable it to ride over the seabed contours. The otter boards can penetrate soft sediments to around 0.3m. Two vessels may tow one net between them, known as pair trawling.

Richards (2013) cites research (unreferenced) with regard to trawl board penetration indicating subsea cables buried to a depth greater than 0.30m should be safe from trawl board damage. In the same report the author does not consider pair trawling to pose significant risk to surface laid or lightly buried subsea cables.

Large shackles and ground gear associated with demersal trawls have the potential to foul submarine cables in suspension and unburied cables, whilst heavy bridle and ground gear towed repeatedly along, or over marine cables have the potential to score and/or damage cables (Richards 2013).

19.5.2 Beam Trawls

In its simplest form a beam trawl is a conical net suspended below a metal or wooden beam with steel 'shoes' supporting the beam at either end. Small inshore vessels typically operate with a single lightweight steel beam rig, whilst larger offshore vessel may tow two larger beam trawl rigs, one either side of the vessel.

The trawls are typically either a stone mat gear type or open gear type. Stone mat beam trawls have a chain mesh strung in front of the footrope to prevent rocks rolling into the net. The weight of the chain mesh causes the trawl to fish very hard on the bed.

Open beam gear is generally used on clear ground and replaces the chain mesh with a number of loops of chain, known as “tickler” chains, used to increase the gear's catch efficiency. Beam trawlers operating with open beam gear will often tow the gear at speeds in excess of 6 knots through the water when fishing for sole.

Most of the beam trawlers that operate in the vicinity of the proposed cable use the heavy stone mat beam gear (Richards 2013). The Celtic Sea ICES subdivision VIIg is regularly fish by beam trawlers from Ireland, the UK and Belgium for high value fish species such as dover (black) sole, monkfish and megrim sole.

Beam trawls have the potential to foul subsea cables with a burial depth of 0.30m or less due to the design of the supporting steel shoes at either end of the beam. Beam shoes can be fitted with steel cable guards or rubber wheels that can reduce the risk of cables being hooked by the leading edge of the steel beam shoe making the gear more cable friendly although not removing the risk (Richards 2013).

19.5.3 Sumwing Beam

The Sumwing beam replaces the heavy steel beam of a beam trawler with a hydrofoil wing which is designed to fish just off the seabed at the same height as the conventional beam (c. 1m) without the use of the heavy steel beam shoes required to suspend the beam. This type of gear has been employed by the Belgian fleet in the Celtic Sea grounds. This gear can fish over softer ground however although the Sumwing beam itself “swims” just above the sea floor, it has a protruding stabilising “snout” that makes bottom contact, and this snout has the potential to foul an unburied subsea cable or a cable in suspension.

19.5.4 Scallop Dredges

Dredges are towed behind a vessel and can be up to 4.5-5m wide and weigh as much as 1 tonne. The dredge commonly consists of a large metal frame with metal bags to hold the catch. Steel teeth protrude some 12cm at the mouth of the dredge and these teeth penetrate the seabed to sift out the scallops. The teeth are spring-loaded and tensioned according to ground conditions to allow teeth to ride over hard and rocky ground. The frame and cutting bar ride along the surface of the seabed, while the bag drags along behind. A tickler chain fitted to the front of the frame triggers organisms such as scallops to propel from the seabed, so they are more easily captured. Rock chains are used on rocky areas of seafloor to prevent large boulders from entering the bag.

Scallop dredging is likely to cause damage or foul unburied subsea cable or where a cable is buried to a depth of 0.30m or less.

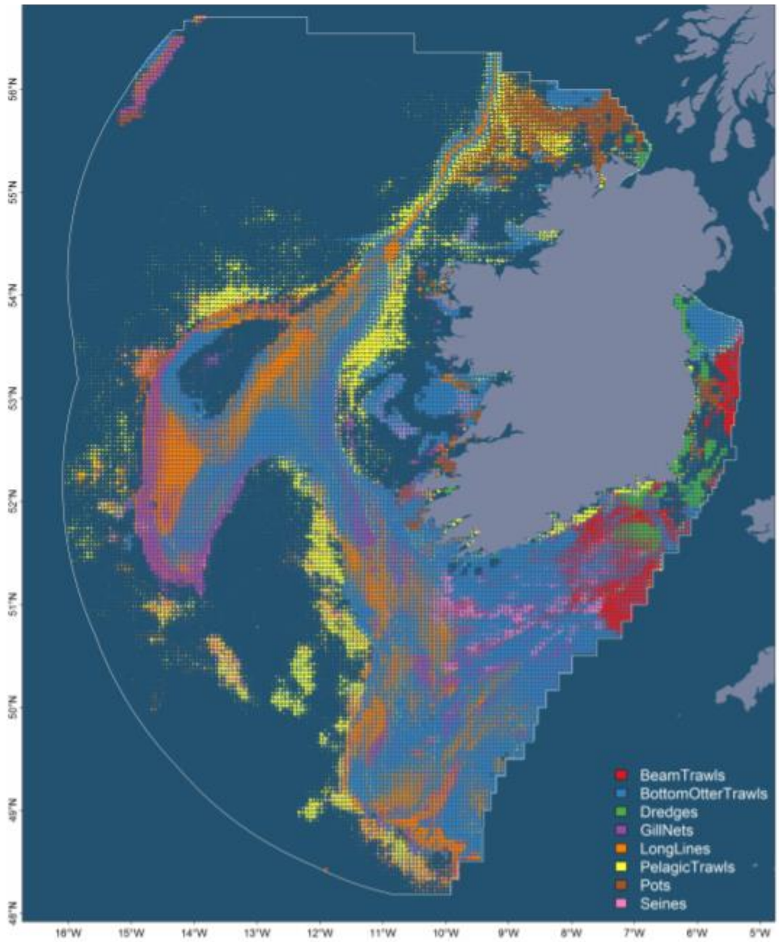
A variation to the conventional spring-loaded dredge is the N-Viro dredge that replaces the spring-loaded tooth bar with a rigid tooth bar with sprung steel tines. The N-Viro dredge is less likely than the spring-loaded dredge to foul and damage an unburied subsea cable.

19.5.5 Pelagic (Mid-Water) Trawl

Pelagic trawl gear is fished mid-water targeting shoaling fish such as mackerel, herring and sprat. The gear seldom contacts the seabed and is considered unlikely to represent any significant risk to subsea cables during normal fishing operations.

Figure 19.3 shows the distribution of fishing effort in Irish EEZ by gear type 2014-2018.

Figure 19.3 Distribution of International Fishing Effort in Irish EEZ by Gear 2014-2018 (Gerritsen and Kelly, 2019)



19.6 Commercial Fishing Fleets Operations

Automatic Identification System (AIS) and Vessel Monitoring Systems (VMS) data collected via both satellite and terrestrial receivers was used to provide an overview of fishing activity of vessel >15m within the study area (Anatec, 2016).

AIS is an automatic tracking system that provides a vessels identification, position, course, and speed to both authorities and other vessels allowing the vessel movements to be tracked and monitored. AIS is required by the International Maritime Organization's International Convention for the Safety of Life at Sea to be carried by all large vessels. VMS relates specifically to commercial fishing vessels and allows the regulatory authorities to track and monitor the activities of fishing vessels within territorial waters and/or the EEZ.

Data analysed by Anatec (2016) covered fishing vessels >15m in length. Whilst a proportion of smaller vessels may carry AIS voluntarily they are not obliged to broadcast and therefore it is assumed they are not covered within this analysis.

Survey data for both AIS and VMS (Anatec, 2016) was available for the following periods:

- AIS:
    - 1 April to 30 September 2014;
    - 1 May to 31 October 2015;
- VMS:
    - January to December 2009.

Whilst it is recognised that there is a time difference between the observations of fishing activity and the current assessment, and that fishing activity can be dynamic in nature due to changes in productivity of fishing grounds, quota allocations, legislation, economic constraints and other restrictions, the analysis does provide an overview of the fisheries during the period of time for which data was available. It is noted in the report that although there is a time difference of 5 to 6 years between the AIS and VMS datasets, the values agree reasonably well, suggesting a degree of stability within the fishery.

The analysis assumed vessels travelling >6 knots was likely to be steaming on passage between ports and / or fishing grounds. Fishing vessels travelling <6 knots were assumed to be actively fishing (this is a conservative assumption as these vessels could also be steaming. The tracks of fishing vessels actively fishing within Irish territorial waters and EEZ along the cable route are presented in Figure 19.4.

Beam and otter trawlers account for the majority of fishing effort along the proposed cable route within the ITW and the EEZ followed by pelagic trawlers and gill netters. Beam trawling appears to be predominant in shore, within territorial waters whilst demersal trawling is common further offshore. Both beam trawlers and demersal trawlers trawl along the seabed and could therefore interact with the cable route (Anatec 2016).

Analysis of the total number of vessels travelling below 6 knots crossing the proposed cable route was used to identify sections of the cable route considered to be high risk from fishing vessels (Anatec 2016). The distribution of the annual number of fishing-cable crossings per kilometre point (KP) of cable is presented in Figure 19.4. This shows that the proposed cable route close to the Irish landfall, KP26 to KP44 is considered a high-risk area for fishing vessel crossings.

Figure 19.5 presents a plot of all fishing-cable crossings for vessels travelling at less than 6 knots, colour-coded by fishing vessel gear type (Anatec, 2016).

Figure 194 AIS Tracks Less than 6 Knots, 12 Months (2014/2015) in Irish Territorial Waters and EEZ

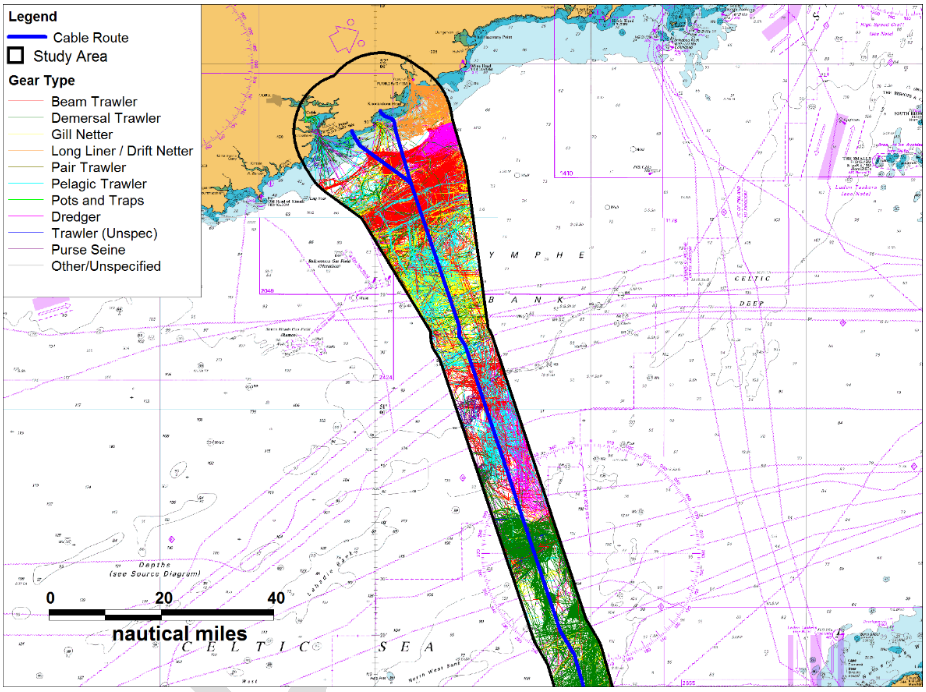


Figure 19.5 Annual Fishing Crossing Frequency Results per KP of Cable Route (source Anatec, 2016a)

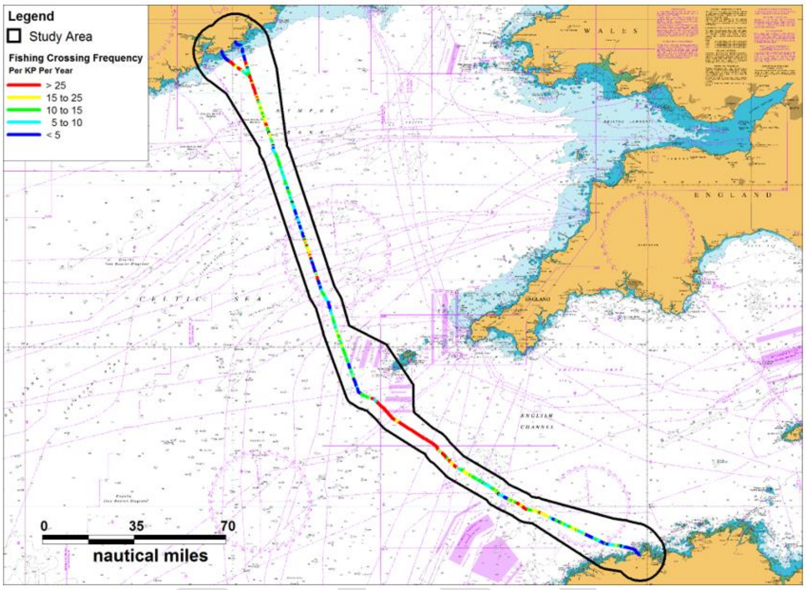
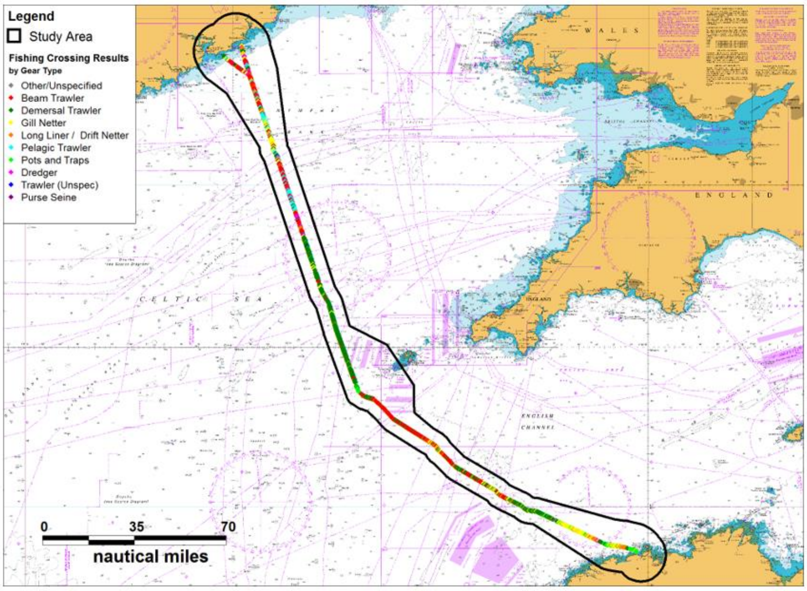


Figure 19.6 Annual Fishing Crossing Results by Gear Type (Anatec, 2016a)



19.7 Principal Target Species for the Commercial Fisheries in the Celtic Sea.

19.7.1 Demersal Fish

Demersal fish are those species that live on or close to the seabed. The key species are primarily targeted within mixed fisheries by trawls (otter and beam). Demersal trawls have the potential to foul a cable in suspension, unburied subsea cable or where a cable is buried to a depth of 0.3m or less (Volume 3D Part 2 EIAR for Ireland Offshore (Specialist Chapters) - Chapter 6: Description of the Offshore Cable). The fisheries along the proposed cable route comprise the following key species:

Hake (Merluccius merluccius)

Hake are widely distributed throughout the north-east Atlantic, mostly between 50m and 700m depth. They are mainly caught close to the bottom in mixed fisheries by both otter and beam trawls. Some fisheries also target hake using static nets and long lines.

Angler fish (Monkfish - Lophius piscatorius)

Monkfish are one of the most economically valuable species landed by Irish vessels (approximately 4.2 kilotons (kt) live weight valued at €14.9 million in 2018) and are primarily targeted within mixed fisheries by trawls (otter and beam). Analysis of landing for key species and of VMS records suggest monkfish are mainly caught along the 200m depth contour and in the Celtic Sea (Atlas 2008). They are targeted by the Belgian, Spanish, French and UK trawler fleets as well as the Irish along the length of the proposed cable corridor (425 tonnes wet weight returned in 2018).

Megrim (Lepidorhombus whiffiagonis)

Megrim are a widespread species throughout the north-east Atlantic, occurring from inshore waters up to depths of around 800m but are most abundant around 100-300m. They are targeted predominantly by Spanish and French demersal trawl vessels, which together have reported more than 65% of the total landings, and by Irish and UK demersal trawlers. The spawning-stock biomass believed to be increasing and capable of sustaining current levels of fishing mortality. Megrim landings by Irish vessels in waters adjacent to the pipeline corridor (ICES Rectangles 30E2, 31E2 and 32E2) were valued at *c*. €1.25 million in 2018.

Whiting (Merlangius merlangus)

Whiting are taken in mixed species (cod, whiting, hake, *Nephrops*) fisheries within the Irish EEZ along the length of the proposed cable route predominantly by French, Irish, UK and Belgian vessels. The Celtic sea represent as significant fishery for the species where they are targeted by demersal seine vessels ≥12m and otter trawls and as bycatch by the beam-trawl fishery targeting sole, anglerfish, cuttlefish, and megrim.

Cod (Gadus morhua)

The majority of the landings are made by demersal trawls targeting roundfish (i.e. cod, haddock and whiting), although, in recent decades an increasing component have been from otter trawls targeting benthic species and *Nephrops* and gillnet fisheries. Landings are made throughout the year but are generally more abundant during the first and second semester.

Recent tagging work by Ireland and the UK supports the idea that there is a resident stock in the Celtic Sea and Western Channel (VIIe–k) and mixing with other areas appears to be minimal. The Irish Sea front, running from SE Ireland (Carnsore Point) to the Welsh Coast, appears to act as a boundary between the Irish Sea and Celtic Sea stocks. Juveniles found close to the SE Irish Coast (south of VIIa) are considered part of the Celtic Sea stock. Some migrations and mixing are known to occur in this cod stock.

Both conventional and DST tagging information for VIIg (where the majority of landings are made) shows that distribution remained fairly constrained within VIIg. A total of approximately 119 tonnes were landed in 2018 from ICES rectangles adjacent to the proposed cable corridor (30E2, 31E2 and 32E2) with a value of approximately €381k. Smaller vessels (<12m; no VMS) operate mainly along the south coast of Ireland contribute approximately 7% of the total cod landings.

Haddock (Melanogrammus aeglefinus)

Haddock is a relatively low value species and targeting practices are highly dependent on availability and market demand. A total of 361 tonnes of haddock were landed from ICES rectangle 30E2, 31E2 and 32E2 during 2018 mainly by otter trawlers targeting gadoids and *Nephrops* and to a lesser extent beam trawlers.

Rays and skates (Rajidae)
Both thornback ray (*Raja clavate*) and spotted ray (*Raja montagui*) are typically landed as a bycatch in the demersal fisheries (otter and beam trawls) that are primarily targeting gadoids and flatfish throughout ICES subdivision VIIg, although there are a few localized targeted fisheries. Smaller vessels (<12m; no VMS) contribute 12% of the total landings mostly from inshore areas. Rays exhibit a relatively small range of movement in comparison to other elasmobranchs with species showing a preference for sandy grounds habitat. Species landed include *R. clavate, R. montagui, R. brachyura and Leucoraja naevus* totalling 0.93 kt weight, valued at €141k during 2018 within the ICES rectangles adjacent to the pipeline corridor (30E2, 31E2 and 32E2).

Witch (Glyptocephalus cynoglossus)
Witch is a benthic species typically found on soft substrates in deep water. Spawning typically occurs in deep water between May and September. It is widely distributed throughout the Celtic Sea. Total landings within the ICES rectangles 30E2, 31E2 and 32E2 along the proposed cable corridor were valued at €315k in 2018.

Lemon sole (Microstomus kitt)
Lemon sole are widely distributed around Ireland and throughout the British Isles where it shows preference for gravel and stony ground. It is targeted with demersal trawls in all three ICES rectangles that describe the proposed cable corridor which contribute approximately 30% of the total Irish landings, 0.125kt weight valued at €425in 2018 (SFPA pers comm..

Ling (Molva molva)
Ling, a member of the cod family, is widely recorded around the Irish coast where it leads a benthic lifestyle in typically deep water with rock substrate. Spawning occurs from March to July further south in the Bay of Biscay and eggs are pelagic in deep water. Landed as part of a mixed fishery using demersal trawls, longlines and gillnets.

19.7.2 Pelagic Fisheries

Atlantic herring (Clupea harengus)
Herring are mainly caught inshore along the Irish coasts. These are shoaling species normally caught in large volumes by pelagic trawls. Landings from ICES rectangle 32E2 (inshore) during 2018 totalled 1,229 tonnes in total and was valued at €1,850,000.

Atlantic mackerel (Scomber scombrus)
Mackerel is an abundant and widely distributed species commercially exploited within all Celtic Sea areas by demersal and pelagic trawls, seines and pair trawlers.

Horse mackerel (Trachurus trachurus)
Along with mackerel and blue whiting, horse mackerel are amongst the most economically valuable migratory pelagic stocks landed by Irish vessels. Targeted with trawls fishing off the bottom horse mackerel are mainly caught along the continental shelf edge (200m) to the west of the study area and are not a target species along the proposed cable corridor.

19.7.3 Shellfish

Nephrops (Nephrops norvegicus)

Nephrops are caught in localised areas on “muddy patches” throughout the Celtic Sea. They are primarily fished for with demersal otter trawls all year using single, twin or quad rigs and both pots and trawls inside 6nm (Marine Institute, 2017). Within the 12nm territorial limits principal fisheries lie predominantly to the east of the proposed cable route. Further offshore within the EEZ, fisheries lie predominantly to the West of the proposed cable route.

Scallops (Pecten maximus)

An important, commercially exploited, species of bivalve off the south east coast of Ireland. It is a high value species fished exclusively by the Irish fleet within the 12nm territorial limits. In Ireland, the fishery for king scallops occurs mainly, in the south Irish Sea and in the western approaches to England and Wales where up to 10-20 vessels >15m from the Irish and UK fleet fish with up to 24 spring loaded dredges per vessel. Vessels under 15m work inshore with single or up to 8 toothed dredges per vessel. Landings up to 3,000 tonnes per year. Gear efficiency is considered low. Fishing grounds primarily to the north east of the proposed cable corridor (Marine Institute, 2017).

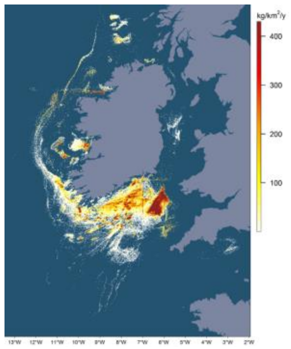
Crab

Brown crab (*Cancer pagurus*) is caught on Irish coasts in deeper waters (>50m) in baited traps, all year but mainly March to November. There is a targeted fishery in inshore waters and offshore predominantly to the west of the proposed cable corridor, with a fleet of up to 20 vessels between Roches Point to Helvick.

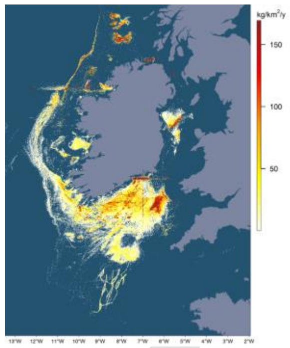
Velvet crab (*Necora puber*) is caught in baited traps, all year but mainly March to October. The species is usually a by-catch in the lobster fishery, but occasionally targeted locally.

Spider crab (*Maja brachydactyla*) are targeted with baited top entrance traps, mainly in spring and early summer along the south east coast with smaller landings elsewhere.

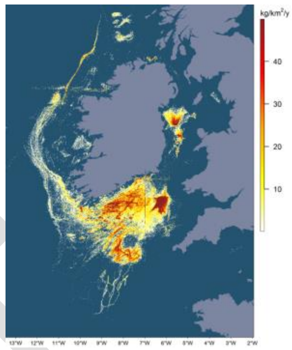
Figure 19.7 Distribution of Main Fishing Grounds for Principal Commercial Demersal Species in the Southern Celtic Sea (Gerritsen and Kelly, 2019).



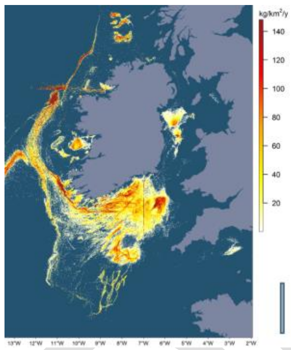
Whiting (*Merlangius merlangus*)



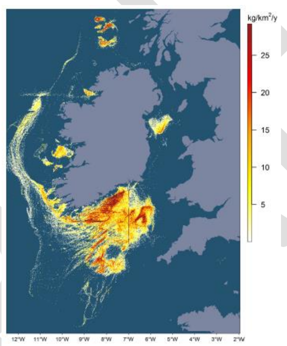
Haddock (*Melanogrammus aeglefinus*)



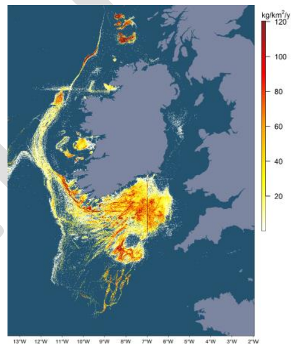
Atlantic cod (*Gadus morhua*)



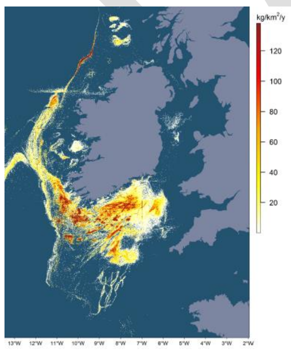
Anglerfish (Monkfish -*Lophius piscatorius*)



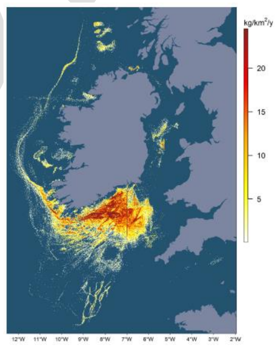
Witch (*Glyptocephalus cynoglossus*)



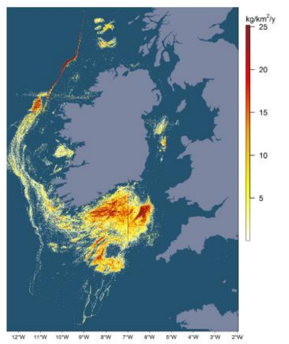
Megrim (*Lepidorhombus whiffiagonis*)



Hake (*Merluccius merluccius*)



Lemon Sole (Microstomus kitt)



Ling (*Molva molva*)

Figure 19.8 Distribution of Main Fishing Grounds for Principal Commercial Pelagic Species in the Southern Celtic Sea (Gerritsen and Kelly, 2019).

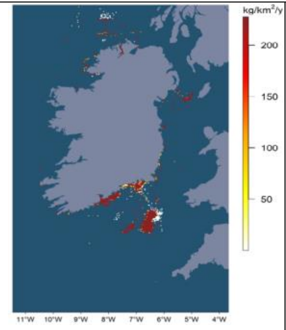
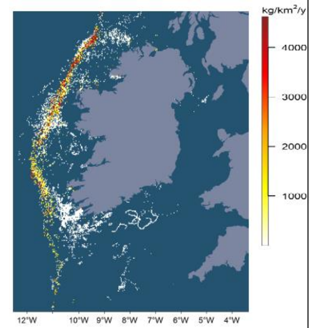
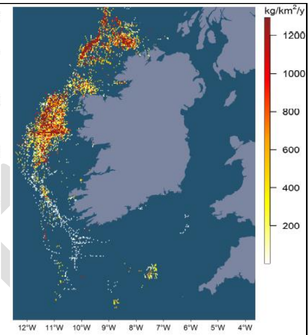
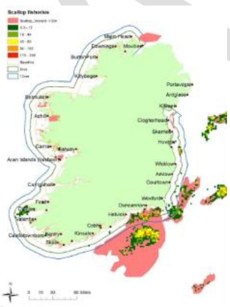
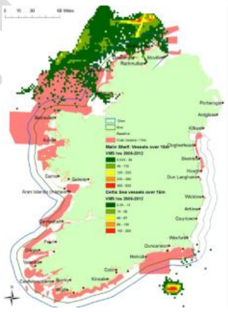
		
Atlantic herring (*Clupea harengus*)	Mackerel *(Scomber scombrus)*	Horse mackerel (*Trachurus trachurus*)

Figure 19.9 Distribution of Main Fishing Grounds for Principal Commercial Shellfish in the Southern Celtic Sea (Marine Institute, 2017)Principle fishing grounds highlighted in pink.

Nephrops (*Nephrops norvegicus*)



Scallop (*Pecten maximus*)



Brown crab (*Cancer pagurus*)

A comparison of landings from statistical rectangles adjacent to the proposed pipeline corridor for which full data was made available (2017) is presented in Table 19.4 to Table 19.6.

Table 19.4 Tonnage and Values of the Ten Most Commercially Caught Species in ICES Rectangle 30E2 in 2017 (SFPA)

Tonnage and Value of landings within ICES Rectangle 30E2			Total landings by Irish and Foreign Vessels into Ireland		Landings from Project area compared to total Irish landings (%)
Species	**Tonnes caught (t)**	**Value (€000)**	**Tonnes caught (t)**	**Value (€000)***	
Nephrops	108.4	952.5	8,447	74,223	1.3
Hake	148.8	449.0	19,221	57,999	0.8
Megrims nei	96.5	315.8	6,731	22,027	1.4
Anglerfishes nei	69.5	283.4	10,613	43,277	0.7
Whiting	166.4	245.0	6,435	9,475	2.6
Haddock	76.5	154.0	4,091	8,235	1.9
Atlantic cod	29.2	93.3	786	2,511	3.7
Witch	28.4	54.4	896	1,716	3.2
Lemon Sole	10.5	35.1	564	1,885	1.9
Turbot	3.4	34.7	241	2,460	1.4

* Value Based on Average Value Landed by IRL Vessels (SFPA).

Table X19.5 Tonnage and Values of the Ten Most Commercially Caught Species in ICES Rectangle 31E2 in 2017 (SFPA)

Tonnage and Value of landings within ICES Rectangle 31E2			Total landings by Irish and Foreign Vessels into Ireland		Landings from Project area compared to total Irish landings (%)
Species	**Tonnes caught (t)**	**Value (€000)**	**Tonnes caught (t)**	**Value (€000)***	
Anglerfishes nei	243.3	992.2	10,613	43,281	2.3
Hake	312.8	944.1	19,221	58,013	1.6
Megrims nei	276.8	906.4	6,731	22,041	4.1
Whiting	577.3	849.9	6,435	9,474	9.0
Turbot	39.7	408.1	241	2,477	16.4
Haddock	175.6	353.3	4,091	8,231	4.3
Atlantic cod	90	287.4	786	2,510	11.4

Tonnage and Value of landings within ICES Rectangle 31E2			Total landings by Irish and Foreign Vessels into Ireland		Landings from Project area compared to total Irish landings (%)
Species	**Tonnes caught (t)**	**Value (€000)**	**Tonnes caught (t)**	**Value (€000)***	
Lemon Sole	78.7	264.2	564	1,893	13.9
Nephrops	25.5	224.3	8,447	74,300	0.3
Scallop - Great Atlantic	7.8	52.3	2,036	13,652	0.4

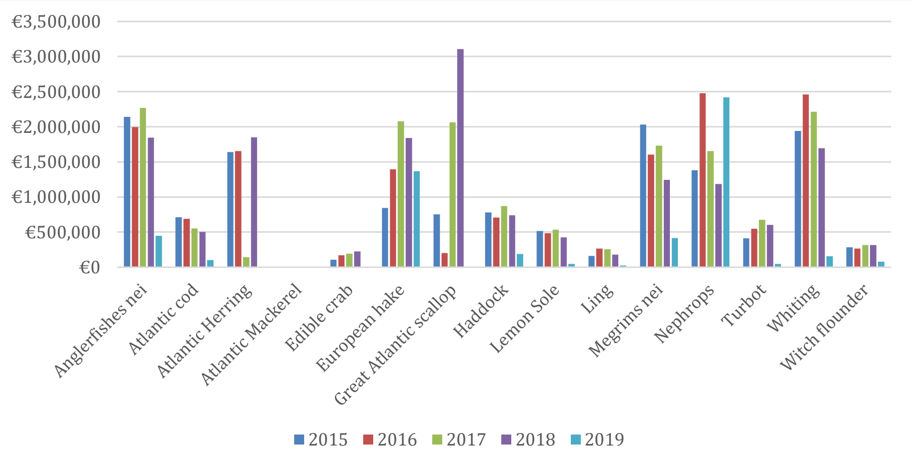
* Value Based on Average Value Landed by IRL Vessels (SFPA).

Table 19.6 Tonnage and Values of the Ten Most Commercially Caught Species in ICES Rectangle 32E2 in 2017. (SFPA)

Tonnage and Value of landings within ICES Rectangle 32E2			Total landings by Irish and Foreign Vessels into Ireland		Landings from Project area compared to total Irish landings (%)
Species	**Tonnes caught (t)**	**Value (€000)**	**Tonnes caught (t)**	**Value (€000)***	
Scallop - Great Atlantic	301	2,010.6	2,036	13,599.9	14.7%
Whiting	760.8	1,120.1	6,435	9,474.0	11.8
Anglerfishes nei	243.6	993.9	10,613	43,301	2.3
European hake	226.1	682.5	19,221	58,020	1.2
Megrims nei	155.3	508.5	6,731	22,039	2.3
Haddock	179.8	361.6	4,091	8,228	4.4
Lemon Sole	69.7	233.9	564	1,893	12.4
Edible crab	97.1	192.3	7,326	14,509	1.3
Atlantic Herring	461	141.3	14,237	4,391	3.2

* Value Based on Average Value Landed by IRL Vessels (SFPA).

Figure 19.10 Annual Landings Value (€) for the Principal Commercial Species from all ICES Rectangles Through Which the Cable Corridor Passes within ITW and Irish EEZ (Sources: An t-Údarás um Chosaint Iascaigh Mhara (Sea Fisheries Protection Authority))



19.8 Local inshore fleet

The inshore local fishing fleet is predominantly based out of the following ports:

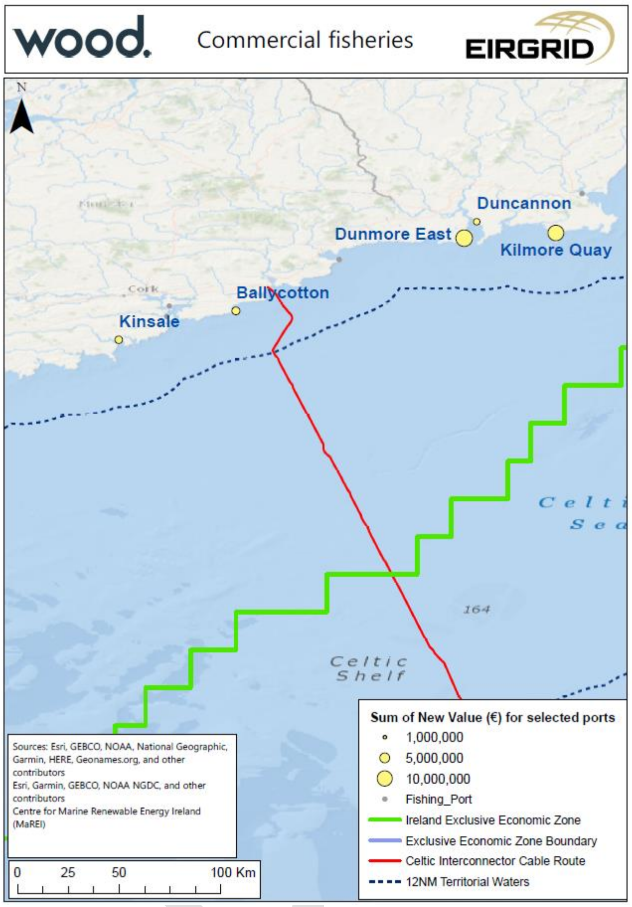
- **Kilmore Quay:** Approximately 70 miles north east of the Irish landfall point, contributes significantly to the overall catch within the south west of Ireland;
- **Duncannon:** Approximately 55 miles north east of the Irish landfall point;
- **Dunmore East:** Approximately 50 miles north east of the Irish landfall point, an important port bringing in a significant catch and value to Ireland;
- **Ballycotton:** Approximately 13 miles south of the Irish landfall point;
- **Ringaskiddy:** Approximately 30 miles south west of the Irish landfall point. There is little data available on the catch and value of this port suggesting it is not significant in contributing to Irish landings (site not included in Table X.7 below); and
- **Kinsale:** Approximately 40 miles south of the Irish landfall point.

Landings to these ports for the most recent years figures are available (2019) and their locations in relation to the proposed cable route are provided in Table 19.7 and Figure 19.11.

Table 19.7 Irish Landings into Irish Ports 2019 (CSO, 2019)

Port	Sum of Tonnes	Sum of New Value (€)
Kilmore Quay	3,467	10,682,466
Duncannon/St Helen’s	1,404	2,249,700
Dunmore East	6,221	12,186,874
Ballycotton	734	3,297,527
Kinsale	1,048	2,848,468

Figure 19.11 Location of Fishing Ports in Ireland within the Vicinity of the Cable Route



19.9 Classified Bivalve Mollusc Production Areas

The Classified Bivalve Mollusc Production Areas (2011/2012) in Ireland designates the areas from which bivalve molluscs may be taken commercially in accordance with requirement of Annex II of EC 854/2004.

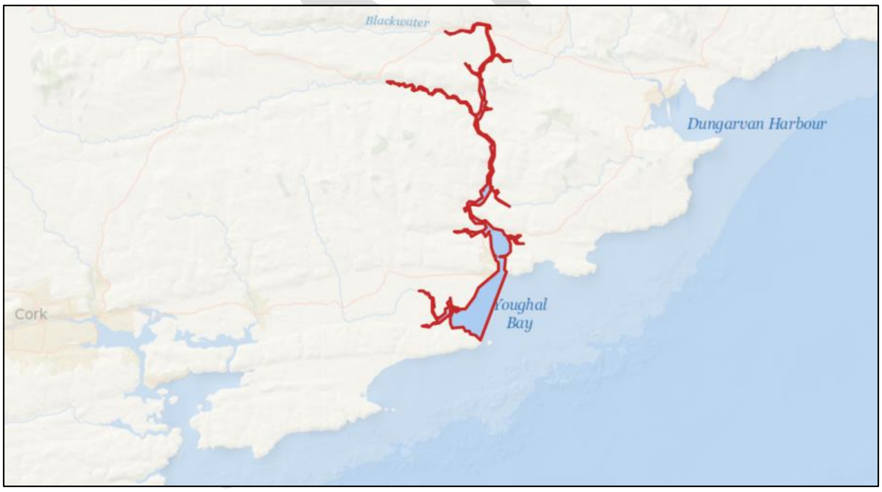
The proposed Irish landfall site lies within Youghal Bay Classified Bivalve Mollusc Production Area where both the Pacific oyster and the surf clam, also referred to as the thick trough shell may be commercially harvested.

C. gigas is epifaunal bivalve mollusc that inhabits firm substrate, mixed sediments and reef at depths of between 5 and 40m occasional as deep as 80m (Hughes, 2008, WoRMS, 2020). They can also be found on mud or mud-sand bottoms. Although an introduced invasive species it is now established as a commercial crop throughout its range (Tully, 2017). Once settled *C. gigas* is not tolerant of smothering or displacement although where disturbance is local and temporary population capable of rapid recovery.

S. solida is a burrowing bivalve typically found in the sublittoral zone at depths between 5 to 50m although occasionally higher up the shoreline. It can be found at high densities within sandy beds (although avoids finer sediments) along open coasts. Fahy *et al.* (2003) reports biomasses of up to 600g/m^2 at the entrance to Waterford Harbour (Sabatini, 2007). Their thick shells provide a degree of protection from abrasion and disturbance and they can rebury rapidly (within three minutes) when displaced to the surface (Sabatini, 2007) although vulnerable to predation during this time. Living within exposed coastal waters were substrate is relatively mobile individuals are subject to drift. They are however considered relatively tolerant of displacement and rapidly resettle. Surf clams are considered relatively tolerant of temporary disturbance with high recoverability.

S. solida is able to reposition itself within the sediment should it be smothered to depths of *c.* 5cm and recoverability is assessed as high.

Figure 19.12 Youghal Bay Classified Bivalve Mollusc Production Area



19.10 Potential Impacts

During the laying, operation and removal of subsea cables, there is potential for a number of impacts to occur that may affect commercial fishery interests. Potential impacts include damage or disturbance to fishing grounds, temporary displacement of fishing activity, placement of seabed obstructions, electromagnetic fields, and heat emission, which can affect fish behaviour.

Table 19.8 Potential Impact to Commercial Fisheries

Potential Source of Impact	**Potential Effect**
Construction Phase	
Damage / disturbance to fishing grounds during installation.	Temporary loss of traditional fishing grounds.
Displacement of fishing activity by cable installation activities.	Reduction in access to, or exclusion from, potential and/or established fishing grounds.
Seabed obstructions (cables on the seabed).	Potential impact of gear snagging along the cable corridor route.
Operational effects	
Seabed obstructions (cable protection).	Potential impact of gear snagging along the cable corridor route.
Exposed cable (safety risk).	Potential impact of gear snagging along the cable corridor route.
Disruption of fishing activity from repairs / maintenance work.	Reduction in access to, or exclusion from, potential and/or established fishing grounds.
Cable exposed following cable maintenance / repair.	Potential impact of gear snagging along the cable corridor route.
Electromagnetic fields (EMF) emitted by offshore cable causing behavioural responses in fish and shellfish receptors.	Disturbance to fish and shellfish may result in knock on effect to Commercial Fisheries.

It is anticipated that there will not be any long-term restrictions around the cable. However, as with other installed seabed infrastructure, the cable will be included on charts, and fishing vessels, as with other marine users, need to be aware that the cable is present, and act accordingly. Vessel masters will be responsible for any damage caused to charted cables, in line with international maritime law.

19.11 Mitigation

As part of the assessment process design mitigation measures have been proposed to reduce the potential for impacts on Commercial Fisheries (Table 19.8) and these have been taken into account when considering the significance of impact in Table 19.9. These measures are considered standard industry practice for a development of this type (BERR, 2008; FLOWW, 2014),

Commented [A77]: Placeholder: All mitigation measures remain under review / discussion, and will be confirmed prior to submission of the final Application File.

Table 19.9 Mitigation Measures to be Adopted to Protect Commercial Fisheries Interests

Mitigation Ref.	**Measures Adopted as Part of Project**	**Reasoning**
Construction		
A	The developer will appointment a Fisheries Liaison Officer during the project who will maintain communication with fisheries representatives and organisations throughout construction and installation in accordance with good practice (FLOWW, 2014).	Ensure appropriate and proactive communication.
B	Application for and use of 500m (radius) mobile safety zones around all maintenance operations.	Ensure navigational safety.
C	Advanced warning and accurate location details of construction operation and associated mobile safety zones. Safety zones to be brought to the attention of mariners with as much advance warning as possible via frequent notice to Mariners and other means eg the Kingfisher Bulletin, VHF radio broadcasts etc. and through direct communications via the Fisheries Liaison Officer.	Ensure sufficient notice for either gear removal and/or avoidance of construction areas. Ensure navigational safety.
D	Ensure that the temporary cofferdam within intertidal foreshore is marked correctly with temporary Aids to Navigation.	Ensure navigational safety of inshore craft.
E	Use of appropriate installation methods, as determined by seabed type.	Damage / disturbance to fishing grounds during installation
F	Seabed obstructions created by installation of the marine cables, that are considered to pose a risk to the fishing industry will be made safe for towed fishing gear.	Ensure operational safety - minimising risk of gear snagging.
G	Seabed obstruction such as rock berms and concrete mattressing will be installed where adequate cable burial has not been possible. They will be designed to have a smooth over-trawlable profile so that they do not present an obstruction to fishing activity.	Ensure operational safety - minimising risk of gear snagging.
H	Guard vessels will be used for any sections of marine cables left temporarily unburied or unprotected during installation operations.	Ensure operational safety - minimising risk of gear snagging.

Mitigation Ref.	Measures Adopted as Part of Project	Reasoning
Operation		
I	Advance warning and accurate location details of maintenance operations and associated advisory safety zones to be published through regular Notice to Mariners and through direct communications via the Fisheries Liaison Officer.	Ensure sufficient notice for either gear removal and/or avoidance of maintenance area.
J	Application for and use of 500m safety zones around all maintenance operations.	Ensure navigational safety.
K	Fisheries Liaison Officer to advise all fishing fleets of emergency procedures to be adopted in instances of fouling a submarine cable/structure (KIS-ORCA Emergency Procedures) through on-going liaison with all fishing fleets via the FLO.	Ensure appropriate and proactive communication.
L	Notification of all offshore and seabed structures (eg via Kingfisher Information Service - Cable Awareness (KISCA) Charts).	Minimise risk of gear snagging.
M	Bathymetric survey to be undertaken following completion of installation or repair works to ensure that the cables have been buried or protected and sediment is able to move over any installed cable protection.	Minimise risk of gear snagging.
N	In the instance that snagging does occur, protocols are laid out within the guidance by the FLOWW and 'Recommendations for Fisheries Liaison: Best Practice' guidance for offshore renewable developers, in particular Section 9: Dealing with claims for loss or damage of gear (BERR, 2008).	Manage occurrence of gear snagging.

19.12 Impact Assessment

This assessment draws on the detailed project description, as presented in Volume 3D Part 2 EIAR for Ireland Offshore (Specialist Chapters) - Chapter 5: Description of the Landfall and Chapter 6: Description of the Offshore Cable.

19.12.1 Construction Phase Effects

Damage / Disturbance to Fishing Grounds during Installation

The construction phase, including preparation and clearance of the proposed route and burial of the cable will result in physical disturbance to the bed substrate. However, following construction, the installation scar and seabed disturbance are not likely to be a subsequent obstruction to commercial fishing interests. Associated impacts may include damage, displacement and removal (including direct mortality) of benthic fauna and disturbance may result in a temporary reduction of abundance and biomass along the cable route. The width and level of disturbance caused during clearance or installation will depend on the methodology employed, however most commercial benthic species of fish and shellfish are mobile and able to avoid most disturbance and such stocks are not considered vulnerable to this level of disturbance.

Nephrops form shallow (depth of 20-30cm) burrows in soft sediments such as fine or silty mud in which they take refuge when not foraging. Burrows within the direct path of the cable route are likely to be damaged by both ground preparation and cable laying, and individuals suffering such subsea cable interactions may suffer direct mortality. *Nephrops* have however been assessed as having intermediate tolerance of physical disturbance with a high recoverability (Marrs et al., 1998 cited in Sabatini & Hill, 2008). Where individuals remain unharmed by the physical disturbance burrows are re-established within two days.

Ground preparation and cable burial may also cause damage to the scallops with damaged specimens more prone to subsequent predation. Scallops are capable of repositioning themselves within the substrate if disturbed and of limited movement if displaced, although again are vulnerable to predation until recessed (Marshall & Wilson, 2008). Cable laying is not thought to have a particularly adverse effect on the scallops which are considered tolerant of displacement and given the relatively narrow cable corridor. Cable laying is considered a temporary impact over a relatively narrow corridor with the seabed returning to its original state. Whilst some individual scallops may be damaged and/or killed those in the near vicinity are considered relatively tolerant to physical disturbance with high recoverability (Marshall & Wilson, 2008).

Based on an assumption that a route corridor of approximately 15m in width will be directly disturbed by cable-laying equipment (within the general indicative 500m installation corridor), along a length of 151km within the Irish territorial waters and EEZ, an area of approximately 2.265km^2 will be directly, temporarily disturbed by cable installation. This is considered a relatively small area of the three ICES statistical rectangles (30E2, 31E2 and 32E2) through which the cable route corridor passes that comprise a total surface area of 11,651km^2 and within which the seabed is frequently disturbed by benthic trawls.

The magnitude of the impact to inshore fisheries is considered **Low.** The principal fisheries are either mobile species or tolerant to temporary disturbance with rapid recolonization of disturbed areas the sensitivity is also considered **Low**. The magnitude of the effect on inshore fisheries is therefore considered **Negligible or Minor** and **not significant.**

Given that the cable corridor is routed to avoid the principal *Nephrops* and scallop fishing grounds located further to the east and south west, and that the principal commercial species are both mobile and tolerant of temporary disturbance, sensitivity of the commercial fishery to damage and disturbance has been assessed as **Low**. The temporary nature of disturbance, the recoverability of stock with disturbed ground and the limited spatial extent of the proposed work has led the magnitude of the impact to be assessed as **Low**. The magnitude of the effect on inshore fisheries is considered **Negligible or Minor** and **not significant**.

Based on the temporary nature of the installation phase, the resilience of the fisheries located offshore to this disturbance and the temporary nature of the works the magnitude of the impact to offshore demersal trawls is considered **Low**, the sensitivity is considered **Low**. The magnitude of the effect on inshore fisheries is considered **Negligible or Minor** and **not significant**.

Disturbance to the bed will not influence pelagic trawls or seines and both the magnitude and sensitivity are considered **Negligible**. The magnitude of the effect is considered **Negligible** and **not significant**.

The landfall is located away from rock outcrops and hard substrate. The magnitude of the impact to the harvesting of periwinkles is considered **Neutral** and the sensitivity **Negligible**. The magnitude of the effect is **Negligible** and **not significant**.

Displacement of Fishing Activity by Cable Installation Activities

The proposed landfall installation method across the foreshore at Claycastle Beach requires a trench to be excavated across the intertidal foreshore. The trench would be excavated with the aid of a temporary sheet piled cofferdam that will require a safety zone of approximately 500m (radius) for a period of approximately 10-week between October to April.

Further offshore within both Irish territorial waters and EEZ there will be a mobile safety zone around the cable laying operation of 500m (radius) that will progress at a rate of 275m/hr where standard cable burial tools are employed reducing to 40m/hr over chalk out crops where specialist rock cutting tools are required for trenching. Where cable burial is not possible simultaneously to laying or where burial is not possible and protection such as mattressing is required (e.g. crossing of other infrastructure or areas of hard seabed), the cable may remain unprotected for a period of up to 6-8 weeks.

Fishing with static gear within the footprint of the cable lay corridor will not be possible during the period of installation and cable lay will result in short-term exclusion from the fishing grounds.

Similarly, trawl gear such as otter and beam trawls and dredges will also require to be excluded from a 500m safety zone around the cable lay operation and from any unprotected or temporary unburied sections of the cable.

The area of exclusion is both small and temporary and the local inshore and offshore static gear fishery is expected to be able to move gear from locations of construction operations given adequate notification. Similarly, the offshore fleet has access to high levels of alternative fishing grounds during the temporary exclusion.

The sensitivity of commercial fisheries to displacement has been assessed as **Low**. It is estimated that will be restricted to small areas of the cable route at any given time and the cable laying schedule will be designed to minimise exclusion periods. The proposed cable route avoids the principal *Nephrops* fisheries located to the east and south west of the cable route. Fin fish fisheries include anglerfish, whiting and megrim are widespread across most of the Assessment Area.

The fisheries are assessed as having high recoverability following disturbance. Once installation is complete, static and trawl gear can be re-deployed in the area if desired.

The magnitude of the impact has been assessed as **Low**, due to the localised and temporary nature of the safety zones. The overall magnitude of the effect has therefore been assessed as **Negligible** or **Minor** and **not significant**.

Seabed Obstructions (Cables on the Seabed)

Where surface sediment comprises loose to dense sand, dense sandy gravel and clay, the marine cable will be simultaneously laid and buried; however over boulder outcrops or where the cable trench requires specialised rock cutters, simultaneous cable laying and burial may not be possible. At such locations subsequent cable burial may require a back-filling pass post lay to close the trench back over or where trenching is not deemed feasible e.g. due to the presence of a boulder field, hard rock or third-party infrastructure or where remedial secondary protection measure are require (for example where depth of lay cannot be achieved), external cable protection may be required. Possible external cable protection may include rock protection or a concrete mattress. Within such areas the cable may remain unprotected for a period of up to 6-8 weeks, during which period it could present a safety risk to demersal trawl vessels fishing in the vicinity which may potentially snag their gear on the exposed cable.

Intensive use of trawl gear along the proposed cable corridor for *inter alia* gadoids, megrim and anglerfish presents a potential safety risk that may result from any trawl interaction with an unburied cable to fishing vessel. Despite design mitigation of a 500m safety zone around any unburied or unprotected cable lengths and publication of a notice to mariners this risk is considered of high fisheries interest and the sensitivity has been assessed as **High**.

Once cable burial is complete or external cable protection installed, static and trawl gear can be re-deployed in the area. Given the localised and temporary nature (up to 8 weeks) of the impact along with the proposed design mitigation the magnitude of this potential impact has been assessed as **Low**. The magnitude of the effect to commercial fisheries of seabed obstructions during installation to commercial fisheries has been assessed as **Negligible** or **Minor** and **not significant.**

Near shore, within the Irish Territorial Waters, a cable lay barge may be required to lay and bury the cables, which may use anchors to maintain position. The use of anchors may result in the formation of anchor mounds if deployed on clay and these mounds may present a safety risk to fishing vessels using towed gear. Concerns regards the safety of demersal trawl vessel raises the sensitivity of anchor mounds to **High**. However, given wave and current induced sediment mobility within the near shore environment, giving only a temporary nature to these features and the relatively localised nature of the clay outcrops the magnitude of the impact is considered as **Low.** The magnitude of the effect is assessed as **Minor** or **Moderate** and **not significant**.

Further offshore in deeper water cable installation will be undertaken by dynamically positioned vessels, therefore no impacts from anchors are likely.

19.12.2 Operational Phase Effects

Seabed Obstructions (Cable Protection)

Structures on the seabed represent potential snagging points for fishing gear and could lead to damage to, or loss of, fishing gear.

The target depth of lay for the offshore cable is 1.8m below stable seabed inshore and between 0.8 and 2.5m offshore subject to a cable burial assessment, where cable protection (rock placement) is not required. Where the target depth of lay cannot be achieved, cable protection may be required. Cable protection may take the form of rock placement or concrete mattressing.

Rock placement as a means of primary cable protection is not envisaged along the section of the cable route within Irish Territorial Waters. However, it is possible that some secondary rock protection may be required where the target depth of cable lay is not fully achieved. The probability is estimated at 5% based on the seabed conditions. The worst-case scenario regards rock quantity to be placed within Irish territorial waters has been estimated as 5,100 tonnes based on 5% in sediment (1.7km).

Similarly, within the Irish EEZ rock placement as a means of primary cable protection is not envisaged. However, it is likely that some secondary rock protection may be required where the appropriate cable burial depth cannot be achieved. The worst-case scenario regards rock quantity placed within Irish territorial waters has been estimated as 42,500 tonnes based on 5% in sediment (4.2km) and 30% in chalk (10km).

There are six in-service telecommunication cable crossings identified along the cable route within the Irish EEZ. Each cable crossing will require a specific crossing design to be agreed with each asset owner however are likely to comprise of rock protection berms or concrete mattresses. Both rock berms and concrete mattresses are designed to protect the cable and have an over-trawlable profile.

The locations of any rock placement, rock berm or concrete mattress would be communicated to all fishermen via Notice to Mariners.

The design of the cable protection indicates that sensitivity to cable protection is **Low** to all fishing fleets.

The magnitude of the impact has been assessed as **Low** due to the small extent and localised nature of cable protection. The magnitude of the effect of cable protection to all commercial fishing operations has been assessed as **Negligible** or **Minor** and **not significant**.

Exposed Cable (Safety Risk)

Target depth of lay for the marine cables throughout Irish Territorial Waters and EEZ lies between 0.8 and 2.5m, however, over the lifetime of the cable scour resulting from *inter alia* tides and currents may become partially or totally unburied. Should any section of the marine cable become exposed during the operational phase, this could present a serious risk to fishing activities in the vicinity. Exposed cable represents potential snagging points for fishing gear and presents a significant hazard to fishing vessels potentially resulting in damage to, or loss of, fishing gear and in extreme cases may compromise the safety of the vessels. The safety risks associated with the possible exposure of buried cable is considered of high fisheries interest and the sensitivity has been assessed as **High**.

The magnitude of this potential impact has however been assessed as **Low** as due to the initial depth of lay and the metocean conditions along the cable route it is considered unlikely the marine cables will become exposed after installation. The metocean conditions within Irish territorial waters are characterised by very weak currents (up to 0.175m/s on average along the approach to Claycastle), dissipated swell but strong wind fields. The hydro-sedimentary study performed shows that the Claycastle Beach has a low potential for erosion, that is 1m erosion expected after a 50-year event (Volume 3D Part 2 EIAR for Ireland Offshore (Specialist Chapters) - Chapter 11: Marine Physical Processes). Wave-induced sediment mobility only occurs close to shore with a probability of occurrence of 20%, with decreasing impact up to the 60m water depth, beyond which there is no more influence on surficial sediments. Current-induced sediment mobility occurs mostly beyond the 80m water depth with a lower probability of occurrence inshore. The sediment thickness that can be impacted by mobility across the offshore part of the route is generally less than 1m.

Further offshore in the Irish EEZ the metocean conditions are characterised by weak currents and tides, medium exposure to swell but a very strong wind field. Current-induced sediment mobility occurs mostly in water depths of 80m or greater. The sediment thickness that can be impacted by mobility along this section of the route is generally less than 1m. The target depth of lay for the cable is c. 2.5m. Where the target depth of lay cannot be met, design mitigation such as secondary rock cable protection will be installed. Where the cable cannot be placed within a trench or requires crossing third party infrastructure the cable will be protected by rock armouring or concrete mattressing.

Routine monitoring and maintenance of the cable corridor in line with good practice (BERR 2008) during the operational phase should ensure the integrity of the cable is maintained, thus minimising snagging risk and reducing the magnitude to **Negligible**. The magnitude of this effect has been assessed as **Minor** and **not significant**.

Disruption of Fishing Activity from Repairs / Maintenance Work

Should maintenance or repair activities be required for the offshore marine cable during its lifetime it may be necessary for the developer to apply for a safety zone of up to 500m to be implemented around the zone of operations. Notice to Mariners will be issued in advance of any maintenance works. Potting vessels and vessels fishing static gear may be required to move pots and nets during maintenance works, although such works are likely to be both temporary and infrequent. The commercial fishing fleets are considered to have high availability of alternative fishing grounds during the period of localised exclusion and an operational range that is not limited to the footprint of the offshore cable route.

Disruption caused by maintenance works has been assessed as **Low** as seasonal fishing cannot be avoided if maintenance work becomes necessary, however, the works would be temporary.

The impact resulting from maintenance work to the offshore cable route is predicted to be of local spatial extent and of short-term duration. It is predicted that the impact will affect the receptor directly. The magnitude is therefore considered to be **Low** for all fishing fleets. The magnitude of the effect has been assessed as **Negligible or Minor** and **not significant.**

Cable Exposed Following Cable Maintenance / Repair

The life expectancy for the cable is estimated to be 40 years; however, during the operational life there may be requirement for cable repair. Where a cable has been lifted from the seabed for repair there is the potential for a bight to form in the cable where it has been repaired following it being lowered to the bed which may stand proud of the seabed presenting a hazard to fishing activities e.g. potential for fouling by trawl doors. Repaired lengths of cable are, however, typically reburied using a remotely operated vehicle.

A residual hazard to fishing gear following a cable repairs is, however, the 'Final Splice Bight'. Burial of this section of cable, which is used to raise and lower the main cable to the cable ship is often not completely successful due to the sharp turns in the cable and poor visibility conditions at the seabed during burial, therefore, a potential for interaction of the final splice bight with trawls or static gear anchors is increased, it is advised therefore that fishing vessel avoid trawling over final splices.

The magnitude of the potential impact stemming from surface exposure of a final splice bight is considered **Medium** as although the likelihood of a cable repair within the lifetime of the cable, given the initial burial depth and / or protection afforded to the cable in Irish territorial waters and EEZ is low, it is recommended that subsequent avoidance of the seabed in the area of the repair would be long term. However, given the localised nature of any impact which would not be of significant detriment to the character of the fishery the sensitivity has been assessed as **Low**.

The location of the repair shall be communicated to the fishing fleet through e.g. Notice to Mariners and KIS-ORCA as well as through direct communications with the fleet from the Fisheries Liaison Officer.

The magnitude of this effect has been assessed as **Minor** and **not significant**.

Electromagnetic Fields (EMF) Emitted by Offshore Cable Causing Behavioural Responses in Fish and Shellfish Receptors.

Submarine power cables can generate localised electromagnetic fields (EMF) in the surrounding seabed and water. The EMF is composed of both an electric (E) and an induced magnetic (B) field (Cada *et al.* 2011) that will radiate into the environment within the immediate vicinity. Electric fields are normally fully contained within the insulation surrounding the cable and are not sensed by fish, whilst B fields propagate outside the cable and can be sensed by electro-sensitive species. Where a fish or tidal movement occurs through a B field, a further induced electric (iE) field can be created (Gill & Bartlett, 2010). Both the B and iE components of EMFs are within the range of detection by EM-sensitive aquatic species, such as sharks and rays (Elasmobranchii) (Nedwell, 2007). The main potential impact of any electric field is the disruption of the sensory cues for feeding in benthic dwelling elasmobranchii (BERR, 2008). Two possible effects could result from this behavioural disruption. Firstly, resident elasmobranchii could be deterred from feeding along the linear field where the cable is buried. Secondly, the impact could be one of attraction of elasmobranchii to the vicinity of the cable corridor potentially causing an unnatural clustering effect in the area (BERR, 2008).

There is a paucity of research into the response of shellfish to EMF. Whilst commercially important species of crustacea including lobster and brown crab have been shown to demonstrate a response to the weaker B fields (Boles and Lohmann, 2003), it is uncertain whether these species are able to detect and respond to magnetic fields. There are no published findings from post construction monitoring programmes for offshore marine cable routes or windfarms that suggest sensitive species of crustaceans or molluscs have been affected by the presence of submarine power cables. And whilst there is limited data available on which to base an assessment the commercial species are all mobile and the magnetic fields highly localised around the cable within a widespread habitat and as such crustacea are able to avoid the impacted areas.

The strength of the magnetic field (and consequently, induced electrical fields) decreases rapidly horizontally and vertically with distance from source. It is however unlikely that cables can be buried at depths that will reduce the magnitude of the B field, and hence the sediment-sea water interface iE field, below a level that could be detected by certain marine organisms on or close to the seabed (Gill *et al*., 2009).

Whilst rays, both thornback and spotted ray are landed commercially from ICES rectangles 30E2, 31E2 and 32E2, they are typically caught as a bycatch in the demersal fisheries that are primarily targeting gadoids and other flatfish, although there are a few localized seasonal targeted fisheries. Total landings from these three ICES subdivision were valued at approximately €61k in 2018.

Elasmobranchs do not form a targeted fishery in the area adjacent to the offshore cable corridor and are taken in low quantities. The cable corridor does not pass-through known spawning or nursery habit for either thornback or spotted ray. The sensitivity of commercial fisheries as determined by displacement or disturbance of commercially important fish and shellfish species as a result of EMF is considered **Low**. The potential consequence (magnitude) of the impact upon commercial fisheries is considered **Negligible**.

The magnitude of this effect has been assessed as **Negligible** or **Minor** and **not significant**

19.12.3 Decommissioning Phase Effects

The effects of decommissioning activities are expected to be the same or similar to the effects from construction.

19.13 Summary of Potential Environmental Effects.

Table 19.10 Summary of Potential Environment Effects, Mitigation and Monitoring

Potential Impact	**Commercial Fisheries Assessment**				
Receptor	**Sensitivity**	**Magnitude of impact**	**Mitigation**	**Magnitude of effect**	**Significance**
Construction phase effects					
Damage / disturbance to fishing grounds during installation	Low	Low	E	Negligible or Minor.	Not significant
Displacement of fishing activity by cable installation activities	Low	Low	A,B,C, D, H	Negligible or Minor.	Not significant
Seabed obstructions (cables on the seabed)	High	Low	A, F, G, H	Minor or Moderate	Not significant
Operational phase effects					
Seabed obstructions (cable protection)	Low	Low	K, L,M,N	Negligible or Minor	Not significant
Exposed cable (safety risk)	High	Negligible.	K, L,M,N	Minor	Not significant
Disruption of fishing activity from repairs / maintenance work	Low	Low	I, J,	Negligible or Minor	Not significant
Cable exposed following cable maintenance / repair.	Low	Medium	K, L, M, N	Minor	Not significant
Electromagnetic fields	Low	Negligible	M	Negligible or Minor	Not significant

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20 Major accidents and disasters

20.1 Introduction

This chapter assesses the likely significant effects of the Celtic Interconnector Project with respect to major accidents and disasters in the marine environment. The chapter should be read in conjunction with the project description provided in Volume 3D Part 2 EIAR for Ireland Offshore (Specialist Chapters) - Chapter 5: Description of the Landfall and Chapter 6: Description of the Offshore Cable. It should also be read with respect to relevant parts of other chapters of this EIAR where common receptors have been considered and where there is an overlap or relationship between the assessment of effects. This notably includes Volume 3D Part 2 EIAR for Ireland Offshore (Specialist Chapters) - Chapter 12: Marine Water Quality, Chapter 13: Biodiversity, Chapter 18: Population and Human Health, Chapter 18: Shipping and Navigation and Chapter 19: Commercial Fisheries.

Directive 2014/52/EU (the EIA Directive) that amended the 2011 EIA Directive 2011/92/EU, as implemented through S.I. No. 419/2012 - European Union (Environmental Impact Assessment) (Planning and Development Act, 2000) Regulations 2012 is the primary driver for the assessment of major accidents and disasters in the EIAR for the Celtic Interconnector as it requires these factors to be a material consideration in decisions to grant consent for developments requiring EIA.

The four objectives of this chapter are to:

- Identify ways in which the Project could create sources of hazard or interact with any external sources of hazard that could result in a major accident or disaster;
- Identify any impact pathways from major accidents and disasters to the receiving environment;
- Determine whether the design measures, mitigations in place, legal requirements, and other industry codes or standards are adequate for the control of risk relating to the hazards identified; and
- Identify any residual impacts associated with the above.

For the purposes of this EIAR, major accidents are defined as an occurrence resulting from an uncontrolled event caused by a man-made activity or asset leading to serious damage on receptors. Possible examples may include:

- Industrial or mechanical failures resulting in fire, explosions or the accidental release of pollutants;
- Accidents caused by the improper storage, transport or use of materials or substances;
- Transport-related accidents such as vessel collisions; and
- Intentional acts resulting in any of the outcomes previously described.

The term ‘disaster’ is used to describe a natural occurrence leading to serious damage on receptors. In both cases, the effects could be either immediate or delayed. Possible examples of disasters may include:

- Severe meteorological conditions such as high winds or seas affecting construction and maintenance vessels;
- Climatological extremes of temperature;
- Geophysical hazards such as landslides or earthquakes leading to structural collapse;
- Severe hydrological events such as storm surges or coastal/tidal flooding that affect human populations; and,
- Biological hazards such as disease, swarms or infestations.

20.2 Methodology and Limitations

20.2.1 Legislation and Guidance

Directive 2014/52/EU (the EIA Directive, as amended) requires consideration of the vulnerability of the Project to risks of major accidents and / or disasters. Article 3 (1) of the 2014 EIA Directive requires the expected effects from this vulnerability to be defined, including those caused by climate change. Annex IV (Information for the Environmental Impact Assessment Report) 5(d) requires:

“*A description of the expected significant adverse effects of the project on the environment deriving from the vulnerability of the project to risks of major accidents and / or disasters which are relevant to the project concerned’* and that ‘*Where appropriate, this should include measures envisaged to prevent or mitigate the significant adverse effects of such events on the environment and details of the preparedness for and proposed response to such emergencies”*.

A key aim of the 2014 amendment to the EIA Directive update was to ensure efforts are not duplicated, reinforcing the need for proportionality. Paragraph 15 of the EIA Directive further states:

“*In order to avoid duplications, it should be possible to use any relevant information available and obtained through risk assessments carried out pursuant to Union legislation, such as Directive 2012/18/EU of the European Parliament and the Council (13) and Council Directive 2009/71/Euratom (14), or through relevant assessments carried out pursuant to national legislation provided that the requirements of this Directive are met*.”

Paragraph 15 of the EIA Directive then goes on determine the underlying objective of the assessment to ensure that appropriate precautionary actions are taken for those developments which:

“…because of their vulnerability to major accidents and/or natural disasters (such as flooding, sea level rise, or earthquakes), are likely to have significant adverse effects on the environment.”

The Environmental Protection Agency (EPA) 2017 Guidelines on the information to be contained in Environmental Impact Assessment Reports makes a number of references to the consideration of unplanned events such as accidents. It recommends that the risk of accidents is described in EIAR having regard to substances or technologies used.

The EPA 2017 Guidelines note the importance of accounting for the vulnerability of the Project to the risks identified, as defined by the EIA Directive. With further reference to the EIA Directive, the EPA Guidelines emphasise that those risks may relate to human health, cultural heritage, or the environment more generally.

The EPA 2017 Guidelines recommends that the approach to assessment is "*guided by an assessment of the likelihood of their occurrence (risk)*" and that "*the potential for a project to cause risks to human health, cultural heritage or the environment due to its vulnerability to external accidents or disasters is considered where such risks are significant"*. The significance is typically defined in the technical chapters relating to the receptor group concerned, and this approach is advocated by the EPA 2017 Guidelines which specify "*the EIAR should refer to those separate assessments while avoiding duplication of their contents"*.

There is currently no regulatory guidance in Ireland that dictates how to undertake an assessment of major accidents and disasters. However, the Institute of Environmental Management and Assessment (IEMA) has published a primer document[59] that offers an assessment methodology based on current practices being employed in the UK. It offers a proportionate method for the consideration of major accidents and disasters through screening, scoping and assessment and further reference is made to the approach presented in this chapter.

The following Irish legislation and guidance is also relevant to the assessment of the effects on major accidents and disasters receptors:

- Safety, Health and Welfare (Offshore Installations) Act,1987;
- Safety, Health and Welfare at Work Act 2005;
- Safety, Health and Welfare at Work (General Application) Regulations 2007;
- Safety, Health and Welfare at Work (Construction) Regulations 2013;
- Chemicals Act (Control of Major Accident Hazards Involving Dangerous Substances) Regulations 2015 (COMAH Regulations, 2015) (S.I. No. 209 of 2015);
- Guidance on the Safety, Health and Welfare at Work (Reporting of Accidents and Dangerous Occurrences) Regulations 2016;
- Code of Practice for Working in Confined Spaces 2017; and

[59] IEMA, 2020. Major Accidents and Disasters in EIA: A Primer. Online [Accessed November 2020] https://www.iema.net/resources/blog/2020/09/23/iema-major-accidents-and-disasters-in-eia-primer

- Chemicals Act (Control of Major Accident Hazards involving Dangerous Substances) Regulations 2015 (S.I. No. 209 of 2015), that implements the Seveso III Directive (2012/18/EU).

20.2.2 Desktop Studies

This chapter has been informed by data presented in other chapters as appropriate and has therefore taken the form of a desktop study. It has been informed by a desktop study undertaken during the scoping phase and the outcomes of the relevant technical assessments.

20.2.3 Field Studies

No surveys were undertaken to specifically inform this chapter of the EIAR. This chapter has been informed by data presented in other chapters as appropriate, which includes field survey data and analysis of publicly available datasets as referenced in the relevant technical chapters. Those of relevance are listed below:

- Marine and coastal surveys relating to marine water quality as described in Volume 3D Part 2 EIAR for Ireland Offshore (Specialist Chapters) - Chapter 12: Water Quality;
- Data used to inform the baseline presented in Volume 3D Part 2 EIAR for Ireland Offshore (Specialist Chapters) - Chapter 13: Biodiversity;
- Consultation with Cork County Council regarding the use of Claycastle Beach by the public, as reported upon in Volume 3D Part 2 EIAR for Ireland Offshore (Specialist Chapters) - Chapter 18: Population and Human Health; and
- AIS data and wider shipping and fishing studies and risk assessments that informed Volume 3D Part 2 EIAR for Ireland Offshore (Specialist Chapters) - Chapter 18: Shipping and Navigation and Volume 3D Part 2 EIAR for Ireland Offshore (Specialist Chapters) - Chapter 19: Commercial Fisheries.

20.3 Methodology for Assessment of Effects

The methodology for assessing the vulnerability of the Project to foreseeable risks of major accidents and disasters and the potential for natural and man-made hazards to occur is guided by the EPA Guidelines on the information to be contained in Environmental Impact Assessment Reports (2017) and by current practice as defined by IEMA (2020). The approach that has been adopted is also aligned to the European guidance made available by the EC (European Union, 2017)[60].

The noted guidance for major accidents and disasters recommends that the scope covers those factors that could impede the Project’s activities and objectives and that may have adverse effects to receptors. The focus of the assessment is therefore to recognise significant risk arising from major accidents and disasters and leading to potential significant

[60] European Union 2017. Environmental Impact Assessment of Projects, Guidance on the preparation of the Environmental Impact Assessment Report (Directive 2011/92/EU as amended by 2014/52/EU).

environmental effects, thereby building resilience into the Project and reducing its vulnerability to risk.

Major accidents and disasters are by their nature of high consequence (if they occur) and are ‘unplanned’ with the effects not part of the intended design, construction, or operational intent. The assessment of significant effects for major accidents and disasters focuses on the risk significance, the combination of the severity of harm (if they were realised), sensitivity of the receptor and likelihood rather than the magnitude of the change and sensitivity of the receptor only.

Risk tolerability for major accidents and disasters is defined based on a principle of eliminating intolerable risks and to ensure, particularly at engineering design stages, that any residual risks while small are further minimised where practicable. This principle has been applied in this assessment, with ‘intolerable risk’ interpreted as equivalent to ‘significant adverse effects’ as defined by the EPA 2017 Guidelines for the purposes of consistency with other topic assessments considered in this EIAR.

A significant adverse effect from major accidents and disasters is therefore one that would result in the following consequence, with a likelihood that the effect is considered intolerable to general society, based on commonly accepted benchmarks for what is intolerable:

- Serious damage to human populations – this includes harm which would be considered substantial (i.e. death(s), multiple serious injuries or a substantial number requiring medical attention).
- Serious damage on the environment – loss or significant detriment to populations of species or organisms, valued sites (including designated sites), valued cultural heritage sites, contamination of drinking water supplies, ground or groundwater, or harm to wider environmental receptors.

A significant effect could include both immediate and delayed effects. An immediate effect would be one that is self-evident at the time of the event such as damage to property or injury. A delayed effect is one that becomes evident only after time, such as loss of feeding ground leading to a change in the ecosystem.

In the planning stage, it is necessary for estimates to be qualitative and based on expert judgement informed by comparison against experience in similar industries and for similar developments, where practical. After the foreshore licence is granted and as the design advances through further detailed engineering design stages, additional risk assessments (qualitative and where necessary quantitative) will be undertaken as part of the routine design process, to account for all emerging and relevant engineering details in the evolving design scheme.

The methodology for the EIA follows a risk screening exercise:

- Identify the sources of potential major accidents and disasters arising from or affecting the Project;

- Identify potential receptors in the receiving environment and assess whether any credible pathways (or the link between an event and a receptor) exist. This is risk identification via a source-pathway-receptor model. Risks will then be screened out if no receptor is present, if no pathway exists, or the consequence will not constitute 'serious damage';
- For those risks that remain, qualitatively assess the harm / damage which could be caused to the receptor to estimate the magnitude of accidents and disasters (if they were realised), at the receptor;
- Qualitatively assess the likelihood of the effect, considering the range of impacts that may be associated with the source or initiator of an accident or disaster and taking into account the measures embedded in the Project that would reduce their occurrence or severity; and
- Establish whether significant (i.e. intolerable) effects from major accidents and disasters exist.

This chapter does not duplicate the assessment of risks that are already assessed in other EIAR chapters. For remaining risks, the likelihood of the hazard(s) will be defined. The severity of the consequence will then be defined, both before and after the implementation of risk management options (for example barriers, interventions, mitigations and controls and emergency response plans).

Where hazards causing a foreseeable risk of accidents or disasters are defined, the legislation, industry regulation or wider measures that can mitigate the risk are identified. The latter may include design factors, installation methods, management systems, and/or reliance upon emergency services. This approach intends to deliver a proportionate response to the requirements of the 2014 EIA Directive by setting out practical solutions and comprehensive controls for preventing, mitigating, and demonstrating preparedness and responsiveness to emergency situations that could arise as a result of the Celtic Interconnector Project.

This is achieved with reference to the receptors at risk of impacts from those hazards from the topic-specific baselines and risk-receptor pathways.

20.3.1 Significance Evaluation Criteria

A significant adverse effect for major accidents and disasters is focused on risk. This differs from the way in which many other topics are assessed. Typically, other topics examine effects that are considered likely to occur and therefore are unlikely to meet the thresholds required to be considered a major accident or a disaster.

This chapter considers reasonably foreseeable but unplanned events where the effects are not part of the intended design, installation or operational intent. By their nature, these are typically very infrequent but are important considerations so that resilience against them can be built into the Project at the planning stage, and to provide sufficient information for informed decisions to be made for planning purposes. Resilience is built by ensuring that high consequence events are eliminated or, where elimination is not possible, reduced to such an extent the chance of them occurring is so small that they can be deemed not to be significant.

In Ireland, risk tolerability limits for people have been established by the Commission for Energy Regulation (CER, 2017)[61]. The CER guidance also provides an approach to risk management based upon reducing the risk as low as reasonably practicable. While the CER 2017 guidance was designed to specifically inform the hydrocarbons industry and with a focus on human receptors, it includes a broad approach for evaluating the significance of major accident hazards that can be applied to the Celtic Interconnector Project.

The following factors are important in defining risk tolerability criteria:

- Magnitude of change – the consequence thresholds of major accidents and disasters are established from the following dimensions and intrinsically account for receptor sensitivity and can be described as the severity of harm (a combination of extent and damage potential);
- Duration of harm (the recovery period) for non-human receptors or the numbers of people affected for human receptors; and
- Likelihood of the event occurring.

These combine to provide a measure of risk (i.e. the combination of the serious damage arising from a potential event and its likelihood of occurrence).

20.3.2 Magnitude of Change / Severity of Harm

In order to distinguish between potential events of differing severities, all potential major accidents and disasters are categorised into one of four magnitude of change, or severity of harm categories. Any scenario that does not meet the criteria of a major accident or disaster is listed as Non-Major Accident Hazard (non-MAH) in relation to safety hazards, and as non-Major Accident to the Environment (non-MATTE) in relation to COMAH sites.

Magnitude of change within the context of major accidents and disasters is assessed from both the severity of the harm, and either the duration over which the receptor experiences harm or the number of people affected.

The CER 2017 guidelines define criteria limits for individual risk for workers and the public, and for societal risk, with the acceptance that all works in the marine environment have an inherent level of risk. In line with the CER guidelines, members of the public are afforded a higher level of protection from risk than workers as they have no choice or control over the risk. This is incorporated into the severity criteria where the threshold for harm which is considered a major accident is lower for members of the public.

Four categories of magnitude of change, or harm severity are considered:

[61] Commission for Energy Regulation, 2017. ALARP Guidance – Part of the Petroleum Safety Framework and the Gas Safety Regulatory Framework. CER/16/106. Online [Accessed November 2020] https://www.cru.ie/wp-content/uploads/2017/11/CER16106-ALARP-Guidance-V3.0.pdf

- Not Significant: This level of harm is below the minimum threshold determined for a major accident or disaster in the CER 2017 guidelines. The upper limit of tolerability for fatalities as defined by CER 2017 is 10^{-3} per year for workers and 10^{-4} per year for the public. The lower limit of tolerability for workers and the public is defined as 10^{-6} per year.
- Severe, Major, Catastrophic: These represent increasing levels of damage or harm to populations or environmental receptors.

The CER 2017 guidelines do not define criteria for non-human receptors. To account for non-fatal consequences and those relating to non-human receptors such as marine species and the physical environment, further criteria are defined in alignment with and largely extracted from definitions used in commonly applied major hazard guidance for the environment (CDOIF, 2016)[62] and risk tolerability criteria for people applied by the UK's Health and Safety Executive (HSE, 2001)[63]. It is noted that CDOIF uses discrete harm criteria for severity and harm duration, for the purpose of this EIAR, these have been combined to reflect the lowest level that would be considered a major accident.

The major accident thresholds based upon severity of harm used in this EIAR are presented in Table .

Table 20.1 Severity of harm criteria

Receptor	Non-Major Accident	Major Accident Threshold
Human populations (public)	Small number of minor injuries	Substantial number of people requiring medical attention. Events of this magnitude may also involve some damage to housing, with low numbers of people being displaced. Potential for localised interruption to utilities and damage to infrastructure.
Human populations (workers)	Accidents below the major accident threshold (eg several workers requiring medical attention)	Multiple life changing injuries to workers or any number of fatalities
Fresh and estuarine water habitats[64]	Impact below that indicated to be sever	WFD chemical or ecological status lowered by one class for 2-10km of watercourse or 2-20ha or 10-50% area of estuaries or ponds where the harm takes >1 year to recover
Marine[65]	<2ha littoral or sub-littoral zone, <100ha of open sea benthic	Severe impacts over 2-20ha littoral or sub-littoral zone, or

[62] Chemical and Downstream Oil Industries Forum (CDOIF), (2016), "*Guideline - Environmental Risk Tolerability for COMAH Establishments Rev 2*"
[63] Health and Safety Executive, (2001). "*Reducing Risks, Protecting People, HSE's decision-making process"*
[64] Criteria extracted directly from CDOIF Guidance Criteria (CDOIF, 2016)
[65] Criteria extracted directly from CDOIF Guidance Criteria (CDOIF, 2016)

Receptor	Non-Major Accident	Major Accident Threshold
(Includes coastal and transitional water bodies)	community, <100 dead sea birds (<500 gulls), <5 dead / significantly impaired sea mammals	100-1000ha of open sea benthic community. Alternatively, 100-1000 dead sea birds (500-5000 gulls), or 5-50 dead/significantly impaired sea mammals. Harm which takes >1 year to recover.
Marine (Includes designated Bathing Waters)	Contamination that does not prevent fishing or aquaculture and that does not render it inaccessible to the public	Contamination of aquatic habitat (freshwater or marine) which prevents fishing or aquaculture or renders it inaccessible to the public.

20.3.3 Determination of Significance

When the credible worst-case severity of the potential major accidents has been determined, if this severity exceeds the level which is considered a major accident given in Table 20.1, then a magnitude of change has been assigned. For each potential major accident or disaster which has a magnitude of change, a qualitative assessment of the likelihood is undertaken to determine whether the risk has been or will be reduced as low as reasonably practicable based upon the embedded mitigation.

20.4 Difficulties Encountered

The assessment is based upon some assumptions regarding the use of vessels by the Project. An Engineering, Procurement and Construction (EPC) contractor has not yet been engaged to undertake the installation of the Project, so it is possible that the number of vessels and the vessel types used will vary to some degree to those referred to in the assessment. However, a precautionary approach has been undertaken whereby a realistic worst-case is assumed. These limitations do not affect the mitigation measures which will be applied to the installation vessels and installation process. The selection of vessels and a contractor will have due regard to good practice in the use of these vessels and the approach to installation.

There are no further limitations relating to major accidents and disasters that affect the robustness of the assessment of the likely significant effects of the Project.

20.5 Receiving Environment

The baseline receiving environment for major accidents and disasters varies depending on the type and scale of the event in question. The scope of this chapter is determined by the nature of the potential major accidents which could be associated with this project. It is focused upon to the movement of vessels and navigational risk, as well as the use of plant and machinery in the foreshore area with associated risks to water quality and biodiversity from accidental leaks and spills.

A thorough description of the relevant baseline receiving environment is therefore presented in Volume 3D Part 2 EIAR for Ireland Offshore (Specialist Chapters) - Chapter 12: Water Quality, Chapter 13: Biodiversity, and Chapter 18: Shipping and Navigation. This chapter should be read in conjunction with, and with reference to those chapters. Reference is also made in this chapter to the data and information presented in Volume 3D Part 2 EIAR for Ireland Offshore (Specialist Chapters) - Chapter 5: Description of the Landfall and Chapter 6: Description of the Offshore Cable

It is not considered that there is any additional baseline information required to inform the assessment of major accidents and disasters.

The receptors to the navigational risk hazard identified are those sea users defined in Volume 3D Part 2 EIAR for Ireland Offshore (Specialist Chapters) - Chapter 8: Population and Human Health, Chapter 18: Shipping and Navigation and Chapter 19: Commercial Fishing. These include recreational boat users, commercial shipping activities such as ferry operators and marine freight haulage, as well as the operators of inshore and offshore fishing vessels.

The water body receptors to the risk associated with accidental spills are:

- WFD designated coastal water body - Youghal Bay;
- WFD designated coastal water body - Western Celtic Sea;
- Bathing Waters Directive designated bathing waters - Youghal, Claycastle;
- Bathing Waters Directive designated bathing waters – Youghal Front Strand Beach; and
- Bathing Waters Directive designated bathing waters – Redbarn.

The status of these water bodies is described in Volume 8C – Water Framework Directive Assessment.

The ecological receptors to the risk associated with accidental spills are the species groups identified in Volume 3D Part 2 EIAR for Ireland Offshore (Specialist Chapters) - Chapter 13: Biodiversity, which includes benthos, fish, birds, and marine mammals. Also relevant are the Natura 2000 sites identified in Volume 6B – NIS for Ireland Offshore, which has a scope limited to the Ballymacoda Bay SPA and the Blackwater Estuary SPA.

20.6 Characteristics of the Development

The proposed project has been reviewed and potential sources of major accidents have been identified at key locations in the project.

20.6.1 Landfall Interface Area at Claycastle Beach

The characteristics of the development that have the potential to result in a major accident during the installation of the landfall at Claycastle Beach are:

- Large scale construction phase civil works including installation of cofferdams and a causeway for access during construction;

- Movement of cable installation vessels during offshore cable installation works, notably the pull-in of the offshore cables through pre-installed conduits and into the Transition Joint Bays (TJBs), which may create a potential navigational hazard by increasing the risk of vessel collisions affecting other sea users; and,
- Use of plant and machinery on and near the foreshore, which may result in a risk of accidental spills of fuel and lubricants in the foreshore or marine environment with the potential for direct effects on water quality and consequences for ecological receptors and designated sites.

20.6.2 Cable Route

The characteristics of the development that have the potential to result in a major accident during the installation of the offshore cable are:

- Movement of vessels during offshore cable installation works, notably the offshore cable lay, which may create a potential navigational hazard by increasing the risk of vessel collisions affecting other sea users.
- Use of plant and machinery in the marine environment, which may result in a risk of accidental spills of fuel and lubricants in the marine environment with the potential for direct effects on water quality and consequences for ecological receptors, marine habitats and nature conservation designations (noting that the interconnector cable route does not intersect any nature conservation designations).
- There is a risk that the Celtic Interconnector cable could be damaged by anchor dragging or emergency anchoring or foundering in the vicinity of the cable. The likelihood of this is low considering that the cable will be buried to an appropriate depth and adequately protected where required. It is not considered credible that the cable poses a serious risk of major accident to other sea users, but the economic consequence for the project could be severe. As there is no credible major accident hazard associated with this scenario, it has been discounted from further analysis.

20.6.3 Cable Protection

The Celtic Interconnector cable in Irish waters will be protected through burial. The need for external cable protection is likely to be minimal in Irish waters, therefore there is no risk of a major accident as a result of this activity and it is screened out of further assessment.

20.7 Sources of Disasters

Disasters are, by their nature, external hazards that could be caused by Project activities or that could affect the Project. Either situation could result in impacts on third party receptors. Once operational, the project does not have a permanent or fixed workforce which could be considered a receptor. Therefore, the consideration of disaster hazards impacting the project is limited to the construction / installation workers who would be present during this phase of the project.

20.7.1 Landfall Interface Area at Claycastle Beach

Given the landfall location on the south-eastern coast of Ireland, the disaster hazards that could credibly occur during the installation of the Project relate to severe meteorological and hydrological conditions. These are commonly inter-related and are most likely to involve storm surges, tidal surges, and high significant wave action.

The potential impacts of marine conditions such as fog, wind direction, lightning, and extreme winds and waves have been considered and the Project is designed to account for hazards of this type. These hazards are unavoidable when working in the foreshore environment and they will be factored into the approach taken by the installation contractor. As the landfall installation is programmed to occur during the summer months, the likelihood of storms and associated extreme conditions is minimised. Landfall installation would not occur in conjunction with unsuitable conditions such as severe storm conditions and contractors would be required to undertake risk assessments to consider the risk posed by external factors and implement appropriate mitigation. There is therefore no pathway for this hazard so natural disasters resulting from severe weather conditions are screened out of the assessment.

Climate change predictions by the EPA Climate Change Research Programme[66] indicate that winters in Ireland will generally become wetter, summers will become drier, and that peak rainfall intensities could increase with a consequent effect on the frequency and magnitude of high river flows. Flood risk including coastal and tidal flooding is scoped out of this chapter as it is addressed in the Flood Risk Assessment presented in Volume 3C Ireland Onshore – Chapter 7.

20.7.2 Cable Route and Cable Protection

Given the location of the offshore installation of the cable route into the Irish Sea, the disaster hazards that could credibly occur during the installation and operation of the Project relate to severe meteorological and hydrological conditions. These are commonly inter-related and are most likely to involve high winds, storm surges and high significant wave action. These are considered to be causal factors, meaning that they do not directly cause accidents, but they do increase the risk or likelihood of accidents occurring.

Hazards of this nature are unavoidable when working in an offshore environment. The Project is designed to account for hazards of this type and it will be factored into the approach taken by the installation contractor. As the offshore installation sequencing is programmed to occur during the summer months, the likelihood of storms and associated extreme conditions is minimised. In line with the Project-wide Health and Safety Plan, offshore installation and monitoring works during the operational phase of the Project would not occur during storm conditions.

20.8 Likely Significant Impacts of the Development

20.8.1 Do Nothing

[66] https://www.epa.ie/climate/communicatingclimatescience/whatisclimatechange/whatimpactwillclimatechangehaveforireland/

In the absence of the Project, there will be no works at the Landfall Interface Area relating to the Celtic Interconnector so there will be no additional risk of navigational hazard to other coastal sea users. There will also be no risk of Project-related hazards to the water quality of the designated Bathing Waters at Claycastle Beach or to the waterbody designated by Directive 2000/60/EC of the European Parliament and of the Council establishing a framework for the Community action in the field of water policy (the Water Framework Directive, or WFD).

In the 'Do Nothing' scenario, there will be no offshore activities in Irish waters relating to the Project so there will be no associated risk of navigational hazard to recreational boat users, commercial shipping operators, or commercial fishing vessels.

20.8.2 Installation Phase

The movement of cable installation vessels during offshore cable installation works, notably the pull-in of the offshore cables through pre-installed conduits and into the Transition Joint Bays (TJBs) in the Landfall Interface Area and the cable laying activities in the offshore environment has the potential to create a navigational hazard that could result in vessel collisions.

While the likelihood of the risk is low given that safe navigational practices will be a Project requirement, vessel collisions have the potential to result in injury and fatality to other sea users and the offshore project workforce. The likelihood and severity of this risk are assessed in the Navigational Risk Assessment (NRA) presented in Volume 3D Part 2 EIAR for Ireland Offshore (Specialist Chapters) - Chapter 18:Shipping and Navigation. In line with the methodology described in this chapter, the NRA is not duplicated here.

The use of plant and machinery during the installation of the Project creates a risk of accidental spills of fuel and lubricants in the foreshore or marine environment including during the installation of any causeways or cofferdams required with the potential for direct effects on water quality, with possible consequences for designated Bathing Waters such as potential temporary loss of designation. The magnitude of change from such an event is negligible, in line with the severity of harm criteria presented in Table 20.1.

The Project will adopt all appropriate good practice measures for site management in line with the requirements of the Safety, Health and Welfare at Work (Construction) Regulations 2013. This will be ensured through the appointment of a Project Supervisor and binding commitments in the CEMP, which will ensure that any potential environmental impacts are risk assessed and appropriate mitigation provided. Mitigation for minimising the likelihood of leaks and spills is embedded into Project design through the use of best practice site management, spill contingency and emergency response plans in line with the CEMP and relevant Irish regulations such as the Chemicals Act (Control of Major Accident Hazards involving Dangerous Substances) Regulations 2015[67].

[67] The Chemicals Act (Control of Major Accident Hazards involving Dangerous Substances) Regulations 2015 (S.I. No. 209 of 2015)

Specifically, in relation to fuels and lubricant oils, the risk assessment will minimise the inventory used and seek to use less hazardous alternatives where practicable to do so. Other measures such as bunding and spill kits will be provided to allow containment and timely clean-up of any accidental leaks and spills. Personnel will be trained in the correct implementation of such arrangements and emergency plans will be in place to enable unforeseen events to be responded to quickly and effectively. This will prevent any spillages from disseminating into the environment so the likelihood of contaminants being experienced by users of the designated Bathing Waters at Claycastle Beach is extremely low.

As a result of the embedded mitigation, the risk to human health and the environment will be reduced as low as is reasonably practicable.

There is an inherent safety risk to the workforce of any construction project, which cannot be eliminated but can be suitably managed. The risk to workers on-site from the use of plant and machinery and the possibility of slips, trips and falls is covered by the project-wide Health and Safety Plan in addition to the measures described above relating to site management. All workers on-site will be required to wear appropriate Personal Protective Equipment (PPE) in line with the requirements of the European Union (Personal Protective Equipment) Regulations 2018 (S.I. No. 136/2018) and the Personal Protective Equipment Guidance to the Safety, Health and Welfare at Work (General Application) Regulations 2007. This will reduce the likelihood of serious harm to workers and meet the expectations of good practice for the construction industry. The risk of harm to workers is therefore assessed as not significant.

The use of plant and machinery on and near the foreshore creates a risk of accidental spills of fuel and lubricants in the foreshore or marine environment with the potential for effects on ecological receptors such as coastal species, habitats and nature conservation designations. Given the measures described above and the consequentially low volumes of pollutants that could be released into the environment, the area of estuarine or marine water at risk is considerably lower than 2ha, which is the major accident threshold defined in Table 20.2 for the severity of harm. Given the worst-case credible consequence is not considered a major accident, the magnitude of change is non-MAH and it is therefore assessed as not significant.

20.8.3 Operational Phase

During the operational phase, periodic vessel movements will occur to enable the integrity of the cable burial and any cable protection to be monitored. This has the potential to create a navigational hazard that could result in the risk of a vessel collision. The frequency of this monitoring is not yet known. As described for the installation phase, the likelihood and severity of this risk are assessed in the Navigational Risk Assessment (NRA) presented in Volume 3D Part 2 EIAR for Ireland Offshore (Specialist Chapters) - Chapter 18: Shipping and Navigation. In line with the methodology described in this chapter, the NRA is not duplicated here.

20.8.4 Decommissioning Phase

It is currently anticipated that the Celtic Interconnector cable in Irish waters may well be left in-situ upon decommissioning, however, this depends on environmental and other considerations in the future. Routine surveys will be undertaken to assess the status and safety of the decommissioned infrastructure. In this scenario, the potential for major accidents would be comparable with those described during the installation phase. Given the conclusions drawn above, there are no significant impacts anticipated as a result of the low magnitude of change, and the low likelihood of the occurrences defined.

In the event that any part of the Project is removed from the foreshore or offshore environment upon decommissioning, any associated risk of major accidents would be managed by the contractor in line with relevant legislation and guidance at that time.

20.9 Cumulative Effects

There is some potential for a cumulative increase in navigational risk as a result of the activities that may be planned to occur in relation to the Inis Ealga Marine Park. Given the paucity of data relating to the location and scheduling of any vessel-related activities for the Inis Ealga Marine Park, it is not possible to draw a clear conclusion in relation to the likelihood of this risk. It is anticipated that installation works for the Celtic Interconnector Project will be complete before the installation works of the Inis Ealga Marine Park. It will therefore be the duty of the Inis Ealga Marine Park developers to consult with the Celtic Interconnector Project promoters in relation to navigational safety concerns.

20.10 Mitigation and Monitoring Measures

Commented [A78]: Placeholder: All mitigation measures remain under review / discussion, and will be confirmed prior to submission of the final Application File.

The embedded mitigation in place relates to the effective management of navigational safety (Volume 3D Part 2 EIAR for Ireland Offshore (Specialist Chapters) - Chapter 18: Shipping and Navigation) as well as through emergency planning and the on-site and on-board management of leaks and spills. Risk to workers from on-site accidents such as slips, trips and falls as well as from exposure to chemicals such as fuels and lubricants is reduced to as low as reasonably possible (ALARP) through a Project-wide requirement for all on-site and on-board personnel to be supplied with and to wear the appropriate PPE in line with the requirements of the European Union (Personal Protective Equipment) Regulations 2018 (S.I. No. 136/2018) and the Personal Protective Equipment Guidance to the Safety, Health and Welfare at Work (General Application) Regulations 2007. Risk to the marine environment and to the public from exposure to contaminants is reduced to ALARP through the prevention of leaks and spills being released into the environment. This is achieved through on-site and on-board good practice in line with the COMAH Regulations and the International Convention for the Prevention of Pollution from Ships (MARPOL) Convention.

The risk of major accidents and disasters from the Celtic Interconnector Project in the Irish marine environment is reduced to ALARP. A hazard identification record that summarises the findings of this assessment is presented in Table 20.3.

Table 20.3 Hazard identification record

Risk event	Source	Pathways	Receptor	Reasonable worst consequence if event did occur	Likely cross-disciplinary impacts	Mitigation	Magnitude of change	Is reasonable worst consequence managed to an acceptable level?
Movement of cable installation vessels	Vessel presence in coastal and offshore waters that are navigated by other sea users	Navigational hazard creating a risk of vessel collision	Other sea users Construction or maintenance workforce	Vessel collision with potential for loss of property, injury or loss or life	Population and human health Shipping navigation Commercial fisheries	Risks managed through installation planning, adherence to navigational best practice, issue of Notice to Mariners, and use navigational markers (Volume 3D Part 2 EIAR for Ireland Offshore (Specialist Chapters) - Chapter 18: Shipping and Navigation).	Above Major Accident Threshold	Yes
Use of plant and machinery on and near the foreshore	Accidental leak or spill of fuel or lubricants during use of	Dependent on spill location – most likely pathway is spill directly onto	Designated Bathing Waters of Claycastle Beach,	Temporary failure of Claycastle Beach to meet requirements	Population and human health Marine water quality	Construction and site management good practice including	Non-MATTE	Yes

Risk event	Source	Pathways	Receptor	Reasonable worst consequence if event did occur	Likely cross-disciplinary impacts	Mitigation	Magnitude of change	Is reasonable worst consequence managed to an acceptable level?
	plant and machinery	beach draining to the receptor.	Youghal Front Strand Beach and Redbarn	of Bathing Water Directive		CEMP, adherence to the International Convention for the Prevention of Pollution from Ships (MARPOL), and CEMP. These will limit the likelihood and size of leaks or spills and provide measures to contain accidental releases such that they cannot discharge into the environment.		
			Water quality of coastal water bodies designated by WFD (Youghal Bay and Western Celtic Sea)	Temporary failure of water body to meet requirements of Water Framework Directive	Marine water quality		Non-MATTE	Yes
			Marine species (benthos, fish, birds, and marine mammals)	Direct toxicity effects of pollutants through bioaccumulation in the food chain or direct physical contamination	Biodiversity		Non-MATTE	Yes
			Ballymacoda Bay SPA and the Blackwater Estuary SPA	Direct toxicity effects of pollutants and habitat degradation	Biodiversity and Natura Impact Statement		Non-MATTE	Yes
	Accident involving plant or machinery	Direct	Construction or maintenance workforce	Direct physical effects leading to injury or loss of life	Population and human health			

Risk event	Source	Pathways	Receptor	Reasonable worst consequence if event did occur	Likely cross-disciplinary impacts	Mitigation	Magnitude of change	Is reasonable worst consequence managed to an acceptable level?
Extreme weather or storm conditions	Hazardous offshore working conditions	Extreme weather causing navigational accidents	Offshore personnel	Navigational accident with potential for loss of property, injury or loss or life	Population and human health Shipping navigation	Offshore works will not typically be undertaken in storm conditions above sea state 3. Safety measures onboard vessels and the adequate training of crew will minimize risk to personnel.	Non-MAH	Yes

21 Summary of Transboundary and Cumulative Impacts

Commented [A79]: Placeholder: Draft status text only. Section to be fully reviewed in line with finalized technical assessments, and amended prior to submission of final Application File, including preparation of tables, as described.

21.1 Introduction

This chapter summarises the conclusions of the assessments of both transboundary effects and cumulative effects, details of which are provided in the specialist chapters of Volume 3C and Volume 3D of this EIAR.

21.2 Transboundary Effects

Certain environmental effects of a proposed development have the potential to cross state boundaries and have a 'transboundary effect'. Under the amended EIA Directive, the likely significant transboundary effects of a proposed development must be described.

All activities associated with the construction and operation of the proposed development were assessed for the likely significant transboundary effects, and these are detailed in the specialist chapters of Volume 3C and Volume 3D. Table 21.1 below summarises the conclusions of said assessments.

21.3 Cumulative Effects

Cumulative effects take account of the addition of many minor or significant effects to create larger, more significant effects.

All activities associated with the construction and operation of the proposed development were assessed for cumulative effects. As detailed in Table 4.2, these are detailed in the specialist chapters of Volume 3C and Volume 3D. Table 21.2 below summarises the conclusions of said assessments.

22 Summary of monitoring and mitigation

Commented [A80]: **Placeholder: Summary table is presented at draft status, and will be updated following finalization of the technical assessments, prior to submission of the final Application File.**

Volume 3D Part 2 EIAR for Ireland Offshore (Specialist Chapters) - Chapters 8-20 consider the potential for environmental effects to arise as a result of the Celtic Interconnector Project.

Table 22.1 below provides a summary of the mitigation and monitoring measures required to avoid, reduce and minimise potential impacts which may arise from the Project during construction and / or operation.

Table 22.1 Summary of Monitoring and Mitigation Measures

Environmental Topic	Potential Impacts	Monitoring and Mitigation	Residual Impact
Chapter 4: Population and Human Health	• Impact on beach users due to reduced width of the beach and temporarily reduced parking capacity and access during landfall works. • Impact on participants of water sport and angling due to reduced parking affecting the transport of equipment to the beach, and due to limitations on access in offshore areas during installation.	• Installation activities are planned to take place over short periods, avoiding as far as possible the peak tourist season and to avoid specific events. The approach to design of the construction plan includes flexibility to allow for circumstances such as the combination of a fixed date for an event, a weather window and restrictions on vessel deployment schedules. • Public information will be provided about the works including: signage at and near the site; information at tourist information points; timely distribution of information to civic authorities and local organisations. There will be identification of and engagement with organisations assessed as likely to be particularly concerned or affected. • Regular physical monitoring of the site and additional monitoring of the construction site as appropriate before, during and after natural events, organised events (such as festivals) or other circumstances in which any aspect of works, barriers or associated safety equipment and procedures may be detrimentally affected.	Not significant

Environmental Topic	Potential Impacts	Monitoring and Mitigation	Residual Impact
Chapter 5: Air Quality and Climate	No potential impacts are identified which require monitoring or mitigation.	N/A	Not significant
Chapter 6: Marine sediment quality	• Disturbance of surficial sediments at Claycastle Beach and along the marine cable route during installation causing increased turbidity and sediment plumes. • Potential release / remobilisation of contaminants held within the sediment when the seabed is disturbed during installation. • Installation of cable protection has the potential to impact marine water quality via the release of hazardous substances through loss of chemicals/fuels from installation vessels.	• During the pre-construction engineering and design phase, a detailed analysis of the seabed along the route of the interconnector will be undertaken. From this, the most appropriate installation techniques will be established, as determined by seabed type, to minimise sediment disturbance and hence minimise effects on marine water quality. • Vessels used for installation will be compliant with the International Convention for the Prevention of Pollution from Ships (MARPOL) regulations. These regulations cover the prevention of pollution from accidents and routine operations. • During installation measures will be taken to minimise the risk of collision between installation vessels and other vessels, including issue of appropriate notifications via official channels. • All vessels used during installation will have shipboard oil pollution emergency plans (SOPEP) in operation.	Not significant

Environmental Topic	Potential Impacts	Monitoring and Mitigation	Residual Impact
		• Throughout the Project's lifespan, periodic monitoring of the cable route will be undertaken; should such monitoring identify significant changes in the bathymetry or seabed features (i.e. sediment type) in the vicinity of the cable route, appropriate measures will be taken, including replacement or addition of further external cable protection, as necessary.	
Chapter 7: Marine physical processes	• Disturbance to, and loss of, seabed features during cable installation. • Disturbance to, and loss of, seabed features during installation of cable protection. • Changes to coastal erosion patterns due to installation works at the cable landfall.	• During the pre-construction engineering and design phase, detailed sub-bottom profiling and accompanying analysis of the seabed along the route of the interconnector will be undertaken. From this, the most appropriate installation techniques will be established to minimise sediment disturbance. • Where the need for external rock protection is identified, this will be designed according to the receiving environment, based on seabed type, and the need to reduce seabed disturbance. • Throughout the Project's lifespan, periodic monitoring of the route will be undertaken; should such monitoring identify significant changes in the bathymetry or seabed features in the vicinity of the cable route, appropriate measures will be taken.	Not significant

Environmental Topic	Potential Impacts	Monitoring and Mitigation	Residual Impact
Chapter 8: Marine Water Quality	• Disturbance of the seabed along the route through release of contaminants held in surficial sediments. • Use of vessels during maintenance works has the potential to impact marine water quality via the release of hazardous substances through loss of chemicals / fuels.	• When the trench is excavated at Claycastle Beach spoil will be stored within the compound on the hard standing to allow the site to be restored to its previous conditions following the installation of the conduits. • Stored spoil shall be adequately covered in order to prevent exposure to the elements and leaching of sediment. • During the pre-construction engineering and design phase, a detailed analysis of the seabed along the route of the Celtic Interconnector will be undertaken. From this, the most appropriate installation techniques will be established, as determined by seabed type, to minimise sediment disturbance and hence minimise effects on marine water quality. • Where the need for external rock protection is identified, this will be designed according to the receiving environment, based on seabed type, and the need to reduce seabed disturbance. Cable protection will be designed to minimise scour, and hence resuspension of sediments. • Vessels used for any monitoring or maintenance activities during the operation phase of the Project will be expected to be compliant with MARPOL	Not significant

Environmental Topic	Potential Impacts	Monitoring and Mitigation	Residual Impact
		regulations. These regulations cover the prevention of pollution from accidents and routine operations. • Throughout the Project's lifespan, periodic monitoring of the cable route will be undertaken; should such monitoring identify significant changes in the bathymetry or seabed features (i.e. sediment type) in the vicinity of the cable route, appropriate measures will be taken, including replacement or addition of further external cable protection, as necessary.	
Chapter 9: Biodiversity	• Potential for loss of chemicals, fuels, or other pollutants as a result of accidental spills from installation vessels and other associated heavy plant affecting biodiversity. • Underwater noise and disturbance effects on marine mammals in the intertidal zone (seals) and subtidal zone (all groups) during the installation phase particularly as a result of piling causing potential disturbance, hearing loss / injury and/or direct mortality, subsea survey and monitoring equipment (causing potential disturbance, hearing loss/injury and / or direct mortality) and increased vessel movements (causing seal injury from ducted propellers).	Project-related vessels to be operated in line with IMO Guidelines for the reduction of underwater noise to address adverse impacts on marine life. • Operations will be undertaken in line with the 'Guidance to manage the risk to marine mammals from man-made sound sources in Irish waters', as published by the Department of Arts, Heritage and the Gaeltacht in 2014. • Seek to avoid noisiest works in January and February as these months typically coincide with peaks in bird numbers as reported on in the wintering and monthly bird surveys undertaken in 2019 and 2020, and as recorded at high and low tide at the landfall point, and	Not significant

Environmental Topic	Potential Impacts	Monitoring and Mitigation	Residual Impact
	• Disturbance to seabirds due to installation works including temporary habitat loss from installation works including due to increases in suspended sediment and pollution events reducing habitat quality or having direct toxic effects. • Installation of the cofferdam will result in the loss of any trapped fished and shellfish not displaced by site disruption and noise.	elevated sensitivity due to heightened food scarcity and winter climatic conditions. • Use soft start piling techniques to prevent birds, and other receptors from being startled, and allow individuals to move away from the area, avoiding potential impacts, e.g. fish and marine turtles; • Use of appropriate burial depths and heat shielding during cable installation to reduce effects from heat emissions and electro-magnetic fields (EMF).	
Chapter 10: Seascape and Landscape	• Changes to landscape / seascape character at the landfall site (up to Mean HWM) during the operational phase. • Changes to visual receptors' views close to the landfall site (up to Mean HWM) during the operational phase.	• Following completion of the installation works across Claycastle Beach to Mean HWM, the installation corridor (incorporating the cofferdam and raised causeway) would be reinstated using native materials previously excavated from the beach to original beach levels and gradients.	Not significant
Chapter 11: Archaeology and Cultural Heritage	• Near-shore peat deposits would be directly disturbed by the installation of the cable trench through the intertidal zone. • Disturbance and removal of remains of geoarchaeological interest and through the disruption of a single stratigraphic sequence.	• Implementation of an agreed scheme of archaeological work aimed at identifying and recording deposits of archaeological interest, retrieving and analysing archaeological material would allow for these deposits to be adequately understood.	Not significant

Environmental Topic	Potential Impacts	Monitoring and Mitigation	Residual Impact
	• Offshore deposits of geoarchaeological interest would be directly disturbed during the insertion of the marine cable where the cable is installed by jetting or ploughing. • Disturbance of archaeologically significant deposits.	• An agreed programme of further archaeological investigation and recordings combined with analysis of archaeological material already recovered and appropriate publication / dissemination of the results. • Archaeological exclusion zones will be established round the sites of known and potential wrecks along the cable route. These exclusion zones would be 100m from the recorded location of a wreck or location of any high potential sites, and 50m from the location of any medium potential sites.	
Chapter 12: Material assets	• Risk of damage to existing subsea cables at cable crossings intersected by the Project. • Project intersecting with concept or early planning area for an offshore windfarm.	• Consultation with existing cable operators, use of crossing-specific cable protection specifications, and approval of Cable Crossing Agreements prior to works. • Consultation with windfarm developers to determine the likelihood of the offshore windfarm proceeding in this location, the level of risk associated with the cable location and the cable installation methods including cable protection.	Not significant
Chapter 13: Noise and Vibration	• Noise and noise from vessel movement during installation.	• Vessels used by the Project will be operated and maintained in line with IMO Guidelines for the	Not significant

Environmental Topic	Potential Impacts	Monitoring and Mitigation	Residual Impact
		reduction of underwater noise from commercial shipping.	
Chapter 14: Shipping and navigation	• Temporary presence of work vessels with limited ability to manoeuvre during the construction phase and potentially an associated temporary exclusion zone. • Presence of rock armour above the previous seabed level, resulting in localised reduction in water depth available for navigation. • Presence of cables within anchor burial depth of the seabed, imposing restrictions on where vessels may anchor. • Installation of the cable landfall at Claycastle Beach will involve construction of a temporary cofferdam and causeway down the beach causing a temporary restriction on use of part of the beach which may affect users of beach-launched craft, such as personal watercraft, kite surf boards, etc.	• Compliance by both work and passing vessels with the COLREGS for vessel safety during installation. This will be encouraged and facilitated by keeping all sea users fully informed of plans and progress regarding the cable installation and procedures in place to ensure their safety when navigating in the vicinity. • Supply of information to appropriate authorities to enable marine charts and sailing directions to be updated to show the cable route.	Not significant
Chapter 15: Commercial fisheries	• Displacement of fishing activity by cable installation activities. Structures on the seabed represent potential snagging points for fishing	• A Fisheries Liaison Officer (FLO) will be maintained throughout the Project, to facilitate ongoing communication with fisheries representatives and	Not significant

Environmental Topic	Potential Impacts	Monitoring and Mitigation	Residual Impact
	gear and could lead to damage to, or loss of, fishing gear. • Seabed obstructions from cables on the seabed and from cable protection. • Disruption of fishing activity from repairs/maintenance work. • Exposed Cable during the operational phase presents a serious risk to fishing activities in the vicinity.	organisations throughout construction and installation in accordance with good practice. • Application for and use of 500m (radius) mobile safety zones around all maintenance operations. • Advanced warning and accurate location details of construction operation and associated mobile safety zones. Safety zones to be brought to the attention of mariners with as much advance warning as possible via frequent notification and other means e.g. the Kingfisher Bulletin, VHF radio broadcasts etc. and through direct communications via the FLO. • Bathymetric survey to be undertaken following completion of installation or repair works to ensure that the cables have been buried or protected and sediment is able to move over any installed cable protection.	
Chapter 16: Major Accidents and Disasters	• Vessel collision with potential for loss of property, injury or loss or life. • Accidental leak or spill of fuel or lubricants during use of plant and machinery. • Accident involving plant or machinery and Hazardous offshore working conditions	• Impacts managed through installation planning, adherence to navigational best practice, issue of Notice to Mariners, and use navigational markers. • Construction and site management good practice including preparation of a Construction Environmental Management Plan (CEMP), and adherence to the International Convention for the Prevention of	Not significant

Environmental Topic	Potential Impacts	Monitoring and Mitigation	Residual Impact
		Pollution from Ships (MARPOL). These will limit the likelihood and size of leaks or spills and provide measures to contain accidental releases such that they cannot discharge into the environment. • Offshore works will not typically be undertaken in storm conditions above sea state 3. • Safety measures onboard vessels and the adequate training of crew will minimize risk to personnel.	

23 Interaction of Effects

23.1 Introduction

This chapter outlines the interactions between the various impacts identified in this EIAR.

Aspects of the existing environment likely to be affected by the proposed development, during both the construction and operational phases, have been considered in detail in the relevant chapters of this report.

The matrices presented in Table 23.1 and Table 23.2 have been developed to identify interaction impacts between environmental topics. The nature of the environment is such that interactions between all environmental topics are potentially possible and / or may occur to a certain extent for most projects. The purpose of the matrices is therefore to highlight key interactions that are recognised to be specific to this project and warranting special consideration. In the matrices, a grey square indicates no interaction, while a blue square indicates that a key interaction exists. The key environmental interactions that have been identified are discussed further in the following sections.

23.2 Interaction of Effects (Irish Offshore Land-Based Elements)

Commented [A81]: Placeholder: Table / narrative regarding interaction of effects to be prepared and inserted here, prior to submission of the final Application File.

Appendix A

Appendix B: