GREENLINK
MARINE ENVIRONMENTAL STATEMENT- WALES

NON TECHNICAL SUMMARY

P1975_R4484_RevF1
June 2019

Greenlink Interconnector
- connecting the power markets
in Ireland and Great Britain

Greenlink
INTERCONNECTOR

CONTENTS

1. Introduction

1.1 The Proposed Development

Greenlink Interconnector Limited (GIL) is proposing to develop an electricity interconnector (Greenlink) linking the existing electricity grids in Great Britain and Republic of Ireland. The Greenlink project will consist of two converter stations, one close to the existing EirGrid substation at Great Island in County Wexford (Ireland) and one close to the existing National Grid substation at Pembroke in Pembrokeshire (Wales). The converter stations will be connected by underground cables (onshore) and subsea cables (offshore).

Greenlink is configured so that power will be able to flow in either direction at different times, depending on supply and demand in each country.

The project is designated as a European Union Project of Common Interest (PCI), project number 1.9.1, under the provisions of European Union Regulation No. 347/2013 on guidelines for Trans-European Network for Energy (TEN-E Regulations) and has successfully applied for funding under the Connecting Europe Facility.

The landfall points for the submarine cables are Freshwater West, Pembrokeshire and Baginbun Beach, County Wexford. The overall length of the interconnector is approximately 159.27kmof submarine cabling and approximately 7km and 23km of onshore cable in Wales and Ireland respectively.

The Environmental Statement (ES), to which this Non-Technical Summary (NTS) relates covers the Welsh Marine components of Greenlink from mean high-water springs (MHWS) at the Welsh landfall at Freshwater West, Pembrokeshire out to the UK/Ireland median line, a distance of 73.9km with an average width of 500m. This is defined as the Proposed Development and comprises:

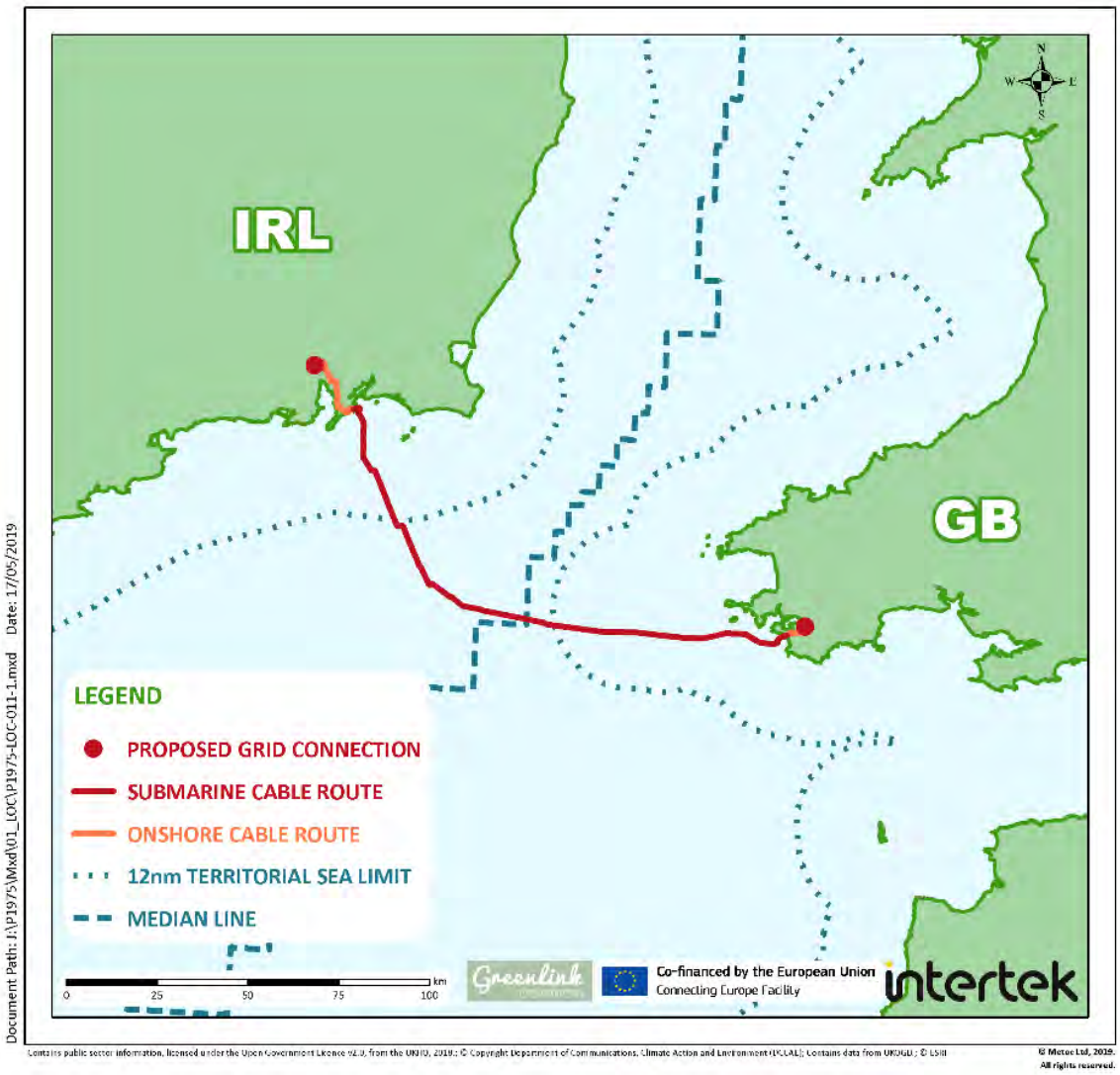
- Two high voltage direct current (HVDC) electricity power cables;
- A smaller fibre-optic cable for control and communication purposes;
- All associated works required to install, test, commission and complete the aforementioned cables; and
- All associated works required to operate, maintain, repair and decommission the aforementioned cables, including five repair events over the 40 year lifetime of Greenlink.

This ES will be submitted to Natural Resources Wales (NRW) in line with The Marine Works (Environmental Impact Assessment) Regulations 2007 (as amended) in support of an application for a Marine Licence under the Marine and Coastal Access Act 2009.

Separate ESs will be prepared which cover individually the Welsh Onshore; the Irish Onshore; the Irish Marine and Irish Offshore (the submarine route from MHWS at Baginbun Beach to the Ireland/UK median line); and the Welsh Marine (the subject of this ES). Once submitted these will be available online at www.greenlink.ie.

A wrapper document which summarises all components of the planning application (Welsh Onshore, Welsh Marine, Irish Offshore, Irish Marine, Irish Onshore), will be prepared and will be available online at www.greenlink.ie once all planning applications have been submitted.

Figure 1-1 Greenlink route overview



1.2 Need for the Project

Regional investment and jobs	•Greenlink represents around €400m/£350m of private capital investment in Ireland and Wales and will create jobs during construction and operation as well as knockon economic benefits.
An integrated European Grid	•Interconnection has a vital role to play in connecting energy generation between countries to provide reliable and affordable power for all. Greenlink will have strategic importance, by doubling the interconnection capacity between Ireland and GB and contribute to each country's interconnection targets.
Security of supply	•The construction of Greenlink will deliver increased security of supply for electricity consumers, by diversifying energy sources and providing additional import and export capacity in both countries.
Integration of renewable energy	•Greenlink improves the integration of renewable technologies in Ireland and GB supporting the growth of the green energy sector, which offers significant economic and environmental benefits to both countries.
Better energy price competition	•Greenlink will deliver greater market integration and competition in the provision of electricity, ultimately providing significant benefits to consumers in Ireland, GB and continental Europe.

2. Development of Greenlink

A full description of the alternatives considered and route development is provided in Chapter 3 of the Greenlink Marine ES. The following sections summarise the key points.

2.1 Connection point selection

2.1.1 Irish and GB Transmission Networks

The importance of Greenlink, linking the Irish and GB Transmission Networks, is recognised through its PCI status which makes it one of Europe's most important energy infrastructure projects and granting it the "highest national significance" possible. The requirement and need for Greenlink has been reinforced by Ofgem (GB) and CRU (Ireland) via the completion of a Cost Benefit Analysis which demonstrates that Greenlink offers economic benefit to consumers in both jurisdictions.

2.1.2 Transmission Network Substation Connection Options

The configuration of any interconnector project is influenced by the location of the existing network infrastructure, its ability to accommodate the required connection capacity, any requirement for network reinforcements, and other factors such as environmental constraints. A review of these factors was undertaken for both the Irish and GB Transmission Networks by EirGrid and National Grid Electricity System Operator, respectively.

2.1.3 Irish Transmission Network

A review of suitable points of connection was undertaken in Ireland. Connection locations on the east of Ireland were assessed. Following a network review the most suitable location on the east of the Irish Transmission Network was found to be the Great Island Substation in County Wexford.

2.1.4 GB Transmission Network

The National Grid completed a Connections and Infrastructure Options Note process to assess potential grid connection locations within the GB Transmission Network. Connection locations to the west of the GB Transmission Network were assessed.

The Connections and Infrastructure Options Note process is a defined procedure which is used for all large electricity users and generators seeking connection to the GB electricity network. This process considers both the cost benefit of different connection options and the engineering limitations of the existing network.

Eight substations were initially considered as potential connection points. National Grid Electricity System Operator then completed a Cost Benefit Analysis for the four remaining options (Alverdiscott 400kV, Swansea North 400kV, Pembroke 400kV and Pentir 400kV). Table 2-1 summarises route distances between Ireland and the four options.

Table 2-1 Summary of project distances

Site	Distance (km)		
	Onshore	Offshore	Total Distance
Alverdiscott 400kV	38	222 (direct)	260
Pembroke 400kV	36	159 (known constraints included)	195
Swansea North 400kV	59	207 (direct)	266
Pentir 400kV	49	220 (direct)	269

Note: It was acknowledged that length of direct offshore routes is likely to increase by 10 to 20% as constraints become known and therefore costs would increase accordingly.

After completing the Connections and Infrastructure Options Note and Cost Benefit Analysis, National Grid Electricity System Operator determined the most economical connection point to be Pembroke 400kV substation, requiring only a busbar extension to provide a connection point for Greenlink. National Grid Electricity System Operator also concluded that the site facilitates the connection from other points of view (environmental, consenting etc) and as such is the preferred connection point.

2.2 *Landfall selection*

Following identification of Pembroke substation as the connection point, an options appraisal study of the Pembrokeshire coastline was undertaken to determine a suitable landfall site. Eight potential suitable landfall locations were identified and assessed using a range of environmental, technical and economic criteria. Criteria assessed included vessel access, beach composition, amenity impact, environmental constraints (e.g. presence of European sites), exposure, coastal erosion, access to beach, cable engineering and protection requirements, obstructions and existing infrastructure. All potential sites were located within the Pembrokeshire Marine / Sir Benfro Forol Special Area of Conservation (SAC) and therefore would be subject to the same Habitats Regulations Assessment process (Figure 2-1).

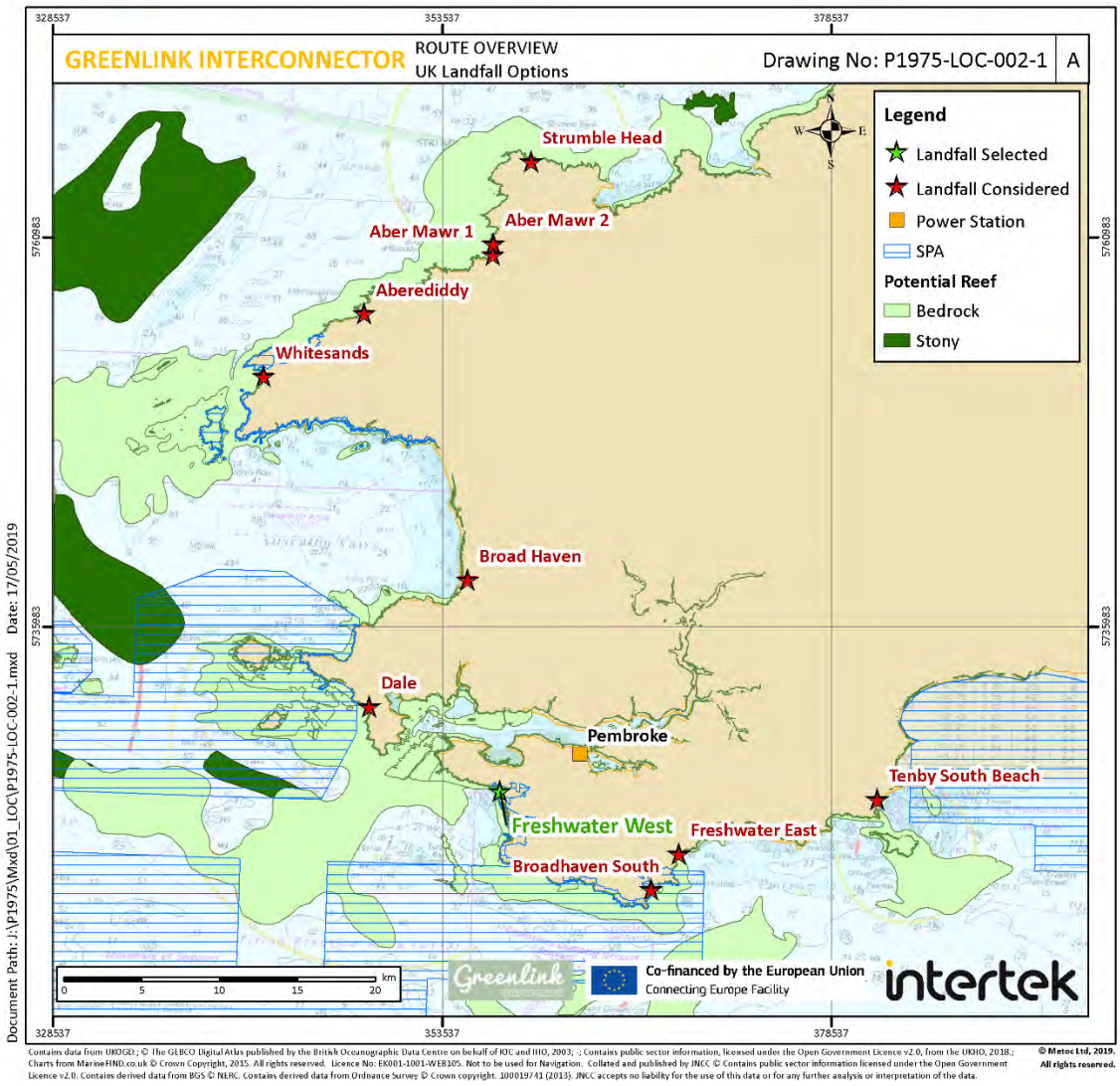
Of the eleven potential sites, nine were discounted as less preferential on environmental and technical grounds. For the selection process please refer to the Greenlink Marine ES – Technical Appendix N. Two 'preferred' landfall options were recommended for further investigation; Broad Haven and Freshwater West.

The Broad Haven landfall, north of Milford Haven, has minimal offshore routeing constraints but the main disadvantage was that the onshore route would require a technically challenging crossing of the Milford Haven estuary. The main benefit was that it avoided an offshore route through the Castlemartin Firing Range.

The Freshwater West landfall provided the shortest onshore route to the converter substation and tie in point. It was recognised that the sand dunes behind the beach are environmentally sensitive but that a trenchless technique (horizontal directional drilling) could be used to avoid disturbance of the feature. Offshore the route was

highly constrained due to the proximity of the Castlemartin Firing Range and Milford Haven harbour mouth. However, consultation with the Ministry of Defence and Port of Milford Haven Authority from 2013 through to 2018 determined that the co-location of a submarine cable, the military firing range and port activities was possible. Therefore, Freshwater West was chosen as the preferred landfall.

Figure 2-1 Landfall options



2.3 Offshore route selection

Route development has been an iterative process involving cycles of consultation, refinement and survey. The submarine cable route has been designed to avoid or reduce environmental effects while also accommodating other factors.

Three main objectives have driven route development:

- To avoid where possible, or otherwise minimise the distance through which the route crosses reef habitat within the Pembrokeshire Marine / Sir Benfro Forol SAC and Hook Head SAC;
- To avoid where possible, or otherwise minimise the distance through which the route crosses the Castlemartin Firing Range; and
- To minimise disruption to shipping associated with Milford Haven, Waterford Port and offshore traffic separation schemes.

Initial desk-top studies undertaken in 2015 identified offshore routes between Freshwater West and three short-listed landfalls in Ireland. These routes were refined and developed following consultation with the Irish National Parks & Wildlife Service (NPWS).

Ahead of the cable route surveys, the route options were re-examined. In Wales, NRW, Milford Haven Port Authority and Castlemartin Firing Range were consulted on route options and three alternatives were developed (Route A, Route B and Route E). These sought to reduce the distance the cable route crossed a Special Protection Area (SPA); and areas defined by the Joint Nature Conservation Committee (JNCC) as having the potential to be reef habitat within the Pembrokeshire Marine / Sir Benfro Forol SAC. They also made use of bathymetric data obtained from Bangor University.

A survey strategy was agreed with NRW and a reconnaissance survey was conducted on Route A and Route E in autumn 2018. Extensive route development was carried out during the cable route survey, which resulted in a final route being designed between Route E and Route A that avoided sensitive reef habitat on both routes.

Minor route refinements were made to the Irish route. Mapping of the bedrock reflector shows that installation of the cable along Route A would likely require external cable protection measures e.g. rock berm, in order to protect the cable. Therefore, Option D was chosen as the preferred route , although Option D increases the length of the cable, it avoids the sensitive reef habitat.

3. Description of the Proposed Development

3.1 Submarine cable route description

The submarine cable corridor derived from preliminary cable route engineering, consultation with stakeholders and survey is shown in Figure 3-1 (Drawing P1975-CORR-001). The Proposed Development is 73.9km long between Freshwater West and the UK/Ireland median line.

The Proposed Development is generally 500m wide. The final cable configuration will only need a small part of this width for installation (of the order of 10-20m). It is proposed to finalise the precise position of the submarine cables within the corridor after permits are granted but before installation has commenced. This will allow for optimisation of the final laid submarine cables to minimise engineering and environmental challenges.

It is likely that cables will be bundled together as a pair with no separation between the cables.

3.2 Indicative programme

The programme for the commencement of installation has not yet been agreed but for a scheme of this size to be constructed it is expected to take approximately 36 months from start to finish. The project is envisaged to commence on-site construction in late 2020 and be fully operational in 2023. Table 3-1 presents an indicative programme of the marine works for Greenlink.

Table 3-1 Indicative programme for marine works

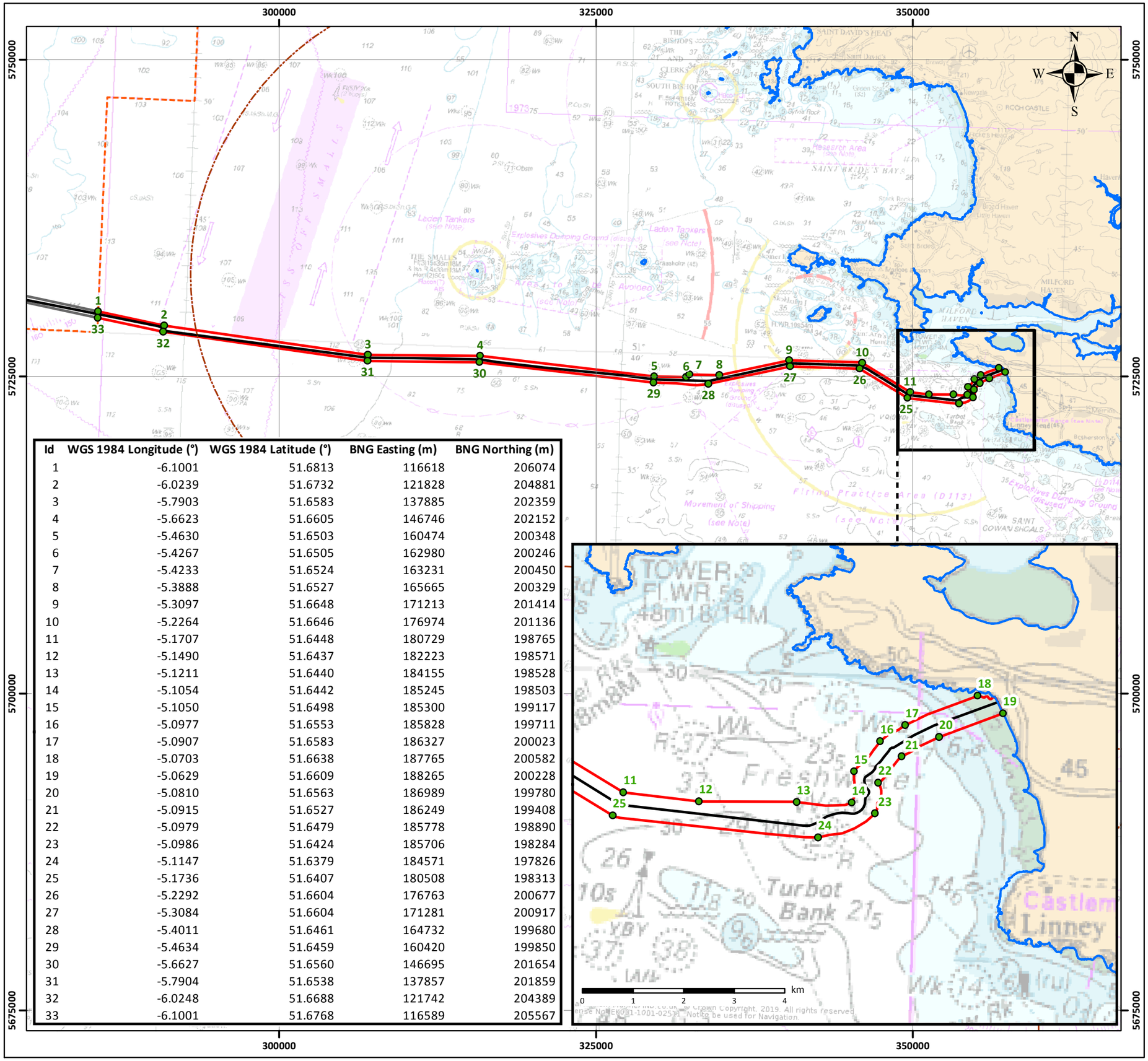
Activity	Duration (months)	2021				2022			
		Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4
Landfall preparations – Ireland*	3								
Landfall preparations – Wales*	5								
Pre-lay survey	1								
Route preparation	1								
Cable lay & burial	3								
External cable protection installation	1								

* Sequencing of landfall preparation works may change

GREENLINK INTERCONNECTOR

PROPOSED DEVELOPMENT
UK Waters

Drawing No: P1975-CORR-001 | **A**



Id	WGS 1984 Longitude (°)	WGS 1984 Latitude (°)	BNG Easting (m)	BNG Northing (m)
1	-6.1001	51.6813	116618	206074
2	-6.0239	51.6732	121828	204881
3	-5.7903	51.6583	137885	202359
4	-5.6623	51.6605	146746	202152
5	-5.4630	51.6503	160474	200348
6	-5.4267	51.6505	162980	200246
7	-5.4233	51.6524	163231	200450
8	-5.3888	51.6527	165665	200329
9	-5.3097	51.6648	171213	201414
10	-5.2264	51.6646	176974	201136
11	-5.1707	51.6448	180729	198765
12	-5.1490	51.6437	182223	198571
13	-5.1211	51.6440	184155	198528
14	-5.1054	51.6442	185245	198503
15	-5.1050	51.6498	185300	199117
16	-5.0977	51.6553	185828	199711
17	-5.0907	51.6583	186327	200023
18	-5.0703	51.6638	187765	200582
19	-5.0629	51.6609	188265	200228
20	-5.0810	51.6563	186989	199780
21	-5.0915	51.6527	186249	199408
22	-5.0979	51.6479	185778	198890
23	-5.0986	51.6424	185706	198284
24	-5.1147	51.6379	184571	197826
25	-5.1736	51.6407	180508	198313
26	-5.2292	51.6604	176763	200677
27	-5.3084	51.6604	171281	200917
28	-5.4011	51.6461	164732	199680
29	-5.4634	51.6459	160420	199850
30	-5.6627	51.6560	146695	201654
31	-5.7904	51.6538	137857	201859
32	-6.0248	51.6688	121742	204389
33	-6.1001	51.6768	116589	205567

Legend

- Proposed Development Points
- Greenlink Route Centreline (Indicative)
- Proposed Development
- Irish Offshore
- UK Mean High Water
- 12nm Limit
- Median Line

NOTE: Not to be used for Navigation

Date	Wednesday, June 5, 2019 12:44:02
Projection	WGS_1984_UTM_Zone_30N
Spheroid	WGS_1984
Datum	D_WGS_1984
Data Source	CDA; GEBCO; UKHO; ;OSOD; MarineFind
File Reference	J:\P1975\Mxd\03_CORR\ P1975-CORR-001.mxd
Created By	Chris Goode
Reviewed By	Emma Langley
Approved By	Anna Farley

Co-financed by the European Union Connecting Europe Facility

km
0 3 6 9 12

3.3 Pre-installation works

3.3.1 Survey requirements

Although detailed engineering surveys have been completed for the proposed submarine cable corridor (autumn 2018 – spring 2019), further surveys will be completed prior to the commencement of cable installation. This typically takes place 3-6 months ahead of installation.

The primary objective of these surveys is to confirm that no new obstructions have appeared on the seabed since the detailed engineering surveys, and to complete a unexploded ordnance (UXO) clearance survey. The survey will involve a range of standard geophysical survey techniques such as multi-beam echosounder (MBES), side scan sonar (SSS), sub-bottom profiler (SBP) and magnetometer.

3.3.2 Route preparation

Prior to the start of marine cable installation, it is essential to ensure the proposed centreline is clear of obstructions that may hinder the installation works. A pre-lay grapnel (a wire with a string of specially designed hooks) will be towed along the entire route to remove any debris.

For areas with large stones and/or boulders along the route, there may be a requirement to move these objects out of the way (if they cannot be avoided) so that the marine equipment can operate. To prepare a clear path for the cable to be laid and buried, a plough will be towed across the seabed, pushing the boulders to both sides. A swathe of between 5 and 10m width will be cleared of surface boulders. Areas identified as potentially requiring boulder clearance are presented in Table 3-2.

Table 3-2 Indicative route lengths potentially requiring boulder clearance

Indicative KP	Approximate length (km)	EUNIS Biotope present	Annex I habitat present
KP11.3 to KP12	0.7	A5.451 - Polychaete-rich deep Venus community in offshore mixed sediments	No
KP15 to KP22	7.0	A5.141 - *Pomatoceros triqueter* with barnacles and bryozoan crusts on unstable circalittoral cobbles and pebbles	Annex I - Medium grade stony Reef
KP20.5	0.1	A5.141 - *Pomatoceros triqueter* with barnacles and bryozoan crusts on unstable circalittoral cobbles and pebbles	Between two areas of Annex I - Medium grade stony Reef
KP24.9 to KP25.5	0.6	A5.142 - *Mediomastus fragilis*, *Lumbrineris spp.* and venerid bivalves in circalittoral coarse sand or gravel	No
KP34 to KP34.4	0.4	A5.611 - *Sabellaria spinulosa* on stable circalittoral mixed sediment	No
KP53 to KP53.5	0.5	A5.611 - *Sabellaria spinulosa* on stable circalittoral mixed sediment	No

Discrete areas of seabed will also require preparatory works known as pre-sweeping. A dredger or mass flow excavator will be used in areas of mobile sandwaves to remove

a portion of the sandwave. This is to allow the cable to be buried relative to a non-mobile reference level below the lowest level of undulations; reducing the risk of the cable becoming exposed through sandwave movement.

No pre-sweeping will be required on the Turbot Bank; a Qualifying Feature of the Pembrokeshire Marine / Sir Benfro Forol SAC. Table 3-3 presents indicative dimensions for the areas of pre-sweeping. The first location is within the Pembrokeshire Marine / Sir Benfro Forol SAC, but the second is not within a European site.

Table 3-3 Indicative pre-sweeping requirements

KP start	KP end	Length (m)	Maximum width (m)	Seabed footprint (m^2)	Maximum volume of sediment removed and re-deposited (m^3)
KP25.8	KP26.4	600	20	12,000	96,000*
KP64	KP69	5000	20	100,000	400,000**

* Assumes that 8m of sand (7m trough to crest + 1m for cable burial) will need to be removed across the whole profile. In reality it is likely to be less as the two sand waves are not 7m high across the entire length of the transect.

**Assumes that 4m of sand (3m trough to crest + 1m for cable burial) will need to be removed across the whole profile.

In reality the removed sand volumes are likely to be less as the sand waves are not the quoted height across the entire length of the transect.

3.3.3 Route preparation at subsea cable crossing

Greenlink crosses one in-service telecommunications cable, Pan European Crossing 2, within the Proposed Development at KP59.791. Greenlink will cross the cable on a 'bridge' comprised of either aggregate (rock) or concrete mattresses. This first layer of protective material will be positioned during route preparation. Construction of the remainder of the crossing will occur once the cables are laid, and will consist of a graded rock berm approximately 120m in length, up to 1.2m high, covering an area of 1009m^2. The crossing location lies in sandy sediments classified as EUNIS habitat A5.251 - *Echinocyamus pusillus*, *Ophelia borealis* and *Abra prismatica* in circalittoral fine sand.

3.3.4 UXO clearance

During route design a UXO desk top study was prepared (1st Line Defence 2018), which describes the risk of encountering UXO's along the cable route. The Proposed Development crosses the Castlemartin Firing Range, and it is extremely likely that UXO's will be found here, making this a high-risk area. Due to this risk, a UXO survey was undertaken of the cable route within the Castlemartin Firing Range, with the results being used to refine the indicative centreline of the cables within the Proposed Development.

The primary objective will be to avoid encountered potential UXO by micro-routeing within the permitted corridor. If re-routeing around a particular potential UXO appears not to be possible, and visual inspection confirms a UXO, then if it is safe to do so the UXO will be removed. As a last resort demolition measures will be undertaken in accordance with Best Practice.

UXO detonation in the Proposed Development is deemed possible, and for the purposes of this assessment it is assumed that one UXO denotation will be required

3.4 Cable installation

The cable lay operation will be performed on a 24-hour basis. It will be undertaken by a cable lay vessel (CLV); a specialist ship designed specifically to carry and handle long lengths of heavy power cables. Other vessels, such as a jack-up barge or cable lay barge and small work boats may be used to support the CLV, particularly in the nearshore area where water depths are shallow.

Two cable installation techniques are being considered for the Proposed Development:

- Simultaneous lay and burial – in this operation the CLV may tow the burial equipment or it is deployed by another vessel navigating close behind, creating effectively a single large spread. The cables are fed into the burial equipment directly from above and the cables are buried as the spread progresses along the route.
- Post-lay burial – in this operation the CLV lays the cables on the seabed first. A post-lay burial vessel follows to bury the cables. The post-lay burial vessel may be some physical distance, or indeed some days, behind the lay vessel, so there are two discrete operations separated physically and in time.

Guard vessels may be deployed in areas where the cables are exposed on the seabed prior to burial or external protection being applied.

Due to the length of the route, it may be necessary to install the cables in two sections. A cable joint will be made on board the cable lay vessel, at which point the vessel is likely to remain in position for up to a week.

3.5 Cable burial and protection

The nature of the seabed varies along the cable route ranging from fine sediments to stony reefs, consisting of pebbles and boulders and bedrock outcrops. Bedrock outcrops are predominantly found relatively close to the Pembrokeshire coastline. The choice of burial technique or protection method will depend upon the seabed conditions in each section. The preference is burial in the seabed as this provides the best protection. Where the seabed composition is not suitable for burial, external mechanical protection will be provided through rock placement or concrete mattressing.

There are three generic types of equipment for installing cables into the seabed:

- Jetting machines – use water jets to fluidise the seabed and allow the cable to sink into the seabed.
- Cable ploughs - like ploughs used in farming, a narrow blade (the plough 'share') is pulled through the seabed to create a furrow.
- Cutting - a trench is cut using a wheel or a driven chain cutter to break and move rock and hard sediments.

A typical trench is up to 1m wide. The overall footprint of the installation machinery is approximately 15m. Whilst jetting is considered to have the least effect on the environment because the footprint of the tool is smaller than other installation tools such as ploughs, the use of jetting tools does result in higher suspended sediment concentrations. However, in a review of seabed disturbance from various activities it was observed that disturbance resulting from jetting was largely restricted to fines (e.g. clay and silt particles) and remained low in comparison with dredging and some fishing techniques (BERR 2008).

The recommended target burial depths along the cable length were determined in a detailed Cable Burial Risk Assessment study completed in 2019 using the Carbon Trust cable burial risk assessment (CBRA) methodology. This concluded the target burial depth is 1.0m for all areas of loose sediment (sands / gravels) and 0.6m for areas of glacial till. A preliminary assessment of cable installation methods is presented in Table 3-4.

Table 3-4 Potential installation method

Cable Protection Option	Length (km)
Burial in sediment (jetting or ploughing)	57.44
External cable protection only	0.120
Potential burial in rock or external cable protection	16.34
Total	**73.9**

3.6 Landfall installation

The landfall is where the marine cables come ashore. In Wales it is Freshwater West, Pembrokeshire.

The shore-crossing will be accomplished by horizontal directional drilling (HDD) which will exit seaward of the low water mark. The cable ducts will pass approximately 10m below the beach. There will be no works on the beach at Freshwater West between MHWS and mean low water.

HDD is a surface-launched process for boring a hole, under any sensitive features, to a point a suitable distance in the nearshore. A pipe is inserted into the drilled hole which is used as a duct into which the cables are installed.

The land cables will connect with the marine cables in transition joint pits. These will be dug above MHWS within the area defined as the temporary HDD compound in Figure 3-1. Three cable ducts (two for use and one as a spare) will be drilled from

the HDD compound to an exit location in the nearshore. The fibre optic cable will be installed in a duct with one of the power cables.

The ducts will fan out of the transition joint pits to achieve exit points approximately 10m distance from each other in the nearshore. From the exit point the cables will then merge back together, usually within 100m to form the bundle. The cables and duct exits will be buried into the sediment.

Preliminary design of the HDD has been undertaken, but the final design will be completed by the Installation Contractor. Based on the geological conditions at Freshwater West, the HDD is likely to exit within the orange hatched box presented in Figure 3-2.

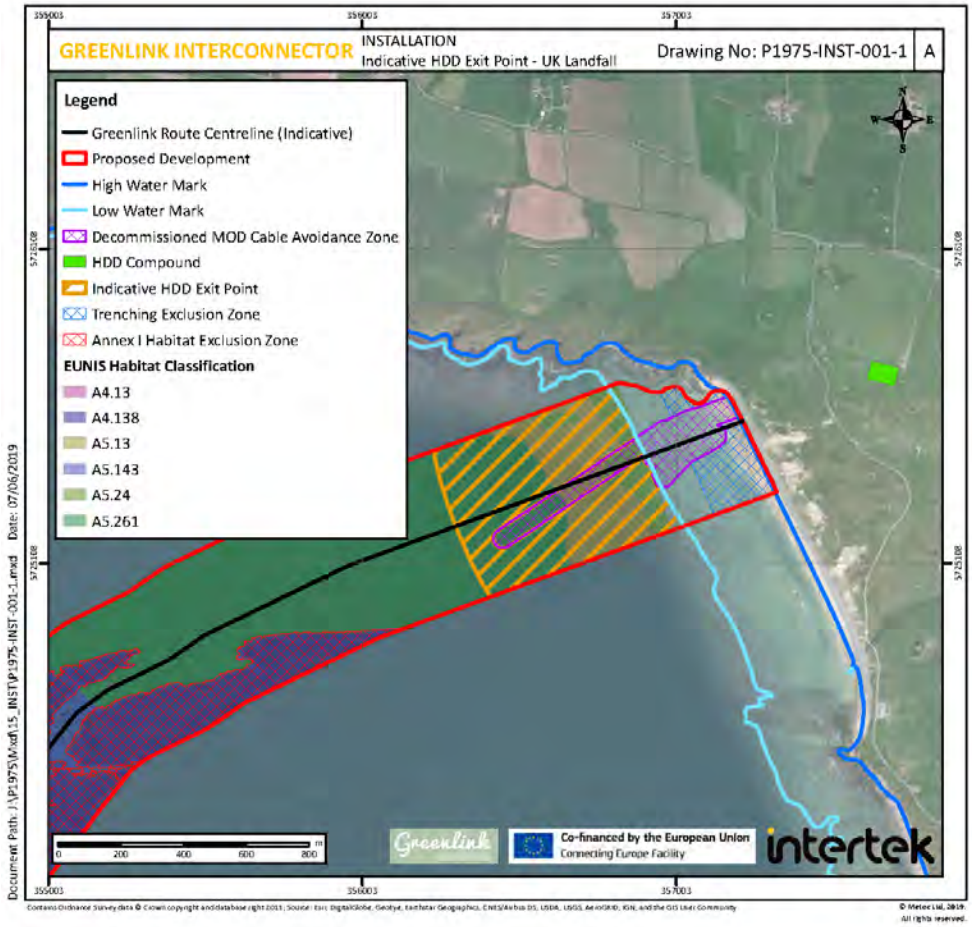
The ducts will be drilled in advance of the arrival of the CLV, so that that vessel is not delayed in its operations.

The installation sequence for each of the submarine cables and the fibre optic cable is likely to be similar, and will be defined by the Installation Contractor. An indicative methodology is provided below:

- The end of the duct accepting the cable will be dug out using an excavator positioned on a jack-up barge or anchored barge.
- Material excavated will be left adjacent to the HDD exit point and refilled after the cable pull-in. The submarine cable would be floated to the exit point of the duct. Small work boats and divers would support this activity.
- The submarine cable would then be connected to the messenger wire pre-installed in the duct and winched from a position close to the TJP through the duct; whereupon it can be jointed to the onshore cables.
- The cable is then installed away from the beach either using a plough or trencher (as per the offshore installation section above).

Figure 3-1 Indicative location of HDD compound – Freshwater West

Figure 3-2 Indicative HDD exit point (Drawing P1975-INST-001-1)



3.7 Cable operation

3.7.1 Emissions

During operation of the cables emissions to the environment will consist of magnetic (B) and induced electric (iE) fields and heat. The influence of Greenlink on the background geomagnetic field along the cable route has been calculated to be low with B and iE fields dissipating to natural background levels within 2m of the cables.

Temperature increases in the upper sediments of the seabed over buried cables are not expected to emanate further than 1m from the cable and exceed 2°C.

3.7.2 Maintenance and repair

It is likely that routine inspection surveys using standard geophysical survey equipment and/or remotely operated vehicles to monitor buried depth and integrity of rock berms will be undertaken, particularly in the initial years of operation, and should the local environmental conditions change or be suspected as having changed.

Once installed, marine cables are not expected to require routine maintenance. If a cable fault is detected, usually as a consequence of damage cause by external interaction e.g. trawlers and commercial ship anchors, the relevant section of the cable will be located and retrieved to surface for inspection and replacement. It may be necessary to unbury the cable prior to cable recovery. A repair will typically be carried out by either a single or two vessels.

The extra length of a repaired short cable section means it cannot be returned to its exact previous alignment on the seabed. The excess cable will be laid on the seabed in a loop off to one side of the original route. The additional joints and the extra cable length will be buried, typically using jetting machines deployed from either the repair vessel itself or a separate specialised vessel.

3.8 Decommissioning

GIL recognise the importance of considering the decommissioning process at an early stage and should decommissioning be undertaken the operation will be conducted according to the standard industry protocol at the agreed time.

At the end of the cable's life the options for decommissioning will be evaluated.

The objectives during the decommissioning process will be to minimise both the short and long term effects on the environment whilst making the sea safe for others to navigate. Based on current regulations and available technology, the following level of decommissioning is proposed and has been assessed:

- Cables - to be either removed or to be left safely in-situ, buried to below the natural seabed level
- Mattresses - to be left in-situ
- External cable protection - to be left in-situ

3.9 Embedded Mitigation

Greenlink has been developed through an iterative process that sought to avoid or reduce potential environmental effects. Steps taken to reduce environmental disturbance include:

- Sensitive environmental features were identified through a desk-based assessment that used publicly available datasets and survey data acquired from other developers in the region.
- Nearshore sections of the route in Wales were refined to follow identified sand channels through the bedrock reef habitat.
- Geophysical survey was widened to investigate previously unknown sand channels and route engineered to make use of this feature.
- A reconnaissance survey was undertaken on two route options (Route A & Route E) through the Pembrokeshire Marine / Sir Benfro Forol SAC to identify areas of reef habitat. In consultation with NRW, a new route option was engineered between Route A and Route E that sought to minimise the crossing of the sensitive habitats in the area. This route is the Proposed Development.

In addition, to the route engineering that has taken place, the project will comply with international and national statute which is designed to avoid or abate negative environmental effects.

Embedded mitigation which forms part of the design of Greenlink and is considered the 'base case' as primary mitigation is outlined in Chapter 4 of the Greenlink Marine ES.

4. Approach to the Assessment

4.1 Environmental Impact Assessment

EIA is a process that identifies the likely significant effects of a project and suggests ways that those effects that are classed as Significant can be avoided, reduced or managed. EIA is a requirement under UK law for certain types of projects that are likely to cause significant effects.

Under the Environmental Impact Assessment (EIA) Directive 2014/52/EU (amending Directives 2011/92/EU and 85/337/EEC) on the assessment of the impacts of certain private and public projects on the environment (EIA Directive), there are three stages to the EIA process: screening, scoping and assessment.

The current requirements for EIA for Welsh offshore projects are set out in The Marine Works (Environmental Impact Assessment) Regulations 2007 (as amended) ('EIA Regulations'). GIL sought a screening opinion in 2018 (since superseded), which concluded that the Proposed Development was not the type of development that would require a statutory EIA.

GIL has been advised of a risk of legal challenge in Ireland, where a sometimes broad approach has been taken to the project categories. GIL is keen to ensure that Greenlink is not exposed to any such challenge risk and that actions taken in Wales cannot be suggested to undermine the Irish consenting process. Therefore, an ES/EIAR will be submitted with all relevant applications for consent. GIL obtained a 'Scoping Opinion' from Welsh Ministers (Natural Resources Wales) whom consulted with relevant organisations before issuing the Scoping Opinion. The Scoping Opinion was based on a Scoping Report submitted by GIL and confirmed agreement or otherwise of which aspects of the environment should be addressed in the ES.

The impact assessment takes into account guidance published by the Welsh Government, the Institute of Environmental Management and Assessment, and the Chartered Institute of Ecology and Environmental Management, and Scottish Natural Heritage.

There are a number of different EIA guidance documents available for terrestrial and marine applications which set out what an EIA should include and suggested ways it can be undertaken. However, there are few prescriptive examples on how to measure the significance of an effect. The SNH Handbook provides an example of a matrix showing effect significance related to sensitivity of the receptor and magnitude of change. This method can be applied to any marine project irrespective of its location in the UK and has been used as a guide for the EIA methodology in this ES.

The significance of the effect ranges from 'negligible' to 'major', with effects regarded as Not Significant if they are 'negligible' or 'minor' and Significant if they are 'moderate' or 'major'. The description of the impact assessment methodology adopted for the Proposed Development is set out in Chapter 5 of the ES.

A number of specialist studies and surveys have been carried out to inform the EIA. The data collected throughout these assessments and surveys have been used to define the baseline conditions against which effects have been measured and predicted, in turn helping to define the mitigation measures required.

The assessment of significance is undertaken prior to any mitigation. Project Specific Mitigation will generally only be proposed if effects are Significant. Project Specific Mitigation are measures to be adopted and implemented during construction and operation that are over and above legal compliance. Appropriate, feasible and cost-effective mitigation measures have been proposed as necessary in each topic Chapter. All project specific mitigation commitments made in the EIA are additionally listed in a Schedule of Mitigation provided as Chapter 17.

The significance assessment is repeated taking into consideration the application of Project Specific Mitigation, to determine whether there is likely to be a residual effect.

The information contained within the ES is divided into individual topic Chapters that cover the physical, biological and human environment. Chapters follow a common structure (shown below).

1. Topic Chapter	1.1 Data Sources
	1.2 Consultation
	1.3 Existing Baseline
	1.4 Potential Pressure Identification and Zone of Influence
	1.5 Embedded Mitigation
	1.6 Significant Assessment
	1.7 Project Specific Mitigation
	1.8 Residual Effect

4.2 *Habitats Regulations Assessment*

Certain habitats and species of European importance are protected under the EU Habitats Directive (92/43/EEC) and Birds Directives (2009/147/EC), creating a network or protected areas referred to in the UK as European sites. In the UK the Habitats Regulations[1] require consideration as to whether a plan or project has the potential to have an adverse effect on the integrity of a European site either alone or in combination with other plans and projects. This process is known as Habitats Regulations Assessment (HRA).

The HRA process consists of four sequential steps. Each step in the assessment process precedes and provides a basis for other steps. The results at each step must be documented so there is transparency of the decisions made. The Proposed Development crosses five European sites. The Proposed Development is not directly

[1] The Conservation of Habitats and Species Regulations 2017 for territorial waters (out to 12nm); and The Conservation of Offshore Marine Habitats and Species Regulations 2017 for UK Exclusive Economic Zone waters. Collectively they are referred to as the 'Habitat Regulations'

connected with or necessary to the management of the European sites. Therefore, under the Habitats Regulations it is necessary that the Proposed Development should be subject to the HRA process.

Stage 1 Screening and Stage 2 Information to Inform Appropriate Assessment has been submitted alongside the ES. It is provided as Technical Appendix C.

4.3 Consultation

Early consultation is a critical first step in the development of a comprehensive and balanced EIA. GIL started discussions in 2015 with Natural Resources Wales (the Welsh Regulator), Pembrokeshire County Council, Pembrokeshire Coast National Park Authority, Milford Haven Port Authority and Castlemartin Firing Range. Meetings have helped to inform route development, discuss potential areas of conflict and inform environmental assessment. Wider consultation with other stakeholders and the public commenced in 2018. Consultation remains an ongoing process to ensure that consultee comments and recommendations are appropriately captured. A summary of the received responses up to submission of the Marine Licence application (June 2019) and how they have been taken into account in finalising the ES is presented at the start of each relevant topic chapter.

As a PCI project, GIL is also required to conduct public and stakeholder consultation meetings through a variety of means set out in Section 4.23 of the TEN-E UK Manual of Procedures (DECC 2014). Wider public participation was achieved through:

- Development and regular updates to the Project website (www.greenlink.ie);
- Public consultation meetings;
- Newspaper notices published in both local and national newspapers; and
- Provision of public information brochure (TEN-E Regulation Information Brochure) – published before the start of formal public consultation and updated throughout the development process.

5. Summary of Environmental Effects

5.1 Physical Conditions and Marine Processes

Existing baseline: The seabed within the Proposed Development is generally characterised by flat or a gradually changing seabed with very gentle to gentle slopes. The water depth slowly increases from the UK landfall to a bathymetric trough in the St George's Channel, just after the UK/Ireland median line. The maximum depth along the route is 127.8m.

Close to the coastline, the cable route follows a sediment channel between outcropping bedrock before crossing the Turbot Bank, a large sandbank, for 5km. The Proposed Development then avoids further outcropping bedrock by routeing to the north and west through an area of mixed cobbles and boulders. It crosses two large sandwaves before routeing through mainly sand and gravelly sand to sandy gravel sediments to the UK/Ireland median line. Sampling confirmed sediments are not contaminated.

The beach at Freshwater West is known for its exposed character, strong waves and currents. The beach is exposed to high wave energy during the winter months (November to April) where sediment is generally suspended and moved offshore. During the summer months, lower energy waves act upon the sediment to build up the beach to a fuller summer profile.

EIA conclusion: The potential pressures considered by the assessment included penetration and disturbance including abrasion; changes in suspended solids (water clarity); water flow (tidal current) changes; and physical change (to another seabed type). The EIA process concluded that there is the potential for **significant effects** if trenching is undertaken on the upper beach terrace. An area of consolidated coarser sediment is covered by a sand veneer in the upper beach terrace. Trenching through this feature could create a weakness, potentially allowing a scour channel to form, which in turn could affect the way sediment is transported on and off the beach. Trenching across areas of bedrock reef, and pre-sweeping of sandwaves using dredging could also result in a **significant effect**. All other effects were assessed as not significant.

Project Specific Mitigation proposed: Due to the potential for significant effects on coastal processes the decision was made to exclude trenching on the beach from the Project Description. No intrusive works will be carried out between mean high water springs and mean low water. This has been enforced by the designation of an exclusion zone around the upper beach terrace. Further exclusion zones have been established around Bedrock Reef between KP2 and KP5. Should dredging be employed for sandwave pre-sweeping then material should be deposited up-current and as close to the disturbed sandwave as possible.

Residual effect: The EIA concluded implementation of the Project Specific Mitigation will either remove the pressure-receptor pathways resulting in no effect, or reduce the significance of effects to minor, which is **not significant**.

5.2 Intertidal and Benthic Ecology

Existing baseline: Freshwater West consists predominantly of hard rocky substrate, shingle and fine sand habitats. A total of 16 biotopes were identified at Freshwater West, with the majority of the intertidal survey area characterised as barren littoral coarse sand. The paucity of benthic organisms in these sediments can be explained by the highly mobile nature of sediments in this area due to its exposed location and lack of shelter from prevailing southwesterly winds and swell.

A total of 22 subtidal habitats were identified by the benthic survey. The Proposed Development crosses the Pembrokeshire Marine / Sir Benfro Forol SAC for approximately 50km. Three habitats of conservation importance were identified, mudflats and sandflats not covered by seawater at low tide; sandbanks which are slightly covered by seawater all the time; and reef (including all three sub-types - bedrock, stony and biogenic).

EIA conclusion: The potential pressures considered by the assessment included penetration and disturbance including abrasion; siltation rate changes; physical change (to another seabed type); introduction or spread of non-indigenous species; and electromagnetic field effects. The significance of the majority of pressures on subtidal habitats were assessed as **not significant** (i.e. negligible or minor). External cable protection will be required in two habitats: bedrock reef; and medium grade stony reef. The external cable protection will change the seabed in this area, but will provide a similarly hard substrate for colonisation. The habitats identified in the footprint are characterised by fragile sessile or slow moving species such as *Sabellaria spinulosa*, ascidians (sea squirts), hydroids, bryozoans and barnacles. Although the habitat will be lost, the species are short-lived, fast-growing, opportunistic epifauna which have fast rates of colonisation. Colonisation of the external cable protection is therefore expected in the short-term and the overall significance of the effect has been assessed as **not significant**.

Project Specific Mitigation proposed: Exclusion zones have been established around the majority of bedrock reef habitat within the Proposed Development. Micro-routeing will also be used to avoid reef habitat where possible. However, in certain areas the features cover the entire width of the Proposed Development and cannot be avoided.

It is proposed that a monitoring programme will be established to monitor colonisation of the external cable protection within the area of medium grade stony reef. Although monitoring will not reduce the effect, the objective is to validate the conclusion of short-term effects. It is thought monitoring would be beneficial for the management of the Pembrokeshire Marine / Sir Benfro Forol SAC given that a number of renewable energy projects are proposed for testing and development within the SAC. Validating the conclusions of the ES will support the decision making for future applications.

Residual effect: The EIA concluded implementation of the Project Specific Mitigation will reduce the significance of residual effects to minor, which is **not significant**.

5.3 Fish & Shellfish

Existing baseline: The Proposed Development passes within, or close to the spawning grounds (the location where eggs are laid) for nine commercially important fish species and the waters of the area also act as a nursery (the location where juveniles are common) for eleven commercially important fish species. Of the demersal species present in the area, sandeel and herring are known to be particularly sensitive to seabed disturbance. This is because they lay their eggs on the sediment and live within close contact with the sediments. A sandeel and herring habitat assessment has been conducted to support the EIA process. It concluded that the Proposed Development interacts with 12.78 km^2 of potential sandeel habitat within Welsh waters (close to the UK/Ireland median line); and interacts with 7.75km^2 of potential herring habitat within Welsh waters, located just offshore of Freshwater West.

The EC Habitats Directive Annex II listed species sea lamprey, river lamprey, Twaite shad and Allis shad may also be present within the Proposed Development.

Brown crab, green crab, velvet crab, spider crab, lobster, nephrops and whelk are all abundant in the region.

EIA conclusion: The potential pressures considered by the assessment included penetration and disturbance including abrasion; physical change (to another seabed type); underwater noise changes; and electromagnetic changes. The EIA concluded that of the species present herring (including allis and twaite shad which are members of the same family) are likely to be marginally more sensitive and, with the exception of electromagnetic changes, effects on herring will be minor, which is **not significant.** The remaining pressures were all assessed to have a negligible effect on other species.

Project Specific Mitigation proposed: No project specific mitigation is proposed.

Residual effect: No residual effect.

5.4 Birds

Existing baseline: The islands and cliffs of the Pembrokeshire coastline are important places for breeding, nesting, foraging and loafing seabirds. The Proposed Development crosses the Skomer, Skokholm and the seas off Pembrokeshire / Sgomer, Sgogwm a moroedd Benfro SPA and the Castlemartin Coast SPA. The sites are important for red-billed chough, European storm petrel, Atlantic puffin, Manx shearwater, Lesser black-backed gull and seabird assemblages. Other SPAs and Sites of Special Scientific Interest (SSSI) in the area support a wide range of breeding seabirds, including the third largest colony of gannet in the UK.

EIA conclusion: The pressure visual disturbance i.e. from the presence of vessels, was considered by the assessment. Atlantic puffin, Manx shearwater, Gannet and chough were assessed individually. The EIA concluded that the significance of effects on all seabirds is negligible and **not significant**.

Project Specific Mitigation proposed: No project specific mitigation is proposed.

Residual effect: No residual effect.

5.5 Marine Mammals and Reptiles

Existing baseline: Harbour porpoise and short-beaked common dolphin are the most abundant and commonly sighted species in the area, with most sightings taking place during summer months. The Proposed Development crosses the West Wales Marine / Gorllewin Cymru Forol SAC which has recently been designated to conserve harbour porpoise. It is possible the common bottlenose dolphin from the Cardigan Bay / Bae Ceredigion SAC may also be present in the Proposed Development. All cetaceans are European Protected Species.

Grey seal, a Qualifying Feature of the Pembrokeshire Marine / Sir Benfro Forol SAC are likely to be present in the Proposed Development. Common (harbour) seal may also be observed. Otter, also a Qualifying Feature of the Pembrokeshire Marine / Sir Benfro Forol SAC, may use the beach at Freshwater West. Rare sightings of leatherback turtles have been recorded in coastal waters.

EIA conclusion: The potential pressures considered by the assessment included underwater noise changes; and electromagnetic changes. The EIA concluded that the generation of underwater noise from continuous sources such as geophysical survey, and cable installation / repair will have effects assessed as **not significant** on marine mammals. There is the potential that detonation of a UXO may be required, and if this occurs the detonation could cause brief, but extensive disturbance to marine mammals and may cause injury. The EIA concluded that this would be a **significant effect**.

Project Specific Mitigation: The most effective mitigation is to avoid the need for detonation completely. Mitigation embedded into the design of the project seeks to do this by establishing a decision making strategy in which UXO detonation is the last option. If detonation is required it is best practice to follow the JNCC guidelines for minimising the risk of injury to marine mammals from using explosives. However, to further reduce the significance of effect, GIL has selected a range of Project Specific Mitigation. Passive acoustic monitoring (PAM) will be used during periods of darkness and poor visibility (e.g. fog and increased sea states) to support the marine mammal observer watches. In addition, acoustic deterrent devices will be used and smaller charges will be deployed in a soft start procedure to encourage animals to flee the area. GIL will apply for an EPS licence for UXO detonation.

Residual effect: The measures proposed are in line Industry Best Practice for UXO detonation and it is expected that implementation will reduce the significance of the effect to **not significant**.

5.6 Protected Sites

The Proposed Development has been subject to the HRA process as it crosses the Pembrokeshire Marine / Sir Benfro Forol SAC (site code: UK0013116), the West Wales Marine / Gorllewin Cymru Forol SAC (site code: UK0030397), Skomer, Skokholm and the Seas Off Pembrokeshire / Sgomer, Sgogwm a Moroedd Penfro SPA (site code:

UK9014051) and the landfall is within the Castlemartin Coast SPA (site code: UK9014061) and the Limestone Coast of South West Wales / Arfordir Calchfaen de Orllewin Cymru SAC (site code: UK0014787).

A detailed screening assessment has been conducted on the Proposed Development which concluded that significant effects are likely or uncertain on the Qualifying Features and conservation objectives of two sites:

- Pembrokeshire Marine / Sir Benfro Forol SAC; and
- West Wales Marine / Gorllewin Cymru Forol SAC.

The assessment concluded that there was **no potential for cumulative effects** with other plans or projects.

Further to screening, Information to Inform Appropriate Assessment has been provided, which concludes:

- Effects on the Pembrokeshire Marine / Sir Benfro Forol SAC Qualifying Feature Reef from cable installation and external cable protection during installation and repair and maintenance will be short-term and will not adversely affect the long-term achievement of conservation objectives. The Proposed Development **will not affect the integrity of the SAC,** either alone or in combination with other plans or projects.
- Significant effects on the Pembrokeshire Marine / Sir Benfro Forol SAC and West Wales Marine / Gorllewin Cymru Forol SAC Qualifying Features grey seal and harbour porpoise, from the detonation of UXO (if required) can be reduced to levels whereby the conservation objectives of the European sites are not adversely effected, by the implementation of Industry Best Practice mitigation i.e. the use of acoustic deterrent devices, soft-start and passive acoustic monitoring. The Proposed Development **will not affect the integrity of the SAC**, either alone or in combination with other plans or projects.

  The Greenlink Marine HRA is provided as Technical Appendix C.

5.7 Commercial Fisheries

Existing baseline: In Welsh waters demersal and shellfish are the key target species groups. With the exception of larger vessels working out of Milford Haven, most fishing off the southwest coast of Wales occurs close inshore. The most important shellfish species include crabs, lobster, whelk, Nephrops, scallops and razor clams, whilst key demersal target species include cod; haddock; ling; monkfish; plaice; ray; skate; and sole. Pelagic fish landings from this area are mainly of herring and mackerel, and of relatively less economic importance compared to shellfish and demersal species. Most fishermen working from the Pembrokeshire coast rely heavily on potting for crabs and lobsters, with activity peaking during the warmer months.

EIA conclusion: The potential pressures considered by the assessment included temporary displacement of fishing activity; temporary habitat disturbance affecting commercial stocks; permanent habitat loss affecting commercial stocks; changes in

suspended sediments (water clarity); snagging; change in water depth; and electromagnetic changes. The effect of these pressures were assessed as minor or negligible due to the embedded mitigation incorporated into the project design e.g. fisheries liaison, notices to mariners, use of guard vessels. The EIA concluded that the significance of effects are **not significant**.

Project Specific Mitigation proposed: Project specific mitigation has been proposed to ensure that over the life-time of the project the risks to commercial fisheries are managed effectively. It is proposed that operational phase asset management surveys will be reviewed and any areas of exposure/reduced depth of burial communicated to the fishing industry via Notice to Mariners.

Residual effects: It was noted that residual effects remain for example from temporary displacement of fishing activity, and the risk of snagging the cables. However, residual effects were assessed as **not significant**.

5.8 *Shipping and Navigation*

Existing baseline: A Navigation Risk Assessment has been undertaken for the Proposed Development and is presented in Chapter 13. The Proposed Development is a moderately busy shipping area within ships passing to and from Milford Haven. Offshore the Proposed Development crosses a Traffic Separation Scheme that separates north and south bound shipping passing through the eastern side of the Irish Sea. The Proposed Development also intersects the Rosslare to Pembroke ferry route.

EIA conclusion: The potential pressures considered by the assessment included displacement of vessels; change in water depth; and electromagnetic changes effecting navigation systems. All effects were assessed as negligible or minor which is **not significant**.

Project Specific Mitigation proposed: Project specific mitigation proposed relates to how GIL and their Installation Contractor will liaise with Milford Haven Port Authority (MHPA) to ensure that disruption to port activities is kept to a minimum. GIL will apply for a MHPA Marine Works Licence for all installation / construction, repair and maintenance activities. A communication protocol has been established which includes providing two weeks written notice of activities, a project briefing ahead of works starting; and daily briefings. In periods of poor visibility, especially in high density shipping areas, restrictions such as temporary cessation of installation activity may be considered to reduce the risk of collisions.

Residual effect: The EIA concluded that the residual effects remain but that they have been assessed as **not significant**.

5.9 *Offshore Infrastructure and Other Marine Users*

Existing baseline: Freshwater West is a popular public beach, especially important for surfing. The Proposed Development crosses the northern boundary of the Castlemartin Firing Range. The Ministry of Defence, as part of the North Atlantic Treaty Organisation (NATO) hosts Joint Warrior, a UK-led multi-national naval

exercise that takes place every two years. It is possible that exercises in 2021 and 2023 may also use the waters of the Proposed Development. The Proposed Development has been routed to avoid two closed disposal sites, but they remain in close proximity. Marine Energy Wales (MEW) is developing a Marine Energy Test Area (META) in and around the Milford Haven Waterway. Site 8 is located at Freshwater West and Bombora Wave Power are proposing to test a 1.5 MW Wave prototype during 2020 and 2021 at the site. Site 8 and the Proposed Development spatially overlap. There are a number of other renewable energy sites located around the Pembrokeshire coastline. The Proposed Development crosses one in-service telecommunications cable. There are no aggregate extraction areas located near to the Proposed Development and the seas off Pembrokeshire are not important for oil and gas exploration or production.

EIA conclusion: The potential pressures considered by the assessment included: displacement of vessels; disturbance of recreational beach users; disruption to Castlemartin Firing Range; and restricted development options. GIL have been in consultation with the MoD regarding the route through the Castlemartin Firing Range and have agreed an access and communication protocol which forms part of the embedded mitigation for the Proposed Development and therefore effects have been assessed as **not significant**. As there will be no development on the beach the EIA concluded that disturbance effects on recreational users will be minor and are **not significant.** There is the potential that the presence of the Proposed Development will restrict development options for the META Site 8 and Bombora Wave Power projects, which could have a **significant effect** on the projects.

Project Specific Mitigation proposed: No intrusive works are to be undertaken on Freshwater West between mean high water springs and mean low water, in addition no onshore works will be undertaken between July and August (inclusive). There is the potential for a temporal overlap between the nearshore works and the National Surf Championships. GIL will liaise with the Welsh Surfing Federation to ensure nearshore works scheduling is optimized to minimise conflicts. GIL has been in consultation with Marine Energy Wales and Bombora Wave Power since early 2018 but will continue to cooperate in reaching mutually agreeable terms for proximity agreements. GIL and their appointed Installation Contractor will also look at the feasibility of scheduling works within the Castlemartin Firing Range during Easter and August shut-down periods.

Residual effects: The implementation of the Project Specific Mitigation will reduce also residual effects to minor which is **not significant**.

5.10 *Marine Archaeology*

Existing baseline: The wreck of the Willemoes lies buried beneath the sand at Freshwater West, becoming exposed after particular severe storms. The walkover and metal-detecting survey revealed nothing of archaeological interest; although it confirmed the presence of decommissioned MOD cables. In the nearshore, a palaeo-channel associated with the Castlemartin Corse stream was detected crossing the

Proposed Development. A broad 'channel' area was noted in the sub-bottom data off the beach at Freshwater West. This area is believed to be beyond the Irish Sea Ice Sheet (ISIS) limit so it could preserve older Pleistocene material. The two submerged forest exposures at Freshwater West are outside of the Proposed Development.

Analysis of the marine geophysical datasets identified 84 anomalies with archaeological potential. None were identified as wreck sites or were identified as having high archaeological potential. 24 were deemed to have medium potential, with the remaining 60 having low potential. No wreck sites were identified within the available data. For each of the archaeological anomalies identified, archaeological exclusion zones have been defined.

EIA conclusion: The assessment considered both direct disturbance to archaeological assets and indirect disturbance e.g. as a consequence of changes to marine processes. It concluded that direct disturbance has the potential to have minor effect on paleoenvironmental deposits and that all other pressures will have effects which have been assessed as negligible. The EIA concluded the effects on marine archaeology will be **not significant**. This conclusion took into consideration embedded mitigation which includes preparing a Written Scheme of Investigation for the Proposed Development and establishing and implementing a Protocol for Archaeological Discoveries (PAD).

Project Specific Mitigation proposed: Archaeological exclusion zones will be implemented around the geophysical anomalies identified.

Residual effect: No residual effect.

6. Cumulative Effects

6.1 Methodology

The CEA undertaken for the Proposed Development was based on the MMO Strategic Framework for Scoping Cumulative Effects (MMO 2014). It used a pressure – receptor approach to screen other projects and plans. Given the short-term and localised nature of the Proposed Development, most effects will be restricted to a zone within 10km either side of the cable corridor; therefore in line with similar interconnector projects, a search area of 10km was selected.

Known types of projects and plans considered by the CEA include:

- Renewable energy projects i.e. wave power, offshore wind farms;
- Sites for marine aggregate dredging and disposal;
- Cables and pipelines;
- Oil and gas exploration and development;
- Carbon Capture and Storage; and
- Military Practice Areas.

Commercial fisheries, shipping and recreational beach use were scoped out of the CEA as they are considered baseline conditions in the area.

26 projects and plans were identified within the search area that fell under the categories, disposal sites; cables; dredging; military practice area; marine energy; scientific survey; oil and gas; and construction.

Following consideration of the spatial and temporal overlaps, it was identified that there was a common pressure-receptor pathway between the Proposed Development and 9 projects and plans.

6.2 CEA Results

Table 6-1 presents the conclusions of the CEA. The assessment concluded that the Proposed Development could interact with the following projects:

- META Site 8 Bombora Wave Power Seacam device;
- Marine Benthic Invertebrate / Sediment Grab Sampling;
- Neyland Yacht Haven Marina (Piling works);
- Deposit of scientific experiment and marker buoys;
- Castlemartin Firing Range;
- Marker buoy deployment (Bombora Wave Power)

Potential cumulative effects were assessed as **not significant**.

Table 6-1 Summary table of Potential Cumulative Effects (PCE)

Key	Grey = No pressure-receptor pathway	No PCE = No Potential Cumulative Effect	PCE: NS = Potential Cumulative Effect is Not Significant

Pressure	Physical conditions and marine processes	Benthic and intertidal ecology	Fish and shellfish	Marine birds	Marine mammals	Commercial fisheries	Shipping and navigation	Infrastructures and other sea users	Recreation	Marine archaeology
Physical change (to another seabed type)	No PCE	No PCE	No PCE							
Changes in suspended solids (water clarity)	No PCE									
Penetration and disturbance including abrasion	No PCE	No PCE	No PCE							No PCE
Siltation rate changes		No PCE								
Introduction or spread of INNS		No PCE								
Disturbance (physical)				PCE: NS						
Underwater noise changes: Disturbance			PCE: NS		PCE: NS					
Underwater noise changes: Injury					PCE: NS					
Electromagnetic changes					No PCE	No PCE	No PCE		No PCE	
Permanent habitat loss affecting commercial stocks						No PCE				
Temporary habitat disturbance affecting commercial stocks						PCE: NS				
Indirect effects on commercial target species from changes in water clarity						No PCE				
Snagging						PCE: NS				
Change in water depth						No PCE	No PCE		No PCE	
Disturbance / Disruption to planned routes and working areas						PCE: NS	PCE: NS	No PCE	PCE: NS	

7. Summary and Conclusions

The ES presents a comprehensive assessment of the potential effects of the installation, operation (including maintenance and repair) and decommissioning of the Proposed Development, and sets out Embedded Mitigation and proposes Project Specific Mitigation to avoid or reduce significant effects to an acceptable level.

The Embedded Mitigation and Project Specific Mitigation will form the basis of an Environmental Management Plan to be implemented during the installation and operation of the submarine cables.

Following the environmental impact assessment of the residual effects on the physical, biological and human environments, the following can be concluded:

- Intrusive works on the beach at Freshwater West have the potential to cause significant effects on coastal processes. GIL is proposing to employ a trenchless technique (horizontal directional drilling) whereby the sensitive dunes and intertidal area is avoided. This will ensure that there is **no effect on coastal processes**.
- The main effects associated with the Proposed Development are predicted to be localised, temporary disturbance to the seabed during installation. For the majority of subtidal habitats (benthic communities) and fish species this will result in effects which are **not significant**. Trenching across areas of Bedrock Reef, and pre-sweeping of sandwaves could cause **significant effects.** Exclusion zones and Project Specific Mitigation has been proposed that either remove the pathway for effects or reduce the significance of the effects to minor, which is **not significant**.
- Installation, maintenance and decommissioning activities will generate underwater noise which has the potential to cause minor disturbance effects to fish and marine mammals. For all the activities proposed, with the exception of UXO detonation, the assessment concluded that the effects will be **not significant**.
- If required, UXO detonation has the potential to have a **significant effect** on marine mammals including grey seal a Qualifying Feature of the Pembrokeshire Marine / Sir Benfro Forol SAC, and harbour porpoise a Qualifying Feature of the West Wales Marine / Gorllewin Cymru Forol SAC. The most effective mitigation is to avoid the need for detonation completely, but if this is not feasible, Project Specific Mitigation, following Industry Best Practice has been proposed. Implementation of measures such as using passive acoustic monitoring to support marine mammal observer watches, the use of acoustic deterrent devices and soft start charges to encourage animals to flee will reduce the significance of the residual effect to **not significant**.
- The preferred protection method is to bury the cables in the seabed. However, the cable route survey has identified that ground conditions for approximately 16.34km of the Proposed Development may be unsuitable and external cable

protection will be required. A cable burial plan will be produced by the Installation Contractor outlining proposed method statements and cable protection requirements for approval by NRW and discussion with fisheries stakeholders to reduce/avoid disruption to fisheries interests as much as possible. Effective channels of communication will be established and maintained between the appointed Installation Contractor and commercial fishing interests. This will include the appointment of a Fisheries Liaison Officer (FLO). Guard vessels may be used if sections of the cable are exposed between lay and burial.

- The Proposed Development crosses the Pembrokeshire Marine / Sir Benfro Forol SAC for approximately 50km. In relation to the SAC and the Qualifying Features the EIA concluded:
  - Extensive areas of outcropping Bedrock Reef have been avoided close to the coast by following a sediment channel. Exclusion zones have been established around the Qualifying Feature to avoid effects.
  - Localised, narrow areas of the Qualifying Feature Stony Reef habitat will be covered by external cable protection. The rock will provide a suitable hard substrate for colonisation. The characterising species of the habitats have been identified as short-lived, fast-growing, opportunistic epifauna which have fast rates of colonisation. Colonisation of the external cable protection is therefore expected in the short-term and the overall significance of the effect has been assessed as **not significant.**
  - Installation will temporarily disturb seabed sediments and habitats on the protected sandbank Turbot Bank and in areas identified as Biogenic Reef but rapid recovery is predicted and the overall significance of the effect has been assessed as **not significant**.
  - UXO detonation, if required, has the potential for **significant effects** on the Qualifying Feature grey seal, which can be reduced to **not significant** through the implementation of Project Specific Mitigation (as discussed above).
- The EIA concluded that the significance of effects on all seabirds (including Qualifying Features of SPAs) is negligible and **not significant**. This took into consideration the presence of the vessels associated with installation, operation or decommissioning activities.
- During operation, the cables will generate low electromagnetic fields that will emanate up to 2m from the cables before diminishing to natural background levels. There will be **no significant effects** on biological receptors (e.g. fish, marine mammals) and the fields will not interfere with navigation systems for commercial shipping or recreational boating.
- The presence of the cable installation vessels will cause temporary disturbance to fishing and shipping activity in the vicinity of the Proposed Development. Disruption will be limited to discrete sections of the Proposed Development, confined to the location of the maintenance or repair activity, or progressing along the Proposed Development during installation and decommissioning.

Communication protocols are proposed with Milford Haven Port Authority and Castlemartin Firing Range and procedures to minimise disruption near high density shipping areas will be developed and implemented. The residual effect has been assessed as **not significant**.

- There is the potential that presence of the Proposed Development will restrict development options within the Marine Energy Wales Marine Energy Test Area (META) Site 8; which Bombora Wave Power are proposing to use in 2020 and 2021. GIL has been in consultation with Marine Energy Wales and Bombora Wave Power since early 2018 but will continue to cooperate in reaching mutually agreeable terms for proximity agreements. The residual effect has been assessed as **not significant**.
- The EIA concluded the effects on marine archaeology will be **not significant**. This conclusion took into consideration embedded mitigation which includes preparing a Written Scheme of Investigation for the Proposed Development and establishing and implementing a Protocol for Archaeological Discoveries (PAD). Archaeological exclusion zones will be implemented around the geophysical anomalies identified.
- There will be **no significant cumulative effects** with other existing and proposed projects and plans during the installation and operation of the Proposed Development. The potential for cumulative effects has been identified but all effects are not significant.
- Any effects from decommissioning activities (cable removal) will be broadly similar to those during installation. The appropriate method of cable decommissioning will be considered towards the end of the interconnectors life. This will consider hazards presented by leaving the cables in situ and potential disturbances if removed entirely. The effects of removal are predicted to be minor and temporary in nature, and will be considered thoroughly at the time of removal.