Volume 3C Part 2 Environmental Impact Assessment Report

Celtic Interconnector

March 2021

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Mott MacDonald
South Block
Rockfield
Dundrum
Dublin 16
D16 R6V0
Ireland

T +353 (0)1 2916 700
mottmac.com

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Directors: J T Murphy BE HDipMM CEng FIEI FConsEI FIAE (Managing), D Herlihy BE MSc CEng, R Jefferson BSC MSCS MRICS MCIArb DipConLaw, J Shinkwin BE DipMechEng CEng MIEI, M D Haigh BSc CEng FICE MCIWEM (British)
Innealtoirí Comhairleach (Consulting Engineers)
Company Secretary: Michael Cremin CPA
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Abbreviations

Abbreviation	Full Title
AA	Appropriate Assessment
AADT	Annual Average Daily Traffic
ABP	An Bord Pleanála
AC	Alternating Current
ACA	Architectural Conservation Area
AOD	Above Ordnance Datum
AQS	Air Quality Standards
CDP	County Development Plan
CEMP	Construction Environmental Management Plan
CRU	Commission of Regulation of Utilities
DAU	Development Applications Unit
DCCAE	Department of Communications, Climate Action and Environment
DEHLG	Department of the Environment Heritage and Local Government
DECC	Department of the Environment, Climate and Communications
DHLGH	Department of Housing, Local Government and Heritage
DECLG	Department of the Environment, Community and Local Government
DC	Direct Current
DMRB	Design Manual for Roads and Bridges
EC	European Council
EU	European Union
EIA	Environmental Impact Assessment
EIAR	Environmental Impact Assessment Report
EPA	Environment Protection Agency
HDD	Horizontal Directional Drilling
HGV	Heavy Goods Vehicle
HV	High Voltage
HVAC	High Voltage Alternating Current
HVDC	High Voltage Direct Current
IAQM	Institute of Air Quality Management
IEMA	Institute of Environmental Management and Assessment
LAP	Local Area Plan
LCA	Landscape Character Area
LGV	Light Goods Vehicle
MHW	Mean High Water
NIAH	National Inventory of Architectural Heritage
NIS	Natura Impact Statement
NMPF	National Marine Planning Framework
NPWS	National Parks and Wildlife Service
PCI	Project of Common Interest

Abbreviation	Full Title
pNHA	Proposed Natural Heritage Area
RTE	Réseau de Transport d'Électricité [French TSO]
SAC	Special Area of Conservation
SPA	Special Protection Area
TEN-E	Regulation (EU) No 347/2013 guidelines for trans-European energy infrastructure
TJB	Transition Joint Bay
TSO	Transmission System Operator
UNFCCC	United Nations Framework Convention on Climate Change

1 Alternatives Considered

1.1 EirGrid's Six-Step Framework for Grid Development

The Irish onshore elements of the Celtic interconnector project have been developed in accordance with EirGrid's bespoke six-step Framework for Grid Development, as presented in Figure 1.1.

Figure 1.1: EirGrid Six-Step Framework for Grid Development

Source: EirGrid

The Framework is discussed in more detail in Volume 2A of the application submission. In summary, it ensures that project development occurs in a consistent and structured manner, with adequate and appropriate opportunities for public and stakeholder participation in project decision-making.

The Consideration of Alternatives for the project must be understood as occurring in the context of, and from the early stages of, the Framework for Grid Development. As discussed in more detail below, alternatives considered for the Celtic Interconnector include strategic and more localised technological and locational topics.

In accordance with EirGrid's Framework, a comprehensive and consistent multi criteria analysis was applied to decision making at various stages of project development, including in considering a variety of alternatives. The multi criteria analysis facilitated a balanced consideration of the following criteria relating to project development, as illustrated in Figure 1.2:

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

Figure 1.2: EirGrid's Assessment Criteria

Source: EirGrid

This chapter provides an overview of the alternatives considered for the onshore (land) elements of the project. This overview derives from the following detailed reports, which are included in Appendix 1 of this EIAR. The reports are also available to view on EirGrid's project website[1].

- Feasibility Study - Converter Station Site & Route Identification in Ireland (ESBI, 2016)
- Network Analysis Celtic Interconnector Feasibility Study (EirGrid, November 2016)
- Step 3 Onshore Constraints Report (Mott MacDonald, April 2019)
- Step 3 - Performance Matrix Assessments (EirGrid, Spring 2019)
- Offshore Constraints Report (Wood, April 2019)
- Step 4 Consultation Report (Traverse, April 2020)
- Step 3 Preferred Options Report (Mott MacDonald, August 2019)
- Step 4A Consultant's Development Options Report (Mott MacDonald, November 2019)
- Step 4 Project Update Document (EirGrid, Spring 2020)
- Step 4B Consultant's Development Options Report (Mott MacDonald, November 2020)

1.2 Do Nothing Scenario

As a Project of Common Interest (PCI), the Celtic Interconnector project has been identified as meeting the criteria detailed in Article 4 of the EU Regulation 347/2013 on guidelines for trans-European energy infrastructure i.e. the project contributes significantly to at least one of the following specific criteria:

- Market integration, inter alia through lifting the isolation of at least one Member State and reducing energy infrastructure bottlenecks; competition and system flexibility;
- Sustainability, inter alia through the integration of renewable energy into the grid and the transmission of renewable generation to major consumption centres and storage sites; and,

[1] Related Documents (eirgridgroup.com) (https://www.eirgridgroup.com/the-grid/projects/celtic-interconnector/related-documents/index.xml)

- Security of supply, inter alia through interoperability, appropriate connections and secure and reliable system operation.

Non-implementation of the Celtic Interconnector project would mean foregoing its benefits and slowing down the development of renewable energy required to combat climate change.

Alternative proposals would likely be developed at the proposed site of the converter station compound within Industrial Development Authority (IDA) owned lands zoned for Industrial use at Ballyadam in County Cork.

The Do-nothing scenario is however considered for each technical chapter of this Environmental Impact Assessment Report (EIAR).

1.3 Connection to the Irish Transmission Network

A Step 2 feasibility study carried out by EirGrid in 2016 considered the substations at Knockraha in County Cork and Great Island in County Wexford as potential connection points for the Celtic interconnector project to the Irish national grid, as illustrated in Figure 1.3.

The Step 2 Feasibility Study - Converter Station Site & Route Identification in Ireland (ESBI, 2016) also considered options for converter station locations, High Voltage Direct Current (HVDC) and High Voltage Alternating Current (HVAC) land circuit routes and landfall suitability for two potential transmission connection points for both options.

Technical studies were carried out to determine the network implications of connecting the Celtic Interconnector at each of these connection points. The analysis undertaken concluded that the transmission system can accommodate the potential power flows from the Celtic Interconnector significantly better by way of the connection point at Knockraha rather than a connection point at Great Island. Connection at Great Island would likely require a significant extent of upgrading of existing transmission system infrastructure and / or the construction of new infrastructure across the region, in comparison to the Knockraha option.

Knockraha 220 kV substation was subsequently identified as the connection point for the Celtic interconnector project to the Irish national grid.

Figure 1.3: Connection Point Options (Step 2)

Source: Feasibility Study - Converter Station Site & Route Identification in Ireland (ESBI, 2016)

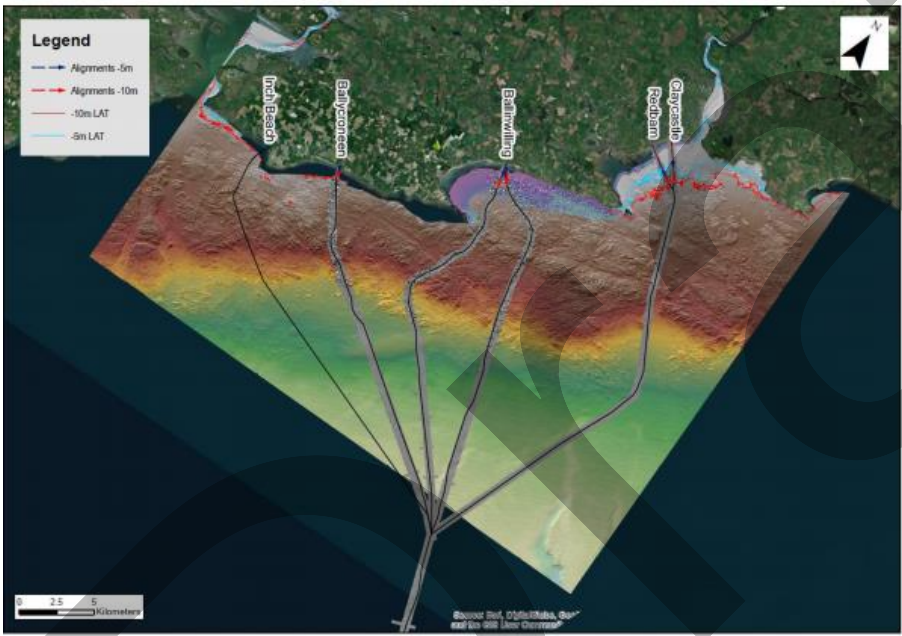
1.4 Landfall Options

As noted above, the Step 2 Feasibility Study - Converter Station Site & Route Identification in Ireland (ESBI, 2016) identified potential landfall options at both West Wexford and East Cork.

Following identification of Knockraha substation as the connection point, the following landfall options in the East Cork area were further considered, as detailed in the Step 3 Offshore Constraints Report (Wood, April 2019):

- Inch Beach
- Ballycroneen Beach
- Ballinwilling Strand (Western Approach) (BW2)
- Ballinwilling Strand (Eastern Approach) (BW1)
- Redbarn Beach
- Claycastle Beach

Figure 1.4: Landfall Options (Step 3)



Source: Offshore Constraints Report (Wood, April 2019)

The Step 3 Performance Matrix Assessments identified Ballinwilling Strand 2, Redbarn Beach and Claycastle Beach as the shortlisted landfall location options for further assessment.

Claycastle Beach was chosen as the proposed Irish landfall for the submarine cable, primarily due to its offshore approach which follows a sediment channel with sufficient depth to bury the cable and protect it against fishing and shipping without the requirement for rock cutting or external protection (by way of rock placement). This compares to other options considered, including Redbarn, which are characterised by rocky outcrops, boulder fields and high seabed gradients which would necessitate rock cutting.

The selection of Claycastle Beach as the landfall mitigates significant short to long term impacts on the marine environment associated with rock cutting and permanent disruption to the seabed, compared with all other identified options in the East Cork area.

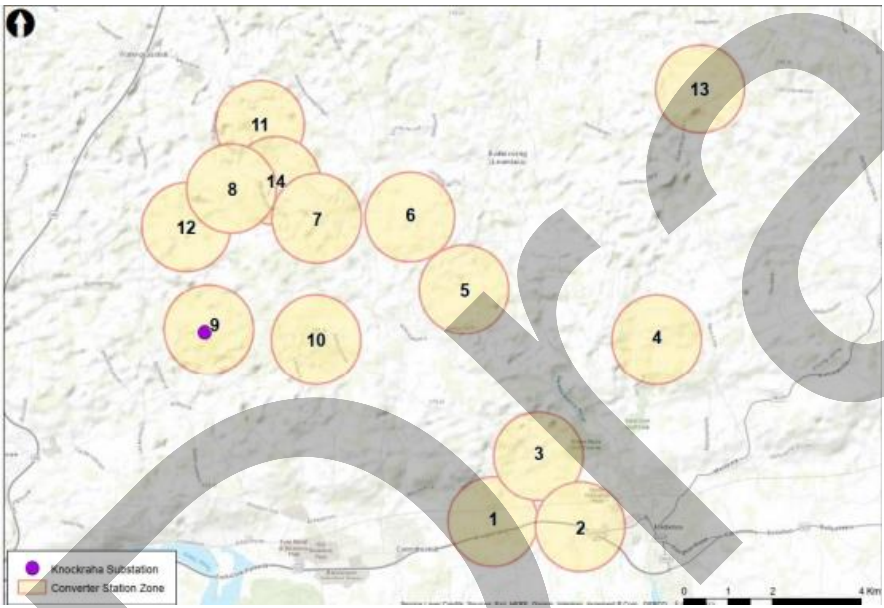
1.5 Converter Station Site Options

A converter station is required to convert the electricity from HVDC (used on the submarine cable) to HVAC (used on the Irish transmission grid) and vice versa.

The Step 2 Feasibility Study - Converter Station Site & Route Identification in Ireland (ESBI, 2016) identified ten general location area options (Converter Station Location Areas) for the siting of the converter station. Each Converter Station Location Area represented an area approximately 2km in diameter.

A further four general location area options were identified and considered in the Step 3 Onshore Constraints Report (Mott MacDonald, April 2019). The constraints report presented baseline information on identified onshore constraints associated with the Converter Station Location Zones (CSLZs). Each CSLZ also represented an area approximately 2km in diameter.

Figure 1.5: Converter Station Location Zones (Step 3)



Source: Step 3 Onshore Constraints Report (Mott MacDonald, April 2019).

The Step 3 Preferred Options Report (Mott MacDonald, August 2019) documented the Step 3 consultations undertaken and the feedback received in the context of the six shortlisted CSLZs.

The Step 4A Consultant's Development Options Report (Mott MacDonald, November 2019), presented an analysis of the six shortlisted CSLZs identifying at least one potential Converter Station Site (CSS) within each of the CSLZs, as follows:

- CSS 1 Ballyadam;
- CSS 6 Leamlara;
- CSS 9A Knockraha;
- CSS 9B Knockraha;
- CSS 10 Pigeon Hill;

- CSS 12 Kilquane (Meeleen); and
- CSS 14 Ballyvatta.

The Step 4A Consultant's Development Options Report also presented a comparative evaluation of the above referenced CSSs against the criteria illustrated in Figure 1.2.

The Step 4A Consultant's Development Options Report concluded that CSS 12 (Kilquane / Meeleen) would be brought forward as the Emerging Best Performing Option (EBPO) to Step 4B and further consideration would also be given to both CSS 1 (Ballyadam) and CSS 9B (Knockraha) at Step 4B. The Step 4A Report also stated that further assessment would be required on the shortlisted sites prior to the identification of the Best Performing Option (BPO) for the project. Public consultation was carried out between 11 November 2019 and 2 February 2020 as outlined in the Step 4 Project Update Document (EirGrid, Spring 2020).

The Step 4B Consultant's Development Options Report (Mott MacDonald, November 2020), having reviewed and considered the outcomes of the assessment process from a multi-criteria perspective, as well as considering public and stakeholder feedback in respect of the EBPO, and having undertaken technical, environmental and other analysis of the site options under consideration, identified the Ballyadam site as the BPO for the siting of the converter station.

In presenting this decision, the report cited social and deliverability aspects and management of challenges through technical and site design. This demonstrates the relevance and importance of undertaking a multi-criteria approach to project decision-making, as per EirGrid's Framework for Grid Development.

1.6 Onshore HVAC Route Selection

A HVAC connection is required between the proposed CSS at Ballyadam and the identified connection point at Knockraha.

Given the length of any underground cable (UGC) route along relatively narrow local roads, and the need for the UGC to cross under the existing live railway line, there are a number of challenges associated with this HVAC connection. As detailed in the Step 4B Consultant's Development Options Report (Mott MacDonald, November 2020), a number of options were therefore considered, as outlined below:

- A 220 kV UGC in a two cables per phase arrangement.
- A 400 kV UGC.
- A 220 kV double circuit overhead line (OHL) 'loop in' plus a 220 kV single cable per phase UGC.

Installation of an UGC 220 kV HVAC two cables per phase arrangement (option 1 above) typically requires a trench width in the order of 2m.

Both a 400 kV (single circuit) HVAC option (option 2 above) and a 220 kV single cable per phase option (required in conjunction with a "loop-in" to an existing OHL – option 3 above) require a trench width of approximately 1m.

A circuit of either voltage extending directly between the converter station and Knockraha 220 kV substation, and thereby exclusively serving the Celtic Interconnector is known as a "tail" connection.

1.6.1 220 kV "Loop-in"

A 220 kV "loop-in" to an existing 220 kV double circuit overhead line (meaning two circuits carried on a single pylon) which passes over the south-western corner of the overall IDA site at Ballyadam was considered. The existing OHL circuits run between Aghada and Knockraha 220 kV substations. This option would necessitate new OHL pylons to facilitate the tie-in, in addition to a substation at Ballyadam and other additional equipment. A 220 kV UGC would also be required, as the OHL “loop-in” could not by itself carry the amount of power associated with the interconnector, in combination with existing power generated at Aghada.

The evaluation of the 220 kV “loop-in” focused on works that would be required within and in the vicinity of the south west of the IDA site at Ballyadam to specifically facilitate the loop-in itself, as well as the provision of a single circuit 220 kV UGC between Ballyadam and Knockraha substation (including necessary works within the existing substation itself). It should be noted, however, that further uprate works to the remaining sections of the existing OHL between Ballyadam and Knockraha substation could also be required to facilitate this option. The 220 kV “loop-in” was not considered further due to its performance against environmental, social, technical, deliverability and economic criteria, when compared with the 220 kV and 400 kV UGC options.

1.6.2 220 kV UGC and 400 kV UGC Options

The 220 kV UGC option would require a trench width of approximately 2m. The 400 kV UGC option would require a trench width of approximately 1m.

The majority of the 400 kV option would be constructed in the road while the two cables per phase arrangement 220 kV option would require more off-road routing given its wider trench requirement. Longer trench installation times and road closures would be required for the 220 kV option. Due to cross-country routing requirements, more hedgerow removal and more drain crossings would be required to facilitate the 220 kV option when compared with the 400 kV option. As the majority of the 400 kV option would be constructed in the road it is also preferred from a cultural heritage perspective.

Having regard to the constraints and considerations identified in the Step 4B Consultant’s Development Options Report (Mott MacDonald, November 2020), the 400 kV HVAC tail option has been identified as the BPO for the HVAC land circuit connection.

1.7 Onshore HVDC Route Selection

The determination of the HVDC route was informed by detailed consultation between EirGrid, Transport Infrastructure Ireland (TII) and Cork County Council. These consultations included avoidance or minimising potential conflict of the proposed development with both prospective upgrades of the N25 and with vehicular and community activity and amenity in the towns and villages through which the HVDC UGC will pass.

1.7.1 Midleton and N25 West of Midleton

The N25 National Road between Carrigtwohilll and Midleton is planned for major upgrading, including widening to full dual carriageway status, and provision of a new or modified interchange in the vicinity of the IDA site at Ballyadam.

The project (known as the Carrigtwohill-Midleton Scheme), is being progressed by the Cork Roads Design Office (RDO) on behalf of TII.

TII has confirmed to EirGrid that the N25 is part of the Trans European Network for Transport (TEN-T) Comprehensive network and, as such, is required to be upgraded to TEN-T standard by 2050. The N25 Carrigtwohill-Midleton Scheme is specifically identified in the National Development Plan 2018 – 2027 as contributing towards the achievement of National Planning Framework’s National Strategic Outcome 2 – Enhanced Regional Accessibility. It is listed as a scheme to be progressed over the life of the plan. The section of N25 between Carrigtwohill and Midleton is the only remaining section of legacy dual carriageway with median crossing points and direct access from domestic dwellings. As this section of route carries up to 30,000 vehicles every day, accesses and crossing points along this section constitutes an unacceptable risk to road safety. Therefore, in accordance with National Development Plan Objectives, TII and Cork County Council are progressing the planning and design of the N25 Carrigtwohill-Midleton Scheme.

It is Government policy, included in the Section 28 Ministerial Guidelines on Spatial Planning and National Roads (DoECLG, 2012), that development objectives must not compromise the route selection process. TII hold the view that the construction of a high-voltage interconnector along the route of the existing N25 corridor will represent an additional significant constraint to planning and design for the N25 Carrigtwohill-Midleton Scheme and is very likely to add significant additional costs to the delivery of the scheme. In such circumstances, the route of the existing N25 should be avoided.

There is also the consideration of the need to maintain the strategic capacity and safety of the national roads network, including planning for future capacity enhancements, in National Strategic Outcome 2 of the National Planning Framework. While the National Development Plan, 2018 – 2027, outlines the investment priority to ensure that the existing extensive transport networks, which have been greatly enhanced over the last two decades, are maintained to a high level to ensure quality levels of service, accessibility and connectivity to transport users. TII holds the view that introducing an additional constraint such as the Celtic Interconnector DC underground cable within this corridor could significantly affect planning and design for the N25 Carrigtwohill-Midleton Scheme and potentially compromise scheme delivery, contrary to need to realise the objectives of the National Planning Framework and the National Development Plan.

This major infrastructure project is currently the subject of public consultation, in respect of four broad design and alignment options all of which will upgrade this existing portion of the N25 to full dual carriageway.

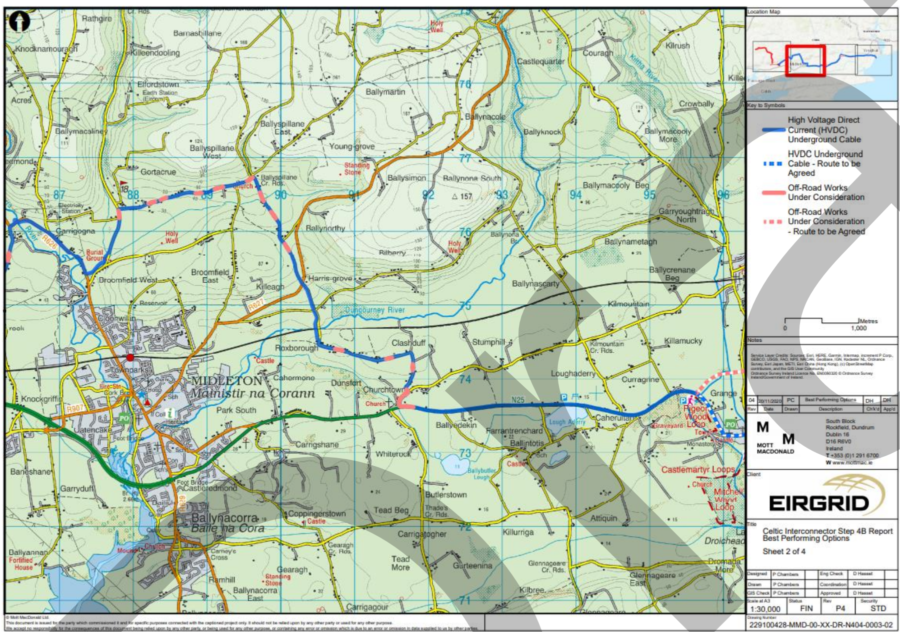
In discussions between EirGrid and TII, it was confirmed that, while formal consent from TII is required under Section 53 of the Roads Act for the installation of services in motorways and protected roads, it is established practice to treat other dual carriageways in a broadly similar fashion requiring consent from the relevant motorway maintenance contractor for works on the road. There is a clear rationale for this, in ensuring any such highly trafficked, strategic road asset can function to its most effective extent, without need for closure or other constraint to facilitate the activities of other parties. In relation to the N25 Carrigtwohill-Midleton Scheme, while it is too early in the route selection process for a final decision to have been made, TII have advised EirGrid that the option of making the scheme a protected road or motorway are both under consideration due to the strategic importance and traffic demand on this section of road.

EirGrid and TII share the view that, in the scenario whereby the Celtic Interconnector DC cable was laid within the N25 corridor in advance of these major planned construction and upgrading works, it would inevitably form a significant and adverse constraint to the road project as the cable would have to be fully assured of protection within what will comprise a major construction site. Moreover, the cable rating (i.e. the power that can be carried) is profoundly dependent on an assured burial depth, and this could be inadvertently or unavoidably altered by the road works over and adjacent. Moreover, there would be no final certainty as to the specific location or depth of burial of the cable at this point in time as detailed designs for the road alignment would only be prepared following consent being given for the road project. In short, there is considerable uncertainty generated for both EirGrid and TII; and even if this could be overcome, there remains a clear and significant risk of damage to the cable, and thereby to the operation of the interconnector.

Bringing the UGC off the N25 through the core built-up area of Midleton would also unduly impact on this town; particularly in terms of traffic disruption, disturbance and nuisance, and conflict with existing services, for no meaningful benefit in comparison with use of an alternative local road route.

Consequently, the proposed HVDC route will follow a local road route to the east and north of Midleton, extending north and north-westwards off the N25 at Churchtown (Two Mile Inn), refer to Figure 1.6. While this inevitably adds additional length to the HVDC cable (approximately 4km), this is offset by avoiding significant issues in delivering and operating the Celtic Interconnector Strategic Infrastructure Project that would otherwise arise with seeking to lay the cable further westwards along the N25 to Ballyadam.

Figure 1.6: Midleton (Step 4B)



Source: Step 4B Consultant's Development Options Report (Mott MacDonald, November 2020)

1.7.2 Greenway (Midleton to Youghal disused railway)

The Greenway along the disused Midleton to Youghal railway line is being developed by Cork County Council. This is occurring under licence, with the ownership of the alignment remaining with Iarnród Éireann.

The duration of the lease is likely to be in the order of 15-20 years. The design life of a circuit such as the Celtic Interconnector is in the order of 40-60 years.

Work has now commenced on the Greenway project with the clearance of vegetation and obsolete railway sleepers. The Greenway is expected to be complete and operational as a regional tourism resource by the end of 2022, some years prior to construction of the onshore HVDC cable, and indeed completion of the Celtic Interconnector project.

EirGrid has engaged with both Iarnród Eireann and Cork County Council with regard to the potential for its use to lay the HVDC UGC. It has become clear that there remains potential for the corridor to be used in the future, and certainly during the design life of the Celtic Interconnector project, as a railway corridor connecting Youghal and the villages of East Cork with the existing Cork-Midleton rail service. This presents a number of issues for the security and reliability of the interconnector, such as unrestricted access in case of a fault or maintenance when a rail service is in operation, potential for damage during railway construction and / or operation, and indeed, the consequent potential requirement to establish a new cable route for the Interconnector should the railway be reopened and should there be undue conflict between the electrical components of both infrastructure projects.

While engagement with the Cork County Council Greenway development team will continue in terms of crossings of the Greenway by the HVDC cable at a number of locations along its route, it remains the case that the Greenway is not of itself a preferred option for routing the HVDC land circuit of the Celtic Interconnector, relative to a route primarily within the public road, given its potential future use as an operational rail corridor.

1.7.3 Castlemartyr and Killeagh

EirGrid has undertaken significant engagement with the communities of Castlemartyr and Killeagh, two villages on the N25 which require to be traversed by the HVDC UGC.

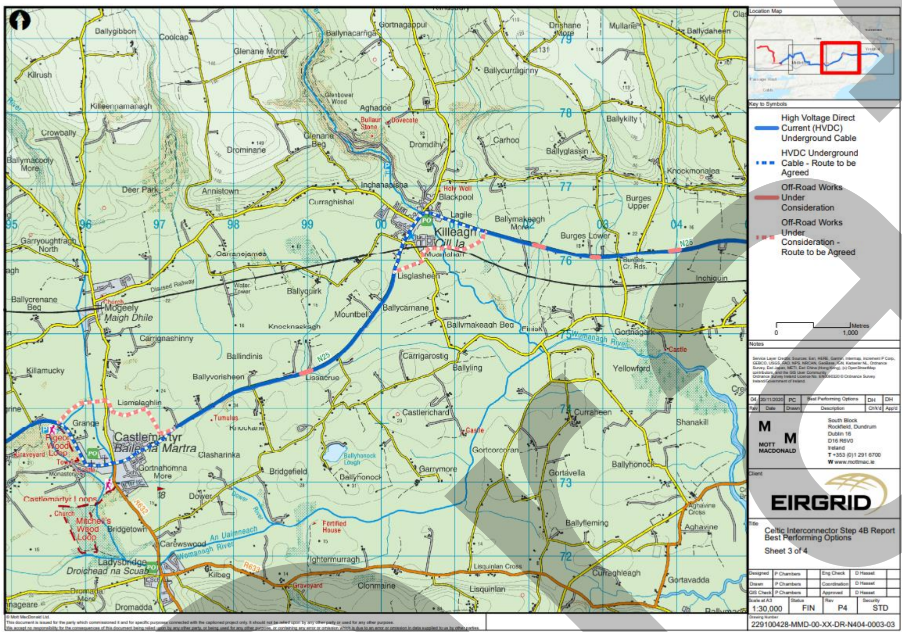
It is clear, both from this engagement, and from technical and environmental studies undertaken to date, that routing a HVDC cable circuit through both villages presents particular issues, summarised below:

- Castlemartyr is an Architectural Conservation Area (ACA). The route would need to cross the Kiltha River at the Kiltha River Bridge in Castlemartyr which is a stone bridge listed on the National Inventory of Architectural Heritage (NIAH). The road surface on the bridge is too shallow to install the cable route with sufficient cover over the bridge. Navigating the bridge is also difficult given the parallel underground utilities at Castlemartyr as well as crossings of underground services;
- The Castlemartyr Forest Bridge is also a stone bridge on the N25 with insufficient cover for installation of the trench. In this situation, crossing the Kiltha River would require HDD which may be complex given the density of vegetation and apparent depth and width of the water crossing.
- Killeagh is a medieval village and conservation area with a high archaeological potential; bridge crossings are listed on the NIAH;
- The route would need to cross the Dissour River at the Killeagh River Bridge in Killeagh. The road surface on the bridge is too shallow to install the cable route with sufficient cover over the bridge. Further, the height of the bridge and road surface above the river combined with the bend of the N25 at this point means that HDD at this point would be challenging;
- There are numerous parallel underground utilities at Killeagh as well as crossings of underground services;
- The road in Killeagh has recently been re-surfaced;
- The Killeagh Railway bridge would need to be crossed but it has insufficient cover to install the cable to the appropriate depth; and
- The Ballymakeagh More Bridge has insufficient cover to accommodate the trench, and as such, an off road crossing of the water course would be required. The width of the water course may allow for a culvert, failing which, HDD would likely be required).

In addition to new off-road bridge crossings being required in Killeagh and Castlemartyr, it is also noted that both villages have undergone urban improvement works over the last number of years, with resulting construction impacts for the receiving communities. In this regard, EirGrid has received ongoing feedback from the community representatives of the two villages favouring a solution which minimised disruption and nuisance for the village cores in the laying of the UGC.

For these reasons cross-country UGC alignments around Castlemartyr and Killeagh were considered, refer to Figure 1.7, with engagement with directly affected landowners.

Figure 1.7: Killeagh and Castlemartyr Options (Step 4B)



Source: Step 4B Consultant's Development Options Report (Mott MacDonald, November 2020)

In Castlemartyr, a potential route was originally identified extending to the north of the village, threading to the northern portion of the built-up area. Further consideration by EIrGrid noted that this could affect the longer-term development potential of the village, potentially as a key settlement node of East Cork. Subsequently a potential route (as now proposed), was identified extending somewhat further to the north, situated outside the built-up area of the village. It is considered that, from a land use planning perspective, it is likely that the settlement would retain its village settlement form and character, and while having clear potential for additional infill development within the existing built-up area, it would be unlikely to extend development to the area of the potential UGC route.

Other options considered in this regard were to extend the northern cross-country route further north to the settlement of Mogeely, and either use the greenway corridor from this location, or to use a local road between Mogeely and Churchtown / Two Mile Inn. Further consideration ruled out these options. The non-use of the former railway corridor is discussed at Section 1.7.2 above and this would also apply to its use from Mogeely; the existing local road between Mogeely and the Churchtown area now accommodates a major wastewater pipe and other drainage infrastructure serving the existing Dairygold manufacturing facility at Mogeely, such that there would not be sufficient space and alignment in the road also to accommodate the planned HVDC UGC.

It was requested in public feedback that EirGrid consider the UGC route to occur within any corridor of a northern by-pass of Castlemartyr, an indicative corridor of this bypass is included in the current Cork County Development Plan. EirGrid has engaged with both Cork County Council and TII on this matter. It is clear that, while an indicative corridor is identified in the Development Plan, there has been no design, investigation or other engineering work undertaken to date on the by-pass that would provide any meaningful reference as an alignment which could be followed by the HVDC UGC alignment. Moreover, TII has confirmed that the by-pass of the village is not an identified priority under current capital spending programmes. As such, it is considered that the bypass is unlikely to be developed in the short or medium-terms. It was further considered that any attempt to align in closer proximity to a “best-guess” potential route of the bypass could actually adversely constrain its future design and routing.

As a consequence of all this, and following productive engagement with both community and elected representatives and affected landowners in Castlemartyr, the alignment now proposed runs to the north of the village core off the N25, across agricultural lands outside but proximate to the northern extent of the village, before re-joining the N25 west of the village.

At Killeagh, a cross-country route has been identified to the south-east of the village core, across agricultural lands. This has occurred in consultation and engagement with affected landowners. As with Castlemartyr, it was further considered whether the UGC could join the disused rail corridor / greenway at Killeagh, but this was discounted for similar reasons as set out in Section 1.7.2 above. EirGrid was also asked to investigate alignment with any potential by-pass of the village; however, during consultation with TII and Cork County Council, it has been confirmed that there are no plans for a bypass of the village.

1.7.4 Ballyvergan Marsh

As detailed in Section 1.4, due to structural constraints associated with the railway bridge to the north of Claycastle Beach, it is necessary to divert the onshore (land) cable off road for approximately 160m under the proposed Mildleton to Youghal Greenway (currently under construction).

Approximately 65 metres of the 241 metres of land cable will be installed within Ballyvergan Marsh pNHA (site code 000078) to the west of the railway bridge. Installation of the cable to the east of the railway bridge was considered, however, there is insufficient space in the verge to facilitate the required works.

1.8 Conclusions

In line with EirGrid’s bespoke six-step Framework for Grid Development, Environmental; Socio-Economic; Technical; Deliverability; and Economic considerations have informed the determination of the onshore elements of the Celtic Interconnector being brought forward for consent.

Having regard to each criteria, the BPO was selected to meet the specific circumstances of this project that allows it to meet its intended need as a strategic infrastructure development of National and European importance, while avoiding or minimising environmental impact on the receiving environment.

The Proposed Development has been developed through an iterative process which involved seeking to avoid or reduce potential environmental effects through options appraisal and evaluation while having regard to feedback from consultation and engagement with a range of bodies, agencies, landowners and the public.

Alternatives considered for the Celtic Interconnector included strategic and more localised technological and locational topics and considerations. A summary of the steps involved in the determination of the BPO is outlined hereunder:

- The Step 2 Feasibility Study - Converter Station Site & Route Identification in Ireland (ESBI, 2016) identified;
  - substations at Knockraha in County Cork and Great Island in County Wexford as potential connection points. Knockraha 220 kV substation was subsequently identified as the connection point for the Celtic interconnector project to the Irish national grid.
  - potential landfall options at both West Wexford (Rathmoylan Cove, Baginbun Beach, Fethard Beach, – Bannow Beach, Cullenstown Beach) and East Cork (Inch Beach, Ballycroneen Beach, Ballinwilling Strand, Redbarn Beach and Claycastle Beach).
  - seven Feasible Converter Station Location Areas in County Wexford and ten Feasible Converter Station Location Areas in County Cork, including the area of Ballyadam, representing an areas of approximately 2km in diameter.
- Having identified Knockraha 220 kV substation as the connection point for the Celtic interconnector project to the Irish national grid in Step 2, the Step 3 Offshore Constraints Report (Wood Group, April 2019):assessed the above referenced landfall options in the East Cork area.
- The Step 3 Onshore Constraints Report (Mott MacDonald, April 2019) identified and assessed;
  - four general location area options for the siting of the converter station, in addition to the ten identified during Step 2.
- The Step 3 Performance Matrix Assessments (EirGrid, Spring 2019) identified;
  - Ballinwilling Strand 2, Redbarn Beach and Claycastle Beach as the shortlisted landfall location options for further assessment.
  - Six shortlisted CSLZs.(CSS 1 Ballyadam, CSS 6 Leamlara, CSS 9A Knockraha, CSS 9B Knockraha, CSS 10 Pigeon Hill, CSS 12 Kilquane (Meeleen); and CSS 14 Ballyvatta.
- The Step 3 Preferred Options Report (Mott MacDonald, August 2019) confirmed the following short-list of options to be brought forward to Step 4:
  - Ballinwilling Strand 2, Redbarn Beach and Claycastle Beach.
  - Six shortlisted CSLZs.(CSLZ 1 Ballyadam, CSLZ 6 Leamlara, CSLZ 9A Knockraha, CSLZ 9B Knockraha, CSLZ 10 Pigeon Hill, CSLZ 12 Kilquane (Meeleen); and CSLZ 14 Ballyvatta.
- The Step 4A Consultant's Development Options Report (Mott MacDonald, November 2019) presented an analysis of the shortlisted CSLZs identifying at least one potential CSS within each of the CSLZs. The report concluded that;
  - CSS 12 (Kilquane / Meeleen), CSS 1 (Ballyadam) and CSS 9B (Knockraha) would be brought forward for further assessment in Step 4B.
- The Step 4B Consultant's Development Options Report (Mott MacDonald, November 2020). Identified:
  - the Ballyadam site (CSS 1) as the BPO for the siting of the converter station, having particular regard to social and deliverability considerations, noting that particular challenges can be managed by way of embedded design and environmental mitigation.
  - Claycastle Beach as the BPO landfall location, particularly as it offers the least constrained offshore approach, and a relatively good road network for the HVDC cable connection to the Ballyadam site when compared to the other landfall location options considered.

- a HVAC Underground Cable connection between Knockraha substation and Ballyadam with 220 kV two cables per phase or 400 kV single circuit options brought forward for further consideration and assessment. As detailed in Section 1.6.2, the 400 kV single circuit option was subsequently identified as the BPO.
- a HVDC Underground Cable connection between Ballyadam and Claycastle Beach along local and regional roads and along the N25. Due to a number of constraints along these routes, local cross-country options bypassing Killeagh and Castlemartyr were also brought forward for further consideration and assessment. As detailed in Section 1.7.3, cross country routes bypassing Killeagh and Castlemartyr were subsequently identified as the BPO. Similarly, as detailed in Section 1.7.1. Midleton is also proposed to be by-passed, having regard to constraints associated with the N25 Carrigtwohill-Midleton Scheme.

The outline design for the BPO has subsequently been refined and optimised to address the potential impacts associated with the challenges set out in the evaluation process. The proposed development description is set out in Chapter 2 and Chapter 3 of Volume 3C of this EIAR.

2 Description of the Onshore Development

Commented [DH1]: NON TECHNICAL SUMMARY TO BE COMPLETED FOR FINAL APPLICATION

2.1 Project Overview

The Celtic Interconnector is a subsea link that will enable the exchange of electricity between the electrical transmission grids in Ireland and France. The link will have the capacity to carry up to 700 MW of electrical energy between the two systems.

The transmission grids in both Ireland and France are operated at High Voltage Alternating Current (HVAC). High Voltage Direct Current (HVDC) is used for the transmission of electrical power over large distances where HVAC is not technically or economically feasible. Converter stations are therefore required in both France and Ireland to convert the HVDC power to HVAC.

The main elements of the Celtic Interconnector project are:

- A HVDC submarine cable of approximately 500 km in length laid between the Ceinture Dorée (Gold Belt) coast in Brittany France, and the Cork coast in Ireland. The submarine cable will be either buried beneath the seabed or laid on the seabed and covered for protection;
- A landfall location in Ireland and France, where the HVDC submarine circuit will come onshore and terminate at a transition joint bay;
- An HVDC underground cable (UGC) in both countries between the landfall location and a converter station compound;
- A converter station to convert the electricity from HVDC to HVAC and vice versa;
- A HVAC UGC in both countries between the converter station compound and the connection point to the National Grid; and,
- A connection to the National grid;

A fibre optic link, with associated power supply, will also be laid along the route for operational control, communication and telemetry purposes.

This section of the EIAR presents a description of the main elements of the onshore interconnector between the connection point at Knockraha substation (in County Cork) and the submarine cable landfall area at Claycastle Beach near Youghal (in County Cork).

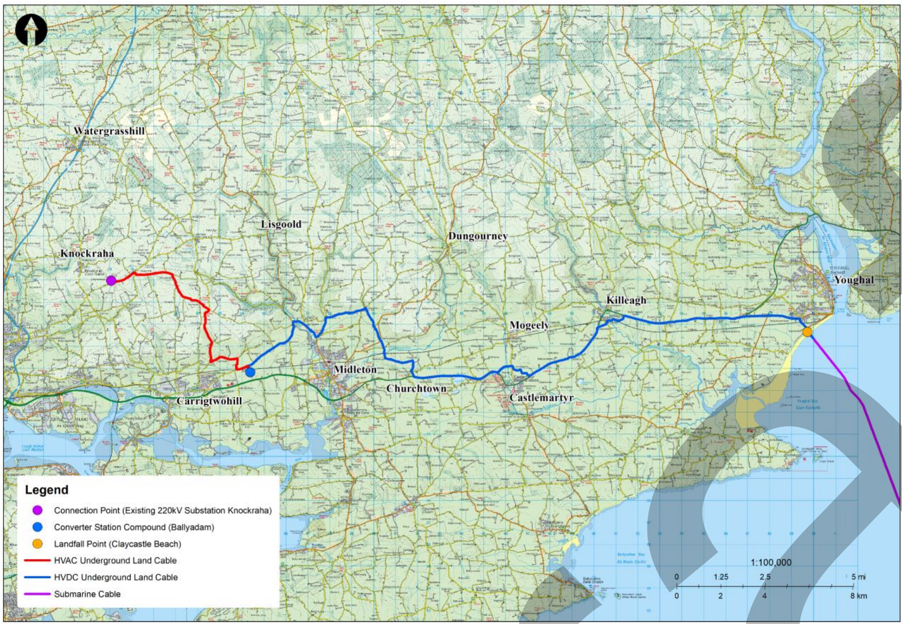
Figure 2.1 below illustrates the main elements of the proposals. Detailed mapping is included in Appendix 2 *Mapping.*

Commented [DH2]: MAPPING, TO BE BASED ON FINAL PLANNING DRAWINGS, TO BE INCLUDED IN THE FINAL FILE

Table 2.1 provides a description of these locations. For ease of reference, the route section nomenclature detailed in Table 2.1 has been assigned to both the HVAC (AC) and HVDC (DC) routes between the connection point and the converter station (AC) and between the converter station and the landfall interface area at Claycastle Beach (DC). These references are used throughout this EIAR.

Associated construction phase activities, including construction traffic and scheduling of works are discussed in Chapter 3 *Onshore Construction Phase Activities (Ireland).* As such, Chapters 2 and 3 should be read together to provide a full description of the development, construction and operation of the onshore elements.

Figure 2.1: The Proposed Development



Source: Mott MacDonald

Table 2.1: Route Sections

Route Section Name	Route Section Descriptor (and Townland)
Connection Point	Knockraha Substation (Ballynanelagh)
AC01-AC02	Knockraha Substation (Ballynanelagh) to east of Ballynanleagh (Killeena)
AC02-AC03	East of Ballynanleagh, west of T-Junction (Killeena) to East of Ballynanleagh, east of T-Junction (Killeena)
AC03-AC04	East of Ballynanleagh, east of T-Junction (Killeena) to Garranes crossroads (Garranes)
AC04-AC05	Garranes crossroads (Garranes) to south of Woodstock (Woodstock)
AC05-AC06	Woodstock (Woodstock)/Gortnamucky to north of Ballyadam (Ballyadam)
AC06-AC07	North of Ballyadam (Ballyadam) to Ballyadam (Ballyadam)
Converter Station Site	Ballyadam (Ballyadam)
DC01-DC02	Ballyadam (Ballyadam) to Carrigogna/R626 (Carrigogna)
DC02-DC03	Carrigogna (Carrigogna) to Ballyspillane East (Ballyspillane East)
DC03-DC04	Ballyspillane East (Ballyspillane East) to Roxborough (Roxborough)
DC04-DC05	Roxborough (Roxborough) to Churchtown North / N25 (Ballyedekin)
DC05-DC06	Churchtown North (Ballyedekin) to West of Castlemartyr (Killamucky)
DC06-DC07	West of Castlemartyr (Killamucky) to East of Castlemartyr (Clasharinka)
DC07-DC08	East of Castlemartyr (Clasharinka) to West of Killeagh (Mountbell)
DC08-DC09	West of Killeagh (Mountbell) to east of Killeagh (Ballymakeagh More)
DC09-DC010	Killeagh (Ballymakeagh More) to N25/west of R634 (Ballyvergan West)

Route Section Name	Route Section Descriptor (and Townland)
DC10-DC011	Ballyvergan West (Ballyvergan West) to R634 / R908 (Summerfield)
DC11-DC012	R634 / R908 (Summerfield) to north of Claycastle Beach car park (Summerfield)
Landfall Area	Transition Joint Bay (Summerfield) to Claycastle Beach (Summerfield)

2.2 Connection Point

The connection point is the point at which the Celtic Interconnector will connect to the HVAC national transmission grid enabling the transfer of electricity across the island of Ireland. The connection will be made by a single 400 kV HVAC cable underground circuit. The location for this connection point will be the existing 220 kV Knockraha substation in County Cork.

A connection to the 220 kV busbar will be required. This will be done by equipping an existing unused bay (bay F14) within the existing station. The bay will be equipped with new Air Insulated Switchgear (AIS) equipment, similar to other bays in the substation. This AIS equipment will consist of busbar disconnectors, circuit breakers, instrument transformers, transformer disconnectors, surge arresters, post insulators and tubular aluminium busbar. AIS is high voltage electrical equipment which uses the open air as its insulating medium. Live conductors are typically mounted outdoors on porcelain insulators on steel supports (refer to Figure 2.2).

Figure 2.2: Typical AIS Equipment

Source: Mott MacDonald

The single 400 kV cable circuit option will consist of three power cables (one cable per phase) and a single fibre optic link entering from the public road to the south into the ESB owned substation from which it will connect to the grid via the existing 220 kV busbar. One or more bunded transformers will be installed to 'step down' the voltage level of the 400 kV cable circuit to match the voltage level of the existing 220 kV busbar. The 400 kV bay, fitted out with 400 kV AIS equipment, will be installed within the existing footprint of the substation.

The proposed development at the connection point will be accommodated within the existing fence line of Knockraha substation.

2.2.1 Operation and Maintenance

No additional operating requirements will be required for the connection point compared to the existing bays in the substation.

Similarly, the maintenance regime will not differ from maintenance regimes of the existing bays at Knockraha 220kV substation aside from a yearly inspection and maintenance to the 400kV transformer. The maintenance regime for the connection within Knockraha substation will be the responsibility of ESBN.

2.3 Converter Station Compound

2.3.1 Site Location and Description

The proposed Irish converter station will be located in the townland of Ballyadam in the north eastern section of an overall landholding in the ownership of the IDA.

The overall IDA landholding is approximately 54 hectares and is located between the settlements of Carrigtwohill and Midleton County Cork. The site is bounded to the south by the N25 national road and bounded to the north by the Cork to Midleton commuter rail line. The location of the site is presented in Figure 2.1 and Appendix 2 *Mapping*. The proposed site layout is presented in Figure 2.3.

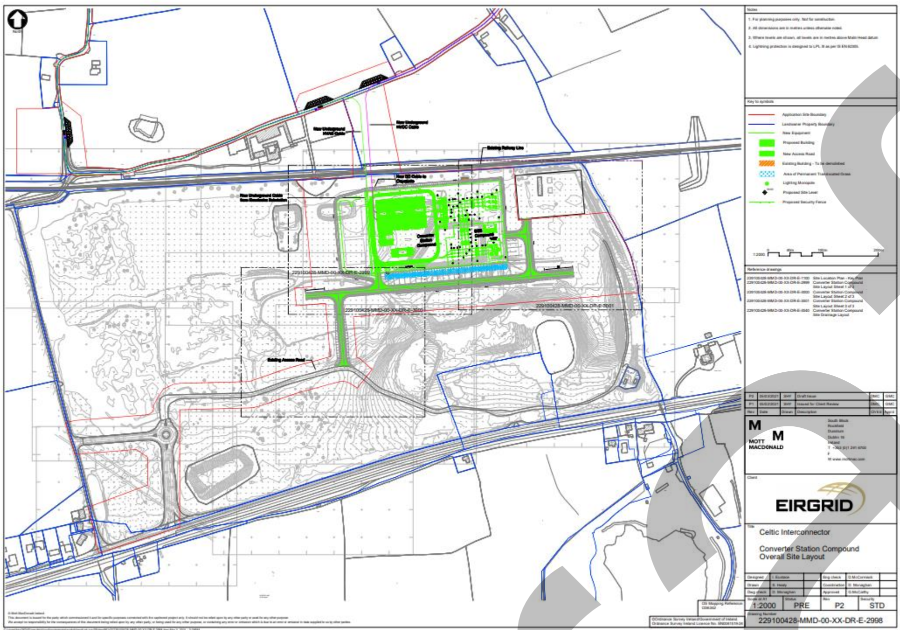
Commented [DH3]: MAPPING, TO BE BASED ON FINAL PLANNING DRAWINGS, TO BE INCLUDED IN THE FINAL FILE

The site is zoned for industrial use and was formerly intended for the location of the Amgen biotechnology manufacturing facility. Planning consent for the Amgen facility was granted by An Bord Pleanála, on appeal, on 17 July 2007 (An Bord Pleanála Reference PL04 .222364, Cork County Council Reference, Reference 06/13225 (Refer to Volume 2A of the application).

Prior to 2007, the site was in agricultural use and was largely improved grassland. Following grant of consent, the site was prepared for development. Extensive clearance of surface vegetation was carried out (with the exception of the woodland on a knoll to the south of the site) and substantial earthworks were undertaken. Stone / gravel was imported for roads and hardstand areas. The preparatory site works were abandoned in ca. 2009 / 2010, and since then, revegetation has been taking place with grassland vegetation / habitat developing on calcareous soils in recent years.

The proposed development site now includes Near Threatened plants, and European protected habitat parcels. Prior to enabling works (and in the appropriate season), these will be moved to a temporary storage area to be located south of the proposed construction compound, refer to Figure 2.3. Post-construction, these features will be moved from the temporary storage area to their new permanent location south of the compound, and north of the proposed site access road and construction site offices and parking shown in Figure 2.3). Further detail on these proposals is provided in Chapter 8 *Biodiversity*.

Figure 2.3: Converter Station Site Layout (Construction Phase)



Source: Mott MacDonald Planning Drawing Reference 229100428-MMD-00-XX-DR-E-2998

The site is low lying and is located within an area of known karst (soluble rock) features. Karst regions typically contain un-mapped underground draining systems with sinkholes and caves.

There are two depressions within the proposed converter station footprint in the north eastern section of the IDA site. It is understood that these were excavated as part of permitted ground improvement works carried out by Amgen and were subsequently abandoned between approximately 2007 and 2009 / 2010. These depressions currently collect rainwater and will be infilled to facilitate development of the converter station. An area of compensatory storage will be developed to replace this storage capacity as detailed in Section 2.5.3 *Drainage Design and Wastewater Discharge*. This proposed 'cut' could potentially be used to 'fill' the existing depressions, subject to geotechnical and ground investigation studies. For the purposes of the assessments in this EIAR however, it has been assumed that material will need to be imported as a worst-case scenario.

An existing substation building with a concrete roof will be removed to facilitate the proposed converter station, refer to Figure 2.4. It is understood that it was constructed to facilitate the proposed Amgen works but works were not completed.

Figure 2.4: Building to be Removed

Source: Mott MacDonald

The site is located approximately 10km distance by road from the existing Knockraha substation. The nearest residence is located approximately 139m from the proposed converter station location.

The nearest ecologically protected areas are Great Island Channel Special Area of Conservation (SAC; site code 1058) /proposed National Heritage Area (pNHA) and Cork Harbour Special Protection Area (SPA; site code 4030). These sites are located approximately 3km from the proposed converter station. The Great Island Channel pNHA is largely coincident with these European sites. Karst landscapes however offer minimum attenuation and allow the rapid movement of contaminants into groundwater. It has therefore been assumed, on a precautionary basis. that without the implementation of embedded mitigation by design, there is potential hydrogeological connectivity between the proposed converter station site and the European sites protected within Cork Harbour.

There is also potentially (weak) surface water connectivity between the proposed converter station site and Cork Harbour, via the proposed surface water system which will enter Cork Harbour at 'Slatty Water' via Annagrove Stream, following treatment (oil / water interceptors and silt traps) , attenuation to 'greenfield' run-off rates, and discharge via the existing municipal storm sewer network. Further detail is provided in Chapter 8 *Biodiversity*. A Natura Impact Statement (NIS) also supports the applications for consent.

A number of archaeological finds were recorded, and archaeologically excavated, within the overall IDA landholding during site archaeological monitoring carried out in 2007 as part of the Amgen facility development i.e. Excavation - Miscellaneous (record no. CO076-119----), Fulacht fia (record no. CO076-120----), Fulacht fia (record number CO076-121----), Burnt Mound (record no. CO076-122----), Fulacht fia (record no. CO076-123----). These are discussed further in Chapter 10 *Archaeology and Cultural Heritage*.

2.3.2 Converter Station Design

The converter station compound and ESB substation will measure approximately 3.6 hectares. The converter station compound will measure approximately 250m x 150m and will include three main buildings, up to 25m in height, outdoor equipment including 400 kV AIS equipment and four bunded transformers.

The key components of the proposed converter station and compound comprise:

- Main converter building;
- Control building;
- Storage buildings;
- Valve cooler area;
- Harmonic filter compound;
- Reactive compensation compound;
- Lightning protection poles;
- Lighting poles;
- Interface kiosk;
- Property fence / gates;
- Palisade fence / gates;
- Security lighting;
- Compound and control building for Transmission Asset Owner (TAO; i.e. ESB);
- Storm water drainage / Sustainable Urban Drainage System (SuDS) including below ground storage attenuation tanks;
- Landscaping and other associated finishing works; and
- Internal roads and access.

The main converter building will comprise a single storey structure divided into three halls; a reactor hall, a valve hall and a DC Hall.

The control room will house the auxiliary services equipment, such as control and telecoms equipment, low voltage switchgear, and emergency diesel generator, batteries and welfare facilities (i.e. toilets, messroom, etc.).

A below ground earth grid will be installed in a grid arrangement approximately 600mm below the finished surface. The earth grid will consist of a $95mm^2$ bare stranded copper conductor. The purpose of the earth grid is to ensure personnel and public safety during electrical faults that may occur on the transmission grid.

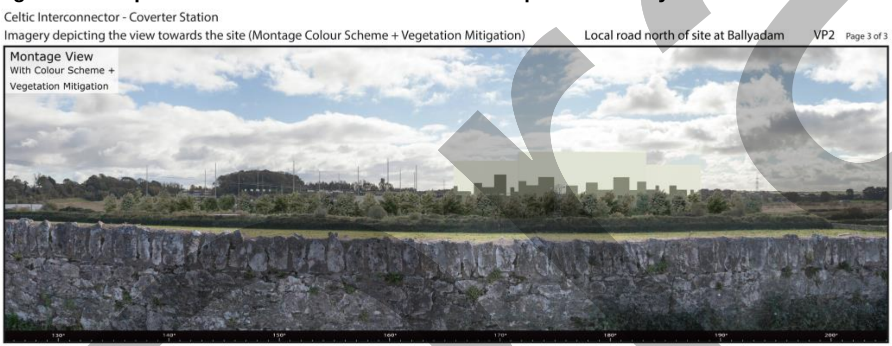
Fencing around the entire converter station compound, with the exception of the site entrances gates, will comprise external 1.4m high post-and-rail property fencing and internal 2.6m high galvanised steel palisade fencing.

The dimensions of the proposed structures on the converter station compound site are summarised in the Table 2.2, a representation of what the structures may look like is presented in Figure 2.5.

Table 2.2: Approximate Dimensions of Structures within the Proposed Converter Station Compound

Component	Length	Width	Height
Converter Station (Reactor hall)	23m	55m	22m
Converter Station (Valve Hall)	45m	55m	25m
Converter Station (DC Hall)	20m	55m	22m
Converter Station (Overall)	88m	55m	25m
Converter Control Building	28m	25m	8.5m
Storage Building	40m	15m	8.5m
Chilled Water Cooling Area	25m	15m	7m
Harmonic Filter Compound	30m	25m	11m
Transformer Area	45m	12m	12m
ESB Control Building	25m	15m	8m
Shunt Reactor (6no. structures, each with the following approximate dimensions	5m Dia.	N/A	10m

Figure 2.5: Representation of Converter Station Compound at Ballyadam



Source: Macroworks

The buildings will comprise a typical industrial form, with a structural steel frame clad with lightweight profiled metal cladding to walls and roof. Internal masonry walls will be adopted, except where specific load carrying requirements necessitate the use of reinforced concrete walls.

Industrial claddings will be factory finished. The roof will be shallow pitched and constructed of profiled metal decking on purlins spanning between rafters. The buildings will have access gantries and walkways for access to equipment. These will be constructed of stainless / galvanised steel open grating type flooring supported on steel beams and columns.

The ultimate choice of finish and colour of the metal cladding coating will be made by the appointed contractor, considering the specified service life, resistance to degradation under long term exposure to climatic conditions and will comply with the requirements of the statutory approval, if granted. All finishes will be agreed with the planning authority.

The exception to the above, is the Electricity Supply Board (ESB) owned single storey control building. This building will be designed to established ESB design specifications and will comprise a load bearing masonry building with duo-pitched timber trussed roof. The external face of the outer leaf of the perimeter cavity walls will be cement rendered and the roof will be tiled. A precast concrete slab is typically located in the ceiling of the building below the bottom chord of the roof trusses, for security reasons.

For all buildings, the external doors and escape doors will generally comprise metal flush doors and mild steel frames. Fire doors will comply with BS 476-22:1987 - Fire tests on building materials and structures. A fire detection and fire alarm system will be specified during the detail design of the station buildings in compliance with EirGrid requirements. A Fire Safety certificate application to Cork County Council will be made in advance of construction in accordance with the standard approach for the construction of Converter stations.

A lighting plan has been designed in accordance with EirGrid functional specification requirements.

Directional light fittings will be incorporated within the plan in order to minimise light pollution in the surrounding area. All external lighting will be controlled from a 2-way switch at the converter station compound entrance to prevent outside lighting being permanently illuminated. Emergency lighting will be provided above all emergency doors on the converter station. Unless incompatible with asset security / operational requirements, converter station lighting will adopt the following specifications having regard for best practice (BCT and ILP, 2018[2]) in minimising impacts to foraging bats along the railway line north of the converter station:

- LED lights only where practicable, but as a minimum lights to include no Ultra Violet (UV) elements;
- External security lighting on motion sensors and short (1 min) timers;
- Lighting with peak wavelengths of 550nm; and
- Lighting to avoid blue colour, and ideally to be warm white (<2700 Kelvin).

Figure 2.6 presents an image of the existing East West HVDC interconnector (EWIC) converter station compound in County Meath. The East West HVDC interconnector was consented by An Bord Pleanála on 14 September 2009 (An Bord Pleanála Reference PL17 .VA0002).

[2] BCT and ILP (2018). Guidance Note 08/18 Bats and artificial lighting in the UK. Bats and the Built Environment series . Available from https://cdn.bats.org.uk/pdf/Resources/ilp-guidance-note-8-bats-and-artificial-lighting-compressed.pdf?mtime=20181113114229&focal=none Accessed January 2021.

Figure 2.6: EWIC HVDC Converter Station with an outdoor compound

Source: EirGrid

2.3.3 Drainage Design and Wastewater Discharge

The following section provides an overview of the drainage proposals and wastewater management at the proposed converter station site.

2.3.3.1 Water Supply

The proposed converter station will require a clean water supply for both fire-fighting and welfare purposes (i.e. hand-washing, toilet flushing etc.).

Due to the 'unmanned' nature of the proposed development, there will be no demand for water at the site during a typical week. Demand for water will arise however when personnel are present on site to carry out periodic inspections or maintenance work and the peak demand during this period has been estimated at 675 l/week based on the following assumptions:

- 4 No. person crew on-site for a total of 3 days;
- Per-capita demand of 45 litres per day and a peaking factor of 1.25 applied in line with Irish Water standards;
- No urinals or automatic flushing mechanisms in place; and,
- Taps incorporate automatic shut-off mechanisms.

Although records indicate that there are numerous water supply pipelines within the Ballyadam area, the IDA landholding, including the site of the proposed converter station, is not currently serviced. Permission will therefore be sought from Irish Water for a new connection to an existing 150mm watermain located in the local road which forms the western boundary of the overall IDA landholding.

2.3.3.2 Wastewater Drainage

The proposed converter station will require welfare facilities (toilets, wash-hand basins etc.) in a number of the buildings for use by staff when present on site.

As detailed above, the station will generally be 'unmanned, the peak loading during this period has therefore been estimated at 600 litres per week based on the following assumptions :

- 4 No. person crew on-site for a total of 3 days;
- Per-capita demand of 50 litres per day in line with Irish Water standards;
- No urinals or automatic flushing mechanisms in place; and
- Taps incorporate automatic shut-off mechanisms.

Records indicate that a 500mm diameter foul water drainage pipe has been laid in the south-west corner of the existing IDA site, presumably to facilitate connection to the public wastewater network by developers on the overall landholding. Due to the shallow depth of this pipe and the significant distance (>700m) between it and the proposed convertor station compound, it is not possible to achieve a gravity connection to this pipeline.

Although a connection could be achieved by installing a package pumping station to lift flows to the discharge point, this option is undesirable from cost and reliability perspectives due to the very low and intermittent volumes of wastewater flow expected to be generated at the site. It is instead proposed that wastewater is collected in proprietary holding tanks which will be periodically emptied by a licensed waste disposal contractor to licenced facilities. Separate holding tanks will be provided for control buildings located in the converter station and for those located in the reactor compound to facilitate separate billing.

The holding tanks will be fully sealed to prevent discharge to ground and will include a high-level alarm and telemetry link to the converter station's control system such that they can be monitored remotely and emptied when necessary.

2.3.3.3 Storm Water Drainage

Development of the proposed converter station will require existing permeable ground to be replaced with impermeable surfaces (roads, roofs, etc.) and this will result in a corresponding increase in storm water runoff during rainfall events.

To comply with established best practice, a storm water drainage system incorporating SuDS features will be constructed to manage the quantity and quality of runoff during rainfall events. The system will operate by gravity and be sized to ensure that no internal property flooding occurs for the critical storm with a 1 in 100-year return period including a +20% allowance for climate change.

The proposed storm water drainage / SuDS system will incorporate the following key features:

- Traditional storm water collection and conveyance elements such as gutters, downpipes, gullies, channels and below ground pipework;
- Flow control devices (e.g. 'hydrobrake' or equivalent) to restrict the rate of discharge from the site to greenfield runoff rates;
- Below ground attenuation tanks to balance incoming flows and prevent flooding in the event of an extreme storm event;
- Silt traps and hydrocarbon interceptors to remove any pollutants which may have become entrained in the runoff; and,
- Shut-off valve chambers to prevent discharge from the drainage network in the event of an emergency.

All proposed surfaces and storm water drainage elements will be sealed to protect the soluble karst rock beneath the site.

Runoff is proposed to be discharged to an existing 600mm diameter storm water drainage pipe which has been laid in the south-west corner of the existing IDA site. This 600mm pipe is part of to the public storm water drainage system which serves the Carrigtwohill area and which discharges to 'Slatty Water' via Annagrove Stream.

Discharge from the converter station site and the associated access roads is proposed to be restricted to greenfield runoff rates in line with the recommendations of the Greater Dublin Strategic Drainage Study (GDSDS Vol. 2 – New Development) which have generally been adopted by Local Authorities across the country.

2.3.3.4 Flood Risk

A detailed and site-specific flood risk assessment has been undertaken to assess the level of flood risk associated with the proposed development and a copy of the associated report is included in Appendix 7.2.

Commented [DH4]: **REPORT TO BE INCLUDED IN THE FINAL FILE**

2.3.3.5 Compensatory Storage

The existing lands within the footprint of the proposed convertor station include two large depressions which are understood to have been formed during undertaking of the previously permitted site development works. The previously permitted development was subsequently abandoned but these excavations were never backfilled.

The depressions have a combined area of approximately 20,000m^2 and are between 2.5 and 3m in depth. They will need to be backfilled with suitable material in order to provide a stable foundation for the proposed convertor station compound.

From hydraulic modelling carried out as part of the flood risk assessment for the site, it has been established that these depressions provide a level of storm water storage during rainfall events and, as a consequence, are helping to reduce the level of flood risk within the overall IDA landholding.

Backfilling of the depressions will reduce the volume of storm water storage currently available on site and this has the potential to increase the risk of flooding elsewhere within the overall IDA landholding.

In order to mitigate the increase in flood risk caused by backfilling the two depressions, it is proposed to develop an area of 'compensatory storage' adjacent to the convertor station compound. This area will be specifically designed to accept and store water during rainfall events and it will be sized to ensure that there is no significant increase in flood risk in the 'post-development' case when compared to the 'pre-development' case. In the latter, the storage area does not need to have a volume and depth equivalent to that of the two existing depressions because it has been established through hydraulic modelling that the existing depressions only partially fill, even during extreme storm events. This compensatory storage area will consist of a below ground and covered storage tank, which will be emptied at a controlled rate via a pumped connection to the storm water drainage system which will serve the proposed converter station access road. Discharge from the compensatory storage area will be restricted to greenfield runoff rates to ensure that there is no significant increase in flood risk elsewhere.

Flood water routing in the form of open channel drains and culverts will be installed around the perimeter of the proposed converter station to divert overland flow towards the dedicated compensatory storage area, rather than towards the location of the infilled depressions.

2.3.4 Site Access Roads

The proposed internal access road for the converter station site has been developed during detailed engagement with the IDA and its consultants to tie into the existing internal roads within the larger IDA landholding. This proposed internal access road has been developed independent of any potential future access routes to the Ballyadam site (including a potential N25 interchange to the south west). The design can however readily connect into such proposals in the future, in the context of the anticipated evolution of the overall IDA Ballyadam landholding as an industrial/employment node, without affecting the conclusions of this EIAR.

The internal access road is proposed to be a paved 8m wide two lane single carriageway with pathways each side. The road construction will consist of flexible pavement layers and relevant sub-base and capping layers.

2.3.5 Operation and Maintenance

The converter station does not require any full-time personnel for operation. Two types of maintenance regimes will be required on an annual basis for the converter station, namely scheduled and unscheduled maintenance.

Scheduled maintenance of the converter station will occur once a year and take approximately three days for a crew of four personnel. The HVDC link will need to be taken offline for essential maintenance during this time. This maintenance will involve replacement of faulted power electronic equipment, replacement of faulted fibre optic links, general cleaning of HV areas and visual inspection of HV plant.

Typically, every five years, during this scheduled maintenance, more invasive maintenance works will be required for works such as transformer taps cleaning and switchgear cleaning.

Unscheduled maintenance of the converter station will typically occur at unknown times throughout the year and, it is assumed for the purpose of this EIAR, will lead to loss of operation for approximately 3 days per annum to repair and / or replace faulted equipment. Unscheduled maintenance occurs due to unforeseen trips and emergency outages, but these will be infrequent.

2.4 Laying of Underground Cable

As detailed previously, the Celtic interconnector will connect to the Irish electricity transmission system at the connection point at Knockraha substation via a HVAC underground cable. AC is the technology utilised on the Irish electricity transmission network.

In contrast, electricity is best carried over long distances by means of HVDC technology. As such, a HVDC submarine cable will connect to a HVDC onshore underground cable at a TJB north of the car park at Claycastle Beach near Youghal in County Cork.

The majority of the HVAC and HVDC underground cables (UGCs) will be installed within the existing public road network. Off-road (cross-country) routes are proposed at particular locations to avoid constraints. These locations include:

- North of Claycastle Beach where, due to structural constraints associated with an existing narrow railway bridge, it is necessary to divert the UGC off road for approximately 241 metres in the area of, and under, the planned Midleton to Youghal Greenway (currently under construction). Approximately 65 metres of the 241 metres of land cable for this off-road section will be installed within Ballyvergan Marsh proposed Natural Heritage Area (pNHA (site code 000078).
- The villages of Killeagh and Castlemartyr will be avoided by means of cross-country routing; this will minimise disruption and nuisance for these villages, their residents and communities,

and for traffic passing through the villages which are both located on the N25 Cork-Waterford-Wexford / Rosslare National route.

The HVAC and the HVDC UGCs will terminate at the converter station site compound described in Section 2.3.2.

Laydown areas, where construction materials can be temporarily stored, and construction compounds, where welfare facilities can be provided, will also be required along the route. These are discussed in Chapter 3.

The following sections describe the key project elements common to both the HVAC and HVDC routes.

2.4.1 Joint Bays

The cable will be delivered to site on drums. Joint bays will be required to be installed along the cable route to join consecutive lengths of cable and to facilitate cable pulling. These are underground chambers which are used as the location to pull the various lengths of UGC through pre-installed ducts, and to connect ("Joint") together those lengths of UGC into a single overall circuit. Typically, joint bay separation is between 500m and 850m, depending on the cable supplier, with all joint bays being located with the cable corridor. A 400kV joint bay is typically 6m x 3m.

Provision will also be made for the installation of (C2) communications chambers and link box chambers at various joint bay locations. The C2 chamber is used to join the fibre optic communications cable and the link box chambers are used to accommodate the link box, which earths the outer sheaths of the power cables.

The chambers are provided with removable lids and access to the chambers will be required on a permanent basis to facilitate maintenance. Typically, these chambers are located within the verge to minimise traffic disruption during routine maintenance.

Joint bays are not readily accessible during operation as there is no ongoing maintenance required; however, they need to be immediately accessible in the unlikely event of cable failure requiring cable replacement. The extent to which traffic management or other measures would be required in this situation will depend on the location of the joint bay within the roadway.

An image of a HVAC joint bay is presented in Figure 2.7. An image of a joint bay with the link box and communications chamber visible is provided in Figure 2.8. An extract from a drawing showing the scale of the link box and communications chamber relative to the joint bay is shown in Figure 2.9.

To facilitate traffic management at locations where joint bays are located within the carriageway, the use of temporary passing bays is proposed.

Further detail on passing bays and the installation of joint bays is provided in Section 3.4 of this EIAR.

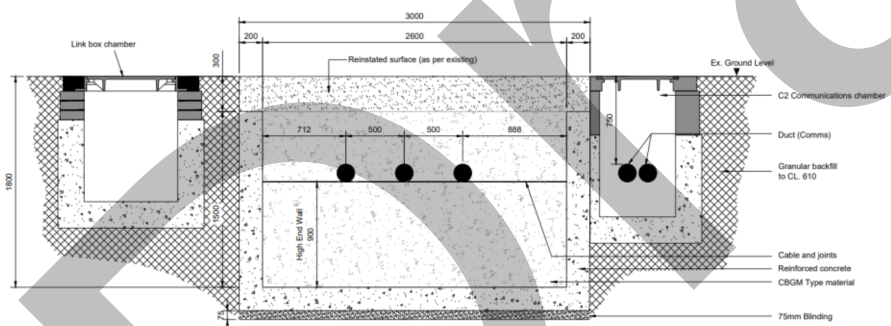
Figure 2.7: HVAC joint bay with one cable pulled

Source: EirGrid

Figure 2.8: Joint bay with link box and communications chamber shown

Source: Mott MacDonald

Figure 2.9: Typical joint bay drawing showing scale of link box and communications chambers



Source: Mott MacDonald

2.4.2 HVAC / HVDC Underground Cable

In general, and wherever possible, the UGC will be pulled into pre-installed ducts laid within a trench. The installation conditions of the cable, including depth, affect its performance.

The standard trench dimensions for a (400 kV) HVAC route is approximately 0.8m wide x 1.5m deep.

The standard trench dimensions for a HVDC route is approximately 0.8m wide x 1.3m deep.

These dimensions are based on a standard arrangement within the public roadway. In open land, for cross country routing, space is relatively unconstrained. Additional space may however be required for route alignment to avoid underground objects such as tree roots or other unidentified obstructions that cannot be removed.

The final specific trench dimensions will be confirmed at detailed design stage.

A trench will be opened, the ducts installed in the correct arrangement and the trench will be backfilled with suitable back-fill material and marker boards for protection. Following duct installation, the road above the trench will be reinstated to match the environment in which it is installed to the standard required by the relevant authority at that location, in this case Cork County Council and / or TII. Figure 2.10 shows a typical trench in a public road for a pair of HVDC cables after installation of ducts and prior to back fill. Marker boards can be seen within the trench prior to final reinstatement.

Cable is manufactured and delivered to site on drums, in lengths of approximately 750 to 1000 metres, requiring the installation of joint bays to join consecutive lengths of cable together. Refer to Section 2.4.1 above for further detail on joint bays.

Figure 2.10: Typical HVDC Cable Trench in Road

Source: EirGrid

A number of crossings of watercourses, drainage ditches, utilities, railway lines and the Midleton to Youghal Greenway will also be required along the cable route. These crossings will be facilitated by either open cut trenching or by use of Horizontal Directional Drilling (HDD) as and when appropriate. The specific detail of each crossing will be developed by the appointed contractor. Further detail on the installation of the UGC and crossings is provided in Section 3.4 of this EIAR.

2.4.3 Operation and Maintenance

The HVAC / HVDC cable route will require no specific or routine maintenance activities along the cable trench or joint bay locations. Access may be required at joint bays on rare occasions to facilitate cable replacement if a failure occurs.

Access to link boxes and communications chambers, as described in Section 2.4.1, will be required on an annual basis for inspection and any necessary maintenance. It is expected that ESB Networks (ESBN) will own the HVAC assets and that ESBN will be responsible for maintenance of the HVAC cable. The HVDC cable assets will be owned by EirGrid

Interconnector DAC and EirGrid Interconnector will be responsible for the maintenance of the HVDC cable.

2.5 Landfall Area

The HVDC submarine cable will be brought ashore at Claycastle Beach. The HVDC land cable and the HVDC submarine cable will join at a Transition Joint Bay (TJB) to be located to the north of the car park at Claycastle Beach.

Infrastructure at the landfall area is limited and will consist of:

- One TJB with two underground concrete chambers which will house the joint between the submarine cable and the land cable. Two chambers are required: one for each pole.
- One communications (C2) chamber, which will house the joint between the submarine communications / fibre optic link and the land communications / fibre optic link.

The layout and arrangement of the above elements are as shown in Figure 2.11. All permanent infrastructure at the landfall will be underground.

Two options are available for the installation of the submarine cable at Claycastle Beach.

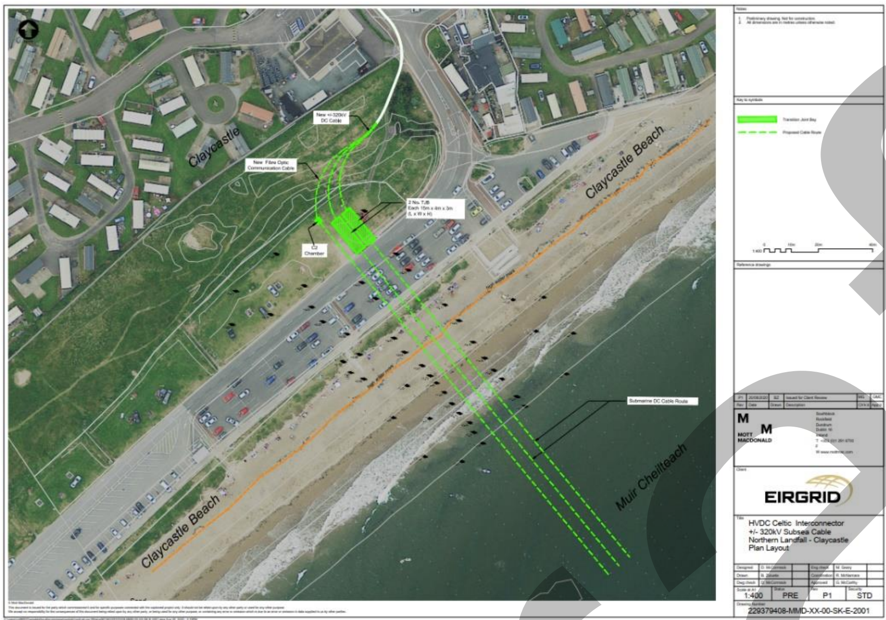
1. Install the conduits almost to the LAT level and thus minimise disruption to the beach during the bathing season but increase the construction effort in phase one.
2. Install the conduits below the car park and extending only a short distance below the beach, significantly reducing the construction effort, in particular there would be no requirement for a causeway and the extent of cofferdam piling would be minimal reducing associated noise and traffic. However, it would result in short duration exclusion zone and detours on the beach during the cable installation.

Option 1, in general, represents the worst-case option in terms of potential environmental impacts due to the requisite installation of temporary steel-piled cofferdams and a temporary causeway for access. Option 2 would however require access to the beach to be restricted for approximately two to three days per cable (three in total).

Option 1 is the option that is assessed in the subsequent sections of this EIAR (Volume 3C2). Further detail on Option 1 and Option 2 is provided in Volume 3D2.

As detailed above, temporary steel-piled cofferdams and a temporary causeway for access will be required along Claycastle Beach in order to facilitate installation of the submarine cable. The beach and surrounding areas will be reinstated following construction. Option 2 would not require a causeway and the cofferdam would be much reduced in length, approximately 5m). Further information on the proposed landfall is provided in Section 3.4. A detailed description of the installation of the submarine cable is provided in Volume 3D2.

Figure 2.11: Proposed Underground Development at Claycastle Beach (Irish landfall)



Source: Mott MacDonald

3 Onshore Construction Phase Activities

3.1 Introduction

The following sections provide an outline of the anticipated construction phase activities and controls.

3.2 Converter Station Construction

Prior to enabling works the Near Threatened plants and European protected habitat parcels, discussed in Section 2.3.2 (and Chapter 8 *Biodiversity*), will be moved to a temporary storage area. In addition, the existing substation building to the north of the proposed converter station compound, also discussed in Section 2.3.2, will be demolished.

The converter station site will consist of a new engineered stone fill platform which will raise the proposed site level above its existing level. This will ensure that a gravity below ground closed drainage system can be accommodated.

Any poor ground (soft spots or contaminated areas) below the platform will be excavated and removed from site. Any waste arising will be managed in accordance with the Waste Management Act 1996 S.I. No. 10/1996 (as amended), and associated Regulations. All engineered stone fill for the new platform will be brought to site. Contaminated ground identified during enabling works will be handled according to the contractors Construction Environmental management plan (CEMP) and associated Risk Assessment Method Statements (RAMS). Any such ground will be characterised according to Waste Acceptance Criteria and dealt with via a bespoke remediation strategy or materials management plan

The completed platform will provide a stable base from which the proposed buildings and structures on site will then be constructed. Rotary bored cast-in-place reinforced concrete piles will likely be adopted for all foundations on this site, as detailed in Section 3.3.1. The site piling can commence as soon as a large enough area of platform is completed.

The site below ground drainage installation can commence on completion of the proposed platform. The access road drainage installation can commence on completion of the access road enabling works.

The construction of the proposed site access road can commence at the same time as the piling works. This would consist of removing all poor ground and any material from areas to be cut and removing this material from site. All fill for embankments will consist of engineered stone that will be brought to site.

A Contractors compound will be located within, or in proximity to, the converter station site boundary and will be located on an area of ground that will be temporarily surfaced with engineered stone and levelled. The compound will house the Contractors cabins and areas for temporary storage of construction materials (excluding cut / fill ground, which will be brought directly to and from site with no need for temporary storage).

Construction of the reinforced concrete piled raft for all of the buildings and structures can commence once the piling is complete. The structures and building will then progress commensurate with typical construction practice, as follows;

- Steel frame for the buildings will be installed and fixed down to the piled raft slabs.
- The lightweight cladding to the roofs and walls will be installed and fixed back to the primary frames making the structures weather tight.

- The works within the buildings can then progress, including mechanical, electrical and plumbing (MEP) installation and building fit-out.

3.2.1 Converter Station Piling

Due to the ground conditions on the Ballyadam site, it is likely that rotary bored cast-in-place reinforced concrete piles socketed into rock will be adopted for all foundations on this site.

Specialist and experienced piling Contractors will be employed to carry out any such piling works. Method statements, piling risk assessments and environmental management plans, specific for the area where the drilling is to take place, will be carried out / prepared in line with contractual agreements. The piling risk assessments will include for example, groundwater / aquifer protection and the implementation of robust monitoring of the works and an emergency response plan. These documents will be submitted by the Contractor to the planning authorities for discussion and acceptance prior to commencing piling operations.

The presence of voids would be recognised by an experienced piling operator during the boring of the piles, prior to concrete placement. In such cases, the piling Contractor would install a permanent casing (likely a thin steel sleeve) to retain concrete within the pile bore / shaft. This requirement will be clearly stated in the piling performance specification and contractual agreements.

Additional measures will include, but will not be limited to:

- A minimum of one Geotechnical Engineer and one Resident Engineer will supervise the piling works. Supervision of each piling rig will be required.
- The piling operator will be experienced in successful piling within Karst regions.
- Clear lines of communication with defined roles and responsibilities will be maintained between the site team, the Contractors and the Design Engineers throughout the works.
- Monitoring of the concrete volumes poured into the pile against the estimated volume that the pile requires will be carried out, to ensure that concrete is not being lost into voids in the ground.
- Monitoring of piles for potential vertical settlement of fresh concrete; an indicator of potential concrete loss.

3.3 Laying of Underground Cable

The cable route construction phase is split over two stages as follows:

- Installation of an underground ducting system, requiring excavation and reinstatement; and,
- Installation of the cables into the ducting system using pulling equipment.

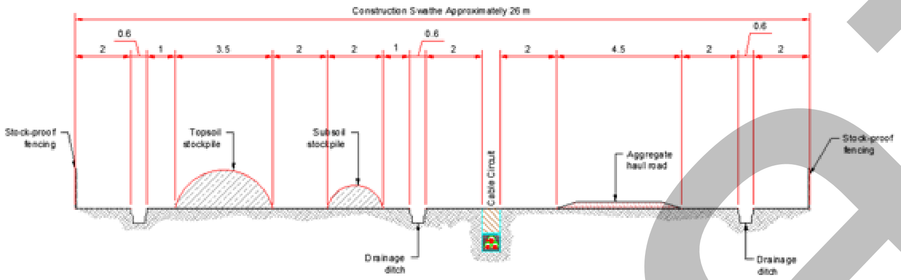
Construction activities require temporary areas for laydown and sufficient area for all construction activities including access and egress. The proposed construction site areas along the route will be required to accommodate the following:

- Installation of below ground drainage systems;
- Excavation of cable trenches;
- Temporary storage of excavated material in preparation for its reuse, if suitable;
- Temporary storage of excavated topsoil in preparation for its reuse, if suitable;
- On greenfield sites, temporary access roads may be required (approximately 4.5m wide typically constructed of compacted engineered stone and removed after works are completed);
- Pedestrian walkway / access for construction workers;

- Laydown areas. These are areas where construction materials can be temporarily stored;
- Security fencing;
- Appropriate welfare facilities; and,
- Additional space requirements at joint bays and sites of engineering.

Additional space may also be required for route alignment to avoid underground objects such as tree roots or other unidentified obstructions that cannot be removed. A typical construction swathe for an open countryside, i.e. without a space limitation and without need for laydown / storage etc. is shown in Figure 3.1.

Figure 3.1: Typical Cable Circuit Construction Swathe for Open Land



Source: Mott MacDonald

3.3.1 Duct Installation Typical

To construct a duct bank, a trench is excavated to the specified depth, refer to Section 2.4.2 for details. Once the desired depth is reached, the trench walls will be temporarily supported, typically with wooden shuttering boards.

When a trench length of approximately 20m to 50m has been excavated and temporarily supported, a layer of bedding material (sand, concrete or sand / cement mix) is laid onto the base of the trench. The ducts are then installed onto the bedding and then the ducts are surrounded and covered with appropriate material. Protective tiles and hazard marker tape are installed. The trench is then backfilled and compacted with thermally suitable indigenous material and the ground reinstated to the original standard or as agreed with the landowner or consenting authority.

The duct installation will progress sequentially starting at one joint bay and moving towards the next joint bay along the route. The construction area moves along in tandem with the progress of the duct installation, with only the relevant portion of the section cordoned off while under construction.

3.3.2 Duct Installation in Roads

The installation of a duct bank within roads is similar to the typical installation described above, with some additions. Traffic control measures will be required as appropriate, including passing bays, road diversions, closures and stop / go traffic management. Once the traffic control measures are in place, the road surface will be saw cut to the width of the trench and excavated using an excavator with hydraulic breaker. Trenches will be excavated to a specified depth, in accordance with the required project trench design and requirements of the relevant authority. Once the depth is reached, the trench will be temporarily supported.

The primary difference between construction outside of road areas and those within road areas is that there is very little space for local storage of construction materials including excavated material and new fill material. This necessitates the requirement for designated laydown areas along the road bound cable route.

3.3.2.1 Excavation within Roads of Width Greater than 3m

For trench excavation works in roads where space is relatively unconstrained, an excavator is typically used to load a truck with excavated material. The truck will then extract the material away from site for appropriate remediation or storage. The excavator and tipper truck would typically sit in parallel to each other and the trench run direction. This allows the excavator to load the truck with minimal bucket swing and the tipper lorry to approach, stop and drive away once full.

For roads with a width greater than 3m, an average rate of construction for the cable route is assumed to be 50m per day. In places it may be slower than this, particularly built up areas where utilities are more common, however, across the period of construction 50m a day is considered a representative average for the proposed works. Typical excavation is shown in Figure 3.2.

Figure 3.2: Typical Excavation

Source: pl.depositphotos.com

3.3.2.2 Excavation within Roads of Width of 3m or less (Narrow Roads)

Excavation in narrow roads (i.e. widths of 3m or less) introduces a number of challenges compared to the more standard road widths described above.

The excavation process where the excavator and truck sit in parallel is unlikely to be feasible due to available road width.

In addition, it may not be practical for a relatively wide truck (approx. 2.6m width) to navigate such roads. If this is the case, then smaller site vehicles will be required to remove the material from the trench area to an area where the material can then be transferred into larger tipper trucks.

For narrow roads, a progress rate for site preparation, excavation, cable installation and reinstatement is estimated at approximately 20m per day.

3.3.3 Duct Installation in Ballyvergan Marsh

Duct installation, by HDD (refer to Section 3.3.7), in Ballyvergan Marsh pNHA will be subject to special restrictions to protect the reasons for designation of the site as follows.

Regardless of season, all works will be carried out within sound reducing hoarding.

If duct installation is programmed from March to August inclusive (i.e. the breeding bird season), the Contractor may only remove vegetation (including scrub and grass) if this is permissible in accordance with the planning conditions and:

- Vegetation removal has already been carried out during September to March inclusive (i.e. the wintering bird season); or
- A suitably qualified ecologist with demonstrated experience in finding bird nests has determined that nesting birds and other protected species are absent or are otherwise protected from disturbance / injury.

If duct installation is carried out from September to March inclusive (i.e. the wintering bird season):

- A restriction of high-noise level operations to the period approximately 30 minutes prior to the earliest sightings of arriving Hen Harriers. Cut-off times are as follows:
  - November: 15: 30
  - January: 14:15
  - February: 16:50
  - March: 17:25
- During the works monitoring for hen harrier will take place. Should hen harrier be observed returning to a roost, works will cease until the bird has left.

3.3.4 Cable Installation

The cables will be brought to site on cable drums which will then be placed into position by tractor and trailer. Once the drum is set up, a winch system including pulling cable will be attached to the nose of the cable and rollers will be used to guide the cable end towards the duct. The cables will then be pulled into the duct with lubrication being applied to the cable and duct throughout the process in order to control pulling tensions.

The main parameter to be evaluated when assessing the cable laying aspects is the cable pulling tension. The techniques to be used depend on the pulling tension required. For example, caterpillars or hauling machines could be used to reduce or null the force applied. It is necessary to synchronise the winch, drum and any intermediary hauling machines to prevent damage to the cable occurring as a result of the imparting of undue force onto the cable during installation.

A bend radius of typically 20m or greater is used to navigate changes in direction for the cable route. The bend radius can be reduced to 6m to navigate very tight corners however as this introduces increased pulling tensions when installing the cable, it is used sparingly and only where required. This applies for both the HVAC and HVDC cable routes.

For tight bends with acute angles, this would require that the excavation and the installation of the ducts and cables being conducted using synchronised cable haulers and split ducts or a similar methodology, rather than pulled through the duct system.

3.3.5 Cable Jointing

As detailed in Section 2.4 *Laying of Underground Cable*, joint bays will be required to be installed along the cable route to join consecutive lengths of cable and to facilitate cable pulling.

The cable jointing process is labour intensive, technically demanding and essential to the effective operation of the cables. For this reason, a temporary waterproof shelter system is either placed or constructed around the joint chamber to provide a clean environment in which the jointing process can be undertaken.

The width of the joint bays and the nature of the road network in the area means that road closures may be required along the route during construction and operation.

Joint bays generally consist of precast concrete walls and base located below ground with typical approximate dimensions of 10m long and 3m wide, with a depth of approximately 2.4m. Sand or lean mix concrete may be used as a blinding layer to the underside of the chamber. The ducts will be installed to each end of the chamber, then proven, cleaned and sealed.

The open concrete chamber will temporarily support the retained ground on the outside of the chamber during the ducting activities. Once these activities are completed, the open chamber will be temporarily backfilled with appropriate material and the road temporarily reinstated to the satisfaction of Cork County Council / TII until such time as cable installation will occur. The construction schedule is detailed in Section 3.8 *Outline Construction Schedule and Timing of Works*.

During cable installation, the joint bay will be excavated, and material within the chamber removed, some of which may be stored adjacent to the excavation for use in the reinstatement. As illustrated in Figure 3.3, the cables will be pulled into each end of the chamber and the cable ends jointed together within the chamber. Jointing is expected to take approximately one to two weeks per joint bay, during which time a shelter will be erected over the chamber to protect the cable from moisture and contamination during jointing.

Following jointing, the joint bay will be backfilled and the road surface permanently reinstated to the standard required by the relevant authority at that location, i.e. Cork County Council, and for the HVDC cable on national roads, TII, depending on the location.

An example of HVDC cable pulling is shown in Figure 3.3. An example of the shelter used during jointing is provided in Figure 3.4.

Figure 3.3: Typical HVDC Cable pulling?

Source: EirGrid

Figure 3.4: Typical HVDC Cable Jointing Bay Shelter

Source: EirGrid

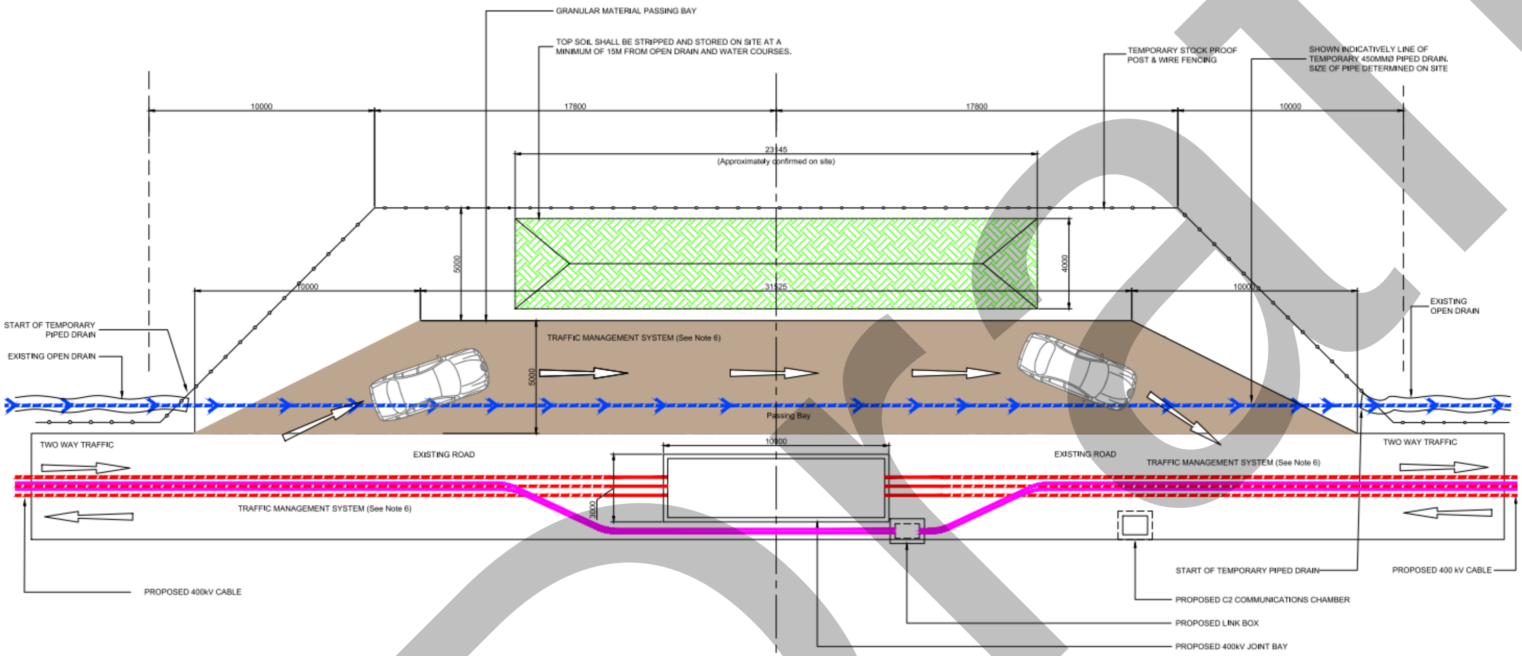
3.3.6 Passing Bays

To facilitate traffic management at locations where joint bays are located within the carriageway, the use of temporary passing bays is proposed.

Prior to the commencement of joint bay works, construction of the passing bay will be carried out. This will entail removing the top layer of ground to the side of the carriageway and temporarily storing it local to the site for reinstatement following the works. The passing bay will then be constructed to a standard agreeable to Cork County Council / Transport Infrastructure Ireland (TII) requirements.

This passing bay can then be used for diverted traffic whilst the joint bay works are conducted. Figure 3.5 illustrates the concept of a typical passing bay, dimensions may change depending on location and number of joint bays positioned locally.

Figure 3.5: Typical Passing Bay



Source: Mott MacDonald

3.3.7 Cable Crossings (Water, Rail and Utility)

A number of crossings will be required along the cable routes. These crossings will be facilitated by either open cut trenching or HDD as and when appropriate.

A description of typical open cut trenching and HDD methods is provided hereunder. Table 3.1 presents the known anticipated crossings along the proposed cable routes. All works will be preceded by detailed utilities / services location assessments, and where existing utilities / services are identified, the works will be diverted around the service / utility or below them depending on the level of complexity arising.

The identification of crossings along the proposed cable routes has been based on consultations with utility providers, site walkovers, field studies and reviews of publicly available datasets such as Environmental Protection Agency (EPA) datasets and mapping. Some smaller features, such as some drainage ditches, may remain unidentified as they do not appear on mapping or databases. However, such features will be identified at construction stage and the embedded and additional mitigation detailed and proposed as part of this EIAR will be implemented when dealing with any such features.

Table 3.1: Known Anticipated Crossings

Route Section Reference	Crossing Detail	Crossing	Proposed Crossing Method
AC02-AC03	Utility (Eir)	Ducting	Trench
	Watercourse IE_SW_19B060800	Existing Culvert	Trench
	Unnamed drainage ditch	Existing Culvert	Trench
AC03 – AC04	Unnamed drainage ditch	Existing Culvert	Trench
AC04-AC05	Unnamed drainage ditch	Existing Culvert	Trench
AC05-AC06	Utility (Eir- several locations)	Ducting	Trench
	Utility (Irish Water Supply – several locations)	Pressurised pipe	Trench
	Unnamed drainage ditch	Existing Culvert	Trench
	Unnamed drainage ditch	Existing Culvert	Trench
AC06-AC07	Railway (Live)	Rail Embankment	HDD
DC01-DC02	Railway (Live)	Rail Embankment	HDD
	Utility (Irish Water Supply – several)	Pressurised pipe	Trench
	Utility (Eir – several)	Ducting	Trench
	Utility (ESB)	Ducting	Trench
	Unnamed drainage ditch	Existing Culvert	Trench
	Owennacurra - IE_SW_190030400	River	HDD
DC02-DC03	Utility (Eir - several)	Ducting	Trench
	Utility (Gas Networks Ireland Transmission)	Gas Transmission Pipeline	HDD
	Utility (Gas Networks Ireland Transmission)	Gas Transmission Pipeline	HDD
	Utility (Irish Water Supply – several locations)	Pressurised pipe	Trench

Route Section Reference	Crossing Detail	Crossing	Proposed Crossing Method
	Owennacurra - IE_SW_190030500	Twin Culvert	Trench
	Owennacurra - IE_SW_190030500	Existing Culvert	Trench
DC03-DC04	Utility (Eir)	Ducting	Trench
	Owennacurra - IE_SW_190030500	Existing Culvert	Trench
	Greenway Midleton to Youghal (Historic Railway)	Rail Embankment	HDD
	Dungourney - IE_SW_D070700	River	HDD
DC04-DC05	Utility (Water supply)	Pressurised pipe	Trench
	Utility (Water foul drainage)	Existing Culvert	Trench
	Utility (Telecoms)	Ducting	Trench
	Unnamed drainage ditch	Culvert	Trench
DC05-DC06	Utility (ESB)	Ducting (for electrified cable)	Trench
	Utility (Water Supply)	Pressurised pipe	Trench
	Utility (Telecoms)	Ducting	Trench
	Unnamed drainage ditch	Existing Culvert	Trench
	Unnamed drainage ditch	Existing Culvert	Trench
DC06-DC07	Utility (Water Supply)	Pressurised pipe	Trench
	Utility (Gas)	Gas Transmission Pipeline	Trench
	Womanagh_010 - IE_SW_19W011000 Unnamed drainage ditch	River	HDD
DC07-DC08	Utility (Telecoms)	Ducting	Trench
	Womanagh_020 - IE_SW_19W011300	Existing Culvert	Trench
	Moanlahan_010 - IE_SW_19M290850	Twin Existing Culverts	Trench
DC08-DC09	Greenway Midleton to Youghal (Historic Railway)	Rail Embankment	HDD
	Dissour_20 - IE_SW_19D030600	River	HDD
	Dissour_20 - IE_SW_19D030600	River	HDD
DC09-DC10	Utility (Water Supply)	Pressurised pipe	Trench
	Utility (Telecoms)	Ducting	Trench
	Utility (ESB)	Ducting (for electrified cable)	Trench
	Dissour_20 - IE_SW_19D030600	River	Trench
	Womanagh_030 - IE_SW_19W011400	River	Trench
	Womanagh_030 - IE_SW_19W011400	River	HDD

Route Section Reference	Crossing Detail	Crossing	Proposed Crossing Method
	East Ballyvergan_10 - IE_SW_19E040700	River	Trench
	Cattle Underpass (Gortroe Cross)	Existing Culvert	HDD
DC10-DC11	Utility (Water Supply)	Pressurised pipe	Trench
	Utility (Telecoms)	Ducting	Trench
	Utility (ESB)	Ducting (for electrified cable)	Trench
DC11-DC12	Utility (Foul Drainage)	Existing Culvert	Trench
	Utility (Water supply)	Pressurised pipe	Trench
	Utility (ESB)	Ducting (for electrified cable)	Trench
	Greenway Midleton to Youghal (Historic Railway)	Rail Embankment Approximately 65m of the HVDC cable will traverse Ballyvergan Marsh pNHA	HDD
	Unnamed drainage ditch	Existing Culvert	Trench

3.3.7.1 Open Cut Trenches at Water Locations

Open cut water crossings have the potential to generate silt and suspended solids. In order to reduce the risk of discharging sediment it is proposed to carry out all of these works in a dry works area.

The dry works area will be isolated by installing an impermeable barrier between the watercourse and the works area. The impermeable barrier will be tailored to the watercourse in question. Potential techniques include the use of inflatable dams, frame dams or, in smaller watercourses, sandbags (double-bagged and underfilled; containing only clean washed sand). Water pumped from the dry works area will be treated using settlement tanks to remove sediment prior to discharge back to the watercourse. In more sensitive (i.e. salmonid and / or lamprey) watercourses and in consultation with IFI, greater filtration of silt may be achieved prior to discharge, e.g. through use of silt de-watering bags which trap silt and expel only clean water, and can be left to biodegrade on riverbanks as a habitat enhancement measure.

Water will be conveyed over the isolated section of channel by pumping or the use of a temporary diversion. Where sufficient capacity is available, and there is no risk of excessive scour, the diversion will be within the footprint of the existing channel.

The existence of a temporary impermeable barrier within the channel, will have a direct impact on the cross section of the channel and is expected to give rise to localised changes in water depth, velocities and sediment erosion / deposition.

Where open trenching is proposed, site restoration works will be carried out following completion of the crossing, in agreement with IFI. These works may include riverbank stabilization, gravel replacements etc. In all cases, the site will be restored post installation.

The in-channel works will not commence if a Met Éireann Status Orange or Red weather warning is in place (www.met.ie), unless otherwise agreed with the Ecologist in the Employer's Representative team.

Except in exceptional circumstances and with the agreement of Inland Fisheries Ireland (IFI), any element of the scheme requiring instream works will be restricted to the fisheries open season (i.e. restricted to July to September inclusive). At a number of specific crossing locations electrofishing may be required to remove fish under licence from IFI. These locations will be agreed with IFI prior to works commencing. A detailed method statement for instream works specific to each river crossing will be prepared and the report authorised by a suitably experienced aquatic ecologist. This will be finalised and agreed with IFI.

Detailed mitigation measures, including setback distances from watercourses, refuelling and concrete pouring restrictions, biosecurity protocols, and emergency response procedures are contained in Chapter 7 *Surface Water, including Flood Risk* and Chapter 8 *Biodiversity.*

3.3.7.2 Open Cut trenches at Utilities Locations

There are a number of existing utility services of varying diameters and depths along the HVAC and HVDC route as described in Table 3.1. At these locations, the following options are available:

- Locate below the existing service. The UGC would be positioned locally below the existing service keeping minimum allowed spacing limitations between both as determined by the particular service provider.
- Locate above the existing service. The depth to the top of the UGC ducts could be reduced to a minimum of 450mm below surface level as per the Health and Safety Authority's paper entitled, 'Code of Practice for Avoiding Danger from Underground Services[3]'. This depth would accommodate the required separation from the service being crossed and would provide sufficient mechanical protection to the UGC system. Steel plates would be installed above concrete encased ducts.
- Divert the existing utility. An existing utility service may be relocated to facilitate the installation of the proposed UGC ducts. The works required to do so would be coordinated with the service / utility provider and a complete coordinated methodology would be mutually agreed between all parties prior to commencement of any diversions taking place. All proposed work methodologies would aim to prevent any outages or loss of service. If the risk cannot be avoided, prearranged agreements on outages would be set in place prior to works commencement.

3.3.7.3 Horizontal Directional Drilling

Horizontal Directional Drilling (HDD) technology has been widely used in the oil and gas industries for several decades. It has become more commonplace in recent times in municipal engineering projects, such as for the installation of electrical cables, optical cables and potable water pipes. Competent specialist contractors with proven successful drilling experience working on projects within ground conditions similar to those expected within this project will be appointed to undertake the work.

As with all construction works proposed, no drilling works will be allowed to commence until the relevant RAMS incorporating appropriate environmental controls and pertinent Health and Safety documents are received from the specialist Contractor and are reviewed and agreed by the Client's representative. These Contractor documents will include method statements, drilling risk assessments and environmental management plans specific to the area where the drilling is to take place. These documents will, as a minimum, list proposals to eradicate any risk or mitigate against them and would include for example utilities / services plans and avoidance

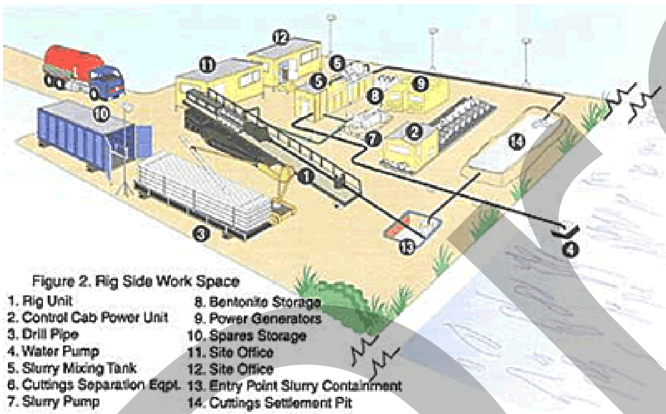
[3] Code of Practice for Avoiding Danger from Underground Services - Health and Safety Authority (hsa.ie) (HAS.ie, 2010)

measures, groundwater / aquifer protection measures, and implementation of robust monitoring of the works, including action plans to mitigate / rectify any environmental incident.

For HDD, the launch and reception pits for the drilling rig typically requires the temporary installation of a level hardstanding area on a geotextile base; the footprint of this working area can vary from site to site but on average is typically 10 m x 10 m. A pilot hole will be drilled from one side of the crossing to the other side while supporting the bored hole with bentonite. The drill bit will be oriented by the surveyor, and the driller will push the drill string into the ground to maintain the bore path. A steering system, guided by tri-axial magnetometers and accelerometers that provide real time directional information to the surveyor at the driller's console, will be used to navigate the bores.

The drilled cuttings will then be flushed back by the drill fluid flowing via nozzles in the drill bit, up the annulus to the surface, where they will be separated from the fluid fraction for disposal. A comprehensive closed-loop drilling fluid mixing and circulation system with recycling capability will be utilised to minimise the volume of fluids required on site. A typical HDD site is shown in Figure 3.6, with an HDD Drilling Rig shown in Figure 3.7.

Figure 3.6: Typical HDD site



Source: www.hdd-consult.com

Figure 3.7: HDD Drilling Rig

Source: www.vermeersouthafrica.com

Constant monitoring by the specialist drilling team of fluid volume pressure, pH, weight and viscosity will be carried out. The volume of cuttings produced will also be monitored to ensure that no over cutting takes place and that hole cleaning is maintained. The mud returns will be pumped to the circulation system trailer by means of a bunded centrifugal pump. The nature of the cuttings will also be monitored to understand the ground conditions as the drilling progresses.

After the initial pilot hole is completed, it will be reamed in a number of passes to reach the required bore size to enable the duct lining to be pulled [usually High-Density Polyethylene (HDPE)]. To ensure that the prevailing geological conditions have suitable cohesion that can maintain the bore during the drilling and reaming process, close attention will be paid by the specialist drilling team to modelled drag forces during pullback with constant monitoring of load stress undertaken to ensure that modelled tensile stress, collapse pressures, hoop stress and buckling stress are not exceeded. In addition to the above measures, the rate of drilling progress will be monitored to assist with the identification of any voids or changes in strata.

On completion of the works, the stone and geotextile will be carefully removed using a back-hoe or 360^0 excavator and removed off-site to an appropriately permitted waste facility. The site will then be reinstated to its original condition (to include hedge planting where it has been removed) or to the requirements of the relevant authority at that location should these be different.

There are limitations in entry angle and radius of curvature for drilling and often accommodating these to match favoured ground conditions can be challenging. The advantage with this method is that a number of standalone cable ducts can be provided as required with suitable separation to meet the preferred requirement. Unlike other installation techniques, a key advantage of HDD is that shafts are not required, but only entry / exit transition pits.

Where directional drilling takes place within limestone bedrock beneath a watercourse , settlement will be monitored at the surface to provide an early warning of any unexpected stability issues. If visible settlement occurs the directional drilling contractor will cease boring, although drilling fluid may still be circulated if required to maintain the stability of the drilled hole, until remedial measures can be put in place to stabilise the ground. The remedial measures used will vary depending on the exact situation encountered but may include switching to an alternative drilling fluid or the injection of grout.

In addition, river / stream flows will be monitored upstream and downstream of any directional drilling watercourse crossings. The flow monitoring will be undertaken on a daily basis for five working days prior to the directional drilling, during the directional drilling and for five working days following completion of the directional drilling. If a measurable increase in losses from the watercourse to ground is observed in the reach where the directional drilling took place, bed lining will be undertaken if required by IFI. The exact nature of any bed lining will be determined through consultation with IFI and will vary depending on ground conditions and channel morphology. Potential bed lining options include the use of clay, cement or geotextile liners.

3.3.8 Vegetation Removal

The presence of trees on cable routes requires careful management. During periods of low or no rainfall, increased drying of the soil due to root capillary action may affect the thermal capability of the cable system. Tree root systems may also get entwined around the cables causing damage to the ducts and cables. As a result, it is recommended (and sometimes imposed by local authorities) that sufficient distance be adopted between the cable system and trees.

For narrow roads, the cable systems may need to be installed in the centre or may need to switch from one side of the road to another to reduce the impact on trees and also to accommodate the trench excavation works.

If cables have to be laid in close proximity to trees excavation by hand may need to be employed which is typically slower than mechanical excavation techniques. Excavations close to large / mature trees (within approximately 10m) are often completed by hand.

Section AC04-AC05 (Longstown / Woodstock) of the HVAC cable route is heavily populated by trees and other vegetation. As this section of road is very narrow, regardless of the side of the road excavated, primary and secondary roots will likely be severed and torn.

Section DC03-DC-4 (Killeagh / Harrisgrove) is less populated than section AC04-AC05 however large trees will likely be impacted.

At the time of writing, an amount of vegetation along section DC03-DC04 (Ballyrichard Beg) had recently been cleared. Excavating the trench on one side of the road and switching to the other side will minimise the arboricultural impact at this location.

The removal of hedgerows, treelines or scrub vegetation will not take place from March to August inclusive having regard to the Wildlife Act 1976 S.I. No. 39/1976, as amended (unless a suitably experienced ecologist has determined that nesting birds are absent or otherwise protected from injury or disturbance).

Details of surveys for protected species carried out to date are provided below in Chapter 8. Given the potential for new bat roosts to occur, and limitations surrounding ecological field surveys, prior to felling further precautionary pre-construction checks of trees to be removed will be carried out for roosting bats. This may comprise detailed inspections of trees from height given the timing restrictions surrounding tree clearance.

A full arboricultural impact assessment will be carried out at detailed design stage to determine the detailed design alignment of HVAC and HVDC trench excavations. Where possible, trees and hedgerows will be replaced post construction.

Additional ecological surveys for badgers (*Meles meles*), otter (*Lutra lutra*), various notable plant species and invasive species will also be required prior to vegetation clearance in suitable habitat. Full details of these are outlined in Chapter 8.

3.4 Landfall Area

The Irish landfall construction works will be progressed in two phases, to mitigate beach access restrictions and disturbance at the caravan park during the busy summer months. There are two options for landfall construction with varying levels of impact in terms of access restrictions and disturbance. Option 1 has the greater potential for impact and so is the basis for assessment in the onshore EIAR (Volume 3C2). Further detail is provided in Volume 3D.

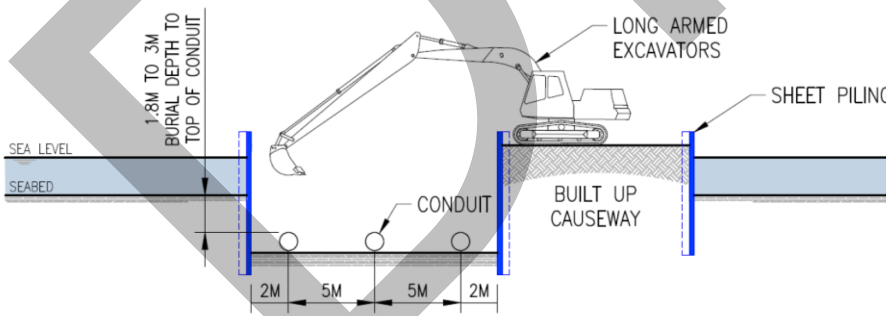
Phase 1 will be conducted in the winter months (i.e. October to April inclusive) and will consist of the construction of the transition joint bay (TJB) and communication chambers, and the installation of the cable ducts within open cut trenches up the beach and into the beach car park. The areas will then be reinstated to their original condition prior to completion of this Phase. The estimated duration of the works is approximately ten weeks.

Phase 2 will be conducted in the summer months and will consist of the installation of the cables through the Phase 1 ducts. This will be achieved by pulling the cables from the cable lay vessel through the ducts by means of a cable winch located within the TJB chambers. The estimated duration of the works is approximately four weeks.

3.4.1 Landfall Open Trench Method

The cable ducts will be placed within excavated trenches up the beach from the sea to the TJB chambers. The excavation into the intertidal zone will require the temporary construction of a causeway, to form a stable platform from which excavators can work freely above the tidal zones. The platform and the trench excavation will be formed by a cofferdam (sheet piling) to mitigate against sea erosion during the winter months.

Figure 3.8: Typical Temporary Works for the Excavation and Causeway



Source: Wood Group (Sketch not to scale)

A portion of the trench route will pass below the carpark necessitating its temporary closure during phase 1 (winter months). These works can be conducted using conventional excavating machines and methods, resulting in a relatively short closure of the carpark.

3.4.2 Phase One Installation

The first phase 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. A temporary sheet piled cofferdam will be required (for Option 1) to ensure trench stability and an adjacent temporary causeway will be required for access. The trench will be backfilled, and the site will be 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.

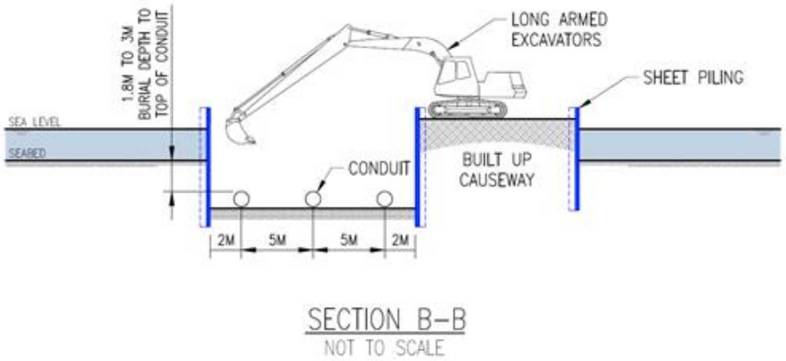
The cofferdam will be approximately 130m long and formed from two lines of sheet piles installed parallel to the centreline of the conduits. The cofferdam will also be enclosed by sheet piles at its offshore end. With the conduits installed at a 5m spacing between centres, a 14m wide cofferdam is conservatively 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. 6000m3) is assumed to be sufficient. The temporary causeway will be constructed from aggregate material to provide sufficient strength to support excavating equipment. The temporary causeway will be constructed, utilized and removed during the 10 week period of phase one.

Option 2 would not require a causeway and the cofferdam would be much reduced in length, approximately 5m).

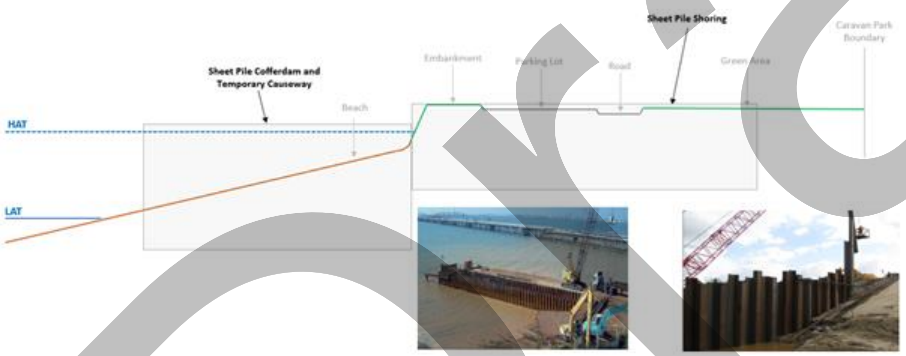
The proposed offshore trench, cofferdam and temporary causeway for Option 1 are illustrated in Figure 3.9 and Figure 3.10.

Figure 3.9: Temporary Works (Trench, Cofferdam, Causeway (Not to Scale)]



Source: Wood

Figure 3.10: Temporary Works (Cofferdam and Causeway Construction)

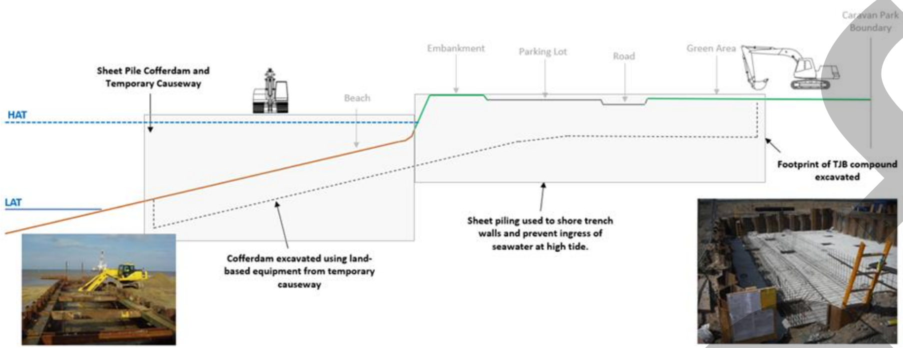


Source: Wood

Following installation of the temporary cofferdam the trench will 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 3.11 provides a sketch of this phase of installation. Spoil material from the trench (est. 4000m^3) will be stored within a temporary construction compound, 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 will be adequately covered to prevent exposure to the elements.

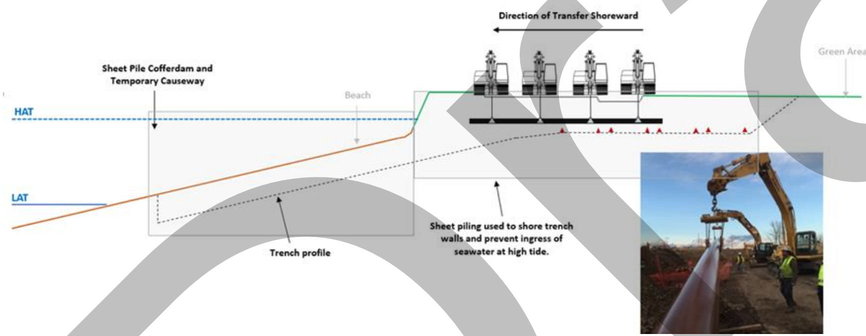
Following completion of the trench the conduits will be transported from a staging area located in the hard standing car park within the construction compound and will be laid above ground in the trench on top of support structures such as sandbags, trestles, and plinths. Conduit pipe segments (3m-5m) will be strung together by welding to form the conduit pipe string and transferred shoreward using lifting machinery as shown in Figure 3.12.

Figure 3.11: Temporary Works – Trench Excavation



Source: Wood

Figure 3.12: Temporary Works – Conduit installation



Source: Wood

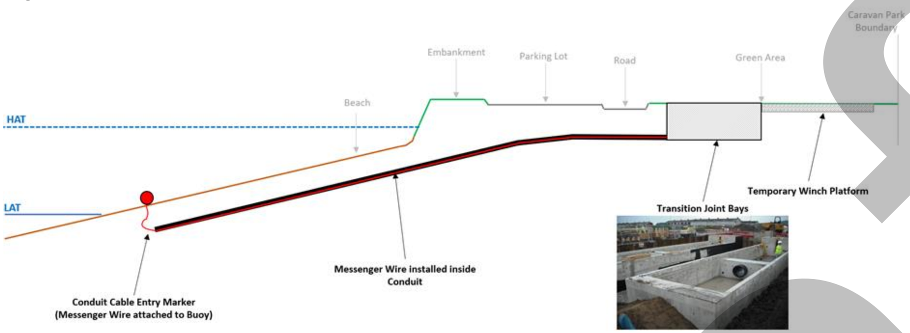
Following the installation of the conduits any temporary conduit supports within the trench will be removed and a messenger wire will be pre-installed within the conduits. The trench spoil will be returned to the trench to re-instate the beach to its prior condition. The temporary causeway and cofferdam 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 x 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 3.13 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 3.13: Phase One Post-Construction



Source: Wood

3.4.3 Phase Two Installation

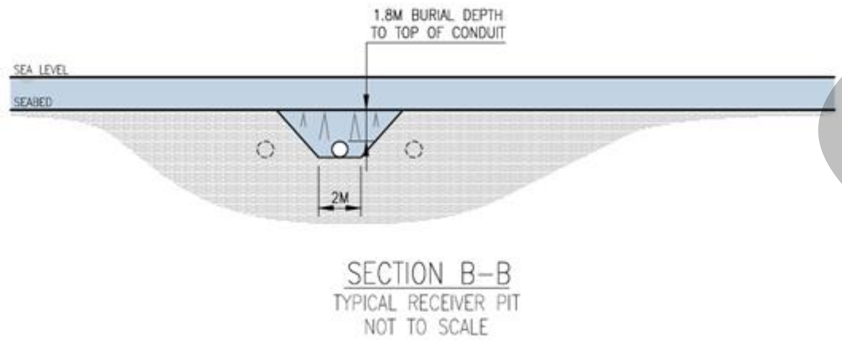
The second phase of the installation sequence involves pull-in of the offshore cables through the pre-installed conduits and into the TJB using a cable winch spread. The location of the receiver pit will vary between Option 1 and Option 2, however, all other activities are similar. Option 2 would require 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 3.14.

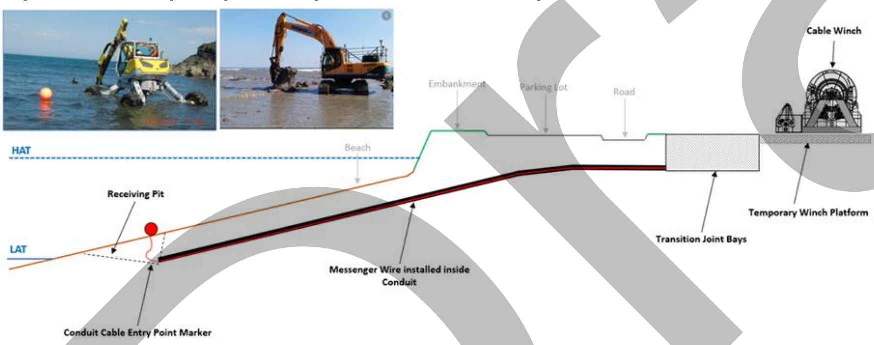
Figure 3.14: Temporary Works (Cable Conduit Entry Excavation)



Source: Wood

A cable winch will be installed on the temporary plinth located behind the TJB. The onshore end of the messenger wire will be retrieved from the TJB and connected to the cable winch wire. Figure 3.15 shows the arrangement once the cable winch has been installed.

Figure 3.15: Temporary Works (Cable Winch installed)

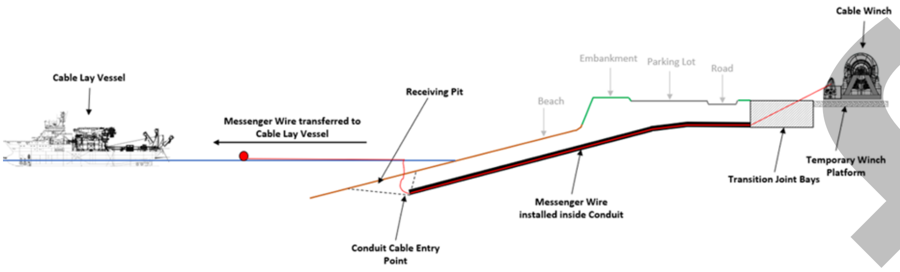


Source: Wood

The submarine cables will arrive on site aboard a cable lay vessel. The messenger wire will be transferred to the cable lay vessel for connection to the end of the submarine cable as shown in Figure 3.16

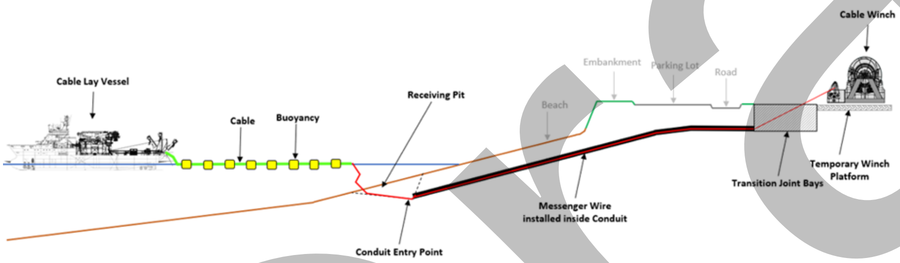
The submarine cable is then floated / pulled onto shore with the aid of temporary buoyancy aids which are removed prior to pull into the conduit. The temporary buoyancy aids are retrieved by the cable lay vessel as shown in Figure 3.17. The winch is used to pull the cable ends up to the TJB. Once the cable is secured in the TJB, the offshore cable lay and burial process will commence. For this, a plough / jetter will be transferred to the beach to bury the cable seaward. Following departure of the cable lay equipment, the receiving pit will be filled in and the beach restored to its prior condition as shown in Figure 3.18.

Figure 3.16: Messenger Wire Transfer to Cable Lay vessel



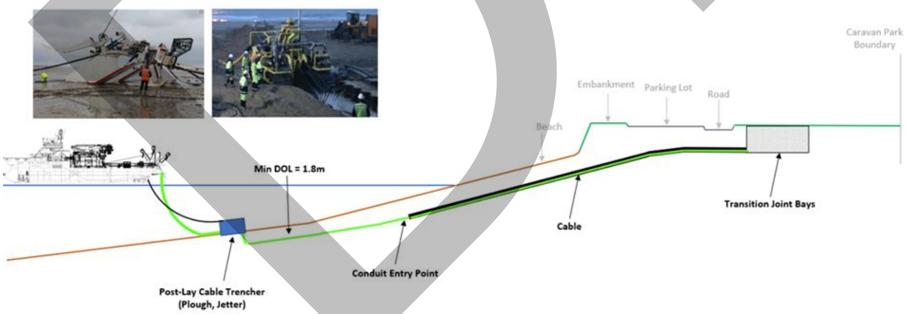
Source: Wood

Figure 3.17: Submarine Cable floated to Shore



Source: Wood

Figure 3.18: Post-Construction



Source: Wood

3.4.4 Landfall Transition Joint Bay Chambers

The submarine cables will be jointed with the land cable within underground TJB chambers. The chambers will have approximate plan dimensions of 15m x 4m x 3m deep and will be installed behind the landfall area at Claycastle Beach. Such chambers generally consist of reinforced concrete base slab and walls. The chamber is then typically backfilled with a suitable material (such as cement bound sand) following installation of the cable joints. The top layer can then be backfilled. It is estimated that construction of the transition joint bay chambers will take approximately 18 weeks and will commence at the beginning of Phase 1 activities, as appropriate, having regard to any seasonal constraints that may apply.

The extent of the area required for the joint bay chamber construction works will be minimised as much as possible to limit potential access restrictions for the public to the carpark.

3.5 Temporary Laydown Areas

All temporary laydown areas will be secured with hoarding / fencing around their perimeter as appropriate.

Where an access road is required, engineering stone fill will be laid and compacted and maintained as required for the duration of the works. Once the works are completed, the engineered stone fill will be removed and the land will be reinstated to its original condition.

All construction workers will be directed to use the designated access / egress routes only.

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

Security lighting will be directional and cowled, away from vegetated areas and wetlands.

3.6 Temporary Construction Compounds

Temporary construction compounds will be required at the connection point (Knockraha substation), the converter station (Ballyadam) and the landfall (Claycastle). Final agreement of specific locations of these compounds will be a matter for the appointed contractor with the planning authority.

All temporary construction compounds will be secured with hoarding / fencing around the compound perimeters as appropriate. Where temporary construction areas are required and existing hardstanding is not available, engineering stone fill will be laid and compacted and maintained as required for the duration of the works. Once the works are completed, the engineered stone fill will be removed and the land will be reinstated to its original condition.

All construction workers will be directed to use the designated access / egress routes only.

Temporary facilities will be provided which will include construction phase car parking and welfare facilities and temporary material storage areas as necessary. Any discharges from temporary welfare facilities will be connected to a sealed holding tank to be emptied and disposed of off-site by a licenced contractor to an approved licenced facility.

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

All temporary security lighting will be directional and cowled, away from vegetated areas and wetlands.

3.7 Construction Traffic

For the converter station construction, it is expected that a peak of approximately 300 Heavy Good Vehicles (HGV) movements per day will be required during the construction phase.

It is expected that a maximum of approximately five abnormal load deliveries will be required during the construction phase, and therefore approximately 10 abnormal load movements would be required for the delivery of the transformers and cranes to place the transformers on their plinths.

The number of construction workers required during the construction phase is expected to peak at approximately 100 persons for the converter station. Crew sizes for the installation of the cable routes are estimated at approximately 10 persons per crew.

The estimated traffic movements associated with construction of the converter station and installation of the land cable and are presented in Table 3.2.

Table 3.2: Construction Vehicles

Task	Activity	Approximate HGV Movements Total	Approximate Duration (Days)	Approximate HGV Movements/ Day	Indicative Approach to Construction (To Be Determined by the Contractor)
Ballyadam Site Platform	Cut	(568x2) = 1136	24	(24x2) = 48	One team excavating
	Fill	(11145x2) = 22290	78	(143x2) = 286	Four teams working simultaneously
Ballyadam Site Access Road	Cut	(348x2) = 696	15	(23x2) = 46	One team excavating
	Fill	(1592x2) = 3184	23	(70x2) = 140	One team filling
Ballyadam Site Piling	Spoil	(407x2) = 814	111	(4x2) = 8	Two teams working simultaneously
	Concrete Fill	(391x2) = 782	111	(4x2) = 8	Two teams working simultaneously
Ballyadam Site Concrete Piled Raft	Spoil	0	0	0	Not applicable
	Concrete Fill	(1015x2) = 2030	76	(14x2) = 28	Two teams working simultaneously
Cable Trench (Knockraha to Claycastle)	Cut	(15722x2) = 31444	237	(65x2) = 130	Four teams working simultaneously
	Fill	(12923x2) = 25846	261	(50x2) = 100	Four teams working simultaneously
Carriageway passing bays (Knockraha to Claycastle)	Cut	0	0	0	Not applicable
	Fill	(634x2) = 1268	201	(4x2) = 8	Two teams working simultaneously
Carriageway passing bays (Knockraha to Claycastle)	Cut	(244x2) = 488	291	(1x2) = 2	Not applicable
	Fill	206	291	(1x2) =2	Two teams working simultaneously

Traffic associated with the installation of the submarine cable is estimated at 600 HGVs.

Further detail is provided in Chapter 11 *Roads and Traffic*.

3.8 Outline Construction Schedule and Timing of Works

Subject to the grant of statutory approvals, it is anticipated that the construction phase will commence in Q4 2022, with the Celtic Interconnector becoming fully operational by the end of 2026.

Construction activities will gradually phase out from pre-construction to predominantly civil activities followed by commissioning and testing.

In general, it is anticipated that construction will occur during normal working hours i.e. Monday to Friday 7 am to 7 pm and Saturday from 7 am to 2 pm. There may be instances where extended hours / days are required however should working outside these hours / days be required they will only be undertaken with prior agreement with the statutory authorities.

Clearance of hedgerow, treeline or scrub vegetation, where required, will take place after 31 August and before 1 March in order to protect breeding birds, (i.e. outside of the bird breeding season). Clearance may take place during the restricted period, if a suitably qualified ecologist has determined that nesting birds and other protected species are absent. Any element of the scheme requiring instream works in watercourses with fisheries value will be restricted to the fisheries open season (i.e. typically the summer months), unless in exception circumstances and with the agreement of IFI.

A preliminary construction programme is presented in Table 3.3.

3.8.1 Cable Route Installation Schedule

Cables will typically be installed in two phases, as follows:

- Duct and joint bay installation; and
- Cable pulling and jointing

Duct and joint bay installation are the most construction-heavy and invasive elements of the cable route installation as digging of a trench within the roadway will be required. This phase will have the largest impact on traffic disturbance and the need for diversions. Once this installation is completed, the roads will be trafficable until the cable pulling and jointing phase is executed.

3.8.2 Preliminary Construction Schedule

Indicative durations for the proposed works are detailed in Table 3.3. It is anticipated that construction of the converter station, including enabling works and equipment installation, will take approximately 36 months, commencing in Q1 2023. Installation of the land cables is anticipated to take approximately 24 months. However, safety requirements for the installation operations / procedures and weather condition will ultimately dictate the final programme.

As detailed previously, the following seasonal restrictions will apply:

- Any element of the scheme requiring instream works in watercourses with fisheries value will be restricted to the fisheries open season (i.e. typically the summer months), unless in exception circumstances and with the agreement of Inland Fisheries Ireland (IFI)
- For duct installation, restrictions will apply to works in Ballyvergan Marsh pNHA (and additionally to vegetation clearance in particular), refer to Section 3.4.3.
- The removal of hedgerow, treeline or scrub vegetation will not take place from March to August inclusive (unless nesting birds and other protected species are absent, as determined by a suitably qualified ecologist).

The majority of the construction activities are not dependant on outages on the existing transmission system, however, activities associated with the connection at Knockraha will be planned in line with EirGrid's scheduled outage programme.

Table 3.3: Indicative Preliminary Construction Programme

Construction Element	Duration
Converter Station Site Set Up	Ca. 1 month
Converter Station Enabling Works	Ca. 10 months
Converter Station Construction of Buildings	Ca. 12 months
Converter Station Equipment Installation	Ca. 12 months
Commissioning of Converter Station	Ca. 4 months
Cable Trench Excavations, Construction of Joint Chambers and Cable Pulling and Jointing	Ca. 24 months
Carriageway Passing Bays Reinstatement	Ca. 5 months
Works at Knockraha substation	Ca. 8 months
Commissioning at Knockraha substation	Ca. 1 months
Landfall Transition Bay Construction	Ca. 5 months
Landfall Phase 1	Ca. 2.5 months
Landfall Phase 2	Ca, 1 month

3.8.3 Construction Environmental Management Plan

A CEMP will be prepared by the Contractor and implemented during the construction phase in consultation with the Cork County Council. The CEMP will remain a 'live' document which will be reviewed regularly and revised as necessary to ensure that the measures implemented are effective.

The primary objective of the CEMP is to safeguard the environment, site personnel and nearby sensitive receptors from site activity which may cause harm or nuisance. As such, the CEMP sets out a project framework to ensure key mitigation measures and conditions set out as part of the planning and foreshore consent process are translated into measurable actions and are appropriately implemented during the construction phase of the proposed development. As part of this framework, transparent and effective monitoring of the receiving environment during construction will be used to inform and manage on-going activities on site and to demonstrate effectiveness of the measures outlined therein.

A contractual obligation will be included within the tendering processes and implemented on appointment of the Contractor to ensure that the proposed works are developed in compliance with the requirements of the CEMP, and the methods, monitoring and mitigation included in this report.

The Developer will monitor the contractor(s) performance on a regular basis and will undertake the following compliance checks throughout the duration of the construction period:

- Review contractor documents against the requirements of the CEMP;
- Undertake regular audits;
- Continuously check records;
- Set up a contractor reporting structure; and
- Conduct regular meetings where Environmental Health and Safety is an agenda item.

Records of the implementation of the measures identified in the CEMP will be provided if required to the Planning Authority at a time scale to be agreed.

3.8.4 Environmental Clerk of Works

The Developers Environmental Clerk of Works (EnCoW) will have suitable environmental qualifications and the necessary experience and knowledge appropriate to the role. The EnCoW will be delegated sufficient powers under the construction contract so that she / he will be able to instruct the Contractor to stop works and to direct the carrying out of emergency mitigation / clean-up operations. The EnCoW will also manage consultation with environmental bodies including the NPWS and IFI. The EnCoW will be responsible for carrying out regular monitoring of the Contractors CEMP.

3.8.4.1 Traffic Management Plan

Prior to commencement of the development, the appointed Contractor will prepare a Traffic Management Plan which will be developed and implemented to mitigate any potential construction traffic impacts on the public road network. All construction activities, including construction traffic, will be managed through the site CEMP.

3.8.4.2 Construction Waste Management Plan

Prior to commencement of the development, the appointed Contractor will prepare a Construction Waste Management Plan (as part of the overall CEMP) which will provide for the segregation of all construction wastes into recyclable, biodegradable and residual wastes to facilitate optimum levels of re-use, recovery, and recycling operations.

The plan will be prepared in accordance with waste management guidance and principles as outlined in *Design Out Waste: A design team guide to waste reduction in construction and demolition projects* (EPA, 2015).

All operations at the site will be managed and programmed in such a manner as to prevent / minimise waste production and maximise upper tier waste management (i.e. re-use, recycle, and recovery) in line with the Waste Hierarchy where technically and economically feasible. The Plan will also deal with any litter arising during the construction phase of the development.

Waste sent off site for recovery or disposal will only be conveyed by an authorised waste contractor and transported from the proposed development site to an authorised site of recovery / disposal in a manner which will not adversely affect the environment. All employees will be made aware of the obligations under the Plan.

The Plan will be available for inspection at the site office at all reasonable times for examination by the Consenting Authority. Waste management is discussed further in Chapter 12.

3.9 Decommissioning

The operational life of the equipment and apparatus of the Celtic Interconnector is expected to be 40 years. Thereafter, it is assumed that the equipment will be decommissioned and replaced with new equipment.

The HVAC and HVDC 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. All equipment for the converter station will be removed for recycling or disposal as required by the regulations are the time.

Decommissioning impacts have been assessed in this EIAR, notwithstanding, any works required to remove infrastructure as part of the decommissioning phase, will be subject to the relevant consent applications, and associated environmental assessments.

4 Population and Human Health

4.1 Introduction

This chapter presents an assessment of the likely and significant impacts arising from the Irish onshore elements of the proposed development on population and human health.

In relation to population, the assessment considers demographics, land use, economic activity, tourism and recreation, community and amenities and human health.

The Draft Guidelines on the information to be contained in Environmental Impact Assessment Reports, hereafter referred to as the EPA Draft Guidelines 2017 state that:

'in an EIAR, the assessment of impacts on population and human health should refer to the assessments of those factors under which human health effects might occur, as addressed elsewhere in this EIAR e.g. under the environmental factors of air, water, soil etc'

In addition to electric and magnetic fields, the analysis of human health consequently considers those impacts associated with relevant environmental disciplines which have been comprehensively addressed elsewhere in this report including:

- Air Quality and Climate (Chapter 5);
- Land Soils and Hydrogeology (Chapter 6);
- Surface Water, including Flood Risk (Chapter 7);
- Biodiversity (Chapter 8);
- Landscape (Chapter 9);
- Archaeology and Cultural Heritage (Chapter 10);
- Roads and Traffic (Chapter 11);
- Noise and Vibration (Chapter 13); and
- Major Accidents and / or Disasters (Chapter 14).

Mitigation and monitoring measures, residual impacts and cumulative impacts are also discussed where appropriate in order to minimise any significant adverse impacts.

4.2 Methodology and Limitations

A baseline condition was established using a desktop study which reviewed national guidance documents, publicly available datasets and resources to assess the potential impacts of the onshore proposed development and to provide mitigation and monitoring measures where required. It should be noted that recent unemployment figures due to the Covid-19 pandemic have been taken into account and discussed in section 4.3 of this EIAR.

4.2.1 Guidelines

This chapter was prepared in line with the methodology detailed in Volume 3C1 Chapter 4 of this EIAR.

Publications and other data sources that guided the preparation of this Chapter are listed hereunder:

- Guidelines on the Information to be Contained in Environmental Impact Statements Environmental Protection Agency 2002;
- EPA Draft Guidelines 2017;
- Draft Advice Notes for Preparing Environmental Impact Statements (Environmental Protection Agency, 2015); and,
- Guidelines for Planning Authorities and An Bord Pleanála on carrying out Environmental Impact Assessment (2018).

4.2.2 Data Sources

A desk study of the proposed development locations and surrounding environs was carried out to collate all relevant and available data in relation to population and human health and for the study area using the following sources:

- Regional Spatial and Economic Strategy for the Southern Region;
- Cork County Development Plan 2014, as extended (including Variation No.2);
- Cork County Development Plan 2022-2028;
- East Cork Municipal District Local Area Plan 2017;
- Cobh Municipal District Local Area Plan 2017 (including Amendment No. 1);
- Draft Cork Metropolitan Strategic Area Plan;
- National Spatial Strategy for Ireland 2002-2020;
- EirGrid Social Impact Assessment Baseline Report Celtic Interconnector Project;
- EirGrid Strategic Social Impact Assessment Scoping Report;
- EirGrid The Electricity Grid and Your Health, Answering Your Questions;
- Fáilte Ireland Tourism Product Development Strategy 2007-2013;
- Fáilte Ireland Tourism Development & Innovation a Strategy for Investment 2016-2022;
- Labour Force Survey, Central Statistics Office www.cso.ie ;
- Census 2016, Central Statistics Office www.cso.ie ;
- Geodirectory Data;
- Ordinance Survey Ireland (OSI) Mapping and aerial photography (www.osi.ie);
- Cork County Council Planning Website (https://www.corkcoco.ie/en/planning);
- Corine land cover data (www.epa.ie);
- Central Statistics Office (www.cso.ie) ;
- Open Street Mapping (www.openstreetmap.org);
- All-Island Research Observatory (AIRO) Primary and Post Primary Schools;
- Google Street Mapping;
- Health Services Executive (www.hse.ie); and
- Failte Ireland (www.failteireland.ie).

4.2.3 Limitations of this EIAR

All third-party reports, data and mapping are assumed to be correct for the purposes of this EIAR.

There were no limitations encountered in compiling the information required to carry out this assessment of likely significant impacts on the population and human health as a result of the Irish onshore components of the Celtic Interconnector project.

4.3 Receiving Environment

The proposed onshore development is located in County Cork and over the two Municipal Districts (MD) of East Cork and Cobh. The landfall area at Claycastle Beach is in East Cork MD while the new converter station in Ballyadam and the existing Knockraha substation are in Cobh MD.

The landfall at Claycastle Beach is situated in the townland of Summerfield, at the Youghal settlement boundary.

The proposed converter station is in the townland of Ballyadam, the Electoral Division (ED) of Carrigtwohill and is bounded to the north by the Cork / Midleton rail line and to the south by the N25. The site location is situated in the north eastern section of the Industrial Development Authority (IDA) owned site which is 'brownfield' in nature.

The settlement of Knockraha is situated approximately 1.2 km north west of the proposed connection point at the existing Knockraha 220 kV substation.

The full description of the onshore development is outlined in Chapter 2 and Chapter 3 of this report.

For the purpose of this chapter, the assessment of the receiving environment has been conducted with regard to the study area, settlements in which the proposed development is situated, as well as those within close proximity to, which are likely to be influenced.

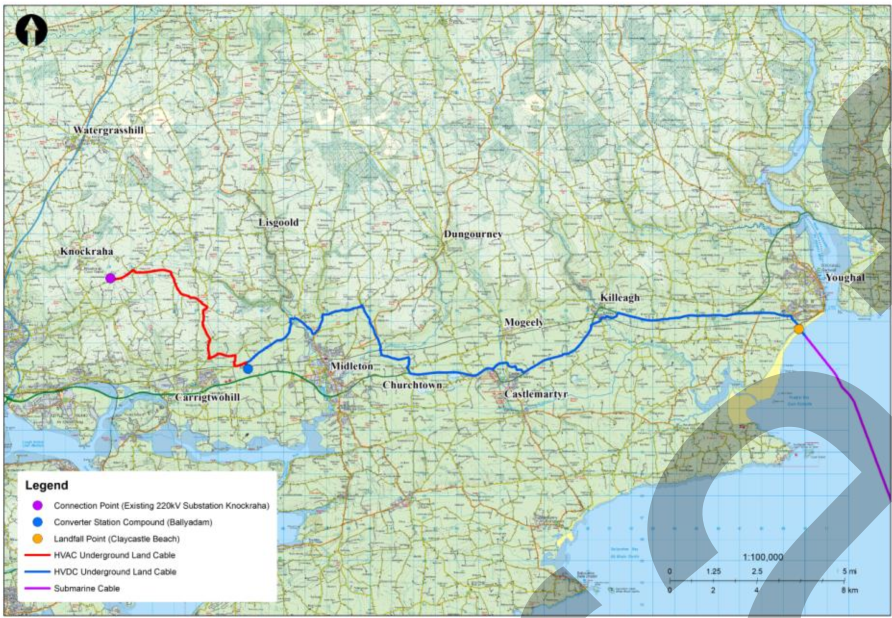
Due to the spatial area of the development, the baseline environment in relation to population and human health has been assessed on a regional and local level.

The EPA Draft Guidelines 2017[4] identify "sensitive receptors" as neighbouring landowners, local communities and other parties which are likely to be directly affected by the proposed development. In particular homes, hospitals, hotels and holiday accommodation, schools and rehabilitation workshops and commercial premises are noted. Regard is also given to transient populations including drivers, tourists and walkers.

A study area for the assessment of population and human health was developed to analyse the most significant sensitive social receptors within 500m of the of the application site boundary for the cable route and a 1km buffer for the landfall at Claycastle, connection point at Knockraha and converter station site at Ballyadam, Wider environs including proximate settlements have also been included for the purpose of this chapter as they represent the densest populations of sensitive social receptors.

[4] https://www.epa.ie/pubs/advice/ea/EPA%20EIAR%20Guidelines.pdf

Figure 4.1: The Proposed Development



Source: Mott MacDonald

Table 4.1: Route Sections

Route Section Name	Route Section Descriptor (and Townland)
Connection Point	Knockraha Substation (Ballynanelagh)
AC01-AC02	Knockraha Substation (Ballynanelagh) to east of Ballynanleagh (Killeena)
AC02-AC03B	East of Ballynanleagh, west of T-Junction (Killeena) to East of Ballynanleagh, east of T-Junction (Killeena) off road
AC03-AC04	East of Ballynanleagh, east of T-Junction (Killeena) to Garranes crossroads (Garranes)
AC04-AC05	Garranes crossroads (Garranes) to south of Woodstock (Woodstock)
AC05-AC06	Woodstock (Woodstock)/Gortnamucky to north of Ballyadam (Ballyadam)
AC06-AC07	North of Ballyadam (Ballyadam) to Ballyadam (Ballyadam)
Converter Station Site	Ballyadam (Ballyadam)
DC01-DC02	Ballyadam (Ballyadam) to Carrigogna/R626 (Carrigogna)
DC02-DC03	Carrigogna (Carrigogna) to Ballyspillane East (Ballyspillane East)
DC03-DC04	Ballyspillane East (Ballyspillane East) to Roxborough (Roxborough)
DC04-DC05	Roxborough (Roxborough) to Churchtown North/N25 (Ballyedekin)
DC05-DC06	Churchtown North (Ballyedekin) to West of Castlemartyr (Killamucky)
DC06-DC07	West of Castlemartyr (Killamucky) to East of Castlemartyr (Clasharinka)
DC07-DC08	East of Castlemartyr (Clasharinka) to West of Killeagh (Mountbell)

Route Section Name	Route Section Descriptor (and Townland)
DC08-DC09	West of Killeagh (Mountbell) to east of Killeagh (Ballymakeagh More)
DC09-DC010	Killeagh (Ballymakeagh More) to N25/west of R634 (Ballyvergan West)
DC10-DC011	Ballyvergan West (Ballyvergan West) to R634/ R908 (Summerfield)
DC11-DC012	R634/ R908 (Summerfield) to north of Claycastle Beach car park (Summerfield)
Landfall	Transition Joint Bay (Summerfield) to HW mark at Claycastle Beach (Summerfield)

4.3.1 Demographic Profile

Demographics are used to study the characteristics of a population at a specific point in time. In this assessment, demographics such as population and housing have been examined.

4.3.1.1 Population

According to Census 2016 (the most recent official Census), population growth in the Republic of Ireland increased from 4,588,252 in 2011 to 4,757,976 in 2016 (3.7%).

The proposed development is situated in the administrative boundary of Cork County Council. The total population of County Cork in 2016 was 417,211, of which 206,953 were male and 210,258 were female. This compares to a total population of 399,802 in 2011 indicating an increase of 4.35%, lower than the national county average growth at 5.3%.

Table 4.2 indicates the population increase from 2011 to 2016 on a county, municipal district and settlement basis. It should be noted that a census for the Municipal Districts (MD)'s of East Cork and Cobh was not conducted in 2011 and as the settlement boundaries can change between censuses an approximate percentage increase has been estimated in some instances.

Table 4.2: Population by County and Local Level

Area	Population 2011	Population 2016	Approximate % Increase
County			
County Cork	399,802	417,211	4.2%
Cork City	119,230	125,657	5.1%
Municipal District			
East Cork Municipal District	n/a	56,722	n/a
Cobh Municipal District	n/a	45,441	n/a
Settlements			
Cork City and Suburbs	198,582	208,669	4.8%
Youghal	7,794	7,963	2.1%
Killeagh	721	899	19.8%
Castlemartyr	1,277	1,600	20.2%
Midleton	12,001	12,496	4.0%
Carrigtwohill	4,551	5,080	10.4%
Knockraha	341	371	8.1%

Source: www.cso.ie

4.3.1.2 Housing

According to the Draft Cork Metropolitan Area Strategic Plan (MASP) an objective is to progress the sustainable development of new areas for housing expansion areas such as the rail corridor between Carrigtwohill and Midleton.

As well as residential development, the urban expansion of the area between Carrigtwohill and Midleton will include cycling / pedestrian facilities, a new school campus and road upgrades.

A search of recent planning applications to Cork County Council reveal a number of planning applications related to dwellings and farm buildings along the proposed cables routes. Typically, these applications relate to extensions, demolition and construction of dwellings and installation of solar panels on roofs.

A review of applications to An Bord Pleanála received under Section 4 of the Planning and Development Act 2000, as amended, show that there are currently no Strategic Housing Development applications (Current Applications.pdf (pleanala.ie) , accessed 4 March 2021) in close proximity of the proposed development. It is understood however that a Part 8 application for a services corridor for approximately 2,500 houses in the Carrigtwohill – Midleton area will be lodged in 2021.

According to available Geodirectory data there are approximately 1,474 no. buildings in total located within the 500m buffer zone of the proposed development route from the landfall at Claycastle to the connection point at Knockraha. Within the 1km buffer zone, around the landfall at Claycastle there are approximately 192 no. buildings; around the converter station site there are approximately 23 buildings, while at the connection point there are approximately 21 buildings.

The majority of the buildings are dwellings and situated within close proximity to the settlements along the proposed route, notably Claycastle, Midleton, Castlemartyr and Killeagh, as well as a number of clustered townland communities, with the remaining being scattered / dispersed rural dwellings.

It is noted that Geodirectory data lists residential, commercial, residential and commercial (both) and unknown status buildings within the buffer which are included in the above data.

Census 2016 states there are 18,702 private households within the Municipal District of Cobh and 16,091 within the Municipal District of East Cork. Table 4.3 lists the household types within East Cork and Cobh MD's. The majority of dwellings within both municipalities are houses / bungalows.

Table 4.3: Households of Municipal Districts (2016)

Municipal District	Households
East Cork	There are 16,091 private households 90.7% are houses / bungalows 7.5% are flats / apartments 0.1% are bed-sits 0.3% Caravan / Mobile Home 1.8% are not stated
Cobh	There are 18,702 private households 93.7% are houses / bungalows 5.1% are flats / apartments 0.04% are bed-sits 0.16% Caravan / Mobile Home 1.0% are not stated

Source: www.cso.ie

4.3.2 Land Use

The majority of the land cable will be installed within the road network along local, regional and national roads. According to 2018 land cover data (Corine data), the land surrounding Knockraha substation and the majority of the land cable routes comprise pasture and arable land. Land Use of the receiving environment is discussed further in Chapter 6 of Volume 3C of this EIAR.

The landfall at Claycastle generally comprises Claycastle Beach; a public carpark serving the beach, which has been in-situ for over 25 years; and undeveloped land between the public carpark and Summerfield Holiday Park.

The development potential of the new converter station site at Ballyadam is promoted on the IDA's website in accordance with its zoning under the Cobh Municipal District Local Area Plan 2017 as *"zoned for large stand-alone high-quality industrial development of regional or national economic importance"*.

Finding's from EirGrid's evidence-based Environmental Study on settlement and land use (2016)[5] has established that there is no evidence of any significant impact arising from the construction or existence of transmission infrastructure in terms of patterns of settlement and land use. Notwithstanding, the study concluded that transmission infrastructure can be a local physical constraint on subsequent development. As such, local land-use, communities and supporting social infrastructure within and linked to the study area were evaluated.

4.3.3 Tourism and Recreation

Tourism is one of Ireland's most important economic sectors. In 2019, revenue gained from tourism was worth approximately €1.8 billion to the economy[6]. At a national policy level, Cork is recognised as a potential growth platform for inbound traffic. 'A National Aviation Policy for Ireland', specifically identifies the unique position of Cork Airport as a 'gateway' to each of the two main tourism policy propositions – Ireland's Ancient East and the Wild Atlantic Way – and

[5] EirGrid-Evidence-Based-Environmental-Study-9-Settlement-and-Landuse.pdf (eirgridgroup.com)
[6] Key-Tourism-Facts-2019.pdf (failteireland.ie)

recognises that Cork Airport offers a significant advantage to the region and as a potential hub for visitors coming to Ireland.[7]

The Cork County Development Plan 2014 (Cork CDP 2014) states that: '*A national review of the tourism sector 'Failte Ireland Tourism Product Development Strategy 2007-2013' confirms that tourism has a critical role to play in the development of the Irish economy. It has the potential to create and maintain employment, invest in local communities and contribute to the national exchequer.'*

East Cork Tourism Limited, Ireland's Ancient East and Ring of Cork are tourism groups which operate throughout County Cork.

4.3.3.1 Knockraha

Knockraha village is located approximately 1.2km west of the existing Knockraha substation. The village of Knockraha and surrounding areas are known areas of activity during the War of Independence.

4.3.3.2 Carrigtwohill

The town of Carrigtwohill is situated approximately 1.2km west of the proposed Converter Station site at Ballyadam. Main tourist attractions associated with Carrigtwohill and environs include Barryscourt Castle, Jasmine Villa Caravan and Camping Park, located in the western extent of Carrigtwohill, is situated approximately 250m west of the IDA lands.

Barryscourt Castle situated just off the N25, was originally built in the 12th century and subsequently rebuilt in the 16th century. Barryscourt Castle has a café and gift shop and is a significant tourist attraction and local resource for Carrigtwohill with tours held in the summer months.

4.3.3.3 Fota Island

In the wider context of the Converter Station site there is a combination of flat farmland and an extensive quarry to the south of the N25 and the Cork estuary is approximately 3km to the south of the site. Fota Island Resort and Wildlife Park and Fota Island Golf Course are located within Cork harbour approximately 3.5km to the southwest of the IDA lands.

Fota Island has numerous tourist attractions including Fota Island Golf Club and Resort, Fota Island House, Fota Gardens and Fota Island Wildlife Park. The Wildlife Park is a conservation centre for many endangered species and received over 445,000 visitors in 2017. The island can be accessed via the N25 or by train to Fota railway station.

4.3.3.4 Midleton

Midleton is located within the Cork Metropolitan Area. The development of the Midleton - Youghal-Greenway along the disused railway corridor has potential for inter-regional greenway connectivity and will have huge tourism potential once constructed. It is predicted to attract approximately 250,000 visitors per annum. The Greenway is currently under construction and expected to be complete and operational by end of 2022.

As noted within the East Cork Municipal District LAP, Midleton is both a destination and a gateway for tourism within the county. Midleton and Environs benefit as a strategic location on the major tourist routes between Rosslare (International Ferry Terminal), Cobh (cruise ships)

[7] https://www.corkairport.com/docs/default-source/default-document-library/growing-tourism-in-cork---a-collective-strategy.pdf?sfvrsn=0

and West Cork whilst facilitating access to other tourist attractions, due to proximate rail, motorway and air (Cork International Airport) infrastructure.

As a destination, Midleton and Environs offer a wide range of festivals and tourist attractions predominantly clustered within Midleton town centre which include the Jamison Experience (Jameson Distillery), Midleton Pitch and Putt Club, Jungle World, Crafts on the Mall, Midleton Country Market, and a acclaimed restaurants such as Farm Gate, SAGE and Ferrit & Lee. The Nellie Cashman Monument, the Choctaw Native American Monument and the World War 1 (WWI) memorial are popular visitor attractions. Other tourist attractions include the Midleton County Market, one of the most prominent farmer's markets in Ireland. To the south-west of Midleton town centre, Ballyannan Woods - Midleton Forest Walk and the newly opened Pontoon walkway which are popular recreational attractions.

In the northern extent of Midleton, where the HVDC cable route is proposed, there are recreational facilities such as Water Rock Golf Club and East Cork Golf Club and The Paddocks Holiday Village. There is also a Coillte owned recreational woodland, Curragh Wood, approximately 2km to the north of the IDA lands.

4.3.3.5 Castlemartyr

Castlemartyr is a village located east of Midleton, situated on the N25 road. Castlemartyr Resort and Spa is a 17th Century manor located west of the village within a wooded area. The resort amenities include a hotel, walled garden lodges, golf course, spa, clay shooting and archery. There are numerous walking trails within the grounds that include Castlemartyr Woodway, Baile na Martra Woodway and Pigeon Wood Castlemartyr Forest Path. Castlemartyr Castle is also located within the grounds of the demesne.

4.3.3.6 Killeagh

Killeagh is a small Medieval village located approximately 10km west of Youghal. Numerous recreational facilities exist within Killeagh and its environs. Glenbower Wood located to the north of the village is a local amenity area with walkways and trails and Greywood Arts, an amenity centre offering workshops and events for locals. The May Sunday Festival, in Glenbower Wood, is an annual event that has occurred since the 1830's.

4.3.3.7 Youghal - Claycastle Beach

Due to its proximity to Youghal, Claycastle Beach is within the vicinity of a variety of social organisations and community facilities which include sport clubs and religious institutions. As shown in Table 4.4, Youghal has an established social network which focuses on a range of interests including economic and maritime development, community health, festivals and events and local governance.[8]

Youghal Bay is a protected bathing water area. Claycastle Beach is a blue flag bathing water status beach and is a very significant tourism asset for Youghal. It is the location of key year round tourism and recreational amenities including the popular beachfront and Youghal Eco-Boardwalk, a 400m hardwood panelled beach walk-way that stretches from Front Strand Beach to Claycastle, the Aura Youghal Leisure Centre and Claycastle Pitch and Putt Club all of which are located along Front Strand. At the time of writing, the Midleton to Youghal Greenway, to the north of Claycastle, was also under construction. Mobile home parks, including Summerfield

[8] https://youghal.ie/

Holiday Park and Seafield Caravan Park, further illustrate that the location is a popular tourist destination.

Some of the tourist activities and amenities within the vicinity of Claycastle Beach are detailed below. Certain events were cancelled in 2020 due to the Covid-19 pandemic.

- Fáilte Ireland Activity Listings 2017
  - South Coast Charter
  - Angling
  - Youghal Diver Charters / Deep Sea Angling
  - Perks Entertainment Centre
  - Claycastle Pitch and Putt Club
- Bathing Waters
  - Claycastle and Youghal Front Strand Beach
- Festivals and Misc. Tourism
  - Irelands Ancient East (Youghal)
  - Youghal Food & Mackerel Festival (Youghal, August)
  - Youghal's Queen of the Sea (Youghal, August, July)
  - Youghal Moby Dick Festival (Youghal, June)
  - IRONMAN (Youghal, August)
  - Youghaloween (Youghal, October)
- Camping / Holiday Homes
  - Summerfield Holiday Park
  - Seafield Caravan Park
- Local Tourism Groups
  - Youghal Socio-Economic Development Group (YSEDG)
  - Youghal Heritage Centre and Tourist Office
  - East Cork Tourism Ltd.
  - Ireland's Ancient East
  - Ring of Cork
- Recreation / Amenity
  - Youghal Eco Boardwalk
  - Aura Leisure Centre
  - Claycastle Youghal Sailing Club

The closest tourist and recreational facilities to the proposals at Claycastle are Claycastle Beach, Youghal Eco Boardwalk and Summerfield Caravan Park.

4.3.4 Community and Amenities

According to the Cork CDP 2014, recreation and amenity facilities contribute to the quality of life of the communities they serve. The provision of facilities that cater for the demands of an increasing population and which are accessible to all sectors and age groups is a key component in the creation of successful sustainable communities.

The Cork CDP 2014 lists social, community and multiuse facilities, childcare facilities, education, recreation and amenity, healthcare facilities and planning for aging all under their policies and objectives.

Sensitive receptors within the towns and villages, and within a 500m buffer of the cable route (including other cluster settlements) have been identified and listed below.

4.3.4.1 Knockraha

Knockraha village includes clustered residential development particularly on its northern and western side with a well-defined social and community core which includes Knockraha National School, community centre, St. Mary's Church and a childcare facility. A local road accommodates scattered residential development with some in close proximity to the existing substation.

4.3.4.2 Carrigtwohill

Carrigtwohill is a suburban residential community with a number of community and amenity focused facilities. Carrigtwohill Community Council is a community elected organisation that organises projects for community benefit and interacts with external bodies. There are also a number of Residents Associations in Carrigtwohill.[9]

There are two sports amenities of particular note in Carrigtwohill, Carrigtwohill United AFC which is located adjacent to the IDA lands to the west and site of the proposed converter station and Carrigtwohill GAA Club located south of Main Street within the town centre.

4.3.4.3 Midleton

Midleton is the largest town within the East Cork municipality. It is the central hub of business for the East Cork area and a major employment centre. Supporting a significant population, Midleton provides key social and community facilities such as sport clubs (GAA, football, rugby, and angling), a large range of educational and religious institutions, post office, fire station, Garda Station and medical centres. There are two Golf Club located within the northern area of Midleton, Water Rock Golf Course and East Cork Golf Club.

In relation to transportation links within County Cork, the town is serviced by the N25, which by-passes the city centre to the south, and the Cork – Midleton rail line.

4.3.4.4 Castlemartyr

Castlemartyr has a significant amount of residential development, and associated public houses, shops, restaurants/cafes and community facilities such as Saint Colman's Church, Castlemartyr and Ballintotas National Schools, Castlemartyr Health Centre and sport clubs, i.e. Castlemartyr Camogie Club and Castlemartyr GAA Club.

4.3.4.5 Killeagh

The village of Killeagh has numerous community facilities of local importance. These include a primary school, post office, church and Glenbower Veterinary Clinic Group. It should be noted that according to the East Cork LAP, the existing primary school located on the main street in Killeagh is within walking distance of all residential areas, however, is restricted in its location and currently causes traffic congestion at peak periods. A new site located on the old Cork

[9] Resident Associations (carrigtwohillcommunity.ie)

Road has been identified for a school but has yet to be developed. Killeagh GAA grounds are located to the west of the village.

4.3.4.6 Youghal - Claycastle Beach

Youghal is an urban centre with a harbour area, with a mix of commercial and leisure marine amenities. It also includes a GAA Club, Youghal Greyhound Racing Track Ltd, Aura leisure centre, and Golf Club, as well as a significant extent of residential development, both within the core urban area, and in outlying clustered estates.

A range of community facilities located within Youghal include a post office, regional fire station, RNLI lifeboat station, Garda Station, a range of medical centres (HSE - South (Youghal), Gortroe And Youghal District Hospital and St. Raphael's Centre), educational institutes and Our Lady of Lourdes Church. These community services are critical for those living within Youghal's Environs and hinterland, particularly in regard to medical, educational and religious institutions.

The Midleton- Youghal Greenway[10] is a 23km greenway which will run alongside the old train line in Midleton to the disused Youghal train station. *'The off-road route connects the key towns of Midleton, Mogeely, Killeagh and Youghal and will provide a level gradient suitable for users of all ages and abilities as a safe, accessible and attractive route for cycling and walking'*[11]

The closest community and amenity facilities to the landfall at Claycastle are the beach itself and the car parking facilities. Receptors located along the route here include Youghal Veterinary Clinic, Spar Convenience Store, vehicle dealers and Youghal Tennis Club. Part of the route close to Youghal includes access to multiple residential roads and access towards a community hospital on a neighbouring road.

4.3.5 Economic Profile

Cork has a number of employment locations supporting its economic success. These include Cork City as the centre of employment and locations such as the Cork Harbour, Ringaskiddy for pharmaceutical and associated industries and Little Island. The proposed Cork Science and Innovation Park at Curaheen is also predicted to provide future employment within the City Environs. Public transport services to these locations and along the proposed route include the Midleton to Cork rail line which is located adjacent to the Ballyadam site to the north and numerous bus routes serviced by Bus Éireann. A list of local bus and rail routes are listed in Chapter 11 of Volume 3C of this EIAR.

The N25 Waterford - Cork national primary road is a busy commuter route that bypasses Midleton and continues east to Youghal. There are plans to expand part of the road to a dual carriageway as part of the N25 Carrigtwohill to Midleton Scheme which will be located to the south and south west of the proposed converter station site at Ballyadam.

Settlement locations such as Carrigtwohill, Midleton and Cork City have high levels of mixed-use employment. Carrigtwohill is one of the fastest growing Metropolitan towns in suburban Cork and is a hub for pharmaceutical and biotechnology companies with multinational corporations established in the IDA Business Park to the west of the town. Agriculture and food production are also critical sectors for the sustainable rural economy of County Cork.

[10] https://www.corkbeo.ie/news/local-news/excitement-builds-work-progresses-midleton-18884592

[11] https://www.corkcoco.ie/en/news/funding-boost-midleton-youghal-greenway

According to the MASP, which includes the area of Carrigtwohill, the Regional Spatial and Economic Strategy (RSES) identifies the Ballyadam site as an asset for strategic employment locations with strong foreign direct investments and indigenous enterprises.

4.3.5.1 Employment

Approximately 2.23 million people are employed in Ireland according to the Central Statistics Office Labour Force Survey from Q3 2020. According to Census 2016, the number of people employed in County Cork was 179,890.

Table 4.5 shows employment by industry of the two Municipal Districts in which the proposed development is located. It is evident that the majority of professions are in Commerce and Trade and Professional Services with the minority of professions in Agriculture, Forestry and Fishing.

Table 4.4: Employment by Industry of Municipal Districts (2016)

Municipal District	% by Industry
Cobh	2.4 Agriculture, forestry and fishing 4.7 Building and construction 18. Manufacturing industries 23.4 Commerce and trade 8.5 Transport and communications 6.7 Public administration 21.7 Professional services 14.5 Other
East Cork	4.9 Agriculture, forestry and fishing 5.3 Building and construction 18.1 Manufacturing industries 21.5 Commerce and trade 7.0 Transport and communications 4.3 Public administration 22.5 Professional services 16.4 Other

Source: www.cso.ie

According to the CSO Labour Force Survey, the unemployment rate in Ireland increased from 4.9% in Q2 2020 to 6.7% in Q3 2020, while the seasonally adjusted number of persons unemployed increased by 51,000 (+45.1%) to 164,300.[5]

The unadjusted Live Register total for December 2020 was 189,860 persons; this consisted of 106,152 males (55.9%) and 83,708 females (44.1%). Of those on the Live Register for December 2020, 21,001 or 11.1%, are under 25 years of age, while 168,859, or 88.9%, are 25 years of age and over. Please note, the unadjusted live register refers to those who are not unemployed due to the Covid-19 pandemic and also includes part time workers.

It is also of importance to note that the live register is not the official measure of unemployment, as it includes persons in receipt of benefits who are in part time or casual employment. It should be noted also that the unemployment rate is significantly influenced by the current Covid-19 pandemic. However, the live register is the most up to date information available and is indicative of the current unemployment situation in Ireland.

4.4 Characteristics of the Development

EirGrid's policy for community benefit is an integral element of the Celtic Interconnector project in Ireland, and is in accordance with the Government's Policy Statement of 2012 on the *Strategic Importance of Transmission and Other Energy Infrastructure*[12]. This is outlined in Volume 2A (Planning Report) of the application particulars. In summary, in accordance with EirGrid' policy, community benefit provision for the project comprises three funding streams:

- Community fund stream
- Sustainability stream
- Biodiversity Stream

The value of each stream is calculated both in relation to the length of linear infrastructure and to the area of the converter station. Figures are currently being finalised for this, but it is anticipated that overall community benefit funding will be over €2 million.

In addition to the above, the following descriptions focus on those aspects of the proposed development that are most relevant to population and human health effects and should be read in conjunction with Chapter 2 Description of the Development and Chapter 3 Onshore Construction Phase Activities.

For the purpose of this section, proposed construction and operational phase activities are discussed under the following headings:

- Connection Point;
- Converter Station Site;
- Landfall Area; and
- HVAC / HVDC onshore circuits, laydown areas and passing bays.

4.4.1 Construction Phase Activities

Subject to the grant of statutory approvals, it is anticipated that construction of the converter station, including enabling works and equipment installation, will take approximately 36 months, commencing in Q4 2022. Installation of the land cables is anticipated to take approximately 24 months. Safety requirements however for the installation operations / procedures and weather condition will ultimately dictate the final programme.

A CEMP will be prepared and implemented by the appointed contractor, and as part of this CEMP, a Construction Noise and Vibration Management Plan (CNVMP) will also be prepared and implemented. Set out within this plan, the Contractor will be obliged to give due regard to BS5228:2009+A1:2014 Part 1 and Part 2, which offers detailed guidance on the control of noise and vibration from construction activities. A comprehensive noise and vibration monitoring protocol will also be set out within the CNVMP.

For the CEMP, the Contractor will also develop and implement a stakeholder communications plan which will facilitate community engagement prior to the commencement of construction. This will be in addition to ongoing community liaison by EirGrid as project developer.

Prior to commencement of the development, the appointed Contractor will prepare a Traffic Management Plan which will be developed and implemented to mitigate any potential

[12] Available at http://www.pleanala.ie/misc/PCI/PCI1/DAF2/2.0%20Missing%20Information/3.0%20Requested%20Reference%20Docs/2.0%20DCENR%20%20(2013)%20Govt%20Policy%20Statement%20%20Strategic%20Importance%20of%20%20Energy%20Infrastructure.pdf

construction traffic impacts on the public road network. All construction activities, including construction traffic, will be managed through the site CEMP.

Construction phase activities, as they relate to potential impacts on population and human health are discussed below.

4.4.1.1 Connection Point

The HVAC cable will connect into the Irish transmission system at an existing spare bay within Knockraha substation. The closest settlement to the connection point at Knockraha substation is Knockraha Village located approximately 1.2km west of the substation, although roadside dwellings also extend along the public road to the west of the existing substation.

4.4.1.2 Converter Station Site

Ballyadam converter station site is located approximately 1.2km east of Carrigtwohill. The IDA site is bounded by the N25 to the south, Jasmine Villa Caravan and Camping site and Carrigtwohill United AFC pitches to the west and to the north by the Cork / Midleton rail line. The surrounding areas are predominantly agricultural to the east and north of the site with some scattered residential properties. There are numerous properties situated within close proximity to the IDA site boundary also.

In general, construction will occur during normal working hours i.e. Monday to Friday 7 am to 7 pm and Saturday from 7 am to 2 pm. There may be instances where extended hours / days are required however should working outside these hours / days be required they will only be undertaken with prior agreement with the statutory authorities.

4.4.1.3 Landfall Area

The Irish landfall construction works will be progressed in two phases, to mitigate against beach access and disturbance to the caravan park during the busy summer months

Phase 1 will be conducted in the winter months (i.e. October to April inclusive) and will consist of the construction of the transition joint bay (TJB) and communication chambers, and the installation of the cable ducts within open cut trenches up the beach and into the beach car park. The areas will then be reinstated to their original condition prior to completion of this Phase. The estimated duration of the works is approximately ten weeks.

Phase 2 will be conducted in the summer months and will consist of the installation of the cables through the Phase 1 ducts. This will be achieved by pulling the cables from the cable lay vessel through the ducts by means of a cable winch located within the TJB chambers. The estimated duration of the works is approximately four weeks.

A detailed description of the installation of the submarine cable and the open cut trenching methodology is provided in Volume 3D2.

4.4.1.4 HVAC / HVDC Cable Routes

The majority of the HVAC / HVDC cable routes follow the existing road alignment.

Sections of the HVAC / HVDC cable routes are off-road, for example off-road HVDC routing to avoid roads through the settlements of Killeagh and Castlemartyr.

The cable route construction phase comprises:

- Installation of an underground ducting system, requiring excavation and reinstatement

- Installation of the cables into the ducting system using pulling equipment

During the cable trenching works, trenches typically of 50m in length will be excavated to install the HVAC / HVDC cable. These trenches will then be filled before moving on to the next section of the cable route. In areas with lots of services, for example roads through settlements, only 20m long trenches will be excavated and filled to help minimise disruption. Each section of trench is predicted to take one day to excavate and fill before moving on to the next section of route. Works associated with passing bays, laydown areas, construction compounds and water and utility and rail crossings, as detailed in Chapter 2 and Chapter 3, will also be carried out along the HVAC / HVDC cable route.

It should be noted that bringing the cable off the N25 at Midleton was considered to unduly impact on this large town - particularly in terms of traffic, disturbance, conflict with existing services, for no meaningful benefit in comparison with use of an alternative local road route.

As noted in Chapter 1 of Volume 3C of this EIAR, *Alternatives Considered* Killeagh and Castlemartyr villages have undergone urban improvement works over the last number of years, with resulting construction impacts for the receiving communities. Both villages have considerable cultural heritage value and the roads through both villages are heavily congested with underground utilities. For these reasons cross-country diversions around both villages are proposed.

4.4.2 Operational Phase Activities

Operational phase activities, as they relate to potential impacts on population and human health are discussed below.

4.4.2.1 Connection Point

No additional operating requirements will be required from the connection point compared to the existing bays in the substation. Similarly, the maintenance regime will not differ from maintenance regimes to the existing bays at Knockraha substation and will include annual inspections and maintenance of the 400 kV transformer.

4.4.2.2 Converter Station Site

The proposed converter station will require a clean water supply for both fire-fighting and welfare purposes (i.e. hand-washing, toilet flushing, etc.). There will be no permanent employment opportunities due to the ‘unmanned’ nature of the proposed development.

4.4.2.3 HVAC / HVDC Cable Routes

The HVAC and HVDC cables routes will require no specific maintenance along the cable trench or joint bay locations. Access may be required at joint bays on rare occasions to facilitate cable replacement if a failure occurs.

Access to link boxes and communications chambers will be required on an annual basis for inspection and any necessary maintenance.

4.4.3 Human Health

4.4.3.1 Electric and Magnetic Fields

Electric and magnetic fields, often referred to as EMFs, are produced both naturally and as a result of human activity. Natural sources of EMFs include the earth’s geomagnetic field and electric fields from storm clouds. When electric current flows, both electric and magnetic fields are produced and are present wherever electricity is used, such as in the home or office, and in the vicinity of equipment that makes up the electricity supply system.

A field is defined by the force it exerts on an object placed in it, for example, a gravitational field is used to describe the force of attraction that the Earth exerts on living beings and objects situated within its influence. Electric and magnetic fields can be considered as the regions around electrical equipment in which these effects can be felt or measured. Electric fields are produced by voltages, irrespective of how much current is flowing and indeed whether any current is flowing at all. Magnetic fields are produced by currents, irrespective of the voltage.

Like many other things encountered in nature, EMFs can be harmful at very high levels. But the levels required are much greater than those to which we are normally exposed. Independent and authoritative international panels of scientific experts have reviewed studies on possible health effects from EMFs. These have concluded, based on the weight of the evidence available, that the power frequency electric and magnetic fields encountered in normal living and working conditions do not cause adverse health effects in humans when electrical equipment is properly designed and constructed.

4.4.3.2 EirGrid's EMF Policy

To avoid risk to the public, national and international health and regulatory authorities have recommended exposure limits for EMFs. It is EirGrid's policy to design and operate the electricity transmission system such that these limits are not exceeded.

In Ireland, the protection of the public in this area is the responsibility of the Department of Communications, Climate Action and Environment. (DCCAE) with assistance from the Environmental Protection Agency (EPA). DCCAE has advised that Ireland continue to adopt the international guidelines developed by International Commission on Non-Ionizing Radiation Protection (ICNIRP) and endorsed by the World Health Organisation (WHO) and the European Union.

For time-varying EMFs, such as those produced by the production, transmission and use of electricity by Alternating Current at the standard frequency of 50 cycles per second (50Hz), the EU EMF recommendation (1999/519/EC) advises the adoption of exposure guidelines published by ICNIRP in 1998 [Guidelines for Limiting Exposure to Time-Varying Electric, Magnetic and Electromagnetic Fields (up to 300GHz); Published in Health Physics 74 (4):494-522; 1998].

For static magnetic fields, such as those produced by the transmission of electricity by Direct Current, the EU EMF recommendation advises the adoption of exposure guidelines published by ICNIRP in 1994 [Guidelines on Limits of Exposure to Static Magnetic Fields; Published in Health Physics 66(1):100-106; 1994].

It should be noted that ICNIRP has subsequently published updated guidance on exposure to both time-varying and static fields, which relaxes recommended exposure limits. These revised limits have not yet been recognised by the EU for public exposure and have not been adopted in Ireland.

For time-varying fields ICNIRP recommends a 'Basic Restriction', which is defined as a limit on current density in the central nervous core (head and trunk) of the human body. It is not practical to physically measure this current, therefore ICNIRP also recommends 'Reference Levels', which ensure that the Basic Restriction is not exceeded and are defined in terms of measurable field values. The ICNIRP 'Reference Levels' are recognised as incorporating a significant safety margin and it is widely recognised that higher field limits can be applied where they can be accurately modelled.

The public exposure limits adopted by EirGrid for time-varying fields are presented in Table 4.5 below.

Table 4.5: Public Exposure Reference Levels

	ICNIRP Basic Restriction (Estimated Fields)	ICNIRP Reference Level
Magnetic Field	360 microtesla	100 microtesla
Electric Field	9,000 V/m	5,000 V/m

For static fields, ICNIRP define the recommended continuous exposure limit in terms of a measured magnetic field of 40,000 microtesla. However, it is noted that exposures in excess of 500 microtesla may affect cardiac pacemakers or other implanted devices. No limit is specified for electric fields; however it is suggested that exposures in excess of 25kV/m should be avoided.

The effects of electric and magnetic fields diminish rapidly with increasing distance from the source. The potential of the Celtic Interconnector to contribute to public exposure to EMFs has therefore been assessed at the following worst-case locations:

- At the boundary fence of the substation and converter station (field levels will be higher within the fence, however higher exposure limits apply to workers and these will be assessed independently).
- Immediately above the centre line of AC and DC cable circuits.

In accordance with EU recommendations, public exposure to EMFs is assessed at a height of 1m above ground. This represents the likely effect of the fields on the central nervous core of the body.

4.4.3.3 Health and Safety Considerations

A Project Supervisor for the Construction Stage (PSCS) will be appointed for the proposed development when contractors are appointed to carry out the works. The PSCS will be responsible for developing the construction stage Safety and Health Plan, co-ordinating the work of Contractors and providing the Project Supervisor Design Process (PSDP) with information required in the Safety File. The PSDP ensures coordination of the work of designers throughout the project. This is to ensure effectiveness in addressing and coordinating safety and health matters from the very early stages of the project

Health and safety considerations in relation to major accidents and / or hazards have been addressed in chapter 14 of this EIAR. Reference is made to other technical chapters of the EIAR as appropriate where further studies have been carried out, for example in the case of flood risk assessments.

4.5 Likely Significant Impacts of the Development

4.5.1 Construction Phase

The potential for impacts on population and human health are for the most part associated with the construction phase due to potential impacts of air, noise and dust emissions and traffic on the receiving environment.

Construction phase effects considered include:

- Impacts on Demographic and Economic Profile
- Impacts on Housing, Land Use and Facilities
- Impacts on Tourism, Recreation and Amenities
- Human Health and Wellbeing

4.5.1.1 Demographic / Economic Profile

The number of construction workers required during the construction phase is expected to peak at approximately 100 persons for the converter station. Crew sizes for the installation of the cable routes is estimated at approximately 10 persons per crew. The works are expected to last approximately 36 months for the Converter Station and commence in Q1 2023. Installation of the land cables is anticipated to take approximately 24 months. This will have an imperceptible impact on the economic profile.

There will be and imperceptible temporary increase in economic spend in the local communities during the works as a result of construction workers spending in the area.

It is not expected that there will be an impact on the demographic profile (population or housing) during the construction phase of the proposed development.

4.5.1.2 Housing, Land Use and Facilities

For the converter station construction, it is expected that a peak of approximately 300 Heavy Good Vehicles (HGV) movements per day will be required during the construction phase.

It is expected that a maximum of approximately five abnormal load deliveries will be required during the construction phase, and therefore approximately 10 abnormal load movements would be required for the delivery of the transformers and reactors. Abnormal load deliveries may also be required for construction cranes to place the transformers on their plinths.

The estimated traffic movements associated with construction of the converter station and installation of the land cable are presented in Table 3.2 of this EIAR.

Due to the width of the joint bays and nature of the road network in the area mans that road closures may be required along the route during the construction phase. Accessibility to private properties and lands will be maintained at all times during construction, however there may be potential temporary disruptions.

There will be a permanent change in land use due to construction of converter station site. There will also be increased traffic in area surrounding site due to construction vehicles and alteration of access tracks.

There will be a temporary negative impact on housing, land use and facilities during the construction phase of the development as the majority of the HVAC / HVDC cable routes follow the existing road alignment. Temporary disruption will be transient in nature and will have brief / temporary impacts. Full details of nuisances associated with traffic are noted in Chapter 11 of this EIAR.

Tourism, Recreation and Amenities

There will be temporary disruption to some amenities during the construction phase. Construction works at the landfall at Claycastle will result in temporary nuisance in relation to traffic, dust and noise and restricted movements along Claycastle Beach and the car park during the construction phase.

The proposed Greenway along the disused Midleton to Youghal railway line will be in operation during the construction phase of the Celtic Interconnector and will be crossed at a number of points along the route of the HVDC cable. The Youghal Eco Boardwalk between Youghal and Redbarn should also be in operation in advance of the Celtic Interconnector. A walkway is proposed as part of the urban expansion of the area to the northwest of the IDA lands at Ballyadam. There is also a local heritage walk in the area of Knockraha, 'The Independence Way', hosted by the Knockraha Historical Society, a route comprising several sites of significance relating to the War of Independence.

From the desktop study no other cycling and walking infrastructure was identified on the specific cable route sections, however, local roads imminently beyond the route sections which may be affected by the construction access routes and associated traffic volume increase are detailed in section 11.4 of this EIAR.

There will be a temporary to short-term negative impacts on tourism recreation and amenities as a result of the proposals due to severance of access and disturbance.

Health and Wellbeing

The requirements of the Safety, Health and Welfare at Work (Construction) regulations 2006, amended will be implemented and complied with in full during the construction phase of the development. However, as with any construction project, there is still potential for adverse impacts associated with the natural environment and nuisance (such as noise and dust emissions). The potential for these effects is discussed separately within the respective chapters. There will be no significant offsite health risks.

There will be adverse temporary disturbance impacts associated with the proposals. Given the nature of the development, the sensitivity of human health and wellbeing receptors to disturbance impacts is considered to be medium during the construction phase. There will be no significant long-term adverse effects.

4.5.2 Operational Phase

As detailed previously, given the nature of the proposals, the potential for impacts on population and human health are for the most part associated with the construction phase. Significant adverse impacts during the operational phase are not likely.

For completeness operational phase effects considered include:

- Impacts on Demographic and Economic Profile
- Impacts on Housing, Land Use and Facilities
- Impacts on Tourism, Recreation and Amenities
- Human Health and Wellbeing

There will however be benefits for communities impacted by the proposals due to the proposed community benefit scheme, discussed in Section 4.4. further detail is provided in Volume 2A (Planning Report) of the application particulars.

Demographic / Economic Profile

The Converter Station does not require any personnel for operation. Scheduled maintenance of the Converter Station will occur once a year, the HVDC link will need to be taken offline for essential maintenance during this time. Similarly, there will be yearly inspection and maintenance carried out to the 400 kV transformer at the Connection Point.

While there will be significant strategic benefits of the Celtic Interconnector, as outlined in Volumes 2A, for the purposes of this chapter there will be no long-term impact on the demographic profile or economic profile during the operational phase of the development due to the 'unmanned' nature of the development.

Housing, Land Use and Facilities

The HVAC / HVDC cable route will require no invasive maintenance work along the cable trench or joint bay locations. Access may be required at joint bays on rare occasions to facilitate cable replacement if a failure occurs.

Typically, every five years, during this scheduled maintenance, more invasive maintenance works will be required for works such as transformer taps cleaning and switchgear cleaning.

Unscheduled maintenance of the converter station will typically occur at unknown times throughout the year and will lead to loss of operation for approximately three days per annum to repair and/or replace faulted equipment. Unscheduled maintenance occurs due to unforeseen trips and emergency outages, but these will be infrequent.

There will be no long-term impact on housing, land use and facilities during the operational phase of the development.

Tourism, Recreation and Amenities

It is unlikely there will be a long-term impact envisaged on tourism, recreation and amenities during the operational phase due to the nature of the development.

Health and Wellbeing (EMF)

Independent and authoritative international panels of scientific experts have reviewed studies on possible health effects from EMFs. These have concluded, based on the weight of the evidence available, that the power frequency electric and magnetic fields encountered in normal living and working conditions do not cause adverse health effects in humans when properly designed and constructed. These form the basis for guidelines published by the International Council on Non-Ionising Radiation Protection (ICNIRP) with regard to EMF, to which EirGrid and ESB Networks have strict regard in the design and operation of the transmission system.

Findings from EirGrid's evidence-based EirGrid's evidence-based Environmental Study on EMF (2016)[13] established that;

The maximum magnetic field strength measured at all overhead lines, underground cables and substation perimeters surveyed was well below the ICNIRP public exposure reference level, set to protect public health. Based on the measured data, magnetic field strengths estimated for overhead power lines and underground cables using records of annual load are also well below the ICNIRP reference level to protect public health under typical (mean or median load) and high-power load (95th percentile) conditions. The maximum electric field strength measured at all overhead lines and substation perimeters surveyed was below the ICNIRP reference level to protect public health. Underground cables produce no electric field above ground.

[13] 181601 EirGrid Study 1 EMF Insides.indd (eirgridgroup.com)

In the context of the above evidence, the design of the Cwltic Interconnector has ensured that the strength of the electric and magnetic fields during operation of the proposed development will comply with the ICNIRP and EU guidelines on exposure of the general public to EMF, further detail is provided below.

Connection Point

At the existing Knockraha substation there will be additional 50Hz time varying electric and magnetic fields arising from operation of the new 400kV AC equipment required to connect the Celtic Interconnector to the grid. These will be additive to the fields produced by the current substation.

The fields external to the perimeter fence can generally be expected to be negligible (other than the area in the immediate vicinity of the cable entries, where the fields are still significantly lower than the 'reference' level provided in the ICNIRP guidelines). The connection point therefore is assessed as having no significant adverse effects arising from EMFs.

Converter Station

At the proposed new converter station there will be static electric and magnetic fields emitted from the new HVDC equipment which will be housed within the converter station building. This building will be steel framed, with all main parts bonded to earth, and will therefore provide an earthed screen which will virtually eliminate electric fields external to the building. Magnetic fields will not be shielded, however the distance to the perimeter fence will ensure that their effects outside the perimeter fence are negligible.

There will also be time-varying 50Hz electric and magnetic fields associated with the outdoor high voltage AC equipment. This will include air-cored shunt reactors, which generate strong magnetic fields in their immediate vicinity. These will be sited with sufficient separation from the perimeter fence to ensure that magnetic field exposure limits are not exceeded.

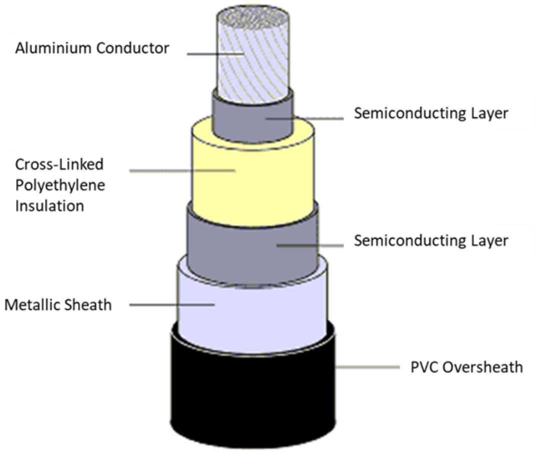
The converter station, including both AC and DC equipment will be in compliance with EMF exposure limits set within international standards.

The HVDC converter station therefore is assessed as having no significant adverse effects arising from EMF.

HVAC Cable Route

The Celtic Interconnector HVAC connection will use buried cross-linked polyethylene (XLPE) insulated cables. The typical construction of such a cable is shown in Figure 4.2.

Figure 4.2: Typical XLPE Cable Construction



Source: Nexans

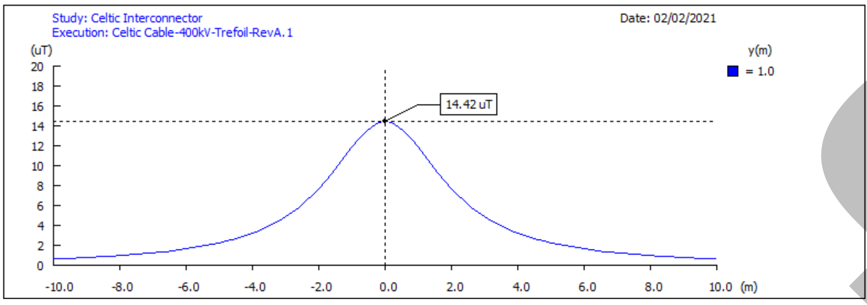
The inner 'core' of the cable will be constructed of copper or aluminium wires. This 'core' is referred to as the conductor and will be energised at 400 kV and carry the electrical currents that will transfer power to/from the interconnector. The conductor is surrounded by an insulating XLPE jacket, which must be of sufficient electrical strength to withstand the voltage applied to the conductor. The insulation is then enclosed within a continuous metallic sheath, which acts as a water barrier and ensures that the insulation is exposed to a uniform electrical field.

The metallic sheath is grounded (connected to the mass of earth) at regular intervals along the length of the cable. This has the effect of ensuring that the electric field, which is measured as the voltage drop between two conducting planes, is entirely contained within the structure of the cable. As the metallic sheath is connected to ground, there can be no significant electric field between it and any other object connected to ground.

For this reason, cables with a continuous metallic sheath cannot generate external electric fields, provided that the metallic sheath is grounded. Consequently, electric field exposure does not need to be considered as a potential impact of the cable installation.

Magnetic fields will not be screened by the metallic sheath. However, the effects of these fields at 1m above ground level can be accurately predicted, as illustrated in Figure 4.3:

Figure 4.3: Calculated Magnetic Field Levels for HVAC Cable



Source: Mott MacDonald

The 50Hz magnetic field at maximum circuit loading is predicted to be 14.42 microtesla, which is significantly lower than the ‘reference’ level provided in the ICNIRP guidelines (refer to Table 4.5). It is noted that these levels are significantly reduced by the cables being laid in a ‘trefoil’ pattern, which provides effective cancellation between the three individual conductors.

The magnetic field level reduces as the distance from the cable centre line increases as shown in Figure 4.4.

Based on the calculations of the magnetic flux density there will be no impact on residential properties at any distance from the proposed alignment as the ICNIRP guidelines are not exceeded. The HVAC Cable route therefore is assessed as having no significant adverse effects arising from EMF.

HVDC Cable Route and Landfall Area

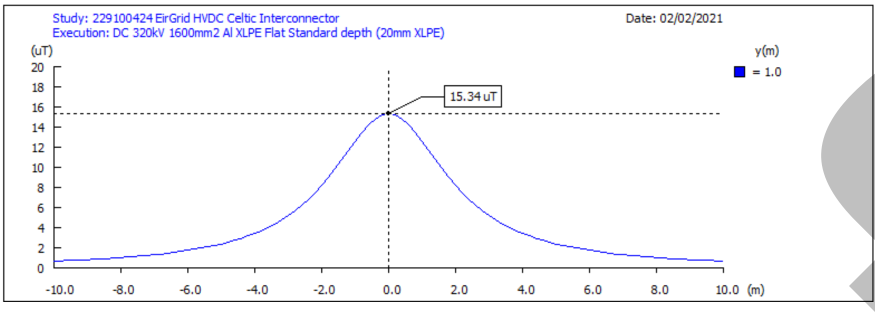
The HVDC cables will be of similar construction to the AC cable, with a grounded metallic sheath. There will also be no detectible electric fields external to the metallic sheath.

The cable will generate static magnetic fields, which will not be screened by the metallic sheath. The effects of these fields at 1m above ground level can be accurately predicted, as illustrated in Figure 4.4.

The static magnetic field at maximum circuit loading is predicted to be 15.34 microtesla, which is significantly lower than the level which the ICNIRP guidelines recommend as avoiding adverse effects on implanted medical devices.

Based on the calculations of the magnetic flux density there will be no impact on residential properties at any distance from the proposed alignment as the ICNIRP guidelines are not exceeded. The HVDC Cable route therefore is assessed as having no significant adverse effects arising from EMF.

Figure 4.4: Calculated Static Magnetic Field Levels for HVDC Cable



Source: Mott MacDonald

4.5.3 Do Nothing

It is predicted that, in the absence of the development proposal or 'do-nothing' scenario, each theme would, in general, continue to develop in line with identified trends. Alternative development could occur at the proposed site of the converter station compound within IDA owned lands at Ballyadam in County Cork, given that the site is zoned for industry.

Non-implementation would however mean foregoing the benefits of the Celtic Interconnector and slowing down the development of renewable energy required to combat climate change.

4.5.4 Decommissioning Phase

The activities associated with the decommissioning phase will be similar to those associated with the construction phase. Therefore, provided that appropriate mitigation is used, the impacts of the decommissioning phase should be, as a worst-case scenario, similar to those at construction phase. Any works required to remove infrastructure as part of the decommissioning phase, will however be subject to relevant consent applications, and associated environmental assessments.

4.5.5 Cumulative Effects

A number of developments are proposed within the immediate environs of the proposals, as detailed in Table 4.2 of Volume 3C1 of this EIAR.

Prior to commencement of construction and during the construction phase engagement with the proponents of these developments (including Transport Infrastructure Ireland, the IDA and Cork County Council will continue and where there is potential for works to be carried out in parallel, appropriate mitigation measures will be implemented including the scheduling of works and regular liaison meetings between project teams to ensure that plans are co-ordinated and impacts on population and human health are minimised.

Cumulative impacts in relation to impacts on population and human health as they relate to various other aspects are considered in relevant chapters of this EIAR.

4.6 Mitigation and Monitoring Measures

4.6.1 Construction Phase

Construction activities have the potential to create a nuisance and cause disruption. All work will be carried out having regard to international and national legislation, and best practice guidance, including but not limited to guidance on preventing pollution from construction sites and pollution prevention guidance.

As noted in Chapter 3 of this EIAR, a CEMP will be prepared by the contractor in consultation with the Cork County Council and implemented during the construction phase to safeguard the environment, site personnel, and nearby sensitive receptors, i.e. occupiers of residential and commercial properties, from site activities which may cause harm or nuisance.

The appointed contractors (in collaboration with EirGrid) will be required to maintain close liaison with local community representatives, landowners and statutory consultees throughout the construction period. This is likely to include circulation of information about ongoing activities; particularly those that could potentially cause disturbance, including due to traffic. A telephone number will be provided and persons with appropriate authority to respond to calls and resolve or escalate any problems arising will be available.

Prior to commencement of the development, the appointed Contractor will prepare a Traffic Management Plan which will be developed and implemented to mitigate any potential construction traffic impacts on the public road network. All construction activities, including construction traffic, will be managed through the site CEMP.

There are no specific mitigation measures required to ameliorate the impacts on population and human health in addition to the measures specified in this EIAR. Specific measures to mitigate potential significant impacts on human health during the construction phase (i.e. Noise and Vibration, Air Quality and Climate, Water, Landscape, Roads and Air and Major Accidents and/or Disasters are dealt with separately in the relevant chapters in this EIAR).

4.6.2 Operational Phase

The location and nature of the proposed development is not expected to have a permanent impact on the population of the area and wider environs. Scheduled maintenance of the Converter Station will occur once a year and the HVAC and HVDC cables routes will require no specific maintenance requirements along the cable trench or joint bay locations.

4.7 Residual Impacts

There will be adverse temporary disturbance impacts associated with the proposals but these will be mitigated with the successful incorporation of specific mitigation measures detailed in this EIAR.

No significant adverse long-term residual impacts are predicted during the operational phase.

4.8 Transboundary Effects

The embedded mitigation measures are sufficient to ensure that transboundary effects associated with the proposed development on population and human health will not occur.

5 Air Quality and Climate

5.1 Introduction

This chapter considers the impacts on air quality and climate arising from the onshore section of proposed development. Any descriptions of the characteristics of development in this chapter should be read in conjunction with Chapter 2 Description of the Development and Chapter 3 Onshore Construction Phase Activities. The assessment predicts the potential air quality and climatic impacts on the surrounding environment arising from the construction and operation of the proposed development and, where appropriate, specifies mitigation measures to reduce potential impacts. Offshore air quality and climate impacts associated with the proposed development have been considered separately within Volume 3D.

The key pollutants considered relevant to the proposed development are outlined below:

- Nitrogen Dioxide (NO_2);
- Dust;
- Particulate matter (PM_{10} / $PM_{2.5}$); and
- Greenhouse gases (GHGs) including carbon dioxide (CO_2) and sulphur hexafluoride (SF_6).

Dust is a generic term which typically refers to particulate matter (PM_{10} / $PM_{2.5}$) in the size range of 1-75 microns in diameter.

5.2 Methodology and Limitations

5.2.1 Relevant Legislation

5.2.1.1 Ambient Air Quality

Directive 2008/50/EC on ambient air quality and cleaner air for Europe was adopted in May 2008 and consolidates previous air quality directives (apart from the Fourth Daughter Directive). This Directive sets out a range of mandatory Limit Values for different pollutants and times by which they are to be achieved for the purpose of protecting human health and the environment by avoiding, reducing or preventing harmful concentrations of air pollutants.

The Air Quality Standards Regulations 2011 (S.I. No. 180 of 2011)[14] implement the EU Ambient Air Quality Directive (2008/50/EC)[15]. The numerical AQS are set at concentrations below which human health impacts or ecological impacts are not expected to occur.

Table 5.1 presents the relevant air quality standards and target values for the pollutants relevant to this assessment as prescribed by EU and Irish legislation, hereafter referred to as air quality standards (AQS).

[14] The Air Quality Standards Regulation 2011 (S.I No. 180 of 2011)

[15] European Union (April 2008) Directive on Ambient Air Quality and cleaner Air for Europe, Directive 2008/50/EC Official Journal, vol. 152, pp. 0001-0044

Table 5.1: Relevant Air Quality Standards

Pollutant	Averaging period	Limit Value ($\mu g/m^3$)	Basis of Application of the Limit Value	Limit Value Attainment Date
NO_2	1 Hour	200	Not to be exceeded more than 18 times in a calendar year	1 Jan 2010
	1 Calendar Year	40	-	1 Jan 2010
PM_{10}	24 hours	50	Not to be exceeded more than 35 times in a calendar year	1 Jan 2005
	1 Calendar year	40	-	1 Jan 2005
$PM_{2.5}$	1 Calendar year Stage 1	25	-	1 Jan 2015
	1 Calendar year Stage 2	20	-	1 Jan 2020

Source: Environmental Protection Agency Air Quality Standards[16]

The AQS presented in Table 5.1 are for the protection of human health and only apply at locations of relevant exposure. The Air Quality Standards Regulations 2011 sets out that the limit values apply everywhere with the exception of:

- Any locations situated within areas where members of the public do not have access and there is no fixed habitation;
- In accordance with Article 2(1), on factory premises or at industrial installations to which all relevant provisions concerning health and safety at work apply; and
- On the carriageway of roads; and on the central reservations of roads except where there is normally pedestrian access to the central reservation.

5.2.1.2 International Climate Change Legislation and Policy

Ireland is a party to the United Nations Framework Convention on Climate Change (UNFCCC) and the Kyoto Protocol. Both provide a legal framework for addressing global climate change. Building on the UNFCCC process, the Paris Agreement is a global treaty established with the intention of developing a unified approach to combating climate change. Agreed in December 2015, the Paris Agreement aims to restrict global temperature rise to well below 2°C above pre-industrial levels, and to pursue efforts to limit the temperature increase to 1.5°C. Under the EU Effort Sharing Decision, Ireland has a target of reducing GHG emissions not included in the EU Emissions Trading Scheme by 20% below 2005 levels by 2020. For the period 2021 to 2030, under the EU Effort Sharing Regulation, Ireland has a target of reducing GHG emissions by 30% compared to 2005 levels[17].

5.2.1.3 Domestic Climate Change Legislation and Policy

The National Policy Position indicates Ireland's national target of achieving a competitive, low carbon, climate-resilient and environmentally sustainable economy by 2050. The long-term vision is for an 80% reduction in CO_2 emissions compared to 1990 levels by 2050 in the electricity generation, built environment and transport sectors[18].

[16] Environmental Protection Agency 2019 Air Quality Standards. Available at: http://epa.ie/air/quality/standards/

[17] Department of Communications, Climate Action and Environment. Available at: https://www.dccae.gov.ie/en-ie/climate-action/topics/eu-and-international-climate-action/2020-eu-targets/Pages/default.aspx

[18] Department of Communications, Climate Action and Environment. Available at: https://www.dccae.gov.ie/en-ie/climate-action/topics/climate-action-at-a-national-level/Pages/default.aspx

The Climate Action and Low Carbon Development Act provides the legal framework for the implementation of the aims outlined in the National Policy Position. Under the Act, the Minister for Communications, Climate Action and Environment must submit to Government a series of National Mitigation Plans and National Adaptation Frameworks.

The draft text for the Climate Action and Low Carbon Development (Amendment) Bill 2020 was published on 7 October 2020, committing the Irish Government to reach net zero by 2050.

5.2.1.4 European F-Gas Regulations 2015

Sulphur hexafluoride (SF_6) is an inorganic, odourless, non-toxic and non-flammable molecule which comprises of six fluorine atoms attached to one sulphur atom. SF_6 is the universally used interrupting medium (dielectric) for high-voltage circuit breakers, replacing the older mediums of oil and air.

SF_6 is listed under Section 3 of Annex 1 of the European F-Gas Regulations 2015. The regulations have been put in place to limit the total amount of regulated F-gases that can be sold in the EU from 2015 onwards and the phasing of them down in increments to one-fifth of 2014 sales in 2030. The regulation also sets out to ban the use of F-gases in many new types of equipment where less harmful alternatives are widely available. The Regulations set out to prevent emissions of F-gases from existing equipment by requiring checks, proper servicing and recovery of the gases at the end of the equipment's life[19].

SF_6 is also listed as a Greenhouse Gas (GHG) and, according to the Intergovernmental Panel on Climate Change (IPPC), it is the most potent GHG that has been tested with a greenhouse gas potential 23,500 times higher than that of carbon dioxide.

5.2.2 Construction Phase Methodology

5.2.2.1 Dust emissions

Construction activities can result in temporary effects from dust. Dust is a generic term and usually refers to particulate matter in the size range of 1-75 microns in diameter. The most common impacts from dust emissions are soiling and increased ambient PM_{10} concentration. Dust can arise from numerous construction activities such as concrete batching, piling, wind erosion on material stockpiles and earth moving. It can be mechanically transported either via wind or through the movements of vehicles onto public highways (transport of debris on vehicle wheels or uncovered loads).

Guidance from the Institute of Air Quality Management (IAQM)[20] states that, where appropriate, a site can be divided into 'zones' for the dust risk assessment to allow different mitigation levels to be applied to each zone. As the proposed development will consist of several different construction activities at different locations, three separate construction dust assessments have been conducted for the:

- HVAC / HVDC onshore circuits, laydown areas and passing bays;
- Landfall area at Claycastle; and
- Ballyadam converter station.

[19] European Union (April 2014) Regulation (EU) No 517/2014 of the European Parliament and of the Council of 16 April 2014 on fluorinated greenhouse gases and repealing Regulation (EC) No 842/2006

[20] Institute of Air Quality Management (2014). 'Guidance on the assessment of dust from demolition and construction.'

This is to allow the most appropriate mitigation level to be applied to each construction activity which accounts for the relevant dust emission magnitude and area sensitivity, rather than applying the same generic mitigation to the entire proposed development.

The construction activities for each construction dust assessment have been split into four separate source categories and the dust risk associated with each of these activities assessed individually. Each assessment has determined the risk of each of the following categories:

- Demolition;
- Earthworks;
- Construction; and
- Trackout[21].

Guidance on the assessment of dust from demolition and construction (Institute of Air Quality Management, IAQM, 2014) defines demolition as *"Any activity involved with the removal of an existing structure (or structures). This may also be referred to as de-construction, specifically when a building is to be removed a small part at a time."* In the context of this assessment the term demolition is used to describe the process of digging up and removing the existing road.

The risk of each source for dust effects can be described as 'negligible, 'low risk', 'medium risk' and 'high risk' depending on the nature and scale of the construction activities and the proximity of sensitive receptors to the construction activities or site boundary. Each assessment is used to identify the mitigation measures proportional to the level of risk to reduce the effects such that they are not significant.

Each assessment considers three separate effects from dust:

- Annoyance due to dust soiling;
- Harm to ecological receptors; and
- The risk of human effects due to increased exposure to PM_{10}.

Step 1 of each assessment applies screening criteria to the proposed development which states that an assessment will be required where there is:

- A 'human receptor' within:
  - 350m of the boundary of the site; and
  - 50m of the route(s) used by construction vehicles on the public highway up to 500m from the site entrance(s).
- An 'ecological receptor' within:
  - 50m of the boundary of the site; and
  - 50m of the route(s) used by construction vehicles on the public highway up to 500m from the site entrance(s).

To assess the likely dust risk, the need to quantify the overall dust emission magnitude (Small, Medium or Large) from each of the dust sources identified (demolition, earthworks, construction and trackout) is first established in alignment with the criteria provided in Appendix 5.1.

The sensitivity of the surrounding area is determined for each activity using the matrices provided in Appendix 5.1. The sensitivity of the area is based on the distance of the source to

[21] Trackout = "The transport of dust and dirt from the construction/demolition site onto the public road network, where it may be deposited and then re-suspended by vehicles using the network. This arises when heavy duty vehicles (HDVs) leave the construction/ demolition site with dusty materials, which may then spill onto the road, and/or when HDVs transfer dust and dirt onto the road having travelled over muddy ground on site" as defined by the IAQM Guidance on the assessment of dust from demolition and construction

the closest receptors, the receptors sensitivity and in the case of PM_{10} effects, the local background concentration. The highest level of area sensitivity defined for dust effect has been used in each assessment.

The final step of the assessment combines the dust emission magnitude and the sensitivity of the surrounding area using the matrices presented in Appendix 5.1 to determine the dust risk categories for each activity for dust soiling and health effects.

The dust risk category defined for each dust source and effect is then used to determine appropriate site-specific mitigation measures to be adopted. It should be noted that, in line with the recommendations of IAQM guidance, significance is only assigned to construct effects following mitigation. Results of the dust assessment are presented in Section 5.4.1.1.

5.2.2.2 Construction site plant and machinery emissions

Construction requires the use of different equipment such as excavators, cranes and on-site generators. All construction plant has an energy demand, with some resulting in direct emission to air from exhausts. Guidance from the IAQM[22] notes that effects from exhausts will likely not be significant. Given the nature of the site plant, effects of plant emissions on local air quality are considered of negligible significance to surrounding road traffic contributions on the local road network. Construction plant emissions have therefore not been assessed further with respect to air quality, however, mitigation measures to reduce the impacts on local air quality are presented in Section 5.5.1.

5.2.2.3 Construction road traffic emissions

The EPUK / IAQM[23] guidance indicates that an assessment of traffic emissions is only likely to be required for large, long term construction sites that will generate an additional annual average flow of greater than 100 Heavy Duty Vehicles (HDVs greater than 3.5 tonnes per day or greater than 500 Light Duty Vehicles (LDV's less than 3.5 tonnes) per day.

The planned duration for the construction phase of the proposed development will be approximately three years, with construction of the Ballyadam Converter Station preceding the cable trenching works. Across the three year construction period, the greatest construction traffic flows are predicted to occur during the platform fill and pilling works stages of construction for the Ballyadam Converter Station. During this phase, the worst-case increase in HDV flows is predicted to be less than 100 Annual Average Daily Traffic (AADT). The EPUK / IAQM criteria of a change in HDV flows of 100 AADT is therefore unlikely to be exceeded during the three year construction period.

LDV flows associated with the construction period are also not anticipated to exceed the EPUK / IAQM screening criteria of 500 AADT. On this basis, no further consideration has been given to the effects of construction road traffic on ambient air quality or GHG emissions as LDV and HDV flows are predicted to be below the relevant screening criteria.

5.2.2.4 Construction GHG assessment

GHG emissions arising through construction are calculated in units of carbon dioxide equivalents (CO_2e) determined by the relative global warming potentials of the different gases.

[22] Institute of Air Quality Management (2014). 'Guidance on the assessment of dust from demolition and construction.'
[23] Environmental Protection UK and Institute of Air Quality Management (2017), 'Land-Use Planning and Development Control: Planning for Air Quality'

Through construction the sources of GHG emissions considered are outlined in Table 5.2 defined by the lifecycle stage.

Table 5.2: Construction GHG assessment scope

Lifecycle stage	Calculation method
A1-3 Products and materials	Bill of quantities mapped to carbon emissions factors using Mott MacDonald's in-house carbon management tool, the Moata Carbon Portal.
A4 Transport to works site	Items on the bill of quantities assigned to material types. Transport distances assumed using Royal Institute of Chartered Surveyors (RICS)[24] data assuming all materials are transported by road.
A5 Construction plant	Where plant specification data was available for components within the Moata Carbon Portal.

The data used for the assessment has been taken from the proposed development description in Chapter 2 and 3 and through collaboration with relevant specialists within the design team, covering the route onshore from the Landfall Area. Data has been collated on the main aspects of the design, the material types and the quantities of the materials required. The provided data has been inputted into the Moata Carbon Portal to calculate the associated emissions measured in tonnes of CO_2e for lifecycle stages A1-3 and A5 (where included within the Moata Carbon Portal). Where necessary, assumptions have been made and the best matches within the Moata Carbon Portal libraries have been chosen.

To account for the transport of materials to site (the A4 lifecycle stage) a methodology adopting the Royal Institute of Chartered Surveyors (RICS) guidance[24] has been used. This considers the distance materials travel based on assumptions, the material masses and the UK's Department for Business Energy and Industrial Strategy (BEIS) 2020 emission factors[25] (for average laden rigid Heavy Goods Vehicles) to determine the emissions.

A number of assets or items have not been designed to a level of detail that was possible to determine the associated carbon. As such, assumptions have been necessary and a number of elements have been excluded, including the following:

- Plant and machinery related to the construction of the buildings has not been included;
- Fittings, e.g. plumbing, within the buildings have been excluded;
- Lighting columns have been excluded;
- Lightning rods have been excluded;
- Site and access road construction has been excluded;
- Site drainage has been excluded;
- The telecommunications mast has been excluded;
- Cable composition and dimensions has been based upon a 20mm diameter copper cable using a Prysmian high voltage cable data sheet;[26]
- It has been assumed that all cut from the site access road and cable trench has been removed from site, whilst other acceptable material has been reused as fill;
- Constituents of the site buildings have been assumed and extrapolated from an analogous example from a previous project; and
- Construction traffic has been excluded (beyond the transport of materials to site and the plant emissions included within the Moata Carbon Portal).

[24] RICS. (2017). Whole life carbon assessment for the built environment.
[25] BEIS. (2020). UK Government GHG Conversion Factors for Company Reporting – Conversion Factors 2020.
[26] http://estralin.com/files/catalogues/hvprysmian.pdf

5.2.3 Operational Phase Methodology

5.2.3.1 Operational road traffic emissions

The EPUK/IAQM[27] guidance indicates that an assessment of traffic emissions is only likely to be required where a development generates an additional annual average flow of greater than 100 HDVs per day or greater than 500 LDVs per day. Considering the nature of the proposed development and the number of operational staff required, it is unlikely that either the LDV or the HDV flows will exceed these thresholds at any point during the operational phase. On this basis, no further considerations have been given to the effects of operational road traffic on ambient air quality or climate.

5.2.3.2 Operational GHG emissions

The main source of operational GHG with regard to the proposed development would be the potential leakages of SF_6 to the environment. Operational energy from lighting and running of the site has been excluded due to the current level of information available.

In 2018, the contribution of SF_6 to Ireland's national emission inventory was 40.9 ktCO_2e. This is approximately 0.06% of Ireland's total GHG emissions. Of this 40.9 ktCO_2e, 16.1 ktCO_2e is associated with electrical equipment which equates to a total of 0.02% of Ireland's total GHG emissions[28].

The main source of SF_6 emissions in the proposed development will be potential leakages from the circuit breaker for the switchgear. To account for this leakage the weight of SF_6 required has been estimated and in combination with the International Electrotechnical Commissions standard 62271[29] estimate for leakage of new equipment (0.5% per annum) and the global warming potential of SF_6, the tonnes of CO_2e has been estimated.

5.3 Receiving Environment

5.3.1 Overview

Information on existing air quality in Ireland can be obtained from the Environmental Protection Agency (EPA) who undertake monitoring at a number of locations across the country. For the purpose of air quality, Ireland is split into four main regions:

- Zone A: Dublin conurbation;
- Zone B: Cork conurbation.
- Zone C: 23 cities and large towns with population >15,000 (Limerick, Galway, Waterford, Drogheda, Dundalk, Bray, Navan, Ennis, Tralee, Kilkenny, Carlow, Naas, Sligo, Newbridge, Mullingar, Wexford, Letterkenny, Athlone, Celbridge, Clonmel, Balbriggan, Greystones, Leixlip and Portlaoise); and
- Zone D: Rural Ireland, i.e. the remainder of the state excluding zones A, B and C.[30]

[27] Environmental Protection UK and Institute of Air Quality Management (2017), 'Land-Use Planning and Development Control: Planning for Air Quality'

[28] Irelands National Inventory report 2020 available at http://www.epa.ie/pubs/reports/air/airemissions/ghg/nir2020/NIR%202020_Merge_finalv2.pdf Note that this breakdown of SF6 data is not reported in the EPA preliminary report for 2019 data.

[29] International Electrotechnical Commissions. (2004). Standard 62271-1-2004: High-voltage switchgear and control gear

[30] Environmental protection Agency (2019), Available at; http://www.epa.ie/air/quality/zones/

5.3.2 Background air concentrations

The proposed development is located within Zone D. The closest Zone D monitoring site to the proposed development is located in Enniscorthy, County Wexford, approximately 110km north east of the proposed landfall area at Claycastle. However, data for this site is only available for 2015 and 2016. Therefore, data from the Zone D monitoring site at Castlebar, a monitoring site located in a similar suburban environment has also been presented.

Monitoring data from the suburban monitoring sites (Heatherton Park and UCC Distillery Fields) in Zone B (Cork) has also been reviewed due to their closer proximity to the site (12-13km south west of the Knockraha substation). Table 5.3 to Table 5.5 present the NO_2, PM_{10} and $PM_{2.5}$ monitoring results from these sites between 2015 to 2019. Annual mean NO_2, PM_{10} and $PM_{2.5}$ concentrations monitored at these sites are all well below the respective national AQS.

Table 5.3: Annual mean NO_2 concentrations

Site Name	Location		Site Type	Annual mean NO_2 concentrations ($\mu g/m^3$)				
	X	Y		2015	2016	2017	2018	2019
Enniscorthy	697902	639825	Suburban Zone D	9 (94%)	9.6 (97%)	-(a)	-(a)	-(a)
Castlebar	514462	789842	Suburban Zone D	8 (100%)	8.5 (99%)	7.4 (99%)	8 (99%)	8 (98%)
UCC Distillery Fields	566517	572116	Suburban Zone B	-(a)	-(a)	-(a)	11 (95%)	10 (100%)

Source: EPA Data Archive
Data Capture is presented in parenthesis
Heatherton Park does not monitor NO_2 so is not presented above
(a) No data available (site decommissioned, not yet operational or low data capture)

Table 5.4: Annual mean PM_{10} concentrations

Site Name	Location		Site Type	Annual mean PM_{10} concentrations ($\mu g/m^3$)				
	X	Y		2015	2016	2017	2018	2019
Enniscorthy	697902	639825	Suburban Zone D	18 (99%)	17.3 (98%)	-(a)	-(a)	18 (100%)
Castlebar	514462	789842	Suburban Zone D	13 (98%)	11.9 (99%)	11.2 (96%)	11 (93%)	16 (93%)
Heatherton Park	568528	570069	Suburban Zone B	11 (75%)	11.5 (100%)	10.4 (98%)	11 (79%)	12 (95%)

Source: EPA data Archive
Data Capture is presented in parenthesis
UCC Distillery Fields does not monitor PM_{10} so is not presented above
(a) No data available (site decommissioned, not yet operational or low data capture)

Table 5.5: Annual mean $PM_{2.5}$ concentrations

Site Name	Location (X,Y)	Site Type	Annual mean $PM_{2.5}$ concentrations ($\mu g/m^3$)				
			2015	2016	2017	2018	2019
Heatherton Park	568528, 570069	Suburban Zone B	7 (100%)	7 (100%)	5.7 (100%)	-(a)	8 (95%)
UCC Distillery Fields	566517, 572116	Suburban Zone B	-(a)	-(a)	-(a)	9 (89%)	8 (94%)

Source: EPA data Archive
Data Capture is presented in parenthesis
Enniscorthy and Castlebar do not monitor $PM_{2.5}$ so is not presented above
(a) No data available (site decommissioned, not yet operational or low data capture)

5.3.3 GHG emission baseline

The baseline for GHG emissions is relevant to compare the level of emissions associated with the proposed development, however, the baseline does not materially impact the level of effect on climate.

GHG emissions for Ireland in 2019 totalled 59.9MtCO_2e with energy industries accounting for 16%[31] and energy consumption being the largest contributor of 59%[32].

The construction industry is the largest consumer of natural resources in the UK and this accounts for approximately 10% of the total UK carbon emissions[33]. Therefore, assuming the UK proportion in lieu of an Ireland specific proportion, it has been estimated that approximately 6MtCO_2 are attributed to the embodied carbon of construction materials in Ireland as a whole based on 2019 emissions.

5.4 Likely Significant Impacts

5.4.1 Construction Phase

5.4.1.1 Dust emissions

For the purpose of this assessment, three separate construction dust assessments have been undertaken to assess the impacts associated with the:

- HVAC / HVDC onshore circuits, laydown areas and passing bays;
- Landfall area at Claycastle; and
- Ballyadam converter station.

This has been undertaken to allow the most appropriate risk level and mitigation to be assigned to each construction activity. As dust emissions from the proposed development will only occur during the construction phase, all effects from the construction dust emissions are described as either temporary or short-term.

It is worth noting that an additional key zone of construction associated with the proposed development is located at the Knockraha substation connection point. The potential dust emission magnitude for the construction activities at the Knockraha substation connection point would be similar to those identified within the landfall at Claycastle construction assessment. However, there are fewer sensitive receptors in close proximity to the construction activities proposed at Knockraha substation, so the overall level of risk will be lower. Therefore, a separate construction dust assessment for the connection point at Knockraha has not been undertaken as the mitigation measures recommended for the landfall area at Claycastle would also be appropriate for the construction activities associated with the connection point at Knockraha.

The dust emission magnitude and sensitivity descriptors for the construction dust assessments are presented in Appendix 5.1.

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[31] EPA (2020). Ireland's Provisional Greenhouse Gas Emissions [online] available at: https://www.epa.ie/pubs/reports/air/airemissions/ghgprovemissions2019/ accessed January 2021

[32] Sustainable Energy Authority of Ireland. (2020). Energy in Ireland 2020 Report [online] available at: https://www.seai.ie/publications/Energy-in-Ireland-2020.pdf accessed January 2021

[33] Institute of Civil Engineers (ICE) (2014): Energy Briefing Sheet: Embodied Energy and Carbon [online] available at: https://www.ice.org.uk/ICEDevelopmentWebPortal/media/Documents/Disciplines%20and%20Resources/Briefing%20Sheet/Embodied_Energy_and_Carbon.pdf, accessed March 2020.

HVAC / HVDC onshore circuits, laydown areas and passing bays

The majority of the HVAC and HVDC underground cable routes will be installed within the existing public road network. Off-road (cross-country) routes are proposed at particular locations to avoid constraints. These locations include:

- North of Claycastle Beach where, due to structural constraints associated with an existing narrow railway bridge, it is necessary to divert the UGC off road for approximately 241 metres in the area of, and under, the planned Midleton to Youghal Greenway (currently under construction)..
- The villages of Killeagh and Castlemartyr will be avoided by means of cross-country routing; this will minimise disruption and nuisance for these villages, their residents and communities, and for traffic passing through the villages which are both located on the N25 Cork-Waterford-Wexford / Rosslare National route.

During the cable trenching works, trenches up to 100m long will be excavated to install the HVAC / HVDC cable. These trenches will then be filled before moving on to the next section of the cable route. In areas with lots of services, for example roads through settlements, only 20m long trenches will be excavated and filled to help minimise disruption. Each 50m section of trench is predicted to take one day to excavate and fill before moving on to the next section of route.

Therefore, to assess a realistic worst-case, a 100m section for each in-road and off-road cable route option was considered. The section of route selected for the assessment was the section that has the greatest number of sensitive human health receptors nearby. A separate section of route was selected when considering the worst-case impacts on sensitive ecological receptors.

Table 5.6 presents a summary of the dust emission magnitude assigned to each construction activity applicable to both the in-road and off-road HVAC / HVDC cable routes.

Table 5.6: Dust emission magnitude - in-road and off-road HVAC / HVDC cable routes

Activity	Dust emission magnitude	Justification
Demolition	Small	For each 100m section of the route, the total volume of existing structures to be demolished will be <20,000m^3. The duration of demolition for each 100m section will be 1-2 days.
Earthworks	Small	For each 100m section of the route, the total site area will be <2,500m^2. The duration of earthworks for each 100m section will be 1-2 days.
Construction	Small	For each 100m section of the route, the total building volume will be <25,000m^3. The duration of construction for each 100m section will be 1-2 days.
Trackout	Medium	For each 100m section of the route, the total number of outward HDV movements is predicted to be between 10-50 per day.

The next step to determine the sensitivity of receptors to dust soiling and PM_{10} has considered the number of receptors within a range of distance bands and defining the annual mean PM_{10} concentration. Figure 5.1 presents the dust assessment buffers used for determining the proximity of sensitive receptors at the worst-case location for the in-road HVAC / HVDC route while Figure 5.2 presents the dust assessment buffers for the off-road HVAC / HVDC route. The worst-case location for the in-road HVAC / HVDC route is located on Main Street, Castlemartyr on the DC06-DC07A section of the cable route. The worst-case location for the off-road HVAC / HVDC route is located on Ballyvergan East on the DC10-DC11 section of the cable route. The trackout routes for both sections of these cable route options are presented in Figure 5.3 and Figure 5.4.

Commented [DH5]: TO BE UPDATED IN FINAL DRAFT.

IN-ROAD OPTIONS THROUGH KILLEAGH AND CASTLEMARTYR ARE NO LONGER PROPOSED

Figure 5.1: In-road HVAC/HVDC cable route construction buffers

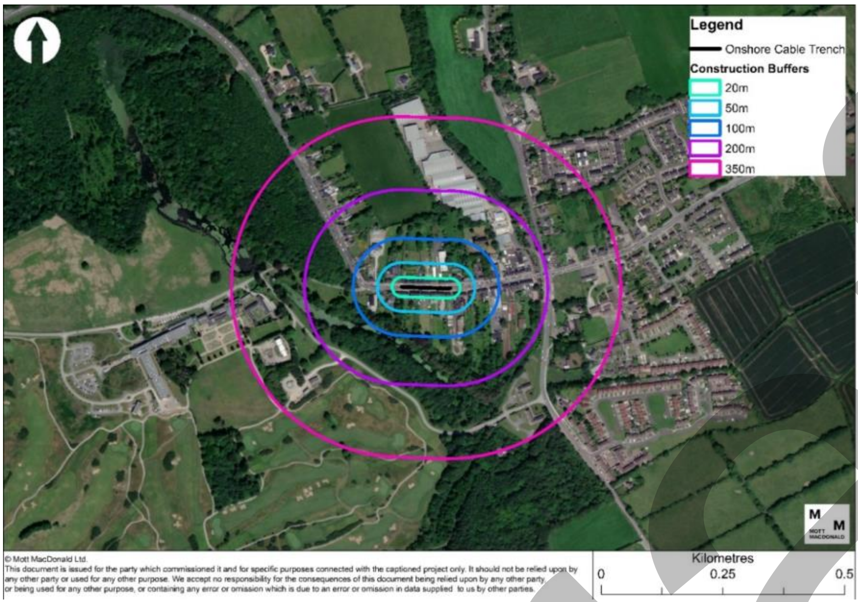


Figure 5.2: Off-road HVAC/HVDC cable route construction buffers

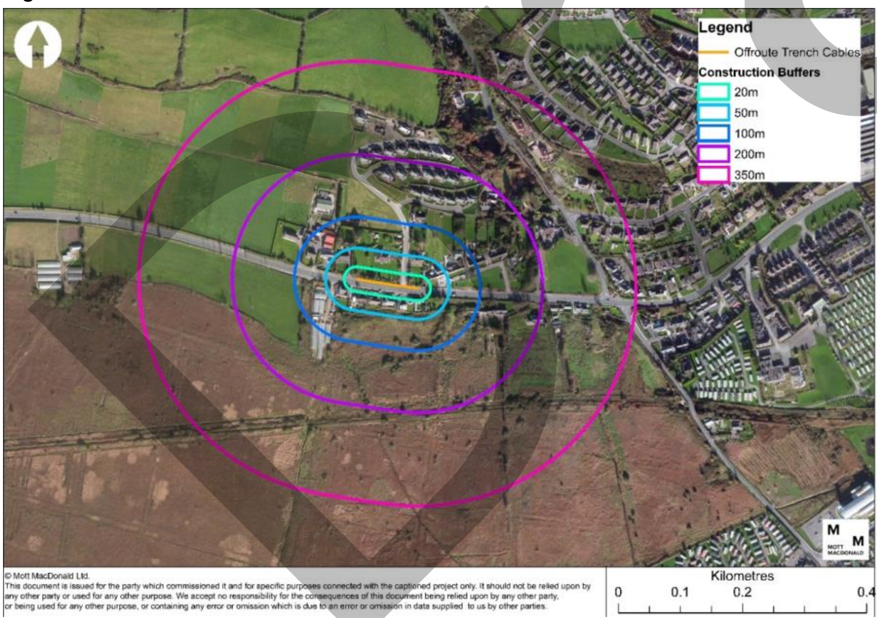


Figure 5.3: In-road HVAC/HVDC cable route trackout buffers

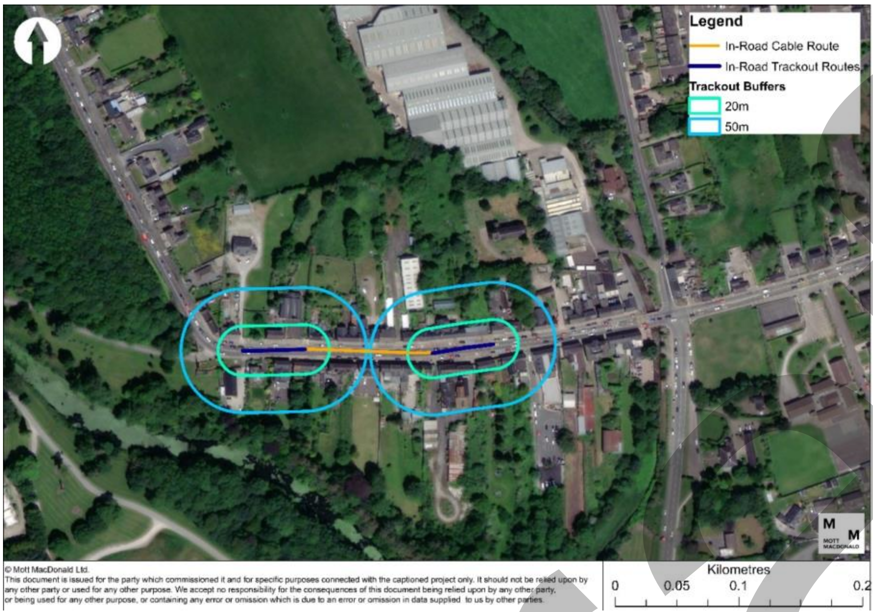
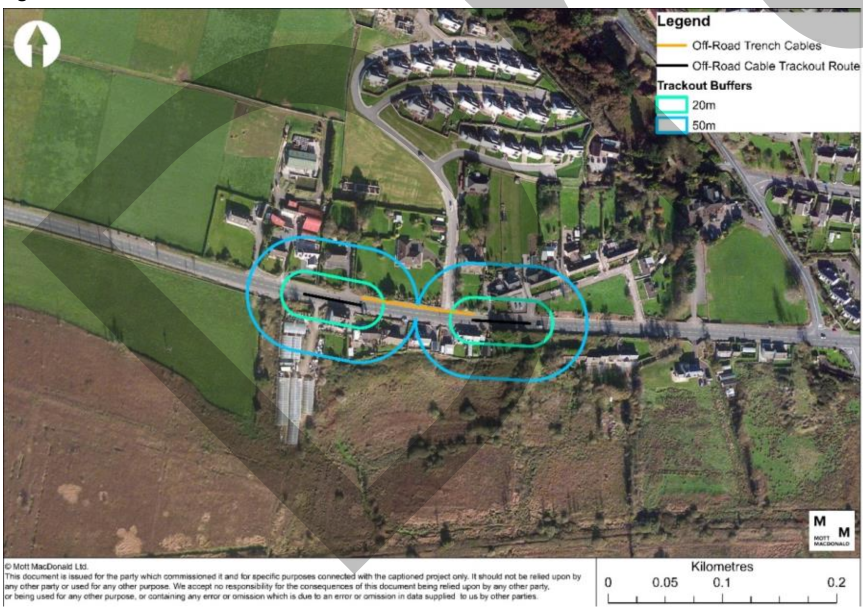


Figure 5.4: Off-road HVAC/HVDC cable route trackout buffers



Based on Figure 5.1 to Figure 5.4 above, Table 5.7 and Table 5.8 below present the sensitivity of the area to effects caused by the in- and off-road HVAC/HVDC cable route construction activities.

Table 5.7: Sensitivity of the area – in-road HVAC / HVDC cable route

Commented [DH6]: TO BE UPDATED FOR FINAL DRAFT BASED ON FINAL ROUTES

Activity	Dust soiling		Health effects of PM_{10}	
	Sensitivity	Comment	Sensitivity	Comment
Demolition	High	There are 10 to 100 residential properties within 20m of the proposed cable route.	Low	There are 10 to 100 residential properties within 20m of the proposed cable route. Background annual mean PM_{10} concentrations are below <24µg/m³ (see Section 5.3).
Earthworks	High		Low	
Construction	High		Low	
Trackout	High	There are 10 to 100 residential properties within 20m of the potential routes used by construction vehicles on the public highway.	Low	There are 10 to 100 residential properties within 20m of the potential routes used by construction vehicles on the public highway. Background annual mean PM_{10} concentrations are below <24µg/m³ (see Section 5).

Table 5.8: Sensitivity of the area - off-road HVAC/HVDC cable route

Commented [DH7]: TO BE UPDATED FOR FINAL DRAFT BASED ON FINAL ROUTES

Activity	Dust soiling		Health effects of PM_{10}	
	Sensitivity	Comment	Sensitivity	Comment
Demolition	Medium	There are less than 10 residential properties within 20m of the proposed cable route.	Low	There are less than 10 residential properties within 20m of the proposed cable route. Background annual mean PM_{10} concentrations are below <24µg/m³ (see Section 5.3).
Earthworks	Medium		Low	
Construction	Medium		Low	
Trackout	High	There are less than 10 residential properties within 20m of the potential routes used by construction vehicles on the public highway.	Low	There are less than 10 residential properties within 20m of the potential routes used by construction vehicles on the public highway. Background annual mean PM_{10} concentrations are below <24µg/m³ (see Section 5.3).

While there are no designated ecological receptors within 50m of the locations considered in Figure 5.1 to Figure 5.4, there are three proposed Natural Heritage Areas (pNHA) found adjacent to roads on both the in-road and off-road HVAC / HVDC cable routes (within in the case of Ballyvergan Marsh pNHA). These include:

- Loughs Aderry and Ballybutler pNHA;
- Clasharinka Pond pNHA; and
- Ballyvergan Marsh pNHA.

Table 5.9 therefore presents the worst-case sensitivity of the area to ecological impacts for the in-road and off-road cable route options for the sections of route adjacent to these pNHAs.

Table 5.9: Sensitivity of the area to ecological impact – in- and off-road HVAC/HVDC cable route

Activity	Ecology	
	Sensitivity	Comment
Demolition	Medium	There are three medium sensitivity ecological receptors (pNHA) found within 20m of the HVAC/HVDC cable routes.
Earthworks		
Construction		
Trackout		

The overall risk of receptors to dust soiling effects for the in-road and off-road cable route options are presented in Table 5.10 and Table 5.11 based on the criteria presented in the tables in Appendix 5.1.

Table 5.10: Summary of the risk of construction dust activity for the in-road HVAC / HVDC cable

Potential Impact	Risk			
	Demolition	Earthworks	Construction	Trackout
Dust soiling	Medium Risk	Low Risk	Low Risk	Medium Risk
Health effects	Negligible	Negligible	Negligible	Low Risk
Ecological	Low Risk	Low Risk	Low Risk	Low Risk

Table 5.11: Summary of the risk of construction dust activity for the off-road HVAC / HVDC cable

Potential Impact	Risk			
	Demolition	Earthworks	Construction	Trackout
Dust soiling	Low Risk	Low Risk	Low Risk	Medium Risk
Health effects	Negligible	Negligible	Negligible	Low Risk
Ecological	Low Risk	Low Risk	Low Risk	Low Risk

Based on the above, the overall effect of dust nuisance and/ or loss of amenity from the construction phase for the in-road and off-road HVAC / HVDC cable route is described as ‘negligible’ to ‘medium risk’, without mitigation. These impacts would also be very temporary as for each 100m section of road, construction activities will last 1-2 days before moving on to the next section of route. Mitigation measures appropriate for the cable routes have been presented in Section 5.5.1.1 and incorporation of such measures within the Construction Environmental Management Plan (CEMP) will reduce this predicted risk to ‘negligible’.

Landfall Area

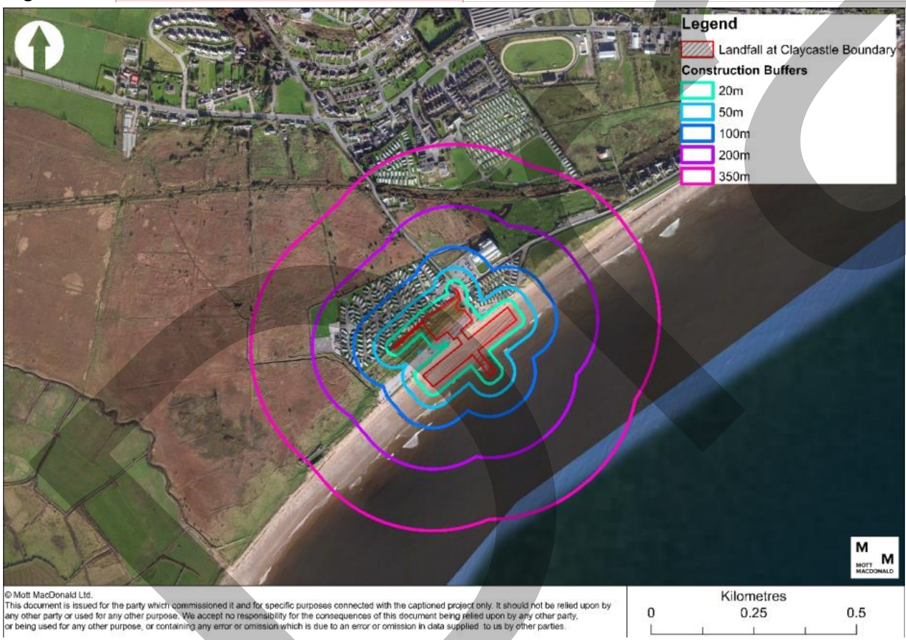
Table 5.12 presents a summary of the dust emission magnitude assigned to each construction activity applicable to the landfall at Claycastle.

Table 5.12: Dust emission magnitude

Activity	Dust emission magnitude	Justification
Demolition	Small	Minor demolition works to be carried out - the total 'building' volume to be demolished will be <20,000m^3
Earthworks	Medium	Earthworks have been measured from the red line boundary as this is the most conservative approach. The total site area is between 2,500m^2-10,000m^2.
Construction	Small	The total volume of construction is expected to be <25,000m^3.
Trackout	Medium	The total number of outward HDV movements is expected to be between 10-50 per day.

The next step to determine the sensitivity of receptors to dust soiling and PM_{10} has considered the number of receptors within a range of distance bands and defining the annual mean PM_{10} concentration. Figure 5.5 presents the dust assessment buffers used for determining the proximity of sensitive receptors to the landfall at Claycastle. The trackout route was measured 200m from the landfall site (as this is indicative of a medium sized site) and is presented in Figure 5.6. There are no designated ecological receptors requiring consideration within 50m of the site boundary or trackout route on the public highway.

Figure 5.5: Landfall Area construction buffers



Commented [DH8]: TO BE UPDATED FOR FINAL DRAFT BASED ON FINAL RED LINE BOUNDARY

Figure 5.6: Landfall Area trackout buffers

Commented [DH9]: TO BE UPDATED FOR FINAL DRAFT BASED ON FINAL RED LINE BOUNDARY

Table 5.13 presents the sensitivity of the area to effects caused by the Landfall Area at Claycastle construction activities.

Table 5.13: Sensitivity of the area

Activity	Dust soiling		Health effects of PM_{10}	
	Sensitivity	Comment	Sensitivity	Comment
Demolition	High	There are 10 to 100 residential receptors within 20m of the site boundary (Summerfield Holiday Park)	Low	There are 10 to 100 residential receptors within 50m of the site boundary (Summerfield Holiday Park) Background annual mean PM_{10} concentrations are below <24µg/m³ (see Section 5.3).
Earthworks	High		Low	
Construction	High		Low	
Trackout	High	There are 10 to 100 residential properties within 20m of the potential routes used by construction vehicles on the public highway, up to 200m from the site entrance.	Low	There are 10 to 100 residential properties within 20m of the potential routes used by construction vehicles on the public highway, up to 200m from the site entrance. Background annual mean PM_{10} concentrations are below <24µg/m³ (see Section 5.3).

The overall risk receptors to dust soiling effects are presented in Table 5.14 and are based on the criteria presented in the tables in Appendix 5.1.

Table 5.14: Summary of the risk of construction dust activity at the landfall at Claycastle Beach

Potential Impact	Risk			
	Demolition	Earthworks	Construction	Trackout
Dust soiling	Medium Risk	Medium Risk	Low Risk	Medium Risk
Health effects	Negligible Risk	Low Risk	Negligible Risk	Low Risk
Ecological	N/A	N/A	N/A	N/A

Based on the above, the overall effect of dust nuisance and/ or loss of amenity from the construction phase of the landfall at Claycastle Beach is described as 'negligible' to 'medium risk', without mitigation. Mitigation measures appropriate for the landfall area works at Claycastle have been presented in Section 5.5.1.2 and incorporation of such measures within the CEMP will reduce this predicted risk to 'negligible'.

Ballyadam Converter Station

Table 5.15 presents a summary of the dust emission magnitude assigned to each construction activity applicable to the Ballyadam Converter Station.

Table 5.15: Dust emission magnitude

Activity	Dust emission magnitude	Justification
Demolition	N/A	No demolition works are being carried out.
Earthworks	Large	Earthworks have been measured from the red line boundary as this is the most conservative approach. The total site area is approximately 78,000m^2. There is expected to be more than 10 heavy earth moving vehicles at any one point and over 100,000 tonnes of material will be moved.
Construction	Large	The total volume of construction is greater than 100,000m^3. This is includes construction of the buildings onsite and a large stone platform to raise the site by approximately 2.5m.
Trackout	Large	The maximum number of HDVs predicted during the construction of the Ballyadam Converter Station is >50 outward movements per day.

The next step to determine the sensitivity of receptors to dust soiling and PM_{10} has considered the number of receptors within a range of distance bands and defining the annual mean PM_{10} concentration. Figure 5.7 presents the dust assessment buffers used for determining the proximity of sensitive receptors to the proposed development. The trackout route was measured 500m from the proposed development site (as this is indicative of a large site) as is presented in Figure 5.8. There are no designated ecological receptors requiring consideration within 50m of the site boundary or trackout route on the public highway.

Figure 5.7: Ballyadam Converter Station construction buffers

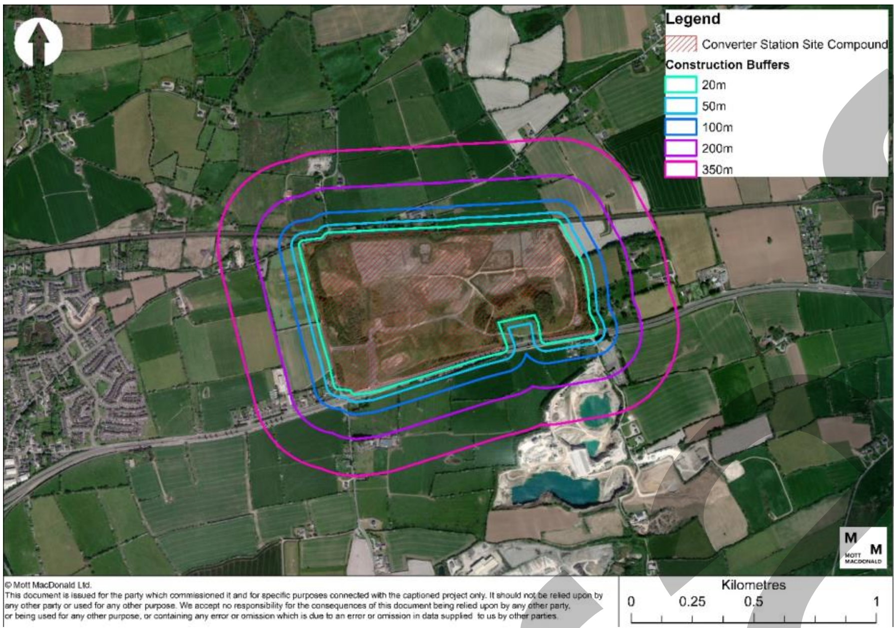


Figure 5.8: Ballyadam Converter Station trackout buffers

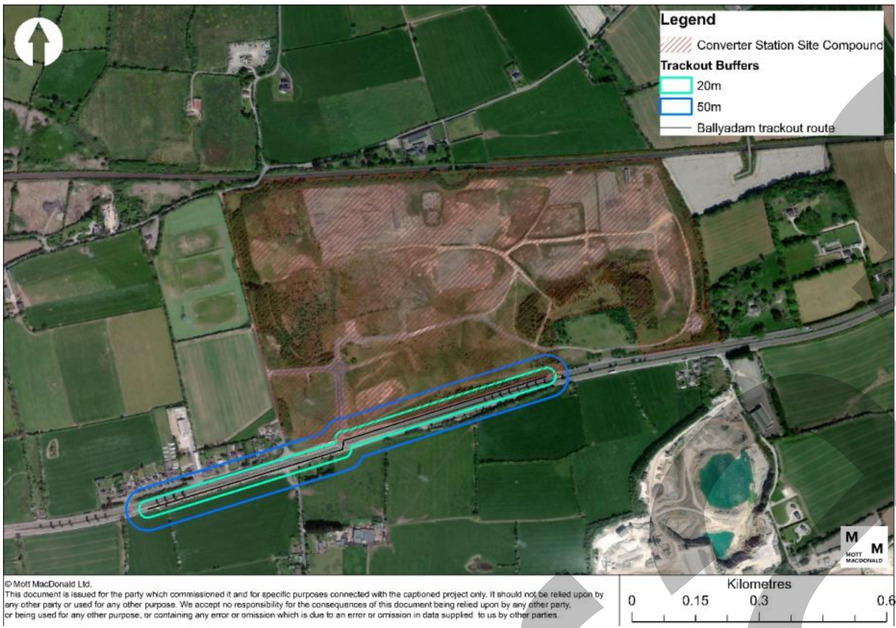


Table 5.16 presents the sensitivity of the area to effects caused by the Ballyadam Converter Station construction activities.

Table 5.16: Sensitivity of the area

Activity	Dust soiling		Health effects of PM_{10}	
	Sensitivity	Comment	Sensitivity	Comment
Demolition	N/A	No demolition activities	N/A	No demolition activities
Earthworks	Medium	There is one residential receptor within 20m of the site boundary (Ballyadam House)	Low	There is one residential receptor within 20m of the site boundary (Ballyadam House). Background annual mean PM_{10} concentrations are below <24µg/m^3 (see Section 5.3).
Construction	Medium		Low	
Trackout	Low	There are 1-10 residential properties within 50m of the potential routes used by construction vehicles on the public highway, up to 500m from the site entrance.	Low	There are 1-10 residential properties within 50m of the potential routes used by construction vehicles on the public highway, up to 500m from the site entrance. Background annual mean PM_{10} concentrations are below <24µg/m^3 (see Section 5.3).

The overall risk receptors to dust soiling effects are presented in Table 5.17 and are based on the criteria presented in the tables in Appendix 5.1.

Table 5.17: Summary of the risk of construction dust activity at the Ballyadam Converter Station

Potential Impact	Risk			
	Demolition	Earthworks	Construction	Trackout
Dust soiling	N/A	Medium Risk	Medium Risk	Low Risk
Health effects	N/A	Low Risk	Low Risk	Low Risk
Ecological	N/A	N/A	N/A	N/A

Based on the above, the overall effect of dust nuisance and/ or loss of amenity from the construction phase of the Ballyadam Converter Station is described as 'medium risk' to 'low risk', without mitigation. Mitigation measures appropriate for the Ballyadam Converter Station have been presented in Section 5.5.1.3 and incorporation of such measures within the Project CEMP will reduce this predicted risk to 'negligible'.

5.4.1.2 Construction GHG emissions

The emissions associated with all the lifecycle stages for construction result in an estimated 38,710tCO_2e with the breakdown between the different stages shown in Table 5.18 below.

Table 5.18: Construction GHG emissions

Lifecycle Stage	Emissions (tCO_2e)*	Percentage of construction emissions
A1-3 Products and materials	18,600	47
A4 Transport to works site	10,550	27
A5 Construction plant	9,560	24
Total	38,710	100

* rounded to nearest 10 tonnes

The following GHG hotspots have been identified as an area to focus carbon reduction upon during the latter stages of design. The focus is on the construction aspects, with the five greatest individual items listed within Table 5.19. Further to this Table 5.20 lists the most intensive aspects of the design. The hotspots were identified to include the emissions associated with the construction lifecycle stages A1-3, A4 and A5.

Table 5.19: Individual item GHG hotspots

Individual Item	Emissions (tCO_2e)*	Percentage of construction emissions
Imported fill material	10,320	27
Disposal of cut material offsite	8,580	22
HVDC power cables	3,580	9
Concrete piles	2,840	7
Piling caps	2,240	6

* rounded to nearest 10 tonnes

Table 5.20: Aspect GHG hotspots

Design Aspect	Emissions (tCO_2e)*	Percentage of construction emissions
Earthworks	19,310	50
Cabling (HVDC and HVAC)	6,990	18
Foundations`	5,250	14
Replacement of road surface for trenching	3,540	9
Converter building	3,400	9

* rounded to nearest 10 tonnes

5.4.2 Operational Phase

The operational GHG assessment based on the assumption of 0.5% SF_6 leakage per year over the 40 year operation is estimated to result in 940tCO_2e.

5.4.3 Do-Nothing Assessment

There would be no air quality or climate impacts in a Do-Nothing scenario. Therefore, no further Do-Nothing assessment has been made.

5.4.4 Decommissioning Phase

The impact associated with the decommissioning phase is similar to the impacts associated with the construction phase. No detailed information is available to complete a GHG assessment for the decommissioning. However, the impacts and mitigation measures stated for the construction phase should be referred to for the decommissioning phase. Therefore, provided that appropriate mitigation is used, the impact of the decommissioning phase on air quality should be reduced to a level that is not significant.

The decommissioning phase would result in the use of plant and the consumption of materials, and therefore, there would be GHG emissions associated with decommissioning. Due to the stage of design and the information available for decommissioning the emissions cannot be estimated at present. The mitigation measures detailed in Section 5.5.2 are however applicable to reducing the impact and would be considered by the overseeing organisation, contractor and designer facilitating the decommissioning.

Furthermore, any works required to remove infrastructure as part of the decommissioning phase will be subject to the relevant consent applications and associated environmental assessments.

5.4.5 Cumulative Effects

5.4.5.1 Construction Phase

In general, there should be no cumulative impact associated with construction dust due to phasing of the construction period and the geographic extent of the proposed development. There will be more than 350m separating different construction sites so sensitive receptors will not experience cumulative effects from construction dust generated from the different construction sites.

There is a risk of cumulative construction dust impacts associated with the construction phases of the proposed development occurring at the same time as the construction phases of nearby committed developments (see Table 4.2 of Volume 3C1 of this EIAR for further details of these developments). It is therefore recommended, in line with IAQM guidance, that regular liaison meetings are held with construction sites within 500m of the site boundary to ensure plans are co-ordinated and dust and particulate matter emissions are minimised. Provided this and other appropriate mitigation measures are implemented, such as those outlined in Section 5.6 of this chapter, the cumulative air quality impact associated with the construction phase should not be significant.

GHG emissions are by nature cumulative, as it is the combined cumulative effect of all GHG emissions that contribute to the changing climate. The GHG assessment does not consider cumulative effects as GHG emissions do not result in a regional effect on climate and the nature of the effect on climate would not differ when combined with other developments. Other proposed developments would be required to consider the GHG emissions from the construction activities associated with that development.

5.4.5.2 Operational Phase

The GHG assessment does not consider cumulative effects as GHG emissions do not result in a regional effect on climate and the nature of the effect on climate would not differ when combined with other developments. Other proposed developments would be required to consider the GHG emissions from the operational activities associated with that development.

5.5 Mitigation and Monitoring Measures

5.5.1 Construction Dust emissions

The appointed Contractor will prepare and implement a Dust Management Plan (DMP) as part of the project CEMP. For the CEMP, the Contractor will also develop and implement a stakeholder communications plan which will facilitate community engagement prior to the commencement of construction.

Recommended mitigation measures for inclusion within the DMP are set out below and have been adapted from best practice guidance from the IAQM, based on the dust risk identified in Section 5.4.1.1 and considering the duration of the construction period. This is particularly relevant for the HVAC / HVDC onshore circuits as the construction will be transient and will be very temporary as will only occur over a period of 1-2 days for each section.

Different mitigation measures have therefore been recommended for different construction activities. With the implementation of these measures, fugitive emissions of dust from the proposed development will be negligible and therefore not significant.

5.5.1.1 Mitigation applicable to HVAC / HVDC Onshore Circuits, Laydown Areas and Passing Bays

Construction activities associated with the installation of the HVAC / HVDC cables are predicted to have a 'negligible to medium risk' in terms of dust soiling and PM_{10} effects with no mitigation in place. Best practice mitigation measures for these activities are presented below:

- Communication:
  - Display the name and contact details of person(s) accountable for air quality and dust issues on the site boundary; and
  - Display the head or regional office contact information.
- Site Management:
  - Record all dust and air quality complaints, identify causes and take appropriate measures to reduce emissions in a timely manner and record the measures taken: and

  - Record any exceptional incidents that cause dust and or air emissions, either on or off site, and the action taken to resolve the situation in the log book.
- Monitoring:
  - Carry out regular site inspections to monitor compliance with the DMP and record inspection results.
- Preparing and maintaining the site
  - Avoid site runoff of water or mud.
- Operating vehicles/ machinery and sustainable travel:
  - Ensure all vehicles switch off engines when stationary – no idling vehicles; and,
  - Avoid the use of diesel- or petrol-powered generators and use mains electricity or battery powered equipment where practicable.
- Operations:
  - Only use cutting, grinding or sawing equipment fitted or in conjunction with suitable dust suppression techniques such as water sprays or local extraction;
  - Ensure an adequate water supply on the site for effective dust/ particulate matter suppression/ mitigation using non-potable water where possible and appropriate; and,
  - Use enclosed chutes and conveyors and covered skips.
- Measures specific to demolition:
  - Ensure effective water suppression is used during demolition operations.
- Measures specific to trackout:
  - Ensure vehicles entering and leaving sites are covered to prevent escape of materials during transport;
  - Inspect on-site haul routes for integrity and instigate necessary repairs to the surface as soon as reasonably practicable; and,
  - Record all inspections of haul routes.

5.5.1.2 Mitigation applicable to Landfall at Claycastle

Construction activities associated with the landfall at Claycastle are predicted to have a ‘negligible to medium risk’ in terms of dust soiling and PM_{10} effects with no mitigation in place. Best practice mitigation measures for these activities are presented below:

- Communication:
  - Display the name and contact details of person(s) accountable for air quality and dust issues on the site boundary; and,
  - Display the head or regional office contact information.
- Site Management:
  - Record all dust and air quality complaints, identify causes and take appropriate measures to reduce emissions in a timely manner and record the measures taken; and,
  - Record any exceptional incidents that cause dust and or air emissions, either on or off site, and the action taken to resolve the situation in the log book.
- Monitoring:
  - Carry out regular site inspections to monitor compliance with the DMP and record inspection results; and,
  - Increase the frequency of site inspections by the person accountable for air quality and dust issues on site when activities with a high potential to produce dust are being carried out and during prolonged dry or windy conditions.

- Preparing and maintaining the site:
  - Avoid site runoff of water or mud;
  - Plan site layout so that machinery and dust causing activities are located away from receptors as far as possible: and
  - Erect solid screens or barriers around dusty activities or the site boundary that are at least as high as any stockpiles.
- Operating vehicles / machinery and sustainable travel:
  - Ensure all vehicles switch off engines when stationary – no idling vehicles; and,
  - Avoid the use of diesel- or petrol-powered generators and use mains electricity or battery powered equipment where practicable.
- Operations:
  - Only use cutting, grinding or sawing equipment fitted or in conjunction with suitable dust suppression techniques such as water sprays or local extraction;
  - Ensure an adequate water supply on the site for effective dust/ particulate matter suppression/ mitigation using non-potable water where possible and appropriate;
  - Use enclosed chutes and conveyors and covered skips.
  - Minimise drop heights from conveyors loading shovels hoppers and other loading or handling equipment and use fine water sprays on such equipment wherever available; and,
  - Bonfires and burning of waste materials will be prohibited.
- Measures specific to demolition:
  - Ensure effective water suppression is used during demolition operations; and,
  - Avoid explosive blasting, using appropriate manual or mechanical alternatives.
- Measures specific to earthworks:
  - Re-vegetate earthworks and exposed areas/ soil stockpiles to stabilise surfaces as soon as practicable;
  - Use hessian, mulches or trackifiers where it is not possible to re-vegetate or cover with topsoil as soon as practicable; and,
  - Only remove the cover in small areas during work and not all at once.
- Measures specific to trackout:
  - Use water-assisted dust sweepers on the access and local roads, to remove as necessary any material tracked out of site;
  - Ensure vehicles entering and leaving sites are covered to prevent escape of materials during transport;
  - Inspect on-site haul routes for integrity and instigate necessary repairs to the surface as soon as reasonably practicable;
  - Record all inspections of haul routes;
  - Implement a wheel washing system (with rumble grids to dislodge accumulated dust and mud prior to leaving the site where reasonably practicable); and,
  - Ensure there is an adequate area of hard surfaced road between the wheel wash facility and the site exit and layout permits.

5.5.1.3 Mitigation applicable to Ballyadam Converter Station

Construction activities associated with the Ballyadam Converter Station are predicted to have a ‘low to medium risk’ in terms of dust soiling and PM_{10} effects with no mitigation in place. Best practice mitigation measures for these activities are presented below:

- Communication:
  - Display the name and contact details of person(s) accountable for air quality and dust issues on the site boundary; and,
  - Display the head or regional office contact information.
- Site Management:
  - Record all dust and air quality complaints, identify causes and take appropriate measures to reduce emissions in a timely manner and record the measures taken; and,
  - Record any exceptional incidents that cause dust and or air emissions, either on or off site, and the action taken to resolve the situation in the log book.
- Monitoring:
  - Carry out regular site inspections to monitor compliance with the DMP and record inspection results; and,
  - Increase the frequency of site inspections by the person accountable for air quality and dust issues on site when activities with a high potential to produce dust are being carried out and during prolonged dry or windy conditions.
- Preparing and maintaining the site:
  - Avoid site runoff of water or mud;
  - Plan site layout so that machinery and dust causing activities are located away from receptors as far as possible;
  - Erect solid screens or barriers around dusty activities or the site boundary that are at least as high as any stockpiles;
  - Fully enclose site or specific operations where there is a high potential for dust production and the site is active for an extensive period;
  - Remove materials that have a potential to produce dust from site as soon as possible unless being re-used on site; if they are being reused on site cover as described below; and,
  - Cover seed or fence stockpiles to prevent wind whipping.
- Operating vehicles/ machinery and sustainable travel:
  - Ensure all vehicles switch off engines when stationary – no idling vehicles;
  - Avoid the use of diesel- or petrol-powered generators and use mains electricity or battery powered equipment where practicable; and,
  - Impose and signpost a maximum-speed limit of 15mph on surfaced and 10mph on unpaved surface haul roads and work areas.
- Operations
  - Only use cutting, grinding or sawing equipment fitted or in conjunction with suitable dust suppression techniques such as water sprays or local extraction;
  - Ensure an adequate water supply on the site for effective dust/ particulate matter suppression/ mitigation using non-potable water where possible and appropriate;
  - Use enclosed chutes and conveyors and covered skips;
  - Minimise drop heights from conveyors loading shovels hoppers and other loading or handling equipment and use fine water sprays on such equipment wherever available;
  - Avoid bonfires and burning of waste materials; and,
  - Ensure equipment is readily available on site to clean any dry spillages, and clean up spillages as soon as reasonably practicable after the event using wet cleaning methods.
- Measures specific to demolition:
  - Ensure effective water suppression is used during demolition operations; and,

  - Avoid explosive blasting, using appropriate manual or mechanical alternatives.
- Measures specific to construction:
  - Avoid scabbling (roughening of concrete surfaces) if possible:
  - Ensure sand and other aggregates are stored in bunded areas and are not allowed to dry out, unless this is required for a particular process, in which case ensure that appropriate additional control measures are in place;
  - Ensure bulk cement and other fine powder materials are delivered in enclosed tankers and stored in silos where suitable emission control systems to prevent escape of material and overfilling during delivery: and,
  - For smaller supplies of fine power materials ensure bags are sealed after use and stored appropriately to prevent dust.
- Measures specific to earthworks:
  - Re-vegetate earthworks and exposed areas/ soil stockpiles to stabilise surfaces as soon as practicable;
  - Use hessian, mulches or trackifiers where it is not possible to re-vegetate or cover with topsoil as soon as practicable; and,
  - Only remove the cover in small areas during work and not all at once.
- Measures specific to trackout:
  - Use water-assisted dust sweepers on the access and local roads, to remove as necessary any material tracked out of site;
  - Ensure vehicles entering and leaving sites are covered to prevent escape of materials during transport;
  - Inspect on-site haul routes for integrity and instigate necessary repairs to the surface as soon as reasonably practicable;
  - Record all inspections of haul routes;
  - Implement a wheel washing system (with rumble grids to dislodge accumulated dust and mud prior to leaving the site where reasonably practicable);
  - Ensure there is an adequate area of hard surfaced road between the wheel wash facility and the site exit and layout permits;
  - Install hard surfaced haul routes which are regularly damped down with fixed or mobile sprinkler system or mobile water bowsers and regularly cleaned;
  - Avoid dry sweeping of large areas; and,
  - Access gates to be located at least 10m from receptors where possible.

5.5.2 Construction GHG emission mitigation

It is important that the design seeks to limit GHG emissions from the earliest stage possible to ensure the greatest reductions can occur. The following high-level approach will 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 will 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.

The latter stages of the design should consider the hotspots as detailed in Section 5.4.1 as the focus for reductions of GHG emissions. The key idea to further consider is the increased reuse of site-won material as this would both reduce the off-site disposal of material and the import of material which currently, based on a worst-case assumption, accounts for 50% of the construction emissions.

5.5.3 Operational Phase

In relation to operational impacts on climate change, the following best practice will be implemented in order to prevent fugitive emissions of SF_6 during operation of the proposed development.

- Staff or any sub-contractors involved in equipment installation, servicing or disposal will be trained to ensure they understand the techniques required to minimise the generation of fugitive emissions. The training will include best management practices for handling, managing and monitoring SF_6.
- The supply and maintenance of the proposed equipment will comply with all relevant international standards and best practice:
  - *BS EN 62271-203:2004 High-voltage switchgear and control gear. Gas-insulated metal-enclosed switchgear for rated voltages above 52 kV*;
  - *BS EN 62271-4. High-voltage switchgear and control gear. Part 4. Use and handling of sulphur hexafluoride (SF6)*;
  - *PD CLC/TR 62271-303:2009 High-voltage switchgear and control gear. Use and handling of sulphur hexafluoride (SF6)*;
  - *BS EN 60376:2005 Specification of Technical Grade Sulphur Hexafluoride(SF6) for Use in Electrical Equipment;*
  - *BS EN 60480:2004 Guidelines for the checking and treatment of Sulphur Hexafluoride (SF6) taken from electrical equipment and specification for its re-use;*
  - *CIGRE 276: Guide for the Preparation of Customised 'Practical SF6 Handling Instructions.' Task Force B3.02.01 (2005); and*
  - *BS 6867:1987 Code of practice for maintenance of electrical switchgear for voltages above 36 kV*.

Leak detection methods, i.e. pressure or density monitoring device, will be used as necessary and on a regular basis to identify any sources of fugitive emissions of SF_6 from equipment at the proposed development.

5.6 Residual Impacts

There are no significant impacts predicted during the construction and operational phases for air quality with the successful incorporation of best practice mitigation.

The Institute of Environmental Management and Assessment (IEMA) guidance on assessing GHG emissions[34] advises that all GHG emissions should be considered significant, regardless of the scale of the emissions. Numerous governments have recognised the critical nature of climate change and the impact of GHG emissions by set out the goal of net zero carbon, this includes the Irish Government which has committed to net zero by 2050. To provide context for

[34] IEMA, 2017, Environmental Impact Assessment Guide to: Assessing Greenhouse Gas Emissions and Evaluating their Significance

the level of emissions for the proposed development the estimates have been compared to Irelands total emissions and the emissions estimated to be accounted to consumption of natural resources for construction in Table 5.21 below.

Table 5.21: Proposed development GHG emissions comparison

Phase	Proposed development emissions	Percentage of Ireland's annual emissions	Percentage of estimated resource consumption for construction emissions in Ireland
Construction	38,710	0.6	6
Operation	940	0.02	N/A
Total	39,650	0.7	N/A

As shown in the table above the proposed development's contribution to Ireland's total emissions is relatively small at 0.6%, however, when compared to the estimated consumption of natural resources for construction in Ireland this equates to approximately 6%. Therefore, the emissions associated with the proposed development are not immaterial and as such it is imperative the subsequent stages of design seek to reduce the GHG emissions as far as possible by considering the mitigation detailed in Section 5.5.

The Investment Request File for this project[35] refers to a residual benefit of the project in allowing for integration of additional renewable energy sources. The projection for 2030 is an average additional 813 GWh renewable energy a year with an estimated emissions reduction of 331,000 tonnes CO_2 per year (Table 6 in the Investment Request File). Integrating renewable energy sources was one of the EU 20-20-20 targets, and this project will interconnect transmission grids which is anticipated to facilitate development and use of renewable energy sources. This operational benefit would outweigh the calculated embodied emissions during construction and anticipated SF6 emissions during operation.

5.7 Transboundary Effects

In accordance with IAQM guidance, the risk associated with construction dust impacts occurs up to 350m from a construction site or within 50m of the trackout routes, up to 500m from the construction site entrance. Beyond this distance, the risk is negligible. However, as previously discussed, the impacts associated with construction dust from the proposed development are anticipated to be negligible with the implementation of appropriate mitigation measures, such as those suggested in Section 5.6.1. Therefore, the risk of transboundary effects associated with construction dust is not significant.

The GHG assessment does not consider transboundary effects as GHG emissions do not result in a regional effect on climate and the nature of the effect on climate would not differ when considered from a transboundary perspective.

5.8 Summary

This chapter provides an assessment of the impacts on air quality and climate arising from the proposed development.

[35] The Celtic Interconnector Project, Investment Request File, 7th September 2018 [online] CRU18265a-Celtic-Investment-Request.pdf (Accessed November 2020)

As discussed in Section 5.2, air quality impacts associated with vehicle traffic and combustion activities during construction and operation of the proposed development are anticipated to be of negligible significance so have been scoped out of the assessment.

A qualitative assessment of construction dust effects has however been undertaken for the different construction activities associated with the proposed development. Across the different construction activities, the level of risk of dust creating nuisance and/or loss of amenity and PM_{10} leading to adverse health effects (without mitigation) is predicted to range from 'negligible' to 'medium risk'. Following the appropriate implementation of the mitigation measures, such as those presented in Section 5.5.1, the air quality impacts associated with dust are predicted to be not significant.

As the air quality impacts associated with the proposed development are not significant and ambient pollutant concentrations are well below the relevant air quality standards, no exceedances of air quality standards are anticipated.

The GHG assessment considered the embodied carbon of materials used for construction, transport of materials to site, construction plant emissions, and emissions of SF_6 through operation. The total emissions associated with the proposed development are estimated to be 39,650tCO_2e.

The emissions must be reduced where possible through the later stages of the design, considering the Irish Government's commitment to net zero by 2050 and the impact all GHG emissions have upon the climate. Any increase or decrease in GHG emissions can be considered to be significant based on their effect on the global climate[36]. Mitigation measures to aid the reduction are detailed in Section 5.5. Considering the overall benefit of the project to facilitate development and use of renewable energy sources, lifetime savings of GHG emissions are anticipated to outweigh the calculated embodied emissions during construction and anticipated SF_6 emissions during operation.

[36] IEMA, 2017, Environmental Impact Assessment Guide to: Assessing Greenhouse Gas Emissions and Evaluating their Significance

Table 5.22: Summary

Phase	Description of likely impact	Embedded design, mitigation and enhancement measures	Sensitivity /value of receptor	Duration of impact	Magnitude of impact (with mitigation)	Significance impact
Construction	Dust soiling and particulate emissions	CEMP dust mitigation measures (see section 5.6.1)	High	Temporary and/or short-term	Negligible	Not significant
	GHG emissions from embodied carbon within materials, construction plant and transport of materials to site	Reduction principles within section 5.6.2 focused on the hotspots detailed in section 5.5.1	N/A	Permanent [37]	N/A	Significant adverse
Operation	GHG emissions due to leakage of SF_6	Best practice as detailed in section 5.6.3	N/A	Permanent	N/A	Significant adverse
	Project facilitates use of renewable energy sources	Residual impacts as summarised in section 5.6	N/A	Permanent	N/A	Significant beneficial

[37] Note that GHG emissions are considered permanent and significant as they will not be removed from the atmosphere and will contribute towards climate change once emitted.

6 Land, Soils and Hydrogeology

6.1 Introduction

This chapter presents the assessment of the likely significant effects arising from the Irish onshore elements of the proposed development on land, soils and hydrogeology between the landfall area and Knockraha substation. This chapter also provides a high-level assessment of the compliance of the proposed development with the Water Framework Directive (WFD) 2000/60/EC.

This assessment focuses on impacts associated with the installation of the land cable and is based on the embedded mitigation detailed in Chapter 2 Description of the Development and Chapter 3 Construction Phase Activities, prior to the implementation of additional mitigation measures. The proposed development location references are as detailed in Table 2.1 and presented in Appendix 2.1 Mapping. Impacts associated with the installation of the submarine cable are discussed in Volume 3D.

This chapter considers the potential impacts during construction, operation and decommissioning associated with:

- Land and land use;
- Soils and geology; and,
- Hydrogeology.

Proposed environmental control measures and additional mitigation measures to prevent, reduce and/or offset the anticipated potential impacts are presented as appropriate.

The assessment of the likely significant effects arising from the proposed development on surface water is presented in Chapter 7: Water. The assessment of impacts on biodiversity is discussed in Chapter 8: Biodiversity.

6.2 Methodology and Limitations

6.2.1 Legislative Context

This chapter has been prepared in accordance with the requirements of European Union Directive 2011/92/EU on the assessment of the effects of certain public and private projects on the environment (the ‘EIA Directive’) as amended by Directive 2014/52/EU.

The requirements of the following legislation have also been complied with:

- S.I. No. 272 of 2009: European Communities Environmental Objectives (Surface Waters) Regulations 2009 (as amended by S.I. No. 296/2009; S.I. No. 386/2015; S.I. No. 327/2012; and S.I. No. 77/2019 and giving effect to Directive 2008/105/EC on environmental quality standards in the field of water policy and Directive 2000/60/EC establishing a framework for Community action in the field of water policy) and;
- S.I. No. 722 of 2003 European Communities (Water Policy) Regulations which implement EU Water Framework Directive (2000/60/EC) establishing a framework for the Community action in the field of water policy and provide for implementation of ‘daughter’ Groundwater Directive (2006/118/EC) on the protection of groundwater against pollution and deterioration. Since 2000 water management in the EU has been directed by the Water Framework Directive (2000/60/EC) (as amended by Decision No. 2455/2011/EC; Directive 2008/32/EC;

Directive 2008/105/EC; Directive 2009/31/EC; Directive 2013/39/EU; Council Directive 2013/64/EU; and Commission Directive 2014/101/EU (WFD). The WFD was given legal effect in Ireland by the European Communities (Water Policy) Regulations 2003 (S.I. No. 722 of 2003);

- S.I. No. 684 of 2007: Waste Water Discharge (Authorisation) Regulations 2017, resulting from EU Directive 80/68/EEC on the protection of groundwater against pollution caused by certain dangerous substances (the Groundwater Directive);S.I. No. 106 of 2007: European Communities (Drinking Water) Regulations 2007and S.I. No. 122 of 2014: European Communities (Drinking Water) Regulations 2014, arising from EU Directive 98/83/EC on the quality of water intended for human consumption (the Drinking Water Directive) and EU Directive 2000/60/EC; and
- S.I. No. 9 of 2010: European Communities Environmental Objectives (Groundwater) Regulations 2010 (as amended by S.I. No. 389/2011; S.I. No. 149/2012; S.I. No. 366/2016; the Radiological Protection (Miscellaneous Provisions) Act 2014; and S.I. No. 366/2016).

6.2.2 Relevant Guidelines

The assessment was carried out in accordance with the following guidance and tailored accordingly based on professional judgement and experience:

- Institute of Geologists Ireland (2013): Guidelines for Preparation of Soils, Geology & Hydrogeology Chapters in Environmental Impact Statements;
- National Roads Authority (2009): Guidelines on Procedures for Assessment and Treatment of Geology, Hydrology and Hydrogeology for National Road Schemes; and
- CIRIA 2006: Control of Water Pollution from Construction Sites - Guidance for Consultants and Contractors. CIRIA C532. London, 2006.

6.2.3 Desk-top Assessment

A desk study of the proposed development locations and surrounding area was carried out to collate all available and relevant geological, hydrogeological, hydrological and meteorological data for the study area, using the following data sources:

- Ordnance Survey Ireland 1:50,000 topographic maps.
- Geological Survey of Ireland (GSI) online mapping;
- Environmental Protection Agency (EPA) database (www.epa.ie);
- Geological Survey of Ireland - Groundwater Database (www.gsi.ie);
- Teagasc Subsoil Mapping (2004) (www.gis.teagasc.ie/soils/map.php)
- Teagasc Soils Mapping (2007) (www.gis.teagasc.ie/soils/map.php)
- Met Eireann Meteorological Databases (www.met.ie);
- National Parks & Wildlife Service (NPWS) Public Map Viewer (www.npws.ie);
- Water Framework Directive Catchments Map Viewer (www.catchments.ie);
- Bedrock Geology 1:100,000 Scale Map Series, Sheets 12,15,16,18 and 19; Geological Survey of Ireland (GSI, 1995 - 2003);
- Geological Survey of Ireland - Groundwater Body Characterisation Reports;
- Office of Public Works Indicative Flood Maps (www.floodmaps.ie)
- Environment Protection Agency, EPA (Water Framework Ireland Map viewer) databases;
- Environmental Protection Agency – Hydrotool Map Viewer (www.watermaps.wfdireland.ie/HydroTool)

- CFRAM Preliminary Flood Risk Assessment (PFRA) maps (www.floodinfo.ie); and,
- Department of Housing, Local Government and Heritage on-line mapping viewer (www.myplan.ie).
- CORINE Land Cover mapping (Copernicus, 2018)

Collation of the groundwater wells and springs data was undertaken using the GSI datasets. As no ground investigations or site walkover surveys were conducted, it is possible there are additional features (e.g. springs) not included within the GSI dataset.

6.3 Methodology

6.3.1.1 Assessment Scope

Unless otherwise stated, the study area for this assessment extends to a 500m buffer either side of the cable route, and up to a 1km radius from the proposed Converter Station site, connection point and landfall. For the purpose of this assessment the cable route is divided into the following sections:

- Knockraha connection point;
- HVAC underground cable route (ca.10km);
- Ballyadam Converter Station site;
- HVDC cable route (ca.30km); and
- Landfall at Claycastle Beach.

In addition to which there are a number of cable connection points used to define specific sections of cable falling under the longer HVAC and HVDC cable route sections (cable only) as defined at Table 2.1 in Chapter 2.

6.3.1.2 Identification of receptors

The methodology and scope used to identify the various baseline receptors in proximity to the cable route are summarised in Table 6.1.

Table 6.1: Scope for identification of baseline receptors

Receiving Environment	Scope
Land and land use	• Land use types and potential contaminant profiles
Soils and geology	• Soils, subsoils, bedrock geology and other geological features, further to a review of GSI data. • Mapped karst landforms including boreholes, caves, dry valleys, enclosed depressions, estavelles, springs, superficial solution features, swallow holes and turloughs. • Traced underground connections of known water dye trace studies and results • Geological heritage sites (within 1km of the proposals) • Geohazards: recorded events, primarily landslides, within 1km of the proposals
Hydrogeology	• Groundwater body and both quantitative and qualitative status classification as assigned under the WFD. • Groundwater: Groundwater abstractions from Public Supply Schemes, Group Water Schemes and local domestic/agricultural wells (with varying degrees of location accuracy) mapped by the GSI. • Groundwater Drinking Water Protection Areas • Aquifer Type, as assigned by the GSI; relates to the aquifers productivity in terms of well yields as detailed below: ○ Ll - Locally Important Aquifer - Bedrock which is Moderately Productive only in Local Zones

Receiving Environment	Scope
	○ Lm - Bedrock which is Generally Moderately Productive ○ Lk – Locally Important Aquifer – Karstified to a limited degree or area ○ Rkd - Regionally Important Aquifer-Karstified (diffuse) ○ Lg – Locally Important Aquifer- Sand and gravel • Aquifer Vulnerability • Designated sites that are hydrologically or hydrogeologically connected to the proposals

Source: (DOE, 1996) (EPA Catchments, 2020) (EPA, 2020) (GSI, 2020)

6.3.1.3 Assessment of Importance/Sensitivity of Receptors

The importance / sensitivity of the geological, hydrogeological and hydrological receptors was assessed on completion of the desk study and baseline assessment.

Using NRA (2009) Guidance, with additional criteria for the assessment of ground stability, the criteria used for assessing the importance/sensitivity of the geological, environments within the study area is outlined out in Table 6.2.

Table 6.2: Estimation of Importance of geological attributes

Importance	Criteria	Typical Example
Very High	Attribute has a high quality, significance or value on a regional or national scale. Degree or extent of soil contamination is significant on a national or regional scale. Volume of peat and / or soft organic soil underlying route is significant on a national or regional scale. Ground instability is significant on a national or regional scale.	• Geological feature rare on a regional or national scale (NHA). • Large existing quarry or pit. • Proven economically extractable mineral resource. • Major historical landslide or widespread subsidence.
High	Attribute has a high quality, significance or value on a local scale. Degree or extent of soil contamination is significant on a local scale. Volume of peat and / or soft organic soil underlying site is significant on a local scale. Ground instability is significant on a local scale.	• Contaminated soil on site with previous heavy industrial usage. • Large recent landfill site for mixed wastes. • Geologically feature of high value on a local scale (County Geological Site). • Well drained and / or high fertility soils. • Moderately sized existing quarry or pit. • Marginally economic extractable mineral resource. • Large or small repeated historical landslide or localised subsidence.
Medium	Attribute has a medium quality, significance or value on a local scale. Degree or extent of soil contamination is moderate on a local scale. Volume of peat and / or soft organic soil underlying site is moderate on a local scale. Ground instability is moderate on a local scale.	• Contaminated soil on site with previous light industrial usage. • Small recent landfill site for mixed wastes. • Moderately drained and / or moderate fertility soils. • Small existing quarry or pit. • Sub-economic extractable mineral resource. • Minor historical landslide or historical subsidence.
Low	Attribute has a low quality, significance or value on a local scale. Degree or extent of soil contamination is minor on a local scale. Volume of peat and / or soft organic soil underlying site is small on a local scale.	• Large historical and / or recent site for construction and demolition wastes. • Small historical and / or recent site for construction and demolition wastes. • Poorly drained and / or low fertility soils. • Uneconomically extractable mineral resource.

	Ground instability is very limited and only on a local scale.	• No historical landslides, weak or no evidence of any localised subsidence.

Source: (NRA, 2009) / Mott MacDonald

Using NRA (2009) Guidance, with additional criteria for the assessment of ground stability, the criteria used for assessing the importance/sensitivity of the hydrogeological environments within the study area is outlined out in Table 6.3.

Table 6.3: Estimation of Importance of Hydrogeology Attributes

Importance	Criteria	Typical Example
Extremely High	Attribute has a high quality or value on an international scale	• Groundwater supports river, wetland or surface water body ecosystem protected by EU legislation, e.g. SAC or SPA status.
Very High	Attribute has a high quality or value on a regional or national scale	• Regionally Important Aquifer with multiple wellfields. • Groundwater supports river, wetland or surface water body ecosystem protected by national legislation - NHA status. • Regionally important potable water source supplying >2500 homes Inner source protection area for regionally important water source.
High	Attribute has a high quality or value on a local scale	• Regionally Important Aquifer Groundwater provides large proportion of baseflow to local rivers. • Locally important potable water source supplying >1000 homes. • Outer source protection area for regionally • important water source. • Inner source protection area for locally important water source.
Medium	Attribute has a medium quality or value on a local scale	• Locally Important Aquifer. • Potable water source supplying >50 homes. • Outer source protection area for locally important water source.
Low	Attribute has a low quality or value on a local scale	• Poor Bedrock Aquifer Potable water source supplying <50 homes

Source: (NRA, 2009)

6.3.1.4 WFD Assessment Methodology

The design of the proposed development was screened against the characteristics for groundwater bodies numbered below. This determines whether the physical works require a further assessment to be compliant with the WFD and should be repeated if the proposed works are significantly altered in the future.

3. Water balance;
4. Groundwater abstraction related deterioration of dependent surface water body status;
5. Groundwater dependent ecosystems (GWDE); and
6. Saline or other intrusion test.

Following these assessments, where mitigation can be incorporated to maximise opportunities for enhancement, the activity will be considered to have very low residual risk and therefore will be compliant with the WFD. Where mitigation cannot be incorporated, assessment against criteria presented in WFD Article 4(7) 'deterioration of status or non-achievement of good status or potential under certain distinct conditions' (WFD, 2000) will be applied.

6.3.2 Limitations of this EIAR

All third-party reports, data and mapping are assumed to be correct for the purposes of this EIAR.

This EIAR chapter is a desk-based study. No site-walkover surveys or any intrusive ground investigations have been undertaken to confirm, corroborate or inform the assessments made.

6.4 Receiving Environment

The following sections present an overview of the baseline features within the receiving environments: *land and land use, soils and geology* and *hydrogeology*. The baseline has been identified using the methodology outlined in Section 6.2. For each section, the baseline features are summarised under the route sections defined in Table 2.1.

The proposed works intersect two WFD groundwater bodies, the Ballinhassig East sandstone (IE_SW_G_004); and Midleton limestone (IE_SW_G_0580). Details of the WFD groundwater bodies may be found in Section 6.4.3.6.

A summary of the receiving environments for the proposed development may be found in Appendix 6.

6.4.1 Land and Land Use

The land and land use baseline encountered across the onshore interconnector route may be divided into several land use types for which potential contaminant profiles may be assigned.

The baseline land use (from the CORINE 2018 land use dataset) is summarized in bullet form below, and detailed in Appendix 6.

- 3 land use types within the Connection Point section;
- 5 land use types within the HVAC Underground Cable Route (Ca.10km) section;
- 4 land use types within the Converter Station Site section;
- 4 land use type within the HVDC Underground Cable Route (Ca.30km) section; and
- 1 land use type within the Landfall at Claycastle Beach section.

Table 6.4: Land Use Baseline

Proposals	Land Use Type	Location/Distribution
Connection Point	Electricity substations	Connection Point.
	Agriculture	Surrounding Connection Point.
	Roads / vehicles / HGV parking	Surrounding/access to Connection Point Substation
HVAC Cable	Agricultural Land (Pastures, non-irrigated arable land, complex cultivation patterns)	Surrounds entire route AC01 – AC07 often bordering the route section, interspersed with rural settlements.
	Electricity substations	At the Connection point and Converter Station Site
	Historical Quarry – Lackenbehy	Approximately 500m north-east of the centre line of cable route AC03 – AC04.
	Railways works and sidings	Approximately 400m south of cable route AC05-AC06A and runs parallel within 100m of proposed cable route AC05-AC06 C/D. HDD railway crossing at AC06-AC07.
	Roads / vehicles / HGV parking	Underlies the majority of the proposed route with cable installation within the road network.
Converter Station Site	Agricultural Land (Pastures, non-irrigated arable land, complex cultivation patterns)	Surrounds Converter Station perimeter.
	Electricity substations	Converter Station Site.
	Railways works and sidings	Railway within 100m north of the centre of the Converter Site. Proposed Railway HDD crossing within DC01-DC02.
	Roads / vehicles / HGV parking	Access to Converter Station site established within existing road network into site.
HVDC Cable	Agricultural Land (Pastures, non-irrigated arable land, complex cultivation patterns)	Surrounds entire route AC01 – AC07 often bordering the route section, interspersed with rural settlements.
	Electricity substations	At the Converter Station site (Ballyadam) DC01 – DC02
	Railways works and sidings	Railway HDD crossing between DC01- DC02 cable route 100m north of Converter Site.
	Roads / vehicles / HGV parking	Underlies the majority of the proposed route with cable installation within the road network
Landfall	Roads / vehicles / HGV parking	Landfall (access).

Source: (DOE, 1996)

6.4.2 Soils and Geology

For the purpose of this EIA chapter, Geohazards were identified as any karst features or areas susceptible to landslides/subsidence that would need to be considered prior to development (NRA, 2009). Karst features include sinkholes, caves, some types of springs and turloughs. Sinkholes caves and springs are all noted on or near the site.

Soil and subsoil receptors were identified using Teagasc (Teagasc, 2020) and GSI databases (GSI, 2020), with the latter including the national Quaternary sediments database.

There were a wide range of shallow, basic, and poorly drained soil types interspersed throughout the assessment area. Devonian Sandstone Till was the primary subsoil receptor identified but there were also a variety of bedrock outcrop, marine and estuarine sediments and manmade sub soil layers throughout the proposed route.

The classification of receptor values for soil type was based on Table 6.2 with soils identified as well drained and/or highly fertile classified as high importance value with the poorly drained and/or low fertility soils classified as low importance (NRA, 2009). Where soil was identified as potentially significantly contaminated at the local scale this was also identified as a receptor of high importance. Man Made soil type was the only receptor identified as being potentially significantly contaminated within the scope of this EIAR.

The soil and geology baseline receptors, and their corresponding values, are outlined in Sections 6.4.2.1 to 6.4.2.5 of which there are a total of:

- 1 soil receptor, 1 sub soil receptor, 1 bedrock receptor, and 0 geohazards and karst receptors within the Connection Point section;
- 5 soil receptors, 4 sub soil receptors, 6 bedrock receptors and 5 geohazard and karst receptors within the HVAC Underground Cable (ca. 10km) section;
- 1 soil receptor, 1 sub soil receptor, 1 bedrock receptor and 4 geohazard and karst receptors within the Converter Station Site section;
- 9 soil receptors, 7 sub soil receptors, 8 bedrock receptors and 6 geohazard and karst receptors within the HVAC Underground Cable (Ca.30km) section; and
- 1 soil receptor, 2 sub soil receptors, 1 bedrock receptor and 0 geohazard and karst receptors within the Landfall at Claycastle Beach section.

6.4.2.1 Connection Point

The following table presents the soil and geology baseline for the connection point.

Table 6.5: Connection Point soil and geology baseline

Receptor	Receptor Value	Distribution
Soils		
Man Made	High	Underlies Connection Point Substation Perimeter.
Sub soils		
Man Made	High	Underlies Connection Point
Bedrock		
Ballytrasna Formation	Medium	Underlies Connection Point
Geohazards and Karst		
None present		

Source: (Teagasc, 2020) (GSI, 2020)

6.4.2.2 HVAC Underground Cable (Ca.10km)

The following table presents the soil and geology baseline for the HVAC underground cable route.

Table 6.6: HVAC Underground Cable Route (Ca.10km) soil and geology baseline

Receptor	Receptor Value	Distribution
Soils		
Amin DW (Deep well drained mineral mainly acidic)	High	AC01- AC07. Underlies entire study area.
Amin SW (Shallow well drained mineral mainly acidic)	High	Interspersed throughout route section underlying sections AC03 – AC04, AC04 – AC05, AC05 – AC06
BminSW (shallow well drained mineral mainly basic)	High	Underlies small sections of the cable route between AC05- AC06, AC06 – AC07.
Man Made	High	Underlies connection point at Knockraha substation at AC01 – AC02
AminSRPT - Shallow, rocky, peaty (poorly drained mineral)	Low	Narrow section parallel to cable route section between AC05 – AC06
Sub soils		
Karstified bedrock outcrop	High	Exists in many areas of the cable route section including; AC03-AC04, AC04- AC05, AC05-AC06, AC06-AC07.
Till derived from Devonian sandstones	Medium	AC01- AC02, AC02 – AC03, AC03 – AC04, AC04 – AC05, AC05- AC06, AC06- AC07.Underlies entire study area.
Bedrock outcrop close to the surface - Lackenbehy Quarry	Medium	Approximately 500m north east of the centre line of cable route AC03 – AC04.
Man Made	High	Underlies cable connection point to Knockraha Substation at section AC01 – AC02
Bedrock		
Waulsortian Limestone	Very high	Underlies cable route sections between AC05 – AC06, AC06 – AC07
Ballytrasna Formation	Medium	AC01 – AC02, AC02 – AC03, AC03 – AC04, AC04 – AC05. Underlies entire study area up to AC05.
Ballysteen Formation	Medium	Underlies cable route sections between AC05 – AC06, AC06 – AC07

Receptor	Receptor Value	Distribution
Old Head Sandstone Formation	Medium	Underlies cable route in section AC05 – AC06
Kinsale Formation	Medium	Underlies cable route sections between AC05 – AC06, AC06 – AC07
Gyleen Formation	Medium	Underlies cable route in section AC05 – AC06
Geohazards and Karst		
Swallow Hole - Limestone, clean, unbedded	High	Approximately 300m south of connection point in centre of cable route AC06- AC07
Cave - limestone, clean unbedded	High	Approximately 500m south from the proposed cable route section AC05-AC06 north of Carrigtwohill.
2 enclosed depressions (Ballyadam)	High	Approximately 600m south of connection point AC06 and 500m south-west of the centre of the Converter Station Site (Ballyadam)
Turlough - Limestone, clean, unbedded	High	Approximately 200m north east of the cable route section AC06-AC07, within close proximity to the rail line.
Lackenbehy Quarry = Moderate-High landslide susceptibility	High	Approximately 500m north east of the centre line of cable route AC03 – AC04.

Source: (Teagasc, 2020) (GSI, 2020)

6.4.2.3 Converter Station Site

The following table presents the soil and geology baseline for the Converter Station site.

Table 6.7: Converter Station Site soil and geology baseline

Receptor	Receptor Value	Distribution
Soils		
Amin DW (Deep well drained mineral mainly acidic)	High	Underlies Converter Station
Sub soils		
Till derived from Devonian sandstones	Medium	Underlies Converter Station
Bedrock		
Waulsortian Limestone	Very high	Underlies Converter Station
Geohazards and Karst		
Swallow Hole - Limestone, clean, unbedded	High	Approximately 200m west of the centre of the Converter Station site.
2 enclosed depressions (Ballyadam)	High	Approximately 500m west of the centre of the Converter Station site.
Turlough - Limestone, clean, unbedded	High	Approximately 300m North of the centre of the Converter Station Site.

Source: (Teagasc, 2020) (GSI, 2020)

6.4.2.4 HVDC Underground Cable (Ca.30km)

The following table presents the soil and geology baseline for the HVDC underground cable route.

Table 6.8: HVDC Underground Cable Route (Ca.30km) soil and geology baseline

Receptor	Receptor Value	Distribution
Soils		
Amin DW (Deep well drained mineral mainly acidic)	High	Underlies entire cable route section.
Amin SW (Shallow well drained mineral mainly acidic)	High	Underlies sections of the cable route between; DC01-DC02, DC02-DC03, DC03-DC04, DC10-DC11.
A (Alluvial Mineral)	High	Underlies sections of the cable route between; DC01-DC02, DC03-DC04, DC04-DC05, DC06-DC07.
BminSW (Shallow well drained mineral mainly basic)	High	Underlies sections of the cable route between; DC06-DC07, DC07-DC08.
BminSW (Deep well drained mineral mainly basic)	High	Underlies sections of the cable route between; DC06-DC07, DC07-DC08.
Man Made	High	Underlies sections of the cable route particularly close to the Converter Station site and landfall at Youghal Bay, DC01-DC02, DC02-DC03, DC06-DC07, DC10-DC11, DC11-DC12.
MarSands (Marine sands and gravels)	Medium	Underlies cable route section DC11-DC!2 close to landfall.
MarSed (Marine/Estuarine Sediments)	Medium	Underlies cable route at sections DC09-DC10, DC10-DC11, DC11-DC12 as the route approaches landfall at Youghal Bay
AminPD (Acidic mineral poorly drained)	Low	Underlies sections of entire cable route between DC04 and DC12.
Sub soils		
AlluvMin (alluvium mineral)	High	Underlies sections of the cable route between; DC01-DC02, DC03-DC04, DC04-DC05, DC06-DC07.
Till Derived from Limestone	High	Underlies sections of the cable route between; DC06-DC07, DC07-DC08

Receptor	Receptor Value	Distribution
Till derived from Devonian sandstones	Medium	Underlies entire cable route section.
Bedrock outcrop close to the surface	Low	Underlies cable route sections DC01-DC02, DC02-DC03, DC03-DC04, DC06-DC07, DC07-DC08, DC10-DC11.
Man Made	Low	Underlies sections of the cable route particularly close to the Converter Station site and landfall at Youghal Bay, DC01-DC02, DC02-DC03, DC06-DC07, DC08-DC09, DC10-DC11, DC11-DC12.
Estuarine Sediments	Low	Underlies cable route sections DC09-DC12 as the cable approaches landfall.
Marine Beach Sands	Low	Underlies cable route sections DC11-DC12 as the cable approaches landfall.
Bedrock		
Waulsortian limestone - Regionally Important Aquifer - Karstified (diffuse)	High	Underlies entire cable route section.
Little Island Formation - Regionally Important Aquifer - Karstified (diffuse)	High	Underlies cable route between sections DC05 to DC10.
Cork red marble Formation - Regionally Important Aquifer - Karstified (diffuse)	High	Underlies cable route between sections DC06 and DC08.
Ballysteen Formation - Locally Important Aquifer - Bedrock which is Moderately Productive only in Local Zones	Medium	Underlies cable route between sections DC01 and DC04 and between DC08-DC09.
Old Head Sandstone Formation - Locally Important Aquifer - Bedrock which is Moderately Productive only in Local Zones	Medium	Underlies cable route between sections DC01-DC04
Kinsale Formation - Locally Important Aquifer - Bedrock which is Moderately Productive only in Local Zones	Medium	Underlies cable route between sections DC01 and DC04 and between DC08-DC09.
Gyleen Formation - Locally Important Aquifer - Bedrock which is Moderately Productive only in Local Zones	Medium	Underlies cable route between sections DC01-DC02, DC02-DC03, DC03- DC04, DC08-DC09, DC10-DC11, DC11-DC12.
Ballytrasna Formation - Locally Important Aquifer - Bedrock which is Moderately Productive only in Local Zones	Medium	Underlies cable route between sections DC02-DC03 and DC10-DC11.
Geohazards and Karst		
2 Karst cave/swallow hole landforms North of Castlemartyr	High	Approximately 500m north of cable route section DC07-DC08
Water Rock Golf Course - medium landslide susceptibility	High	Approximately 100m east of cable route section DC01-DC02 which borders the golf course perimeter.
Castlemartyr - area of high landslide susceptibility	Very high	Approximately 500m north of the cable route section DC06-DC07.

Receptor	Receptor Value	Distribution
Castlemartyr - area of high landslide susceptibility	Very high	Approximately 500m south of the cable route section DC06-DC07.
Youghal Bay - area at high landslide susceptibility	Very high	Approximately 500m north east of cable route section as it makes landfall at Youghal Bay.

Source: (Teagasc, 2020) (GSI, 2020)

6.4.2.5 Landfall Area

The following table presents the soil and geology baseline for the HVAC underground cable route.

Table 6.9: Landfall at Claycastle Beach soil and geology baseline

Receptor	Receptor Value	Distribution
Soils		
MarSands (Marine sands and gravels)	Medium	Underlies Landfall at Youghal Bay
Sub soils		
Man Made Sub Soils	High	Underlies Landfall at Youghal Bay
Marine Beach Sands	Low	Underlies Landfall at Youghal Bay
Bedrock		
Waulsortian Limestone	Very High	Underlies Landfall at Youghal Bay
Geohazards and Karst		
None Present		

Source: (Teagasc, 2020) (GSI, 2020)

6.4.3 Hydrogeology

The hydrogeology receptors have been identified as aquifers, boreholes/abstractions, groundwater/surface water interactions and karst features. These have been identified using relevant GSI and EPA datasets (GSI, 2020) (EPA, 2020).

The aquifer types identified throughout the proposed route have been described both by the aquifer productivity and through the bedrock aquifer types. The productivity of the aquifer was used, as outlined in Table 6.3, to assign receptor value.

For boreholes/abstractions the value was also identified by the productivity and use of the abstraction for public/domestic or agricultural supply.

The Groundwater/surface water interactions included the identification of any designated ecological sites that may be influenced by the hydrogeology of the local area.

Springs were identified using the GSI dataset. Only the springs listed within 1km of the proposed route in the GSI dataset were included within this EIAR. Karst data was included both within the hydrogeology and geology assessments.

The hydrogeology baseline receptors, and their corresponding values, are outlined in Sections 6.4.3.1 to 6.4.3.6 of which there are a total of:

- 1 aquifer receptor, 1 borehole receptor, 0 groundwater/surface water interaction receptors and 0 karst feature receptors within the Connection Point section;
- 6 aquifer receptors, 15 borehole receptors, 2 groundwater/surface water interaction receptors and 4 karst feature receptors within the HVAC Underground Cable Route (Ca.10km) section;
- 1 aquifer receptor, 1 borehole receptor, 2 groundwater/surface water interaction receptors and 0 karst receptors within the Converter Station Site section;

- 8 aquifer receptors, 11 borehole receptors, 7 groundwater/surface water interaction receptors and 2 karst feature receptors within the HVAC Underground Cable (ca.30km) section; and
- 1 aquifer receptor, 1 borehole receptor, 1 groundwater/surface water interaction receptor and 0 karst feature receptors within the Landfall at Claycastle Beach section.

6.4.3.1 Connection Point

The following table presents the hydrogeology baseline for the Connection Point.

Table 6.10: Connection Point hydrogeology baseline

Receptor	Receptor Value	Location/Distribution
Aquifers		
Ballytrasna Formation - Locally Important Aquifer - Bedrock which is Moderately Productive only in Local Zones	Medium	Underlies Connection Point
Boreholes/Abstractions		
1 x borehole (1707SWW081) 2.5m. Source Use: Other - Pigeon Hill	Low	Lies directly adjacent to cable route section AC02-AC03.
Groundwater/Surface Water Interactions		
None Present		
Karst Features		
None Present		

Source: (GSI, 2020) (EPA, 2020)

6.4.3.2 HVAC Underground Cable Route (Ca.10km)

The following table presents the hydrogeology baseline for the HVAC cable route.

Table 6.11: HVAC Underground Cable Route (Ca.10km) hydrogeology baseline

Receptor	Receptor Value	Location/Distribution
Aquifers		
Waulsortian Limestone	Very high	Underlies cable route sections between AC05 – AC06, AC06 – AC07
Ballytrasna Formation	Medium	AC01 – AC02, AC02 – AC03, AC03 – AC04, AC04 – AC05. Underlies nearly entire study area up to AC05.
Ballysteen Formation	Medium	Underlies cable route sections between AC05 – AC06, AC06- AC07
Old Head Sandstone Formation	Medium	Underlies cable route section, AC05 – AC06
Kinsale Formation	Medium	Underlies cable route sections between AC05 – AC06, AC06 – AC07
Gyleen Formation	Medium	Underlies cable route section, AC05 – AC06
Boreholes/Abstractions		
1 x borehole (1707SWW136) 34.1m. Source Use: Domestic Use – Lackenbehy	Medium	Approximately 500m north east of the cable connection point AC04.
1 x borehole (1707SWW035) 33.5m. Source Use: Unknown – Woodstock	Medium	Directly adjacent to the east of cable connection point AC06.
1 x borehole (1707SWW176) 43.3m. Source Use: Agri and domestic Use – Gortnamucky	Medium	Approximately 500m directly west of the centre of cable route section AC05-AC06.
1 x borehole (1707SWW081) 2.5m. Source Use: Other – PigeonHill	Low	Lies directly adjacent to cable route section AC02-AC03.
1 x borehole (1707SWW031) 13.1m Source Use: Unknown -0 Aghaduff	Low	Approximately 500m location buffer within 200m North-West of cable route section AC03-AC04.

Receptor	Receptor Value	Location/Distribution
1 x borehole (1707SWW027) 19.8m Source Use Unknown – PigeonHill	Low	Cable route section AC03-AC04 is contained within a 500m location accuracy range of the borehole at Pigeon Hill.
Dug Well (1707SWW012) 2.7m. Source Use: Unknown – Ballynakilla	Low	Cable route section AC03-AC04 is contained within a 500m location accuracy range of the borehole at Ballynakilla
1 x borehole (1707SWW013) 36.6m. Source Use: Unknown – Ballynakilla	Low	Cable route section AC03-AC04 is contained within a 500m location accuracy range of the borehole at Ballynakilla
1 x borehole (1707SWW015) 13.7m. Source Use: Unknown – Ballynakilla	Low	Cable route section AC03-AC04 is contained within a 500m location accuracy range of the borehole at Ballynakilla
1 x borehole (1707SWW014) 21.3m Source Use: Unknown – Ballynakilla	Low	Cable route section AC03-AC04 is contained within a 500m location accuracy range of the borehole at Ballynakilla
1 x borehole (1707SWW006) 21.3m. Source Use: Unknown – Codonstown	Low	Approximately 500m well location buffer lies less than 200m North of cable route section AC03-AC04.
1 x borehole (1707SWW017) 44.2m. Source Use: Unknown – Longstown	Low	Approximately 100m west of the cable route AC04-AC05.
1 x borehole (1707SWW034) 4.9m. Source Use: Unknown – Woodstock	Low	Directly adjacent to the east of cable connection point AC06.
1 x borehole (1707SWW036) 25m. Source Use: Unknown – Woodstock	Low	Directly adjacent to the east of cable connection point AC06.
1 x borehole (1707SWW132) 36.6m. Source Use: Domestic – Carrigtwohill	Low	Approximately 500m south west of the cable route section AC06-AC07.
Groundwater/Surface Water Interactions		
Cork Harbour Special Protection Area (SPA) (Owenacurra_30 eventually connects)	Extremely High	Over 2.5km south of proposed Converter Station.
Great Island Channel Special Area of Conservation (SAC) (Owenacurra_30 eventually connects)	Extremely High	Over 2.5km south of proposed Converter Station.

Receptor	Receptor Value	Location/Distribution
Karst Features		
Swallow Hole - Limestone, clean, unbedded	High	Approximately 300m south of connection point in centre of cable route AC06- AC07
Cave - limestone, clean unbedded	High	Approximately 500m south from the proposed cable route section AC05-AC06 north of Carrigtwohill.
2 enclosed depressions (Ballyadam)	High	Approximately 500m south of connection point AC06 and 500m south west of the centre of the Converter Station Site (Ballyadam)
Turlough - Limestone, clean, unbedded	High	Approximately 200m north east of the cable route section AC06-AC07, within close proximity to the rail line.

Source: (GSI, 2020) (EPA, 2020)

6.4.3.3 Converter Station Site

The following table presents the hydrogeology baseline for the Converter Station site.

Table 6.12: Converter Station Site hydrogeology baseline

Receptor	Receptor Value	Location/Distribution
Aquifers		
Waulsortian limestone - Regionally Important Aquifer - Karstified (diffuse)	High	Underlies Converter Station Site
Boreholes/Abstractions		
1 x borehole (1707SWW161) 8m. Source Use: / - Burgesland	Low	400m south of the centre of the Converter Station Site.
Groundwater/Surface Water Interactions		
Great Island Channel SAC	Extremely High	C. 2.7km south of the Converter Station.
Cork Harbour SPA	Extremely High	C. 2.7km south of the Converter Station.
Karst Features		
Swallow Hole - Limestone, clean, unbedded	High	200m west of the centre of the Converter Station site.
2 enclosed depressions (Ballyadam)	High	500m west of the centre of the Converter Station site – contained within the perimeter of the proposed development
Turlough - Limestone, clean, unbedded	High	300m north of the centre of the Converter Station Site.

Source: (GSI, 2020) (EPA, 2020)

6.4.3.4 HVDC Underground Cable Route (Ca.30km)

The following table presents the hydrogeology baseline for the HVDC cable route.

Table 6.13: HVDC Underground Cable Route (Ca.30km) hydrogeology baseline

Receptor	Receptor Value	Location/Distribution
Aquifers		
Waulsortian limestone - Regionally Important Aquifer - Karstified (diffuse)	High	Underlies entire cable route section.
Little Island Formation - Regionally Important Aquifer - Karstified (diffuse)	High	Underlies cable route between sections DC05 to DC10.
Cork red marble Formation - Regionally Important Aquifer - Karstified (diffuse)	High	Underlies cable route between sections DC06 and DC08.
Ballysteen Formation - Locally Important Aquifer - Bedrock which is Moderately Productive only in Local Zones	Medium	Underlies cable route between sections DC01 and DC04 and between DC08-DC09.
Old Head Sandstone Formation - Locally Important Aquifer - Bedrock which is Moderately Productive only in Local Zones	Medium	Underlies cable route between sections DC01-DC04
Kinsale Formation - Locally Important Aquifer - Bedrock which is Moderately Productive only in Local Zones	Medium	Underlies cable route between sections DC01 and DC04 and between DC08-DC09.
Gyleen Formation - Locally Important Aquifer - Bedrock which is Moderately Productive only in Local Zones	Medium	Underlies cable route between sections DC01-DC02, DC02-DC03, DC03- DC04, DC08-DC09, DC10-DC11, DC11-DC12.
Ballytrasna Formation - Locally Important Aquifer - Bedrock which is Moderately Productive only in Local Zones	Medium	Underlies cable route between sections DC02-DC03 and DC10-DC11.
Boreholes/Abstractions		
1 x borehole (2007SWW095)31.8m. Source Use: Public supply – Lagile	High	500m north of cable route section DC08-DC09.
1 x borehole (1707SEW082) 54.9m. Source Use: Domestic – Knockgriffin	Medium	600m south west of cable route section DC02.
1 x borehole (2007SWW082). Source Use: Public Supply – Lisglasheen	Medium	200m east of centre of cable route section DC08-DC09.

Receptor	Receptor Value	Location/Distribution
1 x borehole (2007SWW089) 18.3m Source Use: Agri and domestic use. – Knocknacally	Medium	Cable Route section DC10-DC11 runs through the south of the 500m location buffer for the well.
1 x borehole (2007SWW041) 44.8m. Source Use: Public supply – Kennel	Medium	Cable Route section DC10-DC11 runs through the south of the 500m location buffer for the well.
1 x Dug Well (1707SEW045) 3.7m. Source Use: Unknown – Caherultan	Low	Cable route section DC05-DC06 runs directly through the 500m buffer of the dug well.
1 x borehole (1707SEW043) 21.3m. Source Use Unknown. – Lissacrue	Low	Cable route section DC07-DC08 runs directly through the 500m buffer of the dug well.
1 x borehole (2007SWW094) 91m. Source Use: Public Supply – Lagile	Low	500m north of cable route section DC08-DC09.
1 x borehole (2007SWW092) 29m. Source Use: Domestic. – Ballycarane	Low	350m south of centre of cable route section DC08-DC09.
1 x borehole (2007SWW069) 6.7m. Source Use: Unknown – Gortaroo	Low	500m south of the centre of the cable route section DC09-DC10.
1 x borehole (2007SWW085) 26.2m. Source Use: Other - Summerfield.	Low	Directly south of the proposed cable route section and connection point DC11.
Groundwater/Surface Water Interactions		
Cork Harbour SPA (Owenacurra_30 eventually connects)	Extremely High	Over 2.5km south of the Converter Station.
Great Island Channel SAC (Owenacurra_30 eventually connects)	Extremely High	Over 2.5km south of the Converter Station.
Ballymacoda Bay SPA. - WOMANAGH_030 eventually connects	Extremely High	3-4km south along the coast from the landfall point.
Ballymacoda (Clonpriest and Pillmore) SAC - WOMANAGH_030 eventually connects	Extremely High	3-4km south along the coast from the landfall point.
Ballyvergan Marsh	High	Underlies cable route section DC10-DC11.
Dower Spring - hydraulically connected downgradient of Ballyvorisheen Swallow (karst feature)	High	Approximately 500m north of the cable route DC07-DC08.
1 x Spring (Fitzgerald Spring) – Williamstown	High	Approximately 1km north-east along the coast from the Landfall point.

Receptor	Receptor Value	Location/Distribution
Karst Features		
Swallow hole - Limestone, clean (>=90% CaCO3), unbedded	High	500m north of cable route section DC07-DC08
Cave - Limestone, clean (>=90% CaCO3), unbedded	High	500m north of cable route section DC07-DC08

Source: (GSI, 2020) (EPA, 2020)

6.4.3.5 Landfall Area

The following table presents the hydrogeology baseline for the landfall site.

Table 6.14: Landfall at Claycastle Beach hydrogeology baseline

Receptor	Receptor Value	Location/Distribution
Aquifers		
Waulsortian limestone - Regionally Important Aquifer - Karstified (diffuse)	High	Underlies Landfall at Youghal Bay
Boreholes/Abstractions		
1 x borehole (2007SWW085) 26.2m. Source Use: Other – Summerfield	Low	500m north-west of the landfall point directly south of the DC11 cable connection point.
Groundwater/Surface Water Interactions		
Blackwater River (Cork/Waterford) SAC	Extremely High	Over 5km north of the landfall at Youghal Bay.
Karst Features		
None Present		

Source: (GSI, 2020) (EPA, 2020)

6.4.3.6 WFD Groundwater Bodies

There are a total of two WFD groundwater bodies within the study area of the proposed works, Ballinhassig East (IE_SW_G_004) and Midleton (IE_SW_G_0580).

Details of the status of these groundwater bodies is summarised in Table 6.15. A summary of the receiving environment is presented in Appendix 6.

Table 6.15: WFD groundwater bodies

WFD classification	Ballinhassig East IE_SW_G_004	Midleton IE_SW_G_058
Overall Groundwater Status (2013-2018)	Good	Good
Quantitative Groundwater Status (2013-2018)	Good	Good
Chemical Groundwater Status	Good	Good
High Status Objective:	No	No

Source: (EPA Catchments, 2020)

6.5 Characteristics of the Development and Embedded Mitigation

Certain characteristics of the proposed construction and operational phase activities have the potential to impact land, soils and hydrogeology. The specific activities which pose a risk in causing potential impacts to these receiving environments have been summarised in Table 6.16 and Table 6.17 below. Full design details of the development, including embedded mitigation, may be found in Chapter 2 and Chapter 3 of this volume of the EIAR.

6.5.1 Construction Phase Activities

The following table presents the construction phase activities at risk of causing potential environmental impacts.

Table 6.16: Specific construction phase activities at risk of causing potential impacts

Characteristics of the Development		Embedded Mitigation
Connection Point	The connection will; be made by a single HVAC underground land circuit. A connection to the 220kV busbar will be made and will require one or more new bunded transformers to be installed.	The connection will be made by equipping an existing unused bay within the existing footprint and above ground.
HVAC Underground Cable Route (Ca.10km)	In general, the cables will be installed in ducts within a trench in the road. Joint chambers (joint bays) will be required to be installed along the cable route to join consecutive lengths of cable and facilitate cable pulling.	The depth of the trench and cable installation will be balanced against the performance of the circuit itself.
	Vegetation and topsoil stripping will be required where necessary to facilitate trench construction, including construction of traffic passing bays.	Land and vegetation will be reinstated, where possible, following construction. Cable route located predominantly along existing highway.
	Cable trench will be required to cross watercourses, culverts and HDD rail line.	Trench crossings are proposed in dry works area isolated with an impermeable barrier from water courses/temporary concrete ducts. Site restoration post works provision such as riverbank stabilisation. HDD trench using a comprehensive closed-loop drilling fluid mixing system to minimise volume of fluids required on site with constant monitoring of volume, pressure, pH and viscosity.
	Welfare facilities and temporary material storage areas will be required where necessary, temporary altering the land use at such locations.	Land will be returned to original state following construction
	The joint chambers will consist of precast concrete walls and base slab located below ground with approximate plan dimensions of 8m long and 3.0m wide with a depth of approximately 2.4m. The ducts will be installed to each end of the chamber, then proven, cleaned and sealed. The open concrete chamber will temporarily support the retained ground on the outside of the chamber during the chamber ducting activities. Once these activities are completed, the open chamber will	Temporary shelter erected over joint bays during construction to protect from moisture and contamination during jointing. Before cable installation chamber will be backfilled with appropriate material. Manholes constructed to facilitate maintenance.

Characteristics of the Development		Embedded Mitigation
	be temporarily backfilled with appropriate material and the road temporarily reinstated to the satisfaction of Cork County Council / TII until such time as cable installation will occur at which the chamber will be excavated and subsequently backfilled once more after completion.	Joint chambers will be installed in a staggered approach to reduce width required for installation.
	The width of the joint chambers and the nature of the road network in the area means that road closure may be required along the route during excavation, construction and operation.	Traffic control measures will be in place as appropriate, including road diversions, closures and stop/go traffic management to reduce temporary disruptions to traffic in the surrounding area.
Converter Station Site	The Converter Station site will be located between the settlements of Carrigtwohill and Midleton in County Cork and is bounded to the south by the N25 national road and to the north by the Cork to Midleton commuter rail line. Access to the site and internal access will be required. It is expected that a peak of approximately 300 Heavy Good Vehicles (HGV) movements per day will be required during the construction phase and therefore traffic along access roads is likely to significantly increase and result in temporary disruptions to traffic in the surrounding area.	The proposed internal road access for the Converter Station site has been developed to tie into the existing internal roads within the larger IDA owned Ballyadam site, independent of potential future development of access routes to the Ballyadam site, including a potential N25 interchange to the south west The design can however readily connect into such proposals in the future without affecting the conclusions of this EIAR.
	The site is zoned for industrial use and is on the site formerly intended for the location of the Amgen pharmaceutical facility. Prior to 2006, the site was in agricultural use and was largely improved grassland. During 2006 and 2007 the site was prepared for development with surface vegetation cleared (other than woodland on a knoll to the south of the site) and substantial earthworks undertaken. Stone/gravel was imported for roads and hardstand areas. The preparatory site works were abandoned in ca. 2009/2010, and since then revegetation of site has been taking place with grassland vegetation/habitat developing on calcareous soils in recent years.	Any contaminated ground identified during enabling works will be handled according to the contractors Construction Environment Management Plan and associated Risk Assessment Method Statements. Any such ground will be characterised according to Waste Acceptance Criteria and dealt with via a bespoke remediation strategy or materials management plan ground. Any waste arising will be managed in accordance with the Waste Management Act 1996, and associated Regulations. Any fill that is required will consist of engineered stone that will be brought to site.
	A below ground earth grid will be installed in a grid arrangement approximately 600mm below the finished surface. The earth grid will consist of bare stranded copper conductor with an outside diameter of approximately 95mm^2. The purpose of the earth grid is to ensure personnel and public safety during electrical faults that may occur on the transmission grid. Excavation and topsoil stripping will be required for the installation of the grid. Vegetation present will need to be removed.	Any contaminated ground identified during enabling works will be handled according to the contractors Construction Environment Management Plan and associated Risk Assessment Method Statements. Any such ground will be characterised according to Waste Acceptance Criteria and dealt with via a bespoke remediation strategy or materials management plan ground. Any waste arising will be managed in accordance with the Waste Management Act 1996, and associated Regulations.

Characteristics of the Development	Embedded Mitigation
	Any fill that is required will consist of engineered stone that will be brought to site.
The Converter Station site will consist of a new engineered stone fill platform which will raise the proposed site level above its existing level. This will ensure that a below ground closed gravity drainage system can be accommodated. All engineered stone fill for the new platform will be brought to site. The site is low lying and is located within an area of known karst (soluble rock) features. Karst regions typically contain un-mapped underground draining systems with sinkholes and caves. Due to the ground conditions on the Ballyadam site, it is likely that rotary bored cast-in-place reinforced concrete piles socketed into rock will be adopted for all foundations on this site.	Specialist and experienced piling Contractors will be employed to carry out the works. Method statements, piling risk assessments and environmental management plans, specific for the area where the drilling is to take place, will be carried out / prepared in line with contractual agreements. The piling risk assessments will include for example, groundwater / aquifer protection and the implementation of robustness monitoring of the works. These documents will be submitted by the Contractor to the planning authorities for discussion and acceptance prior to commencing piling operations. The presence of voids would be recognised by an experienced piling operator during the boring of the piles, prior to concrete placement. In such cases, the piling Contractor would install a permanent casing (likely a thin steel sleeve) to retain concrete within the pile bore/shaft. This requirement will be clearly stated in the piling performance specification and contractual agreements. Karst subsidence monitoring will form part of the Construction Environmental Management Plan for the Converter Station site.
A storm water drainage system incorporating SuDS (sustainable drainage systems) features will be constructed to manage the quantity and quality of runoff during rainfall events.	The proposed storm water drainage/SuDS system will incorporate the following key features; • Traditional storm water collection and conveyance elements such as gutters, downpipes, gullies, channels and below ground pipework • Flow control devices (‘hydrobrake’ or equivalent) to restrict the rate of discharge from the site to pre-development runoff rates • Below ground attenuation tanks to balance incoming flows and prevent flooding in the event of an extreme storm event

	Characteristics of the Development	Embedded Mitigation
		• Silt traps and hydrocarbon interceptors to remove any pollutants which may have become entrained in the runoff • Shut-off valve chambers to prevent discharge from the drainage network in the event of an emergency
	There are two depressions within the proposed Converter Station footprint in the north eastern section of the IDA site. It is understood that these were excavated as part of permitted ground improvement works carried out by Amgen and were subsequently abandoned between approximately 2007 and 2009. These depressions currently collect rainwater and will be infilled to facilitate development of the Converter Station.	An area of compensatory storage will be developed to replace this storage capacity as detailed in Section 2.3.3 Drainage Design and Wastewater Discharge. This 'cut' could potentially be used to 'fill' the depressions, subject to geotechnical and ground investigation studies. For the purposes of the assessments in this EIAR however it has been assumed that material will need to be imported as a worst-case scenario.
	The proposed Converter Station will require a clean water supply for both fire-fighting and welfare purposes (i.e. hand-washing, toilet flushing etc.).	Although a single connection to the public main is proposed, separate connections and meters will be provided for control buildings located in the Converter Station and for those located in the reactor compound to facilitate separate billing. A looped 'ring main' with hydrants for fire-fighting purposes is also proposed to be provided within the Converter Station and reactor compounds.
	The nearest ecologically protected areas are Great Island Channel SAC (1058) and Cork Harbour SPA (4030), located c. 2.5 kilometres from the proposed Converter Station. Karst landscapes however offer minimum attenuation and allow the rapid movement of contaminants into groundwater. It has therefore been assumed that, without the implementation of embedded mitigation by design, there would be connectivity between the proposed site and the European Sites protected within Cork Harbour.	Area of compensatory storage developed to collect rainwater with impermeable membrane - material will need to be imported. All storm water drainage elements sealed to protect soluble karst rock. All storm water drainage elements sealed to protect soluble karst rock. Wastewater storing facilities in fully sealed holding tanks.
HVDC Underground Cable Route (Ca.30km)	In general, the cables will be installed in ducts within a trench in the road. Joint chambers (joint bays) will be required to be installed along the cable route to join consecutive lengths of cable and facilitate cable pulling.	The depth of the trench and cable installation will be balanced against the performance of the circuit itself.
	Vegetation and topsoil stripping will be required where necessary to facilitate trench construction, including construction of traffic passing bays.	Land and vegetation will be reinstated, where possible following construction. Cable route located predominantly along existing highway.

Characteristics of the Development	Embedded Mitigation
Cable trench will be required to cross watercourses, culverts and HDD rail line.	Trench crossings are proposed in dry works area isolated with an impermeable barrier from water courses/temporary concrete ducts. Site restoration post works provision such as riverbank stabilisation. HDD trench using a comprehensive closed-loop drilling fluid mixing system to minimise volume of fluids required on site with constant monitoring of volume, pressure, pH and viscosity.
Welfare facilities and temporary material storage areas will be required where necessary, temporary altering the land use at such locations.	Land will be returned to original state following construction
HVDC cable is manufactured and delivered to site on drums, in lengths of approximately 750 to 1000 metres, requiring the installation of joint chambers to join consecutive lengths of cable together. The joint chambers will consist of precast concrete walls and base slab located below ground with approximate plan dimensions of 8m long and 3.0m wide with a depth of approximately 2.4m. The ducts will be installed to each end of the chamber, then proven, cleaned and sealed. The open concrete chamber will temporarily support the retained ground on the outside of the chamber during the chamber ducting activities. Once these activities are completed, the open chamber will be temporarily backfilled with appropriate material and the road temporarily reinstated to the satisfaction of Cork County Council / TII until such time as cable installation will occur at which the chamber will be excavated and subsequently backfilled once more after completion.	Temporary shelter erected over joint bays during construction to protect from moisture and contamination during jointing. Before cable installation chamber will be backfilled. Manholes constructed to facilitate maintenance. Joint chambers will be installed in a staggered approach to reduce width required for installation.
The width of the joint chambers and the nature of the road network in the area means that road closure may be required along the route during construction and operation.	Traffic control measures will be in place as appropriate, including road diversions, closures and stop/go traffic management to reduce temporary disruptions to traffic in the surrounding area.

Characteristics of the Development		Embedded Mitigation
Landfall Area	Infrastructure at the landfall will be underground and consist of: • Two transition chambers: underground concrete chambers which will house the joint between the submarine cable and the terrestrial cable. Two chambers are required: one for each pole • One communications (C2) chamber which will house the joint between the submarine communications / fibre optic cable and the terrestrial communications / fibre optic cable. Excavation will be required to construct the infrastructure at the landfall.	Construction works will be conducted in two phases, to mitigate against beach access and disturbance to the public during the busy summer works: **Phase 1** will be conducted in the winter months and will consist of the construction of the transition joint bay chambers, the installation of the cable ducts within open cut trenches up the beach and into the beach car park. The areas will then be reinstated to their original condition prior to completion of this Phase. **Phase 2** will be conducted in the summer months and will consist of the installation of the cables through the Phase 1 ducts. This is achieved by pulling the cables from the cable lay vessel through the ducts by means of a cable winch located within the transition joint bay chambers.
	The cable ducts will be placed within excavated trenches up the beach from the sea to the transition joint bay chambers. The excavation into the intertidal zone will require the temporary construction of a causeway, to form a stable platform from which excavators can work freely above the tidal zones.	The platform and the trench excavation will be formed by a cofferdam (sheet piling) to mitigate against sea erosion during the winter months.
	During the construction works, the landfall area will require access for both equipment associated with the proposed construction works and for the Contractor compound. Access will be required to the site and internal access along the beach.	Excavation works will be completed in winter months (Phase 1) to limit disruption to traffic accessing Claycastle Beach. Steel piled cofferdams and a causeway for access will be constructed along Claycastle Beach in order to facilitate installation of the submarine cable and the beach and surrounding areas will be reinstated following construction.

Source: (Mott Macdonald, 2020)

6.5.2 Operational Phase Activities

The following table presents the operational phase activities at risk of causing potential environmental impacts.

Table 6.17: Specific operational phase activities at risk of causing potential impacts

Characteristics of the Development		Embedded Mitigation
Connection Point	No additional operating requirements will be required from the connection point compared to the existing bays in the substation. Similarly, the maintenance regime will not differ from maintenance regimes to the existing bays except for a early inspection and maintenance to the 400kV transformer(s). The connection point is within the existing footprint and therefore access and welfare for site personal is already accommodated by current site design..	None required.
HVAC Underground Cable Route (Ca.10km)	The HVAC cable route will require no specific maintenance requirements along the cable trench or joint bay locations. Access may be required at joint bays on rare occasions to facilitate cable replacement if a failure occurs.	Manholes will be installed at several of the joint bays for the C2 chambers and link boxes and access to the manholes will be required on a permanent basis to facilitate such maintenance. Where possible, manholes will be located within the verge to minimise traffic disruption and a permeant access pathway to the manhole will be created.
	Access to link boxes and communications chambers will be required on an annual basis for inspection and any necessary maintenance. This may require road closures or traffic disruption where necessary.	Traffic control measures will be in place as appropriate, including road diversions, closures and stop/go traffic management to reduce temporary disruptions to traffic in the surrounding area.
Converter Station Site	The Converter Station does not require any personnel for operation.	None required.
	Scheduled maintenance of the Converter Station will occur once a year and take approximately four days for a crew of 10 personnel. Unscheduled maintenance of the Converter Station will typically occur at unknown times throughout the year and will require personnel on site for approximately 3 days per annum to repair and/or replace faulted equipment. Unscheduled maintenance occurs due to unforeseen trips and emergency outages, but these will be infrequent. During periods when personnel are on site, increased water demand and use of sewage treatment. Loss of permeable areas for infiltration due to site drainage to surface water sewer rather than to ground results in a loss of 0.15 km^2 from a	Water from mains, no pressure on groundwater so no mitigation required. Sewage from personal on site will be discharged into holding tanks, these tanks will be fully sealed to prevent discharge to ground and will include a high level alarm and telemetry link to the Converter Station's control system such that they can be monitored remotely and emptied when necessary.

Characteristics of the Development		Embedded Mitigation
	groundwater catchment of ~25 km^2, i.e. less than 1%, which is assessed as negligible.	
HVDC Underground Cable Route (ca.30km)	The HVDC cable route will require no specific maintenance requirements along the cable trench or joint bay locations. Access may be required at joint bays on rare occasions to facilitate cable replacement if a failure occurs.	Manholes will be installed at several of the joint bays for the C2 chambers and link boxes and access to the manholes will be required on a permanent basis to facilitate such maintenance. Where possible, manholes will be located within the verge to minimise traffic disruption and a permanent access pathway to the manhole will be created. Where access is required on farmland, manholes will be suitably fenced for protection from ongoing farming activities.
	Access to link boxes and communications chambers will be required on an annual basis for inspection and any necessary maintenance. This may require road closures or traffic disruption where necessary.	Traffic control measures will be in place as appropriate, including road diversions, closures and stop/go traffic management to reduce temporary disruptions to traffic in the surrounding area.
Landfall Area	Joint bays are not readily accessible during operation as there is no ongoing maintenance required, however, they would need to be accessed in the unlikely event of cable failure requiring cable replacement. Manholes will be required at joint bays for the C2 chambers and link boxes and access to the manholes will be required on a permanent basis to facilitate maintenance.	Permanent access pathways will be created to access manholes. Manhole location will be positioned to ensure minimal disruption.

6.6 Likely Significant Impacts of the Development

6.6.1 Construction Phase

Construction phase effects considered include those which have the potential to impact the following receiving environments:

- Land and Land Use
- Soils and Geology
- Hydrogeology

The proposed development location references are as detailed in Table 2.1 and presented in Appendix 2.1 Mapping. The extent of the study area is as described in Section 6.2. A summary of the potential impacts to these environments as a result of the construction phase are summarised in Table 6.18.

6.6.2 Operational Phase

Operational phase effects considered include those which have the potential to impact the following receiving environments:

- Land and land use
- Soils and Geology
- Hydrogeology

A summary of the potential impacts to these environments as a result of the operational phase are summarised in Table 6.19.

Table 6.18: Likely Significant Impacts (Construction Phase)

Proposed Development	Receiving Environment	Construction Phase Impacts
Connection Point	Land and land use	› Temporary disruption to surface during installation. › Temporary disruption to land use with excavation, temporary storage of excavated material and potential laydown areas › Increase in traffic in surrounding area due to vehicles accessing site during construction.
	Soils and Geology	› Localised pollution risk from surface mobilisation of the soil layer during excavation.
	Hydrogeology	› Localised pollution risk from mobilisation of soil contaminants during excavation.
HVAC Underground Cable Route (ca. 10km)	Land and land use	› Temporary disruption to surface during installation through open cut trenching. › Temporary disruption to land use with excavation, temporary storage of excavated material and laydown areas. › Temporary disruptions to traffic due to road closures, diversions and traffic control › Vegetation will be removed › Tree roost systems may be damaged severed.
	Soils and Geology	› Localised pollution risk from surface mobilisation of the soil layer during underground cable installation. › Temporary removal and storage of top layer of ground increasing risk of soil erosion, contamination and compaction. › Disruption to underground soil and subsoil layers could impact soils physical, chemical and biological characteristics. › Water crossings have the potential to generate silt and suspended solids during the proposed works and disturb riparian environments. › Risk of leakage of fluid on site. › Excavation during cable installation changing soil compaction resulting in altered recharge regime. › Risk of ground collapse associated with karst cavities in bedrock.
	Hydrogeology	› Temporary removal of top layer of ground increasing risk of groundwater pollution. › Trench water crossings have the potential to generate silt and suspended solids during the proposed works leading to potential groundwater pollution and increased localised turbidity. › Disruption of soils and subsoil layers, risk of leakage of fluid on site, lack of geological cohesion to support drilling process. › Altered recharge regime to soil and geology may reduce rate of infiltration and recharge to aquifer. › Risk of groundwater pollution through rapid karst pathways to designated ecological sites during construction and excavation of bays and HDD trenching. › Risk of pollution and altered recharge regimes to karst aquifers which are an important source of water supply for river baseflow and groundwater dependent habitats.
Converter Station Site	Land and land use	› Permanent change in land use due to construction of Converter Station site. › Increased traffic in area surrounding site due to construction vehicles. › Alteration of access tracks.

Proposed Development	Receiving Environment	Construction Phase Impacts
		› Vegetation will be removed for excavation.
	Soils and Geology	› Localised pollution risk from surface mobilisation of the soil layer during excavation. › Disruption to underground soil and subsoil layers could impact soils' physical, chemical and biological characteristics. › Alteration of drainage due to new drainage design and loss of permeable recharge areas. › Infilling of depressions disturbing infiltration and recharge to aquifers. › Loss of surface vegetation and exposure of sub soils increasing risk of soil erosion. › Risk of groundwater pollution through rapid karst pathways to designated ecological sites. › Risk of pollution and altered recharge regimes to distinctive karst habitat. › Risk of ground collapse associated with karst cavities in bedrock. › Disruption to surface during construction risks groundwater pollution.
	Hydrogeology	› Disruption to surface during construction risks groundwater pollution. › Risk of groundwater pollution through rapid karst pathways. › Increased risk of groundwater pollution through rapid karst pathways to designated ecological sites. › Risk of groundwater pollution through rapid karst pathways to designated ecological sites.
HVDC Underground Cable Route (ca. 30km)	Land and land use	› Cable route through private land. Temporary disruption to surface during installation through open cut trenching. › Temporary disruption to land use with excavation, temporary storage of excavated material and laydown areas. Temporary access roads may be required. › Temporary disruptions to traffic due to road closures, diversion and traffic control. › Trees and vegetation may be severed.
	Soils and Geology	› Localised pollution risk from surface mobilisation of the soil layer during underground cable installation. › Temporary removal and storage of top layer of ground increasing risk of soil erosion, contamination and compaction. › Disruption to underground soil and subsoil layers could impact soils physical, chemical and biological characteristics. › Water crossings have the potential to generate silt and suspended solids during the proposed works and disturb riparian environments. › Risk of leakage of fluid on site. › Excavation during cable installation changing soil compaction resulting in altered recharge regime. › Risk of ground collapse associated with karst cavities in bedrock.
	Hydrogeology	› Temporary removal of top layer of ground increasing risk of groundwater pollution. › Trench water crossings - have the potential to generate silt and suspended solids during the proposed works leading to potential groundwater pollution and increased localised turbidity. › Disruption of soils and subsoil layers, risk of leakage of fluid on site, lack of geological cohesion to support drilling process. › Altered recharge regime to soil and geology may reduce rate of infiltration and recharge to aquifer.

Proposed Development	Receiving Environment	Construction Phase Impacts
		• Risk of pollution and altered recharge regimes to karst aquifers which are an important source of water supply for river baseflow and groundwater dependent habitats.
Landfall at Claycastle Beach	Land and land use	• Traffic disruption and potential of pollution during excavation and temporary storage of topsoil which may contain traces of the listed potential contaminants. • Several weeks of summer season disruption during the installation of the cables through the ducts. • The excavation into the intertidal zone will require the temporary construction of a causeway, to form a stable platform from which excavators can work freely above the tidal zones.
	Soils and Geology	• Temporary open cut trench with mechanical excavators constructing an underground concrete chamber increasing risk of groundwater pollution. • Temporary soil storage increases risk of erosion. • Temporary removal of top layer of ground and excavation during cable installation increasing risk of groundwater pollution. • Manmade soils risk contamination to surrounding ground.
	Hydrogeology	• Temporary open cut trench with mechanical excavators constructing an underground concrete chamber increases risk of groundwater pollution. • Temporary removal of top layer of ground and excavation during cable installation increases risk of groundwater pollution. • Disruption to surface during construction risks groundwater pollution. • Risk of pollution and altered recharge regimes to karst aquifers which are an important source of water supply for river baseflow and groundwater dependent habitats.

Table 6-19 Likely Significant Impacts (Operational Phase) further to Section 6.4

Proposed Development	Receiving Environment	Operational Phase Impacts
Connection Point	Land and land use	No operational impacts anticipated
	Soils and Geology	
	Hydrogeology	
HVAC Underground Cable Route (ca. 10km)	Land and land use	Traffic disruption during periods of maintenance.
	Soils and Geology	Risk of surface water pollution to soil and geology when manhole in use.
	Hydrogeology	Risk of surface water pollution to groundwater when manhole in use.
Converter Station Site	Land and land use	No operational impacts anticipated
	Soils and Geology	
	Hydrogeology	
HVDC Underground Cable Route (ca. 30km)	Land and land use	Traffic disruption during periods of maintenance.
	Soils and Geology	Risk of surface water pollution to soil and geology via manholes.
	Hydrogeology	Risk of surface water pollution to groundwater via manholes.
Landfall at Claycastle Beach	Land and land use	Traffic disruption during periods of maintenance.
	Soils and Geology	Risk of surface water pollution to soil and geology when manhole in use.
	Hydrogeology	Risk of surface water pollution to groundwater via manholes.

6.6.1 Do Nothing

The 'Do-nothing' alternative describes the circumstance where no development occurs. Baseline is unlikely to change in the absence of development as the majority of the proposed route is scheduled to make use of existing infrastructure including roads, electricity substations and areas already earmarked for industrial development (Converter Station site). Therefore there will be no impact on land, soil or hydrogeology environments if the 'Do-nothing' scenario is followed.

6.6.2 Decommissioning Phase

Impacts during decommissioning are anticipated to be similar to those predicted during construction as similar types of activities would be undertaken. Therefore, provided that appropriate mitigation is used, the impacts of the decommissioning phase should be, as a worst-case scenario, similar to those at construction phase.

Any works required to remove infrastructure as part of the decommissioning phase, will however be subject to relevant consent applications, and associated environmental assessments.

6.6.3 Cumulative Effects

As detailed in Table 4.2 of Volume 3C1 of this EIAR, a number of developments are proposed within the immediate environs of the proposals, for example the wider IDA site surrounding the Converter Station site at Ballyadam is scheduled for significant development activity and which will require meeting similar standards of assessment and construction as detailed herein. The proposed Converter Station compound, drainage and access and HVDC / HVAC routes have been developed independent of these other potential future proposals. Such future proposals do not affect the conclusions of this EIAR.

Prior to commencement of construction and during the construction phase engagement with the proponents of these developments (including Transport Infrastructure Ireland, the IDA, Cork County Council and the OPW) will continue and where there is potential for works to be carried out in parallel, appropriate mitigation measures will be implemented including the scheduling of works and regular liaison meetings between project teams to ensure that plans are co-ordinated and impacts are minimised.

6.7 Mitigation and Monitoring Measures

A pre-construction verification survey of the below boreholes will be carried out to confirm whether they remain in use, and the nature of use. If at the time they are used for drinking water purposes, water quality testing of boreholes will be carried out to ensure no degradation of water quality as a result of the construction activities.

- 1 x borehole (1707SWW035) 33.5m. Source Use: Unknown – Woodstock
- 1 x borehole (1707SWW017) 44.2m. Source Use: Unknown – Longstown
- 1 x borehole (1707SWW034) 4.9m. Source Use: Unknown – Woodstock
- 1 x borehole (1707SWW036) 25m. Source Use: Unknown – Woodstock
- 1 x Dug Well (1707SEW045) 3.7m. Source Use: Unknown – Caherultan
- 1 x borehole (1707SEW043) 21.3m. Source Use Unknown. – Lissacrue

One borehole in close proximity to the proposed works is used for public water supply and another for agricultural and domestic use. These two boreholes will be subject to pre-construction verification survey to confirm whether they remain in use, and the nature of use. If at the time they are in use for drinking water purposes, water quality testing of the boreholes will be conducted to ensure no degradation of water quality as a result of the construction activities.

- 1 x borehole (2007SWW089) 18.3m Source Use: Agri and domestic use. – Knocknacally.
- 1 x borehole (2007SWW041) 44.8m. Source Use: Public supply – Kennel.

6.8 Residual Impacts

The residual risk assessment summarises the characteristics of the development and embedded mitigation outlined in Section 6.4 and the mitigation to determine if there are any residual risks of significance which require further action.

During the construction phase, impacts to land and land use are anticipated to be moderate adverse but localised and temporary in duration, with land use reinstated where possible after the works are completed. Operational phase impacts are anticipated to be minimal due to the infrequency of maintenance required. Maintenance activities will be carried out predominantly through manholes where embedded mitigation will ensure that access will result in minimal impacts. The residual risk to land and land use is therefore considered to be insignificant.

Residual impacts to soils and geology are anticipated to be adequately mitigated through the replacement of vegetation and use of compensatory storage. The residual risk to these receiving environments is therefore considered to be insignificant.

For the majority of receptors within the hydrogeological receiving environment, impacts are adequately mitigated with the mitigation embedded in the design, and therefore the residual risk is considered to be insignificant. Several boreholes/water wells are in close proximity to the proposed construction works and are therefore at greater risk of being impacted. However, with the additional mitigation measures outlined in Section 6.7, it is anticipated that the residual risk to these receptors will be insignificant. With the implementation of the embedded and additional mitigation measures proposed, the Irish onshore elements of the Celtic Interconnector project will not result in a change in status of any WFD quality elements or prevent any groundwater bodies from reaching good status in the future.

6.8.1.1 WFD Groundwater Body Status

The groundwater screening assessment is summarised in Table 6-20 below. The small scale of the scheme relative to the magnitude of the WFD waterbody is deemed to pose very low risk to the delivery of long term WFD no deterioration and status objectives, such that no further (additional) assessment is required. A robust CEMP will be in place during construction to ensure that there are no impacts to groundwater quality during construction.

Table 6.20: WFD Groundwater Assessment

	Test	Residual Risk Assessment
Connection Point	Water balance	Construction and development in existing footprint and above ground. Limited predicted adverse impact of construction on the water level of the relevant groundwater bodies and will not alter groundwater flows and levels significantly.
	Groundwater abstraction related deterioration of dependent surface water body status	Construction and development in existing footprint and above ground. Limited predicted adverse impact of construction on the dependent surface water body status as limited groundwater abstraction predicted.
	Groundwater dependent ecosystems (GWDE)	No GWDEs are located within the study area. Therefore, no impacts are anticipated on GWDEs as a result of the Scheme.
	Saline or other intrusion test	No impact on saline intrusion is expected due to shallow and temporary nature of works.
HVAC Cable Route	Water balance	The cable pipeline cross sectional area is small relative to the scale of the relevant groundwater bodies and will not alter groundwater flows and levels significantly. Any dewatering carried out during the construction will be small scale and temporary and treated water, where suitable, will be returned following cable installation. This is unlikely to alter the water balance of the aquifer.
	Groundwater abstraction related deterioration of dependent surface water body status	Dewatering of excavations may be required during construction of open cut and HDD trenches. No more than 50% of the watercourse will be impacted by the dry works area at any time and shelters will be erected before jointing and cable installation to reduce contamination risk. Groundwater abstracted during dewatering will be returned to the ground after suitable treatment. Approximate depth of cable will be 2.4m. Duration is estimated at 1-2 weeks per joint section.
	Groundwater dependent ecosystems (GWDE)	Multiple SPA and SAC may connect hydrogeologically including Cork Harbour, Great Island Channel. The nearest is 2.5km from the proposed Converter Station but due to the minimal attenuation provided by the Karst habitats embedded mitigation must be incorporated during construction activities. These include, isolating water courses with impermeable barriers tailored to the water course, treating water prior to discharge following dewatering and limiting impact to 50% of the water course width at a time.
	Saline or other intrusion test	No impact on saline intrusion is expected due to shallow and temporary nature of works.
Converter Station	Water balance	Loss of permeable surface area above the karst geology but where depressions have been infilled an area of complementary storage will be instated and therefore this is unlikely to alter the water balance of the aquifer. To comply with established best practice, a storm water drainage system incorporating SuDS (sustainable drainage systems) features will be constructed to manage the quantity and quality of runoff during rainfall events.
	Groundwater abstraction related deterioration of dependent surface water body status	Dewatering of excavations may be required during construction of open cut and HDD trenches. Groundwater abstracted during dewatering will be returned to the ground after suitable treatment. All proposed surfaces and storm water drainage elements will be sealed to protect the soluble karst rock beneath the site.
	Groundwater dependent ecosystems (GWDE)	Multiple SPA and SAC may connect hydrogeologically including Cork Harbour, Great Island Channel and Ballymacoda. The nearest is 2.5km from the proposed Converter Station but due to the minimal attenuation provided by the Karst habitats embedded mitigation must be incorporated during construction activities. These include, isolating water courses with impermeable barriers tailored to the water course, treating water prior to discharge following dewatering and limiting impact to 50% of the water course width at a time.
	Saline or other intrusion test	No impact on saline intrusion is expected due to shallow and temporary nature of works.
HVDC Cable Route	Water balance	The cable pipeline cross sectional area is small relative to the scale of the relevant groundwater bodies and will not alter groundwater flows and levels significantly. Any dewatering carried out during the construction will be small scale and temporary and treated water, where suitable, will be returned following cable installation. This is unlikely to alter the water balance of the aquifer.
	Groundwater abstraction related deterioration of dependent surface water body status	Dewatering of excavations may be required during construction of open cut trenches. No more than 50% of the watercourse will be impacted by the dry works area at any time and shelters will be erected before jointing and cable installation to reduce contamination risk. Groundwater abstracted during dewatering will be returned to the ground after suitable treatment. Approximate depth of cable will be 2.4m. Duration is estimated at 1-2 weeks per joint section.
	Groundwater dependent ecosystems (GWDE)	Multiple SPA and SAC may connect hydrogeologically including Cork Harbour, Great Island Channel and Ballymacoda. The nearest is 2.5km from the proposed Converter Station but due to the minimal attenuation provided by the Karst habitats embedded mitigation must be incorporated during construction activities. These include, isolating water courses with impermeable barriers tailored to the water course, treating water prior to discharge following dewatering and limiting impact to 50% of the water course width at a time.
	Saline or other intrusion test	No impact on saline intrusion is expected due to shallow and temporary nature of works.
Landfall at Claycastle Beach	Water balance	The cable pipeline cross sectional area is small relative to the scale of the relevant groundwater bodies and will not alter groundwater flows and levels significantly. Any dewatering carried out during the construction will be small scale and temporary and treated water, where suitable, will be returned following cable installation. This is unlikely to alter the water balance of the aquifer.
	Groundwater abstraction related deterioration of dependent surface water body status	Dewatering of excavations may be required during construction of open cut and HDD trenches. No more than 50% of the watercourse will be impacted by the dry works area at any time and shelters will be erected before jointing and cable installation to reduce contamination risk. Groundwater abstracted during dewatering will be returned to the ground after suitable treatment. Total construction time estimated at 14 weeks inclusive of phase 1 and 2 of the cable installation
	Groundwater dependent ecosystems (GWDE)	Blackwater River (Cork/Waterford) SAC. This abstraction is located upgradient to the Proposed Scheme. Consequently, it is unlikely to be hydraulically connected to the Proposed Scheme and no impacts are anticipated on GWDE as a result.
	Saline or other intrusion test	Potential risk of temporary saline intrusion during construction of the two transition chambers at the landfall of the submarine cable. Steel lined cofferdams will be used to create a temporary causeway. Total construction time for both phases of cable installation predicted to be 14 weeks and land will be reinstated following construction. Any impacts are predicted to be small scale and temporary.

6.9 Transboundary Effects

All elements of the onshore interconnector are found in County Cork, Ireland. No international boundaries are crossed by the works and therefore there are no transboundary effects to be discussed.

6.10 Summary

This EIAR for land use, soils and geology, including geohazards and hydrogeology, has undertaken a desk-top assessment on the basis of the relevant legislation and guidelines.

The EIAR has presented a detailed analysis of the receiving environment in terms of land use, soils, geology and hydrogeology for the proposed development, which has been divided into a number of specific design elements for the purposes of the assessment.

The characteristics of the development and embedded mitigation have been described, alongside anticipated construction phase and operational phase activities. The likely significant impacts of the proposed development have been assessed and, where significant uncertainties or risks remain, requirements for additional mitigation and monitoring measures have been stated.

Taking into account the embedded mitigation, residual risks to land and land use, and to soils and geology, from both construction and operational phase activities, are assessed as insignificant. For the majority of receptors within the hydrogeological receiving environment, impacts are adequately mitigated with the mitigation embedded in the design, and therefore in the majority of cases the residual risk is considered to be insignificant. The assessment also indicates that the proposed development will not result in a change in status of any WFD quality elements or prevent any groundwater bodies from reaching good status in the future.

Additional mitigation and monitoring requirements which go beyond the mitigation embedded in the proposed design and within the proposed Construction Environmental Management Plan include site visits and monitoring (pending results of site visits) of nine boreholes located in proximity to the proposed development. With the implementation of these additional measures it is anticipated that the residual risk to these receptors will be insignificant.

7 Surface Water, including Flood Risk

7.1 Introduction

This chapter presents the assessment of the likely significant effects from the Irish onshore elements of the proposed development on surface water resources between the landfall area and Knockraha substation.

This assessment focuses on impacts associated with the installation of the land cable and is based on the embedded mitigation detailed in Chapter 2 *Description of the Development* and Chapter 3 *Construction Phase Activities*, prior to the implementation of additional mitigation measures. The proposed development location references are as detailed in Table 2.1 and presented in Appendix 2.1 Mapping. Potential impacts associated with the installation of the offshore cable are discussed in Volume 3D2.

The assessment of the likely significant effects arising from the proposed development on groundwater resources is presented in Chapter 6 *Land, Soils and Hydrogeology*. The assessment of impacts on biodiversity is discussed in Chapter 8 *Biodiversity*. A Natura Impact Statement (NIS) also supports this application and is presented in Volume 6.

This chapter considers the potential impacts during construction, operation and decommissioning associated with:

- Surface water drainage (including watercourses);
- Water supply and wastewater discharge (including drinking water supply network, foul water and the drainage network);
- Water Framework Directive (WFD) surface water objectives; and
- Flood risk.

Proposed environmental control measures and additional mitigation measures to prevent, reduce and/or offset the anticipated potential impacts are presented as appropriate.

7.2 Methodology and Limitations

7.2.1 Legislation Context

This chapter has been prepared in accordance with the requirements of European Union Directive 2011/92/EU on the assessment of the effects of certain public and private projects on the environment (the 'EIA Directive') as amended by Directive 2014/52/EU.

The requirements of the following legislation have also been complied with:

- S.I. No. 272 of 2009: European Communities Environmental Objectives (Surface Waters) Regulations 2009 (as amended by S.I. No. 296/2009; S.I. No. 386/2015; S.I. No. 327/2012; and S.I. No. 77/2019 and giving effect to Directive 2008/105/EC on environmental quality standards in the field of water policy and Directive 2000/60/EC establishing a framework for Community action in the field of water policy, i.e. the Water Framework Directive, WFD).
- European Communities (Water Policy) Regulations 2003 (S.I. No. 722 of 2003), which gave legal effects to the WFD in Ireland.

The WFD 2000/60/EC commits EU member states to achieve good qualitative and quantitative status of all inland and coastal waters at six-year intervals.

The WFD classification scheme for surface water quality includes five status classes: High, Good, Moderate, Poor and Bad based on the biological and supporting physicochemical (nutrients, oxygen condition, temperature, transparency, salinity and river basin specific pollutants (RBSPs) and hydromorphological quality elements.

The Biological Quality Elements are phytoplankton, macrophytes, phytobenthos, benthic invertebrate fauna and fish.

The overall ecological status relates to the biological and physicochemical parameters. Overall ecological status classification for a waterbody is determined, according to the 'one out, all out' principle, by the element with the worst status out of all the biological and supporting quality elements.

Good status means achieving satisfactory quality water, suitable for local communities' drinking, bathing, agricultural, industrial and recreational needs, while maintaining ecosystems that can support all the species of plants, birds, fish and animals that live in these aquatic habitats. The next objective is to achieve a good status by 2021.

While the overall objective of the WFD is to achieve good status for all waterbodies, some waterbodies require extra protection by virtue of their location in a protected area or their function as a drinking water or bathing water. In accordance with the requirements of the WFD and the associated national regulations a register of protected areas has been set out for each River Basin District in Ireland. The protected areas are identified as those requiring special protection under existing National or European legislation, either to protect the surface water resource, or to conserve habitats or species that directly depend on those waters.

The different protected areas included in this register are European drinking water protected areas, designated waters such as fish protected areas and shellfish protected areas, nitrates vulnerable zones, urban wastewater sensitive areas and bathing water protected areas.

7.2.2 Guidance

This assessment follows guidelines established by Transport Infrastructure Ireland (TII) / National Roads Authority (NRA) in its *Guidelines on Procedures for Assessment and Treatment of Geology, Hydrology and Hydrogeology for National Road Schemes* (NRA, 2009), hereafter referred to as the NRA Guidelines. Regard has also been had to:

- Guidelines on Protection of Fisheries During Construction Works in and Adjacent to Waters (Inland Fisheries Ireland, 2016);
- Planning for Watercourses in the Urban Environment: A Guide to the Protection of Watercourses through the use of Buffer Zones, Sustainable Drainage Systems, Instream Rehabilitation, Climate / Flood Risk and Recreational Planning (Inland Fisheries Ireland, 2020);;
- EirGrid's Draft Ecology Guidelines for Electricity Transmission Projects (EirGrid, 2020); and,
- Control of Water Pollution from Construction Sites - Guide to Good Practice (C532) (CIRIA, 2001); and
- The Planning System and Flood Risk Management, Guidelines for Planning Authorities (Office of Public Works, OPW, 2009), hereafter referred to as the Flood Risk Guidelines.

Further detail on the NRA Guidelines is provided in Section 7.2.3. A flood risk assessment of the proposed converter station site (Mott MacDonald, 2020) is included in Appendix 7.1.

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The Flood Risk Guidelines aim to integrate flood risk management into the planning process to assist the delivery of sustainable development. They aim to encourage a transparent and consistent consideration of flood risk in the planning process.

The objectives of the Flood Risk Guidelines are given as:

- Avoid inappropriate development in areas at risk of flooding;
- Avoid new developments increasing flood risk elsewhere, including that which may arise from surface water runoff;
- Ensure effective management of residual risks for development permitted in floodplains;
- Avoid unnecessary restriction of national, regional or local economic and social growth;
- Improve the understanding of flood risk among relevant stakeholders; and
- Ensure that the requirements of EU and national law in relation to the natural environment and nature conservation are complied with at all stages of flood risk management.

The Flood Risk Guidelines categorise flood risk in the form of three Flood Zones. These Flood Zones each relate to geographical areas at high, moderate or low flood risk, depending on if they are zone A, B or C respectively. Table 7.1 provides a definition of each Flood Zone.

The flood risk likelihood is defined as a percentage risk of occurring in any year. For example, a flood event may be described as having an annual exceedance probability (AEP) of 1%, this can also be written as a 1 in 100 year event. Critical infrastructure vulnerable to flooding should be located in Flood Zone C.

Table 7.1: Definition of Flood Zones

Flood Zone	Description
A	The AEP of flooding from rivers and seas is highest (greater than 1%AEP for flooding, or 0.5%AEP for coastal flooding)
B	The AEP of flooding from rivers and the sea is moderate (between 0.1% AEP and 1% AEP for river flooding, and between 0.1% AEP and 0.5% AEP for coastal flooding)
C	The probability of flooding from rivers and the sea is low (less than 0.1% AEP for both river and coastal flooding). Flood Zone C covers all areas of the plan which are not in Zone A or B

Source: The Office of Public Works, The Planning System and Flood Risk Management, Guidelines for Planning Authorities (November 2009).

7.2.3 Methodology for Assessment of Effects

A desktop qualitative appraisal was undertaken to identify the baseline characteristics relating to the hydrology of surface waterbodies proximal to the proposed development and using existing flood risk mapping from the OPW and Cork County Council.

The description of the receiving environment was also informed by an aquatic baseline survey of the land cable route alignment, carried out by Triturus Environmental Ltd on 19 May and 15 and 16 June 2020. The following watercourses, as detailed in Figure 7.3 and Table 7.6, were surveyed: Lisheenroe Stream; Tibbotstown Stream; Owenacurra River; Glenathonocash River; Elfordstown River; Ballyspillane West Stream; Dungourbey River; Harrisgrove Stream; Womanagh (Kiltha) River; Annistown Stream; Moanlahan River; Dissour River; Inchanapisha River; Lagile Stream; Gortnagark Stream; Inchiquin Stream and East Ballyvergan Stream.

The baseline survey report by Triturus Environmental Ltd (2020) has informed both this EIAR chapter, and Chapter 8 *Biodiversity.* The evaluation of ecological receptors used the geographic scale and criteria defined in the Guidelines for Assessment of Ecological Impacts of National Road Schemes (NRA, 2009). The baseline survey report was focused on aquatic habitats in relation to fisheries potential (including both salmonid and lamprey habitat), macro-invertebrates, water quality, macrophytes, aquatic invasive species, and Annex II aquatic species which may use the watercourses in the vicinity of the propose onshore cable route crossings.

Given the proposed cable route alignment, a single lake waterbody – Lough Aderra (Lough Aderry) near Castlemartyr - was also surveyed. This lake is located within a nationally designated nature conservation site: Lough Aderry and Ballybutler proposed Natural Heritage Area (site code 0446)

The study area extends to a buffer of 500m around the proposed development locations. This buffer is in line with the study areas for assessments of the impact on the water environment for other linear construction projects.

Where effects are deemed to have the potential to extend beyond 500m, due to sensitive features, downstream receptors and hydraulic connectivity outside of this buffer, the study area has been extended to the point whereby the significance of the effect from the proposed development of any impact is deemed to be imperceptible.

The key resources used for the purpose of this appraisal were as follows;

- Environment Protection Agency, EPA (Water Framework Ireland Map viewer) databases;
- Water Quality in Ireland 2013-2018 (EPA, 2019);
- An Investigation into Aquatic Invertebrates, Saline Influence and other factors associated with Management of Ballyvergan Marsh, Youghal, Co. Cork (University College Cork, 2020); and
- OPW and Cork County Council Flood Mapping (https://www.floodinfo.ie/map/floodmaps/).

The significance of impacts has been assessed in terms of the magnitude of the effect/impact and the importance of that receptor, based on the criteria outlined in the *Guidelines on Procedures for Assessment and Treatment of Geology, Hydrology and Hydrogeology for National Road Schemes* (NRA, 2009). The WFD status detailed in Table 7.3 has been used in lieu of Biotic ~Index Q values as appropriate, as detailed in Table 7.2.

Table 7.2: Criteria for Rating Site Attributes (NRA, 2009)

Importance	Criteria	Typical Examples
Extremely High	Attribute has a high quality or value on an international scale	River, wetland or surface water body ecosystem protected by EU legislation
Very High	Attribute has a high quality or value on a regional or national scale	River, wetland or surface water body ecosystem protected by national legislation Regionally important potable water source supplying >2500 homes Quality Class A (Biotic Index Q4, Q5) Flood plain protecting more than 50 residential or commercial properties from flooding Nationally important amenity site for wide range of leisure activities
High	Attribute has a high quality or value on a local scale	Salmon fishery Locally important potable water source supplying >1000 homes Quality Class B (Biotic Index Q3-4) Flood plain protecting between 5 and 50 residential or commercial properties from flooding

Importance	Criteria	Typical Examples
		Locally important amenity site for wide range of leisure activities
Medium	Attribute has a medium quality or value on a local scale	Coarse fishery Local potable water source supplying >50 homes Quality Class C (Biotic Index Q3, Q2-3) Flood plain protecting between 1 and 5 residential or commercial properties from flooding
Low	Attribute has a low quality or value on a local scale	Locally important amenity site for small range of leisure activities Local potable water source supplying <50 homes Quality Class D (Biotic Index Q2, Q1) Flood plain protecting 1 residential or commercial property from flooding Amenity site used by small numbers of local people

Source: Guidelines on Procedures for Assessment and Treatment of Geology, Hydrology and Hydrogeology for National Road Schemes (NRA, 2009)

Table 7.3: Reference Values for Q Value / WFD Status (Riverine only)

Q Value*	WFD Status	Pollution Status	Condition**
Q5, Q4-5	High	Unpolluted	Satisfactory
Q4	Good	Unpolluted	Satisfactory
Q3-4	Moderate	Slightly polluted	Unsatisfactory
Q3, Q2-3	Poor	Moderately polluted	Unsatisfactory
Q2, Q1-2, Q1	Bad	Seriously polluted	Unsatisfactory

Source: Environmental Protection Agency Ireland (epa.ie)

Notes:

* These Values are based primarily on the relative proportions of pollution sensitive to tolerant macroinvertebrates (the young stages of insects primarily but also snails, worms, shrimps etc.) resident at a river site.

** "Condition" refers to the likelihood of interference with beneficial or potential beneficial uses.

Table 7.4: Criteria for Rating Impact Significance

Magnitude of Impact	Criteria	Typical Examples
Large Adverse	Results in loss of attribute and /or quality and integrity of attribute	• Loss or extensive change to a waterbody or water dependent habitat • Increase in predicted peak flood level >100mm • Extensive loss of fishery • Calculated risk of serious pollution incident >2% annually[38] • Extensive reduction in amenity value
Moderate Adverse	Results in impact on integrity of attribute or loss of part of attribute	• Increase in predicted peak flood level >50mm • Partial loss of fishery • Calculated risk of serious pollution incident >1% annually

[38] Refer to Annex 1 of HA216/06 Highways Agency (2006) Road Drainage and the Water Environment (HA216/06), Design Manual for Roads and Bridges (DMRB). The UK DMRB suggests that where the probability of a serious pollution incident is greater than1%/year, spill-containment measures should be considered. It also suggests that, in particularly sensitive waters, areas at lower risk of serious pollution may also warrant special measures. The formula is however tailored for road developments where increasing traffic densities and higher proportions of heavy goods vehicles (HGVs) are likely to lead to an increased risk of accidents that could give rise to hazardous spills. While the calculation is not appropriate for use on this project, having regard to the characteristics of the proposals as detailed in Section 7.4, regard has been had to the proposed mitigation as appropriate.

Magnitude of Impact	Criteria	Typical Examples
		• Partial reduction in amenity value
Small Adverse	Results in minor impact on integrity of attribute or loss of small part of attribute	• Increase in predicted peak flood level >10mm • Minor loss of fishery • Calculated risk of serious pollution incident >0.5% annually • Slight reduction in amenity value
Negligible	Results in an impact on attribute but of insufficient magnitude to affect either use or integrity	• Negligible change in predicted peak flood level • Calculated risk of serious pollution incident <0.5% annually
Minor Beneficial	Results in minor improvement of attribute quality	• Reduction in predicted peak flood level >10mm • Calculated reduction in pollution risk of 50% or more where existing risk is <1% annually
Moderate Beneficial	Results in moderate improvement of attribute quality	• Reduction in predicted peak flood level >50mm • Calculated reduction in pollution risk of 50% or more where existing risk is >1% annually
Major Beneficial	Results in major improvement of attribute quality	• Reduction in predicted peak flood level >100mm

Source: Guidelines on Procedures for Assessment and Treatment of Geology, Hydrology and Hydrogeology for National Road Schemes (NRA, 2009)

Table 7.5: Rating of Significant Environmental Impacts

Importance of Attribute	Magnitude of Impact			
	Negligible	**Small**	**Moderate**	**Large**
Extremely High	Imperceptible	Significant	Profound	Profound
Very High	Imperceptible	Significant / Moderate	Profound / Significant	Profound
High	Imperceptible	Moderate / Slight	Significant / Moderate	Severe / Significant
Medium	Imperceptible	Slight	Moderate	Significant
Low	Imperceptible	Imperceptible	Slight	Slight / Moderate

Source: Guidelines on Procedures for Assessment and Treatment of Geology, Hydrology and Hydrogeology for National Road Schemes (NRA, 2009)

7.2.4 Limitations of this EIAR

Identification of surface water features / waterbodies, such as rivers and lakes, has been based on site walkovers, desktop data such as those detailed on Environmental Protection Agency (EPA) datasets and mapping, and consultation with statutory and non-statutory bodies.

It is possible that some minor drainage ditches located in proximity to the works may not be identified in this EIAR. Such waterbodies will be identified at construction stage and the embedded and additional mitigation detailed and proposed as part of this EIAR will be implemented.

All third-party reports, data and mapping are assumed to be correct for the purposes of this EIAR.

There were no other limitations encountered in compiling the information required to carry out this assessment of likely significant impacts on the water environment as a result of the Irish onshore components of the Celtic interconnector project.

7.3 Receiving Environment

In general, the proposed HVAC / HVDC onshore (land) cable routes follow the existing road network between the existing substation at Knockraha and Front Strand, Claycastle, in Youghal.

Water crossings across minor and major watercourses within the Glashaboy [L.Mahon] (WFD sub-catchment ID: 19_11), Tibbotstown (19_2), Owenacurrra (19_13), Womanagh (19_16) river sub-catchments will be required. All are located within the Lee, Cork Harbour and Youghal Bay WFD catchment areas. Photographs of water crossings are presented in Appendix 7.2.

Two EPA Lake Waterbodies' are also identified within the wider Ballyadam site (i.e. remote from the proposed converter station site), approximately 50m from the proposed access routes. These 'lakes' were infilled in ca. 2010. A small area (approximately150 m^2) of ponding, partially infilled, is also noted on the southern edge of the proposed converter station site at Ballyadam. The feature has also been by imported stone, refer to Figure 7.1 .Two depressions within the site currently drain natural surface water run-off within the site.

Figure 7.1: Area of Ponding at Ballyadam

Source: Mott MacDonald

A drainage ditch is located in proximity to the car park at Claycastle Beach, another drainage ditch is located to the north of Summerfield Holiday park.

A number of water supply and wastewater (sewage / stormwater) drainage networks, and other utilities, are located within the receiving environment and will be required to be crossed to facilitate the HVAC / HVDC land cables.

Two existing depressions are located within the converter station compound footprint which currently act to mitigate flood levels in the IDA-owned site area.

7.3.1 Protected Areas

The proposed Irish converter station and land cables are not located within any European protected sites. Surface watercourses within the zone of influence of the proposed onshore elements do however have downstream connectivity with Great Island Channel SAC / proposed Natural Heritage Area, pNHA, (site code 001058) and Cork Harbour SPA (site code: 004030), Ballymacoda Bay SPA (site code 004023) and Ballymacoda (Clonpriest and Pillmore) SAC (site code 000077). Cork Great Island North Channel and Ballymacoda Bay are also protected shellfish areas. Youghal Bay, the proposed landfall for the submarine cable, is a protected bathing water area.

The following watercourses have been identified as nutrient / urban waste water sensitive areas:

- Owennacurra Estuary / North Channel (IE_SW_060_0400) to the south of Midleton;
- Lee Estuary / Lough Mahon (IE_SW_060_0750) to the west of Carrigtwohill; and
- Blackwater Estuary Lower (IE_SW_020_0100) upstream and to east of Youghal.

The HVDC cable route also borders or has hydrological/ hydrogeological connectivity to several proposed Natural Heritage Areas (pNHA), namely Loughs Aderry and Ballybutler pNHA (000446), Clasharinka Pond pNHA (001183) and Ballyvergan Marsh pNHA (000078).

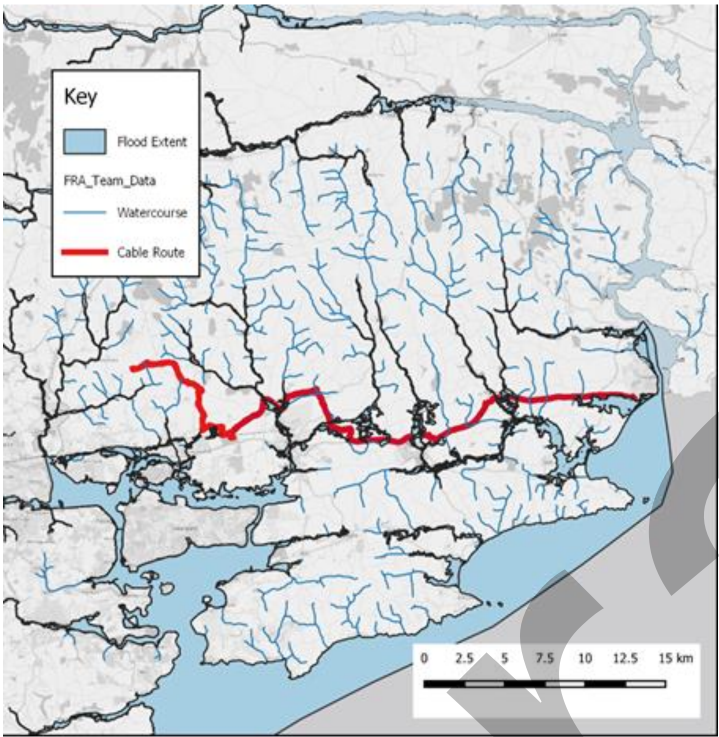
The proposed development (converter station compound and sections of the cable routes) are located within a karstic limestone environment (refer to chapter 6 land, Soils and Hydrogeology) including the catchment of Dower Spring. Dower Spring feeds the Dower Spring: Whitegate Regional Water Supply Scheme. The associated Inner Protection Area is located along the N25 (HVDC land cable route) between Castlemartyr and Killeagh i.e. HVDC land cable route section DC06 to DC08.

The proposed HVAC route (section AC03-04) is also located approximately 45m upstream of the uppermost reaches of the Tibbotstown Stream (EPA code: 19T25) which is approximately 800m upstream of Tibbotstown Reservoir. The primary source of this potable water supply is the impounded lake itself. The secondary source is the Owenacurra River. The Owenacurra River is identified as a water used for the abstraction of drinking water. There are also a number of wells located in proximity to the proposals and these are assessed in Chapter 6 *Land, Soils and Hydrogeology*.

7.3.2 Flood Risk

Identification of the flood extent has been based on OPW and Cork County Council predictive flood extent maps. It can be noted from Figure 7.2, that the cable route passes over a number of watercourses and through existing mapped flood extents. It is important to note that the Flood Zone Extents shown are indicative of fluvial (river) and coastal flood risk only, and do not include information on the flood risk from other sources such as surface water, groundwater or artificial drainage systems.

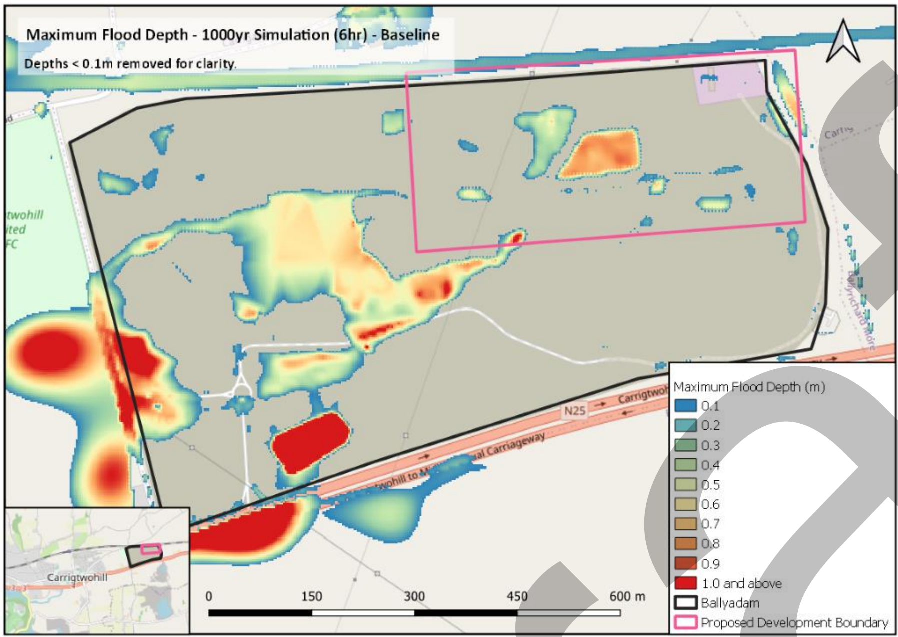
Figure 7.2: Watercourses and indicative low probability flood extent map (0.1% AEP)



Source: Mott MacDonald (data sourced from OPW and Cork County Council)

A hydraulic model has been created to assess the flood risk to the Ballyadam converter station site with the results of the 1 in 1000 year (0.1% AEP) baseline model shown in Figure 7.3. The hydraulic model predicts that the flood risk area is limited to existing depressions which act to reduce flood risk across the IDA site.

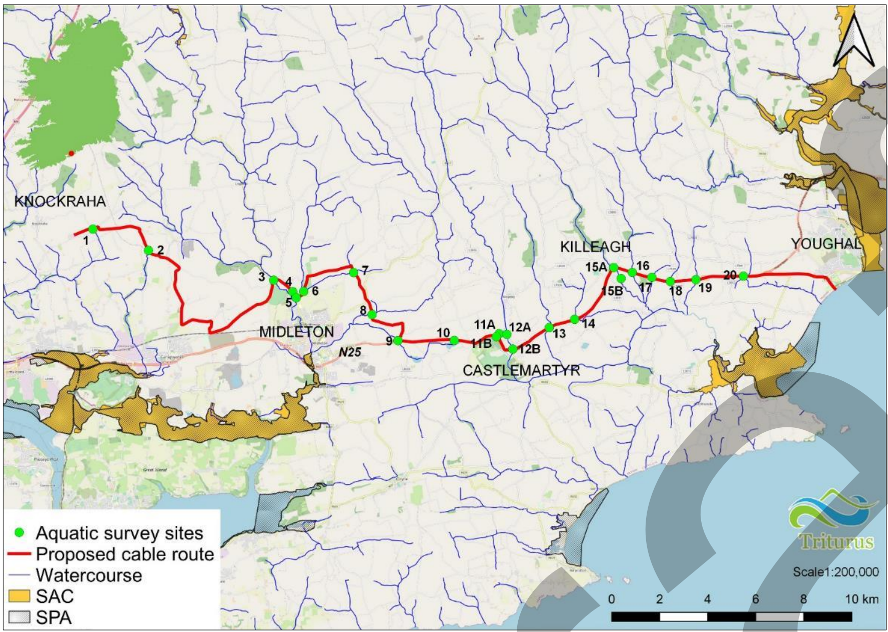
Figure 7.3: Existing predicted flood depths at the Ballyadam Converter Station site (within Proposed Development Boundary) and the wider Ballyadam (IDA) site



7.3.3 Baseline Environment

Table 7.6 presents a description of the watercourses surveyed by Triturus Environmental Ltd. in May and June 2020. Further detail is provided in Chapter 8 *Biodiversity*. The survey locations are presented in Figure 7.4 and photographs of the survey locations are presented in Appendix 7.2. The evaluation of ecological receptors contained used the geographic scale and criteria defined in the Guidelines for Assessment of Ecological Impacts of National Road Schemes (NRA, 2009).

Figure 7.4: Aquatic Survey Site Locations (May-June 2020)



Source: Triturus Environmental Ltd, July 2020

Table 7.6: Site Descriptions (Triturus Environmental Ltd Aquatic Surveys May and June 2020)

Site no.	Watercourse and EPA code	Location (closest to survey point) and ITM Co-ordinates	Site Description
1	Lisheenroe Stream 19L40	AC02-AC03 (Ballynanelagh) 578881 578327	The proposed HVDC cable route traverses Lisheenroe Stream (EPA code: 19L40) at this location. The Lisheenroe Stream offered some locally moderate (at best) value for salmonids given the shallow nature, evident enrichment and siltation. The site had some moderate lamprey potential despite the presence of sub-optimal silts for larvae (often shallow and or compacted). No otter signs were recorded during the site visit. The site offered little potential for otter given the small nature of the stream and moderate (at best) fisheries value. No white-clawed crayfish were recorded during the site visit and suitability was poor given the sandstone geology of the catchment and small nature of the channel. Given the moderate salmonid and European eel value, the aquatic ecological evaluation is of **local importance (higher value).**
2	Tibbotstown Stream 19T25	AC03-AC04 (Ballynakilla) 581185 577435	The HVAC cable will be installed approximately 45m upstream of the uppermost reaches of the Tibbotstown Stream (EPA code: 19T25), approx. 800m upstream of Tibbotstown Reservoir. In terms of fisheries value, the upper reaches of the stream did not offer any fisheries habitat at the time of survey given the lack of water. It was considered likely that the stream periodically dries up completely at this location. The site offered no potential for white-clawed crayfish or otter. The species is typically excluded from the sandstone Cork River catchments given lower alkalinity (i.e. calcium carbonate) that the species requires for carapace growth. Given the semi-dry nature of the site and general lack of fisheries habitat, the aquatic ecological evaluation of site 2 was of **local importance (lower value).**
3	Owenacurra River 19O03	DC01-DC02 (Curragh) 586379 576188	The Owenacurra River (EPA code: 19O03) at the R626 bridge site offered good salmonid nursery habitat with frequent good holding glide habitat upstream and downstream of the bridge. Spawning value was good locally although improved downstream and upstream of the survey site (less compacted). European eel habitat was moderate to good given the presence of undercut banks, large woody debris and scattered boulder refugia. Larval lamprey habitat (i.e. soft sediment) was present locally, particularly in a small cut immediately u/s of the bridge (west bank), where deep silt was present. A single lamprey was observed resting on marginal gravels during the site visit (presumably disturbed from silt habitat). Spawning habitat for lamprey, whilst present, was patchy in distribution due to sedimentation and substrata compaction. No white-clawed crayfish were recorded and there was considered no crayfish value given the species' known absence from the Owenacurra catchment. A regular otter spraint site was recorded on the bridge apron on the upstream side of the west bank (ITM 586378, 576195). The Owenacurra River has known sea trout populations of regional value. It also supports populations of aquatic species of high conservation value including European eel, lamprey and otter. The aquatic ecological evaluation of site 3 is therefore of **County Importance**.
4	Owenacurra River 19O03	DC01-DC02 (Carrigogna) 587169 575712	The Owenacurra River at site 4 offered excellent all-round salmonid habitat, with good nursery conditions present. Nursery habitat was not quite considered of excellent quality due to the fast flow, lack of macrophytes, lack of slower glide etc. but it was near excellent for Atlantic salmon parr, specifically. Excellent quality spawning substrata was present locally (clean mobile gravels and cobbles) and excellent holding habitat was frequent, particularly for Atlantic salmon and adult sea trout. Habitat for European eel was good despite the fast flows (i.e. in pools, large woody debris). Larval lamprey habitat was present at the site but localised to pool slacks; even here it could be considered sub-optimal, i.e. compacted sand. Lamprey spawning areas were present but localised also. No white-clawed crayfish were recorded and the site was considered unsuitable given the species' known absence from the Owenacurra catchment. There were no signs of otter but the species is known from area (Triturus unpublished data) and habitat value was high for the species. The Owenacurra River has known sea trout populations of regional value. It also supports populations of aquatic species of high conservation value including European eel, lamprey and otter. The aquatic ecological evaluation of site 4 is therefore of **County Importance.**

Site no.	Watercourse and EPA code	Location (closest to survey point) and ITM Co-ordinates	Site Description
5	Glenathonocash River 19G66	DC02-DC03 (Broomfield West) 587316 575465	Site 5 on the Glenathonocash River (EPA code: 19G66) was located at the R626 road bridge at Broomfield West (approx. 150m upstream of the Owenacurra confluence) offered good salmonid habitat with good spawning, good nursery and good holding locally. European eel habitat was moderate, reduced overall due to the lack of deeper pools and instream refugia. Larval lamprey habitat was sparse but present at the tailing of pools or in association with gravel shoals. Some localised lamprey spawning habitat was present also although the site was more suited to salmonids. Lamprey spawning was considered superior upstream of the bridge. No white-clawed crayfish were recorded and the site was considered unsuitable given the species' known absence from the wider catchment. A regular otter spraint site (5 spraints, mixed age) was recorded under the bridge (ITM 587308, 575460). Given the good quality salmonid and lamprey habitat, and the ability to support aquatic species of conservation value such as European eel and otter, the aquatic ecological evaluation of site 5 was of **local importance (higher value).**
6	Elfordstown River 19E02	DC02-DC03 (Broomfield West) 587624 575720	Site 6 was located at a local road crossing on a branch of the Elfordstown Stream (EPA code: 19E02) which emanated from East Cork Golf Club. Overall, the site offered good to moderate value for salmonids but was impacted by siltation. The site was small, shallow but offered some value as a spawning site. The main stream channel was good overall (good nursery, good spawning and good holding). European eel habitat was moderate at best due to the shallow nature of the site and was much improved in deeper pools further downstream in the main channel. The concrete bridge culvert offered little to no eel habitat. Larval lamprey habitat was present and patchy in the main stream channel but sun-optimal at the survey site (moderate value). Spawning opportunities for Lampetra sp. were good, however. No white-clawed crayfish were recorded and the site was considered unsuitable given the species' known absence from the wider catchment. No signs of otter were recorded but the presence of healthy salmonid population in the main channel downstream and seclusion from human activity provided high suitability. Given the moderate to good quality salmonid, European eel and lamprey habitat, the aquatic ecological evaluation of site 6 was of **local importance (higher value).**
7	Ballyspillane West Stream 19W06	D03-D04 (Ballyspillane West) 589700 576495	Site 7 on the Ballyspillane West Stream (EPA code: 19W06) was located at a local road crossing (1m box culvert, structural damage on downstream side), at the confluence of a small unnamed stream adjoining from the north. Overall, the stream was of moderate value as a salmonid nursery (small brown trout observed) but the value was reduced given substrata compaction, sedimentation and the shallow nature of the site. Spawning habitat was moderate (to poor locally), with moderate holding. Larval lamprey habitat was limited and localised but present >20m downstream of the bridge crossing, where deeper fine silt accumulations were present. Lamprey spawning habitat was present but compromised by substrata bedding and sedimentation. No white-clawed crayfish were recorded and the site was considered unsuitable given the species' known absence from the wider catchment. No signs of otter were recorded and suitability was considered low. Given the presence of a small salmonid population and suitable lamprey habitat, the aquatic ecological evaluation of site 7 was of **local importance (higher value).**
8	Dungourney River 19D07	D03-D04 (Roxborough) 590464 574758	Site 8 on the Dungourney River at a local road crossing at Roxborough was a good salmonid habitat, with good nursery, good spawning and some excellent holding habitat, particularly downstream of the weir. Spawning habitat was best immediately upstream of the weir (loose, mobile gravels). There was some very good European eel habitat under the bridge and downstream of the weir. Larval lamprey habitat was localised but present (some optimal, some sub-optimal) in marginal slacks and in association with instream macrophyte beds. Lamprey spawning habitat was present throughout although was considered better upstream of the weir.

Site no.	Watercourse and EPA code	Location (closest to survey point) and ITM Co-ordinates	Site Description
			No white-clawed crayfish were recorded (despite some good habitat suitability) and the site was considered unsuitable given the species' known absence from the wider catchment. No signs of otter were recorded but suitability was considered high. Given the good quality salmonid, European eel and lamprey habitat present, the aquatic ecological evaluation of site 8 was of **local importance (higher value).**
9	Harrisgrove Stream 19H02	DC04-DC05 (Ballyedkin) 591537 573677	The proposed HVDC land cable route no longer crosses this point and instead is proposed approximately 200m east of this location. The site offered poor salmonid and European eel habitat. There was, however, some extensive soft sediment habitat suitable for larval Lampetra sp. but spawning opportunities, as with salmonids, were poor. Three-spined stickleback (*Gasterosteus aculeatus*) were evidently abundant at the time of survey. No white-clawed crayfish were recorded and the site was considered unsuitable given high siltation rates and the species' known absence from the wider catchment. No signs of otter were recorded and suitability was considered poor although the species is known from the emanating Ballybutler Lough approx. 1km upstream. Given the poor quality fisheries habitat present, and evident siltation and eutrophication pressures, the aquatic ecological evaluation of site 9 was of **local importance (lower value).**
10	Lough Aderra 19_65	DC05-DC06 (Loughaderry) 593875 573680	Situated south of the N25 road between Castlemartyr and Midleton and the proposed HVDC land cable route, Lough Aderra (EPA waterbody code: 19_65) is a shallow, c.13ha, spring-fed eutrophic lake with underground drainage to the Womanagh River (Bracken & Murray, 1973). The lake forms part of the Loughs Aderry and Ballybutler pNHA (site code: 000406), a site noted for ornithological and botanical interest. In terms of fisheries, the lake was, until recently a put-and-take rainbow trout (*Oncorhynchus mykiss*) fishery managed by Inland Fisheries Ireland. However, the lake is no longer operated as a fishery. Lough Aderra is known locally to support brown trout and large stocks of rudd (*Scardinius erythropthalmus*) in addition to three-spined stickleback, European eel and a small stock of carp (*Cyprinus carpio*). Habitat for cyprinid species and European eel was considered very good given the extensive macrophyte cover and shallow depths (mean depth of 1.5m). No white-clawed crayfish were recorded and the species was not known from the lake. Although no otter signs were recorded during the site visit, the species is known from the lake (Triturus pers. obs.; NBDC data) and habitat suitability was high. Given the location of the site within Loughs Aderry and Ballybutler pNHA (000446), the aquatic ecological evaluation of site 10 was of **National importance.**
11A	Womanagh River 9W01	DC06-DC07 (Grange) 595741 573955	Site 11 was located on an artificially cut branch of the Womanagh River (aka Kiltha River, EPA code: 19W01) situated west of Castlemartyr village. The channel supported brown trout and three-spined stickleback. Salmonid value was poor with the habitat only suitable for larger adult fish. Value for European eel was high. The site was not considered of value for white-clawed crayfish given the species' known absence from the wider catchment. Otter suitability was high given the seclusion and a regular spraint site (latrine) was located along the margins of the channel (east bank) approx. 30m upstream from the survey site (ITM 595731, 573934). Given the presence of salmonids (brown trout), otter, kingfisher and good quality European eel habitat, the aquatic ecological evaluation of site 11A was of **local importance (higher value).**
11B	Womanagh River 19W01	DC06-DC07 (Grange)	Site 11B on an artificially cut branch of the Womanagh River (aka Kiltha River, EPA code: 19W01) was located at the N25 road crossing (bridge ID: CC-N25-007.00), approx. 0.5km west of Castlemartyr village.

Site no.	Watercourse and EPA code	Location (closest to survey point) and ITM Co-ordinates	Site Description
		595697 573908	The channel evidently supported brown trout and three-spined stickleback (both observed during the site visit). However, overall salmonid value was poor with the habitat only suitable for larger adult fish (i.e. no spawning, poor nursery habitat). Value for European eel was considered high given good foraging and refugia opportunities. The presence of cyprinid species such as rudd was considered likely given their known presence in the downstream-connecting lake. No white-clawed crayfish were recorded and the species is not known from the wider catchment. Otter suitability was high given the high habitat seclusion and foraging potential. A regular spraint site (latrine) was located along the margins of the channel (east bank) approx. 250m upstream from the road bridge (ITM 595731, 573934). An adult kingfisher (*Alcedo atthis*) was recorded flying in a downstream direction during the site visit. Given the presence of salmonids (brown trout), otter, kingfisher and good quality European eel habitat, the aquatic ecological evaluation of site 11B was of **local importance (higher value).**
12A	Womanagh River 19W01	DC06-DC07 (Grange) 596064 573928	Site 12A on the Womanagh River (aka Kiltha River, EPA code: 19W01) located 0.7km upstream (north) of Castlemartyr village was a lowland depositing watercourse. The river had been historically straightened but not deepened and flowed in a homogenous shallow habitat. Overall, the site offered good value as a salmonid nursery. However, low water levels reduced the value at the time of survey. Spawning habitat was good owing to the presence of abundant, relatively clean unbedded gravels. Holding habitat was largely absent. European eel habitat was poor given the lack of deeper pool areas. Larval lamprey habitat was not present (compacted sand only, no fine sediment accumulations) although some good spawning habitat was present locally. There was no white-clawed crayfish potential given the known absence of the species from the wider catchment. There were no otter signs in the vicinity of the survey site although there was good potential, particularly during higher water levels. Given the presence of some good quality salmonid and lamprey habitat, and the ability to support aquatic species of conservation value such as European eel, the aquatic ecological evaluation of site 12A was of **local importance (higher value).**
12B	Womanagh River 19W01	DC06-DC07 (Castlemartyr Bridge) 596066 573884	Site 12B on the Womanagh River (EPA code: 19W01) was located at the N25 road crossing in Castlemartyr village. The shallow riffles and glide areas provided some good nursery for salmonids (both brown trout and Atlantic salmon) although the overall value of the site was reduced given the lack of deeper holding areas. European eel habitat was reduced to moderate for the same reason. Silt accumulations immediately downstream of the road crossing adjoining the low three-arch masonry road bridge offered good nursery potential for brook lamprey ammocoetes. No white-clawed crayfish were recorded and the species was not known from the wider catchment. Despite some habitat suitability, no otter signs were recorded in the vicinity of the road bridge. In summary, given the presence of good quality salmonid and lamprey habitat, and the ability to support aquatic species of conservation value such as European eel, the aquatic ecological evaluation of site 12B was of **local importance (higher value).**
13	Annistown Stream 19A24	DC07-DC08 (N25 road crossing) 597825 574208	Site 13 on the Annistown Stream (EPA code: 19A24), also known locally as the Dower River, was 100% dry at the time of survey. The Annistown Stream (Womanagh River tributary), flowed through an agricultural landscape in the vicinity of a karstic limestone system. A number of small limestone caves were present in the vicinity of the proposed road crossing point (north side of road). These may be connected to a wider karstic network that is known from the area (e.g. Dower Spring to the south and others). The channel at this location was considered likely to be subterranean and or dependent on fluctuating groundwater levels (i.e. highly seasonal). Remnants of a dry channel bed were present to the northeast of the road crossing point, adjoining a hawthorn-bramble-ash hedgerow boundary. No standing water was present at the time of survey.

Site no.	Watercourse and EPA code	Location (closest to survey point) and ITM Co-ordinates	Site Description
			Given the absence of water at the time of survey (and evidently, much of the year), the channel was not of value for fish, white-clawed crayfish, otter or other aquatic species. Given the lack of water and fisheries value, the aquatic ecological evaluation of site 13 was of **local importance (lower value).**
14	Moanlahan River 19M29	DC07-DC08 (N25 road crossing) 598876 574549	The Moanlahan River (EPA code: 19M29) at site 14 was a very heavily modified lowland depositing stream. The majority of the bed was dry at the time of survey. The channel was not of fisheries value given evident seasonality (i.e. drying up). No white-clawed crayfish or otter signs were recorded and the site was not considered of value to either species. Given the poor quality fisheries habitat present, and evident siltation and eutrophication pressures, the aquatic ecological evaluation of site 14 was of **local importance (lower value).**
15A	Dissour River 19D03	DC08-DC09 (N25 road crossing) 600504 576691	Site 15A on the Dissour River (EPA code: 19D03) was located at the N25 road crossing in Killeagh village. The site provided a good salmonid nursery although downstream of the recently constructed footbridge there was an old concrete weir with poor fish passage (steep lip with no fish pass). Given the moderate flows and lack of sediment accumulations, the site was considered of limited value for lamprey. European eel habitat was moderate to good locally. No white-clawed crayfish were recorded and the species was not known from the wider catchment. A regular otter spraint site (with fish remains) was recorded underneath the road bridge structure (ITM 600506, 576682). Given the good quality salmonid habitat present, and the ability to support aquatic species of conservation value such as European eel and otter, the aquatic ecological evaluation of site 15A was of **local importance (higher value).**
15B	Dissour River 19D03	DC08-DC09 (Moanlahan) 600810 576240	The channel of the River Dissour (EPA code: 19D03) at site 15B was large enough to support good densities of salmonids and thus was considered an inherently good salmonid fishery, also having value as an angling amenity. The abundance of very good quality spawning areas and nursery habitat (i.e. un-bedded riverine substrata) indicated high value for Atlantic salmon and brown trout which were evident in good densities, swimming in pool and glide habitat. Mixed cohorts were visible including juvenile Atlantic salmon. The coarse cobble and localised boulder in pool areas, also provided good nursery habitat for European eel. Areas of silt near the rail bridge were considered likely to support brook lamprey ammocoetes as upstream and downstream finer gravel spawning areas were also visible (i.e. acting as nearby spawning areas and sources of larvae). No white-clawed crayfish were recorded and the species was not known from the wider catchment. Otter spraint was present on gravel patches upstream and downstream of the crossing with sprainting also evident under the old railway bridge structure. Given the good quality salmonid habitat present, and the ability to support aquatic species of conservation value such as European eel and otter, the aquatic ecological evaluation of site 15B was of **local importance (higher value).**
16	Inchanapisha River 19I19	DC08-DC09 (Lagile) 601273 576492	Site 16 on the Inchanapisha River (EPA code: 19I19) was, despite evident deterioration of the bed, was nonetheless considered of moderate value to salmonids and young fish 0+ and 1+ were observed present in glide areas. Potential for European eel was considered moderate. No white-clawed crayfish were recorded and the species was not known from the wider catchment. Otter spraint sites were frequent underneath the box culvert crossing, on ledge areas and also on boulders downstream of weir. Given the moderate quality salmonid habitat present and evident value as a salmonid nursery, and the ability to support aquatic species of conservation value such as otter, the aquatic ecological evaluation of site 16 was of **local importance (higher value).**

Site no.	Watercourse and EPA code	Location (closest to survey point) and ITM Co-ordinates	Site Description
17	Lagile Stream 19L47	DC09-DC10 (Ballymackeagh More) 602087 576286	Site 17 on the Lagile Stream (EPA code: 19L47) was a very heavily modified stream channel, that had been extensively deepened, straightened and canalised. The stream was not considered of fisheries value apart from European eel that likely use the channel as a nursery given connectivity with the River Dissour. The stream was not considered of value to salmonid fish. No white-clawed crayfish were recorded and the species was not known from the wider catchment. No otter signs were observed but limited accessible bankside areas were present for sprainting. Despite the lack of value for salmonids or lamprey, the connectivity with the River Dissour and ability to support migratory European eel resulted in the aquatic ecological evaluation of site 17 being considered of **local importance (higher value).**
18	Gortnagark Stream 19G72	DC09-D010 (Burges Lower) 602855 576116	Site 18 on the Gortnagark Stream (EPA code: 19G72) was a very heavily modified stream channel (similar to site 17) in that the channel had been straightened and canalised, historically. Given the physical characteristics, the stream was not considered of fisheries value apart from for European eel which likely use the channel as a nursery given connectivity with the River Dissour. The stream was not considered of value to lamprey but may support species such as three spined stickleback which can tolerate low oxygen levels invariably present at such small stream sites. No white-clawed crayfish were recorded and the species was not known from the wider catchment. No otter signs were observed during the site visit. Despite the lack of value for salmonids or lamprey, the connectivity with the River Dissour and ability to support migratory European eel resulted in the aquatic ecological evaluation of site 18 being considered of **local importance (higher value).**
19	Inchiquin Stream 19I14	DC09-DC10 (Burges Lower) 603917 576193	Located downstream of the N25 crossing at Burges Lower, site 19 on the Antiquing Stream (EPA code: 19I14) was a small, semi-natural stream channel. The stream was considered of some value to salmonids given the apparent swift flow. However, it could be rated as moderate at best given historical stream alterations, shallow depth and compaction of instream gravels (with evident heavy siltation) that reduced spawning viability. The stream may also support European eel locally in pool areas. No white-clawed crayfish were recorded, suitability was low and the species was not known from the wider catchment. A single spraint site (old was observed under culvert crossing). The use of the river channel as a feeding and commuting corridor for otter was considered likely but small channels typically are of lower value to otter and less frequently used as larger more productive feeding areas. Given the moderate quality salmonid habitat present, and the ability to support aquatic species of conservation value such as European eel and otter, the aquatic ecological evaluation of site 19 was of **local importance (higher value).**
20	East Ballyvergan Stream 19E04	DC09-DC10 (Colah) 605888 576342	Site 20 on the East Ballyvergan Stream (EPA code: 19E04) was a very heavily modified stream channel, that had been deepened, straightened and canalised, historically. Given the small, shallow nature of the stream and lack of flow, the stream was not considered of fisheries value apart from for three-spined stickleback which were frequent in the stream (shoals observed in glide areas). The site was not suitable for white-clawed crayfish. No otter signs were recorded and suitability was considered low. Given the low fisheries value of the site, the aquatic ecological evaluation of site 20 was of **local importance (lower value).**

Table 7.7 presents an overview of WFD surface waterbodies, as detailed on EPA datasets and mapping. The following detail is provided:

- WFD surface waterbody water crossings (denoted as 0m distance) and WFD surface waterbodies within 500m of the proposed development (closest distance provided);
- River waterbody WFD status 2013-2018;
- EPA name for surface waterbody;
- Summary of aquatic ecology evaluation; and
- An importance rating, having regard to the criteria detailed in Table 7.2.

Proximity to protected areas is also referenced as appropriate. Unnamed surface water feature crossings, such as drainage ditches, identified along the proposed cable routes are also detailed in Table 7.6. As detailed previously, some minor drainage ditches located in proximity to the works may not be identified in this EIAR. Such waterbodies will be identified at construction stage and the embedded and additional mitigation detailed and proposed as part of this EIAR will be implemented.

In terms of hydromorphological value the following waterbodies have been identified as being artificial or heavily modified by human activity, as detailed in Table 7.5:

- Moanlahan (N25 road crossing, DC07-DC08);
- Dissour (N25 road crossing, DC08-DC09);
- Lagile Stream (Ballymackeagh More, DC09-DC10);
- Gortnagark Stream (Burges Lower, DC09-D010); and
- East Ballyvergan (Coolaha, DC09-DC10).

Pressures identified in the receiving environment include:

- Urban Run-off:
  - AC03-AC04 (Tibbotstown Unassigned; and-
  - DC09-DC10 (East Ballyvergan Unassigned)-
- Urban Wastewater:
  - AC03-AC04 (Tibbotstown Unassigned).
- Industry:
  - DC03-DC06 (Dungourney 19 Poor).
- Agriculture:
  - DC03-DC06 (Dungourney 19 Poor);
  - DC07-DC08 (Moanlahan Unassigned): and
  - DC09-DC10 (Womanagh Unassigned).

Table 7.7: Receiving Environment (Receiving WFD Waterbodies Environment Rating)

Route Section Name	WFD Waterbodies WFD Status 2013-2018	Name (EPA)	Aquatic Ecological Evaluation Reference	Importance
Connection Point	None The closest known waterbody to the proposed works at Knockraha substation is Lisheenroe Stream, a tributary of the Butlerstown River, located approximately 650m east of the proposed construction compound	Not Applicable	Not Applicable	Low
AC01-AC02	BUTLERSTOWN_030 (Good) ca. 50m distance	Lisheenroe (EPA code: 19L40)	(1) Lisheenroe: Local importance (higher value). Salmonids present	High (Lisheenroe: Salmonids present)
AC02-AC03	BUTLERSTOWN_030 (Good) - 0m distance Unnamed drainage ditch - - 0m distance	Lisheenroe (EPA code: 19L40)	(1) Lisheenroe: Local importance (higher value). Salmonids present	High (Lisheenroe; Salmonids present) Low (unnamed drainage ditch)
AC03-AC04	OWENNACURRA_030 (Good) ca. 370m Tibbotstown_010 (Unassigned)- ca. 45m Unnamed drainage ditch - 0m distance	Tibbotstown (EPA code: 19T25)	(2) Tibbotstown: Local importance (lower value). Low fisheries value (semi-dry habitat)	High (Tibbotstwon: potable water source). Owennacurra River (Good WFD Status) is upstream of the proposals at this location Low (unnamed drainage ditch)
AC04-AC05	Unnamed drainage ditch 0m distance	Not Applicable	Not Applicable	Low (unnamed drainage ditch)
AC05-AC06	Unnamed drainage ditch x 2 0m distance	Not Applicable	Not Applicable	Low (unnamed drainage ditch x 2)
Converter Station	Two existing depressions within the converter station compound footprint currently collect rainwater Two infilled unnamed lakes ca. 50m from the proposed access routes	Not Applicable	Not Applicable	Low (recent artificial excavation providing flood mitigation to local area within wider IDA site only
DC01-DC02	OWENNACURRA_030 (Good) 0m distance OWENNACURRA_040 (Moderate) ca. 25m distance Unnamed drainage ditch x 3 0m distance	Owennacurra (EPA code: 19O03) / 19O03	(3 & 4) Owenacurra River: County importance sea trout, lamprey, eel & otter present	Very High (Regionally important potable water source and sea trout populations, lamprey, eel & otter present) Low (unnamed drainage ditch x 3)

Route Section Name	WFD Waterbodies WFD Status 2013-2018	Name (EPA)	Aquatic Ecological Evaluation Reference	Importance
DC02-DC03	Two river crossings (OWENNACURRA_040) (Moderate) 0m distance	GLENATHONACASH (EPA code: 19G66), Elfordstown (EPA CODE: 19E02)	(5) Glenathonocash River: Local importance (higher value). Salmonids, lamprey, eel & otter present (6) Elfordstown River: Local Importance (higher value). Salmonids present; lamprey & eel habitat present	Very High (Regionally important potable water source, Salmonids, lamprey, eel & otter present)
DC03-DC04	Two river crossings. OWENNACURRA_040 (Moderate) and DUNGOURNEY_020 (Poor) 0m distance	Dungourney 19 (EPA CODE: 19D07). Elfordstown (EPA CODE: 19E02)	(7) Ballyspillane West Stream & (8) Dungourney River: Local Importance (higher value). Salmonids present; lamprey, eel & otter habitat present	Very High (Regionally important potable water source, Salmonids present; lamprey, eel & otter)
DC04-DC05	DUNGOURNEY_020 (Poor) ca. 30m distance Unnamed drainage ditch	HARRISGROVE (EPA code: 19H02)	(9) Harrisgrove Stream Local Importance (lower value). Low fisheries value	Low (Harrisgrove Stream and unnamed drainage ditch)
DC05-DC06	Loughs Aderry and Ballybutler pNHA boundary within N25. Lough Aderry ca. 15m distance DUNGOURNEY_020 (Poor) ca. 100m distance Unnamed drainage ditch x 2. 0m distance	HARRISGROVE (EPA code: 19H02) Loughs Aderry (EPA code: 19_65)	(10) Lough Aderra: National importance.Site designated as pNHA. Harrisgrove Stream: Local Importance (lower value). Low fisheries value	Very High (Loughs Aderry and Ballybutler pNHA) Low (Harrisgrove Stream and Unnamed drainage ditch x 2)
DC06-DC07	WOMANAGH_010 (Moderate) 0m distance Clasharinka Pond pNHA boundary within N25 WOMANAGH_020 (Good) ca 105m distance Unnamed drainage ditch 0m distance	Womanagh (EPA code: 19W01)	(11) Womanagh River: Local Importance (higher value). Salmonids present; lamprey, eel & otter habitat present. Kingfisher recorded (12) Local Importance (higher value). Salmonids present; lamprey & eel habitat present	Very High (Clasharinka Pond pNHA, Dower Spring: Whitegate Regional Water Supply Scheme - Inner Protection Area) High (Womanagh River)
DC07-DC08	Two Crossings. WOMANAGH_020 (Good) MOANLAHAN_010 (Unassigned) 0m distance Clasharinka Pond pNHA boundary within N25	Annistown (EPA code: 19A24) Moanlahan (EPA code: 19M29)	(13) Annistown Stream: Local Importance (lower value). Site 100% dry at time of survey (14) Moanlahan River: Local Importance (lower value) Low fisheries value	Very High (Clasharinka Pond pNHA, Dower Spring: Whitegate Regional Water Supply Scheme - Inner Protection Area) Low (Annistown Stream and Moanlahan River)

Route Section Name	WFD Waterbodies WFD Status 2013-2018	Name (EPA)	Aquatic Ecological Evaluation Reference	Importance
DC08-DC09	Two river crossings for each DISSOUR_020 (Good) 0m distance	Dissour (EPA code: 19D03) / Inchanapisha (EPA code: 19I19)	(15) Dissour River: Local Importance (higher value). Salmonids present; lamprey, eel & otter habitat present (16) Inchanapisha River: Local Importance (higher value). Good salmonid nursery	High (Salmonids present; lamprey, eel & otter habitat present, Good salmonid nursery)
DC09-DC010	Four Crossings. DISSOUR_020 (Good). WOMANAGH_030 (Unassigned x 2). East Ballyvergan_010 (Unassigned) 0m distance Ballyvergan Marsh pNHA (000078) boundary along R634 0m distance	LAGILE (EPA code: 19L47) GORTNAGARK (EPA code: 19G72) INCHIQUIN (EPA code: 19I14) East Ballyvergan (EPA code: 19E04)	(17) Lagile Stream & (18) Gortnagark Stream: Local Importance (higher value). Likely European eel migratory pathway 19) Inchiquin Stream: Local Importance (higher value). Salmonids present; lamprey, eel & otter habitat present (20) East Ballyvergan Stream: Local Importance (lower value). Low fisheries value	Very High (Ballyvergan Marsh pNHA) High (Lagile Stream Gortnagark Stream, Inchiquin Stream Salmonids present; lamprey, eel & otter habitat present) Low (East Ballyvergan Stream)
DC10-DC011	East Ballyvergan_010 (Unassigned) ca. 180m distance Ballyvergan Marsh pNHA (000078) boundary along R634 0m distance Ballvergan Marsh Bird Pond ca. 145m distance	PIPERSBOG (EPA code: 19P09)	Not Applicable	Very High (Ballyvergan Marsh pNHA)
DC11-DC012	Unnamed drainage ditch 0m distance Ballyvergan Marsh pNHA (000078) 0m distance	Not Applicable	Not Applicable	Very High (Ballyvergan Marsh pNHA)
Landfall	Youghal Bay (Moderate) Excellent Bathing Water Quality 0m distance Large unnamed (saline) drain within Ballyvergan Marsh pNHA (000078) to west of car park ca. 190m	Youghal Bay	NA	Very High (Bathing Area)

7.4 Characteristics of the Development

The following descriptions focus on those aspects of the proposed development that are most relevant to surface water and flood risk effects and should be read in conjunction with Chapter 2 Description of the Development and Chapter 3 Onshore Construction Phase Activities.

For the purpose of this section, proposed construction and operational phase activities are discussed under the following headings:

- Connection Point;
- Converter Station Site;
- Landfall Area at Claycastle Beach;
- HVAC / HVDC Cable Routes; and
- Construction Compounds and Laydown Areas.

7.4.1 Construction Phase Activities

Construction phase activities, as they relate to potential impacts on surface water from working in or near watercourses are discussed below.

7.4.1.1 Connection Point

Knockraha substation is elevated and there are no known surface waterbodies within the proposed works area at Knockraha substation. The closest known surface waterbody to the works areas at Knockraha substation is Lisheenroe Stream, a tributary of the Butlerstown River, located approximately 650m east of the proposals.

7.4.1.2 Converter Station Site

As detailed in Chapter 6, there are a number of karst features within the proposed converter station site. These features may be hydrologically connected to surface water bodies.

The converter station site will consist of a new engineered stone fill platform which will raise the proposed site level above its existing level. This will ensure that a sealed, below ground, gravity drainage system can be accommodated.

Rotary bored cast-in-place (socketed into rock) reinforced concrete piles will likely be adopted for all foundations on this site. Specialist and experienced piling Contractors will be employed to carry out the works. Method statements, piling risk assessments and environmental management plans, specific for the area where the drilling is to take place, will be carried out / prepared in line with contractual agreements. The piling risk assessments will include for example, groundwater / aquifer protection and the implementation of robust monitoring of the works. These documents will be submitted by the Contractor to the planning authorities for discussion and acceptance prior to commencing piling operations.

The presence of voids would be recognised by an experienced piling operator during the boring of the piles, prior to concrete placement. In such cases, the piling Contractor would install a permanent casing (likely a thin steel sleeve) to retain concrete within the pile bore/shaft. This requirement will be clearly stated in the piling performance specification and contractual agreements.

Construction of the below ground drainage system will commence on completion of the proposed platform. The access road below ground drainage system will commence on completion of the access road enabling works.

The construction of the proposed site access road will commence at the same time as the piling works. This will consist of removing all poor ground and any material from areas to be cut and removing this material from site. All fill for embankments will consist of engineered stone that will be brought to site.

A Contractors compound will be located within the site boundary and will be located on an area of ground that will be temporarily surfaced with engineered stone and levelled. The compound will house the Contractors cabins and areas for temporary storage of construction materials (excluding cut/fill ground, which will be brought directly to and from site with no need for temporary storage).

Construction of the reinforced concrete piled raft for all of the buildings and structures can commence once the piling is complete. The structures and building will then progress commensurate with typical construction practice.

The site contains two depressions which act to reduce flood levels in the wider IDA site. These will be infilled during construction and replaced with a compensatory storage area. The transition of the depressions to the storage area will be managed on site so as not to increase flood risk elsewhere during construction.

7.4.1.3 Landfall Area

The submarine cables will be jointed with the land cable within underground transition joint bay chambers. The chambers will be installed between the Summerfield Holiday Park and car park at Front Strand, behind the landfall area at Claycastle Beach. Such chambers generally consist of a reinforced concrete base slab, walls and chamber roof. The chamber is typically backfilled with a suitable material (such as cement bound sand). A construction compound will also be located in this area.

The submarine cable will be installed within Claycastle Beach by open trench excavation in two phases. In the first phase conduits will be installed within a trench excavated across the beach. Temporary sheet piled cofferdams will be installed to achieve the required depth of lowering and prevent the ingress of seawater and sediments and to ensure trench stability. Access will be provided via a temporary causeway.

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 causeway as an access route, but will also take advantage of favourable tidal and weather conditions.

The cofferdam will be 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.

Spoil material from the trench will be stored temporarily within the construction compound prior to re-instatement. Stored spoil will be covered to prevent exposure to the elements.

In the second phase, the submarine cable will be floated / pulled into shore with the aid of temporary buoyancy aides. A winch will be used to pull the cable ends up to the transition joint bay. Once the cable is secured in the transition joint bay the offshore cable lay and burial process can commence, the cable will be buried, the trench will be backfilled, and the site reinstated to its original condition once the submarine cable has been installed.

7.4.1.4 HVAC / HVDC Cable Routes

Works associated with passing bays, laydown areas, construction compounds and utility crossings, as detailed in Chapter 2 and Chapter 3, will be carried out along the HVAC / HVDC cable route. Water crossings will be by either open cut trenching or HDD, as detailed hereunder. Existing utility services, including public water supply pipes, will also need to be crossed.

The cable route will be designed to not be vulnerable to flooding; this includes the avoidance of flood zones A and B where possible. In any case all joint bays and link boxes are designed with watertight connections as standard (as these installations are typically underground) Where it is impossible to avoid Flood Zones A and B the scheme includes embedded mitigation against flood risk. Additional detail on joint bay and link box construction are given in Chapter 2.

7.4.1.5 Water Crossings by Open Cut

Open cut water crossings have the potential to generate silt and suspended solids. In order to reduce the risk of discharging sediment it is proposed to carry out these works in a dry works area.

Unless otherwise agreed with IFI, instream works in watercourses with fisheries value will be restricted to the fisheries open season (i.e. July to September inclusive).

At a number of specific river crossing locations instream works may be required. At these locations electrofishing may be carried out to remove fish under licence from IFI. These locations will be agreed with IFI prior to works commencing. A detailed method statement for instream works specific to each river crossing will be prepared and the report authorised by a suitably experience aquatic ecologist. This will be finalised and agreed with IFI.

Where open trenching is proposed, site restoration works will be carried out following completion of the crossing, in agreement with IFI. These works may include riverbank stabilization, gravel replacements etc. In all cases, the site will be restored post installation.

Further detail is provided in Chapter 3 of Volume 3C.

7.4.1.6 Water Crossings by HDD

Pumping of trenches and HDD could result in increased flow to surrounding watercourses if not managed correctly. This could then affect hydrological discharges and dilution, whilst the works could also release contaminants or sediment into the watercourse.

Competent specialist contractors with proven successful drilling experience working on projects within ground conditions similar to those expected within this project will be appointed to undertake the work.

As with all construction works proposed, no drilling works will be allowed to commence until the relevant RAMS and pertinent Health and Safety documents are received from the specialist Contractor and are reviewed and agreed by the Client’s representative. These Contractor documents will include method statements, drilling risk assessments and environmental management plans specific to the area where the drilling is to take place. These documents will, as a minimum, list proposals to eradicate any risk or mitigate against them and would include for example utilities/services plans and avoidance measures, groundwater / aquifer protection measures, and implementation of robust monitoring of the works, including action plans to mitigate / rectify any environmental incident. This assessment / management plan is expected to be submitted by the Contractor to the Employers Representative on site for review and comment prior to commencing drilling operations.

7.4.1.7 Water Crossings

The following table details the known proposed water crossings. Other minor drainage ditches may be located in proximity to the works and these may also be required to be crossed. These will be identified at construction stage and the embedded and additional mitigation detailed and proposed as part of this EIAR will be implemented.

Table 7.8: Known Water Crossings

Route Section Name	Watercourse	Proposed Crossing Method
Connection Point	• None	• N/A
AC01-AC02	• None	• N/A
AC02-AC03	• BUTLERSTOWN_030 (Good) • Unnamed drainage ditch	• Open cut trench
AC03-AC04	• Unnamed drainage ditch	• Open cut trench
AC04-AC05	• Unnamed drainage ditch	• Open cut trench
AC05-AC06	• Unnamed drainage ditch x 2	• Open cut trench
DC01-DC02	• OWENNACURRA_030 (Good) • Unnamed drainage ditch x 3	• HDD • Open cut trench
DC02-DC03	• OWENNACURRA_040) (Moderate) x 2	• Open cut trench
DC03-DC04	• OWENNACURRA_040 (Moderate) • DUNGOURNEY_020 (Poor) 0m distance	• Open cut trench • HDD
DC04-DC05	• Unnamed drainage ditch	• Open cut trench
DC05-DC06	• Unnamed drainage ditch x 2 • Loughs Aderry and Ballybutler pNHA boundary within N25	• Open cut trench
DC06-DC07	• WOMANAGH_010 (Moderate) • Unnamed drainage ditch	• HDD • HDD
DC07-DC08	• WOMANAGH_020 (Good) • MOANLAHAN_010 (Unassigned) Clasharinka Pond pNHA boundary within N25	• Open cut trench • Open cut trench
DC08-DC09	• DISSOUR_020 x 2	• HDD
DC09-DC010	• DISSOUR_020 (Good). • WOMANAGH_030 (Unassigned). • WOMANAGH_030 (Unassigned). • East Ballyvergan_010 (Unassigned)	• Open cut trench • Open cut trench • HDD • Open cut trench
DC10-DC011	• None	• N/A
DC11-DC012	• Unnamed drainage ditch • Ballyvergan Marsh pNHA	• Open cut trench • HDD
Landfall at Claycastle Beach	• Youghal Bay	• Open cut trench

7.4.1.8 Construction Compounds and Laydown Areas

Temporary construction compounds and laydown areas will be required during the construction phase.

All temporary construction compounds will be secured with hoarding/fencing around the compound perimeters as appropriate. Where temporary construction areas are required and existing hardstanding is not available, engineering stone fill will be laid and compacted and maintained as required for the duration of the works. Once the works are completed, the engineered stone fill will be removed and the land will be reinstated to its original condition.

Temporary facilities will be provided at the construction compounds including construction phase car parking and welfare facilities and temporary material storage areas as necessary. 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 an approved licenced facility.

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

7.4.2 Operational Phase Activities

Operational phase activities, as they relate to potential impacts on surface water from working in or near watercourses are discussed below.

7.4.2.1 Connection Point

The proposed oil filled transformers at the converter station site and at Knockraha substation will be bunded. The bunds will have the capacity to hold 110% of the volume of oil in each transformer.

The maintenance regime will not differ from maintenance regimes to the existing bays at Knockraha substation once the construction phase is complete.

There will be no water demand or wastewater discharges (other than storm water) associated with the operation phase of the development at this location.

The connection point is not located in Flood Zones A or B and has no history of flooding.

7.4.2.2 Converter Station Site

Due to the ‘unmanned’ nature of the proposed development, there will be no demand for water at the site during a typical week. Permission will be sought from Irish Water for a new connection to an existing 150mm watermain located in the local road which forms the western boundary of the IDA lands. A looped ‘ring main’ with hydrants for fire-fighting purposes is proposed to be provided within the converter station and reactor compounds.

Foul wastewater will only be generated on days that maintenance crews are present on site. Foul water will be collected in proprietary holding tanks which will be periodically emptied by a licensed waste disposal contractor. The holding tanks will be fully sealed to prevent discharge to ground and will include a high-level alarm and telemetry link to the converter station’s control system such that they can be monitored remotely and emptied when necessary.

A storm water drainage system incorporating SuDS (sustainable drainage systems) features will be constructed to manage the quantity and quality of runoff during rainfall events. The system will operate by gravity and be sized to ensure that no internal property flooding occurs for the critical storm with a 1 in 100-year return period including a +20% allowance for climate change. All proposed surfaces and storm water drainage elements will be sealed.

A flood risk assessment has been undertaken for the converter station (refer to Appendix 7.1) which shows that the converter station is not in Flood Zones A or B as defined by the OPW’s Flood Risk Guidelines. The proposed converter station will also be elevated above the surrounding ground and is not therefore at risk from overland flow, as demonstrated in the flood risk assessment. Two existing depressions will be infilled during construction and this has the potential to increase flood risk elsewhere unless mitigation measures are implemented. Therefore, it is proposed to develop an area of ‘compensation storage’ adjacent to the compound. The compensation storage area will be specifically designed to accept and store water during rainfall events and it will be sized to ensure that there is no significant increase in flood risk in the 'post-development' case when compared to the 'pre-development' case.

This compensation storage area will consist of a below ground and covered storage tank, which will be emptied at a controlled rate via a pumped connection to the storm water drainage system which will serve the proposed converter station access road. Discharge from the compensation storage area will be restricted to 'greenfield' runoff rates to ensure that there is no significant increase in flood risk elsewhere. Flood water routing in the form of open channel drains and culverts will be installed around the perimeter of the proposed converter station to divert overland flow towards the dedicated compensation storage area, rather than towards the location of the infilled depressions.

Discharge from the converter station site and the associated access roads is proposed to be restricted to greenfield runoff rates in line with the recommendations of the Greater Dublin Strategic Drainage Study (GDSDS Vol. 2 – New Development) which have generally been adopted by Local Authorities across the country.

7.4.2.3 HVAC / HVDC Cable Routes

The HVAC and HVDC cables routes will require no specific maintenance along the cable trench or joint bay locations. Access may be required at joint bays on rare occasions to facilitate cable replacement if a failure occurs.

Access to link boxes and communications chambers will be required on an annual basis for inspection and any necessary maintenance.

7.4.2.4 Landfall Area

The submarine cable will be buried and so not be at flood risk and would not influence flood risk elsewhere. The transition from the submarine cable to the HVDC cable is located outside Flood Zones A and B and so is not considered at risk of flooding.

7.5 Likely Significant Impacts of the Development

The following sections discuss the predicted likely significant impacts, having regard to the embedded mitigation measures discussed in Section 7.4 *Characteristics of the Development,* and prior to the implementation of additional proposed mitigation measures as discussed in Section 7.7 *Mitigation and Monitoring*.

Associated impacts are grouped in this assessment where they are common to multiple locations.

7.5.1 Construction Phase

Given the nature of the proposals, the potential for impacts on the water environment are for the most part associated with the construction phase of the proposals and are similar to any civil engineering project. These include:

- Impacts to surface water quality from sediment runoff, spillages, discharges or physical modification.
- Impacts on drainage patterns from working in or near watercourses.
- Impacts on water supply and drainage infrastructure.
- Impacts on flood risk

7.5.1.1 Surface Water Quality

Excavation works, the storage of excavated material, vegetation clearance, crossing of watercourses and infilling of trenches can pose a risk to surface water quality through surface water run-off and the release of sediment to watercourses. Ground damage from construction vehicles and machinery can also cause rutting and increased erosion of soils. Access tracks used during construction may affect surface run-off patterns, creating alternative flow paths, promoting erosion and localised flooding.

Elevated levels of sediment could impact on spawning fish, through issues including the sedimentation of spawning gravels, clogging of fish gills and reduction in dissolved oxygen.

Accidental release of potentially polluting substances such as cement and oils (hydrocarbons) can result in significant impacts on the aquatic environment.

The release of hydrocarbons can impact water dependant species resulting in disruption to neurosensors, abnormal behaviour and development issues as well as direct impacts on fertility. Oil spills can reduce the capacity of a waterbody to exchange oxygen as well as result in oil coating the gills of aquatic species causing lesions on respiratory surfaces. This can result in significant respiratory difficulties for aquatic organisms. Benthic invertebrates can be adversely affected if fractions of hydrocarbons settle and accumulate in sediments. This can result in the mortality of populations and prevent future colonisation.

Concrete and cement are highly alkali and fresh concrete has corrosive properties. Concrete wash water is a particularly severe pollutant, as it typically has a high pH (11-12) coupled with extremely high suspended sediment content. In the freshwater environment, pH levels which are elevated beyond natural conditions can have significant impacts upon water bodies

Schedule 5 of SI 272 of 2009 (European Communities Environmental Objectives (Surface Waters) Regulations 2009) includes the following (WFD) pH limits for rivers and lakes:

- Soft water 4.5< pH < 9.0, where soft water is ≤100 mg/1 $CaCO_3$; and
- Hard water 6.0< pH < 9.0, where hard water is > 100mg/l $CaCO_3$.

The sensitivity of the receiving surface water environment ranges from low to very high. The magnitude of adverse surface water quality impacts in the absence of additional mitigation is expected to be Small to Moderate resulting in Moderate to Significant adverse impacts of up to short-term duration prior to the implementation of additional mitigation measures.

7.5.1.2 Hydromorphology

A number of unnamed watercourses are required to be crossed within the road network. The drainage patterns associated with watercourses confined to existing culverts will not be impacted significantly as a result of the proposals.

Open cut trenching will be carried out in the dry. The existence of a temporary impermeable barrier to facilitate open cut trenching will have a direct impact on the cross section of the channel and is expected to give rise to localised but temporary changes in water depth, velocities and sediment erosion/deposition.

The proposed activities could result in localised changes to surface water drainage patterns and restrictions to infiltration of rainfall in soils. Given the largely rural locations of the proposed works existing drainage networks are available and any disturbance would be localised and temporary in duration. Surface water contributions would remain unchanged and would likely discharge to the same catchment. Significant construction phase impacts on surface water drainage patterns are not likely.

The sensitivity of the receiving surface water environment ranges from low to very high. The magnitude of adverse impacts in the absence of additional mitigation is expected to be Negligible to Small as there could be some localised temporary impacts resulting in Imperceptible to Moderate adverse impacts prior to the implementation of additional mitigation measures.

7.5.1.3 Water Supply and Drainage infrastructure

All reasonable measures will be taken to avoid unplanned disruptions to any services during the proposed works. This will include thorough investigations to identify and reconfirm the location of all utility infrastructure within the works areas, and the implementation of robust procedures when undertaking works around known infrastructure services.

Service disruptions impacting the surrounding residential, social and commercial properties will be kept to a minimum, only occurring where unavoidable. Prior notification of disruptions will be given to all impacted properties. This will include information on when disruptions are scheduled to occur and the duration of the disruption. Consultation with relevant neighbouring parties will be undertaken prior to any proposed disruptions.

There is potential for disruption to services during construction works. Impacts would be localised and brief in duration, however, the measures detailed above will ensure that this will not result in significant impacts in the receiving environment.

During the construction phase temporary construction compounds will be required at the connection point (Knockraha substation), the converter station (Ballyadam) and the landfall (the area of the car park at Claycastle Beach). Welfare facilities will be provided at these locations and any discharges will be connected to a sealed holding tank to be emptied and disposed of off-site by a licenced contractor to an approved licenced facility. Water will be tankered onto site as required. Consequently, significant adverse impacts on utility services during the construction phase are not likely.

7.5.1.4 Flood Risk

A desk based study flood risk assessment was carried out, which concludes that the impact on flood risk during construction is considered to be small adverse. Watercourse crossing are required as part of the works. In the most part these will be directional drilled under the watercourses and would therefore not influence flood risk. For some minor watercourses (as noted in Table 7.8) during construction temporary excavations will be required which could increase flood risk elsewhere. However, these would be of short duration and managed so that excavations would not occur during high flows, so minimising the flood risk.

During construction there will be laydown areas within flood zones and construction work activities would operate within flood zones. These will be managed so that they would not increase flood risk elsewhere by minimising plant and materials within flood zones and removing potential obstructions in the event of an adverse weather warning.

The converter station is not in Flood Zone A and B and the construction of this would be managed so as to have a small adverse impact on flood risk.

The followed assumptions apply to this assessment:

- Flood risk will be managed during construction for watercourse crossings to not make flood risk worse elsewhere; and
- Laydown areas within flood zones will be managed so that plant and equipment is not vulnerable to flooding.

7.5.2 Operational Phase

As detailed previously, given the nature of the proposals, the potential for impacts on the water environment are for the most part associated with the construction phase. For completeness operational phase effects considered include:

- Impacts to surface water quality from sediment runoff, spillages, discharges or physical modification.
- Impacts on drainage patterns from working in or near watercourses.
- Impacts on water supply and drainage infrastructure.
- Impacts on flood risk

7.5.2.1 Surface Water Quality

As the cables are solid insulation type there are no sources of pollution and as they are buried, they will not offer a pathway to any surface water receptors.

The converter station will be unmanned and so foul wastewater will only be generated on days that maintenance crews are present on site. Foul water will be collected in proprietary holding tanks which will be periodically emptied by a licensed waste disposal contractor. A storm water drainage system incorporating SuDS features will be constructed to manage the quantity and quality of runoff during rainfall events. Runoff is proposed to be discharged to an existing 600mm diameter storm water drainage pipe which has been laid in the south-west corner of the existing IDA site.

The compensation storage area will consist of a below ground and covered storage tank, which will be emptied at a controlled rate via a pumped connection to the storm water drainage system for the proposed converter station access road.

Given the nature of the proposals, described in section 7.4, it is expected that adverse impacts on surface water quality during operation will be imperceptible.

7.5.2.2 Hydromorphology

Site restoration works will be carried out following completion of water crossings, in agreement with IFI. These works may include riverbank stabilization, gravel replacements etc. In all cases, the site will be restored post installation. Adverse impacts in terms of water depth, velocities and sediment erosion/deposition are therefore expected to be imperceptible.

7.5.2.3 Water Supply and Drainage infrastructure

The increase in impermeable surfaces at the converter station site will result in a corresponding increase in surface water runoff, while filling of existing low points and depressions will alter existing drainage patterns within the catchment of the wider IDA site. However, since all surface water generated at the converter station site or flowing towards it will be intercepted and diverted to a sealed underground collection system incorporating SuDS features (flow and pollution control elements plus attenuation storage tanks), there will be a negligible impact on the local surface water drainage patterns and water environment.

An imperceptible impact on surface water drainage routes along the cables routes is expected as the land will continue to drain as per the existing situation.

7.5.2.4 Flood Risk

A desk based assessment of the cable route was undertaken which concludes that the impact on flood risk is considered to be negligible at operation stage due to the cables being buried and so not influencing flood waters. In addition, the cables are characterised by being designed to be not vulnerable to flooding within Flood Zones A and B.

Developments that need to be in Flood Zones A or B for reasons of proper planning and sustainable development require a Justification Test. However, as discussed above, the cable will be designed so that it is considered not to be vulnerable to flooding, thereby being considered appropriate and as such not subject to a justification test for flooding.

A flood risk assessment of the converter station site identified that the infilling of the existing depressions would increase flood risk within the wider IDA site. However, the flood risk assessment has identified that the flood risk is impacted from rainfall events generated on the site only and therefore taken into consideration in the drainage assessment, so as to have a negligible impact on flood risk elsewhere.

The link box at the landfall is not in Flood Zone A or B and would have negligible impact on flood risk.

The followed assumptions have been applied to this assessment:

- New crossings will be designed so as not to increase flood risk elsewhere;
- Joint / link boxes will be designed not to be vulnerable to flooding, through IP68 waterproof joints, when in or in close proximity to a flood zone;
- The cable route will take cognisance of Midleton Flood Relief Scheme. While the cable route is in close proximity to the proposed scheme, it does not cross the proposed flood defence scheme alignment so will have minimal impact on the scheme construction.

7.5.3 Do Nothing

The ‘Do-nothing’ alternative describes the circumstance where no development occurs. It is predicted that, in the absence of the development proposal or ‘do-nothing’ scenario alternative development could occur at the proposed site of the converter station compound within IDA owned lands at Ballyadam in County Cork. There will be no impact on the water environment if the ‘Do-nothing’ scenario is followed and the baseline would be as described in Section 7.3.

7.5.4 Decommissioning Phase

The activities associated with the decommissioning phase will be similar to those associated with the construction phase. Therefore, provided that appropriate mitigation is used, the impacts of the decommissioning phase should be, as a worst-case scenario, similar to those at construction phase. Any works required to remove infrastructure as part of the decommissioning phase, will however be subject to relevant consent applications, and associated environmental assessments.

7.5.5 Cumulative Effects

A number of developments are proposed within the immediate environs of the proposals, as detailed in Table 4.2 of Volume 3C1 of this EIAR. The proposed converter station compound, drainage and access and HVDC / HVAC routes have been developed independent of these other potential future proposals. The design of the Celtic Interconnector can readily connect into such proposals in the future without affecting the conclusions of this EIAR.

Prior to commencement of construction and during the construction phase engagement with the proponents of these developments (including Transport Infrastructure Ireland, the IDA, Cork County Council and the OPW) will continue and where there is potential for works to be carried out in parallel, appropriate mitigation measures will be implemented including the scheduling of works and regular liaison meetings between project teams to ensure that plans are co-ordinated and impacts are minimised.

7.6 Mitigation Measures

Mitigation measures in addition to the embedded measures discussed in Section 7.4 are detailed below.

7.6.1 Construction Phase

7.6.1.1 General

The following mitigation measures will be implemented prior to commencement and throughout the duration of the proposed works.

- A full-time on-site Environmental Clerk of Works (EnCoW) will be appointed prior to commencement of works.
- Pre-construction surveys will be carried out and seasonal constraints will be confirmed in agreement with IFI and National Parks and Wildlife Service (NPWS) and Cork County Council, as appropriate.
- Works will be carried out in accordance with the guidelines set out by IFI in *'Guidelines on Protecting Fisheries During Construction Works in and Adjacent to Waters'* (IFI, 2016).
- The IFI Biosecurity Protocol for Field Survey Works[39] will be complied with.

7.6.1.2 Surface Water Quality Protection Measures

The following water quality mitigation measures will be implemented prior to commencement and throughout the duration of the works.

- Activities will be planned in advance and machinery will be managed to ensure that the number of trips is limited to the minimum required at each location i.e. the more times a piece of ground is tracked, the more likely it is that vegetative cover will be removed and ruts will be created that will act as miniature rivers where dirty water will flow.
- Tracking beside streams and tracks will be avoided to avoid damage to the bankside.
- Geotextile or timber matting will be used on soft ground, and in all protected areas
- A buffer zone of 25-30m will be maintained between storage and working areas and watercourses, taking account of the minimum working area required to facilitate the works.
- The time period over which areas of clearance are left open will be reduced insofar as is reasonably practicable.
- Re-instatement method statements will be subject to approval by the Ecologist within the Employer's Representative Team
- Concrete will be brought to site by covered truck. Wet concrete operations adjacent to watercourses will be avoided where possible.

[39] file.html (fisheriesireland.ie)

- The Contractor will ensure that all concrete truck wash watering / cleaning is undertaken offsite where possible and remote from watercourses.
- In order to reduce the risk of contamination arising as a result of spills or leakages, measures including, but not limited to, the following will be employed. All collected waste will be managed in accordance with the Waste Management Act 1996, and associated Regulations:
  - Fuels, chemicals, liquid and solid waste will be stored on impermeable surfaces;
  - Refuelling of plant, equipment and vehicles will be carried out on impermeable surfaces;
  - All tanks and drums will be bunded in accordance with established best practice guidelines; and
  - Spill kits will be provided at all compound locations and carried by all crews during underground cable installation works.
- Works will not be carried out during Weather Warnings.
- Silt fences (to Hy-Tex Premium specification or similar) and silt traps will be installed prior to commencement of works and will be inspected daily to inform adaptive management as required. The locations of same will be determined by the EnCoW.
- Site restoration post works will be carried out, in agreement with IFI These works may include riverbank stabilization, gravel replacements etc. In all cases, the site will be restored post installation.

Silt Control Measures

Silt control measures will be used to control silt generated from activities on site and prevent it gaining access to surface drainage which could convey silt to larger streams and watercourses.

Silt control measures include silt traps which can be located in small drains where flow is small and silt fences where runoff from large areas needs to be controlled.

Silt fences must be installed in the working areas and not at the watercourse.

Access routes will be delineated such that an appropriate set back distance from watercourses is maintained. Where works are to be undertaken adjacent to watercourses the setback distance will be delineated by the EnCoW on site.

Where distances between the works and watercourse allow, a minimum setback distance of 30m from the watercourse will be maintained.

Where the site is constrained, the best available set back distance will be employed taking account of the minimum working area required to facilitate the works.

Silt Fences

- Silt fences will be installed downslope of the area where silt is being generated on disturbed ground.
- To be effective the silt curtain must contain the area where silt is generated and must terminate on high ground (i.e. an elevated area not in the watercourse).
- Silt fences will be constructed using a permeable filter fabric (e.g. Hy Tex Terrastop Premium silt fence or similar) and not a mesh.
- The base of the silt fence will be bedded at least 15-30 cm into the ground at 2 metre intervals.
- Once installed the silt fence will be inspected regularly, daily during the proposed works, weekly on completion of the works for at least one month, but particularly after heavy rains and periodically thereafter.

- The integrity of the silt fencing will be checked daily by the ENCoW and after poor weather conditions (rain or wind) and any failures rectified immediately.
- Two lines of silt curtain / fence will be installed, where considered necessary, by the ENCoW.
- Any build-up of sediment along the fence boundary will be removed daily.
- Silt fences will be maintained until vegetation on the disturbed ground has re-established. Re-instatement method statements will be subject to approval by the Ecologist within the Employer's Representative Team.
- The silt fencing must be left in place until the works are completed (which includes removal of any temporary ground treatment).
- Silt fences will not be removed during heavy rainfall.
- The silt fence will not be pulled from the ground but cutaway at ground level and posts removed.
- A record of when it was installed, inspected and removed will be maintained by the EnCoW.

Silt Traps

The purpose of the trap is to reduce the level of solids in the slowly flowing water. The silt trap works by allowing a build-up of water behind it slowing flow and allowing solids to settle out. The following requirements will apply:

- Silt traps will only be placed in drains downstream of working areas where the volume of water flow is expected to be low.
- Silt traps will be made of terram or similar material, not mesh.
- The trap will be staked into the banks of the drain / watercourse such that no water can flow around the sides.
- The material will be bedded into the drain bed/watercourse to prevent water flowing beneath it.
- The height of the trap will be lower than the bank heights. The upper edge will be fixed to a timber cross piece. This will allow water to overtop the silt trap and not burst through or around it.
- Inspections will be carried out daily; during the proposed works, weekly on completion of the works for at least one month, and after heavy rains, and monthly thereafter until bare areas have developed new growth.
- Any build-up of solids will be carefully removed without removing any vegetation growing on the bottom.
- In sensitive areas a series of silt traps will be placed in the drain.
- The silt trap will not be pulled from the ground but cutaway at ground level and posts removed.
- A record of when it was installed, inspected and removed will be maintained by the EnCoW.

7.6.2 Operational Phase

In terms of mitigation and monitoring, the on-site drainage systems will include the following features;

- Emergency shut-off valves will be included near the downstream end of all storm water drainage networks such that discharge from the site can be prevented during an emergency situation (e.g. a fire or a significant oil / fuel spill).

- Silt trap chambers will be included near the downstream end of all storm water drainage networks to remove silt, soil and any other settleable material that may become entrained in site runoff.
- All external transformers will be bunded and drained via sump pumps fitted with oil-detection sensors. Stormwater from these sumps will only be pumped into the main collection system when the sensors confirm that the stored rainwater is not contaminated by an oil spill or leak. Storm water from these areas will also pass through a Class 1 'full retention' separator before entering the main site drainage network.
- The compensation storage tank will require a pump set to empty and control its rate of discharge to the main site drainage network. This pump set will include a secondary back-up ('stand by') pump in case of failure of the primary ('duty') pump. The storage tank will also include a high-level alarm, SCADA control system and a telemetry link to the converter station's main control system such that it can be monitored and operated remotely.

In addition to the above features, a regular inspection and maintenance regime will be implemented for the drainage systems as part of the overall operational procedures of the site.

This will involve periodic inspection of key elements to confirm that these are operating as intended and whether any cleaning or remedial maintenance works are required.

7.7 Monitoring

7.7.1 Converter Station Site

The piling operator will be experienced in successful piling within Karst regions and clear lines of communication with defined roles and responsibilities will be maintained between the site team, the Contractors and the Design Engineers throughout the works.

A minimum of one Geotechnical Engineer and one Resident Engineer will supervise the piling works. Supervision of each piling rig may be required.

Monitoring of the concrete volumes poured into the pile against the estimated volume that the pile requires will be carried out, to ensure that concrete is not being lost into voids in the ground.

Piles will be monitored for potential vertical settlement of fresh concrete, an indicator of potential concrete loss.

7.7.2 HDD Water Crossings

Constant monitoring by the specialist drilling team of fluid volume pressure, pH, weight and viscosity will be carried out during the proposed works. The volume of cuttings produced will also be monitored to ensure that no over cutting takes place and that hole cleaning is maintained. The mud returns will be pumped to the circulation system trailer by means of a bunded centrifugal pump. The nature of the cuttings will also be monitored to understand the ground conditions as the drilling progresses.

After the initial pilot hole is completed, it will be reamed in a number of passes to reach the required bore size to enable the duct lining to be pulled [usually High-Density Polyethylene (HDPE)]. To ensure that the prevailing geological conditions have suitable cohesion that can maintain the bore during the drilling and reaming process, close attention will be paid by the specialist drilling team to modelled drag forces during pullback with constant monitoring of load stress undertaken to ensure that modelled tensile stress, collapse pressures, hoop stress and buckling stress are not exceeded. In addition to the above measures, the rate of drilling progress will be monitored to assist with the identification of any voids or changes in strata.

Where directional drilling takes place within limestone bedrock beneath a watercourse, settlement will be monitored at the surface to provide an early warning of any unexpected stability issues. If visible settlement occurs the directional drilling contractor will cease boring, although drilling fluid may still be circulated if required to maintain the stability of the drilled hole, until remedial measures can be put in place to stabilise the ground.

In addition, river/stream flows will be monitored upstream and downstream of any directional drilling watercourse crossings. The flow monitoring will be undertaken on a daily basis for five working days prior to the directional drilling, during the directional drilling and for five working days following completion of the directional drilling. If a measurable increase in losses from the watercourse to ground is observed in the reach where the directional drilling took, place bed lining will be undertaken if required by IFI. The exact nature of any bed lining will be determined through consultation with IFI.

7.8 Residual Impacts

With the implementation of the embedded and additional mitigation measures proposed the Irish onshore elements of the Celtic Interconnector project will not result in a change in status of any WFD quality elements or prevent any waterbodies from reaching good status in the future. During the construction phase impacts on surface water quality are anticipated to be localised and brief to temporary in duration of imperceptible significance

During the construction phase, impacts on surface water drainage and water supply and wastewater discharge networks are anticipated to be localised and brief to temporary in duration of imperceptible to moderate significance. Adverse impacts during the operational phase are expected to be imperceptible.

7.9 Transboundary Effects

All elements of the onshore interconnector are found in County Cork, Ireland. No international boundaries are crossed by the works and the nature of the onshore works is such that there are no transboundary effects to be discussed.

7.10 Summary

Development Phase	Description of Likely Impact	Key embedded and Additional Mitigation Measures	Importance of Receptor	Significance of Residual Effects following Mitigation
Connection Point				
Construction Phase	• Surface water run-off and the release of sediment to watercourses • Accidental release of potentially polluting substances.	• Approximately 650m from known watercourses • Any discharges from temporary welfare facilities will be connected to a sealed holding tank to be emptied and disposed of off-site by a licenced contractor to an approved licenced facility. • Storage of fuel and refuelling will be undertaken within bunded hardstanding areas.	Low	Imperceptible (Not Significant)
Operational Phase	• Accidental release of potentially polluting substances.	• Approximately 650m from known watercourses • Proposals within an existing bay which will connect into the existing drainage system for surface water run-off	Low	Imperceptible (Not Significant)
HVAC / HVAC Land Cable Route / Landfall Area				
Construction Phase	• Surface water run-off and the release of sediment to watercourses • Accidental release of potentially polluting substances • Increased flow to surrounding watercourses	• A full-time on-site Environmental Clerk of Works (EnCoW) will be appointed prior to commencement of works • Excavations in the road will be carried out in tandem with the relevant portion of the section, typically 50m in length, cordoned off while under construction. • Any element of the scheme requiring instream works will be restricted to the fisheries open season (i.e. typically the summer months). • Prior to works, electrofishing will be carried out to remove fish under licence from Inland Fisheries Ireland (IFI). • Water pumped from the dry works area during open cut trenching will be treated using settlement tanks to remove sediment prior to discharge back to the watercourse. • Competent specialist contractors with proven successful HDD drilling experience working on projects within ground conditions similar to	Low to Very High	• Impacts on surface water quality are anticipated to be localised and brief to temporary in duration of imperceptible significance (Not Significant) • During the construction phase impacts on surface water drainage and water supply and wastewater discharge networks are anticipated to be localised and brief to temporary in duration of imperceptible to moderate significance.

Development Phase	Description of Likely Impact	Key embedded and Additional Mitigation Measures	Importance of Receptor	Significance of Residual Effects following Mitigation
		those expected within this project will be appointed to undertake the work. • Spill kits will be provided at high risk sites • Silt control measures will be installed along the proposed works area as appropriate • Where possible, a buffer zone of 25-30m will be maintained between storage and working areas and watercourses, taking account of the minimum working area required to facilitate the works • Works will not be carried out during weather warning. The Contractor will monitor this and other appropriate weather forecasts on a regular basis, at least daily.		
Operational Phase	• Changes in water depth, velocities and sediment erosion/deposition due to open cut trenching	• Site restoration post works carried out, in agreement with IFI	Low to Very High	Imperceptible (Not Significant)
Construction Phase	• Potential increase in flood risk	• Most watercourse crossing are HDD. • Flood Risk will be managed during construction for watercourse crossings to not make flood risk worse elsewhere.	Low to Very High	Small adverse (Not Significant)
Operational Phase	• Potential increase in flood risk	• Works to be design not vulnerable to flooding in the flood zone A&B. • Cable is located mostly underground. Therefore, flood risk is not influenced.	Low to Very High	Negligible
Converter Station Site				
Construction Phase	• Surface water run-off and the release of sediment to watercourses • Accidental release of potentially polluting substances.	• Any discharges from temporary welfare facilities will be connected to a sealed holding tank to be emptied and disposed of off-site by a licenced contractor to an approved licenced facility. • Storage of fuel and refuelling will be undertaken within bunded hardstanding areas.	Low	• Impacts on surface water quality are anticipated to be localised and brief to temporary in duration of imperceptible significance (Not Significant)

Development Phase	Description of Likely Impact	Key embedded and Additional Mitigation Measures	Importance of Receptor	Significance of Residual Effects following Mitigation
Operational Phase	• Accidental release of potentially polluting substances.	• Foul water will be collected in sealed holding tanks and will be emptied when necessary • A SuDS storm water drainage system will be constructed. Discharge from the converter station site and the associated access roads will be restricted to greenfield runoff rates	Low	Imperceptible (Not Significant)
Construction Phase	• Potential increase flood risk elsewhere	• Flood Risk will be managed during construction	Low	Small adverse (Not Significant)
Operational Phase	• Potential increase flood risk elsewhere	• An area of 'compensation storage' will be sized to ensure that there is no significant increase in flood risk in the 'post-development' case when compared to the 'pre-development' case.	Low	Negligible

8 Biodiversity

8.1 Introduction

Commented [DH11]: NOT ALL A APPENDICES REFERENCED IN THIS CHAPTER ARE NOT INCLUDED IN THE DAF BUT WILL BE INCLUDED IN THE FINAL FILE.

This chapter assesses the likely significant effects from the proposed development on biodiversity. Biodiversity (or "biological diversity"), as defined at the United Nations Convention on Biological Diversity (CBD), is '*the variability among living organisms from all sources including, inter alia, terrestrial, marine and other aquatic ecosystems and the ecological complexes of which they are part; this includes genetic diversity within species, between species and of ecosystems*'.

This EIAR chapter was prepared by Mott MacDonald with a provided by a number of specialists. The details regarding the specialist inputs are provided below in the relevant sections which describe the surveys.

8.1.1 Constraints and Optioneering Studies

This EIAR Chapter follows, and was informed by, a series of constraints/optioneering studies carried out for the proposed development. Details in relation to these studies are provided in Chapter 1.

These assessments provided a comprehensive consideration of the biodiversity identified and communicated constraints at the earliest opportunity to the design team.

Regarding conservation sites, the assessments considered European sites that form part of the Natura 2000 network. These sites comprise:

- Special Areas of Conservation (SACs) (and candidate SACs) designated under the Habitats Directive (92/43/EEC) due to their significant ecological importance for species and habitats protected under Annexes I and II respectively of the Habitats Directive; and,
- Special Protection Areas (SPAs), designated for the protection of populations and habitats of bird species protected under the EU Birds Directive (Council Directive 2009/409/EEC).

Potential effects of the proposed (onshore) development on all European sites are presented in this EIAR Chapter, within the EIA framework.

Within the framework of Article 6(3) of the Habitats Directive, an assessment of likely significant effects from the proposed (onshore) development on European sites, in combination with other plans or projects is presented, along with an assessment of adverse effects on European site integrity from the proposed (offshore and onshore) development in combination with other plans or projects, in the 'Screening for Appropriate Assessment and Natura Impact Statement', in Volume 6A.

Reporting within the framework of Article 6(3) of the Habitats Directive for the proposed (offshore) development in Ireland is presented in Volume 6B.

Reporting within the framework of Article 6(3) of the Habitats Directive for the proposed (offshore) development in the UK is presented in Volume 11.

A summary document, gathering the findings of all Article 6(3) reporting is presented in Volume 6C.

8.1.2 Zone of Influence

The study area for desktop and field surveys comprised all marine waters and lands located within the Zone of Influence (ZoI) of the proposed development. The current guidance on ecological assessments (CIEEM, 2018) states that:

"*The 'zone of influence' for a project is the area over which ecological features may be affected by biophysical changes as a result of the proposed project and associated activities. This is likely to extend beyond the project site, for example where there are ecological or hydrological links beyond the site boundaries"* and that *"the zone of influence will vary for different ecological features depending on their sensitivity to an environmental change*."

The ZoI varies depending on the construction and operational activity and the sensitivity of the receptor (e.g., flora, birds, terrestrial mammals) to the effect encountered.

The ZoI identified for the various ecological receptors are as outlined below:

- 100m either side of the cable route midline for breeding passerines[40];
- 150m -200m for terrestrial mammals dependant on species[41] [42];
- 200m either side of the cable route midline for terrestrial habitats as this is the likely estimated zone for physical and dust effects associated with the works (NRA 2011);
- Approximately 400m for disturbance effects to wetland bird species (based on noise levels at Claycastle taken as the worst-case scenario for construction phase for the development as outlined in Chapter 4) (Note: this comprises most of count sectors 3 and 4 in Figure 8.2);
- Up to 1km for certain breeding birds (birds of prey)[40];
- Catchment wide ZoI for surface waterbodies.

8.1.3 Valuation of Ecological Features and Assessment of Likely Impacts

Attention has been paid to the identification of species and habitats of note. These include species and habitats with protection under both national and international legislation including the:

- Wildlife Acts 1976-2012 S.I. 39 of 1976 as amended ('The Wildlife Acts');
- Birds and Natural Habitats Regulations;
- EU Birds Directive 2009/147/EC; and,
- Habitats Directive 92/43/EC ('the Habitats Directive').

[40] Whitfield, D. Philip, Marc Ruddock, and Rhys Bullman. "Expert opinion as a tool for quantifying bird tolerance to human disturbance." Biological Conservation 141.11 (2008): 2708-2717.

[41] NRA (2006) Guidelines for the Treatment of Badgers Prior to the Construction of National Road Schemes

[42] NRA (2009) Guidelines for the Treatment of Otters Prior to the Construction of National Road Schemes

In valuing the ecological receptors and the potential impacts on biodiversity arising from construction and operation of the proposed development, due regard was had to guidance including;

- Guidelines for Ecological Impact Assessment in the UK and Ireland. Terrestrial, Freshwater, Coastal and Marine [Chartered Institute of Ecology and Environmental Management[43];
- Ecology Guidelines for Electricity Transmission Projects, A Standard Approach to Ecological Impact Assessment of High Voltage Transmission Projects[44]; and,
- Guidelines on Protection of Fisheries During Construction Works in and Adjacent to Waters[45].

Methods for the evaluation of ecological receptors and impact assessment were based on a number of documents including those previously listed along with the EPA's Draft Guidelines on the Information to be Contained in Environmental Impact Assessment Reports[46], also refer to Table 4.1 (EIAR methodology).

A sensitive ecological receptor (SER) is defined as any feature valued using a geographic frame of reference as follows:

- International importance;
- National importance;
- County importance; or,
- Local importance (higher value).

Fisheries habitat for salmonids was assessed using the Life Cycle Unit method (Kennedy, 1984[47]; O'Connor & Kennedy, 2002[48]),

The assessment of impact identifies ecological receptors and implements a systematic approach to understand the level and significance of impact based on the following elements:

- Sensitivity of a receptor to the impact mechanism;
- Magnitude of effect on the feature;
- Likelihood of occurrence of impact; and,
- Significance of impact (identified at the geographic frames of reference above).

8.1.4 Field Surveys

Field surveys were carried out subject to landowner agreement. Walkover surveys of the landfall site, cable route, and converter station were conducted on 29 May 2019, and on the following dates in 2020: 26 August, 1 September, 8 September, 9 September, 29 September, 6 October, 7 October, 8 October, 13 October, 14 October, 27 November and 4 December.

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[43] CIEEM (2018) Guidelines for Ecological Impact Assessment in the UK and Ireland: Terrestrial, Freshwater, Coastal and Marine version 1.1. Chartered Institute of Ecology and Environmental Management, Winchester

[44] EirGrid (2020) Ecology Guidelines for Electricity Transmission Projects. A standard Approach to Ecological Impact Assessment of High Voltage Transmission Projects. Draft for Consultation

[45] Inland Fisheries Ireland (2016) Guidelines on Protection of Fisheries During Construction Works in and Adjacent to Waters.

[46] EPA (2017) Guidelines on the Information to be Contained in Environmental Impact Assessment Reports. Draft Document.

[47] Kennedy, G.J.A. (1984) Evaluation of techniques for classifying habitats for juvenile salmon (Salmo salar L.) Proceedings of the Atlantic Salmon trust workshop on stock enhancement. 23 pp.

[48] O'Connor, L. & Kennedy, R.J. (2002). A comparison of catchment-based salmon habitat survey techniques on three rivers in N. Ireland. Fisheries Management and Ecology, 9, 149-161.

All surveys had regard for relevant guidance including, but not limited to, the NRA's *Ecological surveying techniques for protected flora and fauna during the planning of national road schemes*[49], which provides useful information on appropriate survey seasons and methods for many of Ireland's protected species.

8.1.4.1 Habitat Surveys

Between May 2019 and December 2020, walkover surveys were conducted of the proposed development site and environs, including the Converter Station site and wider Ballyadam / IDA site.

Habitat and plant surveys of the entirety of the proposed development were carried out by Mott MacDonald, with bespoke specialist botanical surveys carried out by Dr John Conaghan of BES within the Converter Station site and wider Ballyadam / IDA site only.

Where access allowed close inspection, habitats in all areas were classified to level three according to the scheme outlined in "A Guide to Habitats in Ireland"[50].

Fit to European Annex 1 habitats was informed with reference to the EU Interpretation Manual for EU Habitats (European Commission, 2013);

Habitat survey methods had regard to '*Best Practice Guidance for Habitat Survey and Mapping'* (Smith et al., Heritage Council, 2011).

Particular attention was paid to the possible occurrence of:

- Annex 1 (and priority Annex 1[51]) habitats designated under the EU Habitats Directive 92/43/EEC;
- Protected plant species listed in the 2015 Flora Protection Order S.I. No. 256/2015;
- Flowering plants of conservation concern in the Ireland Red List (No. 10): Vascular Plants[52];
- Potential suitable habitat for red listed bryophytes[53];
- Invasive plant species scheduled to the EC (Birds and Natural Habitats) Regulations 2011 S.I. 477/2011 as amended ('the Birds and Habitats Regulations'); and,
- Species and habitats of special conservation significance within County Cork identified in the County Cork Biodiversity Action Plan (BAP) 2009-2014[54] [not updated at time of writing].

Commented [BV(12]: To be checked prior to submission of the Final File.

Converter Station Botanical Assessment (BES 2020)

Following initial multi-disciplinary habitat surveys which identified the potential presence of the priority Annex 1 habitat Semi-natural dry grasslands and scrubland facies on calcareous substrates (*Festuco-Brometalia*) (* important orchid sites) (code 6210), the footprint of the Converter Station site and wider Ballyadam / IDA site was visited and surveyed on 17 June 2020 and 23 June 2020 by Dr John Conaghan.

[49] NRA (2009) Ecological Surveying Techniques for Protected Flora and Fauna during the Planning of National Road Schemes. National Roads Authority: Ireland.

[50] Fossitt, J., (2007) A Guide to Habitats in Ireland. The Heritage Council of Ireland Series. ISSN 1393 – 68 08

[51] Priority Annex 1 habitats are those in danger of disappearance.

[52] Wyse Jackson, M., FitzPatrick, Ú., Cole, E., Jebb, M., McFerran, D., Sheehy Skeffington, M. and Wright, M. (2016). Ireland Red List No. 10: Vascular Plants. National Parks and Wildlife Service, Department of Arts, Heritage, Regional, Rural and Gaeltacht Affairs, Dublin, Ireland.

[53] Lockhart, N., Hodgetts, N., Holyoak, D. (2008). Ireland Red List No. 8 Bryophytes. National Parks and Wildlife Service, Department of Arts, Heritage and the Gaeltacht, Dublin, Ireland

[54] Layout 1 (corkcoco.ie)

In order to analyse the composition and structure of the vegetation in relation to the Annex I habitat a total of 10 quadrats were described in areas of recolonizing vegetation with some presence of calcareous indicator species. Six quadrats were within the Ballyadam Converter Station Site; four quadrats were within the wider Ballyadam / IDA site to the southeast. These quadrats were assessed in accordance with the assessment outlined in the various surveys of Irish semi-natural grassland (Devaney *et al*.[55]). Quadrats recorded were analysed by the ERICA web application to assign each a degree of membership to:

- The vegetation communities defined by the Irish Vegetation Classification (IVC); and,
- Annex 1 habitat types.

8.1.4.2 Mammal Surveys

Badger Surveys

Survey for badger (*Meles meles*) was carried during the walkover surveys. These surveys followed *Surveying Badgers*[56] . Where landowner access was available, the extent of survey area was defined with regard to *Guidelines for the Treatment of Badgers during the Construction of National Road Schemes* (NRA, 2006) as 150m beyond the proposed works where land access was available.

Bat Surveys

A visual inspection of buildings and trees with potential suitability for roosting bats was conducted in daylight hours during the site walkovers to identify potential roost features and any potential bat entry/exit points. Where access was available the survey included large mature trees which may potentially require felling or limb lopping because of the development. Trees were examined for potential features which may support bat roosts within the trees. Features which may support bats included cracks and splits within the stems or branches, knot holes, cavities within the tree, significant ivy growth (Figure 8.1). The assessment of the trees was made only from ground level.

[55] Devaney, F.M., Martin, J.R., O'Neill, F.H. & Delaney, A. (2013) Irish semi-natural grasslands survey Annual Report No. 4: Western Seaboard Counties (Clare, Galway, Kerry, Limerick, Mayo) and County Tipperary. Unpublished report for National Parks and Wildlife Service, Dublin

[56] Harris, S., Cresswell, P., Jefferies, D., (1989) Surveying Badgers. The mammal Society – No.9.

Figure 8.1: Example of Oak Tree Identified with Potential Bat Roost Features

Source: Mott MacDonald October 2020

The visual inspection also included inspections of safely accessible bridge structures potentially impacted by watercourse crossings of the HVAC and HVDC cable routes, as well as other structures that will be disturbed / removed.

The results were used to grade trees and structures as having Negligible, Low, Moderate, or High suitability for roosting bats having regard for the Bat Conservation Trust's (BCT) *Bat Surveys for Professional Ecologists: Good Practice Guidelines*[57].

Otter Surveys

See Section 8.1.4.3.

57 Collins, J. (ed.) (2016). Bat Surveys for Professional Ecologists: Good Practice Guidelines (3rd edn). The Bat Conservation Trust, London

Other Protected Mammal Species

During walkover surveys of the proposed development site and wider ZoI, the potential was also noted for habitats of other (nationally) protected fauna species to occur, namely hedgehog (*Erinaceus europeaus*), stoat (*Mustela erminea hibernica)*, pygmy shrew (*Sorex minutus*)*,* red squirrel (*Sciurus vulgaris*)*,* pine marten (M*artes martesi)* and Irish hare (*Lepus timidus hibernicus*)*.*

8.1.4.3 Aquatic Survey (Triturus Environmental Ltd 2020)

Aquatic surveys of watercourses within the footprint of the proposed development were carried out by Dr Ross Macklin of Triturus Environmental Limited on 19 May and on 15 and 16 June 2020.

All watercourses which could be affected directly or indirectly were considered as part of the current baseline assessment. This included proposed onshore cable route crossings of riverine watercourses or watercourses in close proximity to the proposed cable route alignment. A single lake waterbody, adjoining the proposed cable route alignment - Lough Aderra near Midleton – also formed part of the aquatic baseline survey. The nomenclature for the watercourses surveyed is as per the Environmental Protection Agency's (EPA) online map viewer.

Survey sites were assessed in light of the proposed Celtic Interconnector development and associated onshore cable route, with survey effort focused on both instream and riparian habitats at each cable route crossing location.

Aquatic Habitat Assessment

A broad aquatic habitat assessment was conducted at each site utilising elements of the methodology given in the Environment Agency's *'River Habitat Survey in Britain and Ireland Field Survey Guidance Manual 2003*[58]' and the Irish Heritage Council's *'A Guide to Habitats in Ireland*'.[59] All sites were assessed in terms of:

- A fisheries habitat appraisal;
- Stream width and depth and other physical characteristics;
- Substrate type, listing substrate fractions in order of dominance, i.e. bedrock, boulder, cobble, gravel, sand, silt, etc.;
- Flow type, listing percentage of riffle, glide and pool in the sampling area;
- Habitat types following *'A Guide to Habitats in Ireland*' including riparian vegetation composition;
- Percentage coverage of the stream bottom at the sampling sites, of in-stream macrophytes, and bryophytes (i.e. non-flowering plants, specifically mosses and liverworts to assess potential presence of such species on the Irish Red List[60];
- Flowering plants of conservation interest;
- Invasive plant species scheduled to the European Communities (Birds and Natural Habitats) Regulations Regulations 2011;

[58] Environment Agency (2003) River Habitat Survey in Britain and Ireland. Field Survey Guidance Manual.
[59] Fossitt, J., (2007) A Guide to Habitats in Ireland. The Heritage Council of Ireland Series. ISSN 1393 – 68 08

[60] Lockhart, N., Hodgetts, N., Holyoak, D. (2008). Ireland Red List No. 8 Bryophytes. National Parks and Wildlife Service, Department of Arts, Heritage and the Gaeltacht, Dublin, Ireland.

- Assessment for white-clawed crayfish *Austropotamobius pallipes* and biological water quality sampling (Q-sampling); and,
- Presence of otter *Lutra lutra.*

This holistic approach informed the overall aquatic ecological evaluation of each site in context of the proposed development and onshore cable route.

The watercourse / waterbody at each aquatic survey site was described in terms of the important aquatic habitats and species. This helped to evaluate species and habitats of ecological value in the vicinity of the proposed onshore cable route layout and watercourse crossings. The aquatic baseline has informed mitigation for the Celtic Interconnector development.

Fisheries Habitat

A fisheries habitat appraisal of the watercourses in the footprint of the onshore cable route (Figure 7.4) was undertaken to establish their importance for salmonid, lamprey, European eel and other fish species. The baseline assessment considered the quality of spawning, nursery and holding habitat within the vicinity of the survey sites using Life Cycle Unit (salmonids) and Lamprey Habitat Quality Index (LHQI) scores (lamprey).

A broad appraisal / overview of the upstream and downstream habitat at each aquatic survey site was also undertaken to evaluate the wider contribution to salmonid and lamprey spawning and general fisheries habitat.

River habitat surveys and fisheries assessments were also carried out utilising elements of the approaches in the River Habitat Survey Methodology[61]and Fishery Assessment Methodology[62] to broadly characterise the river sites (i.e. channel profiles, substrata etc.).

Salmonid Habitat

Fisheries habitat for salmonids was assessed using the Life Cycle Unit method[63] [64] to map survey sites as nursery, spawning and/or holding water, by assigning quality scores to each type of habitat.

Those habitats with poor quality substrata, shallow depth and a poorly defined river profile received a higher score. Higher scores in the Life Cycle Unit method of fisheries quantification are representative of poorer value, with lower scores being more optimal, despite this appearing counter-intuitive. Overall scores are calculated as a simple function of the sum of individual habitat scores.

Lamprey Species

Lamprey habitat evaluation for each survey site was undertaken using the LHQI scoring system, as devised by Macklin *et al*. (2018)[65]. The LHQI broadly follows a similar rationale as the Life Cycle Unit score for salmonids. Those habitats with a lack of soft, largely organic sediment areas for ammocoete burrowing, shallow sediment depth (<10cm) or compacted sediment

[61] Environment Agency (2003) River Habitat Survey in Britain and Ireland. Field Survey Guidance Manual.

[62] O'Grady, M.F. (2006) Channels and challenges: enhancing Salmonid rivers. Irish Fresh- water Fisheries Ecology and Management Series: Number 4. Central Fisheries Board, Dublin.

[63] Kennedy, G.J.A. (1984) Evaluation of techniques for classifying habitats for juvenile salmon (Salmo salar L.) Proceedings of the Atlantic Salmon trust workshop on stock enhancement. 23 pp.

[64] O'Connor, L. & Kennedy, R.J. (2002). A comparison of catchment-based salmon habitat survey techniques on three rivers in N. Ireland. Fisheries Management and Ecology, 9, 149-161.

[65] Macklin, R., Brazier, B. & Gallagher, C. (2018). Fisheries assessment of selected weir sites on the River Barrow, Counties Carlow & Kilkenny. Unpublished report prepared by Triturus Environmental Services for McCarthy-Keville O' Sullivan on behalf of Waterways Ireland.

nature receive a higher score. Higher scores in this index are thus of poorer value (in a similar fashion to the salmonid Life Cycle Unit Index), with lower scores being more optimal. Overall scores are calculated as a simple function of the sum of individual habitat scores.

Larval lamprey habitat quality as well as the suitability of adult spawning habitat is assessed based on the information provided in Maitland (2003)[66] and other relevant literature (e.g. Gardiner, 2003[67]). Unlike the salmonid Life Cycle Unit index, holding habitat for adult lamprey is not assessed owing to their different migratory and life history strategies, and that electro-fishing surveys routinely only sample larval lamprey.

The LHQI scoring system provides additional information compared to the habitat classification based on the observations of Applegate[68] and Slade et al.[69], which deals specifically with larval (sea) lamprey settlement habitat. Under this scheme, habitat is classified into three different types: preferred (Type 1), acceptable (Type 2), and not acceptable for larvae (Type 3). Type 1 habitat is characterized by soft substrate materials usually consisting of a mixture of sand and fine organic matter, often with some cover over the top such as detritus or twigs in areas of deposition. Type 2 habitat is characterized by substrates consisting of shifting sand with little if any organic matter and may also contain some gravel and cobble (lamprey may be present but at much lower densities than Type 1). Type 3 habitat consists of materials too hard for larvae to burrow including bedrock and highly compacted sediment. This classification can also be broadly applied to other lamprey species ammocoetes, including *Lampetra* species.

Biological Water Quality (Macro-Invertebrates)

Biological water quality was assessed at two riverine survey sites; site 12B (Womanagh River) and site 15A (Dissour River) via Q-sampling. Macro-invertebrate samples were converted to Q-ratings as per Toner et al.[70]. All riverine samples were taken with a standard kick sampling hand net (250mm width, 500µm mesh size) from areas of riffle / glide utilising a two-minute sample, as per ISO standards for water quality sampling (ISO 10870:2012).

For Lough Aderra (site 10) and the canalised branch of the Womanagh River (site 11A), two additional macro-invertebrate samples were taken with a standard kick sampling hand net (250mm width, 500µm mesh size) which was used to sweep macrophytes to capture macroinvertebrates. The net was also moved along the benthos to collect epibenthic and epiphytic invertebrates from the substratum (as per Cheal et al.[71]). A 3-minute sampling period was divided amongst the range of meso-habitats present to get a representative sample for sub-habitats. Large cobble or small boulder was also washed at each site where present and samples were elutriated and fixed in 70% ethanol for subsequent laboratory identification. Any

[66] Maitland, P.S. (2003) Ecology of the River, Brook and Sea Lamprey. Conserving Natura 2000 Rivers Ecology Series No. 5. English Nature, Peterborough.

[67] Gardiner R (2003). Identifying Lamprey. A Field Key for Sea, River and Brook Lamprey. Conserving Natura 2000 Rivers Conservation Techniques Series No. 4. English Nature, Peterborough.

[68] Applegate, V.C. (1950). Natural history of the sea lamprey, Petromyzon marinus in Michigan. Special Scientific Report of the US Fish and Wildlife Service, 55, 1-237.

[69] Slade, J. W., Adams, J. V., Christie, G. C., Cuddy, D. W., Fodale, M. F., Heinrich, J. W. & Young, R. J. (2003). Techniques and methods for estimating abundance of larval and metamorphosed sea lampreys in Great Lakes tributaries, 1995 to 2001. Journal of Great Lakes Research, 29, 137-151.

[70] Toner, P., Bowman, J., Clabby, K., Lucey, J., McGarrigle, M., Concannon, C., ... & MacGarthaigh, M. (2005). Water quality in Ireland. Environmental Protection Agency, Co. Wexford, Ireland.

[71] Cheal F, Davis JA, Growns JE, Bradley JS, Whittles FH (1993) The influence of sampling method on the classification of wetland macroinvertebrate communities. Hydrobiologia 257:47–56.

rare invertebrate species were identified from the NPWS Red List publications for beetles[72], mayflies[73] and other relevant taxa (i.e. Byrne et al.[74]; Nelson et al.[75]).

Freshwater Pearl Mussel

The proposed development is not located within any catchments with confirmed or potential freshwater pearl mussel (FWPM) *Margaritifera margaritifera* populations based on the catchments identified by the NPWS[76].

Biosecurity

A strict biosecurity protocol following the Check-Clean-Dry approach was employed during the survey. Equipment and PPE used was disinfected with Virkon® between survey sites to prevent the transfer of pathogens and/or invasive species between survey areas. Where feasible, equipment was also thoroughly dried (through UV exposure) between survey areas. As per best practice, surveys were undertaken at sites in a downstream order (i.e. uppermost site surveyed first etc.) to prevent the upstream mobilisation of invasive propagules and pathogens. Any invasive species recorded within or adjoining the survey area were recorded.

8.1.4.4 Wintering Bird Surveys

Wintering bird surveys consisted of:

- Wetland bird surveys at high and low tide, at Claycastle Beach in February and March 2019, monthly from November 2019 to March 2020; and monthly from October 2020 to March 2021.
- Marine bird surveys at Claycastle beach monthly from November 2019 to March 2020;
- Line-transect surveys at Ballyadam monthly from December 2019 to March 2020; and,
- Winter raptor roost surveys at Ballyvergan Marsh monthly in February and March 2019, and from November 2019 to March 2020.

Commented [DH13]: DATA FROM 2020/2021 BIRD SURVEYS TO BE ADDED FOR FINAL SUBMISSION.

[72] Foster, G. N., Nelson, B. H. & O Connor, Á. (2009) Ireland Red List No. 1 – Water beetles. National Parks and Wildlife Service, Department of Environment, Heritage and Local Government, Dublin, Ireland.

[73] Kelly - Quinn, M. & Regan, E.C. (2012). Ireland Red List No. 7: Mayflies (Ephemeroptera). National Parks and Wildlife Service, Department of Arts, Heritage and the Gaeltacht, Dublin, Ireland.

[74] Byrne, A. W., Moorkens, E. A., Anderson, R., Killeen, I. J., & Regan, E. (2009). Ireland Red List no. 2: Non-marine molluscs. National Parks and Wildlife Service, Department of the Environment, Heritage and Local Government.

[75] Nelson, B., Ronayne, C. & Thompson, R. (2011). Ireland Red List No.6: Damselflies & Dragonflies (Odonata). National Parks and Wildlife Service, Department of the Environment, Heritage and Local Government, Dublin, Ireland.

[76] Available from https://www.npws.ie/maps-and-data Accessed February 2021.

Wetland Bird Surveys

Wetland bird surveys were carried out at Redbarn-Claycastle over two winter seasons. During both seasons, the survey area was sub-divided into 5 sections. These are indicated in red below in Figure 8.2. In all wetland bird surveys, the survey areas for intertidal birds (Sections 1-5) extended up to 1.5 km from the proposed landfall works (proposed works located in vicinity of yellow 'VP' annotation in Figure 8.2). This was significantly greater than the estimated ZoI for disturbance of c. 400m to inform an understanding of bird distribution in the wider area.

Figure 8.2: Redbarn-Claycastle Beach showing Ballyvergan marsh (brown) and the five count sections

Nearby fields that were also used by some wetland bird species were included in the counts as were wetland birds seen in Ballyvergan Marsh. Using Irish Wetland Bird Survey (IWEbS) methodology, bird counts were carried out within two hours either side of high tide.

To gain a better understanding of bird usage at these sites, low-water counts were also conducted within a two hour period either side of low water[77]. Normally these surveys would commence in September but, due to the timing of commissions and other factors:

- The first winter survey season was not commissioned until February 2019 so these surveys commenced in February 2019 and ended in March 2019 (2 survey months).
- The second winter survey season was not commissioned until November 2019 so these surveys commenced in November 2019 and ended in March 2020 (5 survey months).
- The third winter survey season commenced in October 2020 and ended in March 2021 (6 survey months)

[77] Lewis, L. J. and Tierney, T. D. (2014) Low tide waterbird surveys: survey methods and guidance notes. Irish Wildlife Manuals, No. 80. National Parks and Wildlife Service, Department of Arts, Heritage andthe Gaeltacht, Ireland.

In an attempt to assess levels of human disturbance at Redbarn-Claycastle, numbers of walkers and their dogs were recorded on each of the counts (apart from High Tide counts in March).

Marine Bird Surveys

Marine bird surveys were undertaken at Claycastle Beach over one season; each month between November 2019 and March 2020. Marine bird survey area is shown in yellow Figure 8.2. The species totals refer to sightings of birds flying past or landing within the designated survey area (a 420 metre wide area of shoreline and sea extending approximately 450 metres from the shore). This survey consisted of three hour-long dedicated counts of all seabirds recorded using or passing through the site of the proposed landfall at high tide, mid-tide and low-tide. In contrast to the intertidal and inland surveys, the counts of marine birds are totals, recorded over the duration of each survey 'daily totals'.

Line Transect Bird Surveys

Line-transect winter bird surveys were carried out over one season; monthly at the wider Ballyadam/IDA site, between December 2019 and March 2020 (Figure 8.3).

Figure 8.3: Wider Ballyadam/IDA site showing the winter bird survey transect (red line).

The surveys were based on the British Trust for Ornithology English Winter Bird Survey Guidelines (BTO 2019). Most visits were undertaken in the morning between 6.20 am and 10.30 am. Defined transects were walked on each occasion and all birds seen and heard within the survey zone were recorded. Access difficulties in December 2019 restricted counts to vantage points on the north and west perimeters.

Raptor Winter Roost Surveys

Winter raptor roost surveys were carried out from Vantage Points overlooking at Ballyvergan Marsh over two seasons; in February and March 2019, and from November 2019 to March 2020. This methodology had regard for the Irish Hen Harrier Winter Survey Guide [78], as well as Gilbert et al.[79]. Surveys took place from approximately one hour before sunset until dusk.

8.1.4.5 Breeding Bird Surveys

Extensive breeding bird surveys were conducted at several areas, including the proposed development, as part of the site selection process.

[78] Available online from http://www.ihhws.ie/IHHWS_Guide.pdf

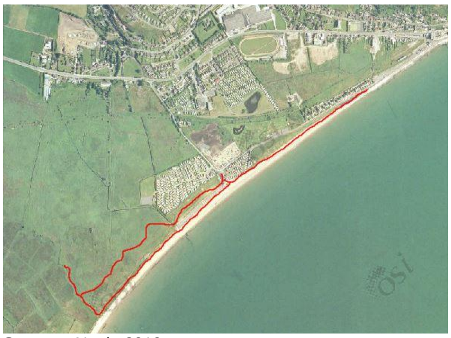
[79] Gilbert G, Gibbons D. W. and Evans J. (1998). Bird Monitoring Methods, a manual of techniques for key UK species. RSPB

- Claycastle Beach (Figure 8.4), Knockraha (Figure 8.5) and the proposed Converter Station Site: two visits between April and June 2019 (only)
- Ballyvergan Marsh pNHA, and the Converter Station Site (and wider Ballyadam/IDA site) (Figure 8.6) from April to June in both 2019 and 2020

Surveys comprised:

- Day-time counts following the Common Birds Census (CBC); and,
- Evening and nocturnal counts.

Figure 8.4: Claycastle Beach Transect



Source: Nagle 2019

Figure 8.5: Knockraha Substation

Source: Nagle 2019

Figure 8.6: Converter Station Transect

Source: Nagle 2019

Common Birds Census (Daytime)

In 2019, breeding bird surveys were carried out at Claycastle Beach, Ballyvergan Marsh pNHA, and the Converter Station Site (and wider Ballyadam / IDA site).

The surveys were based on the Countryside Bird Survey methodology as recommended by BirdWatch Ireland. These surveys involved two visits, the first visit took place in the period April to mid-May and the second visit occurred during the period mid-May to the end of June. Most visits were undertaken in the morning between 6.20am and 10.30am. Defined transects were walked on each occasion and all birds seen and heard within the survey zone were recorded.

In 2020, breeding bird surveys were carried out at Ballyvergan Marsh pNHA, and the Converter Station Site (and wider Ballyadam / IDA site). In contrast to 2019, these were based on the British Trust for Ornithology's (BTO) CBC methodology. The CBC survey often involves up to ten visits to a site whereby all singing males of each species are mapped and over the duration of a breeding season (late-March to late-June) and a map is made of the territories of each species recorded[80].

Covid-19 Pandemic restrictions in 2020 prevented surveying until mid-May and this meant that surveying was confined to the latter half of the breeding season in 2020.

For any one species, ten visits are rarely needed but to ensure that all breeding species are accurately recorded, it is best to have as many visits as possible roughly evenly spaced over the three-month breeding season. Fortunately, at both of the surveyed sites, relatively few early breeding species are likely to occur (other than mallard, grey heron, collared dove, mistle thrush and long-tailed tit).

This fact was established by the winter surveys in 2019/20 that continued until mid-March as well as the breeding surveys that took place in 2019. The modified CBC Breeding surveys involved three visits, the first visit took place in mid-May, the second visit occurred during late May/early June and the final visit was held in mid to late June. All visits were undertaken in the morning period between 5.55am and 12.45pm. All of the surveys were conducted in suitable weather conditions (good visibility, little or no rain and winds no stronger than Beaufort force 4). Defined routes were walked on each occasion and all birds seen and heard within the survey zone were recorded.

Breeding status was established from the presence of singing or displaying males, pairs in suitable breeding habitat, the presence of a nest or an adult seen carrying food into suitable breeding habitat, removal of faecal sacs or fledged young. Routes were varied on each visit to prevent bias as a result of walking the same route at the same time on each visit so routes were rotated to maximise optimal timing.

Evening and Nocturnal Counts

In 2019, a nocturnal survey was undertaken at Ballyvergan Marsh proposed Natural Heritage Area (pNHA; site code 00078). Survey methodology followed that recommended by the British Trust for Ornithology[81]. This survey involved four visits between April and the end of June 2019. The first visit was used to identify a suitable spot to locate the count point and the following three visits involved being in position at the count point for 75 minutes, beginning 15 minutes

[80] Bibby, C., Burgess, N., Hill, D., Mustoe, S., (2000) Bird Census Techniques. Elsevier

[81] Heward, C.J., Hoodless, A.N., Conway, G.J., Aebischer, N.J., Gillings, S. & Fuller, R.J. (2015) Current status and recent trend of the Eurasian Woodcock Scolopax rusticola as a breeding bird in Britain, Bird Study, 62:4, 535-551.

before sunset and finishing 60 minutes after sunset. Survey sections for the marsh are provided in Figure 8.7 and Figure 8.8

Figure 8.7: Ballyvergan Marsh Eastern Survey Sections

Source: Nagle 2020

Figure 8.8: Ballyvergan Marsh Western Survey Sections

Source: Nagle 2020

In 2020, evening surveys were carried out in late evening in the Converter Station Site (Figure 8.9) and Ballyvergan Marsh pNHA primarily to detect the presence of Snipe but also to establish whether or not species that are largely nocturnal (long-eared owl *Asio otus*) or crepuscular (woodcock *Scolopax rusticola*) or more active at these times (grasshopper warbler *Locustella naevia*) were present. Survey methodology followed the O'Brien and Smith[82] method for censusing lowland breeding wader populations (as recommended by the Royal Society for the Protection of Birds). This survey requires three visits to each site between April and the end of June.

The wider Ballyadam / IDA site (as shown above) snipe surveys were focussed on suitable habitat within Section A, E and F. These areas (especially Section A) held significant numbers of snipe during the winter surveys and contain suitable nesting habitat (wet grassland). Surveys were undertaken on three dates in 2020 (14 May, 29 May, and 16 June).

[82] O'Brien, M. and Smith, K.W. (1992). Changes in the status of waders breeding on wet lowland grassland in England and Wales between 1982 and 1989. Bird Study 39: 165-176.

Figure 8.9: Survey sections in The IDA site

Source: Nagle 2020

Due to COVID-19 restrictions, the April visit had to be extended to the mid May period. The survey must be carried out in the three hours after dawn or the three hours prior to dusk (the latter approach was chosen for this survey as it also afforded an opportunity to survey other late evening/nocturnal species). Each likely breeding area is walked so the observer gets to within 100 m of every point. It was not possible to walk within 100m of every part of the Ballyvergan reedbed due to access difficulties associated with health and safety risks as it is a water logged area, but prolonged observation from a distance frequently produced breeding evidence.

8.1.4.6 Other Protected Species

During walkover surveys of the proposed development site and wider ZoI, the potential was also noted for habitats of other protected species, namely: common lizard (*Zootoca vivipara*), common frog (*Rana temporaria*), smooth newt (*Lissotriton vulgaris*), marsh fritillary (*Euphydryas aurinia*).

In the case of the marsh fritillary butterfly, searches were made for suitable habitats for the larval food plants of marsh fritillary (devil's-bit scabious *Succisa pratensis*).

8.1.4.7 Unprotected Species of Conservation Significance

Observations also included the potential for (unprotected) species of conservation concern to occur, as identified in NPWS red lists, and the County Cork BAP.

8.1.5 Desktop Study

The desktop assessment was informed by an examination of aerial imagery and other available datasets to investigate the potential for connectivity to designated and ecologically sensitive areas, as well as a review of available literature e.g. NPWS data on European sites.

Data and mapping consulted for the purpose of this assessment included:

- Existing relevant mapping and databases i.e. species and habitat distribution etc. (sourced from the Environmental Protection Agency (EPA) (https://gis.epa.ie/), the National Biodiversity Data Centre (NBDC) (https://maps.biodiversityireland.ie/Map) and the National Parks and Wildlife Services (NPWS) (https://www.npws.ie/maps-and-data);
- Published and unpublished NPWS reports on protected habitats and species including Irish Wildlife Manuals and associated reports
- Conservation Objectives reports, Site Synopses, Natura 2000 Data forms, Backing Documents and Maps prepared by the NPWS;
- Maps of landscape favourability for each Irish bat species at a 5km resolution as per the NBDC mapping website[83];
- Article 17 reporting data on Qualifying Interests[84 85 86];
- Article 12 reporting data on Special Conservation Interests[87]; and
- Research data available for Ballyvergan Marsh[88]

Habitats within and/ or immediately adjacent to the development area which might be affected by the development were identified and their suitability to support sensitive, rare and/or protected species was assessed (having regard to the typical ranges of species known to occur in the locality and the ZoI of the works).

8.2 Consultations

Pre-application consultations were carried out with prescribed bodies as detailed in Volume 2B Public and Stakeholder Consultation Report.

8.2.1 National Park and Wildlife Service

16 December 2020

Written correspondence was sent to the Development Application Unit (DAU) for the attention of NPWS in November 2020 providing an overview of the proposed development and requesting any additional information on nature conservation and biodiversity within the receiving environment.

A response was received on 16 December 2020. The Department noted that:

- Most of the proposed development was away from any designated areas or areas of known conservation importance;

[83] Available from: https://maps.biodiversityireland.ie/ Accessed: February 2021.

[84] Citation: NPWS (2019). The Status of EU Protected Habitats and Species in Ireland. Volume 1: Summary Overview. Unpublished NPWS report.Edited by: Deirdre Lynn and Fionnuala O'Neill.

[85] NPWS (2019). The Status of EU Protected Habitats and Species in Ireland. Volume 2: Habitat Assessments. Unpublished NPWS report. Edited by: Deirdre Lynn and Fionnuala O'Neill.

[86] NPWS (2019). The Status of EU Protected Habitats and Species in Ireland. Volume 3: Species Assessments. Unpublished NPWS report. Edited by:Deirdre Lynn and Fionnuala O'Neill.

[87] https://www.npws.ie/status-and-trends-ireland%E2%80%99s-bird-species-%E2%80%93-article-12-reporting Accessed: February 20201.

[88] Dineen, K., (2020). An Investigation into Aquatic Invertebrates, Saline Influence and Other Factors Associated with the Management of Ballyvergan Marsh, Youghal Co. Cork.

- The proposal to route the underground cable within existing public roads is welcomed as this reduces potential ecological impacts;
- Subject to the findings of the biodiversity component of Environmental Impact Assessment to be prepared and mitigation measures to be identified relating to the relocation and enhancement of habitat for scarce or rare plant species on the site this Department has, at this time, not identified any concerns that cannot be mitigated relating to the Ballyadam site;
- Subject to more detailed assessment at the application stage and the findings of the EIA and NIS, the Department is at this time satisfied that most of the terrestrial cable route is unlikely to cause significant ecological concern provided proper mitigation measures are implemented.

The Department also included in the response the following requests:

- The intention to provide surface water storage capacity within the Ballyadam site is noted and the creation of a wetland with the dual purpose of providing water storage and biodiversity to fulfil this function would be encouraged.
- That mitigation measures related to watercourses be incorporated to protect watercourses and associated species.
- That otters and bats be surveyed for at bridges and river crossings and impacts mitigated.
- That surplus materials derived from excavations be disposed of only at pre-approved licensed facilities.
- Due to concern about traversing the eastern edge of Ballyvergan Marsh pNHA for a section of up to approximately 200m in length, a full ecological assessment of the potential impacts at this location will need to be carried out and any negative impacts avoided or compensated for.
- It is noted that the proposed cable route passes adjacent to Lough Aderry and Ballybutler pNHA (sitecode 0446) and the EIA should assess any potential impacts to this site.
- The Department would recommend the cable route be contained within the existing road way to reduce any potential for negative effects.
- That a full ecological assessment of the potential impacts at Ballyvergan Marsh pNHA be carried out and negative impacts avoided or compensated for.
- That the potential for disturbance to wintering bird species be assessed.
- That a Natura Impact Statement document be included with application for consent.
- That an assessment on marine mammals be made as to the potential for interaction with marine mammals.

The full response is included in Appendix 8.1.

15 January 2021

A Webex meeting was held between EirGrid, EirGrid's Consultants, and the NPWS on 15 January 2021 to further discuss the written request of 16 December 2020. The following notable actions were observations / actions were recorded by EirGrid; responses to meeting items are italicised.

- NPWS noted that EirGrid's Draft Updated Ecology guidelines (2020) encourage enhancement, and significant opportunity is available at the Converter Station Site;

  EirGrid confirmed a Habitat and Plant Translocation and Enhancement Strategy would accompany the planning application
- NPWS queried whether the current Converter Station Site proposals for sealed tanked drainage could incorporate some element of open water wetland with the dual purpose of water storage and biodiversity;

EirGrid agreed to discuss with the design team, who subsequently advised on 19 January, that whilst open water was potentially feasible, the sealed system presented significant advantages over open water, in terms of available storage capacity within a given footprint.

- EirGrid confirmed an Ecological Clerk of Works would be appointed for the entire project;
- NPWS raised a historical concern with storage of excess fill, by third party landowners;

  EirGrid responded that such activities would be fully assessed, to ensure compliance with relevant waste legislation, and to protect sensitive areas.
- NPWS Marine specialist advised that impacts to marine mammals may be greatest in bays near Youghal. EirGrid confirmed a Marine Mammal Observer would be employed by the Contractor for the entirety of marine works;
- NPWS Marine specialist advised that noise modelling, not available at the time of the meeting, would need to inform marine environmental assessments including impacts to marine mammals;
- The potential impacts to, and mitigation and/or compensation for Ballyvergan marsh, were discussed. EirGrid advised that Cork County Council owned these lands, and committed to exploring practical enhancement measures in the pNHA in the course of the planning application. Mitigation measures discussed included seasonal works, and reducing the footprint of the HDD launch and reception pits within the marsh: Enhancement measures discussed included: increasing areas of open water, by not re-instating all reedbed habitat removed following duct installation; removal of invasive Japanese knotweed plants; surveys for whorl snails Vertigo spp; and
- The potential impacts to, and mitigation and/or compensation for the grassland at Claycastle Beach, which grades to remnant fixed dune to the west of the margin of the works footprint, were also discussed. EirGrid advised that Cork County Council owned these lands, and committed to exploring practical enhancement measures in the course of the planning application. Measures discussed included: signage to dissuade further trampling, reinstatement with species-rich native seed, and removal of invasive sea buckthorn *Rhamnus catharticus* plants.

8.3 Limitations

Due to Covid-19, and limitations due to the associated restrictions, not all offline areas (i.e. area outside of the existing road curtilage) within the potential zone of influence have been subject to a walkover survey.

Areas where works are required outside of the road curtilage that could not be surveyed are outlined below in Table 8.1.

Table 8.1: Areas Not Accessed

Location	Features	Likely Habitats in footprint
Route Section AC01-AC02	Passing bay	Agricultural grassland
Route Section AC02-AC03	Offline section	Agricultural grassland
Route Section AC03-AC04	6 passing bays	Agricultural grassland
Route Section AC04-AC05	Passing bay	Agricultural grassland
Route section AC05 -AC06	6 passing bays	Amenity grassland and agricultural grassland
Route section AC06-AC07	Passing bay, Offline section	Agricultural grassland

Location	Features	Likely Habitats in footprint
	Compound area	
Route section DC01-DC02	4 passing bays, and a laydown area	Agricultural grassland
Route Section DC02-DC03	4 passing bays, offline section laydown area	Agricultural grassland
Route section DC03 -DC04	2 passing bays	Agricultural grassland
Route section DC04 -DC05	3 passing bays, Offline section Laydown area	Agricultural grassland
Route section DC07-DC08	An offline section, Passing bay	Agricultural grassland
Route section DC09-DC10	Two temporary compounds for HDD crossing, One laydown area	Agricultural grassland

Based on aerial photography, and views from publicly accessible areas, inaccessible habitats within the footprint of the works are likely to comprise agricultural and amenity grassland. Both are low in terms of value to biodiversity and common in the wider landscape. As such, the information gathered during the field assessment is considered robust.

Surveys in the highest quality habitats (i.e. Ballyvergan Marsh, the proposed Converter station footprint within the wider Ballyadam/IDA site, and aquatic habitat surveys at watercrossings), and the Knockraha substation, were undertaken during the optimal season, and over two seasons. Surveys of the cable route took place outside of the optimal season for vegetative survey (i.e. surveys were carried out from October to December instead of the optimal April to September window), which was unavoidable due to a combination of covid-19, and third party land access restrictions.

Surveys to identify badger setts and field signs could not be undertaken entirely during the optimal season (November to April). However NRA Guidelines (NRA 2009) note that these surveys can be undertaken at any time of year, and pre-construction badger surveys will be proposed to ensure no badger setts were overlooked in dense vegetation (or inaccessible) lands and a disturbance license sought if required.

Whilst bat activity surveys were not conducted, the potential value of bat foraging habitat has been adequately assessed with reference to desktop data on the importance of landscape and habitat associations to bats across Ireland[89]. Visual assessments of all trees and structures with bat roost potential at risk of impact were conducted, Any works to the trees/structures identified as having bat roost potential, will be subject to licensing and further survey requirements, as will be identified in Section 8.7.

Wintering and breeding bird surveys were conducted during the optimal season, in areas with potential to host significant populations of conservation interest (Claycastle, Ballyvergan, kingfisher potential at watercourse crossings, the proposed Converter Station site, and the wider Ballyadam / IDA site).

[89] Lundy, M.G., Aughney, T., Montgomery, W.I., & Roche, N., (2011) Landscape conservation for Irish bats & species-specific roosting characteristics. Bat Conservation Ireland.

8.4 Baseline Environment

8.4.1 Designated Sites

8.4.1.1 Sites of International Importance

Special Protection Areas and Special Areas of Conservation

The Birds Directive (2009/147/EC) and the Habitats Directive (92/42/EEC) put an obligation on EU Member States to establish the Natura 2000 network. The Natura 2000 network comprises sites of the highest biodiversity importance for rare and threatened habitats and species across the EU. In Ireland, the Natura 2000 network of European sites comprises Special Areas of Conservation (SAC) and Special Protection Areas (SPA). SACs are selected for the conservation of Annex I habitats (including priority types which are in danger of disappearance) and Annex II species (other than birds). SPAs are selected for the conservation of Annex I birds and other regularly occurring migratory birds and their habitats.

The proposed development does not fall within the boundary of any European sites. A number of European sites with connectivity to the proposed works were identified. These are outlined below in Table 8.2. The location of these European sites in relation to the works is presented in Appendix 8.2.

Table 8.2: European Sites with Connectivity to the Proposed Development

Site Name	Distance between the Proposed development and European Site (straight line) at closest point	Qualifying Interests (QI) / Special Conservation Interests (SCI) (* denotes priority habitat)	Type of connectivity
Special Protection Areas			
Blackwater River (Cork/Waterford) SAC (002170)[90]	1.4km	• Estuaries [1130] • Mudflats and sandflats not covered by seawater at low tide [1140] • Perennial vegetation of stony banks [1220] • Salicornia and other annuals colonising mud and sand [1310] • Atlantic salt meadows (*Glauco-Puccinellietalia maritimae*) [1330] • Mediterranean salt meadows (*Juncetalia maritimi*) [1410] • Water courses of plain to montane levels with the *Ranunculion fluitantis* and *Callitricho-Batrachion* vegetation [3260] • Old sessile oak woods with Ilex and Blechnum in the British Isles [91A0] • Alluvial forests with *Alnus glutinosa* and *Fraxinus excelsior* (*Alno-Padion, Alnion incanae, Salicion albae*) [91E0]* • *Margaritifera margaritifera* (Freshwater Pearl Mussel) [1029] • *Austropotamobius pallipes* (White-clawed Crayfish) [1092] • *Petromyzon marinus* (Sea Lamprey) [1095] • *Lampetra planeri* (Brook Lamprey) [1096] • *Lampetra fluviatilis* (River Lamprey) [1099] • *Alosa fallax fallax* (Twaite Shad) [1103] • *Salmo salar* (Salmon) [1106] • *Lutra lutra* (Otter) [1355] • *Trichomanes speciosum* (Killarney Fern) [1421]	Hydrological connectivity is present through the coastal waters of Youghal Bay, and the Lower Blackwater Estuary. A number of QIs associated with the SAC are such that they may occur outside of the European Site boundary in proximity to the proposed development.

[90] NPWS (2016) Blackwater River (Cork/Waterford) SAC 002170.

Great Island Channel SAC (001058)[91]	1.7km	• Mudflats and sandflats not covered by seawater at low tide [1140] • Atlantic salt meadows (*Glauco-Puccinellietalia maritimae*) [1330]	Downstream hydrological connectivity has been identified via the following watercourses: • Tibbotstown_010 • Owennacurra_030 • Owennacurra_040 • Dungourney_020 The potential for underground karst systems within the Converter Station Site has been identified. These may offer connectivity to lands within the European Site boundary.
Ballymacoda (Clonpriest and Pillmore) SAC (000077)[92]	2.8km	• Estuaries [1130] • Mudflats and sandflats not covered by seawater at low tide [1140] • Salicornia and other annuals colonising mud and sand [1310] • Atlantic salt meadows (*Glauco-Puccinellietalia maritimae*) [1330] • Mediterranean salt meadows (*Juncetalia maritimi*) [1410]	Downstream hydrological connectivity has been identified via the following watercourses: • Womanagh_010" • Womanagh_020 • Moanlahan_010 • Dissour_020 • Womanagh_030 • East Ballyvergan_010
Special Protection Areas			
Cork Harbour SPA (004030)[93]	1.9km	• Little Grebe (*Tachybaptus ruficollis*) [A004] • Great Crested Grebe (*Podiceps cristatus*) [A005] • Cormorant (*Phalacrocorax carbo*) [A017] • Grey Heron (*Ardea cinerea*) [A028] • Shelduck (*Tadorna tadorna*) [A048] • Wigeon (*Anas penelope*) [A050] • Teal (*Anas crecca*) [A052] • Pintail (*Anas acuta*) [A054] • Shoveler (*Anas clypeata*) [A056]	Downstream hydrological connectivity to Cork Harbour SPA has been identified via the following watercourses: • Tibbotstown_010 • Owennacurra_030 • Owennacurra_040 • Dungourney_020

[91] NPWS (2014) Conservation Objectives: Great Island Channel SAC 001058. Version 1. National Parks and Wildlife Service, Department of Arts, Heritage and the Gaeltacht.

[92] NPWS (2015) Conservation Objectives: Ballymacoda (Clonpriest and Pillmore) SAC 000077. Version 2. National Parks and Wildlife Service, Department of Arts, Heritage and the Gaeltacht.

[93] NPWS (2014) Conservation Objectives: Cork Harbour SPA 004030. Version 1. National Parks and Wildlife Service, Department of Arts, Heritage and the Gaeltacht.

		• Red-breasted Merganser (*Mergus serrator*) [A069] • Oystercatcher (*Haematopus ostralegus*) [A130] • Golden Plover (*Pluvialis apricaria*) [A140] • Grey Plover (*Pluvialis squatarola*) [A141] • Lapwing (*Vanellus vanellus*) [A142] • Dunlin (*Calidris alpina*) [A149] • Black-tailed Godwit (*Limosa limosa*) [A156] • Bar-tailed Godwit (*Limosa lapponica*) [A157] • Curlew (*Numenius arquata*) [A160] • Redshank (*Tringa totanus*) [A162] • Black-headed Gull (*Chroicocephalus ridibundus*) [A179] • Greenshank (*Tringa nebularia*) [A164] • Common Gull (*Larus canus*) [A182] • Lesser Black-backed Gull (*Larus fuscus*) [A183] • Common Tern (*Sterna hirundo*) [A193] • Wetland and Waterbirds [A999]	The potential for underground karst systems within the Converter Station Site has been identified. These may offer connectivity with the European site. SCIs associated with the SPA may occur outside of the European site boundary. Bird species in proximity to the proposed development are examined further in section 8.1.4.
Ballymacoda Bay SPA (004023)[94]	1.4km	• Wigeon (*Anas penelope*) [A050] • Teal (*Anas crecca*) [A052] • Ringed Plover (*Charadrius hiaticula*) [A137] • Golden Plover (*Pluvialis apricaria*) [A140] • Grey Plover (*Pluvialis squatarola*) [A141] • Lapwing (*Vanellus vanellus*) [A142] • Sanderling (*Calidris alba*) [A144] • Dunlin (*Calidris alpina*) [A149] • Black-tailed Godwit (*Limosa limosa*) [A156] • Bar-tailed Godwit (*Limosa lapponica*) [A157] • Curlew (*Numenius arquata*) [A160] • Redshank (*Tringa totanus*) [A162] • Turnstone (*Arenaria interpres*) [A169] • Black-headed Gull (*Chroicocephalus ridibundus*) [A179] • Common Gull (*Larus canus*) [A182] • Lesser Black-backed Gull (*Larus fuscus*) [A183] • Wetland and Waterbirds [A999]	Downstream hydrological connectivity has been identified via the following watercourses: • Womanagh_010" • Womanagh_020 • Moanlahan_010 • Dissour_020 • Womanagh_030 • East Ballyvergan_010 SCIs associated with the SPA may occur outside of the European site boundary. Disturbance to bird species in proximity to the proposed development at Claycastle beach are examined further in section 8.2.3.

[94] NPWS (2015) Conservation Objectives: Ballymacoda Bay SPA 004023. Version 1. National Parks and Wildlife Service, Department of Arts, Heritage and the Gaeltacht.

Blackwater Estuary SPA (004028)[95]	2.4km	• Wigeon (Anas penelope) [A050] • Golden Plover (Pluvialis apricaria) [A140] • Lapwing (Vanellus vanellus) [A142] • Dunlin (Calidris alpina) [A149] • Black-tailed Godwit (Limosa limosa) [A156] • Bar-tailed Godwit (Limosa lapponica) [A157] • Curlew (Numenius arquata) [A160] • Redshank (Tringa totanus) [A162] • Wetland and Waterbirds [A999]	Hydrological connectivity is present through the coastal waters of Youghal Bay, and the Lower Blackwater Estuary. SCIs associated with the SPA may occur outside of the European site boundary. Bird species in proximity to the proposed development are examined further in Section 8.1.4**.**
Mullaghanish to Musheramore Mountains SPA (004162)[96]	45km	• Hen Harrier (*Circus cyaneus*) [A082]	It is noted that there is a considerable distance between Mullaghanish to Musheramore Mountains SPA and the works areas. However, it has been established that hen harrier migrate outside of breeding grounds to lowland winter roosting areas between October and March[97] [98] (Watson 1977, Clarke & Watson 1990). As such, there is potential for wintering hen harrier to roost in proximity to works areas as suitable winter roost habitat (Ballyvergan Marsh) occurs in proximity to the proposed development.

[95] NPWS (2012) Blackwater Estuary Special Protection Area (Site Code 4028) Conservation Objectives Supporting Document Version 1

[96] NPWS (2020) Conservation objectives for Mullaghanish to Musheramore Mountains SPA [004162]. Generic Version 7.0. Department of Culture, Heritage and the Gaeltacht.

[97] Clarke, R. and Watson, D. (1990). The Hen Harrier Winter Roost Survey in Britain and Ireland. Bird Study 37, 84-100.

[98] Watson, D. (1977). The Hen Harrier. Poyser, Berkhamsted.

Ramsar Sites

Ramsar are wetland sites designated to be of international importance under the Ramsar Convention. The Ramsar Convention is an intergovernmental environmental treaty which was established in 1971 by UNESCO and came into force in 1975.

No Ramsar sites were identified within the footprint of the proposed development. Three were identified downstream of the works areas. These are Cork harbour, Ballymacoda, and Blackwater Estuary. These sites correspond to European designated sites as outlined below in Table 8.3

Table 8.3: European Sites Associated with Proposed Natural Heritage Areas

Proposed Natural Heritage Name	Corresponding European Sites
Cork Harbour	Great Island Channel SAC Cork Harbour SPA
Ballymacoda	Ballymacoda (Clonpriest and Pillmore) SAC Ballymacoda Bay SPA
Blackwater Estuary	Blackwater River (Cork/Waterford) SAC Blackwater Estuary SPA

All Ramsar sites are included within SPA sites outlined in Table 8.3. The potential for effects to these Ramsar sites is considered under the relevant European designation.

8.4.1.2 Sites of National Importance

Natural Heritage Areas

The basic designation for areas of ecological importance in Ireland is the Natural Heritage Area (NHA). These sites comprise areas which are considered important for the habitats, or species of plants and animals whose habitat needs protection. Under the Wildlife Amendment Act (2000), NHAs are legally protected from damage from the date they are formally proposed for designation.

No Natural Heritage Areas are located within the footprint of the proposed development. No Natural Heritage Areas have been identified with connectivity to the proposed development.

Proposed Natural Heritage Areas

Proposed NHAs (pNHAs) are sites which were published on a non-statutory basis in 1995 but have not since been statutorily proposed or designated. These sites are of significance for wildlife and habitats. Prior to statutory designation, pNHAs are still subject to limited protection, in the form of:

- Agri-environmental farm planning schemes support the objective of maintaining and enhancing the conservation status of pNHAs.
- There is a requirement for the Forest Service to gain NPWS approval before they will pay afforestation grants on pNHA lands
- A recognition of the ecological value of pNHAs by Planning and Licencing Authorities

One proposed Natural Heritage Area, Ballyvergan Marsh (site code 0078), falls within the footprint of the proposed development. Two further sites are located directly adjacent to the proposed development. These are Loughs Aderry and Ballybutler pNHA (site code 446), and Clasharinka Pond pNHA (001183). A description of these sites are provided below:

Ballyvergan Marsh

The site synopsis for the pNHA[99] notes that the site "*is of interest because it contains the largest freshwater coastal marsh in Co. Cork, exhibiting well developed plant communities and holding a sizeable breeding population of Reed Warblers*." An additional secondary habitat has been included within the site boundary also. This comprises a clay/sand cliff along the coast. This area of the pNHA supports wild clary (*Salvia verbenaca*) a rare plant species.

The site synopsis states in relation to bird species supported by the site that "*The main interest of the marsh is ornithological, with the reed bed supporting a sizeable proportion of the Irish breeding population of Reed Warblers. This species has only recently become an established breeding bird in Ireland. Other breeding birds using the site include Reed Buntings, Moorhen, Coot, Water Rail and Mallard*."

A research project carried out in Ballyvergan Marsh[88] included records of odonata and lepidoptera which have been recorded (historically and during the research project). These records are outlined below in Table 8.4 and Table 8.5.

Table 8.4: Odonata Associated with Ballyvergan Marsh

Species Name	Included in Red list[100]		Sighting referenced (per Dineen 2020)
Emperor (*Anax imperator*) (sighting)	✓	LC	Murphy and Rogan, 2004[101]
Lesser emperor (*Anaz parthenope*) (sighting)	-	-	Murphy and Rogan, 2004
Hawker (*Aeshna mixta*) (sighting)	✓	LC	Murphy and Rogan, 2004
Darner dragonfly family (*Aeshnidae*) (sighting)	✓	-	Murphy and Rogan, 2004
Crescent bluet (*Coenagrion lunulatum*) (nymph ID)	✓	VU	Nelson et at., 2011[100]
Azure bluet (*Coenagrion puella*) (nymph ID)	✓	LC	Nelson et at., 2011
Variable bluet (*Coenagrion pulchellum*) (nymph ID)	✓	LC	Nelson et at., 2011
Common bluet (*Enallagma cyathigerum*) (nymph ID)	✓	LC	Nelson et at., 2011

[99] NPWS (1997) Site Synopsis: Ballyvergan marsh.

[100] Nelson, B., Ronayne, C. & Thompson, R. (2011) Ireland Red List No.6: Damselflies & Dragonflies (Odonata). National Parks and Wildlife Service, Department of the Environment, Heritage and Local Government, Dublin, Ireland.

[101] Murphy, S., Rogan, E. (2004). Records from the Irish Whale and Dolphin Group for 2000-
2001. The Irish Naturalists' Journat., 27(9), 357-364.

Table 8.5: Lepdoptera Associated with Ballyvergan Marsh

Species Name	Included in Red list[102]		Confirmation of food plant in Ballyvergan Marsh
Pseudopostega crepusculella	-	-	-
Agonopterix yeatiana	-	-	-
Bryotropha senectella	-	-	-
Limnaecia phragmitella	-	-	✓
Phtheochora inopiana	-	-	✓
Phalonidia manniana	-	-	✓
Celyhga striana	-	-	✓
Celypha aurofasciana	-	-	✓
Chilo phragmitella	-	-	✓
Donacula mucranellus	-	-	✓
Anania crocealis	-	-	✓
Cryptic Wood White (*Leptidea juvernia*)	-	-	✓
Lackey (*Malacosoma neustria*)	✓	LC	✓
Latticed Heath (*Chiasmia clathratha*) -	✓	LC	Recorded in land adjacent to Ballyvergan
Shallow Kitten (*Furcula furcula*)	✓	LC	✓
Round-winged Muslin (*Thumantha senex*)	✓	LC	-
Broad-barred White (*Hecatera bicolorata*)	✓	LC	✓
Small Cloud Brindle (*Apamea unanimus*)	✓	LC	✓
Double Lobed (*Lateroligio ophiogramma*)	✓	LC	✓
Webb's wainscot (*Globia sparganii*) -	✓	VU	✓
Silky Wainscot (*Chilodes maritimus*)	✓	LC	✓

[102] Allen, D., O'Donnell, M., Nelson, B., Tyner, A., Bond, K.G.M., Bryant, T., Crory, A., Mellon, C., O'Boyle, J., O'Donnell, E., Rolston, T., Sheppard, R., Strickland, P., Fitzpatrick, U., & Regan, E. (2016) Ireland Red List No. 9: Macro-moths (Lepidoptera). National Parks and Wildlife Service, Department of Arts, Heritage and the Gaeltacht, Dublin, Ireland.

Loughs Aderry and Ballybutler

The site synopsis[103] notes that the site this site includes two rich lowland lakes surrounded by farmland and marshy ground. Two notable plant species orange foxtail (*Alopecurus aequalis*) and musk thistle (*Carduus nutans*) are known to be present within the pNHA. The site synopsis notes that "*both lakes are susceptible to water pollution with agricultural run-off providing the greatest threat*."

The site synopsis states "*This site is also of ornithological value, with Lough Aderry supporting nationally important numbers of Gadwell (average peak 92, 1984/85-1986/87). In addition, both lakes support a variety of waterfowl including Mute Swan, Wigeon, Teal, Mallard, Shoveler, Pochard, Coot and Lapwing.*"

Within the designation as a pNHA Lough Aderry is also a wildfowl sanctuary. Wildfowl Sanctuaries in Ireland have been excluded from the 'Open Season Order' such that game birds can rest and feed undisturbed.

Clasharinka Pond pNHA

The site synopsis[104] (NPWS 1997) describes the site as a large pond, located just south of the Castlemartyr-Youghal main road and the surrounding fields are used for rough grazing by horses.

The site synopsis states "*The rare species - Orange Foxtail (Alopecurus aequalis) is found on mud around the pond at the summer water level. Thousands of plants of this species grow here and the population is healthy, in a good habitat whose management is conducive to the growth of this species and unlikely to change under the present owner. There is however, another possible threat to this habitat - that of housing or industrial development of the area because of its proximity to the town of Castlemartyr*."

Proposed Natural Heritage Areas with Connectivity to the Proposed Development

The location of pNHAs in relation to the proposed development is presented in Appendix 8.3.

Three additional pNHAs were identified outside of the proposed development boundaries, but with connectivity to the proposed development: Great Island Channel, Ballymacoda (Clonpriest and Pillmore) and Blackwater Estuary. These sites are all coincident with one or more European designated sites as outlined below in Table 8.6.

Table 8.6: European Sites Associated with Proposed Natural Heritage Areas

Proposed Natural Heritage Name	Corresponding European Sites
Great Island Channel	Great Island Channel SAC Cork Harbour SPA
Ballymacoda (Clonpriest and Pillmore)	Ballymacoda (Clonpriest and Pillmore) SAC Ballymacoda Bay SPA
Blackwater River and Estuary	Blackwater River (Cork/Waterford) SAC Blackwater Estuary SPA

As outlined in Table 8.4 pNHA detailed are included within European sites. As such, the potential for effects to these specific pNHAs are considered further under the relevant European designation at the impact stage.

[103] NPWS (1997) Site Synopsis: Loughs Aderry and Ballybutler.
[104] NPWS (1997) Site Synopsis: Clarashinka Pond.

8.4.1.3 Other Nature Conservation Sites

No Nature Reserves or Biosphere Reserves occur within the proposed development boundary, or with connectivity to the proposed development.

Loughs Aderry and Ballybutler pNHA is also identified as a Wildfowl Sanctuary, an area that has been excluded from the 'Open Season Order' so that game birds can rest and feed undisturbed. The potential for effect on Lough Aderry Wildfowl Sanctuary will be considered under the pNHA designation.

8.4.2 Records of Protected Species and Habitats

8.4.2.1 Historic Karstic Wetland Features

The geological survey of Ireland (GSI) has mapping of karst features identified throughout Ireland[105]. Three features are located within the wider Ballyadam/IDA site, two enclosed depressions and a swallow hole, while two turloughs are mapped in the land to the north of the converter station site.

In 2012 a groundwater flood risk assessment was commissioned by Cork County Council[106]. This study examined the Ballyadam site and stated that "*the actual (historical) location of the turloughs was approximately 300 m south of the recorded locations... In the same area two turlough-like water features (KF01 & KF02) are shown on the OSI 1:5,000 scale map of the area.*" These are located (based on grid references supplied in the report) outside of the red line boundary and to the south west of the proposed Converter Station footprint.

The report goes on to acknowledge that groundworks carried out historically (ca. 2010) have caused these features to be infilled. The report also states that "*a nature-pond feature appears to have been created along the western boundary of the site", "a large reservoir/attenuation pond has been constructed along the southern boundary of the site adjacent to the N25 road*", and that "*Investigation of the attenuation pond … showed that a new swallow hole (KF14) (not in the GSI Karst Database) has opened up at the base of the pond and the pond now drains into the underlying limestone bedrock*."

Given the earthworks which have been undertaken within the wider Ballyadam site, the topographical levels are such that the lowest point within the wider Ballyadam/IDA site is located within the attenuation pond along the southern boundary of the wider Ballyadam/IDA site. As such, the ponding within the wider Ballyadam/IDA site that occurs is associated with surface-water drainage as opposed to groundwater flooding. The habitats that this is associated with are outlined in section 8.1.4. The potential for impact on other karstic features along the cable route is assessed in Chapter 6.

It is confirmed that no habitat consistent with the Annex 1 priority habitat *Turloughs (3180) exists within the footprint of the proposed development or wider ZoI of works associated with the development.

Given the karstic nature of the wider Ballyadam/IDA site, it is not possible to rule out the presence of underground conduits which may provide connectivity to Cork Harbour. As such, this connectivity is assumed.

[105] https://www.gsi.ie/en-ie/data-and-maps/Pages/Geohazards.aspx#
[106] Conroy, P. (2012) Carrigtohill Flood Risk Assessment Study. Groundwater Flood Risk Assessment.

8.4.2.2 Birds

SCIs for the nearby European Sites are outlined above in section 8.3.1.1. As described above, a Screening Statement for AA and NIS has been prepared for the proposed development considered potential effect on SCIs of nearby European sites where they may occur in proximity to the proposed development.

Annex I of the Birds Directive lists species which are:

- In danger of extinction;
- Vulnerable to change in their habitat;
- Considered rare due to small population sizes or a restricted local distribution; and,
- Require attention due to the nature of their habitat.

The National Biodiversity Data Centre[83] contains records of bird species recorded in the 10km grid squares within which the proposed development is located. These are W77, W87, W97 and X07. Records of Annex I listed species are provided below in Table 8.7.

Records of rare and protected species were obtained from the National Parks and Wildlife Service. The only bird species included in this list was barn owl (*Tyto alba*).

Table 8.7: Annex I Bird Species Recorded in 10 km Grid Squares overlapping the Proposed Development

Species Name	Reasons for Protection / Inclusion of the Species (EC 2020)	Grid Squares Recorded In
Arctic tern (*Sterna paradisea*)	Depletion of the stocks of fish due to overfishing and water pollution, disturbances and predation at nesting sites.	W87
Bar-tailed godwit (*Limosa lapponica*)	The species is vulnerable due its concentration at a few suitable coastal wetlands outside the breeding season.	W77, W87, X07
Bewick's swan (*Cygnus columbianus subsp. bewickii*)	Much of its traditional winter habitat has been lost or degraded.	W97, X07
Black-throated diver (*Gavia arctica*)	A recent decline in breeding population size have been suggested for several countries.	X07
Common kingfisher (*Alcedo atthis*)	Its range has expanded this century, but populations have recently fallen in several countries.	X07, W77, W87 W97
Common tern (*Sterna hirundo*)	The major threat for the species is deterioration of habitat.	W77, W87
Corn crake (*Crex crex*)	Habitat loss and high mortality caused by the intensification and mechanization of hay and silage making.	W77, X07
Dunlin (*Calidris alpina*)	None given.	W77, W87, X07
European golden plover (*Pluvialis apricaria*)	The main threats for the species are the loss and deterioration of habitat and disturbances at the breeding period.	W77, W87, W97, X07
Great northern diver (*Gavia immer*)	The main threat to the species is water pollution, mainly from oil, which means declining food stocks and deterioration of habitat.	W77, W87, X07
Greater white-fronted goose (*Anser albifrons*)	Disturbance at wintering sites and unfavourable climatic condition.	W87, W97, X07
Hen harrier (*Circus cyaneus*)	The widespread loss of breeding habitats and the occurrence of localized persecution and destruction of nests.	W77, W97, X07
Kentish plover (*Charadrius alexandrinus*)	None given.	X07
Leach’s storm-petrol (*Oceanodroma lucorhoa*)	The species is particularly susceptible to introduced predators (rats or cats) on breeding sites. Disturbance by tourists, military bombing and sea pollution.	W87
Little egret (*Egretta garzetta*)	The loss and deterioration of habitats due to drainage and to agricultural and development projects are the major threats that the species is now facing.	W77, W87, W97, X07

Species Name	Reasons for Protection / Inclusion of the Species (EC 2020)	Grid Squares Recorded In
Little tern (*Sternula albifrons*)	Due to habitat loss (tourist development of beaches), human disturbance and predation by gulls and rats.	X07
Mediterranean gull (*Larus melanocephalus*)	Loss of habitat, disturbance and tourism development on coastal areas are the major threats for the species. In winter and during migration, Mediterranean Gulls are threatened by illegal hunting, oil pollution and changes in fishing practices.	W77, W87, W97, X07
Merlin (*Falco columbarius*)	The main threats to this species are loss of habitats, contamination of birds with organochlorines from agriculture, human disturbance and nest-robbing by falconers.	W77, W87, W97, X07
Peregrine falcon (*Falco peregrinus*)	The widespread post-1960 decline in Peregrine numbers were caused by food-chain contamination with persistent toxic chemical residues, mainly of agricultural organochlorines insecticides. The restrictions and later bans on the majority of persistent organochlorines over most of Europe were followed by the general recovery in Peregrine numbers. Today, some nests are robbed by egg-collectors and to supply a clandestine trade for falconry.	W77, W87, W97, X07
Red-billed chough (*Pyrrhocorax pyrrhocorax*)	Numbers are decreasing in about 90% of the population and the distribution is contracting in many areas. The overwhelming factor associated with the recent decline of this species is the loss of traditional livestock farming, through abandonment or conversion to forestry, tourist related developments or intensive or specialist farming.	X07
Red-footed falcon (*Falco vespertinus)*	None given.	X07
Red-throated diver (*Gavia stellata*)	Between 1970 and 1990 numbers declined over a considerable part of the EU. The loss and deterioration of habitats (land drainage, decline of fish stocks, water pollution and mercury levels in fish) and disturbance at breeding sites are the major threats which the species is now facing.	W77, X07
Roseate tern (*Sterna dougallii*)	The Roseate Tern suffered a dramatic population decline through much of its EU range and it is listed as "endangered". Nesting Roseate Terns are particularly sensitive to human disturbance, egg-collection and avian or ground predators (e.g. Peregrine (*Falco peregrinus*), gulls, fox). Hunting in the winter quarters has been identified as a particular threat.	X07
Ruff (*Philomachus pugnax*)	The main threats for the species are the loss of habitat due to changes in agricultural and livestock practices and shooting.	X07
Sandwich tern (*Sterna sandvicensis*)	EU numbers and trends are generally increasing. Main threats include the loss and deterioration of habitat, disturbance, predation by foxes at breeding sites and fluctuation in fish stocks.	X07
Short-eared owl (*Asio flammeus*)	Even if its presence is in many respects dependent on food availability, this owl has declined markedly in parts of eastern Europe due to loss of habitat through agricultural intensification and afforestation as well as disturbances at breeding sites.	W77, W87
Whooper swan (*Cygnus cygnus*)	The greatest problems to the Whooper Swan are disturbances, deterioration of habitat, illegal hunting and pollution by lead and pesticides.	W77, X07
Wood Sandpiper (Tringa glareola)	Much of the breeding population has declined during recent centuries, mainly due to drainage of wetlands. In the north of its breeding range, vast peatlands have already been exploited for forestry.	X07

8.4.2.3 Mammals

The NBDC compiles records of species across Ireland. Within the database they collect records of protected mammals, both marine and terrestrial.

Records from the NBDC were interrogated for records of protected mammals within 10km grid squares the proposed development is located in; W77, W87, W97 and X07. The species recorded are presented below in Table 8.8. Marine mammals in Table 8.6 could occur downstream of the proposed development in Cork Harbour and/or Youghal Bay, within the potential ZoI of the onshore works. Both species of seal regularly occur in Cork Harbour and along the Cork coastline.

No Irish red list has been produced to date for marine mammals in Irish waters. These species are included within the onshore chapter given that the Zone of Impact for the onshore work extends into the marine environment.

Table 8.8: Marine Mammal Recorded in in 10 km Grid Squares overlapping Proposed Development

Species Name	Protection Level	Grid Squares Recorded In
Atlantic white-sided dolphin (*Lagenorhynchus acutus*)	• EU Habitats Directive Annex IV Wildlife Act	X07,
Bottle-nosed dolphin (*Tursiops truncatus*)	• EU Habitats Directive Annex V Wildlife Act	X07
Common dolphin (*Delphinus delphis*)	• EU Habitats Directive Annex IV Wildlife Act	W77, W87, X07
Common porpoise (*Phocoena phocoena*)	• EU Habitats Directive Annex IV Wildlife Act	X07
Cuvier's beaked whale (*Ziphius cavirostris*)	• EU Habitats Directive Annex IV Wildlife Act	X07
Grey seal (*Halichoerus grypus*)	• EU Habitats Directive Annex V Wildlife Act	W77, X07
Killer whale (*Orcinus orca*)	• EU Habitats Directive Annex II and Annex IV • Wildlife Act	X07
Long-finned Pilot Whale (*Globicephala melas*)	• EU Habitats Directive Annex IV • Wildlife Act	X07
Risso's dolphin (*Grampus griseus*)	• EU Habitats Directive Annex IV • Wildlife Act	X07,
Sperm whale (*Physeter macrocephalus*)	• EU Habitats Directive Annex IV • Wildlife Act	X07
Striped dolphin (*Stenella coeruleoalba*)	• EU Habitats Directive Annex IV • Wildlife Act	X07
White-beaked dolphin (Lagenorhynchus albirostris)	• EU Habitats Directive Annex IV Wildlife Act	X07

All of the marine mammals in Table 8.8 could occur downstream of the proposed development in Cork Harbour and/or Youghal Bay, within the potential ZoI of the onshore works. Both species of seal regularly occur in Cork Harbour and along the Cork coastline.

Table 8.9: Terrestrial Mammal Species Recorded in the Vicinity of the Proposed Development

Species Name	Conservation Status[107]	Protection Level	Grid Squares Recorded In
Brown long-eared bat (*Plecotus auritus*)	Least Concern	• EU Habitats Directive Annex IV • Wildlife Act	W77, W87, W97, X07
Daubenton's bat (*Myotis daubentonii*)	Least Concern	• EU Habitats Directive Annex IV • Wildlife Act	W77, W87, W97, X07
Eurasian badger (*Meles meles*)	Least Concern	• Wildlife Act	W77, W87, W97, X07
Eurasian pygmy shrew (*Sorex minutus*)	Least Concern	• Wildlife Act	W77, W87, W97, X07
Eurasian red squirrel (*Sciurus vulgaris*)	Least Concern	• Wildlife Act	W77, W87, W97, X07
European hedgehog (*Erinaceus europaeus*)	Least Concern	• Wildlife Act	W77, W87, W97, X07
European otter (*Lutra lutra*)	Least Concern	• EU Habitats Directive Annex II and Annex IV • Wildlife Act	W77, W87, W97, X07
Irish stoat (*Mustela erminea*)	Least Concern	• Wildlife Act	X07
Leisler's bat (*Nyctalus leisleri*)	Least Concern	• EU Habitats Directive Annex IV • Wildlife Acts	W77, W87, W97, X07
Natterer's bat (*Myotis nattereri*)	Least Concern	• EU Habitats Directive Annex IV • Wildlife Act	W77, W87
Pine marten (*Martes martes*)	Least Concern	• Wildlife Act	W87, X07
Common pipistrelle (*Pipistrellus pipistrellus sensu lato*)	Least Concern	• EU Habitats Directive Annex IV • Wildlife Act	W77, W87, W97, X07
Sika deer (*Cervus nippon*)	Non-Native	• Invasive Species listed under Regulation S.I. 477 (Ireland) • Protected Species: Wildlife Acts	W77,
Soprano pipistrelle (*Pipistrellus pygmaeus*)	Least Concern	• EU Habitats Directive Annex IV • Wildlife Act	W77, W87, W97, X07
Whiskered bat (*Myotis mystacinus*)	Least Concern	• EU Habitats Directive Annex IV • Wildlife Act	W77, W87

Mapping has been produced based on the outcome of a study which examined the relative importance of landscape and habitat associations across Ireland[108]. The online maps of landscape favourability for Irish bat species[109] produced based on the outcomes of this study were examined along the cable route. The maps are a visualisation of the results of the analyses based on a 'habitat suitability' index. The index ranges from 0 to 100 with 0 being least favourable and 100 most favourable for bats. Table 8.10 outlines the range of values for each species for the proposed development site.

[107] Marnell, F., Looney, D. & Lawton, C. (2019) Ireland Red List No. 12: Terrestrial Mammals. National Parks and Wildlife Service, Department of the Culture, Heritage and the Gaeltacht, Dublin, Ireland.

[108] Lundy, M.G., Aughney, T., Montgomery, W.I., & Roche, N., (2011) Landscape conservation for Irish bats & species-specific roosting characteristics. Bat Conservation Ireland.

[109] Available from: https://maps.biodiversityireland.ie/Map Accessed February 2021.

Table 8.10: Landscape Favourability for Irish Bat Species

Bat Species	Lowest Suitability Index	Highest Suitability Index
Brown long-eared bat	25 in the vicinity of Knockraha substation	45 in vicinity of landfall location
Common pipistrelle	31 in vicinity of Knockraha substation	41 in vicinity of landfall location
Soprano pipistrelle	33 in vicinity of Knockraha substation	46 along cable route at DC03-DC04 and DC04 and DC05
Nathusius' pipistrelle	3 along cable route at Castlemartyr	14 in the vicinity of Knockraha
Leisler's bat	27 in vicinity of Knockraha substation	44 along cable route at DC03-DC04 and DC04 and DC05
Daubenton's bat	17 in vicinity of Knockraha substation	30 along cable route at DC03-DC04 and DC04 and DC05
Whiskered bat	16 in vicinity of Knockraha substation	35 along cable route at DC03-DC04 and DC04 and DC05
Natterer's bat	24 in vicinity of Knockraha substation	37 along cable route at DC03-DC04 and DC04 and DC05

The proposed development is located outside the range for lesser horse-shoe (*Rhinolophus hipposideros*) bats. The suitability index for this species is therefore 0 across the entire development.

8.4.2.4 Rare and Protected Flora

Records from the NBDC were interrogated for records of rare and protected flora species within 10km grid squares the proposed development is located in; W77, W87, W97 and X07. The species recorded within the last 50 years are presented below in Table 8.11, along with rare/protected flora records received from NPWS, but excluding extinct, and so-called 'Waiting List' species.

Table 8.11: Rare Flora Species Records in the Vicinity of the Proposed Development

Species Name	Protected - FPO 2015	Conservation Status[5260]	Habitat Requirements[110] [111]	Grid Squares Recorded In
Chives (*Allium schoenoprasum*)	Protected	Vulnerable	Usually on thin soils over limestone, serpentine and basic igneous rocks; it sometimes grows in rank grass on deeper soils, and in crevices of riverside bedrock.	W77
Little-robin (*Geranium purpureum*)	-	Near Threatened	In stony or rocky places near the sea, on sheltered cliffs, disused railway lines, and by roads and fields	W77, W87
Common extinguisher-moss (*Encalypta vulgaris*)	-	Near Threatened	Base-rich substrates in the lowlands	W87
Hasselquist's hyssop	-	Near Threatened	Arable fields and other recently disturbed soil; can	W77

[110] Online Atlas of the British and Irish flora; https://www.brc.ac.uk/plantatlas/

[111] Atherton, I., Bosanquet, S., Lawley, M. (eds) (2010). Mosses and Liverworts of Britain and Ireland. A field Guide, British Bryological Society.Latimer Trend & Co. Ltd: Plymouth.

Species Name	Protected - FPO 2015	Conservation Status[5260]	Habitat Requirements[110] [111]	Grid Squares Recorded In
(*Entosthodon fascicularis*)			be abundant in cereal stubble. Occasionally present on thin soil overlying limestone.. NPWS record for the species notes that the location is Great Island.	
Holt's pouncewort (*Lejeunea holtii*)	-	Near Threatened	Rare plant of southwest Ireland, typically at higher altitudes . Although NPWS record for the species notes that the location is Great Island.	W97
Lesser striated Feather-moss (*Eurhynchium striatulum*)	-	Near Threatened	Calcareous rocks, and stonewalls; also rarely on tree roost	W87, W97,
Orange foxtail (*Alopecurus aequalis*)	Protected	Near Threatened	Most frequent on drying mud but found in a wide variety of habitats associated with freshwater, including the margins of ponds, ditches, reservoirs, turloughs and flooded gravel-pits. It has also recently been found as a weed in aquatic garden centres. The records for this species as supplied by NPWS are known to occur within the nearby Ballyquirk pond, Clarashink pond pNHA, Lough Aderry and Ballybutler pNHA.	W97
Penny royal (*Mentha pulegium*)	Protected	Endangered	Seasonally inundated grassland overlying silt and clay habitats also include damp heathy pastures, lake shores and coastal grassland. Lowland. Record is noted to be associated with Ballyquiggan Railway crossing.	
Tall Aloe-moss (*Aloina ambigua*)	-	Endangered	Lowland species on thin lime-rich soils; rock ledges, exposed banks, quarries, sand pits;	X07

Species Name	Protected - FPO 2015	Conservation Status[5260]	Habitat Requirements[110] [111]	Grid Squares Recorded In
			rare in mortar on walls	
Tufted feather-moss (*Scleropodium cespitans*)	-	Near threatened	Lowland streams and rivers, on roots of trees and on rocks, boulders, silt; also on tarmac	W97
Wild clary (*Salvia verbenaca*)	-	Least Concern	Open grassland on sunny banks, sand dunes and roadsides; usually on well-drained, base-rich soils, including sticky calcareous clays.	X07
Chives (*Allium schoenoprasum*)	Protected	Vulnerable	Usually on thin soils over limestone, serpentine and basic igneous rocks; it sometimes grows in rank grass on deeper soils, and in crevices of riverside bedrock.	W77

8.4.2.5 Fisheries

The proposed development will require crossing a number of rivers and streams. These are outlined below:

- Lisheenroe Stream
- Tibbotstown Stream
- Owenacurra River
- Glenathonocash River
- Elfordstown River
- Ballyspillane West Stream
- Dungourney River
- Harrisgrove Stream
- Lough Aderra
- Womanagh River
- Annistown Stream
- Moanlahan River
- Dissour River
- Inchanapisha River
- Lagile Stream
- Gortnagark Stream
- Inchiquin Stream
- East Ballyvergan Stream

More details on these rivers in terms of their water quality status is provided in Section 8.1.4.

Records from the NBDC for freshwater fish in the within 10km grid squares the proposed development is located in; W77, W87, W97 and X07, as detailed in Table 8.12.

Table 8.12: Freshwater Fish Species in the Vicinity of the Works

Species Name	Conservation Status[112]	Grid Square Recorded In
Atlantic salmon (*Salmo salar*)	Vulnerable	X07
Brown / sea trout (*Salmo trutta)*	Least Concern	W87, W97, X07
Rainbow trout (*Oncorhynchus mykiss*)	Least Concern	W97
Rudd (*Scardinius erythrophthalmus*)	Non-Native	W97
Three-spined stickleback (*Gasterosteus aculeatus*)	Least Concern	W77
Stone loach (*Barbatula barbatula*)	Non-Native	W97
European eel (*Anguilla anguilla*)	Critically Endangered	W77, W87
Tench (*Tinca tinca*)	Non-Native	W87

The IFI National Research Survey Programme data base was interrogated for records of fisheries surveys that had been carried out historically in the vicinity of the Proposed Development.

Only one such survey was identified, a survey of the Womanagh river south of the Proposed Development that was carried out in 2011. Species recorded in this survey include brown trout, European eel, flounder, and lamprey sp., Atlantic salmon and three spined stickleback. The WFD 'fish' biological quality element group status for the river is noted as "good".

8.4.2.6 Other Species of Note

NBDC records for amphibians, reptiles and invertebrates were interrogated for records of note within 10km grid squares the proposed development is located in; W77, W87, W97 and X07**.**

Protected species identified are listed in Table 8.13 below.

Table 8.13: Other Species of Note in the Vicinity of the Proposed Development

Species Name	Conservation Status[112][113]	Designation	Grid Squares Recorded In
Common frog (*Rana temporaria*)	Least Concern	• Wildlife Act	W77, W87, W97
Smooth newt (*Lissotriton vulgaris*)	Least Concern	• Wildlife Act	W77, W97
Marsh Fritillary (*Euphydryas aurinia*)	Vulnerabe	• EU Habitats Directive Annex II and IV	W77
Common Lizard (*Zootoca vivipara*)	Least Concern	• Wildlife Acts	W77
Leatherback Turtle (*Dermochelys coriacea*)	Least Concern	• EU Habitats Directive Annex IV • Wildlife Acts	X07

[112] King, J.L., Marnell, F., Kingston, N., Rosell, R., Boylan, P., Caffrey, J.M., FitzPatrick, Ú., Gargan, P.G., Kelly, F.L., O'Grady, M.F., Poole, R., Roche, W.K. & Cassidy, D. (2011) Ireland Red List No. 5: Amphibians, Reptiles & Freshwater Fish. National Parks and Wildlife Service, Department of Arts, Heritage and the Gaeltacht, Dublin, Ireland.

[113] Regan, E.C., Nelson, B., Aldwell, B., Bertrand, C., Bond, K., Harding, J., Nash, D., Nixon, D., & Wilson, C.J. (2010) Ireland Red List No. 4 – Butterflies. National Parks and Wildlife Service, Department of the Environment, Heritage and Local Government, Ireland.

8.4.2.7 Invasive Species

Records of invasive species listed under the Third Schedule of the European Communities (Birds and Natural Habitats) Regulations 2011 (as amended) were interrogated from the NBDC within 10km grid squares the proposed development is located in; W77, W87, W97 and X07**.** The spread of invasive species can cause a great deal of damage to local biodiversity. Species recorded are listed in Table 8.14 below.

Table 8.14: Invasive Species in Proximity to the Proposed Development

Species Name	Grid Square in Which Recorded
American mink (*Mustela vison*)	W77, W87, W97, X07
Brown rat (*Rattus norvegicus*)	W77, W87, W97, X07
Canada goose (*Branta canadensis*)	W77, W87, W97, X07
Common cordgrass (*Spartina anglica*)	W77, X07
Fallopia japonica x sachalinensis = F. x bohemica	W77, W87
Fallow deer (*Dama dama*)	W77, W87, W97, X07
Giant hogweed (*Heracleum mantegazzianum*)	W77
Giant knotweed (*Fallopia sachalinensis*)	W77
Giant-rhubarb (*Gunnera tinctoria*)	W77
Greylag goose (*Anser anser*) [feral populations]	W77, W97, X07
Harlequin ladybird (*Harmonia axyridis*)	W77, W87, X07
Himalayan knotweed (*Persicaria wallichii*)	W77
Indian balsam *(Impatiens glandulifera*)	W77, W87, X07
Japanese knotweed (*Fallopia japonica*)	W77, W87, W97, X07
Nuttall's Waterweed (*Elodea nuttallii*)	W87
Parrot's-feather (*Myriophyllum aquaticum*)	W77
Rhododendron ponticum	W77, W87, W97, X07
Ruddy duck (*Oxyura jamaicensis*)	W77, W87, W97
Sika deer (*Cervus nippon*)	W77, W87, W97
Three-cornered garlic (*Allium triquetrum*)	W77, W87, W97, X07
Water fern (*Azolla filiculoides*)	W97, X07 W77

The presence of invasive species within the proposed development boundary is discussed below in Section 8.4.3.9.

8.4.3 Field Survey Results

8.4.3.1 Habitat Surveys

The majority of the cable route lies within the existing roadways and improved agricultural grassland. A high-level description of the different sections of the proposed development and the habitats encountered therein is provided below in Table 8.15. Habitat classification codes are provided with reference to level 3 under Fossit (2000).

Habitat maps for the proposed development are presented in Appendix 8.3.

A brief description of the habitats encountered by the proposed development is provided overleaf, along with an assessment of the ecological value of each and identification of any SERs.

Table 8.15: Habitat types within the Footprint of the Works

Location	Habitats[114] Within Footprint of the Proposed Development.
Knockraha Substation	• To the west of the substation the laydown area is located within existing hard standing (BL3) and **scrub** (WS1). • To the east of the existing substation (BL3), the footprint of the substation is within improved and managed agricultural grassland (GA1), and **hedgerow** habitat (WL1).
AC01-AC02	• Cable route is entirely within the road (BL3). • Passing bay footprint is within improved agricultural grassland (GA1) and **hedgerow** habitat (WL1).
AC02-AC03	• Cable route leaves the existing roadway (BL3), running along the edge of an agricultural grassland field (GA1). The cable route crosses two **treelines** (WL2) and enters into another field containing agricultural grassland (GA1). The route then re-enters the existing roadway.
AC03-AC04	• This long stretch of cable is entirely within the existing roadway (BL3). • Six passing bays are located adjacent to the roadway along this section. The passing bays are all located within improved agricultural grassland (GA1) bordered by **hedgerows** (WL1). • One crossing of a drainage ditch (FW4) is required.
AC04-AC05	• The cable is located entirely within the existing roadway (BL3). • Two passing bays are required along this section of the route. The first is located within agricultural field (GA1) with **treeline** border (WL2). • The second passing bay is located within an area of **hazel dominated woodland** (WN2) which has a stream (FW1) running parallel to the road. • One crossing of a drainage ditch (FW4) is required.
ACO5-AC06	• The cable route is located entirely within the existing roadway (BL3). • Three laydown areas are proposed within agricultural field (GA1) bordered by **hedgerows** (WL1). One laydown area (LDA-AC02) is bordered by a flowing drainage ditch. • Two crossings of drainage ditches (FW4) are required.
AC06-AC07	• The cable route runs within the existing road (BL3) before entering into agricultural grassland (GA1) to the south of the road and crossing the existing railway line (BL3). • A passing bay is located within the agricultural grassland (GA1) to the north of the existing road.
Converter Station Site	• The cable route passes through a bank of **scrub** (WS1) where it enters into the converter station site. • The converter station site is comprised of recolonising bare ground (ED3) transitioning into **calcareous grassland** (GS1), **sparsely vegetated bare ground** (ED2), **scrub** (WS1), and the existing internal roads (ED2). A small wetland feature is also present within the footprint of the converter site. Further details in relation to the wider IDA site in which the converter station site is located, is provided below in Section 8.5.
DC01-DC02	• This long stretch of cable is located predominantly within the existing roadway (BL3). • The cable route exits the converter station through the bank of **scrub** (WS1) and crossing the railway line (BL3) through a field of agricultural grassland (GA1), and into the road.

[114] Sensitive Ecological Receptor (SER) habitats are outlined in **BOLD**

Location	Habitats[114] Within Footprint of the Proposed Development.
	• The cable exits the road and crosses a hedgerow to enter a tillage field (BC3). The cable then crosses the **Owenacurra river** (FW1), a **treeline** (WL2) and enters into a field of agricultural grassland (GA1). • The cable route exits the field through the end of a treeline (WL2) and enters back into the existing road (BL3). • Five passing bays are located along this stretch of cable, all within agricultural grassland (GA1) bordered by **hedgerows** (WL1). • One laydown area is proposed within a field of agricultural grassland (GA1). • Three drainage ditches (FW4) require crossings.
DC02-DC03	• The cable route exits the roadway through a treeline (WL2) and enters into an area of wet grassland (GS4) adjacent to the Owennacurra River (FW1). • The cable exits the wet grassland into an agricultural field (GA1). It then crosses the **Owencurra River** (FW1) which is bordered by two **treelines** (WL2), into an area of amenity grassland (GA2) before crossing an additional **treeline** (WL2) and entering back into the road (BL3). • The cable exits the road again at Gortacrue to facilitate crossing a gas line. The cable enters into a field of agricultural grassland (GA1) crossing a **hedgerow** twice before re-entering the road. • Four passing bays are required along this stretch. All are located within agricultural grassland bordered by **hedgerows** (WL1) and **treelines** (WL2).
DC03-DC04	• The cable route runs along the existing roadway (BL3) before entering into a tillage field (BC3). The route crosses a **treeline** (WL2) into a field of agricultural grassland (GA1). • The cable route then crosses two **treelines** (WL2), the **Dungourney River** (FW1), and scrub (WS1) before it enters into another field of agricultural grassland (GA1). • The cable route then exits back into the road (BL3) through a **hedgerow** (WL1).
DC04-DC05	• This stretch of the cable route is entirely within the existing roadway (BL3). • Four passing bays are required along this stretch of the road. These are all located within fields of agricultural grassland (GA1) bordered by **hedgerows** (WL1) and **treelines** (WL2). • A laydown area is required within an additional area of agricultural grassland (GA1). • One drainage ditch (FW4) requires crossing.
DC05-DC06	• This stretch of the cable is entirely within the northern verge of the N25. • A laydown area is located within a tillage field (BC3). • Two drainage ditches require crossings. • The boundary of the **Loughs Aderry and Ballybutler pNHA** extends into the road.
DC06-DC07	• The cable route crosses a **treeline** (WL2) into a tillage field (BC3). • It then crosses through **two treelines** which border a drainage ditch (FW2), into an agricultural field (GA1), and crosses a series of watercourses (Drainage ditches (FW4) and a **river** (FW2) and treelines (WL2) into agricultural grassland (GA1). • After crossing the Mogeely road (BL3) the route navigates a series of agricultural fields bordered by **treelines** (WL2) and **hedgerows** (WL1) before crossing back into the existing roadway (BL3).
DC07-DC08	• The cable route continues along the Killeagh road (BL3) either within the existing roadway or the verge. • The cable route exits the roadway, crossing a **hedgerow** (WL1) to cross the **Moanlahan river** (FW1) before re-entering the road. • One passing bay is required within a field of agricultural grassland.

Location	Habitats[114] Within Footprint of the Proposed Development.
	• The boundary of **Clarashinka Pong pNHA** extends into the road at this location.
DC08-DC09	• The cable route crosses a **hedgerow** into a field of agricultural grassland (GA1). The cable route then exits the field across a treeline (WL2) and road into a tillage field (BC3). • The cable route then crosses a series of **treelines** (WL2), **hedgerows** (WL1), the **river Dissour** (FW2) (two crossings) and fields of agricultural grassland (GA1) before re-entering the N25 roadway (BL3).
DC09-DC10	• The route continues within the existing road (BL3) entering occasionally into the verge. • At Ballyvergan west the cable route crosses hedgerow (WL1) and enters into agricultural grassland (GA1) to avoid a cattle underpass before re-entering the road. • A laydown area is required at Gortroe cross within a field of Agricultural Grassland (GA1). • One crossing of the **river Dissour**, two crossings of the **womanagh river**, and one crossing of the **east Ballyvergan river** are required.
DC11-DC12	• The route continues within the existing road before crossing into fields of **wet grassland** (GS4), **Scrub** (WS1) and **reed swamp** (FS1) associated with the **Ballyvergan Marsh pNHA.** • The cable re-enters the road (BL3) and until it reaches the landfall site.
Claycastle Landfall	• The landfall site is located within an area of dry meadow (GS2) in mosaic with (degraded) **fixed dune habitat** (CD3) and the car park (BL3), before entering the foreshore.

Scrub (WS1)

Scrub encountered by the cable route was typically either dominated by gorse (*Ulex europeaus*) (Figure 8.10) or willows (*Salix spp.*) (Figure 8.11). Other species typically recorded in association with the scrub included bramble (*Rubus fruticosus*), nettle (*Urticus dioica)*, fireweed (*Chamaenerion angustifolium*), and hogweed (*Heracleum sphondylium*).

Scrub within the footprint of the proposed development were assessed as **Local Importance (Higher Value).** This is due to their provision of local biodiversity, and nesting habitat for birds in the locality.

Figure 8.10: Typical Gorse Dominated Scrub

Source: Mott MacDonald May 2019

Figure 8.11: Typical Willow Dominated Scrub

Source: Mott MacDonald September 2020

Improved Agricultural Grassland (GA1)

The improved agricultural grassland encountered was typically intensively managed with little in terms of diversity (Figure 8.12). Fields encountered were grazed by cattle typically, though some fields contained horses and sheep. Species recorded within the agricultural grassland included perennial rye grass (*Lolium perenne*), broad dock (*Rumex obtusifolius*), nettles (*Urtica dioica*), common mouse ear (*Cerastium fontanum*), red fescue (*Festuca rubra*), and white clover (*Trifolium repens*).

Improved Agricultural Grassland within the footprint of the proposed development were assessed as **Local Importance (lower Value).**

Figure 8.12: Typical Improved Agricultural Grassland

Source: Mott MacDonald October 2020

Tillage fields

Tillage fields encountered had either been harvested, such that there was only stubble remaining, or recently ploughed (Figure 8.13 and Figure 8.14). Crops known to have been within the fields included barley (*Hordeum vulgare*) and beans. There is potential for a Near Threatened, albeit not protected bryophyte Hasselquist's hyssop *Entosthodon fascicularis* to occur in this habitat, as identified in Section 8.4.2.4.

Figure 8.13: Recently Ploughed Field

Source: Mott MacDonald October 2020

Figure 8.14: Stubble Field

Source: Mott MacDonald October 2020

Tillage within the footprint of the proposed development were assessed as **Local Importance (lower Value).**

Hedgerow (WL1)

Hedgerows encountered during field survey were generally highly managed and maintained (Figure 8.15). Hedgerows were often species poor and dominated by hawthorn. Other species typically encountered with the hedgerows were bramble, nettle, hogweed, blackthorn (*Prunus spinosa*), elder (*Sambucus nigra*), sycamore (*Acer pseudoplatanus*), ash (*Fraxinus excelsior*), beech (*Fagus sylvatica*), ivy (*Hedera helix*), cleavers (*Galium aparine*), foxglove (*Digitalis purpurea*), bindweed (*Convolvulus arvensis*), Hart's tongue fern (*Asplenium scolopendrium*), and wych elm (*Ulmus glabra*).

Hedgerows within the footprint of the proposed development were assessed as **Local Importance (Higher Value).** This is due to their provision of local biodiversity, and ecological corridors for animals in the locality. Where mature trees were recorded within the hedgerows, these may also offer roosting habitat for bats, and nesting habitats for birds.

Given the importance of hedgerows in the local environment, hedgerows are assessed as being a **SER.**

Figure 8.15: Typical Hedgerows Encountered

Source: Mott MacDonald October 2020

Treelines (WL2)

Treelines (Figure 8.16) ranged in maturity, but species commonly recorded included elder, ash alder (*Alnus glutinosa*), grey willow (*Salix cinerea*) hawthorn, blackthorn, bramble, ivy, foxglove, ferns, cleavers, gorse, lords and ladies (*Arum maculatum*), herb Robert (*Geranium robertianum*), hedge bindweed (*Calystegia sepium*), primrose (*Primula vulgaris*), and lesser celandine (*Ficaria verna*).

Treelines within the footprint of the proposed development were assessed as **Local Importance (Higher Value).** This is due to the provision of local biodiversity, their potential as habitat for nesting birds and roosting bats, and ecological corridors for animals in the locality.

Given the importance of treelines in the local environment, treelines are assessed as being a **SER.** Typical Treelines Encountered

Figure 8.16: Typical Treelines Encountered

Source: Mott MacDonald 2020

Wet Grassland (GS4)

A section of wet grassland was recorded along the edge of an improved agricultural grassland field adjacent to the East cork Gold Club.

Species recorded within the wet grassland included meadow sweet (*Filipendula ulmaria*), soft rush (*Juncus effusus*), Yorkshire fog, creeping bent, silverweed (*Potentilla anserina*), gorse, angelica (*Angelica sylvestris*), rosebay willowherb (*Chamaenerion angustifolium*), creeping buttercup, and nettle. The sward was rankly overgrown and was becoming overgrown with brambles in multiple places (Figure 8.17).

Wet grassland is a common habitat in Ireland and on this basis is assessed as **Local Importance (Lower Value).**

Figure 8.17: Wet Grassland

Source: Mott MacDonald 2020

Oak-Ash-Hazel Woodland (WN2)

A strip of heavily hazel (*Corylus avellane*) dominated woodland was recorded in the townland of Longstown (Figure 8.18). Other species recorded within the woodland included elder, bramble, alder, ash, ivy, beech, male fern (*Dryopteris filix-mas*), and hart's tongue fern. A stream ran through the woodland at the base of the slope down from the road.

Hazel woodland is limited in extent in Ireland. While it is not an annexed habitat it is of conservation importance. The woodland comprises a semi-natural habitat type which is uncommon within the county. It is, therefore, assessed as being of **County Importance.** Given the importance of this type of woodland in Ireland, it is identified as a **SER.**

Figure 8.18: Hazel Woodland Recorded Within the Proposed Development

Source: Mott MacDonald December 2020

Reed Swamp (FS1)

The reed swamp at Ballyvergan Marsh was heavily dominated by common reed (*Phragmites australis*) (Figure 8.19). Other species recorded in the habitat included bindweed, willow, fireweed, flag iris (*Iris pseudacorus*) and nettle.

The reed swamp is designated under the proposed Natural Heritage Area Ballyvergan Marsh. It provides habitat for nesting reed warblers and likely provides habitat for frogs and newts in the vicinity. As such, it is assessed as being of **National Importance**.

Figure 8.19: Reed Swamp at Ballyvergan Marsh

Source: Mott McDonald September 2020

Fixed Dune Habitat (CD3)

A small area of fixed dune habitat was recorded behind the Claycastle beach carpark. Species recorded within the habitat included red fescue (*Festuca rubra*), marram grass (*Ammophila arenaria*), bird's-foot trefoil (*Lotus corniculatus*), kidney vetch (*Anthyllis vulneraria*), ribwort plantain (*Plantago lanceolata*), ragwort (*Jacobaea vulgaris*), yarrow (*Achillea millefolium*), lady's bedstraw (*Galium verum*), gorse, creeping buttercup (*Ranunculus repens*), bramble (*Rubus fruticosus*), creeping bent grass (*Agrostis stolonifera*), hogweed, foxglove, cock's foot grass (*Dactylis glomerata*), creeping cinquefoil (*Potentilla reptans*). Bare sand was recorded in places.

The area of dune habitat at Claycastle overall was localised and restricted in that it is bordered by hardstanding to the east and south, the mobile home park to the north and a substantial drainage ditch to the west. Much of the habitat exhibited signs of disturbance with desire lines running throughout. The area is heavily trafficked with people walking through the habitat from the mobile home park where there is a gate that opens out into it. A section of the dune habitat has been managed as an amenity area with picnic benches and a very low sward. Cars regularly make use of this area to park next to the benches (Figure 8.20).

Within the sand dune habitat, a higher quality of habitat was recorded to the north and west. These areas had a higher sward but contained a greater variety of species including marram grass which was rare in the vicinity of the proposed development. (Figure 8.21). The footprint of the works within this habitat do not extend into this higher quality habitat. It is noted also that the habitat within the footprint of the proposed development is not consistent with the priority listed

Annex 1 sand dune habitats; '*fixed coastal dunes with herbaceous vegetation ("grey dunes") (2130)' or '*decalcified fixed dunes with *Empetrum nigrum* (2140)' or '*Atlantic decalcified fixed dunes (*Calluno-Ulicetea*) (2150)' or the Annex 1 listed sand dune habitat; dunes with *Salix repens* ssp. argentea (*Salicion arenariae*) (2170).

It is of note that populations of wild clary are known to occur within the higher quality dune habitat at Claycastle. This is discussed further in Section 8.4.3.2.

Figure 8.20: Amenity Area Within the Dune Habitat within proposed works area

Source: Mott MacDonald November 2020

Figure 8.21: Less Disturbed Dune Habitat outside works area

Source: Mott MacDonald November 2020

Given the rarity of Fixed Dune Habitats and noted plant species assemblage as detailed above the sand dune habitat is assessed as being of **County Importance** and is a **SER**.

Botanical Surveys Within Converter Station Site

Specialist botanical surveys were undertaken within the wider IDA site which includes the converter station site. The full report is provided in Appendix 8.4. An initial habitat survey of the wider site was carried out. A summary of the findings in relation to the footprint of the converter station site is provided hereunder in Table 8.16.

The wider site beyond the proposed Converter Station footprint contains habitats including a mosaic of wet grassland, marsh and willow scrub. These wet areas within the wider Ballyadam/IDA site may be associated with the historic wetland habitats known to have been within the IDA owned site prior to earthworks taking place. A habitat map of the wider Ballyadam/IDA site is provided in Appendix 8.3.

A small area of ponding was also recorded on the southern edge of the proposed Converter Station site. This habitat does not closely match the Fossit habitat categories and is described as Wet grassland (GS4) / Other artificial ponds and lakes (FL8). The feature is very localized (c. 150m^2), relatively species-poor, and lacks any vascular or bryophyte species indicative of base-rich conditions (Figure 8.22). The feature has been partially infilled by imported stone.

The habitat was dominated by rushes jointed rush (*Juncus articulates*), and dense carpets of (*Calligeron cuspidatum*). Stunted forms of common spike-rush (*Eleocharis palustris*) were abundant. Another bryophyte (*Bryum* sp.) occurred occasionally. Marsh speedwell (*Veronica scutellata*) was the only other species recorded.

Figure 8.22: Wet grassland / Pond Feature

Source: EirGrid 2020

The species within the ponded area indicate that there is some level of inundation throughout the year. Given the topography of the location (as outlined in section 8.5.2.1) and absence of base-rich bryophytes or vascular plants, it is evident that this habitat is not reliant on groundwater inundation. Rather it is likely that surface water run-off ponds in the area regularly.

Further, two depressions within the site currently drain natural surface water run-off within the site, but drain freely, and do not contain vegetation indicative of permanently wet conditions.

Table 8.16: Summary of Habitat Survey Results Within Ballyadam/IDA Site

Habitat Type Recorded	Description	Importance
Recolonizing bare ground (ED3) transitioning to calcareous and neutral grassland (GS1)	In the eastern half of the wider ballyadam/IDA site recolonizing bare ground is the dominant habitat. The cover of bare stone/soil is variable (average 27%). The vegetation, which contains a number of calcareous grassland indicator species, is dominated by varying mixtures of bird's-foot trefoil (*Lotus corniculatus*), knapweed (*Centaurea nigra*) and ladies bedstraw (*Galium verum*). Other frequent species include red fescue (*Festuca rubra*), ribwort plantain (*Plantago lanceolata*), Yorkshire fog (*Holcus lanatus*), yarrow (*Achillea millefolium*) and yellow-wort (*Blackstonia perfoliata*). Bee orchid (*Ophrys apifera*) is occasional throughout the vegetation. Other uncommon species in the vegetation include hoary plantain (*Plantago media*), greater knapweed (*Centaurea scabiosa*) (seven flowering plants recorded within the proposed converter station site), dropwort (*Filipendula vulgaris*) and viper's bugloss (*Echium vulgare*). It is of note that **a very small area (one quadrat in an area of 2000m^2) of the calcareous grassland has been found to qualify as Annex I level habitat.** This is discussed further below.	As the developing calcareous flora within the Recolonising bare ground habitat is presently of ecological interest due to the presence of rare and scarce plant species, it is rated as **Local Importance (higher value)**. An area of calcareous grassland (ca 2000m^2) which qualifies as Annex I level habitat is rated as being of **County Importance.** The area of calcareous grassland, and the greater knapweed are identified as **SERs**.
Sparsely vegetated bare ground (ED2)	A significant proportion of the northern half of the survey area is dominated by coarse limestone aggregate with a very sparse, species-poor vegetation cover, generally less than 50%. The main species in the sparse vegetation are common knapweed, bird's-foot trefoil and Ox-eye daisy (*Leucanthemum vulgare*), with occasional low Willow shrubs.	**Local Importance (lower value)**.
Scrub (WS1)	Scrub is a frequent habitat within the wider Ballyadam/IDA site. Common gorse (*Ulex europaeus*) and grey willow (*Salix cinerea oleifolia*) are the main species, with frequent briar (*Rubus fruticosus agg*.). In the western half of the site the habitat has developed recently on areas of exposed limestone rock/gravel. A wide band of scrub dominated by briar, with frequent common nettle (*Urtica dioica*) and hedge bedstraw (*Galium mullugo*), occurs on embankments bordering the railway to the north, and along the eastern margins of the survey area. Scrub is a common habitat which has a widespread distribution throughout Ireland.	**Local Importance (Higher value)**.
Wet grassland (GS4)	Small areas of rank species poor wet grassland occur on areas of firm, damp soil in the mid sector of the wider Ballyadam/IDA site. The main species in the vegetation are typically soft rush, Yorkshire fog, silverweed (*Potentilla anserina*), red fescue (*Festuca rubra*), oval sedge (*Carex leporina*), creeping bent (*Agrostis stolonifera*), marsh bird's-foot trefoil (*Lotus pedunculatus*), meadow buttercup (*Ranunculus acris*) and the moss *Calliergonella cuspdidata*. On the day of survey the soil conditions were dry however it is likely that this area experiences flooding during times of heavy rainfall. Wet grassland is a common habitat throughout Ireland.	**Local Importance (lower value)**.

As outlined previously a total of ten quadrats were described in areas of recolonizing vegetation with some presence of calcareous indicator species. The results of the assessment is summarised hereunder.

The analysis shows that nine of the ten recorded quadrats failed the assessment for Annex I habitat 6210, with the exception of quadrat 14 which passed. Many of the quadrats failed the assessment as they contained low numbers of either positive indicator species and/or high quality indicator species. The high cover of bare stone/soil in many of the quadrats was also notable.

The report notes that the reason for failure of the majority of the revegetating areas to qualify as Annex 6210 habitat partly reflects the very recent origin of the vegetation here, having developed on a stony substrate which arose as a result of site preparatory works that were abandoned in 2007. While a notable population of ophrys apifera (bee orchid) occurs, it was the only orchid species recorded and the site could hardly be considered 'orchid-rich'. bee orchid is a widespread but locally distributed species in Ireland[115]. It is listed as Least Concern in the Irish Red List[52]. Curtis and Thompson[116] note that bee orchid grows on railway and road embankments, eskers and quarries where light disturbance encourages it to act like a colonist. At Ballyadam, it is obviously a recent colonist as a result of soil movement works in the recent past on the site.

A further occurrence of some note is the presence of greater knapweed. Parnell and Curtis[115] describe its habitat and distribution in Ireland as *"Dry banks and pastures on calcareous soils; frequent, although local, in south and centre, rare elsewhere."* The Irish Red List[52] lists greater knapweed as Near Threatened due to a decline in area of occupancy. Dropwort is another species of interest which occurs sparingly at this site. On the basis that the species has never been recorded in Ireland outside of the Burren and east Galway it is strongly suspected that it is a recent introduction to Ballyadam. It is listed as Least Concern in the Irish Red List[52].

In summary, there are a number of different Sensitive Ecological Receptors within the proposed Converter Station Site. These are:

- While most of the grassland habitat within the site is not consistent with and Annex 1 habitat a localized area (c. 2000 m^2) was found to be consistent with priority Annex 1 habitat (6210*): Semi-natural dry grasslands and scrubland facies on calcareous substrates. An appropriate suite of indicator species includes occasional bee orchids. This SER is valued at **County Importance.** This evaluation takes into account the small scale of the area surrounded by non-Annex 1 habitat, priority status of the habitat at European level, the bad status of the habitat nationally (NPWS, 2013[117]), and the 'special conservation importance' of calcareous grassland in the Cork County BAP.
- Significant areas of Recolonizing bare ground (ED3) transitioning to calcareous and neutral grassland (GS1) (c. 0.091km^2). This SER is valued at **Local Importance (Higher Value)**, given the presence of bee orchids, because the habitat is likely to be declining nationally, and because of the 'special conservation importance' of calcareous grassland in the Cork County BAP.
- A localized wetland feature (GS4/FL8) of **Local Importance (Higher Value).**

[115] Parnell, J., Curtis, T. (2012) Webb's An Irish Flora (8th Edition) Cork University Press, 2012. 560 pp. Hardback. ISBN 978‐185918‐478‐3.

[116] Curtis TG, Thompson R. orchids of Ireland. National Museums Northern Ireland; 2009.

[117] NPWS (2013). The Status of EU Protected Habitats and Species in Ireland. Conservation Status in Ireland of Habitats and Species listed on the European Council Directive on the Conservation of Habitats, Flora and Fauna 92/43/EEC.

The importance of notable plant species recorded within Ballyadam is presented below in 8.4.3.2.

8.4.3.2 Rare and Protected Flora

A total of eleven rare and protected flora species were identified in the desktop study as having been recorded in the vicinity of the proposed development in the last 50 years. Given restrictions on access and limitations in terms of seasonality of survey there is potential for these species to occur within the ZoI for the proposed development. Table 8.17 outlines the potential for these species to occur within ZoI for the development.

Further to these species, two distinct populations (total seven flowering stems in September 2020) of greater knapweed *Centaurea scabiosa.* These populations are valued at **County Importance** given they are listed on the most recent (2019) Irish Red Data List[118] as Near Threatened.

Table 8.17: Potential for Flora of Note to Occur Within the Footprint of the Proposed Development

Species Name	Protection under FPO	Conservation Status	Habitat Requirements ([119], [120], [121])	Potential for Occurrence Within the Proposed Development
Chives (*Allium schoenoprasum*) (Protected)	Protected	Vulnerable	Usually on thin soils over limestone, serpentine and basic igneous rocks; it sometimes grows in rank grass on deeper soils, and in crevices of riverside bedrock.	This species was not recorded during the detailed assessments of the proposed Converter Station site and no records occur in the area. Given the nature and scale of the proposed works largely within existing roads this species is considered unlikely to occur within the works area.
Little-robin (*Geranium purpureum*)	-	Near Threatened	In stony or rocky places near the sea, on sheltered cliffs, disused railway lines, and by roads and fields	This species was not recorded during the field surveys. It has not been recorded to date in the area) Given the nature and scale of the proposed works largely within existing roads this species is considered unlikely to occur within the works area.
Common extinguisher-moss (*Encalypta vulgaris*)	-	Near Threatened	Base-rich substrates in the lowlands, including soil-capped	This species was not recorded during the detailed assessments of the proposed Converter Station site.

[118] Nelson, B., Cummins, S., Fay, L., Jeffrey, R., Kelly, S., Kingston, N., Lockhart, N., Marnell, F., Tierney, D. and Wyse Jackson, M. (2019) Checklists of protected and threatened species in Ireland. Irish Wildlife Manuals, No. 116. National Parks and Wildlife Service, Department of Culture, Heritage and the Gaeltacht, Ireland.

[119] Online Atlas of the British and Irish flora; https://www.brc.ac.uk/plantatlas/

[120] Atherton, I., Bosanquet, S., Lawley, M. (eds) (2010). Mosses and Liverworts of Britain and Ireland. A field Guide, British Bryological Society.Latimer Trend & Co. Ltd: Plymouth.

[121] Watson, E. (1968). British Mosses and Liverworts, second edition. Cambridge University Press.

Species Name	Protection under FPO	Conservation Status	Habitat Requirements ([119], [120], [121])	Potential for Occurrence Within the Proposed Development
			ledges, and crevices in stone walls	No other areas of suitable habitat are identified within the proposed development.
Hasselquist's hyssop (*Entosthodon fascicularis*)	-	Near Threatened	Arable fields and other recently disturbed soil; can be abundant in cereal stubble. Occasionally present on thin soil overlying limestone. NPWS record for the species notes that the location is Great Island.	This species was not recorded during the field surveys. Given the nature and scale of the proposed works largely within existing roads this species is considered unlikely to be affected by the proposed works.
Holt's pouncewort (*Lejeunea holtii*)	-	Near Threatened	Rare plant of southwest Ireland, typically at higher altitudes.	This species was not recorded during the field surveys. The proposed development is not located at higher altitudes. Therefore, there are no habitats within the ZoI which meet the habitat requirements for the species.
Lesser striated Feather-moss (*Eurhynchium striatulum*)	-	Near Threatened	Calcareous rocks, and stonewalls; also rarely on tree roots	This species was not recorded during the field surveys. It has not been recorded to date in the area. Given the nature and scale of the proposed works largely within existing roads this species is considered unlikely to be affected by the proposed works.
Orange foxtail (*Alopecurus aequalis*) (protected)	Protected	Near Threatened	Most frequent on drying mud but found in a wide variety of habitats associated with freshwater, including the margins of ponds, ditches, reservoirs, turloughs and flooded gravel-pits. It has also recently been found as a	Records of orange foxtail are known to be associated with nearby pNHA wetland habitats. This species was not recorded during field surveys. However, the species can be associated with habitat features which are recorded within the ZoI for the development. In addition, the timing and access restrictions are such that there is potential that the species may

Species Name	Protection under FPO	Conservation Status	Habitat Requirements ([119], [120], [121])	Potential for Occurrence Within the Proposed Development
			weed in aquatic garden centres. This records for this species as supplied by NPWS are known to occur within the nearby Ballyquirk pond, Clarashink pond pNHA, Lough Aderry and Ballybutler pNHA.	be affected by the proposed works. Given that orange foxtail is listed under the Flora Protection Order (2015) it is carried forward as an SER and valued at National Importance
Penny royal (*Mentha pulegium*) (protected)	Protected	Near Threatened	Seasonally inundated grassland overlying silt and clay. Habitats also include damp heathy pastures, lake shores and coastal grassland. Lowland. Record is noted to be associated with Ballyquillan Railway crossing.	Coastal grassland is present at the Landfall Location. This species was not recorded during the field surveys. It has been recorded in the past in the area (Source: Botanical Society of Britain and Ireland[122]). Given seasonal constraints associated with the surveys carried out its presence is possible. Given that pennyroyal is listed under the Flora Protection Order (2015) it is carried forward as an SER and valued at National Importance
Tall Aloe-moss (*Aloina ambigua*)	-	Endangered	Lowland species on thin lime-rich soils; rock ledges, exposed banks, quarries, sand pits; rare in mortar on walls	This species was not recorded during the detailed assessments of the proposed Converter Station site. No other areas of suitable habitat are likely within the proposed development. Given the nature and scale of the proposed works largely within existing roads this species is considered unlikely to be affected by the proposed works.
Tufted feather-moss (*Scleropodium cespitans*)	-	Near threatened	Lowland streams and rivers, on roots of trees and on rocks, boulders, silt; also on tarmac	This species was not recorded during surveys. It has been recorded in the area. Given the suitability of localised river habitats within the development for this

[122] https://bsbi.org/maps

Species Name	Protection under FPO	Conservation Status	Habitat Requirements (119, 120, 121)	Potential for Occurrence Within the Proposed Development
				species, its presence is possible. This species is carried forward as an SER and valued at County Importance.
Wild clary (*Salvia verbenaca*)	-	Least Concern	Open grassland on sunny banks, sand dunes and roadsides; usually on well-drained, base-rich soils, including sticky calcareous clays	This species has been recorded within the sand-dune habitat immediately to the west of the land-fall location. This species is carried forward as an SER and valued at Local Importance (Higher value)

8.4.3.3 Mammal Surveys

Badger Survey

Badger activity was recorded throughout the proposed development lands during the field walkovers. Signs recorded included:

- Badger latrines (Figure 8.23);
- Well established mammal trails;
- Badger tracks (Figure 8.24);
- Badger fur on barbed wire; and,
- A dead badger.

Three badger setts were recorded during the walkover surveys along the proposed HVDC route, the locations are presented in a confidential Appendix 8.5 due to badger persecution risk. There were no setts within the proposed Converter Station site. Details in relation to these are provided below.

Sett 1

This sett was located within a field boundary adjacent to agricultural grassland, a stream and bordered by scrub, and the East Cork golf course. This location is within the planning boundary of the development approximately 10m from the cable route. While mammal trails were recorded in the vicinity, the sett itself looked to be inactive as there were no signs of fresh movement into the entrance. Spoil to the front of the entrance was limited. A single entrance (Figure 8.25) was recorded.

Sett 2

This sett was located within a field boundary adjacent to tillage fields along an offline route where the cable cannot be facilitated within the road. The sett had one entrance (Figure 8.26). Two latrines with fresh scatt were recorded directly adjacent to the sett entrance. A dead badger, likely struck by a vehicle, was found on a nearby field boundary. Numerous mammal paths were recorded nearby, with fresh badger tracks recorded throughout. A small amount of fresh spoil was present at the entrance. Given the levels of activity in the area and the tracks and fresh scat in proximity to the entrance this sett is considered occupied.

Sett 3

This sett was located on the edge of agricultural grassland on a bank within wet woodland approximately 200m outside of the red line boundary. Two openings to the sett were recorded (Figure 8.27 and Figure 8.28). A large amount of spoil was present surrounding one of the entrances with straw type bedding pulled out. One latrine was recorded in proximity to the main entrance with a single scat therein. The paths to the sett entrances were well worn and there were signs of badger foraging activity nearby. This sett was active during the first site visit, however when the sett was revisited there were no signs of recent activity at the sett. Given the limited number of entrances it is unlikely to be a main sett.

Figure 8.23: Badger Latrine

Source: Mott MacDonald October 2020

Figure 8.24: Badger Prints

Source: Mott MacDonald October 2020

Figure 8.25: Sett 1

Source: Mott MacDonald October 2020

Figure 8.26: Sett 2

Source: Mott MacDonald October 2020

Figure 8.27: Sett 3

Source: Mott MacDonald October 2020

Figure 8.28: Sett 3 Second Entrance

Source: Mott MacDonald October 2020

The levels of activities surrounding sett 2 (fresh tracks and droppings near the sett entrance) were such that an assumption of activity within the sett could be made. The single entrance indicates that this sett is an occupied outlier sett. The levels of activity in the area indicate that additional setts are likely, however, no further setts were identified during the walkovers in accessible areas.

Activity levels were unclear at sett 1 given the lack of badger signs in the vicinity. Sett 3 showed signs of activity initially in terms of fresh latrines, and bedding pulled out from the setts but upon revisiting the sett it appeared to be inactive.

Camera traps were placed at outlier sett 1 and the two entrances of sett 3. Cameras were placed for a period of two weeks from the 16 November 2020 to 4 December 2020. A single badger was recorded entering sett 1 (Figure 8.29 and Figure 8.30).

Figure 8.29: Badger at sett 1

Source: Mott MacDonald December 2020

Figure 8.30: Badger entering sett 1

Source: Mott MacDonald 2020

Images of the badger at sett 1 were only recorded on the 2 December 2020. No images recorded of the badger leaving the sett. Given the low level of activity at the sett, the single entrance and the lack of obvious paths connecting the sett to a secondary sett, it is considered that sett 1 is likely an active outlier sett. However, given the timing of the footage, there is also potential that this sett is an active breeding sett.

While no badger activity was recorded at sett 3, the sett was clearly in use at least on occasion. Given the number of entrances and the lack of other setts recorded in the vicinity, it is considered that sett 3 is likely an outlier sett that is active at least intermittently.

Badger breeding or resting sites are protected from wilful disturbance under the Wildlife Act 1976 (as amended). Three active badger setts have been recorded during site walkovers, with a significant amount of activity recorded in the area. One of these, Sett 1, is located potentially within the zone of influence of the proposed cable route works area. There may also be additional setts in the vicinity of the development, in areas which have yet to be surveyed due to access restrictions on third party lands. As such badger are assigned **Local Importance (Higher Value)** and identified as a **SER.**

Bat Surveys

The majority of the proposed development falls within habitats that do not support features with potential as bat roosts, i.e. the existing roadways and agricultural fields. There is potential, however for bat roosts to be present within treelines and hedgerows that are to be affected by the works.

Trees identified with potential roost features which may support bat roosts were recorded at:

- DC01-DC02: Large mature treelines adjacent to the road were recorded with potential roost features recorded at the Owennacurra river crossing at Ballydesmond with Moderate potential.
- DC03-DC04: Large mature treelines adjacent to the road at West Park with Moderate potential
- DC06-DC07B: Significant number of large mature trees within the treelines bordering the Kiltha river with High potential

A small building is present on the proposed Converter Station site (Figure 8.31) and is proposed for demolition. Based on an external view it is note that it has no roof space and is well sealed (no cracks or gaps evident) and hence unlikely to be used by bats as a roost site. No evidence of bat was noted on the external walls e.g. bat faeces etc. This building is therefore assessed as likely to be of low potential as a bat roost feature, but given possibility as a bat roost, it is identified as an SER.

Figure 8.31: Building at the Proposed Converter Station Site

Source: Mott MacDonald 2021

Bridges

Where access was available bridges were also assessed for suitability to support bats. Where culverts were small and low to the ground (see for example crossing of the Butlerstown river along AC02 and AC03 in Figure 8.32) these were not assessed further as these did not contain potential for bat roosts within.

Figure 8.32: Crossing over Butlerstown River

Source: Mott MacDonald 2020

The bridge crossing of the Owennacurra river (located along DC01 to DC02) is a single arch masonary bridge (Figure 8.33). The joints between the stones were sealed such that there were no suitable crevices observed for roosting bats to utilise. The value of the bridge for roosting bats is negligible. The crossing at this location is proposed to be via HDD and as such there will be no interference with this bridge.

Figure 8.33: Crossing over Owennacurra

Source: Mott MacDonald 2020

The bridge crossing of the Dungourney river (located along DC02 to DC04) is comprised of a concrete span with stone abutments and piers (Figure 8.34). The joints between the stones were sealed such that there were no suitable crevices observed for roosting bats to utilise. This does not offer suitable features in which roosting bats could occur. The value of the bridge for roosting bats is assessed as negligible. The proposed cable route will not interfere with the bridge and will cross the river to the west of the bridge.

Figure 8.34: Crossing over Dungourney

Source: Mott MacDonald 2020

A bridge crossing over the Womanagh (DC08-DC09) was comprised of steel (Figure 8.35). This did not offer suitable features in which roosting bats could occur. The value of the bridge for roosting bats is assessed as negligible. The proposed cable route will not interfere with the bridge and will cross the river to the north of the bridge.

Figure 8.35: Bridge crossing over Womanagh River

Source: Mott MacDonald 2020

The second bridge crossing over the Womanagh (DC09-DC10) was comprised of smooth concrete (Figure 8.36). This did not offer suitable features in which roosting bats could occur. The value of the bridge for roosting bats is assessed as negligible. The proposed cable route will not interfere with the bridge and will cross the river to the north of the bridge.

Figure 8.36: Second Bridge crossing over Womanagh River

Source: Mott MacDonald 2020

A cattle underpass was also encountered at DC09 and DC10 (Figure 8.37). This underpass was constructed of smooth concrete and did not contain features suitable for roosting bats. The value of the underpass is assessed as negligible.

Figure 8.37: Cattle Underpass

Source: Mott MacDonald 2020

Potential bat roost tree features and the building outlined are assessed as being of **Local Importance (Higher Value)** and are **SERs**.

There is also potential for bats to make use of treelines and hedgerows within the proposed development footprint as foraging or commuting routes. Treelines and hedgerows are evaluated as SER under habitats in Section 8.1.4.1.

Otter Survey

Otter signs were recorded during the aquatic surveys of watercourses affected by the proposed development. The following summarises the findings in relation to otter:

- A regular otter sprainting site was recorded on the Glenathonocash River beneath the bridge.
- No signs of otter were recorded on the Elfordstown Stream and the Dungourney river. However, it is noted that for both watercourses, suitability is high.
- No signs of otter were recorded on the Owenacurra river or at Lough Aderry, however, Otter are well known to make use of the areas (Triturus pers obs., NBDC data) and suitability is high.

Additionally, during the trail cameras placed during the survey of sett 3 a single otter was recorded passing the camera (Figure 8.38). The location is close to the Killtha river, north of an area that has historic records of otter.

Figure 8.38: Otter Recorded Close to Kiltha River

Source: Mott MacDonald 2020

No holts were identified in accessible lands, but there is possibility for undiscovered holts to be present on inaccessible third party lands (which will be addressed under mitigation in 8.7.1).

Otter are protected under Annex II and Annex IV of the EU Habitat's Directive, along with the Irish Wildlife Acts 1976-2011. Given that otter breeding and resting sites are strictly protected, they are assigned **County Importance** based on potential for a maximum of 1% of the county population of otter to include territories within river systems crossed by the project including potential for rivers crossed to be included within territories of otters which use the River Blackwater where they are a qualifying interest. While disturbance of a breeding site is unlikely, they are identified as a **SER.** Foraging and commuting otter are also considered as SER.

Other Protected Mammal Species

While no red squirrels were recorded during surveys, the hazel woodland described in section 8.3.3.1 was identified as suitable habitat for the species and there are records of squirrels in the area. As such, red squirrel is presumed to feed, and potentially breed within this habitat (although no dreys were recorded). The species is protected under the Wildlife Acts, and is Least concern in the Irish Red List (Marnell et al., 2019).

Pygmy shrew was not recorded during surveys, but field signs of this species are much less conspicuous than for larger mammals. Pygmy shrew nests in long grasses in dense vegetation (including damp conditions) or under rocks or logs, occurring wherever adequate insect food supplies exist. This species breeds from April to October. Given the minimum territory size of 200 m^2 (Hayden and Harrington, 2001[123]) and the abundance of rank grassland available, it is considered likely there may be numerous territories within the proposed development site.

[123] Haydyn, T. and Harrington, R. (2001) Exploring Irish Mammals. Town House, Dublin.

There are no known national or county population estimates for the species in Ireland as it is common and widespread and assigned a conservation status of Least Concern (Marnell *et al.*, 2019).

Neither hedgehog nor stoat were recorded during surveys, but similarly to pygmy shrew, field signs of these elusive species are much less conspicuous than for larger mammals. The breeding and resting sites of both hedgehog and stoat are protected under the Wildlife Act 1976 (as amended). Hedgehogs are presumed to breed and/or hibernate within grassland and scrub/woodland within the ZoI of the proposed development. Hedgehog breeding is from May to October (Hayden and Harrington, 2001). There may be numerous hedgehog territories within the ZoI of the Proposed Development site.

There is some limited rocky scrub habitat for stoat on the margins of the Proposed Development site (Hayden and Harrington, 2001). Radio-tracking of stoat in Ireland (Sleeman, 1987[124]) showed they regularly occupied holes dug by brown rat *Rattus norvegicus* and rabbit *Oryctolagus cuniculus*, and often occupied numerous different holes within a territory. On the basis of this evidence, it is considered that detection of stoat breeding or resting sites is unlikely without use of radio-tracking. No field signs were recorded, but stoat droppings and feeding signs are rarely recorded. In the absence of evidence to the contrary, one or more breeding or resting site(s) is presumed present in rat or rabbit holes within the zone of influence of the proposed development, but their locations cannot be determined.

Hedgehog, stoat, and pygmy shrew are assumed to be widespread throughout the area, and are all of Least Concern (Marnell et al., 2019). All these species are assessed as being of **Local Importance (Higher Value).**

Invasive Mammal Species

Mink (*Mustela vision* was recorded on trail cameras. A single dead greater white-toothed shrew *Crocidura russula* was recorded within the footprint of temporary works at Claycastle beach. Both are Schedule 3 listed invasive species under the Regulations[125]. Both species are likely to breed within the ZoI of the proposed development site, although the specific breeding sites are not known, and are difficult to locate. Invasive species, whilst SERs, are not assigned an ecological value.

Other Mammal Species (Unprotected)

During the site walkovers evidence of rabbit, and fox were recorded. The trail cameras also recorded fox (*Vulpes vulpes*), rabbit (*Oryctoloagus europaeus*), brown rat (*Rattus norvegicus*) and wood mouse (*Apodemus sylvaticus*). None of these are protected species, none are priority species in the County Cork BAP, and all are of Least Concern in the Irish Red List (Marnell et al., 2019). As such, all are assessed as being of Local importance (lower value).

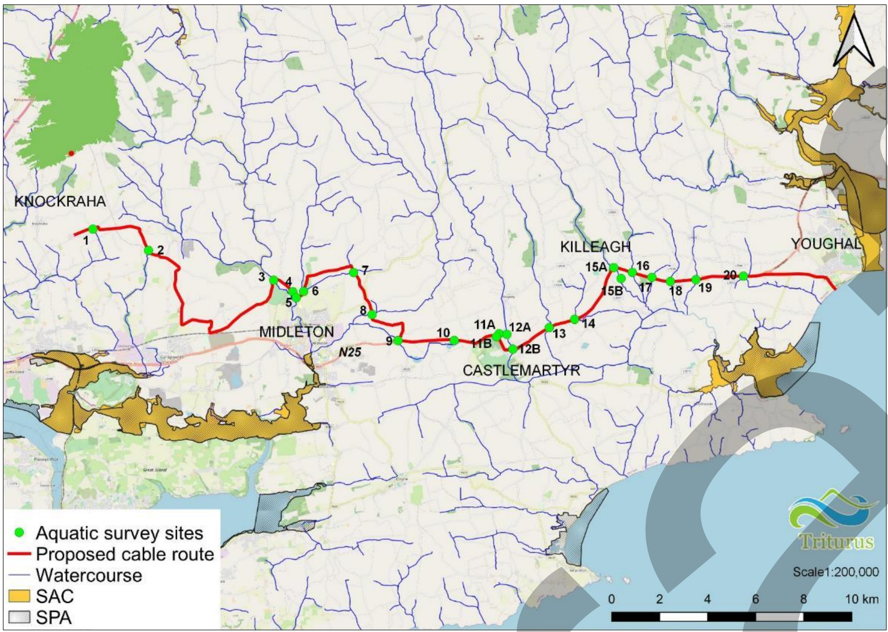
8.4.3.4 Aquatic Ecology Survey

Specialist aquatic surveys were undertaken of waterbodies within and downstream of the Proposed Development footprint. A description of the various watercourses is provided in Table 8.18. The locations of the site numbers referenced within the table in relation to the proposed development are provided in Figure 8.39.

[124] Sleeman, D. P. (1987). The ecology of the Irish stoat. PhD Thesis, University College Cork. Available online at https://cora.ucc.ie/bitstream/handle/10468/1824/SleemanDP_PhD1987.pdf?sequence=1 Accessed February 2018.

[125] European Communities (Birds and Natura Habitats) Regulations 2011 SI 477 of 2011 (as amended)

Figure 8.39: Aquatic Survey Site Locations (May-June 2020)



Source: Triturus Environmental Ltd, July 2020

Table 8.18: Aquatic Site Descriptions (Triturus Environmental Ltd Aquatic Surveys May and June 2020)

Site no.	Watercourse and EPA code	Location (closest to survey point) and ITM Co-ordinates	Site Description
1	Lisheenroe Stream 19L40	AC02-AC03 (Ballynanelagh) 578881 578327	The proposed HVDC cable route traverses Lisheenroe Stream (EPA code: 19L40) at this location. A small, shallow, lowland depositing watercourse (FW2) flowing through an intensive agricultural landscape (GA1). Upstream of the road crossing, the stream was diverted from its natural course through a residential garden and small ornamental pond/impoundment system. Ornamental planting was prevalent along the channel, with an ornamental hedgerow/embankment along the adjacent roadside. Emanating from the pond system, the channel was 1-1.5m wide and averaged <0.15m deep. The channel featured several small natural falls and was dominated by riffle and shallow glide, with little pool. The channel has been straightened historically and boulder revetment was associated with the garden. Instream macrophytes were limited to marginal growth of fool's watercress (*Apium nodiflorum*), bulrush (*Typha latifolia*) and water starwort (*Callitriche stagnalis*) (all occasional). The stream was heavily silted with 30% fine to medium gravels and frequent small cobble. Sand and silt dominated the substrata upstream of the 1m box culvert. Downstream of the 1m-box culvert (which was passable to fish), the stream flowed through agricultural grassland with a narrow riparian buffer supporting common species such as broad-leaved dock (*Rumex obtusifolious*), common sorrel (*Rumex acetosa*), buttercups (*Ranunculus sp*.), nettle (*Urtica dioica*) and rank grasses. The west (right-hand) bank was bound by a dense hedgerow of hawthorn (*Crataegus monogyna*), bramble (*Rubus fruticosus agg*.), gorse (*Ulex europaeus*) with bracken (*Pteridium aquilinum*), nettle and hogweed (*Heracleum sphondylium*). The channel was invariably <1m in width and riffle-glide series averaged <0.1m deep, with only occasional localised pool habitat to 0.2m. Some semi-natural profile (meanders) existed and heavy tunnelling was present further downstream. The stream was heavily encroached by frequent fool's watercress, watercress (*Nasturtium officinale*) and occasional beds of iris (*Iris psuedacorus*). Instream mosses were limited to very localised water earwort (*Scapania unduluata*). The stream bed comprised 50% cobble, 30% coarse gravels, 5% boulder, 5% medium gravels and 10% silt. The Lisheenroe Stream offered **some locally moderate (at best) value for salmonids** given the shallow nature, evident enrichment and siltation. The site had some **moderate lamprey potential** despite the presence of sub-optimal silts for larvae (often shallow and or compacted). No otter signs were recorded during the site visit. The site offered little potential for otter given the small nature of the stream and moderate (at best) fisheries value. No white-clawed crayfish were recorded during the site visit and suitability was poor given the sandstone geology of the catchment and small nature of the channel. Given the moderate salmonid and European eel value, the aquatic ecological evaluation is of **local importance (higher value).**
2	Tibbotstown Stream 19T25	AC03-AC04 (Ballynakilla) 581185 577435	The HVAC cable will be installed approximately 45m upstream of the uppermost reaches of the Tibbotstown Stream (EPA code: 19T25), approx. 800m upstream of Tibbotstown Reservoir. The stream represented a semi-dry drainage ditch (FW4) at the time of survey, which has been extensively straightened and deepened throughout an agricultural landscape (GA1). Flow was imperceptible at the time of survey and the channel was semi-dry, although water capacity increased moving away from the road crossing, downstream of the meander. The stream sat in a 1-1.5m wide, deep U-shaped channel (1m bank height) and an average depth of <0.1m where water pooling was present. The stream drained a number of pipe culverts associated with the local road (dry at the time of survey).

Site no.	Watercourse and EPA code	Location (closest to survey point) and ITM Co-ordinates	Site Description
			The substrata were dominated by small cobble with small mixed gravel and sand, although silt had accumulated in some areas. Here, brooklime (*Veronica beccabunga*) was locally abundant, with heavy encroachment from terrestrial plants such as nettle, broad-leaved dock and rank grasses elsewhere. The riparian zone was atypical of improved agricultural grassland, being narrow (<2m wide) with low growth of scrubby gorse, bramble, creeping thistle (*Cirsium arvense*), common cleavers and rank grasses. The channel and banks had evidently been cleared of vegetation recently and regrowth was present. In terms of fisheries value, the upper reaches of the stream did not offer any fisheries habitat at the time of survey given the lack of water. It was considered likely that the stream periodically dries up completely at this location. The site offered no potential for white-clawed crayfish or otter. The species is typically excluded from the sandstone Cork River catchments given lower alkalinity (i.e. calcium carbonate) that the species requires for carapace growth. Given the semi-dry nature of the site and general lack of fisheries habitat, the aquatic ecological evaluation of site 2 was of **local importance (lower value).**
3	Owenacurra River 19O03	DC01-DC02 (Curragh) 586379 576188	The Owenacurra River (EPA code: 19O03) at the R626 bridge is a large lowland watercourse (FW2). The river had been historically straightened and boulder revetments were present along both banks. Natural recovery was high, however. The river was 10-12m wide, averaged 0.6-1.2m deep and was dominated by homogenous deep glide habitat (90%) with localised deeper pool areas (1.5m max). The substrata were dominated by cobble (60%) with frequent small boulder (10%) locally. Mixed gravels were present in interstitial spaces and areas of lower flow featured shallow silt accumulations. Overall, levels of siltation were moderate with silt plumes present underfoot. The substrata were compacted which reduced the overall value for spawning salmonids. Downstream of the bridge, the river was flanked by improved agricultural grassland (GA1) to the east with a narrow treeline of sycamore (*Acer psuedoplatanus*), wych elm (*Ulmus glabra*) and beech (Fagus sylvatica). The west bank comprised a large block of mixed broad-leaved woodland dominated by beech with frequent sycamore and occasional wych elm and hazel. The well-developed understorey comprised hogweed, bluebell (*Hyacinthoides non-scripta*), common polypody (*Polypodium vulgare*), wood rush (*Luzula sylvatica*), wood avens (*Geum urbanum*), lesser celandine (*Ficaria verna*), abundant ivy (*Hedera helix*), ground ivy (*Glechoma hederacea*), dog violet (*Viola riviniana*) and several fern species. Cherry laurel (*Prunus laurocerasus*) encroachment was very high. Winter heliotrope (*Petasites fragrans*) was present immediately adjacent to the bridge structure (west bank). Riparian shading was high at the site and resultingly, macrophyte cover was limited to occasional marginal hemlock water dropwort (*Oenanthe aquatica*). Filamentous algae was present at low densities (<1%) with occasional Lemanea sp. on larger instream boulders and cobble. Aquatic moss cover was low but St. Winifrid's moss (*Chiloscyphus polyanthos*) was common on instream boulders. The site offered **good salmonid nursery habitat** with frequent good holding glide habitat upstream and downstream of the bridge. **Spawning value was good** locally although improved downstream and upstream of the survey site (less compacted). **European eel habitat was moderate to good** given the presence of undercut banks, large woody debris and scattered boulder refugia. **Larval lamprey habitat (i.e. soft sediment) was present locally**, particularly in a small cut immediately u/s of the bridge (west bank), where deep silt was present. **A single Lampetra sp. ammocoete was observed** resting on marginal gravels during the site visit. Spawning habitat for lamprey, whilst present, was patchy in distribution due to sedimentation and substrata compaction. No white-clawed crayfish were recorded and there was

Site no.	Watercourse and EPA code	Location (closest to survey point) and ITM Co-ordinates	Site Description
			considered no crayfish value given the species' known absence from the Owenacurra catchment. **A regular otter spraint site** was recorded on the bridge apron on the upstream side of the west bank (ITM 586378, 576195). The Owenacurra River has **known sea trout populations** of regional value. It also supports populations of aquatic species of high conservation value **including European eel, lamprey and otter**. The aquatic ecological evaluation of site 3 is therefore of **County Importance**.
4	Owenacurra River 19O03	DC01-DC02 (Carrigogna) 587169 575712	The Owenacurra River at site 4 was a large lowland watercourse (FW2) which ran parallel to the proposed onshore cable route (i.e. was not crossed by cable route). The river was largely unmodified at this location, with a good natural profile, frequent meanders and high habitat heterogeneity. The river was located approx. 20m from the R626 road (cable route) and bordered to the east (roadside) by mature treelines and dense scrub with and area of recolonised bare ground (ED3) supporting spear thistle (*Cirsium vulgare*), comfrey (*Symphytum officinale*), scarlet pimpernel (*Anagallis arvensis*), broad-leaved dock, nettle, elder (*Sambucus nigra*) and bramble. To the west, grey willow-scrub dominated. The river sat in a deep natural, U-shaped channel with mature growth of sycamore, elder, osier (*Salix viminalis*), alder (*Alnus glutinosa*), wych elm, grey willow and ash (*Fraxinus excelsior*), with abundant scrub of bramble, willowherb (*Epilobium spp*.) and nettle. Shading was moderate (30%) with abundant large woody debris present instream. The river averaged 5-6m wide and featured roughly equal proportions of riffle, glide and pool. The flow rate was relatively high at the time of survey, despite unseasonably low water levels. Meanders were frequent. The depth ranged from 0.5-1m with deeper pools to >2m present offering excellent holding habitat for salmonids. The substrata were dominated by cobble (60%) with frequent small boulder present also (20%). Well-sorted gravels were present in interstitial spaces and slacks associated with pools supported localised areas of sand with some soft sediment. Unlike site 3 approx. 1km upstream, the substrata were more mobile, cleaner and not as compacted. Macrophyte growth in the fast flow was limited to marginal water dropwort on exposed gravel shoals and sloping banks. The non-native, high-risk (Kelly et al[126].) invasive Himalayan balsam (*Impatiens glandulifera*) was widespread upstream and downstream of the crossing. Aquatic bryophyte cover was low. The red alga *Lemanea sp*. dominated, particularly in shallower riffle areas (20% cover). Filamentous green algae were also present. The site offered excellent all-round salmonid habitat, with good nursery conditions present. Nursery habitat was not quite considered of excellent quality due to the fast flow, lack of macrophytes, lack of slower glide etc. but it was near excellent for Atlantic salmon parr, specifically. **Excellent quality spawning substrata was present locally** (clean mobile gravels and cobbles) and **excellent holding habitat was frequent**, particularly for Atlantic salmon and adult sea trout. **Habitat for European eel was good** despite the fast flows (i.e. in pools, large woody debris). **Larval lamprey habitat was present** at the site but localised to pool slacks; even here it could be considered sub-optimal, i.e. compacted sand. Lamprey spawning areas were present but localised also. No white-clawed crayfish were recorded and the site was considered unsuitable given the species' known absence from the Owenacurra catchment. There were no signs of otter but the species is known from area (Triturus unpublished data) and habitat value was high for the species. The Owenacurra River has known sea trout populations. It also supports populations of aquatic species of high conservation value including **European eel, lamprey and otter**. The aquatic ecological evaluation of site 4 is therefore of **County Importance.**

[126] Kelly, J., O'Flynn, C., & Maguire, C. (2013). Risk analysis and prioritisation for invasive and non-native species in Ireland and Northern Ireland. A report prepared for the Northern Ireland Environment Agency and National Parks and Wildlife Service as part of Invasive Species Ireland

Site no.	Watercourse and EPA code	Location (closest to survey point) and ITM Co-ordinates	Site Description
5	Glenathonocash River 19G66	DC02-DC03 (Broomfield West) 587316 575465	Site 5 on the Glenathonocash River (EPA code: 19G66) was located at the R626 road bridge at Broomfield West (approx. 150m upstream of the Owenacurra confluence) and was represented by a lowland depositing watercourse (FW2). The river averaged 3-4m in depth and 0.2-0.4m deep. Upstream of the bridge shallow glide dominated (very good salmonid nursery). However, downstream of the bridge the river featured higher energy and shallow glide and riffle dominated with localised deeper pool to 0.75m. A relatively large pool (to 1m) was located immediately downstream of the cobbled bridge apron. The substrata were comprised primarily of cobble and coarse gravel (60% overall), with occasional small boulder and finer gravels/sand (20%) in interstitial spaces. Silt accumulations were present in association with some pool tailings and mid-channel gravel shoals. The substrata were relatively mobile and not compacted (loose). Overall, siltation was light to moderate with silt plumes underfoot in slacker areas of channel. The river flowed in a steep semi-natural V-shaped channel, with bankfull heights of 1-2.5m. The riparian zones were well developed and adjoined by improved agricultural grassland (GA1), meadows and grassy verges habitat (GS2) and built land (BL3). Sycamore treelines dominated both banks, with elder, alder and hawthorn alongside often dense scrub composed of bramble, ivy, foxglove (*Digitalis purpurea*), ferns, common cleavers (*Galium aparine*), water figwort (*Scrophularia auriculata*), gorse, lords and ladies (*Arum maculatum*) and lesser celandine. Cherry laurel was present at bridge (north bank). Shading was high downstream as a result of mature trees (50%). Some natural scouring/erosion of the steep banks was present downstream of the bridge (north bank) but no kingfisher potential was present. Macrophytes were limited to occasional stream water crowfoot (*Ranunculus penicillatus var. penicillatus*) and marginal stands of hemlock water dropwort and fool's watercress, particularly on exposed gravel shoals. The bryophyte community was well-developed with common *Chiloscyphus polyanthos*, river feather moss (*Brachythecium rivulare*) on larger instream boulders, occasional *Fontinalis antipyretica*. *Hygroamblystegium fluviatile* was present on the lip of the bridge apron. **The community of aquatic plants at site 5 would share links with the Annex I Habitat, 3260 Water courses of plain to montane levels with the *Ranunculion fluitantis* and *Callitricho-Batrachion* vegetation**. Filamentous algae (Cladophora sp.) was present at <5% cover. Filamentous algae (*Cladophora sp*.) was present at <5% cover. Overall, the site offered **good salmonid habitat** with good spawning, good nursery and good holding locally. **European eel habitat was moderate**, reduced overall due to the lack of deeper pools and instream refugia. **Larval lamprey habitat was sparse but present** at the tailing of pools or in association with gravel shoals. Some localised lamprey spawning habitat was present also although the site was more suited to salmonids. Lamprey spawning was considered superior upstream of the bridge. No white-clawed crayfish were recorded and the site was considered unsuitable given the species' known absence from the wider catchment. **A regular otter spraint site** (5 spraints, mixed age) was recorded under the bridge (ITM 587308, 575460). In summary, given the good quality salmonid and lamprey habitat, and the ability to support aquatic species of conservation value such as European eel and otter, the aquatic ecological evaluation of site 5 was of **local importance (higher value).**
6	Elfordstown River 19E02	DC02-DC03 (Broomfield West) 587624 575720	Site 6 was located at a local road crossing on a branch of the Elfordstown Stream (EPA code: 19E02) which emanated from East Cork Golf Club. The survey site joined the main stream channel approx. 10m below a box culvert. The stream was 2m wide and 0.2-0.3m deep below the box culvert (fish passable). The channel was located alongside the road and bordered on both banks by dense bramble and nettle-dominated scrub and scattered mature alder trees. Other common species included elder, common cleavers, broad-leaved dock, ground ivy and fern species. Winter heliotrope was present at bridge and along the adjacent roadside. On the south side of the road, extensive stands of treated Japanese

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			knotweed (*Fallopia japonica*), a high-risk invasive species (Kelly et al.[126]), were present. This area is remote from the proposed works area. The substrata were dominated by fine and medium gravels (60% overall) which were moderately to heavily silted (thus reducing spawning potential for fish). Cobble was only occasional but dominated in the main stream channel downstream. Boulder was occasional. Sand was common (20%). In the short section below the bridge (but upstream of the confluence), the stream was dominated by glide and riffle habitat with only localised pool (present at the bridge and at confluence). In comparison, the main stream was dominated by 0.2-0.3m deep riffle and fast glide with occasional deeper pool to 1m. Macrophyte growth was sparse and limited to abundant hemlock water dropwort and occasional fool's watercress in the margins. Some stream water crowfoot was present but no large beds were present, even further downstream. Filamentous algae was present indicating upstream enrichment (more so that main stream). The main channel supported some limited *Fontinalis antipyretica*, *Lemanea* sp. and *Brachythecium rivulare*. Overall, the site offered **good to moderate value for salmonids** but was impacted by siltation. The site was small, shallow but offered some value as a spawning site. The main stream channel was good overall (good nursery, good spawning and good holding). European eel habitat was moderate at best due to the shallow nature of the site and was much improved in deeper pools further downstream in the main channel. The concrete bridge culvert offered little to no eel habitat. Larval lamprey habitat was present and patchy in the main stream channel but sun-optimal at the survey site (moderate value). **Spawning opportunities for Lampetra sp. were good**, however. No white-clawed crayfish were recorded and the site was considered unsuitable given the species' known absence from the wider catchment. No signs of otter were recorded but the presence of **healthy salmonid population** in the main channel downstream and seclusion from human activity provided high suitability. In summary, given the moderate to good quality salmonid, European eel and lamprey habitat, the aquatic ecological evaluation of site 6 was of **local importance (higher value).**
7	Ballyspillane West Stream 19W06	D03-D04 (Ballyspillane West) 589700 576495	Site 7 on the Ballyspillane West Stream (EPA code: 19W06) was located at a local road crossing (1m box culvert, structural damage on downstream side), at the confluence of a small unnamed stream adjoining from the north. The semi-natural stream was bordered by a residential property to the south bank and intensive improved agricultural grassland to the north and upstream. The stream averaged 1.5-2m wide and had been straightened and deepened historically (mostly deep U-shaped channel). However, some limited natural features and profile remained. The stream was flanked to the south by a mature treeline of sycamore, cherry laurel, wych elm, alder and hawthorn with occasional pine and ash. Alder dominated further downstream where it adjoined agricultural grassland again west of the residential property. Shading was high as a result (70%). A scrubby understory of bramble with nettle, ferns, wood rush, herb Robert (*Geranium robertianum*), hedge bindweed (*Calystegia sepium*), primrose (*Primula vulgaris*) and ivy. The north bank was farmed nearly to the edge and featured only a narrow riparian zone with common herbaceous and grassland species such a hogweed, buttercups, willowherbs, and soft rush (*Juncus effusus*). The stream was shallow (average 0.1-0.2m) and was dominated by shallow glide (30%) and riffle (60%) habitat with localised pool (10%), mostly on meanders located downstream. Small cobble predominated and was invariably heavily

Site no.	Watercourse and EPA code	Location (closest to survey point) and ITM Co-ordinates	Site Description
			bedded, with siltation levels high. However, finer gravels were present in interstitial spaces but these, too, were compacted. Boulder was occasional (5%). Silt comprised approx. 30% of the substrata. Some deep silt accumulations were present at the tail end or margins of pools downstream of the bridge. Macrophyte growth was sparse and limited to hemlock water dropwort and fool's watercress in less shaded areas. Some *Chiloscyphus polyanthos* and *Hygroamblystegium fluviatile* was present on larger instream cobble and small boulder. Overall, the **stream was of moderate value as a salmonid nursery** (small brown trout observed) but the value was reduced given substrata compaction, sedimentation and the shallow nature of the site. **Spawning habitat was moderate** (to poor locally), with moderate holding. **Larval lamprey habitat was limited and localised but present** >20m downstream of the bridge crossing, where deeper fine silt accumulations were present. **Lamprey spawning habitat was present** but compromised by substrata bedding and sedimentation. No white-clawed crayfish were recorded and the site was considered unsuitable given the species' known absence from the wider catchment. No signs of otter were recorded and suitability was considered low. In summary, given the presence of a small salmonid population and suitable lamprey habitat, the aquatic ecological evaluation of site 7 was of **local importance (higher value).**
8	Dungourney River 19D07	D03-D04 (Roxborough) 590464 574758	Site 8 on the Dungourney River at a local road crossing at Roxborough was a lowland depositing watercourse (FW2) flowing through an agricultural landscape. The river was 5-6m in width and averaged 0.3-0.6m deep. Moderate-flowing glide habitat predominated near the bridge, with a small defunct weir structure, very much fish passable, present 30m downstream. Below this structure, and associated small pools, the river was dominated by deep glide and pool habitat up to 1.6m in depth, offering excellent holding habitat for adult salmonids. Here, a higher degree of riparian shading also improved holding habitat. Deep pool habitat was also present underneath the bridge structure, which provided some excellent salmonid holding habitat. The substrata were comprised of small cobble (30%) and medium-coarse gravels (50%) upstream of the weir structure, with frequent marginal silt/sand accumulations. A small boulder-dominated zone existed downstream of the weir, with smaller harder substrata (gravels) dominating in the deeper pool and glide downstream. The substrata were generally loose and unbedded despite some locally moderate siltation. The river was bordered by mature ash, sycamore and alder treelines with dense scrub dominated by bramble with nettle, hogweed, herb Robert, privet (*Ligustrum vulgare*), speedwell (*Veronica* sp.), willowherb (*Epilobium* spp.) and grey willow. The medium-risk invasive[127] **three corner leek** (*Allium triquetrum*) was widespread along the riparian zone. Macrophyte cover was moderate, with occasional stream water crowfoot, water starwort and frequent curled pondweed (*Potamogeton crispus*) (the latter indicating enrichment). Hemlock water dropwort was common in channel margins and on exposed gravel shoals. *Fontinalis antipyretica* was common on boulder downstream of the weir structure, with occasional *Hygroamblystegium fluviatile* and *Chiloscyphus polyanthos*. The community of aquatic plants would share

[127] Kelly, J., O'Flynn, C., & Maguire, C. (2013). Risk analysis and prioritisation for invasive and non-native species in Ireland and Northern Ireland. A report prepared for the Northern Ireland Environment Agency and National Parks and Wildlife Service as part of Invasive Species Ireland.

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			links with the **Annex I Habitat, 3260 Water courses of plain to montane levels with the *Ranunculion fluitantis* and *Callitricho-Batrachion* vegetation.** Overall, the site was a **good salmonid habitat**, with good nursery, good spawning and some excellent holding habitat, particularly downstream of the weir. Spawning habitat was best immediately upstream of the weir (loose, mobile gravels). There was some very **good European eel habitat** under the bridge and downstream of the weir. Larval lamprey habitat was localised but present (some optimal, some sub-optimal) in marginal slacks and in association with instream macrophyte beds. Lamprey spawning habitat was present throughout although was considered better upstream of the weir. No white-clawed crayfish were recorded (despite some good habitat suitability) and the site was considered unsuitable given the species' known absence from the wider catchment. No signs of otter were recorded but suitability was considered high. In summary, given the good quality salmonid, European eel and lamprey habitat present, the aquatic ecological evaluation of site 8 was of **local importance (higher value).**
9	Harrisgrove Stream 19H02	DC04-DC05 (Ballyedkin) 591537 573677	The proposed HVDC land cable route no longer crosses this point and instead is proposed approximately 200m east of this location. The Harrisgrove Stream at site 9 was a small lowland depositing watercourse (FW2) flowing under the N25 (large pipe culvert) and through a small area of amenity grassland adjacent to the Two Mile Inn. The stream had been historically straightened and averaged 1.5-2m wide and 0.2m deep, with localised pool to 0.6m. It flowed in a shallow U-shaped channel before entering a series of smaller pipe culverts under a local access road and adjacent car parking area. None of these culverts in the vicinity of the site were fish-friendly (small sizes, debris blockages etc.). The stream was bordered by dry meadow and grassy verges habitat comprising nettle, winter heliotrope, field bindweed (*Convolvulus arvensis*), willowherb (*Epilobium* spp.), hogweed, common cleavers and rank grasses. Upstream, the channel had been historically straightened and deepened and represented a drainage channel (FW4) adjoined by improved agricultural grassland to the east. The stream was heavily silted (70% cover) in the short section between the culverts and was dominated by slow-flowing glide habitat. Some localised cobble (20%) and gravels (10%) were present in faster flowing areas, as well as downstream, but these were bedded and silted. The macrophyte community was dominated by abundant yellow iris (60% cover) and frequent fool's watercress, with common duckweed (*Lemna minor*) also frequent. The bryophyte community was poorly represented due to abundant cover of macrophytes and high siltation. In terms of fisheries, the site offered poor salmonid and European eel habitat. There was, however, some extensive soft sediment habitat suitable for larval *Lampetra sp*. but spawning opportunities, as with salmonids, were poor. Three-spined stickleback (*Gasterosteus aculeatus*) were evidently abundant at the time of survey. No white-clawed crayfish were recorded and the site was considered unsuitable given high siltation rates and the species' known absence from the wider catchment. No signs of otter were recorded and suitability was considered poor although the species is known from the emanating Ballybutler Lough approx. 1km upstream.

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			In summary, given the poor quality fisheries habitat present, and evident siltation and eutrophication pressures, the aquatic ecological evaluation of site 9 was of **local importance (lower value).**
10	Lough Aderra 19_65	DC05-DC06 (Loughaderry) 593875 573680	Situated south of the N25 road between Castlemartyr and Midleton and the proposed HVDC land cable route, Lough Aderra (EPA waterbody code: 19_65) is a shallow, c.13ha, spring-fed eutrophic lake with underground drainage to the Womanagh River[128]. The lake forms part of the Loughs Aderry and Ballybutler pNHA (site code: 000406), a site noted for ornithological and botanical interest. The lakebed was dominated by soft silt with narrow fringes of allochthonous gravels and cobbles along the north and east margins. The lake was surrounded by wet willow vegetation with frequent alder, in addition to extensive mosaics of freshwater marsh reed and large sedge / tall-herb swamp habitats. The riparian zone supported often lush growth of common herbaceous species such as great willowherb (*Epilobium hirsutum*), purple loosestrife (*Lythrum salicaria*), meadowsweet, gypsywort (*Lycopus europaeus*) and herb Robert in addition to bramble and nettle. The lake was heavily vegetated with macrophytes (>75% surface cover) and supported abundant spiked water milfoil (*Myriophyllum spicatum*) that was flowering with large areas of the open water of the eastern basin covered with species. The lake littorals, particularly along the roadsides of the north littoral and east littoral, supported frequent beds of the grey clubrush (*Schoenoplectus tabernaemontani*). The lake featured an unusual assemblage of macrophytes with frequent common spike-rush (*Eleocharis palustris*), lesser bulrush (*Typha angustifolia*), bog bean (*Menyanthes trifoliata*), water mint (*Mentha aquatica*) and shoreweed (*Littorella uniflora*). Branched bur-reed (*Sparganium erectum*) was localised. The cyperus sedge (*Carex psuedocyperus*) in addition to lesser marshwort (*Apium inundatum*) and hornwort (*Ceratophyllum demersum*) were known historically from the lake[129] but these species was recorded during the site visit (nevertheless, the species may be present). The lake was suffering from very heavy coverage of filamentous algae during the site visit, indicating enrichment. In terms of fisheries, the lake was, until recently a put-and-take rainbow trout (*Oncorhynchus mykiss*) fishery managed by Inland Fisheries Ireland. However, the lake is no longer operated as a fishery. Lough Aderra is known locally to support brown trout and large stocks of rudd (*Scardinius erythropthalmus*) in addition to three-spined stickleback, European eel and a small stock of carp (*Cyprinus carpio*). Habitat for cyprinid species and European eel was considered very good given the extensive macrophyte cover and shallow depths (mean depth of 1.5m). No white-clawed crayfish were recorded and the species was not known from the lake. Although no otter signs were recorded during the site visit, the species is known from the lake (Triturus pers. obs.; NBDC data) and habitat suitability was high. Given the location of the site within Loughs Aderry and Ballybutler pNHA (000446), the aquatic ecological evaluation of site 10 was of **National importance.**

[128] Bracken, J.J. & D.A. Murray (1973). Insect emergence data from four small lakes in the south and southwest of Ireland. Irish Fisheries Investigations, Series A, no. 2. Department of Agriculture and Fisheries, Dublin.

[129] Goodwilllie, R. (1986). Report on Areas of Scientific Interest in County Cork.

Site no.	Watercourse and EPA code	Location (closest to survey point) and ITM Co-ordinates	Site Description
11A	Womanagh River 9W01	DC06-DC07 (Grange) 595741 573955	Site 11 was located on an artificially cut branch of the Womanagh River (aka Kiltha River, EPA code: 19W01) situated west of Castlemartyr village. Located approx. 0.15km upstream of the N25 road crossing, the channel represented a canal habitat (FL3), averaging 5-6m wide and >1.5m deep. The base of the channel was 100% silt, invariably >1m in depth. Flow was negligible at the time of survey, i.e. 100% pool habitat. The canal was bordered by dense scrub and mature treelines in the >10m riparian buffer. Grey willow predominated both banks (which adjoined GA1) with scattered oak, alder and beech. The east bank was dominated by willow and bramble scrub, with the west bank more open and supporting lush herbaceous layer. The canal had a very high coverage of macrophytes (>95%). Canadian pondweed (*Elodea canadensis*) dominated, with occasional common duckweed, yellow iris and water horsetail (*Equisetum fluviatile*). The western margin supported dense stands of marginal fool's watercress. Hemlock water dropwort was frequent. Water starwort was frequent in the margins. The channel supported brown trout and three-spined stickleback. Salmonid value was poor with the habitat only suitable for larger adult fish. **Value for European eel was high**. The site was not considered of value for white-clawed crayfish given the species' known absence from the wider catchment. Otter suitability was high given the seclusion and a regular spraint site (latrine) was located along the margins of the channel (east bank) approx. 30m upstream from the survey site (ITM 595731, 573934). Given the presence of salmonids (brown trout), otter, kingfisher and good quality European eel habitat, the aquatic ecological evaluation of site 11A was of **local importance (higher value).**
11B	Womanagh River 19W01	DC06-DC07 (Grange) 595697 573908	Site 11B on an artificially cut branch of the Womanagh River (aka Kiltha River, EPA code: 19W01) was located at the N25 road crossing (bridge ID: CC-N25-007.00), approx. 0.5km west of Castlemartyr village. The channel represented a canal habitat (FL3), averaging 5-6m wide and >1.5m deep. There was an imperceptible flow at the time of survey. The base of the channel was composed of 100% silt, invariably >1m in depth. The channel was bordered by dense scrub and mature treelines in the riparian buffer. Downstream of the bridge, the channel flowed through Castlemartyr Woods (WD1), with the channel feeding an artificial lake (FL8). Sycamore and grey willow predominated both banks with frequent cherry laurel and occasional ash, oak (*Quercus* sp.), alder and beech. The riparian zone was heavily vegetated by common species such as great willowherb, reed canary grass (*Phalaris arundinacea*), nettle, hedge bindweed and creeping buttercup. The channel had a very high coverage of macrophytes (>95%). Canadian pondweed dominated with abundant fool's watercress and common duckweed in channel margins. Yellow iris, unbranched bur-reed, broad-leaved pondweed (*Potamogeton natans*) and water horsetail were occasional. Common water starwort was present, locally. In terms of fisheries, the channel evidently supported brown trout and three-spined stickleback (both observed during the site visit). However, overall salmonid value was poor with the habitat only suitable for larger adult fish (i.e. no spawning, poor nursery habitat). Value for European eel was considered high given good foraging and refugia opportunities. The presence of cyprinid species such as rudd was considered likely given their known presence in the downstream-connecting lake. No white-clawed crayfish were recorded and the species is not known from the wider catchment. Otter suitability was high given the high habitat seclusion and foraging potential. A regular spraint site (latrine) was located

Site no.	Watercourse and EPA code	Location (closest to survey point) and ITM Co-ordinates	Site Description
			along the margins of the channel (east bank) approx. 250m upstream from the road bridge (ITM 595731, 573934). An adult kingfisher (*Alcedo atthis*) was recorded flying in a downstream direction during the site visit. In summary, given the presence of salmonids (brown trout), otter, kingfisher and good quality European eel habitat, the aquatic ecological evaluation of site 11B was of **local importance (higher value).**
12A	Womanagh River 19W01	DC06-DC07 (Grange) 596064 573928	Site 12A on the Womanagh River (aka Kiltha River, EPA code: 19W01) located 0.7km upstream (north) of Castlemartyr village was a lowland depositing watercourse. The river had been historically straightened but not deepened and flowed in a homogenous shallow habitat. The channel flowed through a U-shaped channel and averaged 3m wide and 0.1-0.2m deep, with very few deeper areas. Water levels were evidently very low at the time of survey. The site was dominated by shallow glide and shallow riffle habitat with an almost complete lack of pool areas – habitat heterogeneity was poor. The river was flanked on both banks by dense linear WD1 of willow, ash, alder with elder and hawthorn. The scrubby understorey was dominated by bramble with ferns, ivy, lords and ladies, bluebell, nettle, foxglove, pink water speedwell (*Veronica catenata*), willowherb, sanicle (*Sanicula europ*aea), primrose, dog violet (*Viola riviniana*), lesser celandine, herb Robert, common cleavers and ivy. To the east the river was bordered by an artificial but mature drainage channel. This featured a low flow at the time of survey and was silt-dominated. The substrata were dominated by medium to coarse gravels (40%) and small cobble (30%), all of which were unbedded. Boulder was rare. Fine gravels were present throughout (well-sorted gravels) (20%) with sand (10%) present in interstitial spaces and in marginal areas. Siltation was light to moderate throughout. Riparian shading was relatively high and macrophyte coverage was limited to marginal hemlock water dropwort. Stream water crowfoot was not present at the site but was present upstream and downstream. *Chiloscyphus polyanthus* was present but only occasional on larger instream cobble. Overall, the site offered good value as a salmonid nursery. However, low water levels reduced the value at the time of survey. Spawning habitat was good owing to the presence of abundant, relatively clean unbedded gravels. Holding habitat was largely absent. European eel habitat was poor given the lack of deeper pool areas. Larval lamprey habitat was not present (compacted sand only, no fine sediment accumulations) although some good spawning habitat was present locally. There was no white-clawed crayfish potential given the known absence of the species from the wider catchment. There were no otter signs in the vicinity of the survey site although there was good potential, particularly during higher water levels. Given the presence of some good quality salmonid and lamprey habitat, and the ability to support aquatic species of conservation value such as European eel, the aquatic ecological evaluation of site 12A was of **local importance (higher value).**
12B	Womanagh River 19W01	DC06-DC07 (Castlemartyr Bridge) 596066 573884	Site 12B on the Womanagh River (EPA code: 19W01) was located at the N25 road crossing in Castlemartyr village. Here, the main branch of the river (as opposed to site 11) was a lowland depositing watercourse (FW2) with a shallow (0.2m deep max.) and 5-6m wide channel. The profile was dominated by shallow riffle and glide and the river was contained between two retaining walls, indicating historical straightening. Deeper pools were absent in the vicinity of the bridge. The substrata comprised small boulder (10%), cobble (20%), coarse gravels (30%), medium and fine gravels

Site no.	Watercourse and EPA code	Location (closest to survey point) and ITM Co-ordinates	Site Description
			(30%) with silt and sand making up the remaining 10%. The substrata suffered from moderate siltation and were partially bedded. The riparian areas were poorly vegetated with the exception of some localised ornamental planting given the site featured large retaining walls and peri-urban artificial surfaces. The macrophyte community was dominated by stream water crowfoot with more localised lesser water parsnip (*Berula erecta*). The surface of the river had frequent patches of common duckweed. Hemlock water dropwort was also present but very localised. The only aquatic bryophyte recorded was very localised *Fontanalis antipyretica*. In terms of fisheries habitat, the shallow riffles and glide areas provided some good nursery for salmonids (both brown trout and Atlantic salmon) although the overall value of the site was reduced given the lack of deeper holding areas. European eel habitat was reduced to moderate for the same reason. Silt accumulations immediately downstream of the road crossing adjoining the low three-arch masonry road bridge offered good nursery potential for brook lamprey ammocoetes. No white-clawed crayfish were recorded and the species was not known from the wider catchment. Despite some habitat suitability, no otter signs were recorded in the vicinity of the road bridge. In summary, given the presence of good quality salmonid and lamprey habitat, and the ability to support aquatic species of conservation value such as European eel, the aquatic ecological evaluation of site 12B was of **local importance (higher value).**
13	Annistown Stream 19A24	DC07-DC08 (N25 road crossing) 597825 574208	Site 13 on the Annistown Stream (EPA code: 19A24), also known locally as the Dower River, was 100% dry at the time of survey. The Annistown Stream (Wommangh River tributary), flowed through an agricultural landscape (GA1) in the vicinity of a karstic limestone system. A number of small limestone caves were present in the vicinity of the proposed road crossing point (north side of road). These may be connected to a wider karstic network that is known from the area (e.g. Dower Spring to the south and others). The channel at this location was considered likely to be subterranean and or dependent on fluctuating groundwater levels (i.e. highly seasonal). Remnants of a dry channel bed were present to the northeast of the road crossing point, adjoining a hawthorn-bramble-ash hedgerow boundary. No standing water was present at the time of survey. Given the absence of water at the time of survey (and evidently, much of the year), the channel was not of value for fish, white-clawed crayfish, otter or other aquatic species. Given the lack of water and fisheries value, the aquatic ecological evaluation of site 13 was of **local importance (lower value).**
14	Moanlahan River 19M29	DC07-DC08 (N25 road crossing) 598876 574549	The Moanlahan River (EPA code: 19M29) at site 14 was a very heavily modified lowland depositing stream (FW2). The channel was 2.5m wide and 0.1m deep on average in localised pools but the majority of the bed was dry at the time of survey. The channel had been deepened and straightened historically with evident modified embankments adjoining heavily improved pasture (GA1). Consequentially, the bank heights were high for a small stream, being up to 3m. The riparian zones comprised scrubby grey willow, hawthorn, bramble, nettle, thistle, hedge bindweed, great willowherb and gorse on roadside with open banks and pasture on the south bank.

Site no.	Watercourse and EPA code	Location (closest to survey point) and ITM Co-ordinates	Site Description
			The riverbed comprised very localised boulder, cobble and gravel (10% cover combined) with silt making up 90% of the bed. The river was evidently heavily enriched with 90% cover of lesser water parsnip interspersed with reed canary grass and great willowherb. The channel was not of fisheries value given evident seasonality (i.e. drying up). However, the pools within the modified stream supported metamorphosing common frog (*Rana temporaria*) tadpoles. No white-clawed crayfish or otter signs were recorded and the site was not considered of value to either species. In summary, given the poor quality fisheries habitat present, and evident siltation and eutrophication pressures, the aquatic ecological evaluation of site 14 was of **local importance (lower value).**
15A	Dissour River 19D03	DC08-DC09 (N25 road crossing) 600504 576691	Site 15A on the Dissour River (EPA code: 19D03) was located at the N25 road crossing in Killeagh village. The river represented a lowland depositing watercourse (FW2) with a shallow (0.3m deep) channel of variable width between and 7m and 15m wide. The profile was dominated by shallow riffle and glide with more localised pool habitat (0.6m max depth). The river had been modified near the road crossing with historical weir and numerous storm drain outfalls present. An old concrete weir was present downstream of the road bridge, an associated large plunge pool that then graded into glide and riffle sections downstream. Raw sewage was entering the channel from a point source under the bridge with dark green filamentous algae (*Phormidium* sp.) present downstream. The substrata comprised boulder (20%), cobble (20%), coarse gravels (30%), medium and fine gravels (25%) with silt and sand making up the remaining 5%. The substrata suffered from moderate siltation and were partially bedded. The riparian zone comprised of very mature ash, willow, sycamore, ivy and elder, with abundant hemlock water dropwort and frequent bramble scrub. The macrophyte community was dominated by stream water crowfoot instream with hemlock water dropwort being common on exposed cobble in the margins. *Hygroamblestegium tenax and Fontanalis antipyertica* were the only aquatic bryophytes recorded. The community of aquatic plants at site 15A would share links with the Annex I Habitat, 3260 Water courses of plain to montane levels with the Ranunculion fluitantis and Callitricho-Batrachion vegetation. The site provided a good salmonid nursery although downstream of the recently constructed footbridge there was an old concrete weir with poor fish passage (steep lip with no fish pass). Given the moderate flows and lack of sediment accumulations, the site was considered of limited value for lamprey. European eel habitat was moderate to good locally. No white-clawed crayfish were recorded and the species was not known from the wider catchment. A regular otter spraint site (with fish remains) was recorded underneath the road bridge structure (ITM 600506, 576682). Given the good quality salmonid habitat present, and the ability to support aquatic species of conservation value such as European eel and otter, the aquatic ecological evaluation of site 15A was of **local importance (higher value).**
15B	Dissour River 19D03	DC08-DC09 (Moanlahan) 600810 576240	The River Dissour (EPA code: 19D03) at site 15B was between 6m and 8m wide and had variable depths between 0.3m and 1.5m (deeper in pool areas). While there was evident local bank modifications (i.e. localised straightening), the banks were typically low and between 0.5m and 1.5m high. The River Dissour can be considered a semi-natural sandstone spate river with a well-defined riverine profile. This was exemplified by almost equal proportions of pool, riffle and glide and evident good sinuosity. The substrata comprised well sorted and rounded cobbles and gravels with

Site no.	Watercourse and EPA code	Location (closest to survey point) and ITM Co-ordinates	Site Description
			medium and finer gravels underneath the coarser surface substrata. While the river overall may be considered of higher energy given well sorted substrata, large pockets of silt (including shallower superficial silt) existed in the river margins, the most significant of which were located under the historical railway crossing. Despite localised settlement of sediment the higher flows helped reduce siltation levels that were considered moderate (i.e. some silt deposits on gravels and silt plumes underfoot, but no bedding of substrata). Macrophytes were present at low densities and represented by very localised stands of submerged stream water crowfoot (occasional) and rare common water starwort. Exposed cobble and coarse gravel banks (at base flow) supported emergent fool's watercress (occasional) and hemlock water dropwort (also occasional). The stream bed supported frequent *Lemanea* sp. algae (10% cover) with filamentous *Cladophora* sp. also covering 10% of the bed. Evidently, the Dissour River was suffering from eutrophication pressures, likely as a resulted of intensive agriculture both tillage and dairy farming. The riparian zone was well developed with very good riparian cover of mature elm, alder, grey willow and hawthorn. Dense understories of bramble, elder and holly existed with locally frequent expanses of Japanese knotweed. The most extensive of which was located upstream of the crossing on the west bank (>100m^2 stand). A smaller stand was present approximately 75m downstream of the bridge on the east bank (typically <5m^2). Three-cornered garlic (*Allium triquetrum*), also a 3rd schedule-listed invasive plant, was locally frequent on both banks of the river downstream of the railway crossing. The channel was large enough to support good densities of salmonids and thus was considered an inherently good salmonid fishery, also having value as an angling amenity. The abundance of very good quality spawning areas and nursery habitat (i.e. un-bedded riverine substrata) indicated high value for Atlantic salmon and brown trout which were evident in good densities, swimming in pool and glide habitat. Mixed cohorts were visible including juvenile Atlantic salmon. The coarse cobble and localised boulder in pool areas, also provided good nursery habitat for European eel. Areas of silt near the rail bridge were considered likely to support brook lamprey ammocoetes as upstream and downstream finer gravel spawning areas were also visible (i.e. acting as nearby spawning areas and sources of larvae). No white-clawed crayfish were recorded and the species was not known from the wider catchment. Otter spraint was present on gravel patches upstream and downstream of the crossing with sprainting also evident under the old railway bridge structure. Given the good quality salmonid habitat present, and the ability to support aquatic species of conservation value such as European eel and otter, the aquatic ecological evaluation of site 15B was of **local importance (higher value).**
16	Inchanapisha River 19I19	DC08-DC09 (Lagile) 601273 576492	Site 16 on the Inchanapisha River (EPA code: 19I19) was a small semi-natural channel 2.5m wide, 0.2m deep on average with very high bank heights (3-4m). The small river channel had evidently been deepened and straightened, resulting in deterioration of the quality of the habitat. Notably, the substrata were compacted (bedded) and covered with silt deposits (heavy siltation). Shallow glide and riffle predominated with a general lack of deeper holding areas. The riparian zone of the west bank of the river comprised a mature treeline (WL2) dominated by hazel with ash, holly (*Ilex aquifolium*), oak and hawthorn also present. The understory supported dense bramble scrub. The east bank

Site no.	Watercourse and EPA code	Location (closest to survey point) and ITM Co-ordinates	Site Description
			comprised heavily improved grassland dominated by the characteristic perennial rye grass (*Lolium perenne*). No macrophytes were observed present at the site with the exception of localised fool's watercress and watercress in the margins (both occasional). The bed had 20% cover of filamentous algae. Aquatic bryophytes were limited to yellow fringe-moss (*Racomitrium aciculare*) that was locally frequent on instream boulders below the weir associated with the box culvert structure. Despite evident deterioration of the bed, the stream was nonetheless considered of moderate value to salmonids and young fish 0+ and 1+ were observed present in glide areas. Potential for European eel was considered moderate. No white-clawed crayfish were recorded and the species was not known from the wider catchment. Otter spraint sites were frequent underneath the box culvert crossing, on ledge areas and also on boulders downstream of weir. Given the moderate quality salmonid habitat present and evident value as a salmonid nursery, and the ability to support aquatic species of conservation value such as otter, the aquatic ecological evaluation of site 16 was of **local importance (higher value).**
17	Lagile Stream 19L47	DC09-DC10 (Ballymackeagh More) 602087 576286	Site 17 on the Lagile Stream (EPA code: 19L47) was a very heavily modified stream channel, that had been extensively deepened, straightened and canalised. As such it retained very little semi-natural characteristics comprising a deep U-shaped channel with limited flow patterns. The channel was 2.5m wide and 0.3m deep with 1.5m high banks. The channel comprised 10% riffle and 90% deep slow-moving glide - flows were imperceptible at the time of survey. The stream bed had limited hard substrata (10%) and was dominated by deep silt (90%). The U-shaped channel was very heavily overgrown and difficult to access. Both banks comprised mature ash, guelder rose (*Viburnum opulus*), hawthorn, alder and hazel with a bramble-dominated understory. Ramsons (*Allium ursinum*) was frequent on the ground layer alongside nettle, ivy and hogweed. No macrophytes were recorded due to heavy shading. The stream was not considered of fisheries value apart from European eel that likely use the channel as a nursery given connectivity with the River Dissour. The stream was not considered of value to salmonid fish. No white-clawed crayfish were recorded and the species was not known from the wider catchment. No otter signs were observed but limited accessible bankside areas were present for sprainting. Despite the lack of value for salmonids or lamprey, the connectivity with the River Dissour and ability to support migratory European eel resulted in the aquatic ecological evaluation of site 17 being considered of **local importance (higher value).**
18	Gortnagark Stream 19G72	DC09-D010 (Burges Lower) 602855 576116	Site 18 on the Gortnagark Stream (EPA code: 19G72) was a very heavily modified stream channel (similar to site 17) in that the channel had been straightened and canalised, historically. As such it retained very little semi-natural characteristics apart from the substrata that were dominated by medium and fine gravels rather than silt. The channel was very small (<1m wide) and very shallow (<0.1m deep) with limited flow at the time of survey. The profile comprised 95% very shallow glide and 5% riffle. The riparian composition featured an ash, hawthorn, blackthorn (*Prunus spinosa*), willow, elder and hazel treeline-hedgerow with bramble, great willowherb, nettle and cleavers in the understories. The

Site no.	Watercourse and EPA code	Location (closest to survey point) and ITM Co-ordinates	Site Description
			east bank was devoid of trees and was comprised exclusively of heavily improved grassland (GA1). No macrophytes were recorded apart from localised hemlock water dropwort. Given the physical characteristics, the stream was not considered of fisheries value apart from for European eel which likely use the channel as a nursery given connectivity with the River Dissour. The stream was not considered of value to lamprey but may support species such as three spined stickleback which can tolerate low oxygen levels invariably present at such small stream sites. No white-clawed crayfish were recorded and the species was not known from the wider catchment. No otter signs were observed during the site visit. Despite the lack of value for salmonids or lamprey, the connectivity with the River Dissour and ability to support migratory European eel resulted in the aquatic ecological evaluation of site 18 being considered of **local importance (higher value).**
19	Inchiquin Stream 19I14	DC09-DC10 (Burges Lower) 603917 576193	Located downstream of the N25 crossing at Burges Lower, site 19 on the Inchiquin Stream (EPA code: 19I14) was a small, semi-natural stream channel (FW2), averaging 2.5m wide and 0.1m deep. The bank heights were between 1.2m and 2.0m high. The profile comprised 50% riffle, 40% glide and 10% pool. The channel had been historically straightened and deepened and this had evidently resulted in the compaction of the instream substrata. The substrata were dominated by medium and fine gravels (70%) with smaller proportions of boulder, cobble and sand making up the remaining 30%. The riparian composition comprised a dense treeline-hedgerow that was dominated by grey willow with a dense bramble understory. Bittersweet (*Solanum dulcamara*), pendulous sedge (*Carex pendula*) and smaller quantities of hemlock water dropwort were present on the channel margins near the water's edge. The adjoining land uses were of heavily improved pasture, being slightly wetter with *Juncus* sp. rushes on the eastern bank. No other macrophytes or bryophytes were recorded. The stream was considered of some value to salmonids given the apparent swift flow. However, it could be rated as moderate at best given historical stream alterations, shallow depth and compaction of instream gravels (with evident heavy siltation) that reduced spawning viability. The stream may also support European eel locally in pool areas. No white-clawed crayfish were recorded, suitability was low and the species was not known from the wider catchment. A single spraint site (old was observed under culvert crossing). The use of the river channel as a feeding and commuting corridor for otter was considered likely but small channels typically are of lower value to otter and less frequently used as larger more productive feeding areas. In summary, given the moderate quality salmonid habitat present, and the ability to support aquatic species of conservation value such as European eel and otter, the aquatic ecological evaluation of site 19 was of **local importance (higher value).**
20	East Ballyvergan Stream 19E04	DC09-DC10 (Coolaha) 605888	Site 20 on the East Ballyvergan Stream (EPA code: 19E04) was a very heavily modified stream channel (FW2), that had been deepened, straightened and canalised, historically. As such it retained very little semi-natural characteristics. The channel was 2.5m wide and 0.1m deep with 1.5m high banks. The channel comprised 10% riffle and 90% deep slow-

Site no.	Watercourse and EPA code	Location (closest to survey point) and ITM Co-ordinates	Site Description
		576342	moving glide and flows were imperceptible at the time of survey. The bed had no hard substrata and was exclusively dominated by deep silt. The U-shaped channel was open on both banks apart from a roadside treeline hedgerow of mature poplar (*Populus* sp.), white willow (*Salix alba*) and *Griselinea* sp. hedging. The downstream riparian areas comprised rank grassy areas that graded into adjoining heavily improved pasture. A small area of mature planted alder was located on the east bank downstream of the crossing. No macrophytes were recorded due to the channel being shaded due to deep u-shaped profile. Given the small, shallow nature of the stream and lack of flow, the stream was not considered of fisheries value apart from for three-spined stickleback which were frequent in the stream (shoals observed in glide areas). The site was not suitable for white-clawed crayfish. No otter signs were recorded and suitability was considered low. Given the low fisheries value of the site, the aquatic ecological evaluation of site 20 was of **local importance (lower value).**

The following watercourses were identified as being of **County Importance** given their importance as supporting habitat for fisheries species:

- Owenacurra River

The following watercourses were identified as being of **Local Importance (Higher Value)** given their importance as supporting habitat for fisheries species:

- Lisheenroe Stream
- Glenathonocash River
- Elfordstown River
- Ballyspillane West Stream
- Dungourney River
- Womanagh River
- Dissour River
- Innachanapisha
- Lagile stream
- Gortnagark Stream
- Inchiquin Stream

The following watercourses were identified as being of **Local Importance (Lower Value)**

- Tibbotstown Stream
- Harrisgrove Stream
- Annistown stream
- Moanlahan River
- East Ballyvergan Stream

All watercourses are identified as **SERs** given their quality as supporting habitat for fisheries, as ecological corridors, or due to their connectivity to European sites.

8.4.3.5 Wintering Bird Surveys

Wintering Bird Surveys: Late Winter 2019

Wintering bird surveys were carried out in late winter 2019 by Glas Ecology in 2019. Counts were conducted at Redbarn/Claycastle on the 18 February and 4 March 2019. Results of the surveys are summarised hereunder.

In general, numbers of wintering waterbirds recorded at Redbarn / Claycastle were low, particularly at high tide. At high tide, it was noticeable that the high-water level reached to the foot of the sand dunes and the coastal walkway, meaning that there is very little habitat available for birds to roost at high water. This is coupled with the fact that the area is very popular with walkers and dog walkers. The main walkways are along the dunes and also along a boardwalk and the walkway towards the eastern, Claycastle end. This leads to high levels of disturbance that would also deter birds from roosting along the edge of the shore line.

At low water, sanderling was the species recorded in the highest numbers. This small wading bird is a highly mobile species that is seen scurrying along the edge of the waterline picking at debris washed up the constantly moving drift line. Although count section 1 held the highest numbers of sanderling, this species is likely to move constantly along the beach in search of food. The beach below the high-water level is relatively uniform for its length, with no features (such as rock outcrops or areas of seaweed) that could potentially influence bird distribution. Table 8.19 below shows the peak numbers of each species (at either high or low water) and also gives the estimates of the all-Ireland wintering populations of each species, along with the figure where the numbers would qualify as being of national significance. The colour rating refers to 'Birds of Conservation Concern in Ireland' [130]), where species are included in either red or amber lists to highlight concern about their populations.

Table 8.19: Peak numbers (High and Low Tide) from February-March 2019 ('Late Winter')

Species	Conservation Status (Colhoun and Cummins, 2013)	SCI of Ballymacoda SPA	SCI of Blackwater Estuary SPA	Peak Number Recorded (H=High; L =Low)	Figure of National Significance[131]	Peak as % of Figure of National Significance
Bar-tailed godwit	Amber	✓	✓	6 (L)	170	4%
Black-headed gull	Red	✓	-	22 (L)	1000	2%
Common gull	Amber	✓	-	19 (L)	500	4%
Cormorant	Amber	-	-	1 (H)	110	1%
Curlew	Red	✓	✓	57 (H)	350	16%
Great black-backed gull	Amber	-	-	8 (L)	500	2%
Grey Heron	Green	-	-	1(L)	105	1%
Herring gull	Red	-	-	23 (L)	500	5%
Lesser black backed gull)	Amber	✓	-	5 (L)	500	1%
Oystercatcher	Amber	-	-	43 (L)	610	7%
Redshank	Red	✓	✓	1 (L)	240	<<1%
Sanderling	**Green**	✓	**-**	**117 (L)**	**85**	**138%**

The table shows that four species that are red listed under Birds of Conservation Concern in Ireland (BoCCI) were recorded. However, all of these, with the exception of curlew, are red listed as result of a decrease in their breeding populations. Curlew is red listed due to a decline in breeding and wintering populations.

Only Sanderling exceeded the figure for national significance (peak 117 birds; 138%; at low tide). However, analysis by count sector (Figure 8.2) confirmed that the vast majority of these birds were more than 400 m from the proposed landfall works area. The largest number of sanderling within the likely ZoI of the proposed landfall (i.e. sections 3 and 4; within c. 500 m) was 25 birds (29% of the nationally significant figure).

It should be noted that a peak count of a bird population meeting the nationally significant figure, does not indicate the survey area is as important for this species, as an SPA designated for it. The reason for this is statistical. Figures of national significance are calculated from the peak figures averaged over a five- year period. By contrast, the figures recorded at

[130] Colhoun K. & Cummins, S. 2013 Birds of Conservation Concern in Ireland 2014-19. Irish Birds 9:523-544

[131] Where recorded, averaged over a five year period, this is one of the measures by which SPA qualification is determined.

Burke B, Lewis L, Fitzgerald N, Frost T, Austin G, and Tierney D (2018). Estimates of waterbird numbers wintering in Ireland, 2011/12 – 2015/16. Irish Birds 11: 1-12.

Claycastle/Redbarn in late winter 2019 are from two months' survey work only, with the other count dates recording significantly less than the nationally significant figure. Up to two roosting winter hen harrier were recorded using the Ballyvergan Marsh. This confirms that the Ballyvergan Marsh pNHA continues to be an important winter roost area for hen harrier.

Significant numbers of curlew were also recorded (Peak 57 birds;16% of the nationally significant figure). However again, finer analyses by count sector revealed that all birds (in inland fields south of the Ballyvergan Marsh at high tide), were located greater than 800m from the proposed landfall works area.

There were no other noteworthy bird counts recorded within the ZoI (i.e. sections 3 and 4) in late winter 2019.

Wintering Bird Surveys Early Winter 2019/Late Winter 2020

Further wintering bird surveys were undertaken in early winter 2019 (November – December) and late winter 2020 (January-March) within the Converter Station Site, at Ballyvergan Marsh, and at Claycastle Beach are outlined in section 8.1.4.4. The findings in relation to the proposed development are provided hereunder.

Redbarn-Claycastle

Peak numbers (during both high and low tide) of bird species at Redbarn-Claycastle from winter 2019 / 2020 are outlined in Table 8.20.

Table 8.20: Peak monthly counts at Redbarn-Claycastle (beach, sea and fields) from November 2019 to March 2020

Species	Conservation Status (Colhoun and Cummins, 2013)	SCI of Ballymacoda SPA	SCI of Blackwater Estuary SPA	Peak Number (H=High; L=Low; S =At Sea)	Figure of National Significance	Peak as % of Figure of National Significance
Bar-tailed Godwit	Amber	✓	✓	152 (L)	170	89%
Black-headed Gull	Red	✓	-	38 (H)	1000	4%
Brent Goose	Amber	-	-	16 (L)	350	5%
Common Gull	Amber	✓	-	88 (H)	500	18%
Common Scoter	Red	-	-	1 (S) (N/A)	110	~1%
Cormorant	Amber	-	-	4(S)	110	4%
Curlew	Red	✓	✓	112 (H)	350	32%
Dunlin	Red	✓	✓	1 (H)	460	<<1%
Eider	Amber	-	-	2 (S)	55	4%
Glaucous Gull	Green	-	-	1 (L)	None published – No Irish SPAs for this species	N/A

Species	Conservation Status (Colhoun and Cummins, 2013)	SCI of Ballymacoda SPA	SCI of Blackwater Estuary SPA	Peak Number (H=High; L=Low; S =At Sea)	Figure of National Significance	Peak as % of Figure of National Significance
Great Black-backed Gull	Amber	-	-	6 (H=L)	500	~1%
Greenshank	Green	-	-	1 (H=L)	20	5%
Grey Heron	Green	-	-	1 (H)	25	4%
Grey Plover	Amber	✓	-	4 (H)	30	13%
Herring Gull	Red	-	-	52 (L)	500	10%
Little Egret	Green	-	-	3 (H=L)	20	15%
Mallard	Green	-	-	2 (H=L)	280	~1%
Mute Swan	Amber	-	-	5 (L)	90	6%
Oystercatcher	Amber	-	-	126 (H)	610	20%
Red-throated Diver	Amber	-	-	1 (L)	770	<<1%
Redshank	Red	✓	✓	2 (H=L)	240	~1%
Ringed Plover	Amber	✓	-	40 (H)	120	33%
Sanderling	**Green**	✓	**-**	**159 (H) [during marine surveys]**	**85**	**187%**
Shag	Amber	-	-	17 (H)	Not published – Irish SPAs designated for breeding populations only	N/A
Teal	Amber	✓	-	24 (H)	360	7%
Turnstone	Green	✓	-	26 (H)	95	27%
Water Rail	Amber	-	-	1 (L)	Not published – no Irish SPAs designated for species	N/A
Whimbrel	Green	-	-	1	Not published – no Irish SPAs designated for these (passage) populations	N/A

Table 8.18 shows that sanderling was, as in the late winter 2019 counts, the only population recorded at nationally significant levels (Peak 159 birds; 187%[132]). In contrast to the late winter 2019 surveys the count of 159 sanderling was entirely within c. 500m of the proposed landfall, and in fact within c. 100m of it. Significant sanderling peak counts of 50 and 38 individuals were also recorded on two further occasions within c. 500m of the proposed landfall.

[132] Recorded foraging onshore, within count sector 3, during the

As in the late winter 2019 counts, finer analyses by count sector revealed that most other bird species were not recorded within c.500 m of the proposed landfall. Notable peak counts (albeit below the nationally significant figure) were recorded for ringed plover (Peak 40 birds; 33%), turnstone (Peak 26 birds; 37%), and oystercatcher (Peak 126 birds; 20%). As in the late winter 2019 counts, the majority of birds were typically not concentrated in the count sectors within c. 500 m of the proposed landfall works. The exception being (as outlined above) counts, of 50 sanderling at high tide (57%), and 38 Sanderling at low tide (43%) in sector 3.

Species such as mute wan (*Cygnus olor*), mallard, teal, little egret, grey heron, water rail and most of the curlew were seen in Ballyvergan Marsh or the fields to the west of the marsh. Smaller numbers of black-headed, common and herring gull were recorded in most months, especially during the low tide counts.

In contrast to the late winter 2019 counts of Great Northern Diver, no divers were recorded at Redbarn-Claycastle during the five months of winter surveys but two eiders (a scarce winter visitor to Cork) were recorded in January 2020 during the high tide count.

Small numbers of cormorant, shag and redshank were seen throughout the winter period. Grey plover, turnstone and dunlin were each recorded on single occasions.

Marine Bird Surveys at Claycastle

A summary of monthly bird counts is detailed in Table 8.21 below. In contrast to the intertidal and inland surveys, the counts of marine birds are totals, recorded over the duration of the survey.

Many of the species totals refer to multiple sightings of the same birds as they flew up and down the coast or remained within the survey area for several minutes and this was especially true of gulls. For this reason, the data in Table 8.21 below do not include the counts in the context of nationally significant populations.

Birds seen in flight, but which do not feed at sea (e.g. waders) are excluded from Table 8.21, as they would not be within the zone of influence of disturannce or pollution from onshore activities.

Table 8.21: Highest Daily Totals During Marine Bird Surveys at Claycastle from November 2019 and March 2020

Species	Conservation Status (Colhoun and Cummins, 2013)[133]	SCI of Ballymacoda SPA	SCI of Blackwater Estuary SPA	Highest Daily Totals
Black-headed Gull	Red	✓	-	143
Brent Goose	Amber	-	-	15
Common Gull	Amber	✓	-	153
Common Scoter	Red	-	-	2
Cormorant	Amber	-	-	13
Gannet	Amber	-	-	5
Great Black-backed Gull	Amber	-	-	54
Herring Gull	Red	-	-	212
Kittiwake	Amber	-	-	18
Lesser Black-backed Gull	Amber	✓	-	34

[133] Colhoun K. & Cummins, S. 2013 Birds of Conservation Concern in Ireland 2014-19. Irish Birds 9:523-544

Species	Conservation Status (Colhoun and Cummins, 2013)[133]	SCI of Ballymacoda SPA	SCI of Blackwater Estuary SPA	Highest Daily Totals
Shag	Amber	-	-	1

There was a distinct passage of birds flying northeast during the November survey and it is likely that, in contrast to many other days, the majority of daily totals during that survey refer to individual birds passing through the survey area.

15 species of waterbirds were seen during the surveys. Three of the gull species (black-headed gull, herring gull, common gull) are SCIs of the Balymacoda Bay SPA. Gulls were the most frequently recorded waterbirds and the six species recorded accounted for 79% of the sightings.

508 herring gull sightings accounted for 30% of the total and 353 Black-headed Gull sightings accounted for 21% of the total.

280 sightings of four species of wader accounted for just 16.67% of the total. Gannet, cormorant and shag sightings (37) accounted for 2.2% of the total. Only two species of wildfowl were recorded (brent goose and common scoter) and their combined totals accounted for just 1.7% of the total.

Bird sightings tended to be higher for most species (especially gulls) during the high tide counts November was the only month when common scoter and kittiwakes were recorded and this is likely to be directly related to the strong east winds that occurred during this count. The highest numbers of herring gull (212), great-black-backed gull (54) and lesser black-backed gull were all recorded on this count.

Unusually large numbers of black-headed gull sightings (143) were notable in the December count. Exceptionally large numbers of common gull sightings (153) were recorded during the January count.

Evaluation of Winter Bird Importance Redbarn / Claycastle Beach and Marine Landfall Location

In summary, Sanderling was the only species recorded that reached National thresholds (>1% national wintering population) of importance[134]. In the case of the largest Sanderling count (Peak 159; 187% of the national figure of significance.

Based on these relatively high counts of sanderling and bar tailed godwit and the associated relatively diverse suite of low numbers of other wildfowl and wader species; Ballyvergan Beach is evaluated as potentially of **National Importance** for wintering wildfowl, in particular it may be an important ex-situ site of coastal Special Protection Areas close by, including Ballymacoda SPA c.a. 1km south west of the landfall. In this regard the landfall area is identified as a **SER** for wintering wildfowl and waders.

Ballyadam/IDA site

Wintering line transect counts following a circular path around the interior of the wider Ballydadam/ IDA site began in January (access difficulties in December limited survey work to the north and west perimeters) and continued on a monthly basis through to March. 32 species (all of them widespread and common) were recorded (Table 8.22).

[134] Burke B, Lewis L, Fitzgerald N, Frost T, Austin G, and Tierney D (2018). Estimates of waterbird numbers wintering in Ireland, 2011/12 – 2015/16. Irish Birds 11: 1-12.

Table 8.22: Species recorded on-line transect surveys at the IDA site in January, February and March

Species	Conservation Status (Colhoun and Cummins, 2013)[1]	Annex 1 Birds Directive	Peak Count
Blackbird (*Turdus merula)*	Green	-	8
Black-headed gull	Red	-	2
Blue tit (*Cyanistes caeruleus)*	Green	-	6
Bullfinch (*Pyrrhula pyrrhula)*	Green	-	2
Chaffinch (*Fringilla coelebs)*	Green	-	4
Coal tit (*Periparus ater*)	Green	-	1
Common buzzard	Green	-	1
Dunnock *(Prunella modularis*)	Green	-	9
Goldcrest (*Regulus regulus)*	Green	-	3
Goldfinch (*Carduelis carduelis)*	Green	-	1
Great tit (*Parus major*)	Green	-	3
Greenfinch *(Chloris chloris)*	Green	-	23
Grey heron	Green		1
Hooded crow *(Corvus cornix)*	Green	-	4
Jackdaw (*Corvus monedula)*	Green	-	2
Jay (*Garrulus glandarius*)	Green	-	2
Lesser black-backed gull	Amber	-	6
Lesser redpoll (*Acanthis cabaret)*	Green	-	2
Long-tailed tit (*Aegithalos caudatus)*	Green	-	8
Magpie (*Pica pica*)	Green	-	2
Mallard	Green	-	2
Meadow pipit (*Anthus pratensis)*	Red	-	2
Pied wagtail (*Motacilla alba)*	Green	-	1
Redwing (*Turdus iliacus*)	Green	-	8
Robin (*Erithacus rubecula*)	Amber	-	9
Rook (*Corvus frugilegus*)	Green	-	70
Snipe	Amber	-	12
Song thrush (*Turdus philomelos)*	Green	-	5
Stonechat (*Saxicola rubicola)*	Green	-	1
Teal	Amber	-	10
Woodpigeon (*Columba palumbus)*	Green	✓	5
Wren (*Troglodytes troglodytes*)	Green	✓	8

Small numbers of the red-listed species black-headed gull and meadow pipit and amber-listed species teal, snipe, lesser black-backed gull, robin, stonechat, goldcrest, greenfinch and linnet were recorded. The highest number of birds (132) and the highest number of species (25) were

[1] Colhoun K. & Cummins, S. 2013 Birds of Conservation Concern in Ireland 2014-19. Irish Birds 9:523-544

recorded in January. A considerably lower number of birds (85) and a smaller number of species (22) were recorded in February. In March, 125 birds of 21 species were recorded.

The Ballyadam site had typical counts of common resident species. Snipe and teal are noteworthy and likely include migrants from Europe/ Iceland. These are common wintering species throughout Ireland. In summary typical common species were recorded and the Wider IDA/ Ballyadam area including the substation site is evaluated as Local Importance (Lower value) with no significant SER wintering birds.

Winter Roost Surveys – Ballyvergan Marsh

Winter raptor roost surveys recorded Hen Harriers on four of the five winter roost surveys between November and March. A minimum of two birds was seen on each of the months they were recorded and up to five were seen in November.

Recording the exact number of hen harrier can sometimes be difficult as some birds alight after settling (often unnoticed) and may leave the roost site only to return again later. Three birds (all females or immatures) were seen together and it was thought that at least one and possibly two later sightings (females/immatures) were additional birds arriving after the first three had settled. No birds were seen in December, but it is possible that birds either roosted earlier than usual or alternatively, birds were not seen as they flew in stealthily to roost. A minimum of two birds (adult male and female/immature) was seen in January and possibly a third bird (female/immature). Two birds, (adult male and female/immature) were recorded in February and a minimum of two birds (adult male and female/immature) were recorded in March. Peak counts of species encountered at Ballyvergan Marsh are presented below in Table 8.23.

Table 8.23: Peak Counts Recorded During Hen Harrier Winter Roost Surveys at Ballyvergan Marsh

Species	Conservation Status (Colhoun and Cummins, 2013)[135]	SCI of Ballymacoda SPA	SCI of Blackwater Estuary SPA	Peak Number Recorded	Figure of National Significance	Peak as % of Figure of National Significance (Wetland Birds)
Hen harrier	Amber	-	-	3 – 5	2 to 3	150 – 166%
Buzzard (*Buteo buteo*)	Green	-	-	1	-	
Sparrowhawk (*Accipiter nisus*)	Green	-	-	1	-	
Peregrine (*Falco peregrinus*)	Green	-	-	1	-	
Mute swan	Amber	-	-	2	90	2%
Mallard	Green	-	-	4	280	1.5%
Teal	Amber	□	-	1	360	<1%
Little egret	Green	-	-	3	20	15%
Grey heron	Green	-	-	1	25	4%
Curlew	Red	□	□	97	350	28%

[135] Colhoun K. & Cummins, S. 2013 Birds of Conservation Concern in Ireland 2014-19. Irish Birds 9:523-544

The numbers of regularly recorded hen harrier (3 to 5) are evaluated as nationally significant relative to the most recent Republic of Ireland breeding population estimates (Ruddock *et* al., 2016)[136]. It is noted though that these counts may include hen harrier that breed elsewhere, such as Scotland[137]. Roosting sites varied significantly, and birds appeared to regularly choose different sites. Roost surveys indicate that there is a distinct preference for roosting on the west side of the marsh and the closest roosting bird was estimated to be c.700 metres west of the proposed cable trenching works area within the marsh.

Several other species of conservation interest were recorded during the hen harrier roost survey including a peregrine falcon in November. A maximum of three little egrets were seen each month apart from March and a maximum of 97 (28% of national significance) curlew was recorded flying from the marsh in February. Single sightings of buzzard (*Buteo buteo*) and sparrow hawk (*Accipiter nisus*) were recorded in December and January. Small numbers of mute swan, mallard, teal and grey heron were also recorded over the period. Peregrine falcon (foraging only), little egret, and the winter roosting raptor are Annex 1 species under the Birds directive. None of these species are SCIs of Blackwater Estuary or Ballymacoda Bay SPAs.

As a proposed Natural Heritage Area, Ballyvergan Marsh pNHA (including its bird communities, which include winter raptor roosts) is evaluated as **Nationally Important** and is an SER for wintering birds (winter period) specifically.

<u>Summary evaluation Winter Bird Sites/ Bird populations</u>

Table 8.23 below summarises key findings and evaluations of wintering bird sites relevant to the proposed development.

Table 8.24: Wintering Bird Locations, Key Species, sensitivity and evaluation

Location/ Site	Key Wintering Species Within ZoI	Key Sensitivity/ Potential Associated European Site	Evaluation
Redbarn/ Claycastle Beach	Nationally important Sanderling with smaller numbers of waders, gulls, and other waterfowl	Wintering Sanderling and other wintering wildfowl and wader species. Potential ex-situ site of Ballymacoda Bay SPA, Blackwater Estuary SPA	National Importance
Ballyadam/ IDA site	Typical common resident species with small numbers of winter migrant species teal and snipe.	None	Local Importance (Lower Value)
Ballyvergan Marsh	Wintering raptor roost site. Significant curlew populations	Various potential SPAs associated with winter raptors. Curlew associated with nearby coastal SPAs, including Ballymacoda Bay SPA and Blackwater Estuary SPA	National Importance

In summary the Redbarn/ Claycastle Beach and Ballyvergan Marsh are identified as SER areas for wintering wildfowl and waders

[136] Based on population estimate of 108 to 157 pairs detailed in. Ruddock, M., Mee, A., Lusby, J., Nagle, A., O'Neill, S. & O'Toole, L. (2016). The 2015 National Survey of Breeding Hen Harrier in Ireland. Irish Wildlife Manuals, No. 93. National Parks and Wildlife Service, Department of the Arts, Heritage and the Gaeltacht, Ireland.

[137] Brian Etheridge & Ron W. Summers (2006) Movements of British hen harriers circuscyaneus outside the breeding season, Ringing & Migration, 23:1, 6-14, DOI: 10.1080/03078698.2006.9674338

8.4.3.6 Breeding Bird Survey

Breeding Bird Surveys 2019

Breeding bird surveys were undertaken at a number of sites including Knockraha Substation, Claycastle / Ballyvergan Marsh, and the Converter Station Site. The findings in relation to the proposed development are provided hereunder.

Knockraha Substation

The key findings of the breeding bird at Knockraha substation in 2019 are summarised in Table 8.25

Table 8.25: Species of conservation concern recorded at Knockraha in Spring/Summer 2019

Species	Birds of Conservation Concern Status[138]	MaximumTerritories adjoining substation	Breeding/Non-breeding at the site
Willow Warbler	Green	4	Breeding
Greenfinch	Green	3	Breeding
Yellowhammer	Red	1	Possibly breeding

In summary the breeding bird assemblage at Knockraha in 2019 was limited and included typical common breeding birds. Yellowhammer is noteworthy as it is a declining breeding species, nationally of high conservation concern, albeit locally common.

Ballyadam / IDA Site

A noteworthy community of bird species was recorded during breeding bird surveys on the wider Ballyadam IDA lands. In total 32 species were recorded within the wider Ballyadam / IDA site (including the proposed Converter Station site). Species of conservation note recorded are summarised in Table 8.26.

[138] Colhoun K. & Cummins, S. 2013 Birds of Conservation Concern in Ireland 2014-19. Irish Birds 9:523-544.

Table 8.26: Species of conservation concern recorded at the Ballyadam IDA site in Spring/Summer 2019

Species	Conservation Status (Colhoun and Cummins, 2013)[139]	Annex 1 Birds Directive	The IDA site 01/05/19	The IDA site 18/06/19	Breeding/Non-breeding at the site
Common Buzzard	Green	-	1	2	Probably breeding
Cuckoo	Green	-	-	1	Possibly breeding
Greenfinch	Amber	-	1		Breeding
Linnet	Amber	-	2	2	Breeding
Meadow Pipit	Red	-	5	7	Breeding
Reed Bunting	Green	-	2	2	Breeding
Sedge Warbler	Green	-	2	2	Breeding
Skylark	Amber	-	1	1	Breeding
Stonechat	Amber	-	3	4	Breeding

A record of cuckoo is rare in the intensively farmed areas of County Cork. Skylarks and meadow pipits recorded have become increasingly rare and scarce birds respectively over much of East Cork.

Stonechat, sedge warbler, greenfinch, linnet and reed bunting are noteworthy breeding species. The small wood in the south-eastern corner of the wider Ballyadam IDA site, outside of the footprint of the proposed converter station contains a large rookery of at least 100 nests.

In summary, the breeding bird assemblage at Balladam IDA lands in 2019 was noteworthy in a local context and included scarcer breeding birds (cuckoo) and common species (skylark and meadow pipit) that are of conservation concern respectively. The 2019 and 2020 survey results informed the overall evaluation of the Balladam IDA lands' importance for breeding birds detailed below.

Breeding Bird Surveys 2020

Breeding bird surveys were carried out at the IDA Ballyadam lands (including the Converter Station Site) and at Ballyvergan Marsh between May and June 2020.

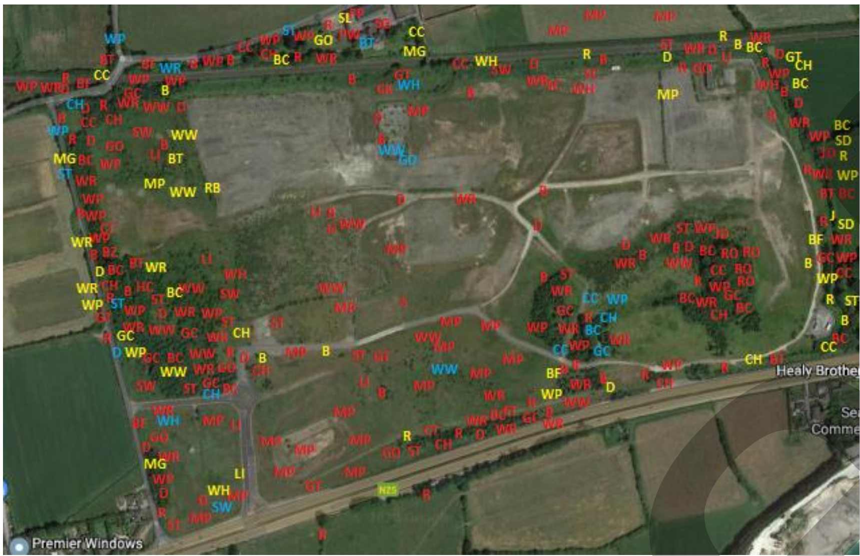
<u>Ballyadam (IDA Site)</u>

No Annex I listed bird species were recorded at the Wider IDA site during the surveys. Two red-listed species of conservation concern were recorded: meadow pipit and yellowhammer and 11 amber-listed species were recorded: stock dove, skylark, sand martin, swallow, house martin, robin, stonechat, goldcrest, starling, linnet and greenfinch.

A composite map of The IDA lands breeding bird locations is provided below in Figure 8.40: Wider Ballyadam / IDA site Bird Record Locations. Red text represents the findings of the first survey (May 15th), yellow text represents the additional findings of the May 31st visit and blue text represents the additional findings of the June 18th survey.

[139] Colhoun K. & Cummins, S. 2013 Birds of Conservation Concern in Ireland 2014-19. Irish Birds 9:523-544

Figure 8.40: Wider Ballyadam / IDA site Bird Record Locations



Source: Nagle 2020. Note Bird codes taken from BTO[140]

A nocturnal bird survey did not detect other species that are active in late evening after sunset such as snipe, woodcock, long-eared owl, barn owl and grasshopper warbler.

The highest densities of birds on the wider Ballyadam IDA lands were associated with the woodland areas and the lowest densities occurred in the exposed limestone and the rank grassland, **which includes the proposed convertor station site**. In terms of the proposed convertor station site; breeding bird activity was low and concentrated in the northern boundary berm adjacent to the railway line. Meadow pipit, whitethroat, stonechat and wren were recorded as possibly breeding at low densities (max 1 each) on the site, where works are proposed.

Based on the 2019 and 2020 results the overall Ballyadam IDA lands had a relatively high concentration of common breeding species. It is noteworthy also that a number of nationally declining species including some rare breeding species in east Cork occur namely, cuckoo, yellowhammer, skylark, meadow pipit, and stock dove. Based on this the overall Ballyadam IDA site is evaluated as being of **Local Importance (Higher Value)** and breeding birds are an **SER**.

Ballyvergan Marsh

Surveying on the east side of the study area was focussed on the proposed cable route along the eastern extremity of Ballyvergan Marsh and surveying in the west side of the study area enabled a more extensive exploration of the marsh to examine breeding bird populations in the wider area.

A total of 43 species was recorded. 37 species were recorded as breeding or likely to be breeding within the study area. Of the 6 species that were not likely to be breeding within the study area, little egret, grey heron, buzzard, house martin and rook are all likely to have bred

[140] https://www.bto.org/sites/default/files/u36/downloads/species_codes-cheat_sheet.pdf

nearby but the single short-eared owl recorded during a snipe survey on May 18 was almost certainly a late migrant bird on passage.

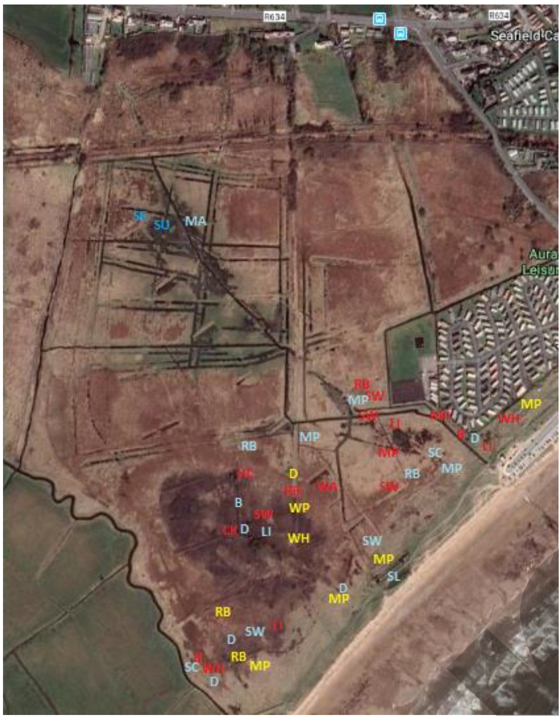
Sedge warbler and wren were found to be the most common species at 15 pairs each, followed by 11 pairs of dunnock, eight pairs of house sparrow, seven pairs of blackbird and six pairs each of meadow pipit and reed bunting. Four pairs of woodpigeon and whitethroat were recorded along with three pairs of water rail, stonechat, song thrush, starling, chaffinch, linnet and goldfinch. Two pairs of collared dove, robin, blue tit, chiffchaff and blackcap were recorded and single pairs of shelduck, mallard, cuckoo, skylark, swallow, pied wagtail, reed warbler, willow warbler, goldcrest, great tit, long-tailed tit, magpie, jackdaw, hooded crow and greenfinch are likely to have bred or attempted to breed in or close the study site.

Composite maps of breeding bird activity at Ballyvergan are presented below in Figure 8.41 and Figure 8.42. Red text represents the findings of the first survey (May 13), yellow text represents the additional findings of the June 1st visit and blue text represents the additional findings of the June 17 survey.

Figure 8.41: Breeding Bird Activity on the Eastern Extremity of Ballyvergan Marsh

Source: Nagle 2020

Figure 8.42: Breeding Bird Activity on the Western Side of Ballyvergan Marsh



Source: Nagle 2020

The highest densities of birds were associated with woodland and scrub areas. In the extensive reedbed areas, sedge warbler and reed bunting were the most frequently encountered species.

Little egret and short-eared owl are both Annex I species, but neither is suspected of breeding or attempting to breed within the study site, and none were recorded during the surveys. Meadow pipit is the only red-listed bird of conservation concern recorded within the site, but 10 amber-listed species were recorded: shelduck, short-eared owl, skylark, swallow, house martin, robin, starling, house sparrow and greenfinch.

The breeding bird assemblage at Ballyvergan is noteworthy as it includes nationally scarce reed warbler, high densities of common passerines and some locally scarce wetland breeding species (shelduck) and passage migrants (short eared owl and large flocks of hirundine's in the Autumn). Ballyvergan Marsh is identified as being of **County Importance** and a **SER** for breeding birds.

Cable Route

Common breeding birds including yellowhammer (red listed) are widespread in hedgerows and field boundaries adjacent to the cable route. These species may also occur in hedgerows and treelines crossed at some locations.

Of note, a single kingfisher (Annex 1 listed) was recorded flying past on the Womanagh River during the aquatic survey. Other riparian bird species that may potentially occur at river crossings include grey wagtail (High Conservation Concern) and dipper. All river crossings and wooded habitats are considered to be of **Local importance (Higher Value)** for breeding birds and identified as **SER**.

8.4.3.7 Other Protected Species

Invertebrates

The agricultural fields are of limited value for insects. There is no suitable humid acid grassland or peatland habitats containing the larval food plants of marsh fritillary butterfly *Euphydryas aurinia.*

Reptiles and Amphibians

Scrub, and dune habitat may also provide habitat for common lizard. While none were recorded during the site walkovers, having regard to the precautionary principal it is assumed that they are likely to be present. Common lizard is assessed as being a **SER** of **Local Importance (Higher Value)** given their protection under law.

The area of ponding within the proposed Converter Station site has potential to offer habitat for amphibians in the locality. The frogs and newts (both of which are protected) are assessed as being of **Local Importance (Higher Value).**

8.4.3.8 Unprotected Species of Conservation Significance

Kidney vetch which is the food plant of the Endangered small blue butterfly, was recorded within sand dune habitat at Claycastle Beach, but to the west of and outside of the footprint of the proposed works. There are also no records of the species within 10 kilometres grid squares of the proposed landfall.

The lands at the Converter Station Site and wider Ballyadam/IDA likely offer food sources for pollinators generally given the abundance of species like ox eye daisy and knapweed throughout the wider IDA site.

Pollinators are assigned a value of **Local Importance (Higher Value)** and are a **SER.**

8.4.3.9 Invasive Species Survey

The following Third Schedule invasive species were recorded:

- Japanese knotweed (Figure 8.43)
- Himalayan balsam (Figure 8.44)
- Sea buckthorn (Figure 8.45)
- American mink (Figure 8.46)
- Three cornered leek

Figure 8.43: Japanese Knotweed along Dissour River

Source: Mott MacDonald September 2020

Figure 8.44: Himalayan Balsam Plants Along Owennacurra River

Source: Mott MacDonald October 2020

Figure 8.45: Sea Buckthorn at Claycastle

Source: Mott MacDonald October 2020

Figure 8.46: Mink Recorded Close to Owenacurra River

Source: MottMacDonald November 2020

The locations of these species relative to the proposed development is outlined in Table 8.27 hereunder.

Table 8.27: Third Schedule Invasive Species Recorded

Location	Invasive Species Recorded	Notes
Knockraha Substation	None	None
AC01-AC02	None	None
AC02-AC03	None	None
AC03-AC04	None	None
AC04-AC05	None	None
AC05-AC06	Japanese knotweed	• Single roadside stand, potentially will be affected by cable
Converter Station Site	None	None
DC01-DC02	Himalayan balsam	• Numerous plants growing along the riverbank both upstream and downstream of the Owennacurra river crossing. Potentially will be affected by cable.
DC02-DC03	Japanese knotweed	• Extensive stand of knotweed located on roadside. Appears to be under treatment by the council. Outside of works area. • American mink recorded during trail camera survey
DC03-DC04	Three cornered leek	• In riparian zone along the Dungourney River
DC04-DC05	None	None
DC05-DC06	None	None
DC06-DC07B	None	None
DC07-DC08	Three cornered leek	• In riparian zone along the Dissour river
DC08-DC09B	Japanese knotweed	• Multiple significant untreated stands of knotweed along the banks of the river Dissour and along field boundaries. Does not appear to be under treatment. Potentially affected by cable.
DC09-DC10	None	None
DC11-DC12	Japanese knotweed	• Stand within an area of scrub in Ballyvergan marsh. Appears to be undergoing treatment, bonsai growth evident. Outside of works area.
Claycastle Landfall	Sea buckthorn	• Single stand within a planted border. Outside of works area.

8.4.3.10 Summary table of SERs

A summary of the SERs identified are shown in Table 8.28: Summary Below. It is noted additional to below that distant European designated sites outlined in Table 8.2 and pNHA outlined in Table 8.3 are additional SER.

Table 8.28: Summary of Identified Sensitive Ecological Receptors

Receptor		Location	Importance	Listed as of Special Conservation Concern in Cork County BAP	Note
European Sites (SACs and SPAs)	Blackwater River (Cork/Waterford) SAC	1.4km from proposed development boundary	International importance	-	-
	Great Island Channel SAC	1.7km from proposed development boundary	International importance	-	-
	Ballymacoda (Clonpriest and Pillmore) SAC	2.8km from proposed development boundary	International importance	-	-
	Cork Harbour SPA	1.9km from proposed development boundary	International importance	-	-
	Ballymacoda Bay SPA	1.4km from proposed development boundary	International importance	-	-
	Blackwater Estuary SPA	2.4km from proposed development boundary	International importance	-	-
	Mullaghanish to Musheramore Mountains SPA	45km from proposed development boundary	International importance	-	-
Proposed Natural Heritage Areas (pNHA)	Ballyvergan Marsh Reed Swamp Wintering Hen harrier Breeding bird assemblage (including Reed Warbler)	Ballyvergan Marsh pNHA along HVDC cable route (including c. 70 m section of HDD within pNHA)	National Importance	-	-
	Loughs Aderry and Ballybutler	Directly adjacent to the cable route	National Importance	-	-
	Clarashinka Pond	Directly adjacent to the cable route	National Importance	-	-
	Great Island Channel	1.7km from proposed development boundary	National Importance	-	-
	Ballymacoda (Clonpriest and Pillmore)	2.8km from proposed development boundary	National Importance	-	-
	Blackwater River and Estuary	1.4km from proposed development boundary	National Importance	-	-
Notable habitats	Annex I fixed Dune Habitat	At the proposed landfall at Claycastle	County Importance	✓	-
	Oak Ash Hazel Woodland	Longstown townland	County Importance	✓	Listed as “ancient and/or semi natural woodland”
	Priority Annex 1 Calcareous Grassland (6210*)	Proposed Converter Station site at Ballyadam	County Importance	✓	-
	Treelines and hedgerows	Throughout cable route	Local Importance (Higher Value)	-	-
Rare and Protected Flora	Orange foxtail	Not recorded. Possible in vicinity of Ballyquillan Railway crossing	National Importance (Protected Species)	✓	-

Receptor		Location	Importance	Listed as of Special Conservation Concern in Cork County BAP	Note
	Penny royal	Not recorded. Possible in vicinity of Ballyquillan Railway crossing	National Importance (Protected Species)	✓	-
	Tufted feather-moss	Not recorded. Possible in sand dune habitat Claycastle Beach area	County Importance	-	-
	Wild clary	Known to occur in sand dune habitat Claycastle Beach area	Local Importance (Higher Value)	✓	-
	Greater knapweed	Recorded at the proposed converter station site	County Importance	-	-
Mammals	Otter	All river crossings	County Importance	✓	-
	Badger setts (outlier and potential breeding sett)	One sett recorded within the zone of impact for works. Additional are possible in hedgerows along HVDC Route	Local Importance (Higher Value)	✓	-
	Bats: Potential Roost Features with suitability to roosting bats	Mature trees near – DC01-DC02 DC03-DC04 DC06-DC07B Additional roost features may be present in trees along cable route Building to be removed within proposed converter station site	Local Importance (Higher Value)	✓	-
	Red squirrel	Not recorded but suitable habitat recorded in the hazel woodland	Local Importance (Higher Value)	✓	-
	Pygmy Shrew	Recorded at claycastle but may be present throughout the proposed development	Local Importance (Higher Value)		-
	Hedgehog	Not recorded but may be present throughout the proposed development	Local Importance (Higher Value)	✓	-
	Stoat	Not recorded but suitable habitat recorded near to the proposed converter station site.	Local Importance (Higher Value)	✓	-
Watercourses	Owencurra River	Multiple watercourse crossings along cable route	County Importance	✓	-
	All other watercourse crossings	Multiple watercourse crossings along cable route	Local importance (Higher Value)	✓	-
Wintering Birds	Waterfowl	Claycastle Beach	National importance	✓	Specific species only
	Waterfowl and winter raptor roosts	Ballyvergan Marsh	National importance	-	-
Breeding birds	General	Proposed converter station site	Local Importance (Higher Value)	-	-

Receptor		Location	Importance	Listed as of Special Conservation Concern in Cork County BAP	Note
	General	Cable route – Hedgerows, treelines and scrub	Local Importance (Higher Value)	✓	Specific species only
	Breeding Kingfisher / riparian birds	River crossings	Local Importance (Higher Value)	-	-
Amphibians	Common frog	Not recorded. Breeding habitat presumed present at Ballyvergan Marsh along HVDC cable route and/or in ponded wet grassland area within proposed Converter Station Site	Local importance (Higher value)	-	-
	Smooth newt	Not recorded, presumed present. - Potential breeding habitat in permanently wet ponded wet grassland area within proposed Converter Station Site	Local Importance (Higher Value)	-	-
Reptiles	Common lizard	Not recorded. Presumed present as suitable basking present in dry/scrubby ground at Ballyadam and Claycastle dunes.	Local Importance (Higher Value)	-	-
Other species of note	Invertebrates of conservation concern presumed present (none protected)	Semi natural habitats at Ballyadam site and Claycastle dunes	Local Importance (Higher Value)	✓	Certain pollinator species listed

8.5 Characteristics of the Development

8.5.1 Construction Phase Activities

Construction phase activities, as they relate to potential impacts on biodiversity are discussed below. Regard is had to the potential for direct damage and disturbance of species, noise related emissions, surface water quality in the context of the baseline environment.

8.5.1.1 Connection Point

The HVAC cable will connect into the Irish transmission system at an existing spare bay within Knockraha substation.

Knockraha substation is elevated, surrounded by improved agricultural grassland and hedgerows and there are no known surface waterbodies within the proposed works area at Knockraha substation. The closest known surface waterbody to the works areas at Knockraha substation is Lisheenroe Stream, a tributary of the Butlerstown River, located approximately 650m east of the proposed construction compound. No significant habitats or other biodiversity receptors exist on this site.

8.5.1.2 Construction Compounds/Laydown Areas

Construction activities require temporary areas for laydown and sufficient area for all construction activities including access and egress. The proposed construction site areas along the route will be required to accommodate various items, as outlined in the description of the development. Temporary construction compounds will be required at Knockraha substation, the converter station (The IDA site) and the landfall (the area of the existing car park at Claycastle Beach).

All temporary construction compounds will be secured with hoarding / fencing around the compound perimeters as appropriate. Site clearance will be required to facilitate the compounds. This has potential to result in direct impact to habitat within the footprint of the works. Where temporary construction areas are required and existing hardstanding is not available, engineering stone fill will be laid and compacted and maintained as required for the duration of the works.

Where an access road is required, engineering stone fill will be laid and compacted and maintained as required for the duration of the works. Once the works are completed, the engineered stone fill will be removed and the land will be reinstated to its original condition.

Temporary facilities will be provided including construction phase car parking and welfare facilities and temporary material storage areas as necessary. Any discharges from temporary welfare facilities will be connected to a sealed holding tank to be emptied and disposed of off-site by a licenced contractor to an approved licenced facility.

Storage of fuel and refuelling will be undertaken within bunded hardstanding areas. Water will be brought to site via tankers as required. There will be no abstraction required as part of the proposed development.

All construction workers will be directed to use the designated access/egress routes only.

Once any temporary works area is completed, the engineered stone fill will be removed, and the land will be reinstated to its original condition.

8.5.1.3 Cable Route Construction

8.5.1.4 HVAC / HVDC Land Cables and Passing Bays

The majority of the HVAC / HVDC cable routes follow the existing road alignment.

Sections of the HVAC / HVDC cable routes are off-road, for example off-road HVDC routing to avoid roads through the settlements of Killeagh and Castlemartyr.

The cable route construction phase comprises:

- Installation of an underground ducting system, requiring excavation and reinstatement.
- Installation of the cables into the ducting system using pulling equipment.

For narrow roads, the cable systems may need to be installed in the centre or may need to switch from one side of the road to another to reduce the impact on trees and also to accommodate the trench excavation works. Where the cable is within the existing road, it is likely vegetation clearance will be minimal. It is, however, likely that vegetation removal will be required along sections of the cable routes where the roadway is narrow so to accommodate the proposals. This may result in treelines and hedgerows which are located adjacent to the road being impacted by the works.

Once a trench length has been excavated and temporarily supported, a layer of bedding material (sand, concrete or sand/cement mix) will be laid onto the base of the trench. The ducts will then be installed onto the bedding and covered with appropriate material. The trench will then backfilled and compacted with thermally suitable indigenous material and the ground reinstated to the original standard. Where concrete is used there will be requirements for washing out of concrete wagons associated.

The installation of a duct bank within roads is similar to the typical installation described above, with some additions. Once traffic control measures are in place, the road surface will be saw cut to the width of the trench and excavated using an excavator with hydraulic breaker. Trenches will be excavated to a specified depth, in accordance with the required project trench design and requirements of the relevant authority. Once completed the road will be reinstated to the original standard. The use of machinery such as saws and hydraulic breakers have the potential to result in an increase in local noise levels.

During the cable trenching works, trenches typically of 50m in length will be excavated to install the HVAC / HVDC cable. These trenches will then be filled before moving on to the next section of the cable route. In areas with lots of services, for example roads through settlements, only 20m long trenches will be excavated and filled to help minimise disruption. Each section of trench is predicted to take one day to excavate and fill before moving on to the next section of route. Works associated with passing bays, laydown areas, construction compounds and utility crossings, as detailed in Chapter 2 and Chapter 3 of Volume 3C, will also be carried out along the HVAC / HVDC cable route. Water crossings will be by either open cut trenching or Horizontal Directional Drilling (HDD). Details relating to watercourse crossings are provided in Chapter 7. Existing utility services, including public water supply pipes, will also need to be crossed.

8.5.1.5 Ballyadam Converter Station

As detailed in Chapter 6 and Chapter 7 of Volume 3C, there are a number of karst features within the proposed converter station site. These features may be hydrologically connected to surface water bodies.

Prior to works commencing the site will require vegetation clearance and levelling. This will result in direct damage to habitats within the footprint of the converter station, the access roads, and in any compound areas within the site.

An existing substation building with a concrete roof will be removed to facilitate the proposed converter station, Figure 8.47. It is understood that it was constructed to facilitate the proposed Amgen works but works were not completed.

Figure 8.47: Building to be Removed

Source: Mott MacDonald

The converter station site will consist of a new engineered stone fill platform which will raise the proposed site level above its existing level. This will ensure that a sealed, below ground, gravity drainage system can be accommodated.

Rotary bored cast-in-place (socketed into rock) reinforced concrete piles will likely be adopted for all foundations on this site. Specialist and experienced piling Contractors will be employed to carry out the works. Details of the methodology to be utilised is outlined in Chapter 7.

Construction of the below ground drainage system will commence on completion of the proposed platform. The access road below ground drainage system will commence on completion of the access road enabling works.

The construction of the proposed site access road will commence at the same time as the piling works. This will consist of removing all poor ground and any material from areas to be cut and removing this material from site. All fill for embankments will consist of engineered stone that will be brought to site.

A Contractors compound will be located within the site boundary and will be located on an area of ground that will be temporarily surfaced with engineered stone and levelled. The compound will house the Contractors cabins and areas for temporary storage of construction materials (excluding cut/fill ground, which will be brought directly to and from site with no need for temporary storage).

Construction of the reinforced concrete piled raft for all of the buildings and structures can commence once the piling is complete. The structures and building will then progress commensurate with typical construction practice.

The site contains two depressions which act to reduce flood levels in the wider IDA site. These will be infilled during construction and replaced with a compensatory storage area. The transition of the depressions to the storage area will be managed on site so as not to increase flood risk elsewhere during construction.

8.5.1.6 Landfall Construction

The Irish landfall construction works will be progressed in two phases, to mitigate against beach access and disturbance to the caravan park during the busy summer months.

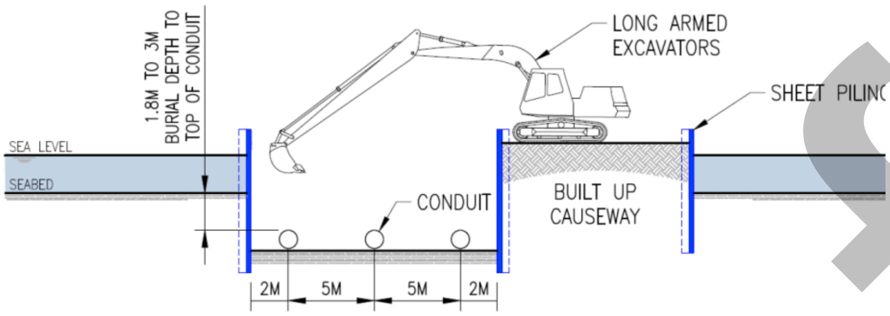
Phase 1 will be conducted in the winter months and will consist of the construction of the transition joint bay chambers, the installation of the cable ducts within open cut trenches up the beach and into the beach car park. The areas will then be reinstated to their original condition prior to completion of this Phase. The estimated duration of the works is approximately 10 weeks.

Phase 2 will be conducted in the summer months and will consist of the installation of the cables through the Phase 1 ducts. This is achieved by pulling the cables from the cable lay vessel through the ducts by means of a cable winch located within the transition joint bay chambers. The estimated duration of the works is approximately 4 weeks.

During the construction works, the landfall area will require access for both equipment associated with the proposed construction works and for the Contractors compound.

The cable ducts will be placed within excavated trenches up the beach from the sea to the transition joint bay chambers (Figure 8.48). The excavation into the intertidal zone will require the temporary construction of a causeway, to form a stable platform from which excavators can work freely above the tidal zones. The platform and the trench excavation will be formed by a cofferdam (sheet piling) to mitigate against sea erosion during the winter months. The excavation of the trenches and the installation of the sheet piles have the potential to cause temporary disturbance/ displacement, in the absence of mitigation, to nearby wintering birds and to habitats within the footprint of the works.

Figure 8.48: Typical Temporary Works for the Excavation and Causeway



Source: Wood Group (Sketch not to scale)

A portion of the trench route will pass below the carpark necessitating its temporary closure. As this is above the high tide mark, these works can be conducted using conventional excavating machines and methods, thus resulting in a relatively short closure of the carpark.

The submarine cables will be jointed with the land cable within underground transition joint bay chambers. The chambers will have approximate plan dimensions of 15m x 4m x 3m deep and will be installed behind the landfall area at Claycastle Beach within the sand dune habitat. Such chambers generally consist of reinforced concrete base slab and walls. The chamber is then typically backfilled with a suitable material (such as cement bound sand) following installation of the cable joints. The top layer can then be backfilled, and the surfaces above reinstated. It is estimated that construction of the transition joint bay chambers will take approximately 18 weeks and will commence at the beginning of Phase 1 activities.

The extent of the area required for the joint bay chamber construction works will be minimised as much as possible to limit potential access restrictions for the public to the carpark and restricted to areas outside of the higher quality sand dune habitat.

8.5.2 Operational Phase Activities

8.5.2.1 Connection Point

No additional operating requirements will be required from the connection point compared to the existing bays in the substation.

8.5.2.2 HVAC Onshore Circuits

The HVAC and HVDC cables routes will require no specific maintenance requirements along the cable trench or joint bay locations. Access may be required at joint bays on rare occasions to facilitate cable replacement if a failure occurs.

8.5.2.3 Converter Station

The converter station does not require any personnel for operation. Maintenance will be required on a yearly basis; however, these will be to the installed equipment and will not result in additional impacts to biodiversity. Potential for impacts to surface water features caused by the operational phase activities are discussed in Chapter 7.

8.6 Likely Significant Impacts

The evaluation and assessment of impacts on Biodiversity within the chapter is carried out as per '*Guidelines for Assessment of Ecological Impacts of National Roads Schemes*' (NRA, 2009). The description of effects is as outlined in the draft "*Guidelines on the on the Information to be Contained in Environmental Impact Assessment Reports*" (EPA, 2017).

The assessment is such that the receptors are defined in the context of their geographic scale (i.e.at an international, national, county level) and with a hierarchy that outlines their importance.

All elements of the proposed development, (as outlined in the description of the development) during the construction, operational and decommissioning phase have been considered in terms of their potential for likely significant adverse effects on ecological receptors.

The assessment of effects, in the absence of mitigation, is undertaken below under the following headings:

- Assessment of the 'Do-Nothing' effect.
- Assessment of effects on European Designated sites (Special Areas of Conservation and Special Protection Areas).
- Assessment of effects on Nationally Designates sites (Natural Heritage Areas and proposed National Heritage Areas).
- Assessment of effects to SERs.
- Assessment of effects to receptors of Local Importance (Lower Value).

8.6.1 Construction Phase

8.6.1.1 Assessment of effects on European Designated Sites (Special Areas of Conservation and Special Protection Areas)

The location of the proposed development is such that the footprint of the development does not fall within the boundaries of any European Sites. However, a number of watercourses were identified which provide hydrological connectivity to a number of European sites. Further, Qualifying Interests/Special Conservation Interests associated with these and other designated areas were identified as having potential to occur in close proximity to the works.

A Screening for Appropriate Assessment for the on-shore element of the development was carried out to achieve compliance with Article 6(3) of the Habitats Directive. This report considered the potential for significant effect on European sites caused by the proposed development. The report concludes that:

"*Likely Significant Effects on European sites cannot be excluded on the basis of objective evidence, from the project alone, and in combination with other plans or projects*."

Potential project-related impacts likely to negatively effect the site integrity of the following European sites, in the absence of mitigation, were identified in the Natura Impact Statement as follows:

- **Great Island Channel SAC**
  - Impacts to **mudflats and sandflats not covered by seawater at low tide** due to pollution of watercourses
  - Impacts to **Atlantic salt meadows** (*Glauco-Puccinellietalia maritimae*) caused by accidental spread of **invasive species**

- **<u>Ballymacoda (Clonpriest and Pilmore) SAC</u>**
  - Impacts to **Estuaries** due to pollution of watercourses
  - Impacts to **mudflats and sandflats not covered by seawater at low tide** due to pollution of watercourses
  - Impacts to **Atlantic salt meadows** (*Glauco-Puccinellietalia maritimae*) caused by accidental spread of **invasive species**
- **<u>Blackwater River (Cork/Waterford) SAC</u>**
  - Impacts (disturbance during construction) to **otter couches and holts, and reduction in fish biomass** due to water quality impacts

  <u>Cork Harbour SPA</u>
  - Impacts to **wintering curlew, teal, and lapwing** caused by disturbance and degradation of ex situ supporting habitat
- **<u>Ballymacoda Bay SPA</u>**
  - Impacts to **wintering curlew, lapwing, sanderling, teal and wigeon** caused by disturbance and degradation of ex situ supporting habitat
- **<u>Blackwater Estuary SPA</u>**
  - Impacts to **wintering curlew, teal and lapwing** caused by disturbance and degradation of ex situ supporting habitat
- **<u>Mullaghanish to Musheramore Mountains SPA</u>**

Impacts to wintering **hen harrier** caused by visual and noise disturbance during construction phase in Ballyvergan marsh

The predicted impacts on these European Sites are fully described in the NIS which will be submitted as part of the planning application. The conclusions of that NIS are:

"*Based on the assessment of the proposed development alone and in combination with other projects and plans, including the* ***implementation of mitigation measures,*** *it can be concluded that no adverse effects on the site's integrity will arise, in view of the site's conservation objectives."*

8.6.1.2 Assessment of Impacts on Nationally Designated sites (Natural Heritage Areas and proposed National Heritage Areas)

No Natural Heritage Areas (NHAs) were identified within the footprint of the proposed development. No NHAs were identified with connectivity to the proposed development. The closest NHA to the proposed development is located 37km to the west. Given the lack of connectivity to any NHAs, there is no potential for impact on same.

<u>Proposed Natural Heritage Areas Within the Footprint of the Proposed Development</u>

Three pNHAs were identified within the footprint of the redline boundary, Ballyvergan Marsh (site code 000078), Loughs Aderry and Ballybutler (site code 000446), and Clasharinka Pond (site code 001183).

The potential for impacts to these sites is presented below.

Ballyvergan Marsh

Within Ballyvergan Marsh, 162m of the cable runs within the boundary of the pNHA at DC11-DC12. The cable enters into the marsh at this location to facilitate the crossing of the railway line.

There are four key ecological receptors identified within Ballyvergan marsh. These are the population of wild clary, wetland habitats within the pNHA, wintering hen harrier and breeding reed warbler associated with the pNHA. Impacts to other species known to utilise the site are also discussed in relation to their species groups.

Impact on wild clary

Wild clary have been recorded historically within the sand dune habitat at Claycastle, albeit outside of the pNHA boundary. There is potential, for a direct impact and loss of some of the population at claycastle.

In the absence of mitigation there is potential for a **medium term slight negative effect** at a local geographic scale to wild clary population associated with the proposed development.

Impact on Habitats Within the pNHA

The area within the pNHA in which the works will take place comprises a relatively small area (approximately 2,655m^2). It is of note that while the fields north of the railway line are not within the pNHA boundary the phragmites reed bed now extends into this area and it has potential to support species associated with the pNHA within it as well. As such, the area with potential to have direct impacts to habitats and species for which the pNHA is listed is taken as approximately 6,245m^2.

An old, disused, railway bisects this area running east to west through the centre. Adjacent to the wall and the railway scrub has become established within the reedbed. This scrub comprises approximately half of the works area within the pNHA. The disused railway is, at the time of writing, undergoing clearance to facilitate the construction of the new Youghal to Midleton greenway. As such, a strip through the centre has now already been cleared.

The crossing of the greenway will be achieved by HDD. Clearance and excavations will be required where the cable enters the marsh and where the entry and exit pits for the HDD are located. There is potential for a loss of phragmites reed bed, and scrub habitat associated with the works. The land in proximity to the wall and the railway line is dry. Impacts to the hydrology of the marsh are assessed in Volume 3C Chapter 6.

Japanese knotweed has been recorded to the south of the works area within Ballyvergan Marsh adjacent to a gap in the wall. While the stand is located outside of the footprint of the works there is potential that access to the site may be gained through the break in the wall. As such, there is potential for translocation of Japanese knotweed further into Ballyvergan Marsh. This has the potential to cause a medium term degradation of the marsh habitat and a loss of phragmites reed bed habitat.

There is potential, therefore for a **medium term slight negative** impact to a marsh habitat at county geographic scale.

Impacts to wintering raptor roosts

The works to lay the cable will result in a local increase in noise emissions and general human presence where the cable runs along the eastern boundary of the pNHA and during works within Ballyvergan marsh. If works are conducted during the winter season than there is a slight risk of disturbance to wintering hen harrier albeit the main roost areas are > 700m from proposed works areas. The impacts to wintering hen harrier are caused by noise, human and machine presence and other disturbance associated with temporary construction works, within Ballyvergan Marsh. These are assessed as **temporary moderate negative impacts** to a wintering population of hen harrier at a national geographic scale.

Impacts to Reed Warbler

The works to lay the cable will result in a local increase in noise emissions where the cable runs along the eastern boundary of the pNHA and during the landfall installation. This is likely to be greatest during piling works for the landfall location, and where the works are within the road curtilage where the existing hard standing will need to be broken out. The zone of impact for noise (where it rises above baseline levels) is anticipated to be 380m.

It is of note that the road along which the cable will be laid is of use consistently throughout the year. As such, birds making use of the eastern extent of the marsh are likely habituated to human presence and are unlikely to be affected by human presence associated with works within the marsh.

Reed warblers nest primarily in phragmites reedbeds, suspending nests between reeds, and have been recorded nesting historically in the vicinity of the works area in 2020. As such, there is potential for direct impact on nesting reed warblers associated with the clearance should the works take place during nesting season. There is clearance required along the cable route and within the temporary compounds for directional drilling pits for the cable crossing of the greenway. This will be reinstated following the cable installation and allowed to re-vegetate. Clearance will take place outside of the breeding season for birds, or subject to findings of a preconstruction survey that confirms no disturbance risk to breeding birds. As such there will be no permanent loss of phragmites habitat within the marsh caused by the proposed works. The impacts to reed warbler as caused by the habitat clearance are, therefore, **temporary slight negative impacts** to a population of breeding Reed Warbler at a county geographic scale.

Loughs Aderry and Ballybutler (000446)

While the cable route does not fall within the boundary of the pNHA, the red line boundary for the proposed development overlaps with it for approximately 700m within the existing road.

There are three ecological receptors identified within the pNHA. These are the populations of rare plant species (protected orange foxtail plant), the habitats associated with the pNHA, and impacts to birds utilising the site.

Impacts to Habitats and Notable Plant Species Within the pNHA

The works are within the curtilage of the existing road on the northern verge. The cable route is buffered from the pNHA bordered by the road, which is not associated with the pNHA itself. There is no potential, therefore, for direct impact on the habitats associated with the works. No suitable habitat for orange foxtail exists that will be impacted.

There is no requirement for concrete at this location. As such there is no potential for cement fines to enter into the water of the lake and cause alterations in pH.

There is potential for the generation of sediment laden water associated with the excavation of the trench for the cable should pumping out of the trench be required. Given the location of the works in the northern verge, any emissions will be discharged to the north of the road away from the pNHA boundary for health and safety reasons. There is potential still for these emissions to enter into the existing road drainage. It is unclear where the road drainage discharges. As such, having regard to the precautionary principal it is assumed that it discharges into the lake. The location of the lake is such that it is likely subject to inputs of sediment from the road and from the adjacent farmland. Given the freshwater nature of the lake, there is potential for a further degradation in water quality. This, in combination with additional run-off from activities in agricultural land has the potential to result in **temporary moderate negative impacts** to the lake and accordingly, to the pNHA at a local geographic scale.

Impacts to Wildfowl Associated with the pNHA

As previously stated, the proposed development is located within the existing road at this location. The cable route is within the northern verge of the roadway. The roadway adjacent is busy with a great deal of traffic regularly making use of it. As such, bird species regularly making use of the site are likely to be habituated to human presence and impacts caused by human presence on site are anticipated to be negligible.

There is potential for an increase in noise associated with breaking out of hard standing to facilitate the cable route installation. This impulsive noise has potential to cause disturbance of birds utilising the lake, and an associated displacement of species from the immediate vicinity. The increased noise level will extend 380m into the pNHA boundary. There is potential therefore, for **a temporary moderate negative impact** on birds utilising the lake at a local geographic scale.

Clasharinka Pond (001183)

Approximately 80m of the cable route falls within the boundary of the pNHA. This section of cable is located within the existing road, and within the verge to the north of the pNHA.

The site is notable for its population of orange foxtail growing in association with the pond habitat.

Impacts to Habitats Within the pNHA

The works adjacent to the pNHA boundary are located within the existing roadway. There is potential for surface water run-off from the works area to enter into the boundary of the pNHA. The pond is set back from the road and buffered by approximately 170m of fields. There is potential for the emissions to enter into field drains which may be present. However, given the nature of the site, any sediment within the run-off will settle within the drain prior to entering into the pond. As such, any impact on the site is anticipated to be a **temporary imperceptible negative impact** to lake habitats at a local geographic scale.

Proposed Natural Heritage Areas with Connectivity to the Proposed Development

The following proposed Natural Heritage Areas were identified with connectivity to the proposed development:

- Great Island Channel (001058)
- Ballymacoda (Clonpriest and Pillmore) (000077)
- Blackwater River and Estuary (000072)

As outlined previously in section 8.3, the potential for impacts to these sites is assessed under the European Site Designation

8.6.1.3 Assessment of Impacts on Other Sensitive Ecological Receptors

Impacts on other SERs as identified previously are assessed below in Table 8.29.

Table 8.29: Potential for Impact to Other Sensitive Ecological Receptors

Receptor		Importance	Potential for Impact in Absence of Mitigation
Notable habitats	Annex I fixed Dune Habitat	County Importance	There is potential for loss and degradation of sand dune habitat at Claycastle associated with the construction of the cable and transition joint bays at the Claycastle land fall location. The elements of infrastructure installed at Claycastle will be underground. As such, in time, the sand dune habitat would likely regenerate to some extent. However, the construction works are likely to cause, in the absence of mitigation, a **permanent moderate negative effect** on sand dune habitat at a local geographic scale.
	Oak Ash Hazel Woodland	County Importance	There is potential for a loss of hazel woodland along the AC04-AC05 route section. This will constitute areas directly adjacent to the existing roadway and at the passing bay on the eastern side of the road. In the absence of mitigation there is potential therefore for a **permanent moderate negative effect** on oak ash hazel woodland associated with the proposed development at a local geographic scale.
	Priority Annex 1 Calcareous Grassland (6210*)	County Importance	The footprint of the works is such that the identified area of Annex I qualifying calcareous grassland within the footprint of the site will be directly affected by the works. As such there is, in the absence of mitigation, the potential for **a permanent significant negative effect** on this Annex I grassland within the converter station site, at a local geographic scale.
	Treelines and hedgerows	Local Importance (Higher Value)	There is potential for a loss of hedgerows and treelines associated with the works. The majority of the works will be within the road curtilage and will not impact hedgerows. However, where the roads are narrow clearance may be required of roadside hedgerows and treelines. There may be clearance of hedgerows and treelines associated with the creation of passing bays, laydown and construction compound areas. Where the cable route is offline and traversing field boundaries, and in areas where the cable is within the roads, but it is narrow, there will be a loss of treeline and hedgerow habitats. In the absence of mitigation, there is potential for a **permanent moderate negative effect** on treelines and hedgerows associated with the proposed development at a local geographic scale.
Rare and Protected Flora	Orange foxtail	National Importance	While it was not recorded during field survey, the species is known to be associated with freshwater related habitats, including the margins of ponds, ditches. As such, in the absence of mitigation, there is potential for the species to occur within the footprint of the proposed development. As such there is potential for **moderate slight negative effect** on orange foxtail populations, at a local geographic scale.

Receptor		Importance	Potential for Impact in Absence of Mitigation
	Penny royal	National Importance	While it was not recorded during field surveys, pennyroyal has potential to occur in sand dune habitat at the proposed landfall location though its presence is considered unlikely as this area was surveyed and no dune slack (wet area) occurs where this species is typically found. As such, in the absence of mitigation, there is potential for **permanent slight negative effect** on the pennyroyal populations, at a local geographic scale.
	Tufted feather-moss	County Importance	This species was not recorded during surveys; however, it has been recorded historically in the area. Given the suitability of localised river habitats within the development for this species, its presence is possible though considered unlikely. As such, in the absence of mitigation, there is potential for **permanent slight negative effect** on the tufted feather-moss populations, at a local geographic scale.
	Wild clary	Local Importance (Higher Value)	Wild clary is known to occur in the sand dune habitat at the proposed landfall location. While the known populations occur to the west of the footprint of the works, there is potential for plants to become established within the footprint of the works. As such, in the absence of mitigation, there is potential for **medium term slight negative effect** on the wild clary populations at a local geographic scale.
	Greater knapweed	Local Importance (Higher Value)	The footprint of the works is such that the identified greater knapweed plants within the footprint of the site will be directly affected by the works. As such there is, in the absence of mitigation, potential for a **permanent moderate negative effect** on the greater knapweed within the converter station site populations, at a local geographic scale.
Mammals	Otter	National Importance	There is potential for otter holts and couches to be present in areas that have not been surveyed to date due to third party land access restrictions. Further, additional holts and couches may become established prior to the commencement of construction. Loss of holts, and associated injuries to Otter therein would result in a **short-term slight negative effect** on otter populations at a county geographic scale.
	Badger	Local Importance (Higher Value)	Badger signs were recorded throughout the proposed development, with three setts recorded close to the development. There is potential for impact on both identified setts, any setts which may occur in un-surveyed parts of the site, and new setts which may be established following the survey but prior to construction The proposed cable route (at DC02-DC03) runs in close proximity to sett 1 which has been identified as a potential breeding sett. The cable route is located approximately 8m at its closest point to the sett. As such, there is the potential for both the disturbance to badger utilising the sett (likely impact), and for direct damage to the sett (probable impact) should the underground chambers protrude beneath the footprint of the cable. Should the cable installation impact these chambers, there is potential for a permanent loss of at least part of the sett. There is also potential for direct mortality of badgers should the sett be occupied. Sett two is located 190m from the cable route (at DC03-DC04). As such it is will not be affected directly by the proposed development, however machinery involved in the construction may

Receptor		Importance	Potential for Impact in Absence of Mitigation
			pass by in proximity to the sett. Given that the sett is located outside of the zone of impact for badgers, the potential for impact on badgers at sett 2 is unlikely. Sett three is located approximately 275m from the cable route (at DC06-DC07B). As such, it will not be affected directly by the proposed development. There is potential for machinery associated with the works to pass close to the sett, given its location close to an access point. However, the sett is located directly adjacent to managed agricultural grassland, the badgers are likely habituated to large farming machinery. As such, the potential for impact on badgers at sett 3 is unlikely. There is potential for impact on badger setts located in areas where surveys have not taken place. Further, there is potential for new setts to become established within the works areas already surveyed prior to works commencing. Where disturbance impacts take place, this impact would be temporary. However, should the works impact the sett directly, this will result in a permanent impact on the sett. There is a potential for a loss of setts utilised by badger associated with the installation of the cable given the proximity of sett 1 to the cable route. Loss of setts, and associated injuries to badgers therein would result in a **medium term moderate negative effect** on badger populations at a local geographic scale
	Bats	Local Importance (Higher Value)	The works will require the removal and lopping of trees which may contain bat roosts. It will also require the demolition of a building within the proposed converter station site which has potential, albeit low, to support roosting bats. As such there is the potential for a permanent loss of roosting habitat for these species. There is also the potential for additional potential roost features in areas of the site along with additional suitable roost features which develop before the construction phase of the proposed development. Loss of bat roosts, and associated injuries to bats therein would result in a **short term moderate negative effect** on bat populations at a local geographic scale
	Red squirrel	Local Importance (Higher Value)	There is potential for a permanent loss of supporting habitat where oak ash hazel woodland is removed. While there will be a slight loss of habitat for the species, it is important to consider this in the context of the location. The Longstown Road bisects the woodland in its entirety. Trees on either side of the woodland are already subject to management. The works will result in a slight widening impact of an existing split in the woodland. The overall impact on squirrels is therefore considered to be a **short term slight negative effect** at a local geographic scale.
	Pygmy Shrew	Local Importance (Higher Value)	Pygmy shrew have wide habitat preferences including hedgerows, grassland, and woodlands. These habitats are widespread in the wider landscape surrounding the proposed development. Given that the development will be largely below ground, and vegetation will generally be reinstated, there will be very little in terms of loss of habitat for the species.

Receptor		Importance	Potential for Impact in Absence of Mitigation
			However, removal of vegetation during the pygmy shrew breeding season has the potential to result in injury or mortality of adult and/or young animals. The species has a high reproductive rate, so any population losses are likely to be local and short-term. In the absence of mitigation to seasonally remove vegetation, there is potential for direct impacts assessed as **temporary slight negative effect** at a local geographic scale.
	Hedgehog	Local Importance (Higher Value)	As previously noted, hedgehog are presumed to breed and/or hibernate within grassland and scrub/woodland within the ZoI of the proposed development. Hedgehog breeding is from May to October (Hayden and Harrington, 2001). There may be numerous hedgehog territories within the Proposed Development site. Given these factors the potential for direct habitat loss impacts on hedgehog is assessed as a **temporary slight negative** effect at a local geographic scale.
	Stoat	Local Importance (Higher Value)	There is some limited rocky scrub habitat for stoat on the margins of the Proposed Development site albeit outside of the footprint of the proposed converter station. There is also potential for stoat to occur along the cable route. Given these factors the potential for direct habitat loss impacts on stoat is assessed as a **temporary slight negative** effect at a local geographic scale.
Watercourses	Owenacurra River	County Importance	It is proposed to cross the Owenacurra river by both HDD and open cut methodology. There is associated potential for a degradation of water quality associated with the release of pollutants and sediment laden water. Sediment can blanket over macroinvertebrate communities and lead to a degradation in habitat, damage to fish spawning beds and juvenile fish. Discharges of fuels and oils into watercourses can cause damage to aquatic life, and interference with diffusion of oxygen. Direct impacts will arise to instream fishery habitat and riparian areas where open cut method is used (Owenacurra_040 – 2 crossings). HDD at Owenacurra_030 will avoid direct impacts to instream and riparian habitats. These impacts are associated with the construction phase of the works. Without adequate reinstatement of instream habitat and other mitigation there is potential for permanent loss locally of watercourse habitat as a result of the in stream works. There is potential, therefore, for a **short term moderate negative impact** at a local geographic scale.
	All other watercourse crossings	Local importance (Higher Value)	There is potential for a degradation of water quality associated with the release of pollutants and sediment laden water. Uncured concrete can kill fish, plant life and macroinvertebrates within the water. Additionally, sediment can blanket over macroinvertebrate communities and lead to a degradation in habitat, damage to fish spawning beds and juvenile fish. Discharges of fuels and oils into watercourses can cause damage to aquatic life, and interference with diffusion of oxygen. Direct impacts will arise to instream fishery habitat and riparian areas where open cut method is used at most river crossings outlined in Table 7.8. HDD method proposed at several river crossings (Table 7.8) avoids direct impacts to instream and riparian habitats.

Receptor		Importance	Potential for Impact in Absence of Mitigation
			These impacts are associated with the construction phase of the works. Without adequate reinstatement of instream habitat and other mitigation there is potential for permanent loss locally of watercourse habitat as a result of the in stream works. There is potential, therefore, for a **short term moderate negative impact** at a local geographic scale.
Wintering Birds	Waterfowl	National importance	The Institute of Estuarine and Coastal Studies (2009) has found that waterfowl have differing sensitivity in terms of responses to disturbance stimuli. The report notes that while birds can habituate to a low level of noise (below 50dB), irregular construction noise above 70dB can have a moderate to high effect. The disturbance caused by the noise impulses has the potential to displace wintering birds away from foraging areas which are in proximity to the proposed development. Where noise levels are increased above baseline level there is potential for displacement of waterfowl. Assessment of noise impacts associated with the construction phase of the proposed development indicates a potential for a zone of impact of approximately 380m, while physical presence on site may disturb birds within 500m of the works. Key sensitive locations identified for wintering birds include Claycastle beach and Ballyvergan Marsh. There is, therefore, the potential for a **temporary slight negative effect** at a potential national geographic scale on wintering waterfowl associated with the proposed development
	Winter hen harrier roost	National importance	A winter raptor roost is located outside of the direct footprint of the works. There is no potential for direct impact to same. There is potential, however, for disturbance to roosting raptors at Ballyvergan Marsh if noise levels are likely to be persistently high in the late afternoon period between November and March. There is, therefore, the potential for a **temporary moderate negative effect** at a potential national geographic scale on hen harrier associated with the proposed development.
Breeding birds	General	Local Importance (Higher Value)	Breeding birds associated with Ballyvergan Marsh have been assessed in Section 8.6.1.2. There is potential for impacts to breeding bird species at the converter station site, and in areas where removal of trees and scrub are required. As such there is potential for disturbance/ displacement of breeding birds in these locations. While habitat is available in the wider landscape, vegetation clearance associated with the works has the potential to result in a long term loss of a very small area of nesting habitat for bird species. In the absence of mitigation there is potential therefore for **slight long-term negative effects** at a local geographic scale on breeding birds.
	Breeding Kingfisher	Local Importance (Higher Value)	Kingfisher was recorded on the Womanagh River and may be present on other watercourses within the ZoI of the development. There is potential for disturbance and displacement of kingfisher caused by the proposed development. There is also the potential for the direct loss of nesting habitat for the species. In the absence of mitigation there is potential therefore for **slight short-term negative effects** at a local geographic scale on kingfisher.

Receptor		Importance	Potential for Impact in Absence of Mitigation
Amphibians	Common frog	Local importance (Higher value)	There is the potential for a permanent impact on habitat for both frogs and smooth newt associated with the proposed development. This loss is of the small area of wetland habitat at the converter station site, drainage ditches and areas of standing water which may occur throughout the development footprint, and at Ballyvergan Marsh. There is also potential for direct mortality should the species occur within these habitats during the works. While there is potential for impact on habitat within the footprint of the works, suitable habitat is available within the wider landscape surrounding the IDA site, throughout Ballyvergan Marsh and in nearby drainage ditches. Further, with the exception of the small wetland at the converter station site, the impacts to habitat within the development footprint will not be permanent as these features and the lands at Ballyvergan Marsh will be reinstated. Despite the temporal nature of the works there is potential still for direct impact and mortality of these species. Having regard to the amount of suitable habitat in the wider locality. The potential for impact on common frog and smooth newt in the absence of mitigation are therefore assessed as being a **slight temporary negative effect** at a local geographic scale**.**
	Smooth newt	Local Importance (Higher Value)	
Reptiles	Common lizard	Local Importance (Higher Value)	There is potential for a permanent loss of a small amount of habitat for common lizard associated with the proposed development. The proposed development also has the potential to result in direct mortality to lizards which may be in a state of brunation within the footprint of the works where works take place in winter. The small footprint of the works within suitable habitats is small, with habitat available in the surrounding area. The potential for direct mortality to lizards in the absence of mitigation is, therefore, also limited and unlikely to cause a significant loss of the local lizard populations. The potential for impact on common lizard in the absence of mitigation are therefore assessed as being a **slight temporary negative effect** at a local geographic scale.
Other species of note	Invertebrates of conservation concern presumed present (none protected)	Local Importance (Higher Value)	Areas of good quality foraging habitat for pollinators were recorded at the converter station site. There will be a permanent loss of areas of foraging habitat or pollinators at the converter station. The cable and landfall will be below ground which will be reinstated. Further, landscaping at the converter station site, this planting will utilise the use of pollinator species insofar as possible. In the absence of mitigation there is potential therefore for a **permanent slight negative effect** at a local geographic level on pollinators.

8.6.2 Operational Phase

The potential for impact to surface water features as a result of the operational phase associated with drainage is discussed in chapter 7.

Given the nature of the operations associated with the proposed development, no potential for significant adverse effects to most biodiversity are identified.

Bats foraging on the site may be impacted by increased outdoor lighting associated with the Ballyadam development specifically. In the absence of mitigation this is assessed as a long term slight negative effect.

8.6.3 Do-Nothing effect

Should the proposed development not go ahead, it is likely that the majority of land uses within the footprint of the development will remain in the same use as it is today. Certain areas within the footprint of the works may be subject to change as residential developments.

A Greenway route which runs from the north-eastern corner of Midleton to the old railway station at Youghal in east Cork will be developed and the lands through which it runs, most notably at Ballyvergan Marsh, will be subject to a higher degree of human disturbance. Further, the footprint of the greenway will be made into a hardstanding surface as part of the development and areas of semi natural scrub and marsh may be impacted.

In time, the lands at the wider IDA site at Ballyadam, in which the converter station site is proposed to be located, will likely be developed. The nature of these developments are unknown as no planning applications have been made to date, however these are likely to be industrial developments given the nature of the land zoning within the site.

Where lands within the IDA site are not developed it is likely that the regeneration of vegetation within the site will continue. Scrub will likely encroach from the edges of the site and areas which are now bare ground will likely vegetate into grassland. The area of calcareous grassland will likely become enveloped in scrub over time.

8.6.4 Decommissioning Phase

Works during the decommissioning phase are anticipated to be similar to those during construction as similar types of activities would be undertaken. Therefore, where the potential for SERs exists, the potential for impact will also be present. Any future works required to remove infrastructure as part of the decommissioning phase, will however be subject to relevant consent applications, and associated environmental assessments.

8.6.5 Cumulative Impacts

An assessment of projects with the potential for cumulative impacts in association with the proposed development was undertaken. Table 4.2 of Volume 3C1 of this EIAR details same.

8.6.5.1 Midleton to Youghal Greenway

The project comprises a Greenway route which runs from the north-eastern corner of Midleton to the old railway station at Youghal in east Cork. As part of the application an Appropriate Assessment Screening report was prepared.

This screening report for the greenway concludes that:

"*Appropriate Assessment, based on the best available scientific information, demonstrates that construction and operation of the proposed Greenway between Midleton and Youghal, Co. Cork, poses no risk of likely significant effects on Natura 2000 sites (e.g. Great Island Channels SAC, Cork Harbour SPA, Ballymacoda (Clonpriest and Pillmore) SAC or Ballymacoda Bay SPA)*."

Construction works for the greenway are currently progressing. No potential for disturbance to wintering birds was identified in the AA screening for the greenway, as no supporting habitat was identified within or along the scheme.

There is potential for surface water run-off associated with the Midleton to Youghal greenway works, however, the timing of the works is such that the greenway will be constructed prior to the commencement of the construction phase of this proposed development. With mitigation outlined for the project no potential for cumulative impacts have been identified.

8.6.5.2 Lower Lee Flood Relief Scheme

The OPW in conjunction with Cork County Council are advancing the Lower Lee (Cork City) Flood Relief Scheme. The scheme will run from Inniscarra Dam to the City Centre. A report for the Screening of Appropriate Assessment was developed for the scheme. Among other European sites, the report examined the potential for significant effects on the Cork harbour SPA, and the Great Island Channel SAC.

The report concluded that "*The evaluation undertaken has identified that there will be no potential significant impact on any Special Conservation Interests and their conservation objectives, either alone or in-combination with any other plans and projects, for European sites given their distance either downstream or upstream of the proposed works and due to the operational proposals for the scheme.*"

Given the location of the flood relief scheme in relation to the proposed development, more than 10km to the west, no potential for cumulative impacts is identified.

8.6.5.3 Midleton Carrigtwohill WWTP upgrades

Irish Water have identified plans to upgrade the capacity of the sewage treatment system in the greater Midleton area. GI works are required to inform the design of the treatment plant. These GI works are anticipated to commence in Q1 2021. As such they will be taking place prior to works for Celtic Interconnector. Further, the ground investigation works are temporary and small scale in nature. As such there is no potential for cumulative or in-combination impacts identified.

Following the design of the proposed upgrades, the project for the upgrade of the Midleton and Carrigtwohill WWTPs will be subject themselves to the provisions of the Directives, i.e. requiring screening for Appropriate Assessment and screening for EIAR.

8.6.5.4 N25 Carrigtwohill to Midleton Scheme

The Cork Roads Design Office (RDO) in liaison with Transport Infrastructure Ireland (TII) are currently planning the upgrading of the part of the existing N25 between Carrigtwohill and Midleton, including that portion which adjoins the proposed converter station site. This road project will involve the expansion of the existing road corridor to dual carriageway. A number of potential options affecting the wider IDA landholding at Ballyadam are currently being considered by the RDO, including the provision of a full dumb-bell interchange at Ballyadam, with associated slip roads, on the southern portion of the overall landholding. There is potential for an overlap in construction for the period of 2025-2026

The potential for cumulative impacts is dependent on the route option selected. However, the route is likely to cause additional clearance and direct impacts to habitats within the footprint of the works, and there is potential for surface water run-off associated with the works.

Given the nature of the potential for impact to biodiversity that is associated with the converter station works i.e potential for loss of calcareous grassland, the location of the midleton to Carrigtwohill scheme, and the mitigation proposed to ameliorate same, no potential for cumulative effects is identified in combination with the N25 Carrigtwohill to Midleton Scheme

8.6.5.5 Midleton Flood Relief Scheme

The flood relief scheme for Midleton is currently under development. There is potential for the scheme's construction to run concurrently with the construction for the Celtic Interconnector project. There is likely the potential for surface water impacts associated with the flood scheme. Given that the project has not yet been defined at the time of writing, the extent of this potential is unclear.

Prior to commencement of construction and during the construction phase engagement with Cork County Council and the Office of Public works (OPW) will continue and where there is potential for works to be carried out in parallel, appropriate mitigation measures will be implemented including the scheduling of works and regular liaison meetings between project teams to ensure that plans are co-ordinated and impacts are minimised.

8.6.5.6 Ballyadam 110kV Substation

The Electricity Supply Board (ESB) propose to construct a new 110kV substation to the east of the proposed converter station compound. These works may require additional site clearance within the wider IDA site, and may result in additional surface water impacts. Given that the project has not yet been defined at the time of writing, the extent of this potential is unclear.

Prior to commencement of construction and during the construction phase engagement with the ESB will continue and where there is potential for works to be carried out in parallel, appropriate mitigation measures will be implemented including the scheduling of works and regular liaison meetings between project teams to ensure that plans are co-ordinated and impacts are minimised.

IDA lands at Ballyadam

Although there were no definitive projects or plans at the time of writing this EIAR it is likely that other developments within the wider Ballyadam site will be developed and that these may have potential for cumulative effects. The IDA are also likely to develop internal access roads and utility connections for the wider Ballyadam site.

As the nature of these projects and plans are not known the associated cumulative impacts cannot be assessed. However, it is likely that the plans will require additional site clearance within the wider IDA site, and may result in additional surface water impacts.

8.7 Mitigation Measures

The following outlined measures that have been prescribed to mitigate any potentially harmful or negative impacts as outlined in the previous sections. Mitigation measures were designed having regard to the Mitigation Hierarchy as outlined in CIRIA C776a "*Biodiversity Net Gain. Good Practice Principles for Development".* This is a sequential order of mitigation actions whereby the preference for mitigation measures are as outlined below:

- Avoidance: Steps to avoid harm to biodiversity.
- Minimisation: Where adverse impacts cannot be avoided, action is taken to minimise these impacts.
- Compensation: Only considered after all possibilities for avoidance and minimisation of impacts have been implemented.

Care has been taken throughout the design process to avoid impacts to sensitive ecological receptors. As such, substantial mitigation through avoidance and minimisation has already been achieved through the consideration of alternatives in the design phase carried out as part of the EirGrid Framework for Grid Development. Additional mitigation measures to ameliorate the impacts as described in section 8.8 are outlined hereunder. These will be incorporated into the CEMP for the proposed development as outlined in Chapter 3.

8.7.1 Construction Phase

8.7.1.1 Pre-construction Surveys

Pre-construction surveys will be conducted for Sensitive Ecological Receptors outlined in the EIAR, so to tailor mitigation as relevant for specific works locations. This is of particular relevance given the dynamic nature in distribution of some biodiversity receptors and changes in habitat distribution (e.g. due to other land clearance works) that can arise between baseline surveys and commencement phase of projects. For example, bat roost locations in trees may change each year.

8.7.1.2 Ecological Clerk of Works (EcOW)

An Ecological Clerk of Works will be employed on behalf of the Employers Representative team to ensure all mitigations measures are implemented in full. This will include monitoring and auditing the works and contractor programmes and works method statements, to ensure mitigation is correctly implemented. The EcOW will also ensure any disturbance licenses are arranged based on relevant details outlined in this EIAR and any significant findings of updated pre-construction surveys outlined above.

A separate site ECoW will be also employed by the site contractor to ensure on site mitigation is implemented.

The EcoW will advise on mitigation measures implementation including the scheduling of works and will be included in regular liaison meetings between project teams to ensure that plans are co-ordinated and impacts are minimised.

8.7.1.3 Mitigation for Indirect Impacts to European Sites

The potential for adverse effects on European sites has been identified through water quality impacts to surface water, contamination of underground conduits, disturbance to wintering ex situ SCIs, and accidental spread of invasive species. The description of these mitigation measures is outlined below as follows:

- Mitigation which addresses impacts to surface water is described in Chapter 7 and in Section 8.7.1.8 below
- Mitigation which addresses disturbance to wintering ex situ SCI's is described in Section 8.7.1.9 below
- Mitigation which addresses accidental spread of invasive species is described in Section 8.7.1.13 below.
- Mitigation which addresses the potential for contamination of underground conduits is outlined in Chapter 6.

8.7.1.4 Mitigation for Direct Impact to Ballyvergan pNHA

Works are required within the Ballyvergan Marsh pNHA to facilitate crossing the consented greenway.

Prior to works commencing, the works area within the marsh will be fenced to keep the footprint of the works within the wetland habitat to the bare minimum required to achieve the works.

Noise attenuating hoarding will be installed around drilling areas to minimise noise effects out with the works areas.

Bog mats will be utilised throughout the works areas to reduce rutting and direct damage to the habitat.

Where excavation is required, any turves of phragmites will be removed and stored such that they can be reinstated following completion of works. Removal of the turves will be carried out during dry weather conditions and monitored by the site EcOW to ensure kept watered etc.

The turves will not be stored on top of each other as this will result in compaction of the soul. The duration of storage will be kept to the minimum time necessary to allow for the translocation works to complete.

Following the completion of the works bog mats will be removed from the works area and the habitat reinstated. Reinstatement will be to the satisfaction of the NPWS and Local Authority.

Where bare earth remains (for example due to the clearance of scrub within the site) these will be planted at an appropriate time of the year with reed shoots. These shoots will be no less than 20cm in length and will be planted at densities of 10-15 cuttings per square metre.

Any additional requirements as outlined by the NPWS or Local Authority relating to the reinstatement of Ballyvergan Marsh will be incorporated, in agreement with the Client's Representative Team.

8.7.1.5 Mitigation for the protection of Notable Habitats

Mitigation for the Protection of Sand Dune Habitat

Works are required on the margin of and partially within Annex fixed dune habitat at Claycastle.

Prior to works commencing, the sand dune habitat will be fenced to keep the footprint of the works within the habitat to the bare minimum required to achieve the works.

Where works encroach on the sand dune habitat temporarily, bog mats will be utilised to reduce rutting and direct damage to the grassland habitat. Where works will take place over a longer period, turves of grassland may be removed and stored such that they can be reinstated following completion of works.

The vegetation will be cut as short as possible prior to removal of turves.

Removal of the turves will be carried out during dry weather conditions.

The turves will not be stored on top of each other as this will result in compaction of the soul. The duration of storage will be kept to the minimum time necessary to allow for the translocation works to complete. This will be monitored by the site EcOW with input from specialist botanic expert if required.

Prior to reinstatement of the grassland, the ground will be prepared such that impacts due to possible compaction by the construction plant will be ameliorated.

Mitigation for the Protection of Calcareous Grassland at Ballyadam

As previously noted, calcareous grassland which qualifies as Annex I grassland has been identified within the footprint of the works at the Ballyadam site. In order to prevent the direct impact to this SER, it is proposed that translocation be carried out to remove them from the footprint of the works.

Translocation will be carried out prior to the commencement of the construction of the Converter station site to a temporary storage area.

Prior to translocation works commencing, a Habitat and Plant Translocation and Enhancement Strategy for the calcareous grassland will be established. This will include details which will outline the timing and co-ordination of the works with reference to the overall construction timeline. The plan will also outline the full suite of management criteria required for the habitat.

A strip of land along the western edge of the proposed converter station site has been identified as a potential temporary receptor site for the calcareous grassland and greater knapweed, refer to Figure TBC. The area of calcareous grassland comprises approximately 2,000m^2 while the donor site is approximately TBC m^2 in size.

Commented [DH14]: FIGURES TO BE INCLUDED IN FINAL APPLICATION

Prior to works commencing, temporary fencing will be established at both the temporary receptor and donor site to clearly mark out these areas. This will prevent accidental damage to either of the sites. The fencing will remain in place following translocation and during the construction of the converter station.

The underlying bedrock is the same across the site, and given that the donor site has already been stripped back and hardcore placed, there is limited work required in terms of preparation of the site.

Within the area of calcareous grassland there may be certain undesirable negative indicator species which have established. These will be removed prior to translocation.

Given that the donor site consists of sparsely vegetated bare ground, there will not be a requirement to strip topsoil.

Translocation of turves is proposed for the calcareous grassland. The top 15cm of soil will be used to include the rooting zone. Larger turves will have the best chance at successful translocation.

The vegetation will be cut as short as possible prior to translocation.

Translocation will be carried out during dry weather conditions.

The turves will be placed close to the donor site. The turves will not be placed on top of each other as this will result in compaction of the soul. The duration of storage will be kept to the minimum time necessary to allow for the translocation of the soil.

Dependant on weather conditions, watering of the turves may be necessary to prevent them from drying out.

Following removal of turves the earth embankment upon which the grassland has established will be translocated to the temporary donor site.

Once the earth bank has been re-created (i.e. mirrored depth of soil to the original bank) the turves will be placed on the bank.

Additionally, seeds from desirable positive indicator plant species within the converter station footprint will be collected and the bank will be seeded, to encourage establishment. Collection times for the seeds will be species dependant, and sowing will be undertaken by hand.

Following the completion of the translocation, permanent stock proof fencing will be placed surrounding the donor site.

Ashwood[141] outlines that grassland establishment can take between 3 and 5 years. Mowing may be required for the ongoing maintenance of the grassland. This will likely be required on a yearly basis to keep the sward fellow 10cm.

Mowing will take place on a yearly basis in the second and third years and will take place after grasses have set seed. All cuttings will be removed from the site to avoid nutrient enrichment of the sward and shading of seedlings (Croft & Jefferson, 1994; Ashwood, 2014).

A final translocation will take place of the grassland from the temporary translocation site between 3 and 5 years after the initial translocation (to the temporary site). The final translocation site is within the convertor station site. The final translocation and establishment methods will follow the approaches outlined above and as follows.

Long-term management through grazing and/or cutting is essential for maintaining species richness. A long-term management plan will be developed which includes a monitoring and evaluation programme. This will be developed in line with JNCC (2014) guidance and include at a minimum:

- The extent of grassland establishment, including details on percentage ground cover, areas where establishment has failed, and the presence of leaf litter.
- Sward composition including grass to her ratio, presence of positive indicator species, establishment of greater knapweed, and any negative indicator species present.

A regular evaluation of the management of the habitat will be undertaken, and where issues regarding the establishment are encountered, proposals will be made as to steps to be taken to improve the chances of re-establishment.

Engagement with the IDA will continue and where there is potential for works to be carried out in parallel, appropriate mitigation measures will be implemented including the scheduling of works and regular liaison meetings between project teams to ensure that plans are co-ordinated, and impacts are minimised.

[141] Ashwood, F (2014) Lowland Calcareous Grassland Creation and Management in Land Generation. Best Practice Guidance for Land Regeneration Note 18.

Mitigation for the protection of Oak Ash Hazel Woodland

Where clearance is required of oak ash hazel woodland this will be kept to the absolute minimum area necessary to facilitate the works. Reinstatement will be carried out where woodland is removed to facilitate passing bays. Reinstatement will be carried out using suitable tree species which are being removed from the habitat. The area impacted will be replanted so no net permanent loss of this habitat arises.

Mitigation for the Protection Hedgerows, Treelines, and Grassland Verges at Passing Bays

This measure applies to verges along public roadways. All passing bays will be removed on completion of the project. The passing bay will be in place for a period of up to 18 months. However, they will be removed sooner if possible. The contractor will be obliged both by the Client's Representative and by the local authority to reinstate all hedges and roadside verges, where practicable.

Unless otherwise agreed with the Client's Representative and the local authority, the Contractor will re-instate hedgerows, and treelines, to a species-rich condition (i.e. five woody species per 30 m), comprising only native species.

Unless otherwise agreed with the Client's Representative and the local authority, the Contractor will seed all grassland verges with a native wildflower mix (to specification of EC12 Wild Flora for Earth Banks, Bunds and Ditches; http://www.wildflowers.ie/mixes/ec/ec12.htm or similar.

All other sites will be returned as close as possible to their pre-existing condition, using the same woody species removed, or similar verge seed mixes, under the supervision and direction of the ECoW.

8.7.1.6 Mitigation for the protection of Notable Plant Species

Mitigation for the Protection of Orange Foxtail

Joint bays (and by proxy, the adjacent passing bays (c.60 m long), were, wherever possible, identified in places which minimised removal of hedgerows and mature trees

Prior to works commencing a detailed survey for the species within suitable habitat (Table 8.17), where direct impacts will arise, will be carried out by an experienced botanist during its flowering season (optimal survey season for grass is between June and August). The botanist, to be appointed by the Contractor, will coordinate with the Contractors ECoW and, report findings to the Ecologist with the Client's Representative Team. The botanist will be contracted for a period lasting at least one year following the cessation of potentially damaging construction works at the plant location(s) (see monitoring below).

A management plan will be drawn up by the appointed botanist, in consultation with a NPWS grassland specialist. The plan will be specific to the species which will outline the measures to protect the species by either avoiding and protecting the plant species *in situ*, or (only as a last resort) through the translocation of the plant species to new receptor locations nearby, under licence from the NPWS. Any additional measures as outlined under the terms of the license will also be included.

For a period lasting at least one year following the cessation of potentially damaging construction works at the plant location(s), the appointed botanist will undertake quarterly site visits to photograph and document the success of the mitigation measures, and discharge any conditions associated with any license(s). Where issues regarding the establishment are encountered, the botanist will consult with the NPWS, in agreement with the Contractor and the

Ecologist within the Employer's Representative Team, to identify reasonable steps to improve the chances of re-establishment.

Mitigation for the Protection of Pennyroyal

Prior to works commencing a detailed survey of suitable habitat (the sand dune habitat at Claycastle) for the species will be carried out by an experienced botanist during its flowering season (August to September).

A management plan will be drawn up specific to the species which will outline the measures to protect the species in the first instance by either avoiding and protecting the plant species *in situ* or (only as a last resort) through the translocation of the plant species to new receptor locations nearby, under licence from the NPWS.

Where the plant is located within the footprint of the works the temporary removal, storage and reinstatement of the turves of grass as outlined for the protection of the sand dune habitat will allow for the reinstatement of the plant species also. Any additional measures as outlined under the terms of the license will also be included.

Following completion of the works a regular evaluation of the success of the mitigation measures will be undertaken, and where issues regarding the establishment are encountered, proposals will be made as to steps to be taken to improve the chances of re-establishment.

Mitigation for the Protection of Tufted Feather Moss

Tufted feather moss is known to be associated with lowland streams and rivers, and can be found on roots of trees and on rocks, boulders, silt, also on tarmac.

Prior to works commencing a detailed survey of suitable habitat for the species will be carried out by an experienced bryologist.

Where the species is confirmed within the red line boundary, a management plan will be drawn up specific to the species which will outline the measures to protect the species by either avoiding or protecting the plant species *in situ*, or through the translocation of the plant species to new receptor locations nearby.

Following completion of the works a regular evaluation of the success of the mitigation measures will be undertaken, and where issues regarding the establishment are encountered, proposals will be made as to steps to be taken to improve the chances of re-establishment.

Mitigation for the Protection of Wild Clary

Prior to works commencing a detailed survey of suitable habitat (the sand dune habitat at Claycastle) for the species will be carried out by an experienced botanist during its flowering season (August to September).

A management plan will be drawn up specific to the species which will outline the measures to protect the species in the first instance by either avoiding or protecting the plant species *in situ*.

Where the plant is located within the footprint of the works the removal and reinstatement of the turves of grass as outlined for the protection of the sand dune habitat will allow for the reinstatement of the plant species also. Any additional measures as outlined under the terms of the license will also be included.

Following completion of the works a regular evaluation of the success of the mitigation measures will be undertaken, and where issues regarding the establishment are encountered, proposals will be made as to steps to be taken to improve the chances of re-establishment.

Mitigation for the Protection of Greater Knapweed

Prior to works commencing a detailed survey of suitable habitat (the grassland at the proposed Converter Station) for the species will be carried out by an experienced botanist during its flowering season (July to September). This will allow for the identification of any additional populations within the ZoI.

A management plan will be drawn up specific to the species which will outline the measures to protect the species.

A short term donor site has been identified TBC. This will allow for storage and protection of greater knapweed plants while the construction phase progresses.

A strip of land along the eastern edge of the proposed converter station site has been identified as a long-term donor site for the calcareous grassland. This will also be used to facilitate the translocation of greater knapweed. The donor site is approximately TBC m^2 in size. The underlying bedrock is the same across both areas within the site and given that the donor site has already been stripped back and hardcore placed, there is limited work required in terms of preparation of the site.

Following the establishment of the long-term donor site the greater knapweed plants will be translocated once more from the short-term location.

Following completion of the works a regular evaluation of the success of the mitigation measures will be undertaken, and where issues regarding the establishment are encountered, proposals will be made as to steps to be taken to improve the chances of re-establishment. This will take place regularly in advance of any mowing of the calcareous grassland so as to protect plants from further damage associated with the management of the site.

Commented [DH15]: DETAILS TO BE INCLUDED IN FINAL APPLICATION

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8.7.1.7 Mitigation for the protection of Mammals

Mitigation for the Protection of Otter

The Contractor will ensure an initial otter survey is undertaken in advance of the commencement of any works within 150m of the works areas as per Guidelines for the Treatment of Otters Prior to the Construction of National Road Schemes. This will allow for the identification of any holts have been established prior to commencement of works.

The pre-construction survey will be conducted no more than 10-12 months prior to construction commencing. A secondary inspection of the works areas immediately prior to site clearance will ensure that no new holts have been created in the intervening periods.

Should holts be identified within 150m of the proposed development the following will, at a minimum, be employed, unless otherwise agreed with the NPWS:

- No works will be undertaken within 150m of holts where breeding females or cubs are present.
- Works within 150m of such a holt can only take place following consultation and in agreement with the NPWS
- No wheeled or tracked vehicles of any kind will be used within 20m of active but non breeding holts
- No light work such as digging by hand or scrub will take place within 15m of such holts except under license from NPWS
- The identified exclusion zones will be fenced and clearly marked on site prior to any invasive works.

- All contractors on site will be made fully aware or the procedures in relation to the holts by the EcoW

Mitigation for the Protection of Badger

Prior to any works commencing a preconstruction badger survey will be carried out. Surveys will be conducted having regard to *Surveying Badgers* (Harris et al.1989) and record signs of badgers including tracks, hair, latrines and setts. The extent of survey area will be defined with regard to Guidelines for the Treatment of Badgers during the Construction of National Road Schemes (NRA, 2006) as 150m beyond the all works areas within suitable habitat.

Prior to works commencing, sett activity at all identified setts within 150m will be confirmed. This may be confirmed through the use of camera monitoring, setting of footprint traps, soft blocking of the sett entrance or similar. Any risk of disturbance to badger will be subject to disturbance license requirements.

A description of the setts i.e. main sett, annex sett, or outlier sett will be provided by the EcoW along with the level of activity at the sett. This will allow for an understanding of the importance of the setts in the wider context of the local population.

As per the Guidelines for the Treatment of Badgers during the Construction of National Road Schemes (NRA, 2006), where setts have been confirmed, no heavy machinery will be used within 30m of badger setts (unless carried out under licence from the NPWS). Lighter machinery (generally wheeled vehicles) will not be used within 20m of a sett entrance; light work, such as digging by hand or scrub clearance will not take place within 10m of sett entrances.

Unless otherwise agreed, and under license from the NPWS, during the breeding season (December to June inclusive), none of the above works will be undertaken within 50m of active setts nor blasting or pile driving within 150m of active setts. An assumption that the sett is active will apply unless proven otherwise during the course of investigation.

All identified exclusion zones as outlined above will be clearly marked out on site and communicated to all site staff prior to works commencing.

Where works may interfere with the badger sett directly exclusion will take place as per NRA (2006) guidelines.

Mitigation for the Protection of Bats

The Design and Construction of bat mitigation measures will be site specific, and comply with licensing requirements, having regard for relevant guidance including the NRA's "Guidelines for the Treatment of Bats During the Construction of National Road Schemes"[142], and the NPWS Bat Mitigation Guidelines for Ireland[143].

Trees will not be felled and removed in advance of surveying for bats. Prior to felling of any trees, an initial bat survey of trees to be felled will be undertaken, by a licensed qualified specialist, to assess the suitability of the tree to contain bat roosts as per Bat Surveys for Professional Ecologists: Good Practice Guidelines.

Trees identified with potential roost features of a Moderate to High value will be thoroughly examined, under licence from the NPWS, to ascertain the presence or absence of roosting bats. The trees will be examined for the presence or absence of bats / bat roosts immediately prior to

[142] https://www.tii.ie/tii-library/environment/construction-guidelines/Guidelines-for-the-Treatment-of-Bats-during-the-Construction-of-National-Road-Schemes.pdf

[143] Kelleher, Conor & Marnell, Ferdia. (2006). Bat Mitigation Guidelines for Ireland.

felling. Where timing facilitates it (ie when felling is being undertaken during the active season for bats), emergence surveys may be carried out to determine presence or absence of roosting bats Where felling does not occur within one day of the examination, the trees will be re-assessed.

Where evidence of a roost, or roosting bats has been determined, a license for destruction of a roost and/or exclusion of bats will be required from the NPWS. The procedures for the exclusion of bats and destruction of roost as detailed in the license document will be obeyed, at all times, by the Contractor.

Where bat exclusions are required, they will be undertaken in accordance with the requirements of the bat specialist. They will not be carried out during the breeding season, between the months of June to August inclusive, or during hibernation in the months of November to March inclusive, unless under license from the NPWS. Where the felling of trees found to be suitable as bat roosts cannot be avoided, appropriate mitigation will be agreed with the NPWS and put in place at least one month in advance of any felling or disturbance.

If any bat roost sites are removed by the Works, appropriate replacement bat roost sites will be provided following consultation with the NPWS, and in consultation with the local authority, on public lands.

The Design and Construction of bat mitigation measures will be site specific, and comply with the requirements of the bat specialist, the Standards, the TII's "Guidelines for the Treatment of Bats During the Construction of National Road Schemes", the National Parks and Wildlife Services Bat Mitigation Guidelines for Ireland, the National Parks and Wildlife Service Circular 2/07 Guidance on Compliance with Regulation 23 of the Habitats Regulations 1997.

Mitigation for the Protection of Red Squirrel

Prior to works commencing in areas of suitable habitat (i.e. hazel woodland) a targeted survey for the species will be carried out prior to any works taking place. Surveys may include observation surveys, drey counts and feeding remain searches.

Should the species be confirmed within the woodland an assessment of potential for direct impact will be undertaken. Any dreys to be removed will only be removed under license from NPWS. These dreys will be replaced using artificial dreys. Any additional measures outlined by the NPWS under the terms of their license will also be incorporated.

Reinstatement of habitat for the species will take place as outlined for Oak Ash Hazel Woodland in 8.7.1.5.

Mitigation for the Protection of Pygmy Shrew, Hedgehog, and Stoat

Implementation of mitigation for breeding birds as outlined below will avoid vegetation removal during March-August inclusive. This existing mitigation will simultaneously avoid the majority of the main breeding season for pygmy shrew and hedgehog which run from April-October, and stoat, which breeds in May-June (Hayden and Harrington, 2001).

8.7.1.8 Mitigation for the Protection of Watercourses

Mitigation for the protection of water quality in watercourses has been outlined previously in Chapter 7.

Mitigation specifically in relation to instream works and protection of fisheries will be conducted in agreement with IFI and follow appropriate guidelines including IFI (2016)[144]. The Contractor will prepare a detailed method statement for instream works specific to each river crossing

[144] Inland Fisheries Ireland (2016). Guidelines on Protection of Fisheries during Construction Works in and Adjacent to Waters.

under supervision and direction of the ECoW. This will be finalised and agreed with IFI, in agreement with the Employer's Representative.

As the river water bodies hold fish species protected under the Wildlife Act and/or the EU Habitats Directive (e.g. Atlantic salmon, lamprey, brown trout, European eel) agreement will be required with IFI for dewatering of the water body reach as part of the instream works required for open trench crossing at stream locations outlined in Table 7.8. A fish salvage operation will be undertaken. The fish salvage operation will be authorised and licensed by the IFI and carried out by either the IFI or by fully qualified, licensed and authorised freshwater ecologists. Instream works will only take place during the period July to September, unless otherwise agreed with IFI. All instream works, silt control measures, sanitising of equipment (to avoid spread of aquatic invasive species), fish salvage operations and habitat protection measures will be monitored by an appropriately experienced ECoW. All instream substrates (gravels, rocks and sand) will be retained during construction and reinstated post works. Bankside turves will also be retained and reinstated post works. Vegetation regrowth on banksides will be monitored for at least three years post works to ensure appropriate development of native semi natural riparian plant growth and where required replanting or control of invasive species will be carried out by the Contractor under the supervision and direction of the ECoW and in agreement with relevant authorities.

8.7.1.9 Mitigation for the Protection of Wintering Birds

Waterfowl

The potential for impact through noise disturbance has been identified for birds at Claycastle landfall site, at Loughs Aderry and Ballybutler pNHA and within Ballyvergan Marsh pNHA. There is potential for works to take place during the wintering season for birds.

Prior to the commencement of the works, a sound reducing hoarding will be placed along work areas adjacent to Ballyvergan Marsh (and moved to follow the cable trenching crews within the marsh itself), at Claycastle beach and along the roadside adjacent to Loughs Aderry and Ballybutler (000446).

This will help to reduce the noise impacts associated with the construction phase of the works and also reduce visibility of personnel and machinery.

All plant used during the construction phase will be the quietest of its type practical for achieving the works.

All plant will be operated and maintained in accordance with the manufacturer's recommendations including the use and maintenance of any specific noise reduction measures.

At a minimum the following will be incorporated to reduce the impact further:

- The use of mufflers on pneumatic tools.
- Effective exhaust silencers.
- Sound reducing enclosures.
- Pumps and static mechanical plant will be enclosed by acoustic sheds or screens.
- Machines in intermittent use will be shut down during periods where they are not required.

Winter Raptor Roosts

The potential for disturbance to hen harriers has been identified for works at Claycastle, within Ballyvergan Marsh, and at the road alongside the marsh where works proceed at early morning or late afternoon between November and March inclusive.

Restrictions of high-noise level operations, (e.g. rock breaking and piling) to outside of arrival and departure times as outlined by O'Donoghue 2021 i.e. commencing work no earlier than 50 minutes before sunrise and concluding 90 minutes before sunset.

During the works monitoring for hen harrier will take place by the EnCow.. Should hen harrier be observed returning to a roost, works will cease until the bird has left. Details pertaining to hen harrier activities and subsequent requirements for work stoppage will be recorded daily and provided to the Developer's Ecologist and Local Authority on a weekly basis.

The potential for disturbance to winter raptor (hen harrier) roosts has been identified for works at Claycastle, within Ballyvergan Marsh, and at the road alongside the marsh where works proceed at late afternoon between November and March inclusive.

8.7.1.10 Mitigation for the Protection of Breeding Birds

As outlined in the description of the development the clearance of trees, and scrub will take place outside of the breeding season for birds where possible or as determined by risk of disturbance to a nest site. A suitably qualified ecologist / EcOW will conduct pre-construction surveys to assess risk of disturbance to nesting birds to inform tree clearance activity.

The reinstatement of habitat for breeding birds will take place as outlined in section 8.9.1 in relation to the reed swamp at Ballyvergan Marsh, and in section 8.9.3 in relation to hedgerows, treelines and woodland reinstatement. Habitat reinstatement will be monitored by the site EnCoW.

Specialist surveys will be carried out for kingfisher in line with NRA guidance. These will incorporate a survey area of 500m upstream and downstream of the works where suitable habitat exists. Surveys will be carried out between March and July. Features likely to be of note to kingfisher will be recorded and watches of suitable nest areas undertaken. The loss of any potentially suitable nesting sites will be compensated through the addition of artificial nesting sites along nearby sections of watercourse and within the breeding territory. The provision of any new nesting sites for kingfisher will be undertaken in line with NPWS and IFI consultation.

8.7.1.11 Mitigation for the Protection of Amphibians

A pre-construction survey for smooth newt and frogs species will be undertaken prior to works commencing at potential suitable breeding habitat (ditches ponds and drains impacted).

When surveying for the species biosecurity measures will be followed to ensure that there is no incidental spread of vector borne diseases between waterbodies. This includes the cleaning, disinfection and drying of all equipment and will have regard to guidelines from Inland Fisheries Ireland.

Should either species be recorded, translocation of the species to areas outside of the proposed development footprint will be undertaken, in consultation with the NPWS. Any translocation of these species will be under license by the NPWS.

Where common frog is recorded within the footprint of the works, any spawn or adult frogs recorded will be captured and removed from affected habitat by hand net and translocated to the nearest area of available suitable habitat.

Where smooth newt are recorded, juveniles or adults will be captured and translocated to the nearest suitable wetland feature outside of the works areas.

8.7.1.12 Mitigation for the Protection of Viviparous Lizard

Prior to the commencement of works within suitable habitat a dedicated survey to ascertain the presence or absence of viviparous lizard within the works areas will be undertaken. Key areas include fixed sand dune habitat, Ballyadam and Ballyvergan marsh. Should their presence be confirmed viviparous lizard within the works area will be translocated under license by NPWS to prevent direct impact on the species. Any translocation will be suitable habitat.

Measures for the reduction of habitat loss are as outlined previously.

8.7.1.13 Mitigation for the Prevention of Spread of Invasive Species

Japanese knotweed, Himalayan balsam, three cornered leek, and sea buckthorn have all been recorded in proximity to the development. There is potential for additional stands of scheduled invasive species to be present within or adjacent to the works areas in accessible areas, or if populations establish between the completion of date of EIA surveys, and the commencement of construction.

Prior to works commencing a full invasive species survey will be carried out. The pre-construction invasive species survey will be carried out within the works areas, including compound locations and laydown areas, and along proposed access routes to identify the presence of all invasive species within and adjacent to works areas.

The findings of this invasive species survey will be incorporated into an Invasive Species Management Plan (ISMP) for the works.

The Invasive Species Management Plan will be in place prior to any works commencing. The Invasive Species Management Plan will be a live document, regularly reviewed and updated throughout the works to include for any additional invasive species encountered.

The Invasive Species Management Plan will set out site-specific and species-specific measures to manage invasive species.

Any stands of invasive species that are recorded within the site will be clearly marked out as restricted areas. This exclusion zone will incorporate a buffer such that below ground growth is accounted for, noting the reduced extents for Japanese knotweed based on recent research[145] . No works will be carried out within the exclusion zones unless fully supervised by the EnCoW.

The appointed EnCoW will carry out a toolbox talk for all construction personnel which will provide information on how to identify and manage invasive species.

The EnCoW will also implement additional biosecurity measures on site such as the visual inspection of vehicles for evidence of attached plant or animal material prior to entering and leaving the works area.

A Check, Clean, Dry protocol will be undertaken with all equipment, machinery and vehicles entering and leaving the Proposed development site boundary.

Where works are carried out within watercourses, all machinery will be inspected and will be completely dry prior to works commencing to prevent the risk of pathogen translocation. All machinery will be cleaned following completion of the works.

Any fill that is required as part of the proposed development will be from a licensed facility

[145] Fennell, M., Wade, M., & Bacon, K. L. (2018). Japanese knotweed (Fallopia japonica): an analysis of capacity to cause structural damage (compared to other plants) and typical rhizome extension. PeerJ, 6, e5246.

8.7.2 Operational Phase

The requirements for mitigation to surface water features during the operational phase of the development is as outlined in Chapter 7.

8.7.2.1 Bat lighting mitigation Ballyadam

For the operational phase it is confirmed here that the detailed design of outdoor lighting will incorporate in full design recommendations[146] from Bat Conservation Ireland as follows:

- Hours of illumination: provide some hours of darkness.
- Light levels: install lighting that meets the lowest light levels permitted under health and safety. Specification and colour of light treatments: use low-pressure sodium lights instead of high-pressure sodium lights or mercury lamps. If mercury lamps are to be used, fit them with UV filters.
- Column heights of lamp posts: reduce the amount of light spillage where it is not needed by restricting the height of lamp columns.
- Type of lamps and luminaries to be installed: directional lighting means lighting is directed to where it is needed and thus prevents light spillage and light pollution.
- Using modern light technology that restricts the horizontal plane of the luminaries thereby directing the lighting to where required ensuring light is not directed at an angle greater than 70 degrees from the vertical plane.

The final lighting plan will be reviewed by an experienced bat ecologist to ensure lighting levels are minimised for the site and excessive light spill is avoided at locations where lighting is not required and directed away from treelines and other retained habitat with some ecological value.

No additional mitigation measures are anticipated during the operational phase.

8.7.3 Decommissioning Phase

Works during the decommissioning phase are anticipated to be similar to those during construction as similar types of activities would be undertaken. Therefore, where the potential for SERs exists, the requirement for mitigation will also be present.

[146] Bat Conservation Ireland (December 2010). Bats and Lighting Guidance for; Planners, engineers, architects and developers.

8.8 Monitoring Measures

During construction, monitoring will be carried out, and reported by the Contractrors Ecologist, in agreement with the Client' Representative Team, and having regard for relevant conditions and licenses where required.

Following completion of construction, the obligation for monitoring (e.g. of translocation and enhancement areas) will pass to the developer's Ecologist, with having regard for relevant conditions and licenses.

Monitoring will take place of areas of translocation within the converter station, any areas where turves were reinstated at the landfall site and at Ballyvergan Marsh. The monitoring of these sites will be carried out by a suitably qualified ecologist. This will enable the identification of potential barriers to successful establishment and determine the overall success of the process.

Where establishment has been found to fail, steps can be taken to boost the chances of establishment. This can include measures such as re-seeding of areas where there is die-back, and removal of negative indicator species such as bramble where the establishment of same will put the habitat at risk of degradation.

The intervals at which the monitoring will take place will be determined by the relevant ecologist, having regard for licenses, and planning conditions. However, at a minimum it is expected that annual monitoring take place for the initial five years following reinstatement/translocation. Following the five-year monitoring it may be reviewed to determine whether the monitoring period requires extension. There may be no requirement for extension should the habitats fully establish by that time. Monitoring reports will be provided to the Ecologist within the Employer's Representative Team.

As outlined in section 8.1.1.8 monitoring will also be conducted at river crossings where instream works, and river bankside disturbance works took place.

8.9 Enhancement Measures

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Mitigation for the Protection Hedgerows, Treelines, and Grassland Verges at Passing Bays

This measure applies to verges along public roadways. All passing bays will be removed on completion of the project. The passing bay will be in place for a period of up to 18 months. However, they will be removed sooner if possible. The contractor will be obliged both by the Client's Representative and by the local authority to reinstate all hedges and roadside verges, where practicable.

Unless otherwise agreed with the Client's Representative and the local authority, the Contractor will re-instate hedgerows, and treelines, to a species-rich condition (i.e. five woody species per 30 m), comprising only native species.

Unless otherwise agreed with the Client's Representative and the local authority, the Contractor will seed all grassland verges with a native wildflower mix (to specification of EC12 Wild Flora for Earth Banks, Bunds and Ditches; http://www.wildflowers.ie/mixes/ec/ec12.htm or similar.

All other sites will be returned as close as possible to their pre-existing condition, using the same woody species removed, or similar verge seed mixes, under the supervision and direction of the ECoW.

8.10 Residual Impacts

The assessment which is provided in the NIS for the proposed development concluded that the mitigation measures detailed will ensure no adverse effects on the integrity of any European sites in light of the site's conservation objectives.

Based on the assessment of the Proposed Development alone and in combination with other projects and plans, including the implementation of mitigation measures, it can be concluded that no adverse effects on the integrity of any European sites will arise, in view of the site's conservation objectives.

The potential for residual impact to pNHAs associated with the proposed development is assessed based on the features within the pNHA (for example wintering and breeding birds) which were identified in section 8.6.2 as SERs.

The Residual Impacts of the Proposed Development on the SERs as previously identified are discussed below in Table 8.29.

Table 8.30: Potential for Residual Impact to Other Sensitive Ecological Receptors

Receptor		Importance	Potential for Impact In Absence of Mitigation	Potential for Residual Impact
Notable habitats	Annex I fixed Dune Habitat	County Importance	Medium term moderate negative impact	The implementation of the reinstatement measures for the habitat are such that there will be no long-term loss of habitat. Thus, the residual effect on the sand dune habitat will be a **temporary not significant negative effect** at a local geographic scale.
	Oak Ash Hazel Woodland	County Importance	Permanent moderate negative impact	Where removal of habitat is required within the passing bay, these trees will be reinstated. It will not, however, be possible to reinstate trees along the roadside which require removal to prevent interference with the cable itself. As such the residual effects on the woodland are will be a **permanent slight negative effect** at a local geographic scale.
	Priority Annex 1 Calcareous Grassland (6210*)	Local Importance (Higher Value)	A permanent significant negative impact	The implementation of translocation, reinstatement and the monitoring regime is such that there will be no permanent loss of Annex I calcareous grassland associated with the proposed development. The residual effect on the habitat will be a **temporary slight negative effect** at a local geographic scale.
	Treelines and hedgerows	Local Importance (Higher Value)	Permanent moderate negative impact	Where removal of habitat is required within the passing bay, treelines and hedgerows will be reinstated. It will not, however, be possible to reinstate deep rooted trees in areas where there is potential for interference with the cable itself. As such the residual effects on the woodland are will be a **permanent slight negative effect** at a local geographic scale
Rare and Protected Flora	Orange foxtail	National Importance	Permanent significant negative impact	The implementation of pre-construction surveys, and where required, translocation of these rare and protected flora will ensure that there is no permanent loss of these species associated with the works. The residual effects to these species are anticipated to be a **temporary imperceptible effect at** a local geographic scale.
	Penny royal	National Importance	permanent significant negative impact	
	Tufted feather-moss	County Importance	Permanent significant negative impact	
	Wild clary	County Importance	permanent significant negative impact	
	Greater knapweed	County Importance	Permanent significant negative impact	
Mammals	Otter	National Importance	Permanent significant negative impact	As outlined previously, while no otter holts were recorded during surveys, there is potential for holts to become established prior to construction commencing. The implementation of pre-construction surveys and measures to protect holts should they be recorded are such that the residual effects to otter will be a **temporary not significant effect** at a county geographic scale.

Receptor		Importance	Potential for Impact In Absence of Mitigation	Potential for Residual Impact
	Badger	Local Importance (Higher Value)	Permanent significant negative impact	The implementation of pre-construction surveys and measures to protect any new or known setts are such that the residual effects to badger will be a **short term imperceptible effect** at a local geographic scale
	Bats	Local Importance (Higher Value)	Permanent significant negative impact	The implementation of pre-construction surveys, and associated mitigation as outlined previously to replace lost roosting features are such that residual effects will be a **short term imperceptible effect** at a local geographic scale
	Red squirrel	Local Importance (Higher Value)	Permanent slight negative impact.	The reinstatement of supporting habitat within the passing bays for red squirrel will reduce the footprint of habitat loss for the species. There will be trees adjacent to the road which cannot be reinstated as they will interfere with the cable itself. As such, the residual impact will be a **short term imperceptible effect** at a local geographic scale
	Pygmy Shrew	Local Importance (Higher Value)	Short term slight negative impact	As outlined in the mitigation measures, clearance of vegetation outside of the breeding season for these species. As such residual impacts will be a **short term imperceptible effect** at a local geographic scale
	Hedgehog	Local Importance (Higher Value)	A temporary slight negative impact.	
	Stoat	Local Importance (Higher Value)	A temporary slight negative impact.	
Watercourses	Owenacurra River	County Importance	Permanent significant negative impact	The measures outlined to protect the watercourses are such that residual impacts will **be short term slight effect** at a local geographic scale.
	All other watercourse crossings	Local importance (Higher Value)	Permanent significant negative impact on watercourses associated with the proposed development.	
Wintering Birds	Waterfowl	National importance	Short-term moderate negative impact on wintering waterfowl associated with the proposed development	Measures to reduce disturbance effects are such that any residual effect to wintering waterfowl will be a **temporary imperceptible effect** at a national geographic scale.
	Winter raptor roost	National importance	Short-term moderate negative impact	Measures to reduce disturbance effects to hen harrier are such that any residual effect will be a **temporary imperceptible effect** at a national geographic scale.
Breeding birds	General	Local Importance (Higher Value)	Permanent slight negative impact on breeding birds.	Mitigation measures outlined to protect breeding birds are such that any residual effects will be **imperceptible** at a local geographic scale.

Receptor		Importance	Potential for Impact In Absence of Mitigation	Potential for Residual Impact
	Breeding Kingfisher	Local Importance (Higher Value)	Permanent slight negative impact on kingfisher.	
Amphibians	Common frog	Local importance (Higher value)	Permanent slight negative impact.	Mitigation measures outlined to protect frog and newt are such that any residual impacts will be **imperceptible** at a local geographic scale.
	Smooth newt	Local Importance (Higher Value)		
Reptiles	Common lizard	Local Importance (Higher Value)	Permanent slight negative impact.	Mitigation measures outlined to protect lizards re such that any residual impacts will be **imperceptible** at a local geographic scale.
Other species of note	Invertebrates of conservation concern presumed present (none protected)	Local Importance (Higher Value)	Permanent medium term slight negative impact	Reinstatement of vegetation and planting with pollinator friendly species mixes are such that effects are anticipated to be **imperceptible** at a local geographic scale.

8.11 Transboundary Effects

All elements of the onshore interconnector are found in County Cork, Ireland. Species identified in this EIAR as SER that may cross international boundaries include; hen harrier and wintering wader (bird) species (sanderling and bar-tailed godwit included). As outlined in this EIAR there are no likely significant effects to these SER. No significant transboundary effects are therefore likely.

9 The Landscape

9.1 Introduction

This Landscape and Visual Impact Assessment (LVIA) describes the landscape context of the proposed project and assesses the likely landscape and visual impacts of the scheme on the receiving environment. Although closely linked, landscape and visual impacts are assessed separately.

Landscape Impact Assessment (LIA) relates to assessing effects of a development on the landscape as a resource in its own right and is concerned with how the proposal will affect the elements that make up the landscape, the aesthetic and perceptual aspects of the landscape and its distinctive character.

Visual Impact Assessment (VIA) relates to assessing effects of a development on specific views and on the general visual amenity experienced by people. This deals with how the surroundings of individuals or groups of people may be specifically affected by changes in the content and character of views as a result of the change or loss of existing elements of the landscape and / or introduction of new elements. Visual impacts may occur from; Visual Obstruction (blocking of a view, be it full, partial or intermittent) or; Visual Intrusion (interruption of a view without blocking).

9.2 Methodology and Limitations

Production of this LVIA involved:

- A desktop study to establish an appropriate study area, relevant landscape and visual designations in the Cork County Development Plan 2014 (Cork CDP 2014), as well as other sensitive visual receptors. This stage culminates in the selection of a set of potential viewpoints from which to study the effects of the proposal;
- Fieldwork to establish the landscape character of the receiving environment and to confirm and refine the set of viewpoints to be used for the visual assessment stage;
- Assessment of the significance of the landscape impact of the development as a function of landscape sensitivity weighed against the magnitude of the landscape impact; and
- Assessment of the significance of the visual impact of the development as a function of visual receptor sensitivity weighed against the magnitude of the visual impact. This aspect of the assessment is supported by photomontages prepared in respect of the selected viewpoints.

9.2.1 Guidance

This LVIA uses methodology as prescribed in the following guidance documents:

- Environmental Protection Agency (EPA) publication 'Guidelines on the Information to be contained in Environmental Impact Assessment Reports' (updated draft 2017) and the accompanying Advice Notes on Current Practice in the Preparation of Environmental Impact Statements (updated draft 2017);
- Landscape Institute and the Institute of Environmental Management and Assessment publication entitled Guidelines for Landscape and Visual Impact Assessment (2013).

9.2.2 Desktop Studies

The LVIA desktop studies involved consideration of the following documents, mapping and websites:

- Cork CDP 2014 and in particular, landscape and visual policies and objectives, the Cork County Landscape Character Assessment and designated scenic routes.
- Zone of Theoretical Visibility (ZTV) mapping overlaid on OSI discovery series mapping to aid viewpoint selection relative to sensitive receptors.
- NPWS mapping to identify sensitive landscapes / habitats (SACs, NHAs, pNHAs).
- Sport Ireland Website – to identify walking trails and cycling routes within the Study Area.
- Tourism and recreational websites for East Cork.

9.2.3 Field Studies

Field studies involved a 'windshield survey' of the landscape contained within the study area undertaken in combination with collecting baseline photography at each of the selected viewpoints. Each of the main above-ground features of the project was visited in the context of collecting baseline photography and the cable route was driven. Field studies were undertaken in October 2020.

9.2.4 Methodology for Assessment of Effects

The following criteria are used for the assessment of landscape impacts and visual impacts.

9.2.4.1 Landscape Impact Assessment Criteria

When assessing the potential impacts on the landscape resulting from a proposed development, the following criteria are considered:

- Landscape character, value and sensitivity;
- Magnitude of likely impacts; and,
- Significance of landscape effects.

The sensitivity of the landscape to change is the degree to which a particular landscape receptor, Landscape Character Area (LCA) or landscape feature can accommodate changes or new elements, without unacceptable detrimental effects to its essential characteristics. Landscape Value and Sensitivity is classified using the following criteria set out in Table 9.1.

Table 9.1: Landscape Value and Sensitivity

Sensitivity	Description
Very High	Areas where the landscape character exhibits a very low capacity for change in the form of development. Examples of which are high value landscapes, protected at an international or national level (World Heritage Site / National Park), where the principal management objectives are likely to be protection of the existing character.
High	Areas where the landscape character exhibits a low capacity for change in the form of development. Examples of which are high value landscapes, protected at a national or regional level (Area of Outstanding Natural Beauty), where the principal management objectives are likely to be considered conservation of the existing character.
Medium	Areas where the landscape character exhibits some capacity and scope for development. Examples of which are landscapes, which have a designation of protection at a county level or at non-designated local level where there is evidence of local value and use.
Low	Areas where the landscape character exhibits a higher capacity for change from development. Typically this would include lower value, non-designated landscapes that may also have some elements or features of recognisable quality, where landscape management objectives include, enhancement, repair and restoration.
Negligible	Areas of landscape character that include derelict, mining, industrial land or are part of the urban fringe where there would be a reasonable capacity to embrace change or the capacity to include the development proposals. Management objectives in such areas could be focused on change, creation of landscape improvements and / or restoration to realise a higher landscape value.

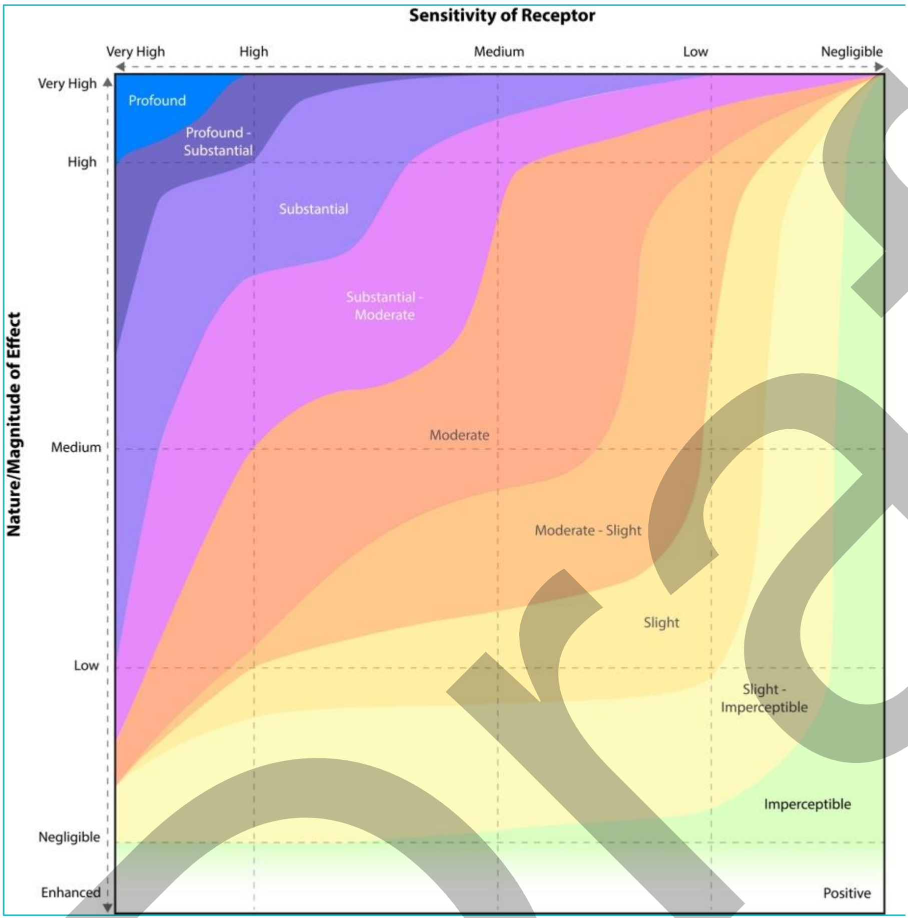
The magnitude of a predicted landscape impact is a product of the scale, extent or degree of change that is likely to be experienced as a result of the proposed development. The magnitude takes into account whether there is a direct physical impact resulting from the loss of landscape components and / or a change that extends beyond the Application Site boundary that may have an effect on the landscape character of the area. Table 9.2 refers.

Table 9.2: Magnitude of Landscape Impacts

Magnitude of Impact	Description
Very High	Change that would be large in extent and scale with the loss of critically important landscape elements and features, that may also involve the introduction of new uncharacteristic elements or features that contribute to an overall change of the landscape in terms of character, value and quality.
High	Change that would be more limited in extent and scale with the loss of important landscape elements and features, that may also involve the introduction of new uncharacteristic elements or features that contribute to an overall change of the landscape in terms of character, value and quality.
Medium	Changes that are modest in extent and scale involving the loss of landscape characteristics or elements that may also involve the introduction of new uncharacteristic elements or features that would lead to changes in landscape character, and quality.
Low	Changes affecting small areas of landscape character and quality, together with the loss of some less characteristic landscape elements or the addition of new features or elements.
Negligible	Changes affecting small or very restricted areas of landscape character. This may include the limited loss of some elements or the addition of some new features or elements that are characteristic of the existing landscape or are hardly perceivable.

The significance of a landscape impact is based on a balance between the sensitivity of the landscape receptor and the magnitude of the impact. The significance of landscape impacts is arrived at using the following matrix set out in Figure 9.1.

Figure 9.1: Impact Significance Matrix



Source: Derived from the Draft EPA EIAR Guidelines (2017; Figure 3.5), but adapted to include more nuanced categories that better reflect the subtleties of LVIA

Note: For the purpose of this LVIA and in accordance with GLVIA-2013, judgements of ‘Substantial’ and above are considered to be ‘significant impacts’ in EIA terms.

9.2.4.2 Visual Impact Assessment Criteria

As with the landscape impact, the visual impact of the proposed development will be assessed as a function of sensitivity versus magnitude. In this instance the sensitivity of the visual receptor, weighed against the magnitude of the visual effect.

9.2.4.3 Sensitivity of Visual Receptors

Unlike landscape sensitivity, the sensitivity of visual receptors has an anthropocentric basis. It considers factors such as the perceived quality and values associated with the view, the landscape context of the viewer, the likely activity they are engaged in and whether this heightens their awareness of the surrounding landscape. A list of the factors considered by the assessor in estimating the level of sensitivity for a particular visual receptor is outlined below and used in the table Appendix 9.1 to establish visual receptor sensitivity at each VRP:

1. **Susceptibility of Receptors** - In accordance with the Institute of Environmental Management and Assessment (IEMA) Guidelines for Landscape and Visual Assessment (3rd edition 2013) visual receptors most susceptible to changes in views and visual amenity are:
   a. *"Residents at home;*
   b. *People, whether residents or visitors, who are engaged in outdoor recreation, including use of public rights of way, whose attention or interest is likely to be focussed on the landscape and on particular views;*
   c. *Visitors to heritage assets, or to other attractions, where views of the surroundings are an important contributor to the experience;*
   d. *Communities where views contribute to the landscape setting enjoyed by residents in the area; and,*
   e. *Travellers on road rail or other transport routes where such travel involves recognised scenic routes and awareness of views is likely to be heightened".*

Visual receptors that are less susceptible to changes in views and visual amenity include;

   f. *"People engaged in outdoor sport or recreation, which does not involve or depend upon appreciation of views of the landscape; and*
   g. *People at their place of work whose attention may be focussed on their work or activity, not their surroundings and where the setting is not important to the quality of working life"*.
2. **Recognised scenic value of the view** (County Development Plan designations, guidebooks, touring maps, postcards, etc.). These represent a consensus in terms of which scenic views and routes within an area are strongly valued by the population because in the case of County Developments Plans, for example, public consultation process is an intrinsic part of the preparation process;
3. **Views from within highly sensitive landscape areas**. Again, highly sensitive landscape designations are usually part of a county's Landscape Character Assessment, which is then incorporated within the County Development Plan and is therefore subject to the public consultation process. Viewers within such areas are likely to be highly attuned to the landscape around them;
4. **Primary views from dwellings**. A proposed development might be seen from anywhere within a particular residential property with varying degrees of sensitivity. Therefore, this category is reserved for those instances in which the design of dwellings or housing estates, has been influenced by the desire to take in a particular view. This might involve the use of a slope or the specific orientation of a house and / or its internal social rooms and exterior spaces;
5. **Intensity of use, popularity**. This relates to the number of viewers likely to experience a view on a regular basis and whether this is significant at county or regional scale;
6. **Connection with the landscape**. This considers whether or not receptors are likely to be highly attuned to views of the landscape i.e. commuters hurriedly driving on busy national route versus hill walkers directly engaged with the landscape enjoying changing sequential views over it;
7. **Provision of elevated panoramic views**. This relates to the extent of the view on offer and the tendency for receptors to become more attuned to the surrounding landscape at locations that afford broad vistas;

8. **Sense of remoteness and / or tranquillity.** Receptors taking in a remote and tranquil scene, which is likely to be fairly static, are likely to be more receptive to changes in the view than those taking in the view of a busy street scene, for example;
9. **Degree of perceived naturalness**. Where a view is valued for the sense of naturalness of the surrounding landscape it is likely to be highly sensitive to visual intrusion by distinctly manmade features;
10. **Presence of striking or noteworthy features.** A view might be strongly valued because it contains a distinctive and memorable landscape feature such as a promontory headland, lough or castle;
11. **Historical, cultural and / or spiritual significance.** Such attributes may be evident or sensed by receptors at certain viewing locations, which may attract visitors for the purposes of contemplation or reflection heightening the sense of their surroundings;
12. **Rarity or uniqueness of the view**. This might include the noteworthy representativeness of a certain landscape type and considers whether the receptor could take in similar views anywhere in the broader region or the country;
13. **Integrity of the landscape character**. This looks at the condition and intactness of the landscape in view and whether the landscape pattern is a regular one of few strongly related components or an irregular one containing a variety of disparate components;
14. **Sense of place**. This considers whether there is special sense of wholeness and harmony at the viewing location; and
15. **Sense of awe**. This considers whether the view inspires an overwhelming sense of scale or the power of nature.

Those locations, which are deemed to satisfy many of the above criteria, are likely to be of higher sensitivity. Overall sensitivity may be a result of a number of these factors or, alternatively, a strong association with one or two in particular.

9.2.4.4 Visual Impact Magnitude

The magnitude of visual effects is determined on the basis of two factors; the visual presence (relative visual dominance) of the proposal and its effect on visual amenity. The magnitude of visual impacts is classified in Table 9.3.

Table 9.3: Magnitude of Visual Impact

Criteria	Description
Very High	The proposal intrudes into a large proportion or critical part of the available vista and is without question the most noticeable element. A high degree of visual clutter or disharmony is also generated, strongly reducing the visual amenity of the scene
High	The proposal intrudes into a significant proportion or important part of the available vista and is one of the most noticeable elements. A considerable degree of visual clutter or disharmony is also likely to be generated, appreciably reducing the visual amenity of the scene
Medium	The proposal represents a moderate intrusion into the available vista, is a readily noticeable element and / or it may generate a degree of visual clutter or disharmony, thereby reducing the visual amenity of the scene. Alternatively, it may represent a balance of higher and lower order estimates in relation to visual presence and visual amenity
Low	The proposal intrudes to a minor extent into the available vista and may not be noticed by a casual observer and / or the proposal would not have a marked effect on the visual amenity of the scene
Negligible	The proposal would be barely discernible within the available vista and / or it would not detract from, and may even enhance, the visual amenity of the scene

9.2.4.5 Visual Impact Significance

As stated above, the significance of visual impacts is a function of visual receptor sensitivity and visual impact magnitude. This relationship is expressed in the same significance matrix and applies the same EPA definitions of significance as used in respect of landscape impacts (Figure 9.1).

9.2.5 Limitations of this EIAR

There are not considered to be any particular limitations to this LVIA.

9.3 Receiving Environment

9.3.1 Connection Point

The proposed Connection Point is at the eastern end of the existing Knockraha substation which is a substantial 220kV facility, which lies approximately 1.2 km to the southeast of Knockraha Village. The substation itself is surrounded by a narrow band of hedgerow / woodland vegetation and then pastoral farmland for several kilometres. The substation is on a localised highpoint with the terrain falling gently then rising again to the north and also descending to the south. Aside from Knockraha Village, the rural population in the vicinity is relatively dispersed, with roadside dwellings occurring on the local road to the west of the substation.

Figure 9.2: Landscape context surrounding the Connection Point at Knockraha

Source: Macroworks

Figure 9.3: View of eastern end of the Knockraha substation from adjacent local road

Source: Macroworks

9.3.1.1 Landscape and Visual Designations – Connection Point

The Landscape Character Assessment from the Cork CDP 2014 identifies that the proposed Connection Point is contained within the 'LCT10b – Fissured Fertile Middleground' Landscape Character Type, which is not designated as a 'High Value Landscape'(HVL). There are no designated scenic routes or NPWS sites in the vicinity that are relevant to the Connection Point aspect of the proposed development.

9.3.2 Converter Station Site Compound

The proposed Converter Station at Ballyadam is contained within a rural hinterland landscape between the settlements of Midleton (ca. 2.5km to the east) and Carrigtwohill (ca. 1.2km to the west). It lies just north of the N25 national route and immediately south of a section of national railway line that runs between Midleton and Cork. The site itself is part of a larger landholding zoned for industrial development, where site development works relating to construction of a large pharmaceutical facility were undertaken, but abandoned in ca. 2009. Partially constructed entrance roads as well as cleared and levelled zones within the north of the site combine with a woodland knoll and reverting grass and scrub areas in the south of the site.

In the wider context of the Converter Station site there is a combination of flat farmland and an extensive quarry to the south of the N25 and the Cork estuary is approximately 3km to the south of the site. Fota Island Resort and Wildlife Park is located within Cork harbour approximately 4km to the southwest.

To the north of the site and railway line the terrain begins to ascend towards Lysaghtstown Hill in a matrix of farmed fields and hedgerows. Water Rock Golf Course is around 2km to the northeast and there is a Coillte owned recreational woodland called Curragh Wood on top of Curragh Hill to the north of the site around 2km away.

Figure 9.4: Landscape context surrounding the Converter Station site at Ballyadam

Source: Macroworks

Figure 9.5: View from the north across proposed Converter site

Source: Macroworks

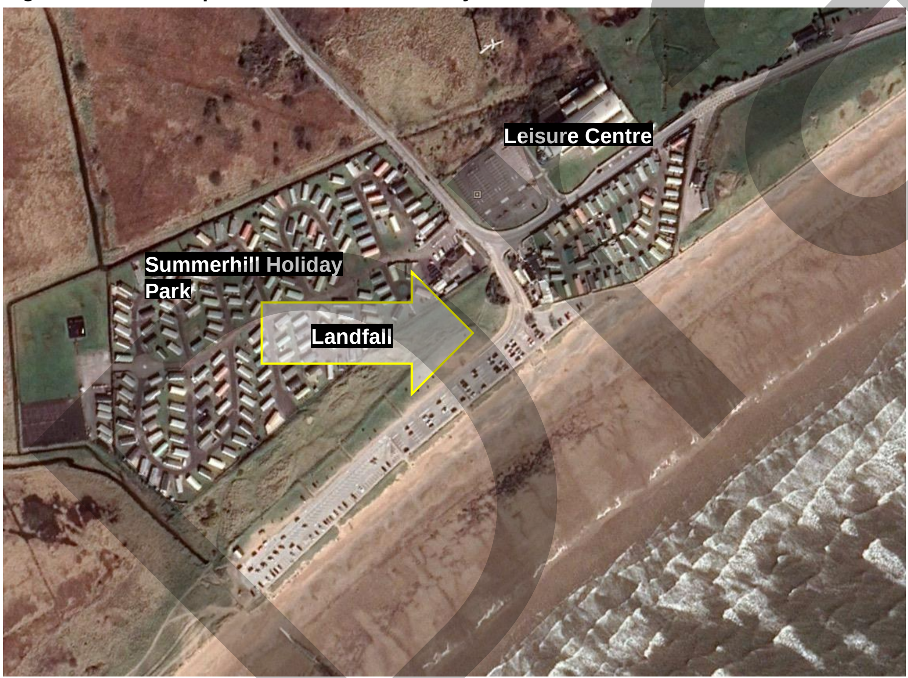
9.3.2.1 Landscape and Visual Designations – Converter Station

The Landscape Character Assessment from the Cork CDP 2014 identifies that the proposed Converter Station is contained within the 'LCT1 – City Harbour and estuary' Landscape Character Type, which is designated as a 'High Value Landscape' (HVL). Scenic route S42 described as "*Road at Cashnagarriffe, N.W. Carrigtwohill and Westwards to Caherlag*" is contained approximately 3km to the west of the site on the farmed slopes above Carrigtwohill. Whilst there is some potential visibility of the Converter Station from a small section of this scenic route, there is no potential visibility from designated scenic route S43 (*"R363 Leamlara to Midleton Road"*), which follows a valley to the north of Middleton. The Great Island Channel SAC and Cork Harbour SPA are contained within the estuary context over 3km south of the site. The site is zoned for industrial use and there is potential that other industrial uses could also be developed within the overall IDA landholding at Ballyadam in the future.

9.3.3 Landfall Area

The landscape / seascape setting of the proposed landfall area at Claycastle is that of a popular East Cork beach where a broad and sandy strand immediately to the west of the mouth of the Blackwater River rises gently towards a public carpark. The extensive tarmacadam carpark, a grassed amenity strip and then undulating dunes separate the beach from the Summerfield Holiday Park and the Aura Youghal Leisure Centre, which hosts a swimming pool. There is also a modest scale ca. 20m tall wind turbine in open ground just to the northwest of the Leisure Centre. More caravans / mobile homes from the Summerhill Holiday Park are contained between the beach and the Leisure centre just to the northeast of the proposed landfall works (see Figure 9.6). A more naturalistic zone of coastal marsh (Ballyvergen Marsh) occurs inland and south-westwards of the Holiday Park. The Claycastle Pitch and Putt golf course lies to the northeast of the Aura Youghal Leisure Centre.

Figure 9.6: Landscape context around the Claycastle Landfall Area



Source: Macroworks

Figure 9.7: View across the car park in the direction of the proposed Claycastle Landfall Area

Source: Macroworks

9.3.3.1 Landscape and Visual Designations - Landfall Area

The Landscape Character Assessment from the Cork CDP 2014 identifies that the proposed landfall area is contained within the 'LCT2 - Broad Bay Coast' Landscape Character Type, which is designated as a 'High Value Landscape' (HVL). Scenic route 46 which follows the Youghal bypass is contained approximately 2.5km inland from the site but is not considered relevant to the proposed landfall. The Ballyvergan Marsh pNHA encompasses the coastal marsh that surrounds the nearby Summerhill Holiday Park.

9.3.4 HVDC / HVAC Onshore Circuits

The proposed HVDC / HVAC Onshore Circuits will run underground within the existing road network and occasionally through private farmland on their journey from the landfall area at Claycastle to the converter station at Ballyadam and then onto Knockraha substation. They will pass through a variety of landscape character types including those designated as High Value Landscapes and Strategic Metropolitan Greenbelt. They also briefly coincide with designated scenic route 46 (Youghal Bypass) and designated scenic route 43 (Road between Leamlara and Midelton). However, given that the circuits will not result in permanent surface expression of any consequence to landscape character or visual amenity, their receiving environment will not be examined in detail.

9.3.5 Construction Compounds, Laydown Areas and Passing Bays

There will be construction compounds at Knockraha, Ballyadam and Claycastle. Passing bays will be provided along the route to facilitate the construction of joint bays. There will also be a number of laydown areas, which will be spaced relatively evenly along the HVAC / HVDC route predominantly in farmed fields and road corridors adjacent to the road trenching operations. As with the cable route, the laydown and passing bay areas will be contained within a variety of landscape character types including those designated as High Value Landscapes and Strategic Metropolitan Greenbelt. They may also be in close proximity to designated scenic route 46 (Youghal Bypass) and designated scenic route 43 (Road between Leamlara and Midelton). However, given that the laydown and passing bay areas will not result in permanent surface expression of any consequence to landscape character or visual amenity, their receiving environment will not be examined in detail.

9.4 Characteristics of the Development

The following descriptions focus on those aspects of the proposed development that are most relevant to landscape and visual effects and should be read in conjunction with Chapter 2 *Description of the Development*. Based on the characteristics of each aspect of the development considered in conjunction with the nature of the receiving environment (described in Section 9.3) relevant Study Areas will be determined for the LVIA.

9.4.1 Connection Point

It is considered that construction or operational stage effects are not likely to be significant beyond 500m of the proposed Connection Point and thus, a 500m radius around the Landfall will define its LVIA Study Area.

9.4.2 Converter Station Site Compound

The Converter Station will be located in the north-eastern corner of the overall IDA landholding at Ballyadam adjacent to the railway line and away from the N25 national road. Excluding access roads, the Converter Station will occupy a compound of approximately 200m x 150m and will consist of external electrical componentry of heights generally up to approximately 12m a.g.l as well as 25m tall lightning masts. It will also include a cluster of three substantial buildings of differing levels, but with an uppermost roof height for the converter station of 25m.

The facility will also host ancillary control / storage buildings, car parking and circulation areas. There will be external 1.4m high post and rail fencing around the wider site with 2.6m high steel palisade security fencing around the internal compound.

Landscaping in the form of planted screen berms is proposed around the perimeter of the compound, particularly to the north and west where the most potential for views into the site occurs.

The Converter Station is the most substantial above-ground component of the Celtic Interconnector project and has the potential to influence the surrounding landscape character and views for several kilometres. It is not considered that construction or operational stage effects are likely to be significant beyond 5km of the proposed Converter Station and thus, a 5km radius around the site will define its LVIA Study Area.

9.4.3 Landfall Area

The construction phase of the Landfall aspect of the development will involve open cut trenching to allow connection between the marine section of the cable and the Transition Joint Bay, which will be located within the grassed amenity strip to the north of the public car park at Claycastle Beach. The Transition Joint Bay itself, approximately 10m x 3m, will comprise sub-surface chambers of requiring excavation for its instalment, but its only surface expression during the operational phase will be a small access cover to a communications cabinet. The open cut trench will be fully reinstated following construction along with the temporary construction compound.

It is not considered that construction or operational stage effects are likely to be significant beyond 500m of the proposed Landfall and thus, a 500m radius around the landfall will define its LVIA Study Area.

9.4.4 HVDC / HVAC Onshore Circuits

The proposed HVDC / HVAC Onshore Circuits will run within the existing road network and occasionally underground through private farmland on their journey from the Landfall at Claycastle to the converter station at Ballyadam and then onto Knockraha substation. Open cut trenching will be required to lay the cables during the construction phase generating temporary and transient effects. The prevailing surface will be fully reinstated following construction.

There will be no material surface expression of the HVDC / HVAC Onshore Circuits during the operational phase even at the sub-surface concrete joint bays / which will be covered in with dry fill and the prevailing surface reinstated. Stream and railway crossings will be achieved using both open cut trenching and Horizontal Directional Drilling (HDD) options and neither will result in permanent surface expression during the operational phase, other than joint bay covers.

It is not considered that construction or operational stage effects are likely to be significant beyond 500m of the proposed Onshore Circuits and thus, a 500m buffer either side of the cable route will define its LVIA Study Area.

9.4.5 Construction Compounds Laydown Areas and Passing Bays

There will be a construction compound located at each of the main development nodes (the Landfall Area, Ballyadam Converter Station and Knockraha Substation). These will host temporary storage of excavated material and construction materials as well as worker welfare facilities. There will also be construction laydown areas along the route where construction materials will be temporarily stored and handled awaiting use and there will be joint bays requiring passing bays for traffic management. In both cases effects will be temporary and contained within close proximity to the road corridor hosing the HVAC / HVDC circuits and thus, the same 500m buffer study area as described in sub-section 9.4.4 will apply.

9.5 Likely Significant Impacts of the Development

Table 9.4 identifies if and where there is potential for significant landscape and visual effects to occur. It is important to note that in accordance with GLVIA-2013, even non-significant effects will be assessed in the interests of providing mitigation insofar as possible and in accordance with best practice. Consequently, all likely material effects will be noted.

Table 9.4: Potential for Significant Landscape and Visual Effects

Location	Potential for Significant Landscape and Visual Effects
Connection Point	It is **not likely that significant landscape or visual effects will arise** from the proposed Connection Point aspect of the development at either construction or operational stage. This is due to the combination of the existing substation context of the connection point, the modest scale and characteristic nature the proposed works and the absence of close sensitive visual receptors.
Converter Station Site Compound	The converter station site compound has the most potential of all of the aspects of the proposed project to give rise to significant effects. **Significant effects could occur during both the construction and operational stages of the converter station**. In terms of physical landscape effects on landcover and vegetation, it is not considered that significant effects will arise on this already highly modified site that was previously prepared for major industrial development more than a decade ago. There is potential for the proposed converter station to give rise to significant landscape character effects in relation to the rural landscape that surrounds the wider IDA landholding at Ballyadam to the north, east and west. Significant landscape character effects are less likely to occur in relation to the rural landscape to the south of the substantial N25 road corridor, which also lies adjacent to a large quarry that decreases the integrity of the rural setting. Significant construction stage effects on landscape character are most likely to occur towards the end of the construction stage due to a combination of construction related activity, machinery and material storage being present at the same time as the substantially completed structures. During the operational stage, significant effects will potentially occur due to the presence of the substantial converter station buildings and associated external electrical componentry within an otherwise substantially rural hinterland setting. For similar reasons as described above in relation to landscape character effects, the proposed converter station could also give rise to potentially significant visual impacts at

Location	Potential for Significant Landscape and Visual Effects
	surrounding receptor locations. These include from local residences, particularly within 1km to the north of the site where elevated views across the site are afforded. Also, from the surrounding road network and from centres of population including Carrigtwohill and Midleton. It is not considered likely that the proposed converter station will generate significant visual impacts along any designated scenic routes within the relevant study area as none have clear views in the direction of the site.
Landfall Area	The only potential for significant landscape or visual effects to occur in relation to the proposed landfall area is during the construction stage, because there will only be very minor surface expression of the development during the operational stage. However, because the construction stage is temporary and its effects almost fully reversible through reinstatement of the prevailing land cover, **significant impacts are not likely to occur.**
HVDC / HVDC Cable Routes	The only potential for significant landscape or visual effects to occur in relation to the proposed HVDC / HVAC onshore UGCs is during the construction stage, because there will only be very minor surface expression of the development during the operational stage. However, because the construction stage is short-term, its effects are transient along the cable route and almost fully reversible through reinstatement of the prevailing land cover, **significant impacts are not likely to occur**.
Construction Compounds Laydown Areas and Passing Bays	The only potential for significant landscape or visual effects to occur in relation to the proposed laydown and passing bay areas is during the construction stage, because they are only temporary installations and prevailing land cover will be restored thereafter. Thus, **significant impacts are not likely to occur.**

9.5.1 Construction Phase

9.5.1.1 Connection Point

The construction stage works required at the connection point are relatively modest in scale and temporary (less than 1 year) in duration. Furthermore, they will occur within and adjacent to the existing Knockraha substation. There will be a noticeably increased level of activity from workers and construction machinery during the period of the construction works (9 months), but there are few visual receptors within close proximity to the works other than passing road users for whom visual amenity is already strongly influenced by the existing Knockraha substation.

The landscape of the Connection Point study area is not contained within a designated High Value Landscape and there are no designated scenic routes in the vicinity. Given the presence of the existing substation facility the sensitivity of the site and its immediate surrounds is considered to be **Low**. The modest scale, nature and duration of the construction stage works at the Connection Point are deemed to result in **Medium-low** landscape and visual impact magnitude. The resulting significance of impact is deemed to be **Slight**.

9.5.1.2 Converter Station Site Compound

The converter station site will be raised up to an optimum site level by means of installation of a new platform of engineered stone fill, which will form the basis of support all of the associated structures, which will in turn be piled and supported by a concrete raft. The buildings are to be constructed of steel frames with lightweight cladding to roofs and walls. The construction of the converter station will involve considerable HGV movements carrying material both to and from site and will last for approximately 36 months. During that period, there will be a high level of activity from people (approximately 100) and construction machinery on site, there will be temporary stockpiling of excavated materials and building material, worker welfare facilities and temporary site lighting. Permanent security fencing and perimeter post and rail fencing will be erected and perimeter landscape berms will be formed from topsoil excavated from the site. This will present as a substantial scale construction project and related landscape and visual effects will be at their greatest when the project is nearing completion. This is on the basis that construction related features and activities will be present at the same time as the emerging, partially completed structures generating intensity of activity and visual clutter.

The landscape sensitivity of the site itself is considered to be **Low** as it is a large scale partially formed / abandoned construction site subject of an industrial zoning that is sandwiched between the N26 road corridor to the south and a section of national railway line to the north. The surrounding rural landscape is, however, contained within a High Value Landscape (HVL) designation, albeit associated with the city harbour and estuary, which does not have a strong influence over the character of the landscape in the central study area. It is a diverse and productive rural hinterland landscape that is strongly influenced by the aforementioned transport corridors, the settlements of Midleton and Carrigtwohill as well as considerable quarrying activity. The upslope landscape to the north has a more traditional pastoral character and afforded broad panoramic views to the south for its rural based residents. Nonetheless, this landscape too is subject of the largest series of solar development permissions in the country, which will also add to its diversity of productive uses in the years to come. On the basis of these reasons, landscape sensitivity and the sensitivity of visual receptors is considered to be **Medium** for the uphill farmed slopes to the north of the converter station site and no greater than **Medium-low** for the remainder of the study area.

Due to scale and intensity balanced against the short term duration the construction stage landscape effects and visual effects within the site are deemed to be of a High-medium magnitude. When coupled with the site's Low degree of sensitivity, the resulting significance is deemed to be **Moderate-slight**.

Due to physical and contextual separation in respect of landscape and visual receptors beyond the site, which are also separated by the railway line and N25 transport corridors, the magnitude of construction stage effects is deemed to reduce to Medium beyond the site boundary and further still beyond the central study area (< ca. 1km). However, on the basis of the Medium landscape sensitivity and visual receptor sensitivity upslope to the north of the site, the construction stage significance of impact is deemed to be **Moderate**. Significance will reduce for lesser sensitivity areas of the lower lying, wider landscape, which will also experience a reduced magnitude of construction stage effects due to increased separation and reduced visibility.

9.5.1.3 Landfall Area

The landfall construction stage at Claycastle will involve trenching of a channel on the beach through the municipal car park that sits adjacent and above the beach and the excavation of an underground transition joint bay within the grassed amenity strip just inland of the carpark. The cable will then be pulled into the transition joint bay from its near shore approach. The construction process will involve excavation machinery, sheet piling of the trench, temporary storage of excavated material and construction material, security fencing as well as welfare facilities and car parking for workers. It will appear much like any other infrastructure building site, albeit the majority of work will occur below ground level and no permanent above ground structures will emerge.

The construction stage will generate localised negative impacts on landscape character and visual amenity at this relatively scenic seaside location enjoyed by recreationalists. However, the duration of construction works will be only 18 weeks and therefore 'temporary' (less than 1 year) in accordance with EPA guidance.

The landscape sensitivity of the Landfall study area is deemed to be **Medium** and so too is the sensitivity of visual receptors being predominantly recreational users of the camping ground and beach. On balance of the factors described above and particularly the temporary duration, the magnitude of landscape impacts and visual impacts during the Landfall construction stage is deemed to be no greater than **Medium-low**. In accordance with the assessment criteria set out in sections 9.2.4, a Medium receptor sensitivity judgement coupled with a Medium-low impact magnitude judgement is deemed to result in a **Moderate-slight** significance of construction stage impact.

9.5.1.4 HVDC / HVAC Onshore Circuits

The construction method for the HVDC / HVAC UGC will primarily involve trenching of existing road surfaces to lay the ducting system for the cables and construction of periodic concrete joint bays. As a second stage, the cables will be installed into the ducting system using pulling equipment. There will be associated machinery and worker activity at the section of cable route being installed as well as site fencing, temporary storage of excavated material and laydown areas for construction materials. The progress of the works will be reasonably rapid at a typical rate of 50m per day and thus, the nature of the work is reasonably intensive, but transient (continually moving). Because the work is transient the effects will be dispersed and temporary. Furthermore, construction and maintenance works within road corridors is a common occurrence with little attention likely to be paid by passers-by as to the nature of the work.

For some sections of the HVDC / HVAC UGC, the cable route will run through open countryside and occasionally cross watercourses and railway lines. The working corridor in open ground will be wider (ca. 26m) than within typical road sections because there is generally more space available. The trenching process will otherwise be much the same but including aggregate haul roads to deliver and remove materials as necessary and temporary drainage works to avoid flooding and compaction to land within the wayleave. Such construction works are more out of the ordinary than works within the road corridor and have the potential to result in temporary / short term effects on the prevailing ground cover and also the loss of some minor sections of vegetation. Construction impacts on landscape character as well as visual impacts are also likely to be noticeable within open countryside than within the road corridor due to increased levels of activity and machinery in areas where this is not commonplace or expected and where people enjoy visual amenity of countryside views from roads, residences and occasionally recreational areas.

At watercourse crossings, depending on circumstances and sensitivities, the UGC will be either trenched through the watercourse or run underneath through the process of HDD. The latter is likely to be more intensive and time consuming at the crossing point but ultimately result in less physical impacts on the water corridor in question.

In terms of sensitivity road corridors themselves are not considered to be a sensitive landscape receptor as they are a highly modified transport route that can be readily reinstated. As visual receptors, road users are susceptible to the changes in the landscape they pass through and views from the road, particularly in scenic areas. However, they are not susceptible to temporary visual change within the road corridor itself. Local residents who view the road corridor from their dwellings are also susceptible to visual change, but generally beyond or away from the road corridor and not when the visual change relates to brief periods of road works. For these reasons, for the vast majority of the UGC route being laid under existing road surfaces the sensitivity of the receiving landscape as well as visual receptors is deemed to be **Low**. For those infrequent sections of the Onshore Circuits through open countryside, the rural landscape and those that enjoy views across it are more susceptible to construction stage impacts. However, this is still a productive and populated area and therefore landscape sensitivity and the sensitivity of visual receptors is deemed to be in the order of **Medium** to **Medium-low**.

Given the relatively modest scale of the proposed HVDC / HVAC UGC construction works and the fact that it is transient and temporary, the magnitude of impact is deemed to be **Low**. Thus, the highest level combination of impact magnitude and receptor sensitivity is Low and Medium respectively resulting in significance of no greater than **Slight** in open countryside areas and **Slight-imperceptible** within road corridors.

9.5.1.5 Construction Compounds Laydown Areas and Passing Bays

The construction of laydown areas and associated access tracks, where hard stands and tracks are not already in existence, will predominantly involve the clearance and temporary storage of topsoil coupled with the introduction of hardcore fill in its place. There may be some minor clearance of vegetation required to facilitate the likes of gateway accesses. For the roadside Passing bays there is a slightly higher potential from woody vegetation clearance within the road corridor, but less potential for the disturbance of grazing land. The process of incorporating hardcore fill within the passing bay areas will be similar to that required for laydown areas involving intense activity from workers and heavy machinery. Such construction works will not appear out of the ordinary in close proximity to the road network and will result in temporary and dispersed effects along the cable route. Once the construction stage is complete, temporary laydown and passing bay areas will be fully reinstated to their former condition.

In terms of sensitivity, road corridors are not considered to be a sensitive landscape receptor as they represent highly modified transport infrastructure and this influences the sensitivity of the landscape immediately adjacent to them that will be utilised for passing bay areas and laydown areas. As visual receptors, road users are susceptible to the changes in the landscape they pass through and views from the road, particularly in scenic areas. However, they are not particularly susceptible to temporary visual change within or immediately adjacent to the road corridor. Local residents who view the road laydown and passing bay from their dwellings are also susceptible to visual change, but generally beyond or away from the road corridor and not when the visual change relates to brief periods of what will be perceived as ancillary hardstand areas associated with road works. For these reasons, for the vast majority of the laydown and passing bay areas being constructed in closed proximity (<ca.100m) to existing roads, the sensitivity of the receiving landscape as well as visual receptors is deemed to be **Low**. For those laydown areas slightly further from the road network within more open countryside, the rural landscape and those that enjoy views across it are more susceptible to construction stage impacts. However, this is still a productive and populated area and therefore landscape sensitivity and the sensitivity of visual receptors is deemed to be in the order of **Medium** to **Medium-low**.

Given the relatively modest scale, temporary duration and dispersed siting of the laydown and passing bay areas, the magnitude of impact is deemed to be **Medium low**. Thus, the highest level combination of impact magnitude and receptor sensitivity is Medium-low and Medium respectively resulting in significance of no greater than **Moderate slight** in open countryside areas and **Slight** adjacent to road corridors.

9.5.2 Operational Phase

9.5.2.1 Connection Point

Once operational the substation extension at the connection point will present as part infill / part minor lateral increase to the eastern end of the existing substation facility. The complex and external electrical componentry will present in a similar manner to the remainder of the existing substation facility to which it adjoins and it will be contained within the existing fence line of the substation.

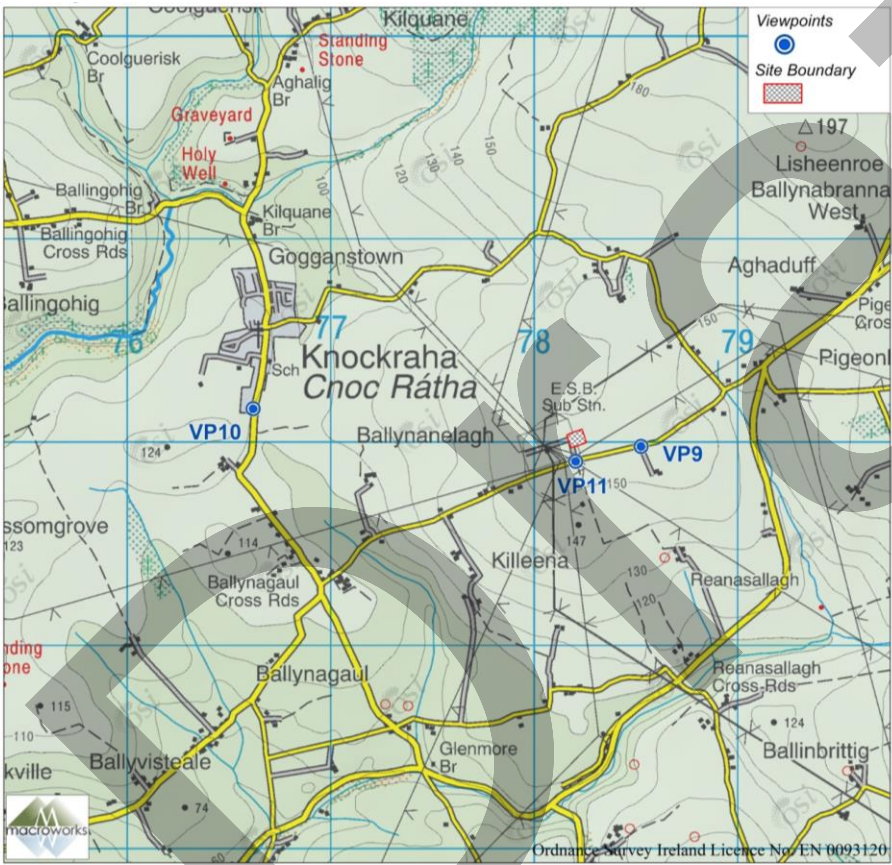
In terms of effects on the physical landscape the proposed extension will occur within the overall compound of the existing facility and within the perimeter security fence. Thus, there will be no notable loss of agricultural grassland or hedgerows and the proposed extension is contained on already disturbed ground. From a landscape character perspective it will add to the overall intensity and scale of the substation facility, but only to a minor extent and will not materially alter the landscape setting in the vicinity which is already influenced by a substantial electrical facility.

Three viewpoints have been selected to examine the visual impact of the connection point substation extension from visual receptors within the surrounding area and these are set out in Table 9.5 below.

Table 9.5: Viewpoint Locations relevant to the Connection Point

VP No.	Location	
VP9	Local road at Ballinanleigh	Connection Point
VP10	Knockraha Village	Connection Point
VP11	Local road adjacent to the south of Knockraha substation	Connection Point

Figure 9.8: VP location map (Connection Point VPs)



Source: Macroworks

Summary of Visual Impact Assessment (Connection Point Viewpoints)

Of the three viewpoints selected to assess the visual impact of the connection point extension to Knockraha substation, two (VP9 and VP10) were assessed to have Imperceptible impacts. VP9 is from the local road that serves the substation and despite being only a short distance to the east of the site, the proposed extension will not be visible due to the containment and screening by roadside vegetation. VP10 is from the settlement of Knockraha to the west of the site and again, due to screening by intervening hedgerow vegetation the proposed substation extension will not be discernible.

Only at VP11, which is immediately adjacent to a gateway at the eastern end of the existing Knockraha substation, is there a relatively clear view of the proposed connection point electrical componentry. However, this is a low sensitivity receptor location that does not represent views from local residences and the nature of the visual change is consistent with the existing scene – just intensified. Consequently, the significance of visual impact at VP11 is deemed to be Slight.

9.5.2.2 Converter Station Site Compound

Once operational, the proposed converter station will consist of a large, partly enclosed / partly externalised electrical facility. The substantial building occupying the north-western quadrant of the compound will consist of roof heights up to 25m for the Valve Hall and 22m each for the adjoining DC Hall and Reactor Hall. This main building will have external dimensions of 88m x 55m and there will also be a 28m x 25m x 8.5m tall control building attached to the larger buildings southwest corner and a 40m x 15m of the same height in the southwestern corner of the compound. An intense and cluttered array of external electrical componentry occupies the eastern half of the compound along with a 25m x 15m ESB Control Building, which sits inside the south-eastern quadrant of the compound that has been set aside for the ESB. Most of the vertical electrical components in the eastern half of the compound have heights in the order of 8m, but with post insulators extending to approximately 12m and the 14 lightning protection poles extending to 25m in height. The south-western perimeter of the site will host around 18 car parking spaces and a security hut.

Landscape Character Effects

Together, the elements that comprise the converter station compound present as a large industrial facility, albeit within a site that is zoned for industrial use and appears primed to receive it even if somewhat derelict. The site is within a rural hinterland landscape where it is bordered by major transport routes and lies between the substantial settlements of Midleton and Carrigtwohill with a large quarry facility a short distance to the southeast. Nonetheless, there is rolling farmland to the north and east and the proposed development represents a substantial increase in the scale and intensity of built development, which will draw from the rural character that exists within the closest of these open countryside areas. The magnitude of impact on landscape character will be greatest within approximately 1km of the site where the converter station makes a noticeable contribution to the landscape setting / land use mix and therefore impacts on landscape character. This effect is considered to be of a **Medium** magnitude.

Beyond approximately 1km, the proposed converter station represents a smaller component of the overall diverse landscape fabric of this hinterland landscape and its influence on landscape character is strongly diluted to a Low and Negligible magnitude of impact with increasing distance.

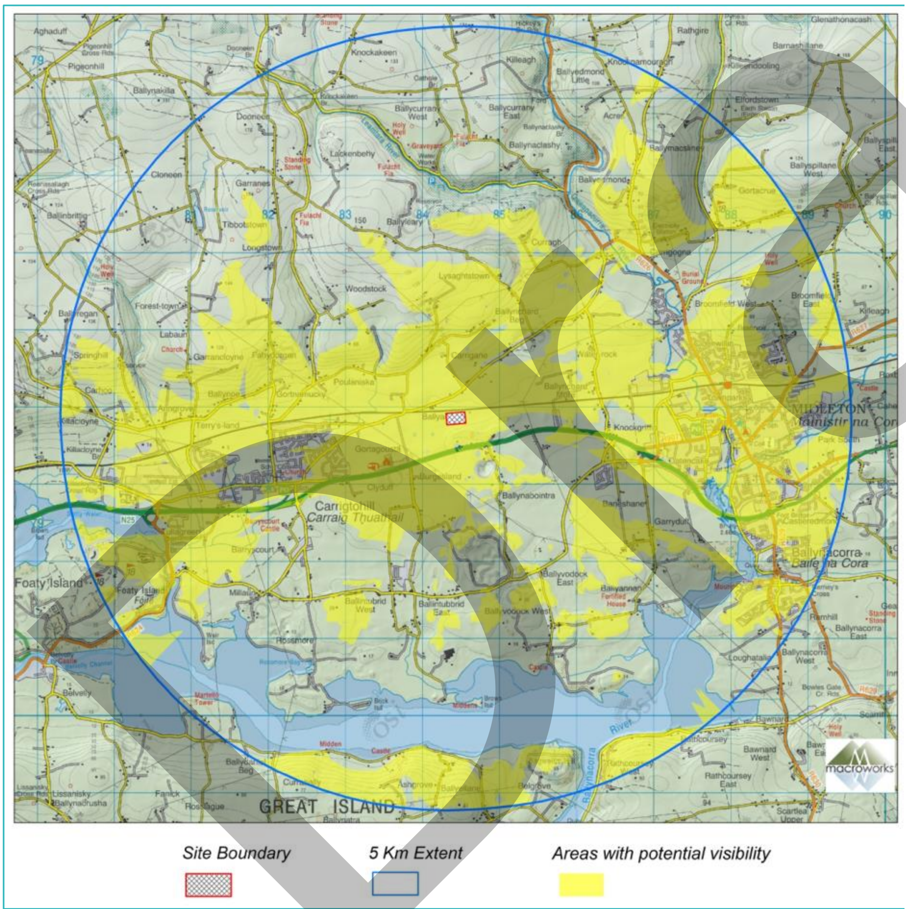
For the reasons described in section 9.7.3, the landscape sensitivity of the site and its immediate surrounds is deemed to be **Low**, but with the farmed landscape uphill to the north considered to be of **Medium** sensitivity and remaining lowland portions of the Converter Station study area considered to be of **Medium-low** sensitivity.

Weighing the magnitude of impact against receptor sensitivity, the highest significance of effect is deemed to occur within the farmed landscape uphill to the north within approximately 1km where Medium sensitivity combines with a Medium magnitude of impact to generate **Moderate** significance. In all other instances, even within the site and its immediate environs, the significance of landscape impact during the operational phase will be Moderate-slight or lower.

Visual Effects

As visual effects are based on changes to views experienced by people, it is important to establish parts of the study area from which the development may be visible and which sensitive receptors occur in these areas. It is also useful to scope-out those receptors that will not have any potential visibility of the proposed Converter Station (due to terrain screening). In the first instance this is determined using Zone of Theoretical Visibility (ZTV) mapping in a bare-ground scenario using a Digital Terrain Model (DTM) for the full converter station study area. Thereafter, a ZTV map based on a Digital Surface Model (DSM) of the area nearer the site (2km radius) can determine how much influence existing screening in the form of vegetation and buildings will screen the proposed development (see Figure 9.9 and 9.10 for these respective ZTV maps).

Figure 9.9: Bare-ground ZTV map of the Converter Station Study Area

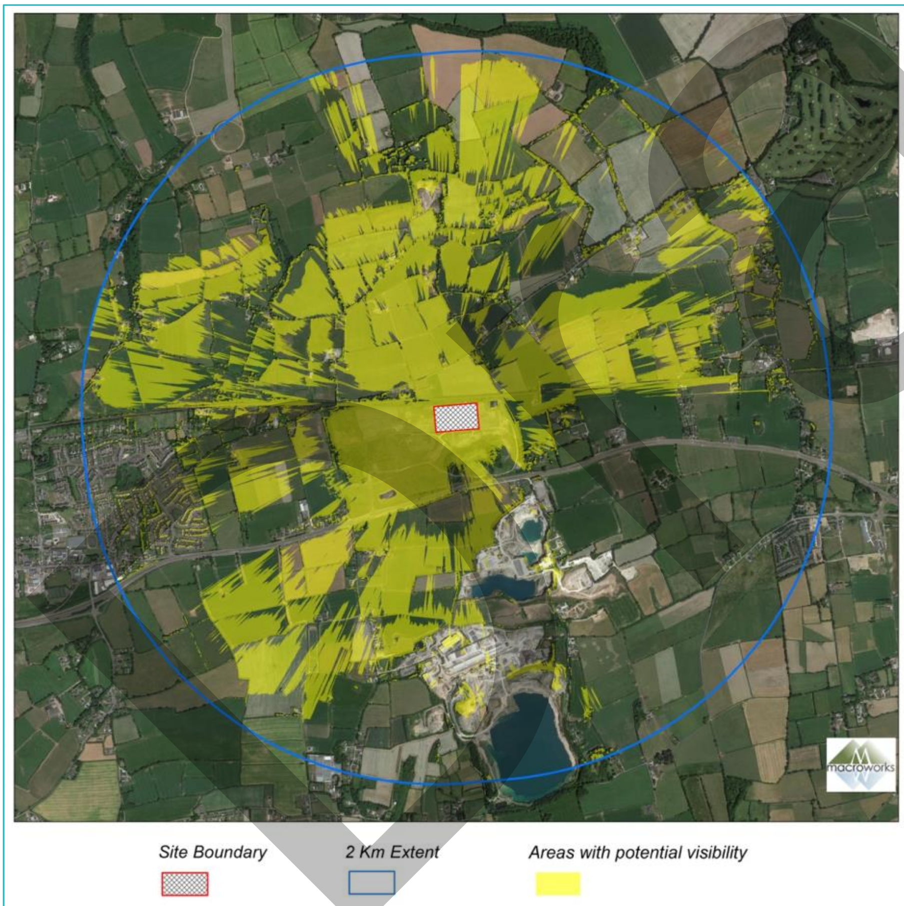


Source: Macroworks

As can be seen from the bare-ground ZTV map (Figure 9.9);

- There is relatively comprehensive potential for visibility of the main converter station building from within 1km of the site, particularly to the north, west and south. Visibility is more limited to the southeast due to a low hill just to the southeast of the site.
- Beyond 1-2km to the south, visibility is substantially restricted all the way to the Cork Harbour estuary and only re-emerges on the north facing slopes of Great Island around 4.5km from the site.
- There is a band of potential visibility that stretches east to west across the study area from Midleton to Fota Island encompassing the flat land landscape and rising farmed slopes predominantly to the north of the N25. However, it should be noted that much of the settlement of Carrigtwohill which is located in this zone is not contained within ZTV pattern indicating no potential for visibility.

Figure 9.10: Digital Surface Model (DSM) based ZTV map 2km radius around



Source: Macroworks

As can be seen for the DSM-based ZTV map (Figure 9.8);

- There remains potential for clear visibility of the main converter station building (or at least its roofline) from within the IDA site to the south and west and also within the farmed slopes up to 1km north of the site.
- The 'shard' visibility pattern in nearly all directions beyond 1km indicates that much of the visibility of the proposed converter station is between trees or sections of hedgerow vegetation rather above these elements and that it is likely to be only the uppermost sections of the building that will be visible.
- Only a short section of the N25 adjacent to the IDA site is afforded visibility of the proposed converter station and views from Carrigtwohill are substantially screened. Visibility in the direction of Midleton (east) also dissipates around 1.5km from the site due to layers of hedgerow screening.

On the basis of the baseline study, examination of ZTV mapping and fieldwork, a selection of representative viewpoints (VPs) were selected for the purposes of the visual impact assessment of the converter station compound. These are set out in Table 9.6 and shown on Figure 9.11. The individual assessments for each of these viewpoints can be found in Appendix 9.1 and these are summarised below.

Table 9.6: Viewpoint Locations relevant to the Converter Station Compound

VP No.	Location
VP1	Designated scenic route on local road north of Carrigtwohill
VP2	Local road north of site at Ballyadam
VP3	Local road intersection at Carrigane
VP4	Local road and housing cluster near entrance to Water Rock Golf Course
VP5	Local Road at Lysaghtstown
VP6	N25 at entrance to IDA site
VP7	N25 south of site
VP8	N25 near entrance to residential housing cluster

Figure 9.11: VP location map (Converter Station Compound VPs)

Source: Macroworks

Summary of Visual Impact Assessment (Converter Station Viewpoints)

Of the eight viewpoints used to assess the visual impact of the proposed converter station, only one (VP1) represented a designated scenic view, which is now questionable in terms the scenic amenity it affords due the degree of screening from roadside vegetation. Notwithstanding roadside screening, there is no potential visibility of the proposed converter station from this designated route.

Visual receptor sensitivity ranged between 'Medium' and 'Low' across converter station viewpoint set with those vast elevated views across a predominantly rural hinterland landscape assigned 'Medium' sensitivity (VP1, VP3 and VP5) and roadside views from the busy N25 looking across the IDA site assigned 'Low' sensitivity (VP6 and VP7). The remaining location were assigned 'Medium-low' sensitivity on the basis of being relatively commonplace, undesignated views across a varied and productive landscape fabric.

The highest level of pre-mitigation visual impact magnitude was deemed to be 'High' resulting in a 'Substantial-moderate' significance at VP2, which lies as short distance to the north of the site where clear views across the converter station compound are afforded in relatively close proximity. While the main converter station building will be a prominent and bulky feature of the near-middle distance view, it rises out of the semi-derelict IDA site and is contained within an otherwise broad vista without obstructing key elements. It considerably increases the intensity of development within this view and alters the nature of the scene from predominantly rural towards rural/industrial.

Once the proposed dispersed earthy colour tone pattern is added to the main converter station building and the mitigation screen planting atop the northern landscape berm has become established, the perceived bulk and massing of the building will be noticeably reduced at VP2. Much of the cluttered external electrical componentry ancillary buildings and ground based activity will also be substantially screened from view. Consequently, the residual visual impact is deemed to reduce to 'Moderate' at VP2.

A similar scenario to VP2 also occurs at the higher and more distant VP3, but with the effects diluted by the wider viewing context and the increased viewing distance from the proposed converter station. The proposed mitigation measures are also effective from VP3 and the pre-mitigation significance of impact is deemed to reduce from 'Moderate' to a residual impact of 'Moderate-slight'.

From the remaining viewpoints the proposed converter station compound is either fully or partially screened within broad viewing contexts where it will be perceived as another anthropogenic element within broad views across a richly diverse and productive hinterland landscape. Thus, visual impact significance does not exceed Slight in either a pre-mitigation or residual scenario. The only exception is a relatively clear and close view of the proposed converter station from the N25 across the IDA site. In this instance the busy road corridor and semi-industrial foreground limits the significance of visual impact to Slight.

9.5.2.3 HVDC / HVAC UGC

Once the construction phase is complete, and the road surface / agricultural grassland reinstated along the HVDC/HVAC UGC routes, there will be no material surface expression of these underground elements. Consequently, the HVDC / HVAC UGC will have **Negligible** magnitude of impact and on visual receptors and landscape character resulting in an **Imperceptible** significance overall.

9.5.2.4 Landfall Area

Once the construction phase is complete, and the prevailing ground cover reinstated at the landfall site, the only above ground expression of the proposed development will be a small hatch to the communications cabinet. Although visible and contained within amenity grassed picnic area at the back of the car park the access hatch will have no discernible effect on even the very localised landscape character and visual amenity. For this reason the magnitude of operational stage landscape impact and visual impact is deemed to be **Negligible**. When coupled with the **Medium** sensitivity of the landscape and visual receptors at this located, the overall significance of impact is deemed to be **Imperceptible** during the operational phase.

9.5.3 Do Nothing

The do-nothing scenario will consider the like future changes to the receiving environment in respect of each of the development features if the proposed development does not proceed.

9.5.4 Decommissioning Phase

The activities associated with the decommissioning phase (subject of separate consent applications at that time) will be similar to those associated with the construction phase.

Therefore, the landscape and visual impacts of the decommissioning phase should be, as a worst-case scenario, similar to those described and assessed at construction phase.

9.5.4.1 Connection Point

In a do-nothing scenario, the proposed Connection Point is likely to remain unchanged in the short term. The developers are not aware of any other major planned development proposals at the connection point.

9.5.4.2 Converter Station Site Compound

In a do-nothing scenario the site of the proposed converter station is very likely to be developed for industrial purposes in the future, given its ownership by the IDA and its zoning for industrial/employment-related use.

9.5.4.3 Landfall Area

In a do-nothing scenario, the proposed landfall area is likely to remain unchanged for the foreseeable future as the beach, municipal car park and amenity grassed area does not represent a development opportunity for other forms of commercial or residential development.

9.5.4.4 HVDC / HVAC Onshore Circuits, Construction Compounds, Laydown Areas and Passing Bays

In a do-nothing scenario, the roads, road verges and rural land subject of the proposed HVDC / HVAC UGCs, laydown areas and passing bays are likely to remain unchanged.

9.5.5 Cumulative Effects

A list of proposed and permitted developments that have the potential to generate cumulative impacts in-combination with the proposed Celtic Interconnector Project have been identified in Table 4.2 of Volume 3C1 of this EIAR The interaction may be a physical or temporal one and it is the former that is of most consequence to landscape and visual impacts as temporal overlap is most likely to result from temporary / off-site construction effects occurring in parallel.

Table 9.7 identifies the potential for cumulative landscape and visual effects to occur in respect of each of these developments.

Table 9.7: Cumulative Effects

Development	Likelihood / Nature of cumulative landscape and visual impacts	Cumulative Impact
Youghal to Midleton Greenway	Potential construction stage cumulative effects (routes crossing each other), but no operational stage cumulative effects likely	Imperceptible
Youghal Eco Boardwalk	There may be very limited construction stage cumulative visual effects, but no operational stage cumulative effects likely	Imperceptible
Various on IDA Lands at Ballyadam	Potential for both construction and operational stage cumulative landscape and visual impacts primarily relating to proximity as well as combined intensity, extent and scale of developments within the IDA landholding. There are no specific developments proposed at this time.	Potential cumulative impacts
N25 Carrigtwohill to Midleton scheme	Potential for both construction and operational stage cumulative landscape and visual impacts primarily relating to proximity as well as combined intensity, extent and scale of these electrical infrastructure and road infrastructure developments. This is on the basis that a major potential junction could be provided to the Ballyadam site from the N25 (irrespective of the propose development). There is potential for	Potentially significant cumulative impacts

Development	Likelihood / Nature of cumulative landscape and visual impacts	Cumulative Impact
	significant cumulative effects to landscape character and visual amenity from these combined developments.	
Urban Expansion Project	Potential for both construction and operational stage cumulative landscape and visual impacts primarily relating to proximity as well as combined intensity, extent and scale of these residential and electrical infrastructure developments. This will mainly be in the form of an increased proportion of urban fabric within this rural hinterland area as well as reduced rural visual amenity for existing residents within this area.	Potentially Moderate cumulative impacts
Waste water infrastructure (pump stations and network)	Potential construction stage cumulative effects (routes coinciding with each other), but no operational stage cumulative effects likely	Imperceptible
Midleton Flood Relief Scheme	Potential construction stage cumulative effects (construction activities temporally coinciding), but no operational stage cumulative effects likely	Imperceptible
CP901 Kilbarry-Knockraha	Potential construction stage cumulative effects (construction activities temporally coinciding), but no operational stage cumulative effects likely	Imperceptible
Ballyadam 110 kV Substation	Potential for both construction and operational stage cumulative landscape and visual impacts primarily relating to proximity as well as combined intensity, extent and scale of these adjacent electrical infrastructure developments. This will mainly be in the form of an increased proportion of overt electrical infrastructure within this rural hinterland area as well as reduced rural visual amenity for existing residents within this area.	Potentially Moderate cumulative impacts
Statkraft (Lightsource) solar Farm	Potential construction stage cumulative effects (construction activities temporally coinciding), but operational stage cumulative effects will be very minor as the visual influence of the proposed Knockraha substation extension does not allow for intervisibility between the two developments. The only material impact will be a marginal increase in the intensification of electrical infrastructure within this predominantly rural farming landscape	Potential for Slight Imperceptible cumulative impacts
Inis Ealga Marine Energy Park	No potential for discernible landscape and visual cumulative impacts with the onshore elements of the proposed Celtic Interconnector project due to separation distance and relative context.	Imperceptible

As can be seen from the cumulative impact assessment contained in Table 9.4, the main potential for cumulative impacts to occur in conjunction with the proposed Celtic Interconnector development relate to other substantial scale developments in close proximity to the proposed Converter Station Compound. In particular, the adjacent ESB 110 kV substation, other future industrial / infrastructure developments that might occur within the industrial zoned IDA lands at Ballyadam and the proposed upgrade works to the N25. Also, potential residential expansion between Midleton and Carrigtwohill.

In respect of the adjacent ESB 110kV substation the cumulative effect is likely to be one of intensification and scale of developments of a similar nature. Mitigation screen planting will help to reduce cumulative visual impacts, particularly for those residential receptors that occur uphill to the north of the IDA landholding (see VP2 and VP3 photomontages). Cumulative impacts for these two developments will be noticeable, but are not likely to be significant. Similarly, other forms of industrial or commercial development within the overall IDA landholding will result in increased intensity, scale and extent of large and potentially bulky buildings. Internal landscaping similar to that set up as a precedent by measures proposed on the converter station site (southern boundary) will aid visual integration and consolidation of development within the wider IDA site (if implemented).

Though likely to occur adjacent to the other side of the IDA site to the proposed converter station, the N25 upgrade and potential intersection with the IDA site is likely to also increase the scale and intensity of infrastructure development in the vicinity of the converter station. Together these developments would serve to reduce the integrity of the current rural hinterland setting of the IDA landholding and the visual amenity of those afforded views across the site, particularly from the slopes to the north.

While the cumulative developments outlined above have the potential to generate moderate or even significant cumulative landscape and visual impacts in-combination with the proposed converter station, there is also strong potential to mitigate such impacts from considered siting and design. It is also important to consider such cumulative impacts in the context of a quickly evolving hinterland landscape that already hosts a rich variety of productive and infrastructural land uses in terms of its baseline context.

9.6 Mitigation and Monitoring Measures

The main focus of mitigation for landscape and visual impacts is in respect of the main buildings of the converter station, which are large in scale and prominently visible from some receptors within the surrounding landscape, particularly from the north. Two methods of mitigation will be utilised, which will work in combination.

The first mitigation measure is a dispersed colour pattern for the facades of the buildings that graduates from darker earthy / vegetation tones at the base of the buildings to lighter sky coloured tones towards the upper sections. The purpose of the colour scheme is to;

- Break down the perceived scale and massing of the proposed converter station buildings
- Provide a dark plinth to the base of the buildings to reduce the perceived vertical height
- To provide earthy / vegetation tones through the base and mid sections of buildings to tie into surrounding existing and proposed vegetation patterns. This has been done in a blocky geometric manner that balances the obvious industrial nature of the development without appearing as an overt attempt to camouflage it.
- To provide a light-tone recessive colour scheme for upper sections of buildings likely to be viewed against a backdrop of sky:

The second mitigation measure is the provision of a band of screen planting along the northern and western sides of the main converter station building and a more formal treeline along the southern boundary of the site. It is intended that this reach a height of around 8-10m over the course of approximately 5-7 growing seasons and will consist of some advanced nursery stock (semi-mature trees) at planting stage in combination with a majority of whip transplants. Optimisation of the ecological function of this planting will also be a consideration though the use of pollinator species insofar as possible.

The mitigation measures outlined above have been incorporated into a post-mitigation establishment set of photomontages to aid the assessment of residual visual impacts.

Landscape and visual mitigation measures are not considered necessary in relation to the landfall area and HVDC/HVAC UGC routes as there will be no material effects from the operational stage above ground elements. Likewise, for temporary / short term elements of the project, including the construction compounds laydown Areas and passing bays, specific landscape and visual mitigation measures are not considered necessary.

9.7 Residual Impacts

The focus of landscape and visual mitigation measures is the converter station at Ballyadam and specifically, reducing the perceived scale and massing of the proposed buildings through a recessive colour scheme and screening them / assimilating them using perimeter screen planting. Consequently, the only aspect of the development for which the residual impacts differs from the likely impacts is in relation to visual impacts at the converter station. A summary of the pre-mitigation and post-mitigation (residual) impacts at relevant viewpoints is set out in table 9.8 below.

Table 9.8: Viewpoint Assessment Summary (Converter Station Compound)

VP No.	Location	Pre-mitigation Significance	Residual Impact Significance
VP1	Designated scenic route on local road north of Carrigtwohill	Imperceptible	Imperceptible
VP2	Local road north of site at Ballyadam	Substantial moderate	Moderate
VP3	Local road intersection at Carrigane	Moderate	Moderate slight
VP4	Local road and housing cluster near entrance to Water Rock Golf Course	Slight	Slight
VP5	Local Road at Lysaghtstown	Slight	Slight-imperceptible
VP6	N25 at entrance to IDA landholding	Slight	Slight-imperceptible
VP7	N25 south of site	Imperceptible	Imperceptible
VP8	N25 near entrance to residential housing cluster	Imperceptible	Imperceptible

As can be seen from the results contained in Table 9.6, the proposed mitigation measures, once established, are deemed to reduce the visual impact of the converter station at VP2, VP3, VP5 and VP6. The most critical of these is VP2, representing a local road and nearby residences to the north of the site, where the pre-mitigation impact is Substantial-moderate. In this instance, the combination of the dispersed colour scheme and perimeter screen planting serve to perceptually reduce the scale and massing of the main converter station building as well as reducing the clutter associated with lower external electrical components at the eastern end of the site. A similar scenario occurs in respect of VP3 which is more elevated but further away then VP2, but also to the north.

At VP5 and VP6 the reducing effects of mitigation are more subtle and only result in reductions from Slight to Slight-imperceptible significance, but this is consistent with design approach to mitigate insofar as possible even where potentially significant impacts are not predicted.

9.8 Transboundary Effects

There are not considered to be any transboundary effects in respect of the onshore ‘Landscape’ factor in this instance as all material effects occur within County Cork.

10 Archaeology and Cultural Heritage

10.1 Introduction

Rubicon Heritage Services Ltd has prepared this chapter of Volume 3C2 of the EIAR which details the archaeological, architectural and cultural heritage issues that need to be addressed in respect of the Irish onshore elements of the Celtic Interconnector Project (Appendix 10.1, Figure 10.1).

This study aims to assess the baseline archaeology and cultural heritage environment, to evaluate the likely significant impacts that the proposed development will have on this environment and to provide mitigation measures, in accordance with the policies of the Department of Housing, Local Government and Heritage (DHLGH) and Cork County Council, the National Monuments Acts 1930-2004 and best practise guidelines, to ameliorate these impacts.

10.2 Study area

The onshore study area has been defined in respect of two factors:

- The ability of sites / information sources to provide information pertaining to the archaeological potential of the proposed development site, and
- The potential physical impact, as well as impact on setting, that the proposed scheme may have on sites of cultural heritage significance.

Taking these factors into account the study area has been defined as follows:

Table 10.1: Dimensions of the study area

Subject	Study Area
National Monuments and Recorded archaeological monuments (RMPs)	Within 250 m of the proposed development
Protected Structures and / or their curtilage	Within 250 m of the proposed development
Architectural Conservation Areas (ACAS)	Within 250 m of the proposed development
Structures recorded in the NIAH	Within 250 m of the proposed development
Unregistered features of cultural heritage	Along any route option for the proposed development
Townland boundaries	Traversed by the proposed development
Areas of archaeological potential	Along any route option for the proposed development
Previous Excavations	Within any townland traversed by the proposed development (see Table 10.7)
Topographical files	Within any townland traversed by the proposed development (see Table 10.7)

10.3 Methodology

This section presents the methodology used in assessing the baseline cultural heritage environment. The scope and methodology for the baseline assessment has been devised in consideration of the following guidelines:

- EirGrid (2015) 'Cultural Heritage Guidelines for Electricity Transmission Projects. A stand approach to archaeological, architectural and cultural heritage impact assessment of high voltage transmission projects.'

- Department of Arts, Heritage, Gaeltacht and the Islands (DAHGI) (1999) 'Frameworks and Principles for the Protection of the Archaeological Heritage'
- Department of the Environment, Heritage and Local Government (2004) 'Architectural Heritage Guidelines'
- National Roads Authority (2005) 'Guidelines for the Assessment of Architectural Heritage Impacts of National Road Schemes'
- National Roads Authority (2005) 'Guidelines for the Assessment of Archaeological Heritage Impacts of National Road Schemes'

10.3.1 Desktop Study Methodology

This assessment of the archaeological, architectural and cultural heritage of the proposed development area is based on a desktop study of a number of documentary and cartographic sources. The desktop study was further augmented by an examination of aerial photography as well as a field survey. The main sources consulted in completing the desktop study are listed here.

- Sites and Monuments Record (SMR) and Record of Monuments and Places (RMP) for County Cork
- Various editions of the Ordnance Survey of Ireland maps
- Archaeological Inventory for County Cork – Volume 1 (Power *et al*. 1992)
- National Inventory of Architectural Heritage
- Excavation Bulletins Database (www.excavations.ie)
- Cork County Development Plan (2014)
- Various published sources for local history
- Ordnance Survey Namebooks and Letters
- Excavations Bulletin
- Aerial Photographs
- Cartographic Sources

10.3.2 Field Inspection Methodology

A field inspection of the proposed development site was undertaken by Rubicon Heritage Services Ltd on 6 June 2020, 8 October 2020, 13-14 October 2020 and 4 December 2020.

The primary purpose of a field inspection is to assess local topography in order to identify any potential low-visibility archaeological and/or historical sites that are not currently recorded and which may be impacted upon negatively by the proposed development. It is also the purpose of the field inspection to survey any known monuments or sites and to consider the relationship between them and the surrounding landscape, all of which need to be considered during the assessment process.

The methodology used during the field inspection involved recording the present land use as well as the existing topography for the entire area comprising the proposed development. A photographic record and written description were compiled for any known and / or potential sites of archaeological, architectural and / or cultural significance. In addition, a Global Positioning System (GPS) waypoint was taken for each identified site of said significance.

In addition to the walkover field inspection, archaeological monitoring was carried out of geo-technical investigations at the convertor station site at Ballyadam between 18 and 22 December 2020 and between 4 and 8 January 2021. All geotechnical test pits and soakaways were excavated under a watching brief.

The results from the field survey and archaeological monitoring of geotechnical investigations have been included within this EIAR as appropriate and also in the Site Description Section of this assessment.

10.3.3 Methodology used for assessing baseline value of sites

In order to categorise the baseline environment in a systemised manner, 'baseline values' have been assigned to each identified site of cultural heritage significance and / or potential within the study area. The baseline value of a site is determined with reference to the 'importance' and 'sensitivity' of the site.

In accordance with NRA Guidelines, the importance of a site is determined based on the following criteria: legal status, condition, historical associations, amenity value, ritual value, specimen value, group value and rarity. The sensitivity of a site is determined based on its susceptibility to physical impact, as well as susceptibility to impact on setting.

It should be noted that the National Monuments Act 1930-2004 does not differentiate between recorded archaeological sites on the basis of relative importance or sensitivity. In addition, the Planning and Development Act 2000 (as amended) does not differentiate between Protected Structures or Areas of Architectural Conservation on the basis of relative importance or sensitivity either. Consequently, professional judgement has been exercised to rate these features based on their perceived importance and sensitivity in relation to physical impacts and impacts on setting.

Taking the above factors into consideration, the criteria that have been defined are provided in Table 10.2 below.

Table 10.2 Baseline values of sites

Subject	Baseline Value
• Recorded Archaeological Monuments • Protected Structures • Architectural Conservation Areas (ACAs) • Shipwrecks known to be more than 100 years old or whose date is uncertain	Very High
• Sites listed in the NIAH that are not Protected Structures • Shipwrecks that are known to be less than 100 years old. • Unregistered built heritage sites that comprise extant remains which are in good condition and/or which are regarded as constituting significant cultural heritage features • Unrecorded features of archaeological potential	High
• Unregistered built heritage sites that comprise extant remains which are in poor condition • Unregistered cultural heritage sites (not including built heritage sites) that comprise extant remains • Townland boundaries that comprise extant remains • Marshy/wetland areas	Medium/High
• Unregistered cultural heritage sites for which there are no extant remains but where there is potential for associated subsurface evidence • Townland boundaries for which there are no extant remains	Medium/Low
• Unregistered cultural heritage sites for which there are no extant remains and where there is little or no potential for associated subsurface evidence	Low

Note: 'All other areas' collectively refers to the areas within the proposed development site that do not contain or comprise features of cultural heritage significance.

10.3.4 Types of impact

The following table lists the type of impacts that a proposed development may have on the cultural heritage resource:

Table 10.3 Types of Impact

Types of Impact	Definition
Direct	Direct impacts arise where an archaeological, architectural and/or cultural heritage feature or site is physically located within the footprint of the proposed development, or its associated physical impact zone, whereby the removal of part, or all of the feature or site is thus required.
Indirect	Indirect impacts arise when an archaeological, architectural or cultural heritage feature is not located within the footprint of the proposed development, or its associated physical impact zone, and thus is not impacted directly. Such an impact could include impact on setting or impact on the zone of archaeological potential of site whereby the actual site itself is not physically affected.
Cumulative	The addition of many impacts to create a large, significant impact.
Undeterminable	Whereby the full consequence that the proposed development may have on the cultural heritage resource is not known
Residual	The degree of environmental change that will occur after the proposed mitigation measures have taken effect.

10.3.5 Assessing physical impacts

The methodology used to assess the magnitude of potential pre-mitigation impacts, as well as residual impacts, of the proposed development on the baseline environment is presented in Table 10.4 below.

Table 10.4: Criteria used for rating magnitude of impacts

Impact Magnitude	Criteria
Severe	• Applies where mitigation would be unlikely to remove adverse effects. Reserved for adverse, negative effects only. These effects arise where an archaeology site is completely and irreversibly destroyed. • An impact that obliterates the architectural heritage of a structure or feature of national or international importance. These effects arise where an architectural structure or feature is completely and irreversibly destroyed by the proposed development. Mitigation is unlikely to remove adverse effects.
Major	• An impact which, by its magnitude, duration or intensity, alters an important aspect of the environment. An impact like this would be where part of a site would be permanently impacted upon, leading to a loss of character, integrity and data about an archaeological feature/site. • An impact that by its magnitude, duration or intensity alters the character and/or the setting of the architectural heritage. These effects arise where an aspect or aspects of the architectural heritage is/are permanently impacted upon leading to a loss of character and integrity in the architectural structure or feature. Appropriate mitigate is likely to reduce the impact • A beneficial or positive effect that permanently enhances or restores the character and/or setting of a feature of archaeological or cultural heritage significance in a clearly noticeable manner.
Moderate	• A medium impact arises where a change to a site/monument is proposed which though noticeable, is not such that the archaeological integrity of the site is compromised and which is reversible. This arises where an archaeological feature can be incorporated into a modern day development without damage and that all procedures used to facilitate this are reversible. • A medium impact to a site/monument may also arise when a site is fully or partly excavated under license and all recovered data is preserved by record. • An impact that results in a change to the architectural heritage which, although noticeable is not such that alters the integrity of the heritage. The change is likely to be consistent with existing and emerging trends. Impacts are probably reversible and may be of relatively short duration. Appropriate mitigation is very likely to reduce the impact. • A beneficial or positive effect that results in partial or temporary enhancement of the character and/or setting of a feature of archaeological or cultural heritage significance in a clearly noticeable manner.

Impact Magnitude	Criteria
Minor	• An impact which causes changes in the character of the environment, such as visual impact, which are not high or very high and do not directly impact or affect an archaeological feature or monument. • An impact that causes some minor change in the character of architectural heritage of local or regional importance without affecting its integrity or sensitivities. Although noticeable, the effects do not directly impact on the architectural structure or feature. Impacts are reversible and of relatively short duration. Appropriate mitigation will reduce the impact. • A beneficial or positive effect that causes some minor or temporary enhancement of the character of an architectural heritage significance which, although positive, is unlikely to be readily noticeable.
Negligible	• An impact on archaeological features or monument capable of measurement but without noticeable consequences. • An impact on architectural heritage of local importance that is capable of measure merit but without noticeable consequences. • A beneficial or positive effect on architectural heritage of local importance that is capable of measurement but without noticeable consequences.

10.3.6 Assessing impacts on setting

There is considerable debate over definitions of setting and approaches to the assessment of setting impacts, with no standardised industry-wide approach. The assessment methodology outlined below has been developed in house by Rubicon Heritage Services Ltd.

The definition of setting follows the guidance set by English Heritage as they have developed a range of comprehensive guidance on this subject specific to heritage assets (English Heritage 2005; 2008). Hence setting is not simply the visual envelope of the asset in question. Rather, it is those parts of the asset's surroundings that are relevant to the significance of the asset and the appreciation thereof.

In most instances setting will relate to the historical value of the asset, where an appreciable relationship between the asset and an element of its surroundings helps the visitor understand and appreciate the asset. This may be in terms of a physical relationship, such as between a castle and the natural rise that it occupies, or a more distant visual relationship, such as a designed vista or the view from, for example, one ringfort to another. The former is referred to as immediate setting and the latter as landscape setting. Many assets will only have an immediate setting. Some assets will have aesthetic value that relates to the surrounding landscape, such as in the case of a designed view incorporating a distant hill, or that relates to the contribution the asset makes to the local landscape, for example a church spire providing a focal point in a view down a valley.

English Heritage has provided a list of factors to be considered when assessing impacts upon setting. These are broad factors and have been taken into consideration when assessing magnitude of impact and sensitivity. They are summarised in Table 10.5.

Table 10.5 Factors to be considered when assessing impacts upon setting (after English Heritage 2005)

Factor	Discussion
Visual dominance	Where an historic feature (such as a hilltop monument or fortification, a church spire, or a plantation belonging to a designed landscape) is the most visually dominant feature in the surrounding landscape, adjacent construction of the proposed development may be inappropriate.
Scale	The extent of a proposed development and the number, density and disposition of its associated elements will also contribute to its visual impact.
Intervisibility	Certain archaeological or historic landscape features were intended to be seen from other historic sites. Construction of a proposed development should respect this intervisibility.

Factor	Discussion
Vistas and sight-lines	Designed landscapes invariably involve key vistas, prospects, panoramas and sight-lines, or the use of topography to add drama. Location of a proposed development within key views, which may often extend beyond any designated area, should be avoided.
Movement, sound or light impacts	The movement associated with a proposed development may be a significant issue in certain historic settings. Adequate distance should always be provided between important historic sites and proposed developments to avoid the site being overshadowed or affected by noise.
Unaltered settings	The setting of some historic sites may be little changed from the period when the site was first constructed, used or abandoned. Largely unaltered settings for certain types of sites, particularly more ancient sites, may be rare survivals and especially vulnerable to modern intrusions such as wind turbines. This may be a particular issue in certain upland areas.

The following are guides to the assessment of magnitude of impact on setting:

- *Obstruction of or distraction from key views*. Some assets have been sited or designed with specific views in mind, such as the view from a country house with designed vistas. The obstruction or cluttering of such views would reduce the extent to which the asset could be understood and appreciated by the visitor. Developments outside key views may distract from them and make them difficult to appreciate on account of their prominence and movement. In such instances the magnitude is likely to be greatest where views have a particular focus or a strong aesthetic character. Sympathetic development may improve key views by removing features that obstruct or distract from key views and hence preserve or enhance the importance of the asset.
- *Changes in prominence*. Some assets are deliberately placed in prominent locations in order to be prominent in the surrounding landscape, for example prehistoric cairns are often placed to be silhouetted against the sky and churches in some areas are deliberately placed on ridges in order to be highly visible. Developments can reduce such prominence and therefore reduce the extent to which such sites can be appreciated or the contribution that they make to the local landscape. Similarly, sympathetic development can enhance the setting of such sites by, for example, removing modern forestry that would otherwise compromise the setting of a cairn that had been placed on a skyline.
- *Changes in landscape character*. A particular landuse regime may be essential to the appreciation of an asset's function, for instance the fields surrounding an Improvement period farmstead are inextricably linked to its appreciation. Changes in land use can leave the asset isolated and reduce its value. In some instances, assets will have aesthetic value or a sense of place that is tied to the surrounding landscape character. Conversely, sympathetic development may restore or preserve the relevant landuse and hence preserve or enhance the relevant value of the asset.
- *Duration of impact*. Impacts that are long term or permanent are generally of greater magnitude than those that are short term.

Readily reversible impacts are generally of lesser magnitude than those that cannot be reversed. Impacts upon the defined setting will be of greater magnitude than those that affect unrelated elements of the asset's surroundings or incidental views to or from an asset that are unrelated to the appreciation of its value. The magnitude of impacts can be rated from Negligible to Major using a similar scale to that for physical impacts.

10.3.7 Methodology used for assessing significance level of impacts

The significance level of a construction or operation impact on a feature is assessed by combining the magnitude of the impact and baseline value of the feature. The matrix in Table 10.6 provides a guide to decision-making, but it is not a substitute for professional judgement and interpretation, particularly where the baseline value or impact magnitude levels are not clear or are borderline between categories. The permanence of the effects are also taken into account, with irreversible effects being more significant while temporary or reversible changes are likely to be less significant.

Table 10.6 Criteria for assessing significance level of impacts

Magnitude of Impact	Baseline Value				
	Very High	High	Medium / High	Medium / Low	Low
Severe	Very significant	Very significant	Significant	Moderate	Slight
Major	Significant	Significant	Moderate	Slight	Slight
Moderate	Moderate	Moderate	Slight	Slight	Negligible
Minor	Moderate	Slight	Slight	Negligible	Negligible
Negligible	Slight	Slight	Negligible	Negligible	Negligible

10.3.8 Limitations of this EIAR

All third-party reports, data and mapping are assumed to be correct for the purposes of this EIAR.

Due to the restrictions imposed by Covid-19 libraries and archival repositories were either closed or had limited access only for the duration of the research phase of this project. As a result, accessible digital and online resources have been relied upon rather than original publication, map or file records.

The Covid-19 restrictions also affected the delivery of field survey; not all sections of the route have been subject to a walkover survey. The affected sections are largely off-road sections in private ownership and primarily section DC08-DC09B to the south of Killeagh. However, there is available LiDAR coverage for the HVDC route from Claycastle Beach to Churchtown North (Ballyedekin), which was reviewed as part of this assessment. It included full coverage for section DC08-DC09B.

10.4 Receiving Environment

10.4.1 Topography, Route and Locational Detail

Table 10.7 Overview of the scheme landscape

Proposed Development	Descriptor (and Townland)	Receiving Environment
Connection Point	Knockraha Substation (Ballynanelagh)	• Greenfield to the east of the existing sub-station; under grass
HVAC Underground Cable Route (ca. 10km)	Between Knockraha Substation (Ballynanelagh) and Ballyadam (Ballyadam)	• Primarily on-road (existing local roads) with localised off-road sections: • Pigeonhill: agricultural greenfield • Woodstock / Poulaniska: agricultural greenfield (mainly grass)
Converter Station Site	Ballyadam (Ballyadam)	• IDA site; partially stripped of topsoil previously, currently rough scrubland
HVDC Underground Cable Route (ca. 30km)	Between Ballyadam (Ballyadam) and Transition Joint Bay (Summerfield)	• Primarily on-road (local roads and N25) with localised off-road sections: • Curragh / Ballyedmond: agricultural lands mainly under grass • Carrigogna: scrubland bordering agricultural fields • Killeagh / Roxbrough: agricultural lands mainly under grass • Ballyedekin: brownfield industrial / agricultural under cultivation

Proposed Development	Descriptor (and Townland)	Receiving Environment
		• Kilamucky / Grange / Lismalaghlin: agricultural mix of grassland and cultivation • Lisglasheen / Moanlahan / Lagile: agricultural mix of grassland and cultivation
Landfall Area	Transition Joint Bay (Summerfield) to Claycastle Beach (Summerfield)	• Foreshore

10.4.2 Archaeological and historical context

10.4.2.1 Prehistoric period

There is abundant evidence for prehistoric settlement in County Cork, and this is evident in the study area. Though few can confidently be dated to early prehistory—Mesolithic to Neolithic—there is clear evidence for settlement from at least the early Bronze Age along the scheme route.

The National Museum files record discovery of an early Bronze Age food vessel in the townland of Ballindinis (NMI Ref: P1948:135) and antiquarian finds of Bronze Age burials are associated with five RMPs in the same townland—a burial site (CO077-077----) and barrow (CO077-008001-; CO077-009001-; CO077-010----; CO077-012001-). This could be indicative of barrow cemetery.

A Bronze Age settlement site was excavated at Ballyvergan West (Licence No 01E0549) that included evidence for a circular structure. The radiocarbon dating results place activity at this site in the mid- to late 2nd millennium BC. A series of excavations associated with the Curraleigh West to Midleton gas pipeline identified a concentration of Middle to Late Bronze Age settlement activity to the east and south of Midleton and north-east of Cork Harbour (Cleary 2015, 49).

Burnt mounds or fulachtaí fia have been identified in the townlands of Tibbotstown (CO064-091----), Longstown (CO064-100----), Garranes (CO064-101----), Gortacrue (CO065-077----), Whiterock (CO076-136----) and Lissacrue (CO077-014----). Archaeological excavations at Ballyadam (CO076-120----; CO076-123----; Licence No 06E0612) identified a number of examples that were radiocarbon dates to the Bronze Age. Fulachtaí fia survive as low mounds, usually horse-shoe shaped, of charcoal-enriched soil packed with fragments of heat-shattered stones (termed 'burnt mound'); when levelled, they are often noticeable as black spreads in ploughed fields. They were usually situated close to a water source, like a stream, or in wet marshy areas. It is generally accepted that they were probably used as cooking places (Ó Drisceóil 1988). Water was boiled in a regular pit (lined with wooden planks or stone slabs to form a trough) by the addition of hot stones from a fire close by. O'Kelly (1954, 105–55) showed by experiment that the large quantities of water can be boiled in this way in about twenty minutes. He also demonstrated that meat, wrapped in straw and immersed in the boiling water, cooked at a rate of twenty minutes per pound weight. When the cooking was over the remnants of heat-shattered stones in the trough were discarded to one side. Eventually, after many episodes of use, these would form a mound curving round three sides of the trough, hence the horse-shape mound (Power et al. 1997, 75). It is not certain whether fulachtaí fia were elements temporary hunting camps or of permanent settlements. The majority of radiocarbon dates place these monuments in the Bronze Age (Brindley and Lanting 1990, 55–6). They are the most numerous prehistoric sites in Ireland, with over 4,500 known examples, some 2,000 of these in County Cork (Power 1990, 13–17).

A review of the use of the term 'fulacht' in early Irish literature and of references to 'activities that may have taken place at such sites', suggest associations with 'the cooking and eating of food, washing and bathing, music and sex' (Ó Drisceóil 1990, 157– 64). The word 'fulacht' means a pit used for cooking. The second element can be interpreted as either 'fiadh' meaning 'of the deer' or 'of the wild' or 'fian' meaning 'of a roving band of hunters or warriors' or 'of Fianna or Fionn Mac Cumhail' (Ó Drisceóil 1988, 671–80).

The investigations at Ballyadam also uncovered a number of features that were radiocarbon dated to the Later Iron Age.

10.4.2.2 Medieval period (AD 400–1540)

The early medieval documentary sources indicate a complex secular social system based on clientship during this period. Landowning commoners such as ócaire and bóaire were obligated to wealthy landowners (mruigfer), lords (flaith) and the king of a region with commoners (betaghs) bonded freemen (fuidirs) and slaves (cumal) lower down the scale but still required to pay tributes. The social system was dependant on clientelism with rents and what amounted to taxes being paid with labour, food and other commodities to the upper echelons and also to the church (Kelly 2000, 447). By the twelfth century the distinction between ócaire and bóaire diminished suggesting a change in the social order (Kelly 2000, 428). The betagh class came to refer to a servile tenant (Kelly 2000, 428). Many of these wealthy landowners and landowning commoners inhabited ringforts

Ringforts are undoubtedly the most widespread and characteristic archaeological field monument in the Irish countryside. There are two known ringfort sites within the constraints study area—in Garranes (CO064-104----) and Lissacrue (CO077-074----)—and it is likely that some or all of the five enclosure sites—at Longstown (CO064-097----; CO064-099----), Ballymakeagh More (CO066-042001-; CO066-042002-) and Lisglasheen (CO066-083----) also date to this period. They are usually known by the names ráth or lios, forming some of the most common placename elements in the countryside. The ringfort is basically a circular or roughly circular area enclosed by an earthen bank formed of material thrown up from concentric fosse (ditch) on its outside. Generally, the diameter of the enclosure is between 25 m and 50 m. A single bank and fosse (univallate) is the most usual form; double rings (bivallate) or triple rings (trivallate) are rarer. The number of rings of defence are thought to reflect on the status of the site, rather than the strengthening of its defences. These sites have endured centuries of erosion, reuse and sometimes deliberate destruction and it is not always possible to distinguish original features; the overgrown nature of many sites compound the problem of field recording. However, entrances may be detected where a clear break in the bank is in line with an uncut causeway over the fosse (Power 1992, 131).

Archaeological excavation has shown that the majority of ringforts were enclosed farmsteads, built in the early medieval period. Though not forts in the military sense, the earthworks acted as a defence against natural predators like wolves, as well as human predators. Local warfare and cattle raiding were commonplace at this time. The construction of so many throughout the country, in a relatively short period (400–500 years), reflects on the stability and wealth of society at the time, and also its homogeneity. As well as farming-related activities like corn-grinding and animal husbandry, the ringfort was home to a wide variety of craft industries, including spinning, weaving, metal- and glass-working. Dwellings and outhouses were built on timber posts, with walls of wattle, mud or sods, which usually leave no trace above ground today. Excavation can trace the remains of these structures by revealing features like post-holes, stake-holes and sunken hearths (Power 1992, 131).

10.4.2.3 Medieval Killeagh (after Hanley 2016)

The origins of Killeagh appear to relate to the foundation of an ecclesiastical nunnery named Cill Ia (hence Killeagh), reportedly by St. Abbán, in the sixth century (Gwynn and Hadcock 1988, 391)—St. Abbán is believed to have died c. AD 650. Other accounts (Power et al. 1994, 266) suggest the founder was Id or Liber, a disciple of St. Finbarr. Recent archaeological investigations within the streetscape of the town have uncovered remains of part of the circuit of the enclosure of this ecclesiastical site as well as part of the associated cemetery (Hourihan and Gooney 2020).

In 1172, following the Norman invasion, lands around Killeagh were granted by Robert FitzStephen to a Philip De Cappell and the manor of Killeagh was duly formed. Killeagh (Cellia) is named in 1199 (Pont. Hib. I, 109), within the barony of Imokilly, which is referenced in the Annals of Inishfallen as early as 1177 (McAirt 1951). The lands of Killeagh remained in the hands of the de la Chapelle (or Supple) family into the post-medieval period. Medieval documentation records notes that a weekly market and annual fair was held at Killeagh suggesting that it was a vibrant manorial village. However, no physical remains of this settlement are known to survive other than the site of the medieval church in the south of the present village settlement.

10.4.2.4 Medieval Castlemartyr (Baile na Martra)

Analysis of the surviving stone church of Ballyoughtera (CO077-006002-) located to the southwest of the present village at the south end of the surviving estate lands of Castlemartyr suggests that the earliest portion of the building reflects a pre-Norman, Romanesque design (Manning 2013). This would imply a church first constructed in the late 12th century. This might indicate that the site was originally an early medieval foundation. Surviving records note the grant of the rectory of Baile na Martra to St Thomas's Abbey, Dublin in 1180 (Manning 2013) and this early grant date might also indicate a pre-existing rather than newly established foundation. Regardless it would appear that this church was the focus for the medieval manor of Baile na Martra (now Castlemartyr). By the late 14th century much of lands of the barony of Imokilly, including Castlemartyr had been acquired by Maurice fitz Richard, knight of Kerry (MacCotter 2016, 191). These lands remained with the Fitzgeralds with the local cadet branch of the family holding the title of Seneschals of Imokilly on behalf of the Geraldine Earls of Desmond and Castlemartyr became their main seat. It is likely that the tower house (CO077-005003-) and bawn (CO077-005005-) at Castlemartyr were constructed by them. The Fitzgeralds forfeited their lands as a result of their involvement in the Desmond Rebellion. Castlemartyr was subsequently included in an Elizabethan grant to Sir Walter Raleigh.

10.4.2.5 Post-medieval period (1540–1900)

By the 17th century the main village settlements in east Cork were Killeagh, Carrigtwohill, Castlemartyr and Cloyne, with the growth of Castlemartyr and Midleton gradually edging out Cloyne as it moved into the 19th century (Lee 2014, 74). Both Midleton and Castlemartyr were newly established centres in the 17th century. Castlemartyr was formally incorporated in 1663 centred on the newly designed village settlement (Lee 2014, 73). The lands of Castlemartyr had been bought by Richard Boyle, first Earl of Cork at the start of the 17th century and remained in the control of the Boyle family (subsequently Earls of Shannon) into the 19th century. Richard Boyle probably built the 17th century manor house (CO077-0050025-) to supplant the earlier Geraldine tower house. This was in turn replaced in the early 18th century when Henry Boyle constructed the twenty-five-bay, two-storey Castlemartyr House located west of it (RMP CO077-005001-; NIAH 20825002). Lewis' Topographical Dictionary of Ireland (1837) lists Castlemartyr village as having 129 houses and describes it as having 'a very cheerful appearance'.

Despite the upheavals of the 17th century, the Supple family retained control of the lands of Killeagh. The Taylor and Skinner map of (1778) suggests that urban development within Killeagh was confined to the area north of the Cork Road, continuing across the bridge as far as the turn off with the old Youghal road (at the junction with the road leading to Aghadoe, the seat of the Supple family). Around 1790 the Old Thatch pub, a landmark building at the northern end of the town, was built. At the beginning of the 19th century (c. 1811) the current Church of Ireland church at Killeagh was built at the southern end of the settlement. Sometime between

1811 and 1840 the new main road was built from Killeagh (turning right over Killeagh bridge, itself rebuilt in 1838) to Youghal; the Roman Catholic Church of Saint John and Saint Virgilius was built c. 1830. Lewis' Topographical Dictionary of Ireland (1837) lists Killeagh village as having 112 houses and describes it as being 'nearly built', suggesting an expanding urban population at that time.

10.4.2.6 War of Independence (1919–1921) (after Shiels 2014)

The area around the village of Knockraha became deeply involved in supporting Irish forces during the War of Independence, a subject which has been the focus of local history groups and academics. Knockraha was never the scene of major engagements with Crown forces during the War of Independence. Its position as a 'quiet' area was far from accidental. Rather it was part of an intentional strategy by the I.R.A. of Cork No. 1 Brigade to avoid suspicion falling on the locality, allowing it to be utilised as a logistical base for the Brigade (Borgonovo 2010, 214).

There is ample documentary evidence to suggest Knockraha's key importance for I.R.A. operations in Cork City and East Cork. Apart from the Ballynanelagh bomb factory it was also the location of a Brigade bomb factory. This was operated by Seamus Fitzgerald (WS 1737 of Seamus Fitzgerald).

The establishment of this Brigade bomb factory in Knockraha had elicited significant effort on behalf of the 4th Battalion in order to get it up and running (WS 1424 of Michael J. Burke). Similarly Edward Moloney, the 'Governor' of Sing Sing and member of the Knockraha Company recalled the efforts he made to support the Brigade bomb factory. A blacksmith with a forge in the village, his facilities were of use. He recalled how he 'worked with the Brigade below in the forge about half a mile, and I gave them the forge while they were making a chimney. And when they had it made they took it away to the fields.' He also stated that the very first bomb was in fact made in his forge: 'I was there [at the forge] the first night a bomb was made, with Mick Leahy [Vice - Commandant of Cork No. 1 Brigade], and I got a piece of it and be got a piece of it' (Edward Moloney Pension Application).

The importance the bomb factories held is evidenced in correspondence relating to the military pensions board in 1935. When a number of those who had served in the Ballynanelagh bomb factory and the Brigade bomb factory sought pensions (Denis Lynch, John Long, Patrick Fitzgerald, James Murphy, Martin Fitzgerald, William Sheehan and Michael Burke) a request was sent to Tom Crofts requesting that he 'submit a detailed statement regarding the Grenade Factories which are stated to have been established in the 4th Battn. Area, Cork I Brigade, during the Black and Tan period, indicating - (a) the names (and addresses if possible) of those who were engaged whole time therein; (b) the nature of the work on which each was engaged. ' (MA/MSPC/RO/31)

Knockraha's importance to the I.R.A. effort extended well beyond its utilisation as a location for bomb production. It also seems to have performed functions as a Battalion depot area. Joseph Aherne, Captain of 'B' (Midleton) Company of the 4th Battalion, Cork No. 1 Brigade, recalled how after an ambush 'we handed over the captured arms to Lt. Fitzgerald, Ballinbrittas, Knockraha Company, and returned to Midleton…' (WS 1367 of Joseph Aherne). The 4th Battalion Officer Commanding, Diarmuid Hurley, was also regularly to be found in Knockraha. Michael Burke recalled how he 'walked to Knockraha, eight miles to the east, where I contacted Diarmuid Hurley, O/C of the 4th Battalion, and told him of the success of my mission' (WS 1424 of Michael J. Burke) while Joseph Aherne related receiving 'a message from Hurley [the O.C.] stating that he wanted to see me and that he was staying at Lt. Fitzgerald's house at Ballinbrittas near Knockraha' (WS 1367 of Joseph Aherne).

When a decision was made to form a 4th Battalion Flying Column, Knockraha was once again the location selected (WS 1449 of Patrick J. Whelan). Joseph Aherne, Captain of the Midleton

Company confirmed that the Flying Column's 'first camp was situated in Knockraha in a disused farmhouse. We remained there for a few weeks and then moved on to Shanagarry' (WS 1367 of Joseph Aherne).

The decision to form the Column in Knockraha and to carry out its initial training there is of extreme significance, as it highlights just what a central role Knockraha played in the development of the guerrilla war in East Cork. It functioned not only as a supply and production centre, but also as a training location and perhaps most importantly a 'safe' area.

The fact that Knockraha was being kept intentionally quiet meant that it was ideal as a safe area and point of retreat. Patrick Whelan, 4th Battalion Vice - Commandant, particularly noted the value of the Fitzgerald farmhouse in Ballinbrittig and Canavan's pub in Knockraha village, noting that they were locals who provided food and board to the Flying Column (WS 1449 of Patrick J. Whelan). After one incident where it became necessary to abandon an ambush, Francis Healy of 'D' Company, 4th Battalion, Cork No. 1 Brigade, issued orders to 'abandon the place [the ambush site] immediately, dump all arms and equipment and retreat towards Knockraha' (WS 1694 of Francis Healy).

Perhaps the most telling evidence of Knockraha's role in this regard were the actions of the Column in the immediate aftermath of the Clonmult Ambush, the disastrous reverse which left 12 volunteers dead in what was the worst loss of life sustained by the I.R.A. in a single event during the War of Independence. Only one man—Jack O' Connell—had escaped Clonmult (WS 1449 of Patrick J. Whelan). It seems probable that there were standing orders to retreat to Knockraha, as men began making their way there as soon as they learned of what had occurred at Clonmult: Seamus Fitzgerald: '…we drove in a trap to our base in Knockraha' (WS 1737 of Seamus Fitzgerald); John P. O'Connell: 'Following the collapse of the blazing roof of the house in which the Column was trapped [in Clonmult], and as the messengers I had sent for help had not returned, I made my way to Knockraha, a few miles distance' (WS 1444 of John P. O'Connell); Joseph Aherne: 'Getting into the car, which was closeby, we proceeded to Knockraha, arriving in the village we met some of the volunteers of the local company, including Martin Corry and Capt. Jack O'Connell' (WS 1367 of Joseph Aherne).

Perhaps Knockraha's most famous connection with the War of Independence was its use as the prison of Cork No. 1 Brigade and as a place where suspected spies, informers and British military were executed (Borgonovo 2010, 213). That the prison was run by the Brigade as opposed to Martin Corry and the local company is confirmed in the pension file of the Governor of Sing-Sing, Edward Moloney, who stated that he would not give the key to Corry even if he wanted it (Edward Moloney Pension Application). The fact that Knockraha was used as place of imprisonment and execution is apparent in a number of Witness Statements (WS 1479 of Sean Healy; WS 1675 of Jos. O'Shea; WS 1643 of Sean Healy).

The burial of those killed at the prison has garnered much attention in recent years, particularly with the publication of the The Year of Disappearances: Political Killings in Cork, 1920-1921 by Gerard Murphy in 2010 and The Graves of the Disappeared television series broadcast by TV3 in 2012, both of which reference the burial of individuals in Knockraha. There is no doubt that such burials did occur, most notably in a boggy area of upland known locally as 'The Rea.'

10.4.2.7 Toponomy of Townlands

The Irish landscape is divided into approximately 60,000 townlands and the system of landholding is unique in Western Europe for its scale and antiquity. Research into the names (toponomy) of these land units frequently provides information relating to the townland's archaeology, history, folklore, ownership, topography or landuse. Most placenames (including townland names) were anglicised by the time the Ordnance Survey began in the 1830s. However, despite some inaccuracies in translation, the Gaelic, Viking, Anglo-Norman and

English origins of place names are generally recognisable. A study of the townland names can provide information on aspects of cultural heritage including descriptions of the use of the landscape by man and the potential presence of archaeological or cultural heritage sites or features.

The proposed development extends through 56 townlands.

Table 10.8 Townlands traversed by the scheme

English Name	Irish Name	Glossary
Ballindinis	*Baile an Doimhnis*	baile townland, town, homestead doimhnis possible corruption of *dubh inis* meaning black island or holm
Ballyadam	*Baile Adaim*	baile townland, town, homestead
Ballycarnane	*Baile Uí Chuirneáin*	baile townland, town, homestead
Ballyedekin	*Baile Eidicín*	baile townland, town, homestead
Ballyedmond	*Baile Éamainn*	baile townland, town, homestead
Ballymakeagh More	*Baile Mhic Ia Mór*	baile townland, town, homestead mór great, big
Ballynakilla	*Baile na Coille*	baile townland, town, homestead coill (also: coillidh, coillte, coille) wood
Ballynanelagh	*Baile na nGeimhleach*	baile townland, town, homestead
Ballyrichard Beg	*Baile Risteaird Beag*	baile townland, town, homestead beag (also: big) small
Ballyrichard More	*Baile Risteaird Mór*	baile townland, town, homestead mór great, big
Ballyspillane East	*Baile Uí Spealáin Thoir*	baile townland, town, homestead
Ballyspillane West	*Baile Uí Spealáin Thiar*	baile townland, town, homestead
Ballyvergan East	*Baile Uí Mheirgín Thoir*	baile townland, town, homestead
Ballyvergan West	*Baile Uí Mheirgín Thiar*	baile townland, town, homestead
Ballyvorisheen	*Baile Mhuirisín*	baile townland, town, homestead
Burges Lower	*An Bhuirgéis Íochtarach*	burgeis burrough or burgage
Caherultan	*Cathair Ultáin*	cathair stone-built fort or enclosure
Carrigane	*An Carragán*	
Carrigogna	*Carraig Ó gCionaoith*	carraig rock
Castlemartyr	*Baile na Martra*	baile townland, town, homestead martra martyrdom or relics (of saint/martyr)
Churchtown	*Baile an Teampaill Theas*	baile townland, town, homestead teampall church
Clasharinka	*Clais an Rince*	clais trench, ravine
Clashduff	*An Chlais Dubh*	clais trench, ravine dubh (also: dú-, duí-)black
Coolaha	*Cúil Áithe*	cúil corner, nook
Curragh	*An Currach*	currach marsh
Curragrine	*Cora Dhraighin*	cora (also: coraidh, corann) weir, stone-fence, ford

English Name	Irish Name	Glossary
Dooneen	*An Dúinín*	dún (also: dúnaibh) fort
Dysart	*An Díseart*	díseart hermitage
Garranes	*Na Garráin*	garrán grove
Gortacrue	*Gort an Chrú*	gort (also: gart) field
Gortaroo	*Gort an Rú*	gort (also: gart) field
Grange	*An Ghráinsigh*	gráinseach (also: gráinsigh) grange, monastic farm
Inchiquin	*Inse Uí Chuinn*	inis (also: inse) island; river meadow
Kennel	*An Conchró*	
Killamucky	*Coill an Mhuicí*	coill (also: coillidh, coillte, coille) wood
Killeagh	*An Choill Liath*	coill (also: coillidh, coillte, coille) wood liath (also: léith) grey, grey place, grey horse
Killeagh Gardens	*Gairdíní Chill Ia*	cill church
Killeena	*An Choillíneach*	
Knockane	*Cnocán Mhic Thíre*	cnocán hillock
Knockmonalea West	*Cnoc an Mhuine Léith Thiar*	cnoc hill liath (also: léith) grey, grey place, grey horse muine thicket
Knocknaskagh	*Cnoc na Sceach*	cnoc hill sceach (also: sceich) hawthorn, thorn-bush
Lagile	*An Leathchoill*	leath (also: leith) half, side
Lisglasheen	*Lios Glaisín*	lios ring-fort, enclosure
Lismalaghlin	*Lios Maoileachlainn*	lios ring-fort, enclosure
Lissacrue	*Lios an Chreamha*	lios ring-fort, enclosure creamh wild garlic
Longstown	*Baile an Longaigh*	baile townland, town, homestead
Loughaderry	*Loch an Doire*	doire (oak-)wood, grove, thicket loch lake; inlet
Moanlahan	*An Mhóin Leathan*	móin (also: mónaidh) bogland leathan broad, wide
Mountbell	*Cnoc an Loiscreáin*	cnoc hill
Pigeonhill	*Cnocán an Cholúir*	cnocán hillock
Poulaniska	*Poll an Uisce*	poll hole, pool, (tidal-)stream? uisce water
Roxborough	*Roxborough*	
Stumphill	*Cnoc na Smután*	cnoc hill
Summerfield	*Gort an tSamhraidh*	gort (also: gart) field
Water-Rock	*Carraig an Uisce*	carraig rock uisce water
Woodstock	*Bun an Stó*	bun (river-)mouth, bottom(-land)

10.4.2.8 Recent Excavations

The Excavations Bulletin is an annual account of all excavations carried out under license. The database is available online at www.excavations.ie and includes excavations from 1985 to 2019. This database was consulted as part of the desktop research for this report to establish if any archaeological investigations had been carried out within the townlands traversed by the scheme route. The database produced 20 examples of archaeological excavations undertaken within the townlands incorporated by the study area (see also Appendix 10.3).

The most directly relevant investigations are those at Ballyadam (which incorporates the site for the Convertor Station) and at Claycastle Beach (the Landfall site). Archaeological monitoring within the IDA site at Ballyadam in 2006 (Licence No 06E0612) uncovered a series of sites, primarily burnt mounds but also some occupation sites that have been radiocarbon dated to the Bronze Age and Iron Age. Archaeological monitoring of geotechnical investigations at Claycastle Beach (Licence Nos 18E0322; 18R0118; 19E0278) indicates that a submerged landscape potentially dating to the Holcene survives beneath the beach. Though no archaeological features or deposits were identified during the investigations to date, there is a potential that such could survive given the characteristics of the palaeo-landscape (Coughlin 2018; Cotswold Archaeology 2019).

Archaeological monitoring and excavation associated with road repaving and resurfacing works through the village of Killeagh (Licence No 16E0346) uncovered extensive remains associated with the early medieval church, including the ecclesiastical cemetery and a series of enclosure ditches. As the investigations were carried out on a minimum-impact basis (i.e. to base of formation for the remedial works only) it is likely that further archaeological material remains in situ underlying the village streetscape.

In addition to archaeological investigations within the Castlemartyr estate (Licence Nos 05E1309; 17E0499), a series of archaeological investigations have been carried out along the northern and western fringes of the village (Licence Nos 01E1057; 03E0449; 03E0644; 04E1401; 09E0014). Some of these investigations revealed evidence for prehistoric settlement activity characterised by burnt mounds and roasting pits at a number of locations.

Investigations associated with the Bord Gais Eireann Curraleigh West to Midleton gas pipeline identified a number of archaeological sites in the townlands of Roxborough, Killeagh and Bloomfield East (Licence Nos 09E0059; 09E0266; 09E0264; 09E0265). These uncovered a mix of prehistoric settlement activity including a burnt mound, pit scatters and a hearth.

10.4.3 Designated archaeological sites

10.4.3.1 Record of Monuments and Places (RMPs)

Section 12 (1) of the National Monuments Act 1994 made provision for the establishment and maintenance of a Record of Monuments and Places (RMP). Under this Act, each site recorded in the Record of Monuments and Places is granted statutory protection. When the owner or occupier of a property, or any other person proposes to carry out, or to cause, or to permit the carrying out of any work at or in relation to a recorded archaeological monument they are required to give notice in writing to the Minister for Housing, Local Government and Heritage 2 months before commencing that work.

There are 66 recorded archaeological monuments incorporated by the study area (Appendix 10.1–10.2; Figure 10.2).

Table 10.9 Overview of RMP sites within the study area

Site Summary	Quantity	CH No by Townland
Barracks	1	Killeagh Gardens CH020
Barrow - mound barrow	5	Ballindinis (Imokilly By., Mogeely Par.) CH048 Ballyvorisheen (Imokilly By.) CH042; CH044; CH046 Clasharinka CH047
Bawn	1	Castlemartyr (Imokilly By., Ballyoughtera Par.) CH041
Bridge	2	Ballyedmond CH012 Castlemartyr (Imokilly By., Mogeely Par.) CH057
Burial	1	Knockane (Imokilly By.) CH061
Burnt mound or Fulacht Fia	11	Ballyadam (Barrymore By.) CH030; CH031; CH032; CH033 Garranes (Barrymore By.) CH006 Gortacrue CH009 Lagile CH021 Lissacrue CH050 Longstown CH005 Tibbotstown CH002 Whiterock CH034
Castle - tower house	2	Castlemartyr (Imokilly By., Ballyoughtera Par.) CH039; CH040
Cave	1	Knockane (Imokilly By.) CH062
Church	5	Ballyspillane West CH011 Castlemartyr (Imokilly By., Ballyoughtera Par.) CH037 Castlemartyr (Imokilly By., Mogeely Par.) CH056 Churchtown (Barrymore By.) CH027 Killeagh Gardens CH016
Cist	2	Ballyvorisheen (Imokilly By.) CH043; CH045
Country house	3	Ballyedekin CH051 Roxborough CH025
Earthwork	1	Gortaroo CH024
Ecclesiastical site	1	Killeagh Gardens CH015
Enclosure	5	Ballymakeagh More CH017; CH018 Lisglasheen CH022 Longstown CH003; CH004
Excavation - Miscellaneous	2	Ballyadam (Barrymore By.) CH029 Gortnahomna Beg CH063; CH065
Graveyard	5	Ballyspillane West CH010 Broomfield West CH013 Castlemartyr (Imokilly By., Ballyoughtera Par.) CH036 Churchtown (Barrymore By.) CH026 Killeagh Gardens CH014
Historic town	1	Castlemartyr (Imokilly By., Mogeely Par.) CH058
House	1	Castlemartyr (Imokilly By., Ballyoughtera Par.) CH038; CH054
Icehouse	2	Castlemartyr (Imokilly By., Ballyoughtera Par.) CH052 Dysart CH023
Kiln - corn-drying	1	Gortnahomna Beg CH064
Market-house	1	Castlemartyr (Imokilly By., Mogeely Par.) CH055
Milestone	1	Killamucky CH053
Mill - corn	1	Aghadoe CH019

Site Summary	Quantity	CH No by Townland
Mound	1	Ballyedekin CH035
Redundant record	1	
Ringfort - rath	3	Garranes (Barrymore By.) CH007 Killeena CH001 Lissacrue CH060
Souterrain	1	Ballindinis (Imokilly By., Mogeely Par.) CH049
Standing stone	1	Garranes (Barrymore By.) CH008
Thatched House	1	Lagile CH068

10.4.3.2 National Monuments

National monuments are broken into two categories; National Monuments in the ownership or guardianship of the state and National Monuments in the ownership or guardianship of a local authority. Section 8 of the National Monuments (Amendment) Act 1954 provides for the publication of a list of monuments, the preservation, of which, are considered to be of national importance. Two months notice must be given to the Minister for Housing, Local Government and Heritage where work is proposed to be carried out at, or in relation to, any National Monument.

There are no National Monuments incorporated by the study area.

10.4.3.3 Sites with Preservation Orders

The National Monuments Act 1930-2004 provide for the making of Preservation Orders and Temporary Preservation Orders in respect of National Monuments. Under Section 8 of the National Monument Act 1930 (as amended) the Minister for Housing, Local Government and Heritage, can place a Preservation Order on a monument if, in the Ministers' opinion, it is a National Monument in danger of being or is actually being destroyed, injured or removed or is falling into decay through neglect. The Preservation Order ensures that the monument will be safeguarded from destruction, alteration, injury, or removal, by any person or persons without the written consent of the Minister.

There are no sites with preservation orders incorporated by the study area.

10.4.4 Designated architectural heritage sites

10.4.4.1 Protected Structures

The Cork County Development Plan (2014) was consulted for schedules of Protected Structures. These are buildings that a planning authority considers to be of special interest from an architectural, historical, archaeological, artistic, cultural, scientific, social, and/or technical point of view. Protected Structures receive statutory protection from injury or demolition under Section 57 (1) of the Planning and Development Act 2000 (as amended). Protected structure status does not exclude development or alteration but requires the developer to consult with the relevant planning authority to ensure that elements which make the structure significant are not lost during development.

There are eight Protected Structures incorporated by the study area (Appendix 10.1–10.2; Figure 10.2).

Table 10.10 Protected Structures within the Study Area

CH No	Summary	Townland
CH019	Mill - corn	Aghadoe
CH038	House - 16th/17th century	Castlemartyr (Imokilly By., Ballyoughtera Par.)
CH040	Castle - tower house	Castlemartyr (Imokilly By., Ballyoughtera Par.)
CH051	Country house	Ballyedekin
CH056	Church	Castlemartyr (Imokilly By., Mogeely Par.)
CH066	St. John and St. Virgilius Catholic Church	Killeagh Gardens
CH067	Castlemartyr School	Grange
CH068	Thatched House	Lagile

10.4.4.2 Architectural Conservation Areas

The Cork County Development Plan (2014) was consulted for records relating to Architectural Conservation Areas (hereinafter ‘ACAs’). The stated objective of ACAs is to conserve and enhance the special character of the area, including traditional building stock and material finishes, spaces, streetscapes, landscape and setting.

There are two areas listed as ACAs incorporated by the study area—the Castlemartyr ACA and the Killeagh ACA (Appendix 10.1–10.2; Figure 10.2).

10.4.4.3 National Inventory of Architectural Heritage (NIAH)

The National Inventory of Architectural Heritage (hereinafter the 'NIAH') is a state initiative under the administration of the DHLGH and was established on a statutory basis under the provisions of the Architectural Heritage (National Inventory) and Historic Monuments (Miscellaneous Provisions) Act 1999. Its purpose is to identify, record and evaluate the post-1700 architectural heritage of Ireland, uniformly and consistently, as an aid in the protection and conservation of the built heritage. NIAH surveys provide the basis for the recommendations of the Minister for Housing, Local Government and Heritage to the planning authorities for the inclusion of particular structures in their Record of Protected Structures (RPS).

There are 54 structures listed in the NIAH incorporated by the study area (Appendix 10.1–10.2; Figure 10.2).

Table 10.11 Overview of NIAH-listed sites within the Study Area

Site Summary	Quantity	CH No by Townland
bakery	1	Castlemartyr CH085
barracks	3	Castlemartyr CH073; CH074 Killeagh Gardens CH020
bridge	7	Ballyedmond CH104; CH105; CH106 Ballyedmond, Carrigogna, Curragh CH103 Carrigtwohill CH111 Castlemartyr (Imokilly By., Mogeely Par.) CH057 Killeagh Gardens CH092
Castlemartyr School	1	Grange CH067
Church	1	Castlemartyr (Imokilly By., Mogeely Par.) CH056
church/chapel	1	Castlemartyr CH088
demesne walls/gates/railings	1	Castlemartyr CH071
gate lodge	1	Castlemartyr CH115
house	23	Aghadoe CH089

Site Summary	Quantity	CH No by Townland
		Ballyspillane West CH109 Burges Lower CH110 Carrigogna CH107 Castlemartyr CH054; CH075; CH076; CH077; CH078; CH079; CH080; CH081; CH082; CH086; CH087 Gortnahomna More CH083 Inchanapisha CH090 Killeagh Gardens CH093; CH094; CH095; CH096; CH097 Lisglasheen CH098
Market-house	1	Castlemartyr (Imokilly By., Mogeely Par.) CH055
Mill - corn	1	Aghadoe CH019
outbuilding	2	Castlemartyr CH072; CH116
presbytery/parochial/curate's house	2	Carrigtwohill CH114 Killeagh Gardens CH091
railway station	2	Carrigtwohill CH112 Lisglasheen CH100
signal box	1	Lisglasheen CH102
St. John and St. Virgilius Catholic Church	1	Killeagh Gardens CH066
station master's house	2	Carrigtwohill CH113 Lisglasheen CH099
store/warehouse	1	Lisglasheen CH101
water pump	1	Grange CH084
worker's house	1	Carrigogna CH108

10.4.5 Undesignated cultural heritage sites

This section deals with sites that are considered to be of cultural heritage value but which do not fall within the above categories as they are not registered. Such sites may include lime kilns, dwellings / outhouses, trackways or townland boundaries etc. identifiable on the 1st edition 6-inch/25-inch OS maps. Aerial photography from the 1995, 2000, and 2005 fly-overs was inspected, as well as the latest OSI images, Google Earth and Bing Maps satellite imagery. In addition, publicly available LiDAR data published by TII and OPW was also consulted.

10.4.5.1 Undesignated cultural heritage sites that comprise extant remains

Undesignated cultural heritage sites which comprise extant remains are typically, though not always, post-1700 in date. The majority of these sites are represented on the 6” and/or 25” Ordnance Survey maps. Many constitute country houses and associated lodges, while others may be bridges or industrial features, hollow-ways, mass rocks etc.

There is one undesignated cultural heritage site that comprises extant remains present within the study area (Appendix 10.1–10.2; Figure 10.2). This is CH130 which is the milling complex called Bloomfield Mill, located in the townland of Bloomfield West. The Historic 25-inch Ordnance Survey map shows the mill pond and mill-race. The mill pond is no longer extant but vestigial remains of the mill race and associated features were visible during field survey.

10.4.5.2 Undesignated cultural heritage sites that do not comprise extant remains

Undesignated cultural heritage features which do comprise extant remains typically include features such as lime kilns, dwellings, outhouses, trackways, etc. which are identifiable on maps such as the 6” and / or 25” Ordnance Surveys but which no longer have an above-ground presence.

Ten undesignated cultural heritage sites (Table 10.12) were identified within the study area from cartographic sources (Appendix 10.1–10.2; Figure 10.2). One further undesignated cultural heritage site (CH126) was identified by local history groups and academic research through witness statements as some of those associated with Knockraha's involvement with Irish forces during the War of Independence (1919–1921) (Shiels 2014).

Table 10.12 Unregistered Cultural Heritage sites with no extant remains

CH No	Summary	Townland
CH125	Smithy	Ballynanelagh (Ed Knockraha)
CH126	War of Independence Site	Ballynanelagh (Ed Knockraha)
CH127	Site of Vernacular building(s)	Ballynanelagh (Ed Knockraha)
CH128	Site of Vernacular building(s)	Woodstock
CH129	Site of Vernacular building(s)	Woodstock
CH131	Church and Glebe	Ballyedekin
CH132	Site of Vernacular building(s)	Lismalaghlin
CH133	Site of Vernacular building(s)	Lagile
CH134	Site of Vernacular building(s)	Carrigtwohill
CH135	Site of Vernacular building(s)	Woodstock
CH136	Site of Vernacular building(s)	Woodstock

10.4.5.3 Townland boundaries

A townland is the smallest official land unit in the country. Ireland is made up of approximately 60,000 townlands. As a result, townland boundaries are ubiquitous in the Irish countryside, and have been incorporated into the modern agricultural landscape. Many townlands predate the arrival of the Anglo Normans, and Irish historical documents consistently use townland names throughout the historic period to describe areas and locate events accurately in their geographical context. This suggests that many the boundaries of many of these territorial units preserve landscape divisions from the medieval period and perhaps earlier. The townland names and boundaries were standardised in the nineteenth century when the Ordnance Survey began to produce large-scale maps of the country. Research into the name of these land units frequently provides information relating to its archaeology, history, folklore, ownership, topography or land use.

The Celtic Interconnector Project traverses 61 no. of townland boundaries (Appendix 10.1–10.2; Figure 10.2).

Table 10.13 Townland boundaries intersected by the scheme

CH No	Summary	CH No	Summary
CH120	Lagile /Moanlahan	CH164	Castlemartyr/Killamucky
CH121	Gortnahomna Beg /Castlemartyr	CH165	Castlemartyr/Curragrine
CH122	Grange/Killamucky	CH166	Caherultan/Loughaderry
CH123	Roxborough /Killeagh	CH167	Loughaderry/Stumphill
CH124	Gortacrue /Carrigogna	CH168	Stumphill/Ballyedekin
CH137	Carrigogna/Curragh	CH169	Ballyedekin/Churchtown
CH139	Claycastle/Ballyvergan East	CH170	Clashduff/Churchtown
CH140	Ballyvergan East/Kennel	CH171	Churchtown/Roxborough
CH141	Kennel/Ballyvergan West	CH172	Killeagh/Ballyspillane West
CH142	Ballyvergan West/Coolaha	CH173	Ballyspillane West/Ballyspillane East
CH143	Coolaha/Ballyhobert	CH174	Ballyspillane West/Gortacrue

CH No	Summary	CH No	Summary
CH144	Ballyhobert/Gortaroo	CH175	Carrigogna/Ballyedmond
CH145	Gortaroo/Inchiquin	CH176	Curragh/Water-rock
CH146	Inchiquin/Burges Lower	CH177	Curragh/Ballyrichard More
CH147	Burges Lower/Ballymakeagh More	CH178	Ballyrichard More/Ballyrichard Beg
CH148	Ballymakeagh More/Lagile	CH179	Ballyrichard More/Carrigane
CH149	Lagile/Killeagh Gardens	CH180	Carrigane/Ballyadam
CH150	Moanlahan/Lisglasheen	CH181	Ballyadam/Carrigtwohill
CH151	Killeagh Gardens/Lisglasheen	CH182	Carrigtwohill/Gortnamucky
CH152	Lisglasheen/Mountbell	CH183	Ballyadam/Poulaniska
CH153	Mountbell/Ballycarnane	CH184	Poulaniska/Woodstock
CH154	Mountbell/Lissacrue	CH185	Gortnamucky/Woodstock
CH155	Lissacrue/Knocknaskagh	CH186	Woodstock/Longstown
CH156	Lissacrue/Knockane	CH187	Woodstock/Garranes
CH157	Knockane/Ballindinis	CH188	Garranes/Dooneen
CH158	Ballyvorisheen/Clasharinka	CH189	Garranes/Ballynakilla
CH159	Clasharinka/Lismalaghlin	CH190	Ballynakilla/Pigeonhill
CH160	Lismalaghlin/Gortnahomna More	CH191	Pigeonhill/Killeena
CH161	Gortnahomna More/Gortnahomna Beg	CH192	Pigeonhill/Ballynanelagh
CH162	Lismalaghlin/Grange	CH193	Killeena/Ballynanelagh
CH163	Grange/Castlemartyr		

10.4.6 Areas of Archaeological Potential

Areas of archaeological potential (AAPs) are areas or locations whose characteristics present a higher potential for unknown archaeological features to be present. Ten AAPs have been identified within the study area for the scheme (Appendix 10.1–10.2; Figure 10.2).

Table 10.14 AAPs within the Study Area

CH No	Description	Townland
CH117	Killeagh Church: Projected extent of the multivallate early medieval ecclesiastical enclosure based on results of 2015 excavation and documentary research.	Killeagh Gardens / Moanlahan / Lisglasheen / Mountbell
CH118	Medieval Killeagh: Projected extent of medieval manorial settlement of Killeagh based on cartographic analysis supported by documentary references to the medieval manor	Killeagh Gardens / Lisglasheen / Moanlahan / Lagile /Dromdihy / Aghadoe / Inchanpisha / Clashdermot East
CH119	Disour River: route crossing point. Rivers are areas of high archaeological potential	Killeagh Gardens
CH120	Disour River: route crossing point. Rivers are areas of high archaeological potential. The river also forms the townland boundary between Lagile and Moanlahan.	Lagile / Moanlahan
CH121	Kiltha River: route crossing point. Rivers are areas of high archaeological potential. This also corresponds to the townland boundary between Gortnahomna Beg and Castlemartyr.	Gortnahomna Beg / Castlemartyr
CH122	Kiltha River: route crossing point. Rivers are areas of high archaeological potential. This section of river channel also forms the townland boundary between Grange and Killamucky.	Grange / Killamucky

CH No	Description	Townland
CH123	Dungourney River: route crossing point. Rivers are areas of high archaeological potential. The river also forms the townland boundary between Roxborough and Killeagh	Roxborough / Killeagh
CH124	Tributary to Owenacurra River: route crossing point. Rivers are areas of high archaeological potential. The river also forms the townland boundary between Gortacrue and Carrigogna.	Gortacrue / Carrigogna
CH137	Owenacurra River crossing south of Ballyedmond Bridge. Rivers are areas of archaeological potential. This section of the river also forms the townland boundary between Carrigogna and Curragh.	Carrigogna / Curragh
CH138	At Claycastle Beach, it is clear that the remains of a submerged landscape potentially dating to the Holcene, survives beneath the beach. This has been confirmed by advance investigations in 2018 and 2019. The peat deposits identified in the intertidal zone have been scientifically dated from the Early Neolithic (at the bottom) through to the Iron Age (at the top) and are therefore of considerable archaeological and palaeo-environmental significance. :Localised features identified during walkover include a possible fulacht fiadh trough and a metal object.	Claycastle

10.5 Characteristics of the Proposal

The following descriptions focus on those aspects of the proposed development that are most relevant to archaeology and cultural heritage and should be read in conjunction with Chapter 2 Description of the Development and Chapter 3 Onshore Construction Phase Activities.

10.5.1 Connection Point

The HVAC cable will connect into the Irish transmission system at an existing spare bay within Knockraha substation. The connection will be made by a single 400kV HVAC UGC. Excavation groundworks will be required, however, the proposed extension will be accommodated within the existing fence line of Knockraha substation.

10.5.2 HVAC Underground Cable Route (ca. 10km)

The majority of the HVAC UGC route follows the existing road alignment with only limited/localised off-road sections. The typical trench dimensions are approximately 1.0m wide x 1.5m deep. However more substantial excavation for Joint Bays (8m long x 3.0m wide x 2.4m deep) will be required at intervals of 500–850m along the route.

While it is expected that the construction of the existing roads would reduce the potential for sub-surface archaeological material to be present, it would not eliminate it. Excavation of the cable trench and Joint Bays could expose sub-surface archaeological features or deposits. Water, rail and utilities crossings will be achieved by either horizontal directional drilling (HDD) or open cut trenches. HDD is proposed to be used on the HVAC route to cross the rail line on section AC06-AC07 only. All other crossings of utilities or water courses on the HVAC route will be by open cut trench. Excavation of open cut trench crossing could expose sub-surface archaeological features or deposits or archaeological features or deposits within a water course.

10.5.3 Converter Station Site

The converter station site will consist of a new engineered stone fill platform which will raise the proposed site level above its existing level. Rotary bored cast-in-place (socketed into rock) reinforced concrete piles will likely be adopted for all foundations on this site. Excavation groundworks for these new foundations expose sub-surface archaeological features or deposits. The construction of the proposed site access road will consist of removing all poor ground and any material from areas to be cut and removing this material from site. This could expose sub-surface archaeological features or deposits.

10.5.4 HVDC Underground Cable Route (ca. 30km)

The majority of the HVDC UGC route follows the existing road alignment with some limited/localised off-road sections and two wholly off-road sections (DC06-DC07 and DC08-DC09) which will by-pass the villages of Castlemartyr and Killeagh respectively. The typical trench dimensions are approximately 0.8m wide x 1.3m deep. However more substantial excavation for Joint Bays (8m long x 3.0m wide x 2.4m deep) will be required at intervals of 500–850m along the route. While it is expected that the construction of the existing roads would reduce the potential for sub-surface archaeological material to be present, it would not eliminate it. Excavation of the cable trench and Joint Bays could expose sub-surface archaeological features or deposits. Water, rail and utilities crossings will be achieved by either horizontal directional drilling (HDD) or open cut trenches. HDD is proposed to be used on the HVDC route to cross:

- The rail line and Owenacurra River within section DC01-DC02
- The Gas Networks Ireland transmissions pipeline at two locations within section DC02-DC03
- The Youghal-Midleton Greenway and the Dungourney River within section DC03-DC04
- The Womanagh River (or Kiltha River) within section DC06-DC07
- The Dissour River at two locations within section DC08-DC09
- The Womanagh River and a Cattle Underpass (Gortroe Cross) within section DC09-DC10
- The Youghal-Midleton Greenway within section DC11-DC12

All other crossings of utilities or water courses on the HVDC route will be by open cut trench. Excavation of open cut trench crossing could expose sub-surface archaeological features or deposits or archaeological features or deposits within a water course.

10.5.5 Landfall Area

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The terrestrial HDVC routes will extend onto Claycastle Beach to a pair of underground transition joint bay chambers (approximate plan dimensions of 15m x 4m x 3m deep for each chamber). There it will be jointed to the submarine cable which will be installed within Claycastle Beach by open trench excavation. Excavation groundworks could expose sub-surface archaeological features or deposits as well as the buried peat deposits.

10.5.6 Construction Laydown Areas, Passing Bays and Compounds

To facilitate traffic management at locations where joint (bays) chambers are located within the carriageway, the use of temporary passing bays is proposed. This would entail removing the top layer of ground to the side of the carriageway and temporarily storing it local to the site for reinstatement following the works.

Temporary laydown areas (with access roads) will be positioned at various greenfield sites along the cable route. Where an access road is required, engineering stone fill will be laid and compacted and maintained as required for the duration of the works. Once the works are completed, the engineered stone fill will be removed and the land will be reinstated to its original condition.

Temporary construction compounds will be required at a number of locations. If existing hardstanding is not available, engineering stone fill will be laid and compacted and maintained as required for the duration of the works. Once the works are completed, the engineered stone fill will be removed and the land will be reinstated to its original condition.

Any removal to topsoil or ground reduction required to facilitate any of these temporary works could expose sub-surface archaeological features or deposits. Compaction impacts to sub-surface archaeological features or deposits are also a possibility from the introduction of hard-standing onto greenfield sites.

10.6 Likely Significant Impacts of the Development

10.6.1 Construction Phase

Direct Impacts: Most impacts during construction phase are likely to be direct impacts as a result of sub-surface disturbance or construction works. All impacts at this phase are considered to be negative and permanent. These are summarised in Table 10.15 and described in detail in Table 10.16.

Note it is not considered that the on-road route options will have any impact on townland boundaries where the townland boundary has already been transected by the existing roadway (and the scheme route will be within that existing break) or where the existing roadway demarcates the current townland boundary. Direct impacts to townland boundaries have only been identified where the proposed scheme requires a new break or the removal of a section of extant townland boundary.

Indirect Impacts: It is not proposed to consider any impacts on setting for any sites either within the development site or the wider study area during the construction phase, as construction works constitute a short-term alteration to the landscape.

Table 10.15 Summary of CH sites subject to impacts at Construction Phase

Proposed Development	Descriptor (and Townland)	Construction Phase Impacts
Connection Point	Knockraha Substation (Ballynanelagh)	None
AC01-AC02	Knockraha Substation (Ballynanelagh) to east of Ballynanleagh (Killeena)	None
AC02-AC03B	East of Ballynanleagh, west of T-Junction (Killeena) to East of Ballynanleagh, east of T-Junction (Killeena) – off road	CH127 Site of Vernacular building(s) CH191 Townland Boundary
AC03-AC04	East of Ballynanleagh, east of T-Junction (Killeena) to Garranes crossroads (Garranes)	None
AC04-AC05	Garranes crossroads (Garranes)) to south of Woodstock (Woodstock)	CH005 Fulacht fia
AC05-AC06	Woodstock (Woodstock)/Gortnamucky to north of Ballyadam (Ballyadam)	None
AC06-AC07	North of Ballyadam (Ballyadam) to Ballyadam (Ballyadam)	None
Converter Station Site	Ballyadam (Ballyadam)	CH029 Excavation - miscellaneous CH030 Fulacht fia CH031 Fulacht fia CH032 Burnt mound CH033 Fulacht fia
DC01-DC02	Ballyadam (Ballyadam) to Carrigogna/R626 (Carrigogna)	CH137 Owenacurra River
DC02-DC03	Carrigogna (Carrigogna) to Ballyspillane East (Ballyspillane East)	CH124 Owenacurra Tributary CH130 Mill Complex
DC03-DC04	Ballyspillane East (Ballyspillane East) to Roxborough (Roxborough)	CH010 Graveyard CH011 Church CH028 Souterrain

Proposed Development	Descriptor (and Townland)	Construction Phase Impacts
		CH123 Dungourney River
DC04-DC05	Roxborough (Roxborough) to Churchtown North/N25 (Ballyedekin)	CH026 Graveyard CH027 Church CH131 Church and Glebe
DC05-DC06	Churchtown North (Ballyedekin) to West of Castlemartyr (Killamucky)	CH053 Milestone
DC06-DC07	West of Castlemartyr (Killamucky) to East of Castlemartyr (Clasharinka) – off road	CH122 Kiltha River/Demesne Landscape CH132 Site of Vernacular building(s) CH162 Townland Boundary
DC07-DC08	East of Castlemartyr (Clasharinka) to West of Killeagh (Mountbell)	CH048 Barrow - mound barrow CH061 Burial CH062 Cave CH155 Townland Boundary
DC08-DC09	west of Killeagh (Mountbell) to east of Killeagh (Ballymakeagh More) – off road	CH120 Disour River CH148 Townland Boundary CH150 Townland Boundary
DC09-DC010	Killeagh (Ballymakeagh More) to N25/west of R634 (Ballyvergan West)	CH018 Enclosure CH142 Townland Boundary
DC10-DC011	Ballyvergan West (Ballyvergan West) to R634/ R908 (Summerfield)	None
DC11-DC012	R634/ R908 (Summerfield) to north of Claycastle Beach car park (Summerfield)	None
Landfall	Transition Joint Bay (Summerfield) to HW mark at Claycastle Beach (Summerfield)	CH138 Claycastle Beach

Table 10.16 Description of Impacts to CH sites at Construction Phase

CH No	Summary	Description of Impact	Magnitude of Impact prior to implementation of mitigation measures	Baseline Value	Significance of Impact prior to implementation of mitigation measures
CH005	Fulacht fia	On-road Cable Trench will pass through the Zone of Notification for this RMP; there is a possibility that sub-surface archaeological features relating to this site could still be present beneath the carriageway.	Major	Very High	Significant
CH010	Graveyard	On-road Cable Trench section DC03-DC04 will pass through the Zone of Notification for this RMP; there is a possibility that sub-surface archaeological features relating to this site could still be present beneath the carriageway.	Major	Very High	Significant
CH011	Church	On-road Cable Trench section DC03-DC04 will pass through the Zone of Notification for this RMP; there is a possibility that sub-surface archaeological features relating to this site could still be present beneath the carriageway.	Major	Very High	Significant
CH018	Enclosure	On-road Cable Trench section DC09-DC010 will pass through the Zone of Notification for this RMP; there is a possibility that sub-surface archaeological features relating to this site could still be present beneath the carriageway.	Major	Very High	Significant
CH026	Graveyard	On-road Cable Trench section DC04-DC05 will pass through the Zone of Notification for this RMP; there is a possibility that sub-surface archaeological features relating to this site could still be present beneath the carriageway.	Major	Very High	Significant
CH027	Church	On-road Cable Trench section DC04-DC05 will pass through the Zone of Notification for this RMP; there is a possibility that sub-surface archaeological features relating to this site could still be present beneath the carriageway.	Major	Very High	Significant
CH028	Souterrain	Cable Trench section DC03-DC04 will pass through the Zone of Notification for this RMP, where it diverts off-road in the townland of Roxborough; there is a possibility that sub-surface archaeological features relating to this site could still be present within the field to the west of the carriageway through which the cable route passes.	Major	Very High	Significant
CH029	Excavation - miscellaneous	This RMP site has been fully archaeologically excavated, however it is still possible that construction of the convertor station at Ballyadam could uncover further related archaeological features	Major	Very High	Significant

CH No	Summary	Description of Impact	Magnitude of Impact prior to implementation of mitigation measures	Baseline Value	Significance of Impact prior to implementation of mitigation measures
CH030	Fulacht fia	This RMP site has been fully archaeologically excavated, however it is still possible that construction of the convertor station at Ballyadam could uncover further related archaeological features	Major	Very High	Significant
CH031	Fulacht fia	This RMP site has been fully archaeologically excavated, however it is still possible that construction of the convertor station at Ballyadam could uncover further related archaeological features	Major	Very High	Significant
CH032	Burnt mound	This RMP site has been fully archaeologically excavated, however it is still possible that construction of the convertor station at Ballyadam could uncover further related archaeological features	Major	Very High	Significant
CH033	Fulacht fia	This RMP site has been fully archaeologically excavated, however it is still possible that construction of the convertor station at Ballyadam could uncover further related archaeological features	Major	Very High	Significant
CH048	Barrow - mound barrow	On-road Cable Trench section DC07-DC08 will pass through the Zone of Notification for this RMP; there is a possibility that sub-surface archaeological features relating to this site could still be present beneath the carriageway.	Major	Very High	Significant
CH053	Milestone	The access road to Laydown Area LDA-DC05 will pass through the Zone of Notification for this RMP site.	Major	Very High	Significant
CH061	Burial	On-road Cable Trench section DC07-DC08 will pass through the Zone of Notification for this RMP; there is a possibility that sub-surface archaeological features relating to this site could still be present beneath the carriageway.	Major	Very High	Significant
CH062	Cave	On-road Cable Trench section DC07-DC08 will pass through the Zone of Notification for this RMP; there is a possibility that sub-surface archaeological features relating to this site could still be present beneath the carriageway.	Major	Very High	Significant
CH120	Disour River	Excavation of Cable Trench section DC08-DC09B would impact on this river channel, which is an area of archaeological potential.	Major	Medium / High	Moderate
CH122	Kiltha River / Demesne Landscape	Excavation of Cable Trench section DC06-DC07B would impact on this river channel, which is an area of archaeological potential; it should also be noted that the riverine island and western river channel may be artificial creations relating to the demesne landscape of the Castlemartyr estate immediately to the southwest, so impacts to demesne landscape features are also a possibility.	Major	Medium / High	Moderate

CH No	Summary	Description of Impact	Magnitude of Impact prior to implementation of mitigation measures	Baseline Value	Significance of Impact prior to implementation of mitigation measures
CH123	Dungourney River	Excavation of Cable Trench section DC03-DC04 would impact on this river channel, which is an area of archaeological potential.	Major	Medium / High	Moderate
CH124	Owenacurra Tributary	Excavation of Cable Trench section DC02-DC03 would impact on this river channel, which is an area of archaeological potential.	Major	Medium / High	Moderate
CH127	Site of Vernacular building(s)	Excavation of Cable Trench section AC02-AC03A could uncover any surviving sub-surface remains of this site.	Major	Medium / Low	Slight
CH130	Mill Complex	Excavation of Cable Trench section DC02-DC03 and groundworks at Layover LDA-DC03 could uncover any surviving sub-surface remains of this site.	Major	Medium / High	Moderate
CH131	Church and Glebe	Excavation of Cable Trench section DC04-DC05 and groundworks at Layover LDA-DC04 could uncover any surviving sub-surface remains of this site.	Major	Medium / High	Moderate
CH132	Site of Vernacular building(s)	Excavation of Cable Trench section DC06-DC07B could uncover any surviving sub-surface remains of this site.	Major	Medium / Low	Slight
CH137	Owenacurra River	Excavation of Cable Trench section DC01-DC02 would impact on this river channel, which is an area of archaeological potential.	Major	Medium / High	Moderate
CH138	Claycastle Beach	Excavation groundworks associated with the cable landfall infrastructure as well as temporary construction compounds could potentially uncover previously unknown archaeological features, in particular associated with the palaeo-landscape and peat deposits that survive sub-surface at Claycastle Beach.	Major	High	Significant
CH142	Townland Boundary	Cable Route DC09-DC010 would transect the extant field boundary hedgerow and roadway that demarcates this townland boundary where the cable route deviates briefly off-road to the south of the N25 carriageway. Townland boundary will remain readable within the landscape despite this additional break in its circuit.	Moderate	Medium / Low	Slight
CH148	Townland Boundary	Cable Route DC08-DC09B would transect the extant field boundary hedgerow and roadway that demarcates this townland boundary. Townland boundary will remain readable within the landscape despite this additional break in its circuit.	Moderate	Medium / Low	Slight

CH No	Summary	Description of Impact	Magnitude of Impact prior to implementation of mitigation measures	Baseline Value	Significance of Impact prior to implementation of mitigation measures
CH150	Townland Boundary	Cable Route DC08-DC09B would transect the extant field boundary hedgerow and roadway that demarcates this townland boundary. The access road to Laydown Area LDA-DC06 would also require a new break in this townland boundary. Townland boundary will remain readable within the landscape despite this additional break in its circuit.	Moderate	Medium / Low	Slight
CH155	Townland Boundary	Cable Route DC07-DC08 would transect the extant field boundary hedgerow that demarcates this townland boundary where the cable route deviates to the north of the existing N25 carriageway into greenfield. Townland boundary will remain readable within the landscape despite this additional break in its circuit.	Moderate	Medium / Low	Slight
CH162	Townland Boundary	Cable Route DC06-DC07B would transect the extant field boundary hedgerow and roadway that demarcates this townland boundary. Townland boundary will remain readable within the landscape despite this additional break in its circuit.	Moderate	Medium / Low	Slight
CH191	Townland Boundary	Excavation of Cable Trench section AC02-AC03B will need to transect the field boundary hedgerow that demarcates this townland boundary. Townland boundary will remain readable within the landscape despite this additional break in its circuit.	Moderate	Medium / Low	Slight

10.6.2 Operational Phase

Direct Impacts: There should be no direct impacts on archaeological, architectural or cultural heritage sites at operational phase.

Indirect Impacts: Indirect impacts at operation stage would largely occur as a result of impacts on the setting of site (notably visual impacts) and on the integrity and character. With the exception of the Connection Point at Knockraha, Converter Station at Ballyadam and Landfall at Claycastle the scheme infrastructure should be largely sub-surface with limited potential for visual impacts. As a result, no indirect impacts or impacts on setting have been identified at operational phase.

10.6.3 Do Nothing

The 'do-nothing' scenario will have no impact on archaeological, architectural or cultural heritage. The only potential exception to this would be the proposed convertor station site at Ballyadam. This is located within lands owned by the IDA and zoned for industrial/employment development. It is expected that this site will be the focus for future development.

10.6.4 Decommissioning Phase

Direct Impacts: There should be no direct impacts on archaeological, architectural or cultural heritage sites at decommissioning phase.

Indirect Impacts: There should be no indirect impacts on archaeological, architectural or cultural heritage sites at decommissioning phase.

10.6.5 Cumulative Impact

A number of developments are proposed within the immediate environs of the Celtic Interconnector project as detailed in Table 4.2 of Volume 3C1 of this EIAR. The cumulative impacts of the proposed development and these projects on archaeology and cultural heritage are considered to be 'not significant'.

Any projects already under construction or for which the appropriate permissions have already been successfully obtained will already have been appropriately evaluated for impacts to archaeology, architectural heritage and cultural heritage and appropriate mitigation – if required –set out to a uniform standard in consultation with the National Monuments Service (DHLGH).

For any planning applications still under application, Cork County Council retains a County Archaeologist and Conservation Officer to evaluate and advise on such applications, to ensure that they have been evaluated for impacts to archaeology, architectural heritage and cultural heritage and to recommend any appropriate mitigation measures to a uniform standard in consultation with the National Monuments Service (DHLGH).

It should be noted, in particular, in relation to the IDA lands at Ballyadam that a previous phase of work at the site in the period 2006-2009 resulted in mitigation (through archaeological excavation or preservation by record) of impacts to (previously unknown) sub-surface archaeological sites / features across a substantial proportion of this site. As a result, any potential further direct impacts to archaeological sites or features within the IDA lands as a result of the proposed Celtic Interconnector Project or any other future development within its bounds have been minimised.

10.7 Mitigation Measures

The mitigation strategies outlined in this section detail the techniques to be adopted in order to ameliorate the impacts that the proposed development may have on features of archaeological, architectural and / or cultural heritage within the study area during both the construction and operation phases of the scheme. The residual impacts that will remain once these mitigation measures have been implemented are set out in Section 10.8.

The following proposed mitigation measures are subject to approval by An Bord Pleanála and the National Monuments Service of DHLGH:

- An underwater archaeological survey and evaluation will be undertaken for all watercourses along the scheme route with particular regard to the Disour River (CH120), Kiltha River and associated demesne landscape (CH122), Dungourney River (CH123) and Owenacurra River (CH137) and its tributary (CH124). This survey and evaluation should
  - Be carried out by a suitably qualified and suitably experienced underwater archaeologist under licence
  - Incorporate appropriate dive and wade survey as well as metal detection survey
  - 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).

  Note, where a HDD methodology is proposed to facilitate a crossing, this should avoid any direct impact on the subject river or water course at that location.
- A combination of advance geophysical survey and advance archaeological test trenching should be carried out for all off-road sections of the cable routes as well as the proposed Laydown Areas. This advance prospection should:
  - Be carried out by a suitably qualified archaeologist under licence
  - 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).
- Where a section of an upstanding townland boundary must be removed then:
  - A representative cross-section of the townland boundary should be investigated and recorded by a suitably qualified archaeologist prior to removal.
- 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*.
- 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.
- The site of the metal object (CA3001) 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 establish its relationship to the peat deposits further to the SW.
- The exact location of milestone CH053 should be identified on the ground by an archaeologist and demarcated precisely on all drawings for this section of the scheme. An exclusion zone a minimum of 15m in diameter should be established around the location of the site. It should be fenced off for the duration of construction works on that section of the scheme and while Laydown Area LDA-DC05 is in use/operation.
- All sub-surface groundworks associated with the proposed development works will be subject to a programme of archaeological monitoring.

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- This should be carried out by a suitably qualified archaeologist under license and in accordance with the provisions of the National Monuments Acts 1930-2004.
- If significant archaeological material is encountered during the course of archaeological monitoring, then resolution of any such significant material will be determined in consultation with the National Monuments Service (DHLGH).
- Where possible, every reasonable effort should be made to preserve in situ or reduce the impact on any identified archaeological material. Where preservation in situ cannot be achieved, either in whole or in part, then a programme of full archaeological excavation should be implemented to ensure the preservation by record of the portion of the site that will be directly impacted upon. This work should be carried out by a suitably qualified archaeologist under license and in accordance with the provisions of the National Monuments Acts 1930-2004.
- A written report will be prepared detailing the results of all archaeological work undertaken.

10.8 Residual Impacts

Table 10.17 Residual Impacts to CH sites once mitigation measures have been implemented

CH No	Phase	Impact Type	Mitigation Measures	Magnitude of Impact after implementation of mitigation measures	Baseline Value	Significance of Impact after implementation of mitigation measures
CH005	Construction	Direct	• All sub-surface groundworks associated with the proposed development works shall be subject to a programme of archaeological monitoring.	Moderate	Very High	Moderate
CH010	Construction	Direct	• All sub-surface groundworks associated with the proposed development works shall be subject to a programme of archaeological monitoring.	Moderate	Very High	Moderate
CH011	Construction	Direct	• All sub-surface groundworks associated with the proposed development works shall be subject to a programme of archaeological monitoring.	Moderate	Very High	Moderate
CH018	Construction	Direct	• All sub-surface groundworks associated with the proposed development works shall be subject to a programme of archaeological monitoring.	Moderate	Very High	Moderate
CH026	Construction	Direct	• All sub-surface groundworks associated with the proposed development works shall be subject to a programme of archaeological monitoring.	Moderate	Very High	Moderate
CH027	Construction	Direct	• All sub-surface groundworks associated with the proposed development works shall be subject to a programme of archaeological monitoring.	Moderate	Very High	Moderate
CH028	Construction	Direct	• A combination of advance geophysical survey and advance archaeological test trenching should be carried out for all off-road sections of the cable routes.	Moderate	Very High	Moderate
CH029	Construction	Direct	• All sub-surface groundworks associated with the proposed development works shall be subject to a programme of archaeological monitoring.	Moderate	Very High	Moderate
CH030	Construction	Direct	• All sub-surface groundworks associated with the proposed development works shall be subject to a programme of archaeological monitoring.	Moderate	Very High	Moderate
CH031	Construction	Direct	• All sub-surface groundworks associated with the proposed development works shall be subject to a programme of archaeological monitoring.	Moderate	Very High	Moderate
CH032	Construction	Direct	• All sub-surface groundworks associated with the proposed development works shall be subject to a programme of archaeological monitoring.	Moderate	Very High	Moderate
CH033	Construction	Direct	• All sub-surface groundworks associated with the proposed development works shall be subject to a programme of archaeological monitoring.	Moderate	Very High	Moderate
CH048	Construction	Direct	• All sub-surface groundworks associated with the proposed development works shall be subject to a programme of archaeological monitoring.	Moderate	Very High	Moderate
CH053	Construction	Direct	• A buffer zone of 15m diameter to be established around this site and fenced off during construction.	Minor	Very High	Moderate

CH No	Phase	Impact Type	Mitigation Measures	Magnitude of Impact after implementation of mitigation measures	Baseline Value	Significance of Impact after implementation of mitigation measures
CH061	Construction	Direct	• On-road Cable Trench section DC07-DC08 will pass through the Zone of Notification for this RMP; there is a possibility that sub-surface archaeological features relating to this site could still be present beneath the carriageway.	Moderate	Very High	Moderate
CH062	Construction	Direct	• On-road Cable Trench section DC07-DC08 will pass through the Zone of Notification for this RMP; there is a possibility that sub-surface archaeological features relating to this site could still be present beneath the carriageway.	Moderate	Very High	Moderate
CH120	Construction	Direct	• An underwater archaeological survey and evaluation must be undertaken for all watercourses along the scheme route with particular regard to the Disour River (CH120), Kiltha River and associated demesne landscape (CH122), Dungourney River (CH123) and Owenacurra River (CH137) and its tributary (CH124). • A combination of advance geophysical survey and advance archaeological test trenching should be carried out for all off-road sections of the cable routes. • HDD methodology to be used to cross Disour River in section DC08-DC09	Moderate	Medium / High	Slight
CH122	Construction	Direct	• "An underwater archaeological survey and evaluation must be undertaken for all watercourses along the scheme route with particular regard to the Disour River (CH120), Kiltha River and associated demesne landscape (CH122), Dungourney River (CH123) and Owenacurra River (CH137) and its tributary (CH124). • A combination of advance geophysical survey and advance archaeological test trenching should be carried out for all off-road sections of the cable routes. • HDD methodology to be used to cross Kiltha River in section DC06-DC07	Moderate	Medium / High	Slight
CH123	Construction	Direct	• An underwater archaeological survey and evaluation must be undertaken for all watercourses along the scheme route with particular regard to the Disour River (CH120), Kiltha River and associated demesne landscape (CH122), Dungourney River (CH123) and Owenacurra River (CH137) and its tributary (CH124). • HDD methodology to be used to cross Dungourney River in section DC03-DC04	Moderate	Medium / High	Slight
CH124	Construction	Direct	• An underwater archaeological survey and evaluation) must be undertaken for all watercourses along the scheme route with particular regard to the Disour River (CH120), Kiltha River and associated demesne landscape (CH122), Dungourney River (CH123) and Owenacurra River (CH137) and its tributary (CH124).	Moderate	Medium / High	Slight

CH No	Phase	Impact Type	Mitigation Measures	Magnitude of Impact after implementation of mitigation measures	Baseline Value	Significance of Impact after implementation of mitigation measures
CH127	Construction	Direct	• A combination of advance geophysical survey and advance archaeological test trenching should be carried out for all off-road sections of the cable routes.	Moderate	Medium / Low	Slight
CH130	Construction	Direct	• A combination of advance geophysical survey and advance archaeological test trenching should be carried out for all off-road sections of the cable routes.	Moderate	Medium / High	Slight
CH131	Construction	Direct	• A combination of advance geophysical survey and advance archaeological test trenching should be carried out for all off-road sections of the cable routes.	Moderate	Medium / High	Slight
CH132	Construction	Direct	• A combination of advance geophysical survey and advance archaeological test trenching should be carried out for all off-road sections of the cable routes.	Moderate	Medium / Low	Slight
CH137	Construction	Direct	• An Underwater Archaeological Impact Assessment (UAIA) must be undertaken for all watercourses along the scheme route with particular regard to the Disour River (CH120), Kiltha River and associated demesne landscape (CH122), Dungourney River (CH123) and Owenacurra River (CH137) and its tributary (CH124). • HDD methodology to be used to cross Owenacurra River in section DC01-DC02	Moderate	Medium / High	Slight
CH138	Construction	Direct	• A suitably qualified and experienced Project Environmental Specialist will develop a Project Environmental Remains Strategy in accordance with the TII Palaeo-environmental Sampling Guidelines. • A buffer zone of 15m diameter to be established around exposed peat deposits to the SW of the cable route including the site of a possible fulacht fiadh trough (CA3007) and fenced off for duration of construction works. • The site of the metal object (CA3001) should be either be fenced off from the construction works for their duration (minimum buffer zone of 15m) or fully archaeologically excavated. • All sub-surface groundworks associated with the proposed development works shall be subject to a programme of archaeological monitoring.	Moderate	High	Moderate
CH142	Construction	Direct	• Where a section of an upstanding townland boundary must be removed then a representative cross-section of the townland boundary should be investigated and recorded	Moderate	Medium / Low	Slight
CH148	Construction	Direct	• Where a section of an upstanding townland boundary must be removed then a representative cross-section of the townland boundary should be investigated and recorded	Moderate	Medium / Low	Slight

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CH No	Phase	Impact Type	Mitigation Measures	Magnitude of Impact after implementation of mitigation measures	Baseline Value	Significance of Impact after implementation of mitigation measures
CH150	Construction	Direct	• Where a section of an upstanding townland boundary must be removed then a representative cross-section of the townland boundary should be investigated and recorded	Moderate	Medium / Low	Slight
CH155	Construction	Direct	• Where a section of an upstanding townland boundary must be removed then a representative cross-section of the townland boundary should be investigated and recorded	Moderate	Medium / Low	Slight
CH162	Construction	Direct	• Where a section of an upstanding townland boundary must be removed then a representative cross-section of the townland boundary should be investigated and recorded	Moderate	Medium / Low	Slight
CH191	Construction	Direct	• Where a section of an upstanding townland boundary must be removed then a representative cross-section of the townland boundary should be investigated and recorded	Moderate	Medium / Low	Slight

10.9 Transboundary Effect

All elements of the onshore interconnector are found in County Cork, Ireland. No international boundaries are crossed by the works and therefore there are no transboundary effects to be discussed.

11 Roads and Traffic

11.1 Introduction

This chapter of the EIAR presents the assessment of the likely roads and traffic effects of the Project considering public roads along the proposed Celtic Interconnector route between the landfall at Claycastle Beach near Youghal and the existing Knockraha substation near Watergrasshill, County Cork and those public roads likely to be used for construction access.

Cumulative effects associated with committed projects which are likely to generate traffic utilising the same public roads within the Project Study Area at the same time as traffic generated by the Project have also been assessed.

This chapter sets out the existing conditions of the receiving environment and details the traffic that is likely to be generated during the construction phase of the Project assessing the effect upon the local, regional and national road network and identifies measures to reduce network disruption.

A Traffic and Transport Assessment (TTA) has not been undertaken as a TTA is not generally considered to be required for temporary construction works and the traffic movements associated with the operational phase of the Project are not high enough to warrant a formal TTA. Similarly, a Workplace Travel Plan is not considered a logical requirement.

Alternative routes for the installation of the cable are discussed in Chapter 1. A detailed description of the development is provided in Chapters 2 and 3. Noise and air quality pertaining to traffic and transport are discussed in Chapter 4 and Chapter 5 respectively.

Maps supporting this document are supplied in Appendix 11.1. A framework Construction Phase Management Plan is included in Appendix 11.2. Construction traffic flow data is included in Appendix 11.3.

Commented [DH21]: APPENDICES WILL BE INCLUDED IN FINAL APPLICATION

11.2 Policy Context

Volume 2A *Planning Report* of this consent application presents a review of policies and strategies relevant to the principle of the Project. This includes a review of those produced at a national level as well as those produced regionally and locally by Cork County Council.

The purpose of this section is to set out transport policies and guidance that are relevant to the assessment of traffic and transport effects of the Project.

Table 11.1 provides a summary of the policies relevant to roads and traffic. Guidance is provided in Table 11.2.

Table 11.1: Policy Summary

Document Title	Policy Detail	Relevance to Assessment
Cork County Development Plan Review Transport and Mobility, Background Document No. 8 (Cork County Council Development Plan 2014) Draft Cork County Development Plan 2022-2028:	2014: This plan includes a strategy for Cork's transport and land use, with several policy objectives relevant to the project: '- Walking TM 2-1: 'Preserve, protect and where possible enhance existing walking routes particularly those providing access to key transport and community infrastructure such as bus stops, rail stations, schools, shops, work places, town and village centres.' 'National Road Network TM 3-1: 'Support and provide for improvements to the national road network, including reserving corridors for proposed routes, free of inappropriate development, so as not to compromise future road schemes. c) Restrict individual access onto national roads, in order to protect the substantial investment in the national road network, to improve carrying capacity, efficiency and safety and to prevent the premature obsolescence of the network. d) Avoid the creation of additional access points from new development or the generation of increased traffic from existing accesses onto national roads to which speed limits greater than 50kph apply. e) Prevent the undermining of the strategic transport function of national roads and to protect the capacity of the interchanges in the County from locally generated traffic.' 'Regional and Local Roads TM 3-2: 'Limit access to Regional Roads where appropriate so as to protect carrying capacity of the road network and have regard to safety considerations particularly where access to a lower category road is available. e) Ensure that in the design of new development adjoining or near Regional & Local Roads, account is taken of the need to include measures that will serve to protect the development from the adverse effects of traffic noise for the design life of the development.' 'Road Safety and Traffic Management TM 3-3: 'Where traffic movements associated with a development proposal will have a material impact on the safety and free flow of traffic on a National, Regional or other Local Routes, to require the submission of a Traffic and Transport Assessment (TTA) and Road Safety Audit as part of the proposal.' '10.3.9 Where traffic movements associated with a development proposal will have a material impact on the safety and free flow of traffic on a National or Regional Route, this Plan will require the submission of a Traffic and Transport Assessment (TTA) and Road Safety Audit to be prepared in accordance with the Traffic Management Guidelines Manual 2003 issued by the Department of Transport and the Traffic and Transport Assessment Guidelines 2007 published by the National Roads Authority.' '10.3.10 The National Transport Authority provide guidance in relation to best practice in this area 'Achieving Effective Workplace Travel Plans – guidance for local authorities. Draft CDP (2022-2028): This draft contains an overview of the existing transport policy context and highlights areas where the existing County Development Plan (CDP) transport policies will need to be reviewed or updated. In alignment with National policy and its goal of achieving sustainable development and compact growth and in the interests of a vibrant economy and a healthy environment, transport policy in County Cork must meet the following key objectives: - Minimise the environmental impact of travel and in particular reduce the need to use a private car; - Provide reliable and resilient connections within and external to Cork County and internationally; Implement transport-oriented development; - Support sustainable transport modes acknowledging the wider benefits to society;	All acknowledged and considered as an integral part of the assessment process unless stated otherwise. In the operational phase there are no extra flows, therefore we are not impacting the road network overall. All effects are temporary in nature during construction. A Traffic and Transport Assessment (TTA) has not been undertaken as a TTA is not generally considered to be required for temporary construction works and the traffic movements associated with the operational phase of the Project are not high enough to warrant a formal TTA, and as such is not deemed necessary for the Project. Similarly, a Workplace Travel Plan is not considered a logical requirement.

11.3 Assessment Methodology and Significance Criteria

The assessment detailed in this Chapter has been undertaken combining desktop study and current policy advice and best practice in line with consultation with statutory agencies. Predicted construction vehicle movement volumes have been compared to baseline traffic flows to identify if there are likely to be periods where the increase in traffic, either all traffic or specifically Heavy Good Vehicle (HGV) traffic, exceeds standard thresholds. This additional traffic may cause effects, for example, on driver delay, road safety or community, those of which have been identified and their significance assessed.

11.3.1 Guidance

This assessment has been carried out applying professional judgement with reference to the following key documents:

- Guidelines on the Information to be Contained in Environmental Impact Reports, Environmental Protection Agency (EPA) (DRAFT 2017)
- Traffic and Transport Assessment Guidelines, Transport Infrastructure Ireland (TII) (2014)
- The Institute of Environmental Management and Assessment Guidelines for the Environmental Assessment of Road Traffic, The Institute of Environmental Management and Assessment (IEMA) (1993)
- Guidelines for Planning Authorities and An Bord Pleanála on carrying out Environmental Impact Assessment (Department of Housing, Planning and Local Government) (August 2018)
- 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) (European Commission) (2017)

The IEMA Guidelines are intended for the assessment of the effect of road traffic associated with new developments. It is common and established practice that they are applied to energy related developments and as such these guidelines are defined as suitable to assess the construction phase of the Project.

Guidance supplementary to those tabulated below in Table 11.2 is made reference to as required in this chapter.

Table 11.2: Core Guidance Summary

Document Title	Source and Year	Guidance Detail
Guidelines on the Information to be Contained in Environmental Impact Reports	Environmental Protection Agency (EPA) (DRAFT 2017)	These guidelines provide advice of best practice, principles and practice of developing an EIAR. Specific reference to transport assessment includes: "*Material assets can now be taken to mean built services and infrastructure. Traffic is included because in effect traffic consumes roads infrastructure*." and "*The provision of new access facilities (e.g. links to motorways) or the upgrading of existing facilities (e.g. road widths, bridges and junctions) carried out by other parties can give rise to significant environmental effects"* The importance of a Construction Management Plan is acknowledged in this document; "*Construction Management Plans are often provided to supplement the project description and to set out specific details of the construction plan. While inclusion of full details may not be practicable at pre-consent stage, it should set out the environmental envelope within which the project will be built, including working areas, hours of work, principal construction methods and phases, volumes of materials, traffic and environmental controls*."
ADVICE NOTES ON CURRENT PRACTICE (in the preparation of Environmental Impact Statements)	Environmental Protection Agency (EPA) (DRAFT 2015)	These notes provide general guidance on assessment practice. Defined environmental topics; 'human beings' and material assets' have relevance to transport assessment
Traffic and Transport Assessment Guidelines	Transport Infrastructure Ireland (TII) (2014)	The guidelines provide guidance for scoping and developing traffic and transport assessment requirements to support development proposals. The guidelines outline the need for assessment of public transport, walking and cycling networks, rather than singularly focussing on the road network. The focus of these guidelines relates to operational traffic aspects.
The Institute of Environmental Management and Assessment Guidelines for the Environmental Assessment of Road Traffic	The Institute of Environmental Management and Assessment (IEMA) (1993)	The guidelines provide internationally referable guidance specific to best practice in transport EIA process and practice.
The UK Design Manual for Roads and Bridges (DMRB)	The UK Design Manual for Roads and Bridges (DMRB) (various dates)	The UK DMRB document set details requirements for appraisal, design, maintenance, operation and disposal of UK motorway and all-purpose trunk roads. DMRB may also be applied to other roads with local authority approval.
Guidelines for Planning Authorities and An Bord Pleanála on carrying out Environmental Impact Assessment	Department of Housing, Planning and Local Government (2018)	Outlines the requirement to assess the potential of the project to cause accidents and/or disasters, including implications for human health, cultural heritage, and the environment. It also highlights consultation; details of consultation undertaken for this EIAR is covered in the headline chapters.
Environmental Impact Assessment of Projects Guidance on the preparation of the Environmental Impact Assessment Report (Directive	(European Commission) (2017)	This guidance sets out what should be covered in logical sections of EIA. With particular reference to traffic and transport, it provides a checklist, including the following: Description of traffic flows, type, volume, temporal pattern and geographical distributed generated or diverted resulting from the Project

Document Title	Source and Year	Guidance Detail
2011/92/EU as amended by 2014/52/EU)		Description of resources and raw materials to the Project site and the associated traffic movements Description of project risks, including mention of the risk of traffic accidents Description of the effects on the environment caused by activities ancillary to the main Project

11.3.2 Study Area

The Study Area for the traffic and transport is effectively the public road network along the proposed cable route and associated construction access and diversion routes. This runs between Claycastle Beach and Knockraha Substation.

For the purposes of the traffic and transport assessment the Project has been considered as three distinct "sites"; this is due to diverse characteristics and methodology of construction / operation between each site and the associated traffic generation and impact. The sites considered are as follows;

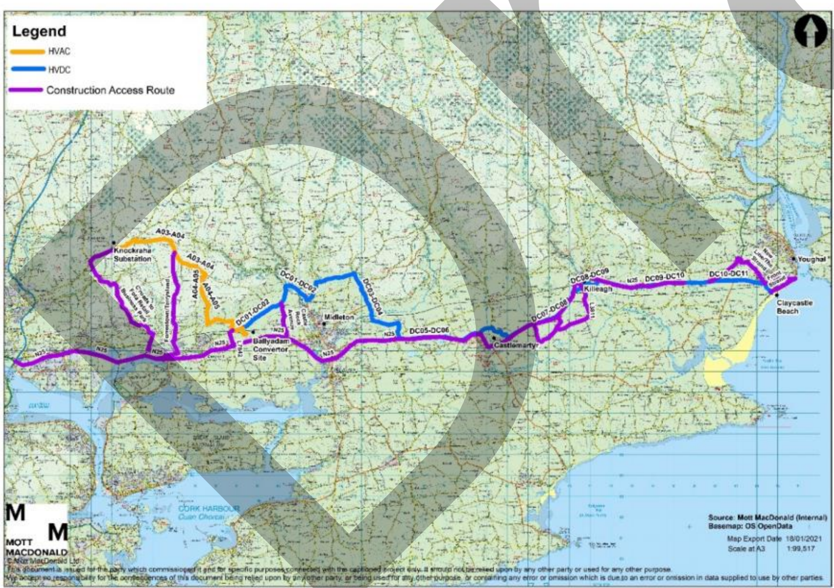
- Proposed Ballyadam Converter Station;
- Proposed underground cable (UGC) route along the N25; and
- Proposed Cable Route along Regional / local rural roads, from Knockraha connection point to Claycastle landfall.

Knockraha Substation has not been considered as a distinct site as the construction and operation phases are assumed to be minor with regards to vehicle movements.

In addition, the public roads which are likely to be used during construction have also been considered within the assessment. Figure 11.1 provides an overview of the Study Area for the purposes of this traffic and transport assessment. A larger version of the Study Area is provided in Appendix 11.1.

Public road sections included in the Study Area which are proposed to be utilised during construction and/or operation are listed in Table 11.3.

Figure 11.1: Study Area



Source: Ordnance Survey/Mott MacDonald

Table 11.3: Public Roads within Study Area

Road Section	Cable Route Section/ Construction Access Route	Ballyadam Site	Cable Route (N25)	Cable Route (Regional/local (off-N25))
L7642 (bordering proposed Ballyadam Site)	Construction Access			✓
N25 (between M8 junction and Clashadonna Roundabout junction)	Construction Access and Cable Route (DC05-DC10)	✓	✓	✓
L3811	Construction Access		✓	
L7848	Construction Access		✓	
L7849	Construction Access		✓	
Unnamed road Knockraha Substation (Ballynanelagh) to east of Ballynanleagh (Killeena)	Construction Access and Cable Route (AC01-AC02)			✓
Unnamed road East of Ballynanleagh, west of T-Junction (Killeena) to East of Ballynanleagh, east of T-Junction (Killeena)	Construction Access and Cable Route (AC02-AC03)			✓
Unnamed road East of Ballynanleagh, east of T-Junction (Killeena) to Garranes crossroads (Garranes)	Construction Access and Cable Route (AC03-AC04)			✓
Unnamed road Garranes crossroads (Garranes) to south of Woodstock (Woodstock)	Construction Access and Cable Route (AC04-AC05)			✓
Unnamed road Woodstock (Woodstock)/Gortnamucky to north of Ballyadam (Ballyadam)	Construction Access and Cable Route (AC05-AC06)			✓
North of Ballyadam (Ballyadam) to Ballyadam (Ballyadam)	Construction Access and Cable Route (AC06-AC07)			✓
R626 and Castle Rock Avenue (Ballyadam (Ballyadam) to Carrigogna/R626 (Carrigogna))	Construction Access and Cable Route (DC01-DC02)			✓
L7617 and Broomfield Ridge (L7822) Carrigogna (Carrigogna) to Ballyspillane East (Ballyspillane East)	Construction Access and Cable Route (DC02-DC03)			✓
Shanty Path (L7620 and L7617) Ballyspillane East (Ballyspillane East) to Roxborough (Roxborough)	Construction Access and Cable Route (DC03-DC04)			✓
L3627 and Shanty Path (L7620) Roxborough (Roxborough) to Churchtown North/N25 (Ballyedekin)	Construction Access and Cable Route (DC04-DC05)			✓

Road Section	Cable Route Section/ Construction Access Route	Ballyadam Site	Cable Route (N25)	Cable Route (Regional/local (off-N25))
L3821 (between Transition Joint Bay at Claycastle Beach and R634) R634/ R908 (Summerfield) to north of Claycastle Beach car park (Summerfield)	Construction Access and Cable Route (DC11-DC12)			✓
Front Strand	Construction Access			✓
R634	Construction Access and Cable Route (DC10-DC11)			✓
L3810/New Line/The Strand	Construction Access			✓
Unnamed road (between the Strand and Clashadonna Roundabout)	Construction Access			✓
Castle Rock Avenue	Construction Access			✓
Local road connection Ballynakilla-Cloneen-Tibbotstown-Forrestown-Labaun-Garrancloyne-Terrysland-Annsgrove-Tullagreen	Construction Access			✓
Unnamed road Knockraha Substation (Ballynanelagh) to crossroads	Construction Access			✓
Crossroads to Upper Killacloyne/Springfield Business Park/Fota Retail and Business Park to Killahora and N25	Construction Access			✓
R624 (to N25)	Construction Access			✓

The primary traffic route in the local area is the N25. The N25 varies between dual and single carriageway National road and provides the main road transport link between Cork and Rosslare Europort via Dunvargan and Waterford. The N25 provides linkage to the broader National primary route network including:

- The M8, a motorway and the main route north between Cork and Dublin; and
- The N72, situated north of the Project Study Area which provides an east west link between the M8 and Dungarvan.

As vehicles will travel to/ from the Project utilising roads outside of the Study Area, and generally via the N25. Beyond the Study Area they will subdivide into smaller traffic volumes and professional judgement therefore suggests that effects relating to roads and traffic across the wider road network outside of the Study Area presented in Figure 11.1 are unlikely to be significant.

11.3.3 Desk-based Research and Data Sources

A desktop study was undertaken to review Project access routes. Constraints and likely sensitive road sections were identified [i.e. locations which are likely to be more vulnerable to change in traffic flow or profile, e.g. potential accident hot spots, high footfall areas, and / or areas in close proximity to a school].

Recorded Personal Injury Collision (PIC) data was obtained from Cork County Council on Thursday 22 October 2020.

Information in relation to existing traffic volumes within the Study Area was obtained from;

- TII Online Data Portal;
- Cork County Council (Thursday 22 October 2020);
- EIAR and TA documents from neighbouring developments, accessed via the Cork County Council Planning Portal, the Department of Housing, Local Government and Heritage's EIA Portal and the Environmental Planning Agency Website; and
- National Transport Model (NToM) Update, Travel Demand Forecasting Report, NToM Volume 3, December 2019, TII, AECOM.

11.3.4 Significance

The IEMA Guidelines infer two-fold rules that can be used to determine both the scale and extent of the assessment of road traffic as a screening process:

- Rule 1 – Include highway links where traffic flows would increase by more than 30% (or the number of Heavy Goods Vehicles (HGVs) would increase by more than 30%).
- Rule 2 – Include any other specifically sensitive areas where traffic flows would increase by 10% or more.

It is acknowledged by the IEMA guidelines that daily variation can vary +/- 10%. As such, it is assumed that projected changes in traffic below 10% means no discernible environmental impact.

Where the predicted increase in traffic volume (whether general or HGV) falls short of these thresholds, the significance of the effects can be termed as not significant. This means that further assessment is not warranted. Consequently, where the predicted traffic flow increase exceeds thresholds, the effects are considered to be potentially significant and accordingly, are assessed in greater detail.

The assessment has clearly identified transport routes which are to be used in connection with the Project. Quantitative assessments have been undertaken alongside the application of professional judgement to determine whether or not the effects are considered to be of significance. Based on the Rule 1 and 2 of the IEMA Guidelines (IEMA, 1993), the predicted significance of the effect was determined considering both the sensitivity of the receiving environment and the magnitude of change against the baseline. As a guide to inform the assessment, but not as a substitute for professional judgement, criteria for determining the significance of traffic related effects are set out in Table 11.4. It should be noted that the assessment considers the effects of the % increase in general traffic HGV+ Light Goods Vehicles and cars (LGV) and also % increase in HGV traffic only based on related baseline traffic flows e.g. % increase in HGVs from existing HGV baseline flow.

The Study Area encompasses a predominantly rural area; as such, all routes have been treated as 'sensitive' and therefore the 10% significance threshold has been applied in view of Rule 2 of the IEMA Guidelines (IEMA, 1993), thereby facilitating a robust assessment.

It is to be noted that, during the operational phase of the Project negligible volumes of traffic generation are anticipated. Considering this, the assessment primarily focuses on the construction phase traffic and transport impacts, with a qualitative summary of the traffic and transport impact during the operational phase and decommissioning phase.

Table 11.4: Effect Significance Matrix

Significance of Effect	% Increase in general traffic (HGV + LGV) volume % Increase in HGV traffic volume
Major (Significant)	Greater than or equal to 60%
Moderate (Significant)	Greater than or equal to 10% and less than 60%
Minor (Not Significant)	Greater than or equal to 5% and less than 10%
None (Not Significant)	Less than 5%

Source: IEMA

The thresholds shown in Table 11.4 have been developed based upon the Rule 2 criteria above as well as the consideration that 'Major' and 'Moderate' effects are significant in the context of Environmental Protection Agency (EPA) Guidelines (2017).

The guidance above does not give thresholds to determine significance associated with driver delay; as such, professional judgement has been applied. For driver delay, using terminology outlined for effect significance in Table 11.4, a similar rationale has been used, with thresholds have been determined and applied as shown below in Table 11.5.

Table 11.5: Driver Delay Effect Significance Matrix

Significance of Effect	Increase in Journey Time
Major (Significant)	31 – 40 minutes
Moderate (Significant)	21 – 30 minutes
Minor (Not Significant)	11 – 20 minutes
None (Not Significant)	0 – 10 minutes

Source: Mott MacDonald

The significance of all effects under consideration is linked to the volume of traffic generated by the Project, therefore it is deemed appropriate to link significance criteria with the scale of the forecast traffic increase. The IEMA Guidelines (IEMA, 1993), also state however that:

"For many effects there are no simple rules or formulae which define the thresholds of significance and there is, therefore, a need for interpretation and judgement on the part of the assessor, backed-up by data or quantified information wherever possible."

As such, professional judgement (led by good practice guidance) has also been applied in the assessment of effects so as to provide more meaningful conclusions in particular where it is not quantifiable by set rules or formulae, particularly in relation to driver delay caused by full or partial road closure and resultant traffic diversion, the assessment of community (pedestrian delay, pedestrian amenity / fear and intimidation) and road safety effects. Information of this nature, gathered from desktop research, where available, in addition to technical knowledge from the wider technical team has also been used.

Furthermore, where baseline traffic flows are very low, it is possible to derive unrealistic determinations of significance when considered against purely numerical assessment criteria. For example, when traffic flow is very low, it is possible to show relatively large traffic increases and for the road to operate well below capacity. Under the numerical criteria defined above, a 60% increase in traffic volume would represent a major effect, but in reality, the effect is likely to be less significant, given the residual capacity of the road.

Effects associated with works which might physically restrict usable road space, thus resulting in localised road or lane closure have also been assessed; considering requirements for diversion and / or journey time delay to traffic by road section.

The following effect classifications are considered;

- Driver Delay;
- Accidents and Safety; and
- Community Effects (Severance, Pedestrian Delay Pedestrian and Cycle Amenity; and Fear and intimidation).

The IEMA Guidelines (1993) also necessitate the consideration of Noise, Visual Impact, Air Pollution and Dust and Dirt which are addressed in other chapters of this EIAR.

The predicted significance of any potential traffic and transport-related environmental impacts has been determined by considering both the sensitivity of the receiving environment and the magnitude of change against the baseline.

The likely duration of an effect is also a relevant consideration and the Environmental Protection Agency have categorised duration of effects in their Draft 2017 guidelines. Potentially of relevance, in respect of the Project, the categories include:

- Brief Effects = Effects lasting less than a day
- Temporary Effects = Effects lasting less than a year
- Short-term Effects = Effects lasting one to seven years

11.3.5 Sensitivity

Subject to guidelines from the IEMA, road links may be highlighted as 'specifically sensitive'. In other words, these portions of road are considered to be more vulnerable to changes in either the profile or volume of flows of traffic.

Within the context of this study and using the IEMA Guidelines for reference, the receptors of sensitivity have been defined in Table 11.6 for various roads links.

Table 11.6 Receptor Sensitivity

Receptor Sensitivity / Importance	Description
High	• Urban/residential roads without pedestrian / cycle facilities that are used by pedestrians
Medium	• Main vehicular route with pedestrian/cycle facilities provided in a built-up area • Congested Junctions, roads with degree of active frontage
Low	• National roads or 'N' class roads constructed to accommodate significant HGV volumes • Strategic vehicular route, such as Regional Roads, in a rural setting with pedestrian/cycle facilities provided • Urban road with limited active frontage and pedestrian/cycle facilities provided
Negligible	• Roads with no significant settlements including new strategic national roads or motorways • Rural road with no/pedestrian cycle facilities provided

Source: IEMA / Mott MacDonald

11.3.6 Magnitude

The magnitude of change has been calculated as the proportional change in traffic flow anticipated on each public road section within the Study Area. This calculation compares the forecast development traffic generation against the baseline traffic during the assumed construction years. It is crucial to ensure that professional judgment is applied in tandem with the criteria stated above; particularly when considering numerical changes in traffic volume.

Given the predominantly rural nature of the environment in which the Project is situated, the rural roads are likely to have small flows. Where baseline traffic flows are very low, it is possible to derive unrealistic determinations of significance when considered against purely numerical assessment criteria. As such, further qualitative criteria have also been employed when assessing magnitude, details of which or provided in Table 11.7 below. This is of particular importance when considering Community Effects.

Table 11.7: Magnitude Criteria

Magnitude	Impact
High / Major (Significant)	Where the proposed development could be expected to have a considerable effect (either positive or negative) on receptors
Medium / Moderate (Significant)	Where the proposed development could be expected to have a noticeable effect (either positive or negative) on receptors
Low / Minor (Not Significant)	Where the proposed development could be expected to result in a small, barely noticeable effect (either positive or negative) on receptors
Negligible (Not Significant)	Where no discernible effect is expected as a result of the proposed development on receptors (i.e. the effect is insignificant)

Source: IEMA

As a guide to inform the assessment, but not as a substitute for professional judgement, criteria for determining the significance of traffic-related effects are set out in Table 11.8 and are based on combining the magnitude of the effect with the receptor sensitivity.

Table 11.8: Significance Assessment Matrix

Magnitude of Change	Sensitivity of Receptor			
	High	Medium	Low	Negligible
High / Major (Significant)	Substantial Adverse	Substantial Adverse	Moderate Adverse	Minor Adverse
Medium / Moderate (Significant)	Substantial Adverse	Moderate Adverse	Minor Adverse	Minor Adverse
Low / Minor (Not Significant)	Moderate Adverse	Minor Adverse	Minor Adverse	Negligible
Negligible (Not Significant)	Minor Adverse	Minor Adverse	Negligible	Negligible

Source: IEMA

Significance is categorised as Substantial Adverse, Moderate Adverse, Minor Adverse or Negligible. Effects deemed to be Substantial Adverse or Moderate Adverse are considered to be Significant and effects that are judged to be Minor Adverse or Negligible are considered Not Significant. The same criteria also apply to positive/beneficial impacts.

11.3.7 Assumptions, Rationale and Limitations

This assessment is based on the detail set out in Chapters 2 and 3 of this EIAR.

It has been necessary to make a number of assumptions to enable the traffic and transport assessment to be undertaken, not least the limitations imposed by the COVID-19 pandemic.

During the COVID-19 pandemic there has been a general trend of reduced traffic on the road, as more people work from home, travel on foot and bike, travel shorter distances and some shops and services have been closed. Because it is difficult to predict when ‘normal’ travel patterns will resume when restrictions are lifted and how patterns of work will change, it is considered robust and reasonable to proceed on the basis of the pre-COVID-19 traffic growth factor applied to future baseline flows.

11.3.7.1 Traffic Forecasting Assumptions

The restrictions placed by the COVID-19 pandemic has resulted in limitations on data collection, in particular site visits and traffic survey counts. As such, efforts have been made to build a profile using available desktop and historical data.

Traffic data for the N25 has been obtained from the TII Data Portal. Directional volumetric data was used to determine the monthly Annual Average Daily Traffic (AADT) for the most recent complete year.

Road capacities relating to national, regional and local roads have been determined using a combination of data sources. For national and regional roads in the Study Area, professional judgement has been applied in determining vehicles per hour (vph) by reviewing road characteristics on Google Street View and referring to road classification descriptors provided in TII Guidance DN-GEO-03031 ‘Rural Road Link Design’ (June 2017). These were then compared to those outlined in DMRB Guidance Volume 5, Part 3 TA 79/99 to determine an equivalent on the basis of said road characteristics. After assignment of a road classification comparing these two sets of guidance, the relevant road capacity (busiest directional flow in vehicles per hour) was noted. For local roads, it has been assumed that, given the rural nature of the Study Area and associated small traffic flows, the local roads be classed as 'minor', and as such hold an AADT of 1000 or fewer, with reference to Temporary Traffic Management Design Guidance (Department of Transport, Tourism and Sport - August 2019). These capacities are considered in Table 11.10.

It is also assumed that for local roads, the capacity percentage of HGVs is assumed to be 10%. Further to this it is assumed that, unless otherwise stated, that local roads have a default speed limit of 80kph, with reference to Guidelines for Classification and Scheduling of Roads in Ireland (2013).

For the purposes of assessment only data relating to 'fatal, 'serious' and 'minor' classified collisions have been included within this study. Collisions resulting in material damage only have therefore been excluded from the assessment.

11.3.7.2 Construction Phase Assumptions

For the duration of works, construction related traffic will take the most appropriate direct route off the N25.

Ballyadam Converter Site

It has been assumed that all concrete deliveries would be sourced from concrete batching plants, located in the wider Cork area. Delivery vehicles in the form of 10m³ lorry capacity trucks (for ready mix concrete and stone) would be routed via the N25 and access the Ballyadam site directly north of the N25 at its southern access point. A 10m³ lorry is typical for the nature of material being transported.

It is assumed that construction personnel will travel to the site from Cork via the N25 for the southern access. The L7642 adjoins the existing western access for the proposed Ballyadam site.

Cable Route along the N25

The number of construction worker vehicles across the network will be negligible, at no more than 10 vehicles (typically cars or small vans) to each worksite.

It is assumed that the four construction teams working on the cable route at any one time are located equidistant from each other along the route and work along the route until the cable joins. This would mean that on the N25 section of the route two construction teams would be working concurrently at different locations along the route.

For this assessment, it is assumed that construction materials (sourced from nearby sources) for works will be temporarily stored within the laydown areas and construction compounds, they will then be distributed to the cable route worksites from these areas and compounds.

It is assumed that the materials will be sourced from quarries within relative proximity situated to the south of the N25 for the Claycastle Beach with access taken via the N25.

For the N25, a lane will always be open during works, which may require use of the hard shoulder and traffic management measures such as temporary traffic signals.

Cable Route along Regional / local rural roads

The same assumptions listed above per the cable route N25 section would apply to the Regional / local rural road section of the cable route during the construction phase.

Cable works will necessitate excavation of an approximately 1m wide trench (the AC and DC cable trenches have specific approximate widths – please refer to Chapters 2 and 3 of Volume 3C), situated either within the carriageway or the adjacent verge space. If this trench is located in the carriageway, this width of trench would require as a minimum a road of 6m width for works to take place (with HGV to the side of the trench). It is assumed that a road closure would then be required for roads of less than 6 metres.

Works taking place at Knockraha are assumed to be minor with regards to vehicle movements, and as such are not considered further in this assessment.

Abnormal Loads

Transformer component deliveries will be required at the Ballyadam and Knockkraha sites; these will require specialist vehicles and will constitute abnormal indivisible loads.

There is potential for one abnormal load (a cable winch) arriving to the Claycastle site, alternatively it may be delivered in sections and assembled on the beach itself.

It is anticipated that there will be one abnormal load delivered to Knockraha substation.

11.3.7.3 Operational Phase Assumptions

During the operational phase of the Project is it assumed that traffic generated by the Project will be negligible, and therefore not significant.

11.3.7.4 Decommissioning Phase Assumptions

The Project is expected to be fully operational by Q4 2026 and have a 40-year operational lifespan. As such it is assumed that the decommissioning phase of the Project will be in 2067. Traffic generation for this phase is assumed to be negligible as the cable can be removed via access chambers; as such, physical civil construction works are not expected.

11.4 Receiving Environment

11.4.1 Road Network and Route Profiles

The road network included in the Study Area was determined on the basis of likely construction routes defined in Section 11.3.2. Confirmation of construction route selection will be agreed with the relevant local authorities/TII when a contractor has been appointed as an integral part of the Construction Traffic Management Plan (CTMP) to be approved by Cork County Council and adopted by appointed contractor(s).

The key characteristics of the defined public road sections in the Study Area have been appraised through desktop study and are set out below in Table 11.9. These are presented graphically in Figure 11.1. Reference is also made to the relevant cable sections, the definitions of which are expanded on in Chapter 2 of this report.

ALCA = Assumed Likely Construction Access, OCR = On Cable Route.

Table 11.9: Road Network and Route Profiles

Section Name	Relevant cable section	Description	Construction Access Route	Cable Route
Ballyadam Convertor Site		This site is located approximately 10km travel distance from the existing Knockraha substation and is nestled between the settlements of Carrigtowhill to the west and Midleton to the east.		
L7642 (bordering proposed Ballyadam Site)	-	1. This road runs along the west perimeter of the Ballyadam site providing access from the West and N25. It is an unmarked road with a 50kph speed limit. A few residential access points are noted near its junction with the N25. Overhanging trees flank the route section. The road narrows north of the access into the Ballyadam site.	Y	N
N25		2. The N25 forms part of the National Road Network in Ireland, connecting Rosslare Europort to Cork. The N25 is a national single carriageway road with a 100kph speed limit including hard shoulder and verges to both sides and features several watercourse crossings. This is a single carriageway, however, at some points along the N25 the directional lanes are separated by an extended central reservation or a steel divider. The road has slip lanes for access to side roads. There are several accesses to farmland and laybys, and a few residences. Several points on the road are marked with 'No overtaking' signage.	Y	N
N25 (from off-cable to M8 junction)	-	3. This is a single carriageway lined with a steel barrier on the eastbound lane and widened central reservation along with hard shoulders to either side. 'No overtaking' signage is observed. At various locations along the length access points were noted into individual residences and businesses. 'No overtaking' signage and a widened central reservation for a turn lane is introduced again on approach to Midleton along with an 80kph speed limit. On approach to Lake View Roundabout the central reservation becomes a grassy verge and separates the two lanes. West of Lake View Roundabout the N25 becomes dual carriageway with a speed limit of 100kph and a hard shoulder. The central reservation is a wide grassy verge. The carriageway passes over the River Owennacurra and again over the main Sherwood Walk road. On approach to Brown Island there is signage for crosswinds and the road passes over the watercourse and later over a railway line. The road maintains dual carriageway up to and beyond its junction with the M8.	Y	N
Cable Route along the N25		The N25 is characterised as a single carriageway with a speed limit of 100kph. The road includes a hard shoulder and verges; the cable will be installed in verge rather than the carriageway, where feasible; this is subject to detailed design assessment, but for purposes of robust assessment it has been assumed that cable will be installed in live road carriageway section.		
N25		See descriptor 2.	Y	Y
N25 (Killeagh)	-	4. This section of the N25 passes through the settlement of Killeagh. Within the built-up area the road is single carriageway with a 50kph speed limit. Parking is also to either side of the carriageway	Y	N

Section Name	Relevant cable section	Description	Construction Access Route	Cable Route
		through Killeagh. Multiple shop and residential frontages as well as a post office and restaurants are observed. St Fergal's National School and St John The Baptist Catholic Church are both situated on the road within Killeagh. Traffic signals are located on Main Street to allow for crossing pedestrians which includes traffic calming measures on approach to the school. Heading out of the settlement of Killeagh there is high-grade pavement installed on either side with trees. On approach to Killeagh from the south there is a vegetated verge by the northbound lane. This section also includes a bridge structure however, no evidence of a weight restriction was observed through desktop study.		
N25 (Castlemartyr)	-	5. This section of the N25 is a single carriageway road with a 60kph limit on westbound approach, reducing to 50kph in the built-up area of Castlemartyr. There are a number of residential frontages onto the road in Castlemartyr. Through the built-up area high-grade paving is observed and a central reservation for vehicles turning into side roads which lead to multiple residential areas. Traffic calming measures are in place for the St Joseph's Catholic Church Castlemartyr National Catholic School and associated 'keep clear' road markings are noted. Signalled crossroads are also observed controlling traffic at the junction with the R632 which runs north south. Through the Main Street section of the route parallel parking is located to the north side of the road. There are multiple receptors here including a pharmacy, post office, convenience stores and other shops. West of Castlemartyr the road becomes more restricted with walling and, briefly, lower-grade road surfacing. Leaving Castlemartyr centre the 60kph speed limit is reintroduced and outside of Castlemartyr itself hard shoulders are introduced to the N25, with the speed limit increasing to 100kph.	Y	N
N25 (between R634 and Clashadonna Roundabout junctions)	-	6. As noted previously this is a 100kph single carriageway road supported with hard shoulder on both sides. Beyond the R634 junction northbound the road becomes two-lane and southbound one lane. Steel barriers are observed to either side of the road and not in the central reservation. Access to the Clashadonna Roundabout is via slip roads off the N25 itself.	Y	N
L3811 (Ballymakeigh Beg and Carrigrostig)	-	7. This rural road has been identified to serve Ladysbridge Quarry and will serve departing HGVs from the T3 section of the cable trench route. It is understood that, from professional judgement HGVs cannot turn around on the N25 itself at their work site and as such would require to route along this section of road to enable them to head westbound on the N25 on departure. At Killeagh, the L3811 is a marked single carriageway 50kph road with multiple accesses to residences. Further away from Killeagh the road becomes more rural. Some gated access to farmland, farms and sharp bends are also observed. The road crosses a watercourse near the junction leading to Carrigrostig. On the road passing through Carrigrostig, the road becomes unmarked and narrower. A few residential access points were also noted along the road and some sharp turns.	Y	N

Section Name	Relevant cable section	Description	Construction Access Route	Cable Route
L7848	-	8. This is a narrow unmarked 80kph rural road. The road includes gated access to farmland, trees and telegraph poles, a watercourse crossing and occasional residential access to individual properties. No restrictions are noted on the crossing.	Y	N
L7849 (to L7848)	-	9. This is a narrow unmarked rural road with a stop sign on approach to N25. Moving away from the N25 junction there is 'Slow' signage, and the road is walled on one side as well as a vegetated verge. Along this road is gated access to farms, farmland and accesses to multiple individual residences.	Y	N
N25		See descriptor 2.	Y	N
N25 (from off-cable to M8 junction)	-	See descriptor 3.	Y	N
Cable Route along Regional / Local Rural Roads		These roads adjoin the N25, connecting with Ballyadam and Knockraha stations and Claycastle Beach. The roads nearest to Claycastle Beach are subject to seasonal tourist traffic. The rural roads off the N25 towards Ballyadam and Knockraha are more rural and limited in their characteristics to cater for larger traffic flows.		
Unnamed road Knockraha Substation (Ballynanelagh) to east of Ballynanleagh (Killeena):	AC01-AC02	10. This is an unmarked rural road with a grassy verge and some informal passing points with gated accesses to farmland. The road passes over watercourse, however, no restrictions were observed to be in place.		Y
Unnamed road East of Ballynanleagh, west of T-Junction (Killeena) to East of Ballynanleagh, east of T-Junction (Killeena)	AC02-AC03	11. This is a narrow, unmarked rural road with some accesses to private properties along the road. Road widens at the adjoining junction.		Y
Unnamed road East of Ballynanleagh, east of T-Junction (Killeena) to Garranes crossroads (Garranes)	AC03-AC04	12. This is an unmarked rural road with some passing areas, gated access to farmland and few accesses to private residences. Stretches of low-grade surfacing are observed on this road.		Y
Unnamed road Garranes crossroads (Garranes) to south of Woodstock (Woodstock)	AC04-AC05	13. This is a single rural road carriageway with signage for a concealed entrance. There are a few accesses to individual properties along the length of the road. Further south the road markings fade but later resume. Overhanging trees were also observed.		Y
Unnamed road Woodstock (Woodstock)/Gortnamucky to north of Ballyadam (Ballyadam)	AC05-AC06	14. This is a narrow, singe track rural unmarked road, and is situated by a rail bridge where the road meets at a junction (no evidence of a weight restriction was observed through desktop study). There are some large trees as well as telegraph poles. There is some access to private residences. At Grangecon Demesne single carriageway resumes, where the roadsides have overhanging trees and		Y

Section Name	Relevant cable section	Description	Construction Access Route	Cable Route
		telegraph poles. Here there are some passing places already established as well as accesses to private residences.		
North of Ballyadam (Ballyadam) to Ballyadam (Ballyadam)	AC06-AC07	15. This is a rural single carriageway road with some overhanging trees as well as a walled edge. A farm is also situated here.		Y
R626 and Castle Rock Avenue (Ballyadam (Ballyadam) to Carrigogna/R626 (Carrigogna))	DC01-DC02	16. This is a 60kph single carriageway rural road which passes over two watercourses including the River Ovennacurra but no restrictions are noted. Access to multiple residences are spread along the road and agricultural businesses. The speed increases to 80kph and stretches of road are observed to be without road markings.		Y
L7617 and Broomfield Ridge (L7822) Carrigogna (Carrigogna) to Ballyspillane East (Ballyspillane East):	DC02-DC03	17. This is an unmarked rural road with telegraph poles. There is much tree cover on this road which limits visibility. There are also stretches of low-grade road surfacing. As for access, there are several residences and farms spread along the road, as well as gated access to farmland. At Broomfield Ridge, the carriageway widens and a small hard shoulder and road markings are introduced. East Cork Golf Club is situated here.		Y
Shanty Path (L7620 and L7617) Ballyspillane East (Ballyspillane East) to Roxborough (Roxborough):	DC03-DC04	18. This is a rural single-track unmarked road with trees on both sides. Visibility is anticipated to be limited along this section of road. The road passes over a watercourse but no restrictions are noted. Multiple accesses into individual residences or farms are spread out along road and there is gated access to farmland. The L7617 is narrower, with a low-grade surfacing in parts. Some sections of road are limited by walling from residences.		Y
L3627 and Shanty Path (L7620) Roxborough (Roxborough) to Churchtown North/N25 (Ballyedekin):	DC04-DC05	19. This is an 80kph single rural road carriageway with walled edges. Homewares shops are noted at the junction with the N25. The desktop study showed that there are no road markings observed for most of this section, however, sharp bends are present. There are multiple residential accesses to individual properties spread out along the road, as well as gated access to farmland. Some portions of the road have broader areas.		Y
L3821 (between Transition Joint Bay at Claycastle Beach and R634) R634/ R908	DC11-DC12	20. The L3821 throughout this section is a single carriageway local road. The route passes next to Aura Youghal Leisure Centre and Summerfield Holiday Park then passes through Cox's Field. There is footway provision from Atlantic Park to the R634 junction. Cox's Field is a hamlet characterised by		Y

Section Name	Relevant cable section	Description	Construction Access Route	Cable Route
(Summerfield) to north of Claycastle Beach car park (Summerfield) (DC11 to DC12):		residential properties fronting the L3821 where it meets the R634. There are traffic management features installed at the junction, including a 'stop' sign at the junction.		
N25		See descriptor 2.	Y	N
N25 (from off-cable to M8 junction):	-	See descriptor 3.	Y	N
Front Strand	-	21. This is a marked single carriageway road connecting Claycastle Beach to the R634. Aura Youghal Leisure centre is situated here. Parking (both on-street and off-street) is provided at points along this road. Access is provided to the beach and Claycastle Pitch and Putt Club. The road width is constricted by brick walls for most of its length. There are multiple terraced residences on the beachfront. At the easternmost point the road splits; a stop line for traffic going left and priority traffic going right. The road then merges with the R634; there is a stop line here.	Y	N
R634	DC10-DC11	22. The R634 is a single carriageway regional road with high quality road surfacing. Perks Entertainment Centre is situated on this road. There are both 'Slow' road markings and double yellow lines on one side with unrestricted sections for residents and locals the other. The road is much higher than 'McCurtains Town' which runs parallel immediately south of this road. At 'Upper Strand', there are several side roads that meet the R634 highlighted with box junctions. On the Upper Strand to the L3821 junction stretch, the road widens, with no parking restrictions, and hard shoulders are introduced. Receptors located here include Youghal Veterinary Clinic, Spar Convenience Store, vehicle dealers and Youghal Tennis Club. The R634 is a single carriageway regional road from the L3821 junction until just before the R633 junction, where the road incorporates a larger central reservation and slip roads to allow for movements to this road. Thereafter the central reservation continues with interspersed turning bays for access to residences along the R634, until it splits as slip roads where it joins the N25. At this split, westbound, the speed limit increases to 100kph onwards to the N25. Eastbound from the N25 off-slip, the speed limit is 80 kph. On most of this road section, there is hard shoulder distinguished by road markings. The R634 runs along the hamlet village of Cox's Yard and several residences and farm buildings.	Y	N
L3810/New Line/The Strand	-	23. This is a single carriageway local road with stop lines and signage where the road meets the R634 and, northbound, has an upward incline. This road includes access to multiple residential roads and access towards a community hospital on a neighbouring road. The speed limit changes to 60kph at which point there are accesses to residences. There is a stop sign and road line where this road adjoins that which connects Parkmountain to Clashadonna roundabout.	Y	N

Section Name	Relevant cable section	Description	Construction Access Route	Cable Route
Unnamed road (between the Strand and Clashadonna Roundabout	-	24. This is a single carriageway 60kph road with steel barriers running along both sides at the junction with The Strand. The speed limit changes to 80kph (signage) with 'no overtaking' central reservation markings, on approach to the roundabout. Central reservation widens to create a turn lane for access to the N25 on-slip.	Y	N
Castle Rock Avenue	-	25. This is an unmarked 50kph rural road with walled sides and lined with overhanging trees. On this road are accesses to individual residences located along the route. The route provides access to a car dealership and a car parts store. There is a signalled railway crossing here featuring signage, barriers and a 'no stopping' box.	Y	N
L7642 (bordering proposed Ballyadam Site)		See descriptor 1.	Y	N
Local road connection Ballynakilla-Cloneen-Tibbotstown-Forrestown-Labaun-Garrancloyne-Terrysland-Annsgrove-Tullagreen	-	26. This narrow local rural road includes multiple accesses to clusters of individual residences in hamlets along this stretch of road and an industrial park. The road has stretches of low-grade surfacing and has a grassy verge, overhanging trees on both sides (some limited visibility on bends) with some access to farmland and farms. There is a reservoir at Cloneen and a church south of Labaun. South of Forrestown there is low-grade surfacing with overhanging trees. On approach to Terrysland the road speed limit changes to 50kph. It is noted that there is a bridge over the railway line that introduces road markings, and the road thereafter widens but markings stop; no restrictions were observed in relation to the bridge so it is assumed to be suitable for HGVs. At Main Street there is a wide central reservation, and, westbound towards the N25 junction, the speed limit changes to 80kph.	Y	N
Unnamed road Knockraha Substation (Ballynanelagh) to crossroads	-	27. This is an unmarked rural road with grassy verge and some informal passing points. There is some access to individual residences. From desktop review it was noted that CleanTech Civils have signs up for Knockraha Substation and part of this road is not permitted, instead to take Reenaslough route, however the date of these signs and length of works is not clear. It is expected that these works will supersede the CleanTech works; as such this will not be relevant during construction.	Y	N
Crossroads to Upper Killacloyne/Springfield Business Park/Fota Retail and Business Park to Killahora and N25	-	28. This is an unmarked rural road with gated access to farmland along the road. At Ballinagaul there are multiple individual residences, a petrol station, a book shop and a convenience store. At the junction, it adjoins a marked single carriageway road. Along its length there are gated access points to farmland and overhanging trees. Southbound the road markings continue, and there is a small former War of Independence site. A small bridge is observed, however, this looks to be capable of accommodating HGVs without restriction noted. South of Upper Killacloyne there are telegraph poles close by. The road is walled on one side on approach to Springhill Business Park. Towards Fota Retail and Business Park the road becomes unmarked and there are accesses to	Y	N

Section Name	Relevant cable section	Description	Construction Access Route	Cable Route
		residences spread out along the road. Here there is access to some residences. There is a rail bridge but no HGV restrictions were noted in the desktop study. There are overhead telegraph wires here as well as access to Carrigtwohill Community College. There is 'Stop' signage and a stop line where the road meets the single carriageway road perpendicular to, and leading to, the N25. On this single carriageway road the central reservation widens for turn lanes into business park areas. Beyond this the on-slip to the N25 has 120kph signage.		
N25		See descriptor 2.	Y	N
N25 (from off-cable to M8 junction)	-	See descriptor 3.	Y	N
L7642	-	See descriptor 1.	Y	N
R624 (to N25)		29. This is a regional road, which takes the form of a bridge over the N25. Here there are 'slow' markings painted with small hard shoulders, lighting columns and steel barriers on both sides. The N25 slips that connects to the R624 is a single carriageway where the central reservation is fortified with small bollards and further signage on approach to the N25.	Y	N

Source: Mott MacDonald

11.4.2 Existing Traffic Flows

Typical capacities for a variety of road types have been determined through a review of TII Guidance DN-GEO-03031 'Rural Road Link Design' (June 2017) in combination with the Design Manual for Roads and Bridges Guidance Volume 5, Part 3. Assumptions applied to determine these can be found in Section 11.3.7.1. These capacities, which are quoted as two way flows in vehicles per hour (vph), are summarised in Table 11.10.

Traffic flow information for roads within the defined Study Area were sourced from a combination of data from the following:

- TII Online Data Portal;
- Cork County Council (Thursday 22 October 2020); and
- EIAR and TA documents from neighbouring developments, accessed via the Cork County Council Planning Portal, the Department of Housing, Local Government and Heritage's EIA Portal and The Environmental Protection Agency.

Where traffic flow data has not been obtained a reasonable assumption has been applied using professional judgement based on knowledge of traffic volumes on adjacent roads. For the purpose of assessment, 246 AADT has been assumed for the rural roads without traffic data within the Study area, and 4,566 AADT for the regional roads. This assumes 3% and 40% of the average flow on the N25 respectively.

Table 11.10 details the existing baseline traffic flows and capacities on the routes within the Study Area considered in the assessment.

Where the construction traffic flows are subject to change due to the construction traffic assessment, roads splitting out these changes are presented below. As such, some roads have been sectioned differently to that presented for other assessments e.g. collision data.

Table 11.10: Route Capacities and Existing Baseline Traffic Count Data

Road Section	Speed Limit (kph)	AADT/ % HGV	Capacity (vph) (two-way hourly flow)
Unnamed road Knockraha Substation (Ballynanelagh) to crossroads	80 (assumed)	246 10%	1000
Unnamed road East of Ballynanleagh, west of T-Junction (Killeena) to East of Ballynanleagh, east of T-Junction (Killeena)	80 (assumed)	246 10%	1000
Unnamed road East of Ballynanleagh, east of T-Junction (Killeena) to Garranes crossroads (Garranes)	80 (assumed)	246 10%	1000
Unnamed road Garranes crossroads (Garranes) to south of Woodstock (Woodstock)	80 (assumed)	246 10%	1000
Unnamed road Woodstock (Woodstock)/Gortnamucky to north of Ballyadam (Ballyadam)	80 (assumed)	246 10%	1000
North of Ballyadam (Ballyadam) to Ballyadam (Ballyadam)	80 (assumed)	246 10%	1000

Road Section	Speed Limit (kph)	AADT/ % HGV	Capacity (vph) (two-way hourly flow)
R626 and Castle Rock Avenue (Ballyadam (Ballyadam) to Carrigogna/R626 (Carrigogna))	80 (assumed)	246 10%	1000
L7617 and Broomfield Ridge (L7822) Carrigogna (Carrigogna) to Ballyspillane East (Ballyspillane East)	80 (assumed)	246 10%	1000
Shanty Path (L7620 and L7617) Ballyspillane East (Ballyspillane East) to Roxborough (Roxborough)	80 (assumed)	246 10%	1000
L3627 and Shanty Path (L7620) Roxborough (Roxborough) to Churchtown North/N25 (Ballyedekin)	80 (assumed)	246 10%	1000
Crossroads to Upper Killacloyne/Springfield Business Park/Fota Retail and Business Park to Killahora and N25	80 (assumed)	246 10%	1000
Maple Lane	80 (assumed)	246 10%	1000
Chestnut Crescent	80 (assumed)	246 10%	1000
Forrestown-Terrysland-Main Street	80 (assumed)	246 10%	1000
L7642	80 (assumed)	246 10%	1000
Castle Rock Avenue	50	246 10%	1000
L7848	80	246 10%	1000
L7849	80 (assumed)	246 10%	1000
L3811	50	246 10%	1000
R634 (DC10-DC11)	60/80 (but 100 on approach to the N25)	4566 10%	2167
New Line	60	246 10%	1000
Front Strand	60 (assumed)	246	1000

Road Section	Speed Limit (kph)	AADT/ % HGV	Capacity (vph) (two-way hourly flow)
		10%	
N25 (Between R624 and Ballyadam/L7642)	100	38980 5%	6667
N25 (Between Ballyadam/L7642 and Healy Brothers exit)	100	38980 5%	6667
N25 (Between Healy Brothers exit and Castle Rock Ave)	100	38980 5%	6667
N25 (Between Rocky Road and Shanty Path)	100	17048 5%	6667
N25 (Between Shanty Path and Castlemartyr) – (DC05-DC06)	100	17048 5%	2650
N25 (Between Castlemartyr and L7849) – (DC07 – DC08)	100	17048 5%	2650
N25 (Between L7849 and L7848) – (DC07 – DC08)	100	17048 5%	1500
N25 (Between L7848 and L3811) – (DC07 -DC08)	100	12658 5%	1500
N25 (Between L3811 to R634 junction) – (DC09 - DC10)	100	12658 5%	2650
R634 junction to Front Strand – (DC10 – DC12)	100	4566 10%	2167
R624	60	4566 10%	2167

Source: a] TII Online Data Portal; [b] Cork County Council Traffic Count Data; [c] Estimated traffic volume; Note: DMRB does not define theoretical capacities for single track roads; [d] 'A local roadway less than 5.5m wide with an AADT of less than 1000 vehicles. All other public roads shall be non-minor roads' from Temporary Traffic Management Design Guidance (Third Edition) Department of Transport, Tourism and Sport (August 2019) (see assumptions). Note: Guidelines for Classification and Scheduling of Roads in Ireland (2013). Department of Transport, Tourism and Sport - . Unmarked local roads assume a default speed limit of 80 kph.

11.4.3 Abnormal Loads Study Summary

Following a review of the Ballyadam and Knockkraha Transformer Transportation reports produced by abnormal load haulage specialists (Exceptional Load Services Ltd.; 29/09/2020 and 24/10/2020 respectively), in total there are to be a minimum of five deliveries of abnormal loads (10 movements for delivery and return, however abnormal load vehicles retract to standard length vehicles for the return journey), comprising:

- One transformer for Knockraha

- Four transformers for Ballyadam

For the abnormal load associated with the Knockraha substation it is assumed that transformer components would be transferred from sea to land at Ringaskaddy Port and then travel to existing Knockraha substation via the following route: Ringaskiddy – N28 – Shanbally – Shannonpark Roundabout – Carr's Hill – Bloomfield Interchange – N40 – Jack Lynch Tunnel – Dunkettle Interchange – M8 – Junction 18 – R639 – L3012 - L3011 – L1540 – L3602 – L7609 – L3604 – L6989. There is also the potential for the components to be transferred from other ports such as Dublin Port, and these will arrive via the M8 Junction 18 adjoining the local route described above.

For abnormal loads associated with the Ballyadam Converter worksite it is proposed that transformer components would be transferred from sea to land at Horgan's Quay and then travel to Ballyadam via the following route: Horgan's Quay (exit contra-flow) - Lower Glanmire Road (N8) – Dunkettle – N25 – Carrigtwohill. There is also the potential for the components to be transferred from other ports such as Dublin Port, and these will arrive via the M8 and N25 adjoining the local route described above.

The abnormal loads study concluded, that for both routes, only minor works involving the relocation or temporary removal of street furniture would be required to safely accommodate abnormal load deliveries. Furthermore, there would be no requirement for incursion into private land and thus no requirement for land acquisition.

All abnormal loads will be transported overnight, and it is therefore probable that associated disruption to road network operation will be minimal.

11.4.4 Tourist and Leisure Use

Within the Study Area for roads and traffic there are a number of local communities, including Carrigtwohill, Midleton, Castlemartyr, Killeagh and Youghal. In addition, there are some smaller residential clusters, including farm buildings and hamlets.

Claycastle Beach, south of Youghal, services seasonal tourism in the summer months and increased traffic due to this is generated on the local road network. The beach, used the year round by walkers, is also a Blue Flag beach and hosts various events including Ironman triathlon, details of which are discussed in Chapter 4 of this EIAR. Events that use other sections of the cable route include the TransAtlanticWay cycle ride and the Cork Standard Triathlon.

The Study Area adjoins multiple locations for both tourism and leisure activities, including recreational routes for cycling and walking, listed out below in Table 11.11. From the desktop study, there are cycling and walking routes that are either subject to road closures, diversions or construction access, either on these roads or on those adjoining are detailed in Table 11.23.

Table 11.11: Existing and Proposed Local Walking and Cycling Routes/Events

Route Type	Description	Location	Existing/Proposed
Cycling	Lane between Chestnut Crescent and Maple Close	Carrigtwohill	Existing
Cycling	Trail between An Tosach and An Guagán	Carrigtwohill	Existing
Cycling	Trail - Fota Rock throughroad	Carrigtwohill	Existing
Cycling	Trail - Riversfield Estate and Coolbawn Court	Midleton	Existing
Walking	Moanbaun Wood - Nature Trail	Watergrasshill	Existing
Walking	Mitchells Wood Loop - Castlemartyr	Castlemartyr	Existing

Route Type	Description	Location	Existing/Proposed
Walking	Pigeon Wood Loop	DC06-DC07	Existing
Walking	Loop - Castlemartyr	Castlemartyr	Existing
Walking/Cycling	Ballintotis Loops - Castle Loop	DC05-DC06	Existing
Walking/Cycling	Ballintotis Loops - Lake Loop	DC05-DC06	Existing
Walking/Cycling	Ballintotis Loops - Woodbine Loop	DC05-DC06	Existing
Walking/Cycling	Ballyannan Woodland Walk	Midleton	Existing
Walking/Cycling	Youghal Green Park	Youghal	Existing
Walking	Amenity Walks (various)	Midleton	Existing
Walking	Pedestrrian Routes (various)	Midleton	Existing
Cycling	Separate Cycle Routes	Midleton	Proposed
Walking/Cycling	Midleton Northern Relief Road (Phase 1) (pedestrian/cycle track)	Midleton	Existing
Walking/Cycling	Separate Cycle Routes (Northern Bypass)	Midleton	Proposed
Cycling	Separate cycle route at and near Maple Lane	Terrysland	Proposed
Cycling	Avoncore Place and Broomfield Court	Midleton	Proposed
Walking/Cycling	Midelton to Youghal Greenway. Work has now commenced on the Greenway project with the clearance of vegetation and obsolete railway sleepers. The Greenway is expected to be complete and operational as a regional tourism resource by the end of 2022, some years prior to construction of the onshore HVDC cable, and indeed completion of the Celtic Interconnector project.	Midleton – Youghal	Existing (complete prior to construction of the Project)
Walking	Youghal Eco Boardwalk between Youghal and Redbarn	Youghal/Redbarn	Existing (complete prior to construction of the Project)
Walking/Cycling	Greenway as part of the Waterrock Urban Expansion Area	Waterrock	Proposed
Cycling	EuroVelo 1 (Celtic Coast, part of Atlantic Coast Route). Route sections under development intersect the N25, passing through Midleton and crossing the cable route on the R634 to Youghal.	Parallel to N25	Proposed
Walking/Cycling	Road upgrades/pedestrian and cycle bridges/Bridge upgrades for pedestrians and cycles (includes rail bridge upgrades and Carrigtwohill Greenway)	Carrigtwohill	Proposed
Walking/Cycling	Upgrades for pedestrians and cycles (R623)	Little Island	Proposed
Walking/Cycling	Pedestrian/Cycling provision	Glounthaune	Proposed
Walking	Development and maintenance of an amenity walk	Knockraha	Proposed
Walking	Walkways	Midleton	Proposed
Walking	Amenity Walk	Castlemartyr	Proposed
Walking	Pedestrian Access	Castlemartyr	Proposed
Walking	Public Footpath Extension	Killeagh	Proposed
Walking	Amenity Walk (Glenbower Wood)	Killeagh	Proposed
Walking/Cycling	Ballinacurra to Midleton Pedestrian/Cycle Loop	Various	Proposed
Walking/Cycling	Bury's Bridge to Carrigtwohill Pedestrian/Cycle Route	Various	Proposed

Source: Sport Ireland Outdoors, Google Maps, Prime2 (Ordnance Survey Ireland), EuroVelo, Cork Cycle Network Plan 2017; Cork County Council Local Area Plans (Cobh and East Cork), Midleton Town Development Plan (2013), Cork County Council website.

The routes listed above are shown in Appendix 11.1. From anecdotal knowledge and assessment of the nature of the roads within the Study Area it is considered that both pedestrian and cycling volumes are expected to be low.

11.4.5 Public Transport

Within the vicinity of the project several bus routes have been identified via outcome of a desktop study. Table 11.12 summarises the local services and their associated frequencies, visualised in Figure 11.2 with a larger version provided in Appendix 11.1. Due to the rural location some bus services were noted to be irregular in frequency and not all services were for the full route extent. Further to this, Carrigtwohill West and Water Rock rail stations, whilst proposed, do not look to be in operation before construction takes place for the Project, and so have not been included below.

Table 11.12: Local Bus and Rail Routes

Service Number	Route Summary	Service Operator	Weekday Frequency (Mon-Fri) (Two-way)	Existing/Proposed
40	Tralee Bus Station - Rosslare Harbour	Bus Éireann	13 hourly at Youghal in either direction daily	Existing
240	Cork Bus Station - Ballycotton	Bus Éireann	Between 08:00 and 18:00: 10 services in total between these times	Existing
214	Cork – Knockraha	Bus Éireann	Between 07:30 and 23:00: 32 services in total between these times (service every half hour) and Between 07:00 and 23:30: 34 services in other direction (service every half hour)	Existing
221	Cork City - Knockraha	Bus Éireann	Between 07:00 and 19:00: 5 services in total between these times	Existing
241	Cork Bus Station - Trabolgan	Bus Éireann	Between 07:00 and 00:00: 13 services in total between these times at Midleton	Existing
260	Cork-Ardmore	Bus Éireann	Between 07:00 and 23:00: 6 services from Cork and nine services from Youghal	Existing
261	Cork Bus Station – Carrigtwohill – Midleton - Ballinacurra	Bus Éireann	Between 08:00 and 23:00: 15 services at Midleton between these times in each direction	Existing
Rail Service	Midleton - Cork	Irish Rail	Approximately every half hour – hour daily for each direction	Existing
Rail Service	Cork – Glounthaune - Cobh	Irish Rail	Approximately every half hour – hour daily for each direction	Existing
Little Island	Rail Station	-	-	Existing
Midleton	Rail Station	-	-	Existing
Fota	Rail Station	-	-	Existing
Carrigtwohill	Rail Station	-	-	Existing
Glounthaune	Rail Station	-	-	Existing

Service Number	Route Summary	Service Operator	Weekday Frequency (Mon-Fri) (Two-way)	Existing/Proposed
Carrigaloe	Rail Station	-	-	Existing

Source: https://www.transportforireland.ie/getting-around/by-bus/route-maps/; https://www.buseireann.ie/ ; Cork Transport Strategy 2040.

Figure 11.2: Public Transport Links

Source: Mott MacDonald based on Ordnance Survey OpenData/Transport for Ireland/Cork Transport Strategy 2040/Irish Rail

Public transport that may be affected by localised closures is listed in Table 11.23.

11.4.6 Collision Data

Recorded Personal Injury Collision (PIC) data (Road Safety Authority) was obtained from Cork County Council (22 October 2020) for the period 2010-2017, the most recent available data. In line with guidelines, data has been reviewed for the five-year period, 2013-2017 inclusive. Within the Study Area there were 105 collisions recorded between 2013 and 2017, of which:

- 75 classified 'Minor Injury';
- 13 classified 'Serious Injury'; and;
- 5 classified 'Fatal'.

Plans showing the location and severity of these collisions is provided in Appendix 11.1.

Recorded PIC are tabulated by Study Area location Table 11.13. Where no collisions were recorded on a public road section within the Study Area 'Not Applicable' has been listed thereafter.

Table 11.13: Collisions by Route Section and Serving Roads

Route Section	No. of Collisions 2013 – 2017	Assessment
Ballyadam Site:		
N25 (note this road also serves regional/local (off-N25) cable route and N25 cable route)	-	See section 'Cable Route along the N25'
Cable Route along the N25:		
N25 (note this road also serves regional/local (off-N25) cable route and Ballyadam site)	• DC05-DC06: 6 (2 fatal, 2 serious, 2 minor) • Non-cable portion (Castlemartyr): 10 (9 minor, 1 serious) • DC07-DC08: 0 • Non-cable portion (Killeagh): 8 (minor) • DC09-DC10: 3 (minor)	• There were 27 recorded PICs during the 5-year period ending 2017. • Of the 27 collisions recorded, 2 resulted in fatal injuries, 3 in serious injuries and 22 in minor injuries • The two fatal collisions involved pedestrians.
N25 (from off-cable to M8 junction)	• Non-cable portion: 46 (2 fatal, 7 serious, 37 minor)	• There were 46 recorded PICs during the 5-year period ending 2017. • Of the 46 recorded, 2 resulted in fatal injuries, 7 in serious injuries and 37 in minor injuries. • Of these collisions, three involved pedestrians. • Of these collisions, seven involved a single vehicle.
L3811	• 2 (minor)	• There were 2 recorded PICs during the 5-year period ending 2017, both resulted in minor injuries.
Cable Route along Regional / Rural Roads:		
N25 (note this road also serves the N25 cable route)	-	See section 'Cable Route along the N25'
Unnamed road East of Ballynanleagh, east of T-Junction (Killeena) to Garranes crossroads (Garranes) (AC03-AC04)	• 1 (Minor)	• There was 1 recorded PIC during the 5-year period ending 2017, resulting in minor injuries.
Unnamed road Woodstock (Woodstock)/Gortnamucky to north of Ballyadam (Ballyadam) (AC05-AC06)	• 3 (minor)	• There were 3 recorded PICs during the 5-year period ending 2017, resulting in minor injuries. • Of these collisions, one involved a single vehicle.
R626 and Castle Rock Avenue (Ballyadam (Ballyadam) to Carrigogna/R626 (Carrigogna)) (DC01-DC02)	• 2 (minor)	• There were 2 recorded PICs during the 5-year period ending 2017, resulting in minor injuries.
L3627 and Shanty Path (L7620) Roxborough (Roxborough) to Churchtown North/N25 (Ballyedekin) (DC04-DC05)	• 1 (serious)	• There was 1 recorded PIC during the 5-year period ending 2017. • This PIC resulted in serious injuries.

Route Section	No. of Collisions 2013 – 2017	Assessment
R634 (between N25 and L3821) (DC10-DC11) and between L3821 and Front Strand	• DC10-DC11: 2 (1 fatal, 1 minor) • Non-cable portion: 4 (2 serious, 2 minor)	• There were 6 recorded PICs during the 5-year period ending 2017. • Of the 6 recorded, 1 resulting in fatal injuries, 2 resulting in serious injuries and 3 resulting in minor injuries. • Of these collisions, two involved pedestrians, and two involved a single vehicle.
L3810/New Line/The Strand	• Non-cable portion: 2 (minor)	• There were 2 recorded PICs during the 5-year period ending 2017, resulting in minor injuries. • Both collisions involved a single vehicle.
Unnamed road (between the Strand and Clashadonna Roundabout)	• Non-cable portion: 1 (minor)	• There was 1 recorded PIC during the 5-year period ending 2017, resulting in minor injuries.
Crossroads to Upper Killacloyne/Springfield Business Park/Fota Retail and Business Park to Killahora and N25	• Non-cable portion: 2 (minor)	• There were 2 recorded PICs during the 5-year period ending 2017, resulting in minor injuries.

Source: RSA. Data supplied by Cork County Council.

Table 11.14: Cluster Analysis

Location	Number of collisions within 100m/200m radius of each other	Description of Collisions
N25 (at junction with R623)	2 (120m apart)	Two collisions located on the westbound lanes of the N25. Both are of 'Minor' severity and occurred in 2015. One happened in the morning and the other late afternoon and are of differing collision types (rear-end, straight and head-on, conflict) thereby causation is unlikely to be the same and no cluster is determined.
N25 (above Brown Island)	5 (143m apart)	One fatal and four minor collisions, mostly on the westbound lanes of the N25. One collision per year, apart from 2016 where there were two collisions, both minor and rear-end and straight in nature. All rear-end and straight collisions (3) occurred in the morning, which include the two in 2016. However, these two 2016 collisions occurred at different times of the year. Further to this, two of the collisions, whilst they occurred immediately next to each other, occurred in the morning and evening in July and January respectively, and are of differing collision severity. The frequency of collisions, circa 1 per year, indicates there is no cluster here.
N25 (at junction with R624)	2	Two collisions, one serious and one slight, occurring in 2014 and 2015, and in the morning and evening respectively. However, both collisions happened in March. One involved a pedestrian and one was a rear end, straight collision. For the reasons stated above it is unlikely that these have a related cause.
N25 (Carrigtwohill)	2 (186m apart)	One serious and one fatal collision located on the eastbound lanes of the N25. Both involved pedestrians; a review of Google Street View showed that there is pavement that is separated from the carriageway by a steel barrier before it adjoins. The collisions occurred early in the morning and in the evening in January and December (both in 2013) respectively, which suggests that visibility may be a factor. Within the 2013-2017 dataset there have been no collisions here since, however more recent data may indicate further collisions at this location.
N25 (at junction with R629)	5 (at roundabout)	Five collisions located at the N25/R629 roundabout, all of minor severity. Each of the collisions is in a different year; two of which occurred in the morning, one at midday, one in the afternoon and one in the evening. Two collisions were Rear-end and straight in nature, but occurred at different times of the day and year in different years. For the reasons stated above it is unlikely that these have a related cause.
N25 (east of Midleton)	2	Two collisions, one serious and one slight, occurring in 2014 and 2016 respectively. The collisions were of differing natures and times in the day, but both occurred in April. For the reasons stated above it is unlikely that these have a related cause.
N25 (west of Castlemartyr adjoining residential bay road)	3 (175m apart)	Three collisions; 2 fatal and 1 slight. All occurred in different years but all were in the morning. These happened between April and June. Both fatals involved pedestrians; possibly attributed to a local walk route, Pigeon Wood Loop. These fatals also occurred where the residential slip road adjoins the N25. No further information is available as to whether Cork County Council have reviewed this location in response to the fatalities or provided improvements here. It is recommended any road closures or diversion routes in this location need to ensure TMP measures provide safe access to the Pigeon Wood Loop walking route.'
N25 (west of Castlemartyr)	2 (145m apart)	Two collisions; one serious and one slight. These occurred in 2016 and 2017, at different times of the year and day. No collision type is provided, but suggests there is not a factor connecting the two.
Castlemartyr	7	All minor in severity. Two of the collisions, whilst they occurred in different years (three years apart), happened in a similar location, both in the same hour (17:00-18:00) but occurred in April and October. Both these collisions were rear-end and straight in nature. Another two

Location	Number of collisions within 100m/200m radius of each other	Description of Collisions
		collisions, also similar in location (but three years apart), took place in the hour 14:00-15:00 and were head-on conflicts. We would note that these occurred within a built-up area where naturally more collisions occur due to the increase in manoeuvres and close contact of vehicles. The time difference in years between collisions indicates that there is no likely related cause.
Killeagh	7	These collisions were all of minor severity. Three occurred in 2013, two in 2014, one 2016 and one 2017. Two of the 2013 collisions occurred 17:00-18:00 but had different collision types; one involving a pedestrian and one rear-end and straight. Two of the 2013 collisions also occurred in the same month but had different collision types. Two collisions involved pedestrians but, whilst they occurred in the same month, occurred in different years and 0.2km apart. Two collisions above the River Dissour occurred late at night/early morning and were single vehicles only. These both occurred in summer months, in 2013 and 2014. Since 2017, works carried out at Killeagh has created greater pedestrian space as well as traffic calming measures, which may well influence the collision rate, however more recent collision data was not available.
R634	2 (91m apart)	Two collisions; one serious and one slight. Both these collisions occurred at different times of the year, day, in different years and collision type, therefore it is unlikely that these collisions have a related cause.

Source: RSA (via CCC), Mott MacDonald

Roads and cable route sections that have no recorded collisions in the 2013-2017 period include:

- Unnamed road Knockraha Substation (Ballynanelagh) to east of Ballynanleagh (Killeena) (AC01-AC02)
- Unnamed road East of Ballynanleagh, west of T-Junction (Killeena) to East of Ballynanleagh, east of T-Junction (Killeena) (AC02-AC03)
- Unnamed road Garranes crossroads (Garranes) to south of Woodstock (Woodstock) (AC04-AC05)
- North of Ballyadam (Ballyadam) to Ballyadam (Ballyadam) (AC06-AC07)
- L7617 and Broomfield Ridge (L7822) Carrigogna (Carrigogna) to Ballyspillane East (Ballyspillane East) (DC02-DC03)
- Shanty Path (L7620 and L7617) Ballyspillane East (Ballyspillane East) to Roxborough (Roxborough) (DC03-DC04)
- N25 (DC07-DC08)
- L7642 (bordering proposed Ballyadam site)
- N25 (between R634 and Clashadonna roundabout)
- L7848
- L7849
- Front Strand
- Castle Rock Avenue
- Local road connection Ballynakilla-Cloneen-Tibbotstown-Forrestown-Labaun-Garrancloyne-Terrysland-Annsgrove-Tullagreen
- Unnamed road Radhard Na Tuaithe/Ballyvinny/ Killalough
- Unnamed road Knockraha Substation (Ballynanelagh) to crossroads
- Midleton Northern Relief Road (Phase 1)
- R624 (above N25)

11.4.7 Future Baseline Traffic

This section outlines traffic conditions anticipated within the Study Area, in the absence of the Project.

11.4.7.1 Planned Changes to the Road Network

TII in conjunction with Cork County Council are progressing plans for an upgrade to the N25 corridor between Carrigtwohill and Midleton. This includes upgrading the part of the existing N25 between Carrigtwohill and Midleton, including that portion which adjoins the proposed converter station site. This road project will involve the expansion of the existing road corridor to dual carriageway. A number of potential options affecting the wider IDA landholding at Ballyadam are currently being considered by the Roads Design Office (RDO), including the provision of a full dumb-bell interchange at Ballyadam, with associated slip roads, on the southern portion of the overall landholding. The options are available to view on the N25 Brochure published by Cork County Council's RDO in October 2020.

The project is also included in Project Ireland 2040 and the National Development Plan 2018-2027.There is potential for an overlap in construction for the period of 2025-2026. Whilst this will be an improvement to the N25 construction is not anticipated to commence until 2025 and as such it will not be in place during the construction of the Project.

Prior to commencement of construction and during the construction phase engagement with the RDO and TII will continue and where there is potential for works to be carried out in parallel, appropriate mitigation measures will be implemented including the scheduling of works and regular liaison meetings between project teams to ensure that plans are co-ordinated and impacts are minimised.

11.4.7.2 Future Baseline Traffic Flow

This assessment considers the effects due to the traffic generated during the construction phase of the Project. Construction is scheduled over a three-year programme, with commencement in February 2023 and completion in December 2026. Safety requirements for the installation operations / procedures and weather conditions may ultimately dictate the final programme.

In the absence of the Project, it has been assumed that local road network traffic flows will increase broadly in line with [National Transport Model Update, Travel Demand Forecasting Report, NTpM Volume 3, TII, AECOM, December 2019]. The level of this increase is assessed to be 'Low'. Low growth of traffic has been assumed given that the Study Area of the Project is sparsely populated. The likelihood of high or medium levels of traffic growth would be used were there to be a drastic increase in car ownership and population in the area during or prior to the construction of the Project, which is not foreseen. Table 11.15 outlines the growth factors used to uplift traffic flows on the local road network. Table 11.16 lists forecast future baseline traffic flows.

Table 11.15: Future Year Scenario Growth Rates

Future Year Scenario	Growth Rate from 2019
2023	5.10%
2024	6.37%
2025	7.65%

Table 11.16: Future Baseline Traffic Flow Data

Road	2023 Average Daily Traffic Flow		2024 Average Daily Traffic Flow		2025 Average Daily Traffic Flow	
	Total Two-Way Vehicles	HGV Only	Total Two-Way Vehicles	HGV Only	Total Two-Way Vehicles	HGV Only
Unnamed road Knockraha Substation (Ballynanelagh) to crossroads	256	26	259	26	262	26
Unnamed road East of Ballynanleagh, west of T-Junction (Killeena) to East of Ballynanleagh, east of T-Junction (Killeena)	256	26	259	26	262	26
Unnamed road East of Ballynanleagh, east of T-Junction (Killeena) to Garranes crossroads (Garranes)	256	26	259	26	262	26
Unnamed road Garranes crossroads (Garranes) to south of Woodstock (Woodstock)	256	26	259	26	262	26
Unnamed road Woodstock (Woodstock)/Gortnamucky to north of Ballyadam (Ballyadam)	256	26	259	26	262	26
North of Ballyadam (Ballyadam) to Ballyadam (Ballyadam)	256	26	259	26	262	26
R626 and Castle Rock Avenue (Ballyadam (Ballyadam) to Carrigogna/R626 (Carrigogna))	256	26	259	26	262	26
L7617 and Broomfield Ridge (L7822) Carrigogna (Carrigogna) to Ballyspillane East (Ballyspillane East)	256	26	259	26	262	26
Shanty Path (L7620 and L7617) Ballyspillane East (Ballyspillane East) to Roxborough (Roxborough)	256	26	259	26	262	26
L3627 and Shanty Path (L7620) Roxborough (Roxborough) to Churchtown North/N25 (Ballyedekin)	256	26	259	26	262	26

Road	2023 Average Daily Traffic Flow		2024 Average Daily Traffic Flow		2025 Average Daily Traffic Flow	
	Total Two-Way Vehicles	HGV Only	Total Two-Way Vehicles	HGV Only	Total Two-Way Vehicles	HGV Only
Crossroads to Upper Killacloyne/Springfield Business Park/Fota Retail and Business Park to Killahora and N25	256	26	259	26	262	26
Maple Lane	256	26	259	26	262	26
Chestnut Crescent	256	26	259	26	262	26
Forrestown-Terrysland-Main Street	256	26	259	26	262	26
L7642	256	26	259	26	262	26
Castle Rock Avenue	256	26	259	26	262	26
L7848	256	26	259	26	262	26
L7849	256	26	259	26	262	26
L3811	256	26	259	26	262	26
R634	4799	480	4857	486	4915	492
New Line	256	26	259	26	262	26
Front Strand	256	26	259	26	262	26
N25 (Between R624 and Ballyadam/L7642)	40967	1885	41464	1907	41961	1930
N25 (Between Ballyadam/L7642 and Healy Brothers exit)	40967	1885	41464	1907	41961	1930
N25 (Between Healy Brothers exit and Castle Rock Ave)	40967	1885	41464	1907	41961	1930
N25 (Between Rocky Road and Shanty Path)	17917	806	18135	816	18352	826
N25 (Between Shanty Path and Castlemartyr) – (DC05 – DC06)	17917	806	18135	816	18352	826
N25 (Between Castlemartyr and L7849) – (DC07-DC08)	17917	806	18135	816	18352	826
N25 (Between L7849 and L7848) – (DC07-DC08)	17917	806	18135	816	18352	826

Road	2023 Average Daily Traffic Flow		2024 Average Daily Traffic Flow		2025 Average Daily Traffic Flow	
	Total Two-Way Vehicles	HGV Only	Total Two-Way Vehicles	HGV Only	Total Two-Way Vehicles	HGV Only
N25 (Between L7848 and L3811) – (DC07-DC08)	13304	599	13465	606	13626	613
N25 (Between L3811 to R634 junction) – (DC09-DC10)	13304	612	13465	619	13626	627
R634 junction to Front Strand – (DC10-DC11)	4799	480	4857	486	4915	492
R624	4799	480	4857	486	4915	492

Source: Mott MacDonald

11.4.8 Planned Developments

A desktop study was undertaken to understand nearby developments that have potential to contribute traffic to the local network during the construction and operation of the Project. These include the following:

- N25 Carrigtwohill to Midleton Bypass
- Urban Expansion Areas of Midleton and Carrigtwohill

With reference to Table 4.2 of Vol 3C1, there are several planned developments that may result in a cumulative impact in tandem with the construction of the Project. Youghal to Midleton Greenway is set to be complete by 2023 and will therefore not affect construction traffic. Given the levels of information available at the time of producing this EIAR means that a conclusive assessment of cumulative effects from construction traffic attributed to other projects has not been produced at this time, however this will be mitigated through continual liaison with the relevant stakeholders.

11.5 Likely Significant Impacts of the Development

Likely significant impacts from the Project assessed are be summarised as follows:

- Driver delay: disruption and delay to users of roads from cable installation work in road corridors;
- Driver delay: disruption and delay to users of roads as a result of the additional traffic movements that will be generated by the Project; and
- Community Effects: Disruption and delay of users of footpaths and cycle paths from cable installation work in or adjacent to active travel infrastructure;
- Accidents and Safety: Detrimental impact on road safety as a result of the additional traffic movements that will be generated by the Project.

11.5.1 Construction Phase

Assessment of the magnitude of construction related effects have been derived with reference to both the IEMA Guidelines and the EPA Guidelines.

As detailed in Chapter 3 of the EIAR, the overall construction period durations are as follows;

- Proposed Ballyadam Converter Station – 12 months
- Proposed Cable Route along the N25 – 7 months
- Proposed Cable Route along Regional / local rural roads – 8 Months

All construction activities in relation to traffic and transport will be undertaken between the working hours of 7am-7pm on a Monday to Friday and 7am-2pm on a Saturday.

Due to the nature of works taking place for Ballyadam and the cable route, different peak periods are envisaged. As such, these are both presented below in Table 11.17, highlighting the relevant peak period to present worst case scenarios and thus provide a suitable basis for robust assessment.

The duration of the peak for the Ballyadam and cable route portion of the works are 3 months and 11 months respectively.

The assessed number of traffic movements generated by construction activity for each site are summarised in Table 11.18..

Table 11.17: Construction Related Traffic Flows

Road	Ballyadam Peak Period Average Daily Traffic Flow – 3 months		Cable Route Peak Period Average Daily Traffic Flow – 11 months		Ballyadam + Cable Route (combined) Peak Period Average Daily Traffic Flow – 1 month	
	Total Two-Way Vehicle Movements	Total HGV Movements	Total Two-Way Vehicle Movements	Total HGV Movements	Total Two-Way Vehicle Movements	Total HGV Movements
Unnamed road Knockraha Substation (Ballynanelagh) to crossroads	0	0	30	30	0	0
Unnamed road East of Ballynanleagh, west of T-Junction (Killeena) to East of Ballynanleagh, east of T-Junction (Killeena)	0	0	30	30	0	0
Unnamed road East of Ballynanleagh, east of T-Junction (Killeena) to Garranes crossroads (Garranes)	0	0	30	30	0	0
Unnamed road Garranes crossroads (Garranes) to south of Woodstock (Woodstock)	0	0	0	0	29	29
Unnamed road Woodstock (Woodstock)/Gortnamucky to north of Ballyadam (Ballyadam)	0	0	0	0	29	29
North of Ballyadam (Ballyadam) to Ballyadam (Ballyadam)	0	0	0	0	29	29
R626 and Castle Rock Avenue (Ballyadam (Ballyadam) to Carrigogna/R626 (Carrigogna)	0	0	30	30	0	0
L7617 and Broomfield Ridge (L7822) Carrigogna (Carrigogna) to Ballyspillane East (Ballyspillane East)	0	0	0	0	29	29
Shanty Path (L7620 and L7617) Ballyspillane East (Ballyspillane East) to Roxborough (Roxborough)	0	0	0	0	29	29

Road	Ballyadam Peak Period Average Daily Traffic Flow – 3 months		Cable Route Peak Period Average Daily Traffic Flow – 11 months		Ballyadam + Cable Route (combined) Peak Period Average Daily Traffic Flow – 1 month	
	Total Two-Way Vehicle Movements	Total HGV Movements	Total Two-Way Vehicle Movements	Total HGV Movements	Total Two-Way Vehicle Movements	Total HGV Movements
L3627 and Shanty Path (L7620) Roxborough (Roxborough) to Churchtown North/N25 (Ballyedekin)	0	0	0	0	29	29
Crossroads to Upper Killacloyne/Springfield Business Park/Fota Retail and Business Park to Killahora and N25	0	0	30	30	0	0
Maple Lane	0	0	30	30	29	29
Chestnut Crescent	0	0	30	30	29	29
Forrestown-Terrysland-Main Street	0	0	30	30	29	29
L7642	0	0	30	30	29	29
Castle Rock Avenue	0	0	30	30	29	29
L7848	0	0	30	30	29	29
L7849	0	0	30	30	0	0
L3811	0	0	0	0	29	29
R634	0	0	0	0	29	29
New Line	0	0	0	0	29	29
Front Strand	0	0	0	0	29	29
N25 (Between R624 and Ballyadam/L7642)	200	0	140	60	169	29
N25 (Between Ballyadam/L7642 and Healy Brothers exit)	286	286	120	120	58	58
N25 (Between Healy Brothers exit and Castle Rock Ave)	0	0	30	30	29	29
N25 (Between Rocky Road and Shanty Path)	0	0	30	30	29	29

Road	Ballyadam Peak Period Average Daily Traffic Flow – 3 months		Cable Route Peak Period Average Daily Traffic Flow – 11 months		Ballyadam + Cable Route (combined) Peak Period Average Daily Traffic Flow – 1 month	
	Total Two-Way Vehicle Movements	Total HGV Movements	Total Two-Way Vehicle Movements	Total HGV Movements	Total Two-Way Vehicle Movements	Total HGV Movements
N25 (Between Shanty Path and Castlemartyr) – (DC05 – DC06)	0	0	30	30	29	29
N25 (Between Castlemartyr and L7849) – (DC07-DC08)	0	0	90	90	118	118
N25 (Between L7849 and L7848) – (DC07-DC08)	0	0	90	90	118	118
N25 (Between L7848 and L3811) – (DC07-DC08)	0	0	60	60	118	118
N25 (Between L3811 to R634 junction) – (DC09-DC10)	0	0	60	60	89	89
R634 junction to Front Strand – (DC10-DC11)	0	0	0	0	59	59
R624	0	0	60	60	29	29

Source: Mott MacDonald

11.5.1.1 Predicted Construction Effects

As presented in Table 11.18, overall, approximately 291,074 movements, of which approximately 94,854 movements will be HGV movements, will be generated by the Project over the approximate 28 months construction period. The main source of these movements can be attributed to the convertor station at Ballyadam, off the N25. Any work undertaken on the cable routes will be of a temporary nature at any one location, even if, overall, the construction traffic is utilising the same road network.

As such, the main construction effects stem from works on the cable route and access to the main sites at connection point, Ballyadam convertor station and landfall area, but not the site themselves. As such, these have not been considered further in the assessment.

Table 11.18: Vehicle Movements Summary

Activity	Vehicle Type	Details/ Deliveries	Total Vehicle Movements
Ballyadam Converter Station	HGV		34,354
	LGV		92,200
N25 Cable Route	HGV		29,550
	LGV		51,240
Non N25 Cable Route, including Claycastle			
	HGV		30,950
	LGV		52,780
TOTAL HGV TRAFFIC MOVEMENTS			**94,854**
TOTAL LGV TRAFFIC MOVEMENTS			**196,220**
TOTAL TRAFFIC MOVEMENTS			**291,074**

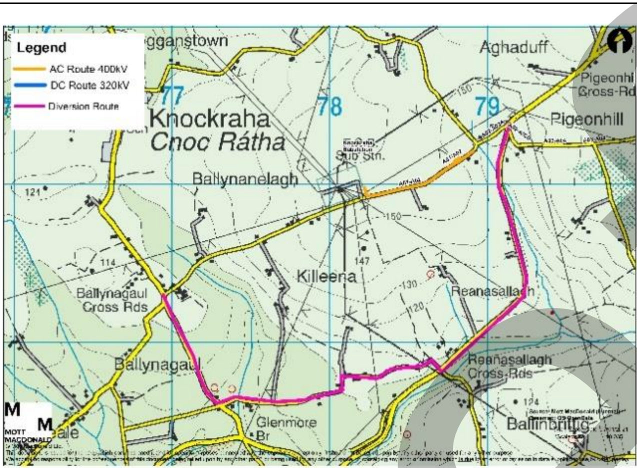
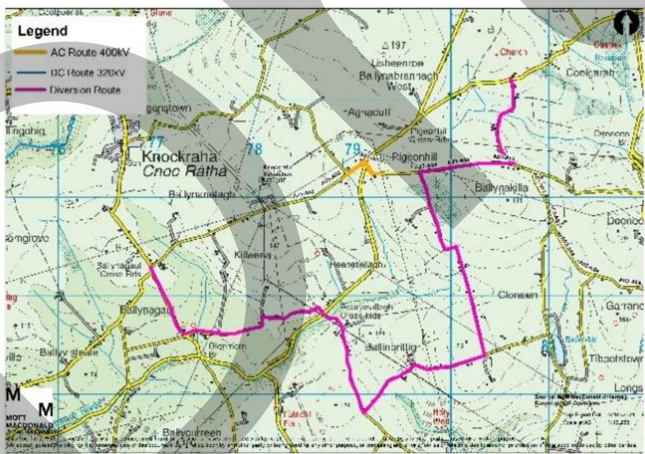
Source: Mott MacDonald

Construction related effects such as driver delay, have potential to arise as a result of the construction worksites associated with cabling works physically restricting usable road space. In some cases, this will manifest in a requirement for localised road or lane closure. Where whole road or lane closure is likely to be required the associated effects have been assessed.

Several diversion routes are available for vehicular traffic if required due to road closures associated with cable route sections. These are indicative routes and are summarised below in Table 11.19: Traffic Diversion Routes

. Note that road closure duration relates to cut, fill and cable installation, and any additional works required may incur more time.

Table 11.19: Traffic Diversion Routes

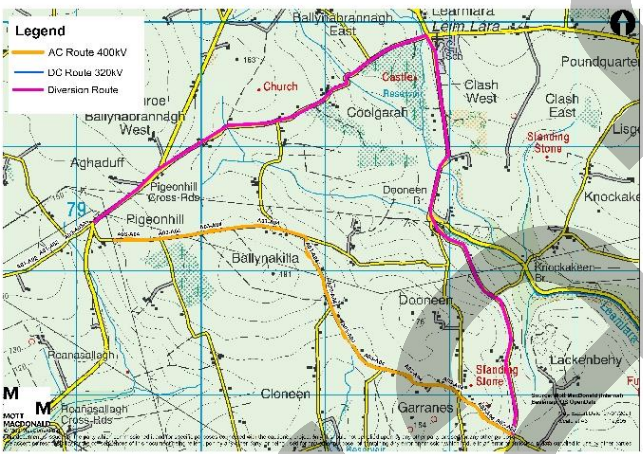
Road Section (Location) [Cable Route Section]	Diversion Route Plan *Duration of diversion, length of diversion route (decision point to decision point) and associated typical additional travel time*
Unnamed road Knockrahaha Substation (Ballynanelagh) to East of Ballynanleagh (Killeena) (AC01-AC02)	 *Approximate period that diversion route will be in place = 16 days.* *Additional length of diversion route = 1.7km* *Approximate additional traffic time = 4 mins* *Impact on Public Transport Route = No* *Length of cable route section closure (including distance between route and decision points) – 2.5km, 3 mins. Diversion – 4.2km, 7 mins.*
Unnamed road East of Ballynanleagh, west of T-Junction (Killeena) to East of Ballynanleagh, East of T-Junction (Killeena) – in road (AC02-AC03)	 *Approximate period that diversion route will be in place = 11 days* *Additional length of diversion route = (East and West) 4km; (North) 7.9km* *Approximate additional traffic time = (East and West) 10 mins; (north) 13 mins* *Impact on Public Transport Route = No*

Road Section (Location) [Cable Route Section]

Diversion Route Plan
Duration of diversion, length of diversion route (decision point to decision point) and associated typical additional travel time

Length of cable route section closure (including distance between route and decision points) (East and West) – 3.1km 4 mins; (North) – 3.2km, 4 mins. Diversion (East and West) - 7.1km, 14 mins; (North) – 11.1km, 17 mins.

Unnamed road East of Ballynanleagh, East of T-Junction (Killeena) to Garranes crossroads (Garranes)
(AC03-AC04)



Approximate period that diversion route will be in place = 12 weeks.
Additional length of diversion route = 2.4km
Approximate additional traffic time = 1 min
Impact on Public Transport Route = No
Length of cable route section closure (including distance between route and decision points) – 4.3km, 6 mins. Diversion – 6.7km, 7 mins

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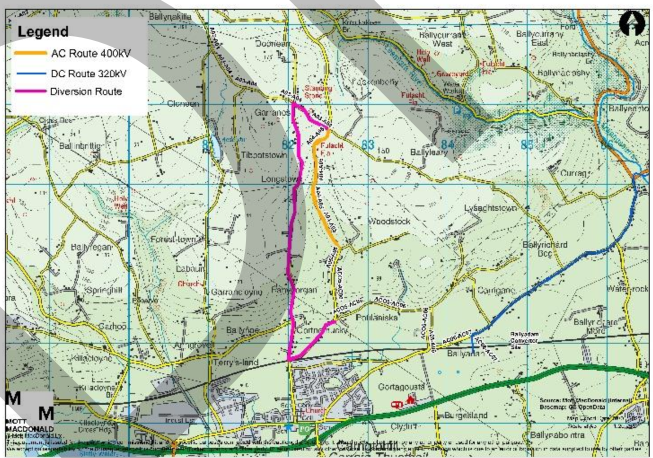
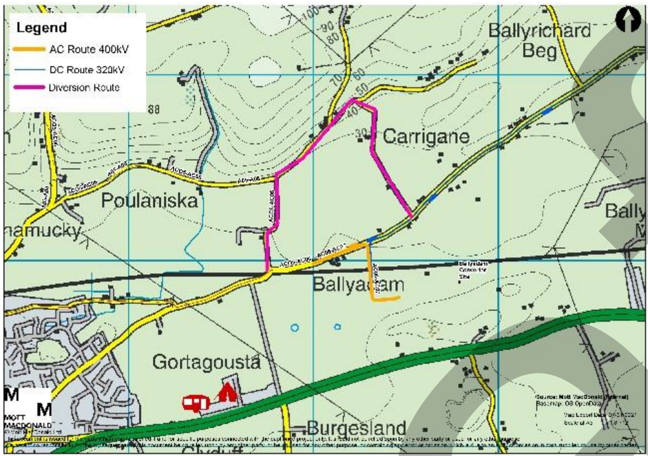
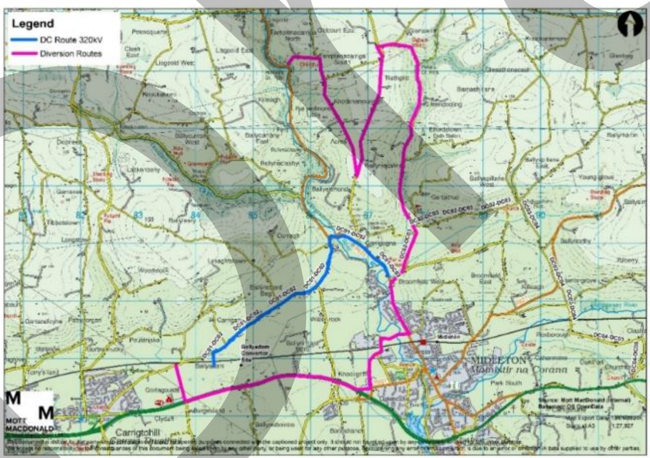
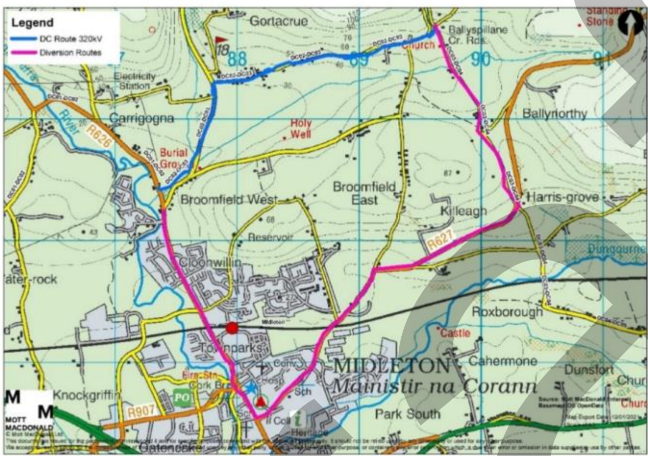
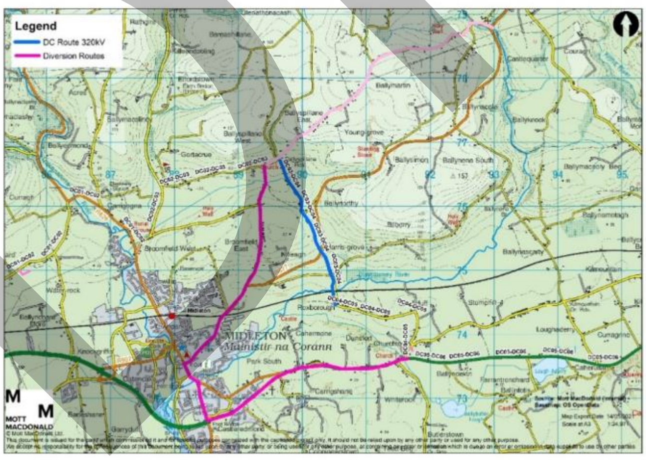
Unnamed road Garranes crossroads (Garranes) to South of Woodstock (Woodstock)
(AC04-AC05)



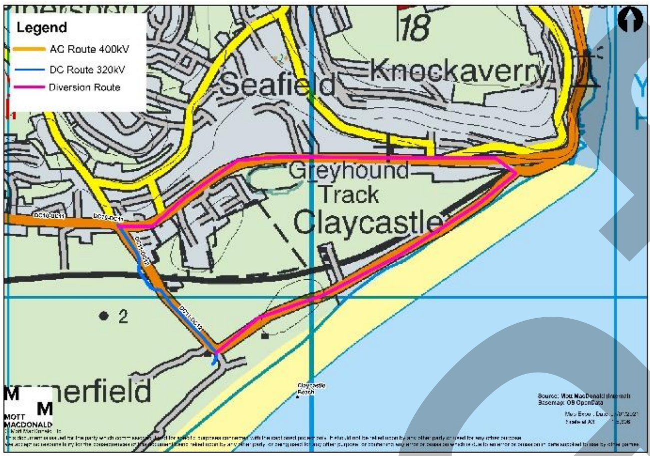
Approximate period that diversion route will be in place = 5 weeks…
Additional length of diversion route = (East) 1.4km; (West and North) 0.8km

Road Section (Location) [Cable Route Section]	**Diversion Route Plan** ***Duration of diversion, length of diversion route (decision point to decision point) and associated typical additional travel time***
	Approximate additional traffic time = (East) 4 mins; (West and North) 2 mins *Impact on Public Transport Route = No* *Length of cable route section closure (including distance between route and decision points) – 3.2km, 4 mins. Diversion (East)– 4.6km, 8 mins; (West and North) – 4km, 6 mins.*
Unnamed road Woodstock (Woodstock)/Gortnamucky to North of Ballyadam (Ballyadam) (AC05-AC06)	 *Approximate period that diversion route will be in place = 9 weeks.* *Additional length of diversion route = East (2.7km shorter), West (1.2km shorter)* *Approximate additional traffic time = East (1 min faster), West (1 min more)* *Impact on Public Transport Route = No* *Length of cable section closure (including distance between route and decision points) – 6.5km, 8 mins. Diversion (East) – 3.8km, 7 mins; (West) – 5.3km, 9 mins.* *It is recommended that for this cable route section that the road closure be implemented in two phases, with localised diversion via Poulaniska and not the N25 to avoid further journey time delay and distance. This should be confirmed as part of the construction methodology by the appointed contractor in agreement with Cork County Council.*

Road Section (Location) [Cable Route Section]	**Diversion Route Plan** ***Duration of diversion, length of diversion route (decision point to decision point) and associated typical additional travel time***
North of Ballyadam (Ballyadam) to Ballyadam (Ballyadam) (AC06-AC07)	 *Approximate period that diversion route will be in place = 6 days.* *Additional length of diversion route = 1.05km* *Approximate additional traffic time = 3 mins* *Impact on Public Transport Route = No* *Length of cable section closure (including distance between route and decision points) – 850m, 1 min. Diversion – 1.9km, 4 mins*
R626 and Castle Rock Avenue (Ballyadam) (Ballyadam) to Carrigogna/R626 (Carrigogna) (DC01-DC02)	 *Approximate period that diversion route will be in place = 13 weeks.* *Additional length of diversion route = (East and West) 1.2km; (North) 4.9km* *Approximate additional traffic time = (East and West) 3 mins; (North) 7 mins* *Impact on Public Transport Route = No*

Road Section (Location) [Cable Route Section]	Diversion Route Plan *Duration of diversion, length of diversion route (decision point to decision point) and associated typical additional travel time*
	Length of cable section closure (including distance between route and decision points) (East and West) – 5.2km, 5 mins. Diversion – 6.4km, 8 mins. Closure (North) R626 (from diversion to Broomfield West) – 5.3km, 5 mins. Diversion –10.2km, 12 mins. *Note: for vehicles coming from the north via the R626, would use the northernmost diversion through to the junction where the diversion meets the cable route at Broomfield West.*
L7617 and Broomfield Ridge (L7822) Carrigogna (Carrigogna) to Ballyspillane East (Ballyspillane East) (DC02-DC03)	 *Approximate period that diversion route will be in place = 9 weeks.* *Additional length of diversion route = 3.8km* *Approximate additional traffic time = 7 mins* *Impact on Public Transport Route = No* *Length of cable section closure (including distance between route and decision points) – 2.7km, 4 mins. Diversion – 6.5km, 11 mins.*
Shanty Path (L7620 and L7617) Ballyspillane East (Ballyspillane East to Roxborough) (DC03-DC04)	

Road Section (Location) [Cable Route Section]	Diversion Route Plan *Duration of diversion, length of diversion route (decision point to decision point) and associated typical additional travel time*
	Approximate period that diversion route will be in place = 7 weeks. *Additional length of diversion route = (East and West) 5.3km* *Approximate additional traffic time = (East and West) 5 mins* *Impact on Public Transport Route = No* *Length of cable section closure (*including distance between route and decision points) – *(East and West) 2.5km, 5 mins; (North) 4.9km, 8 mins. Diversion – (East and West) 7.8km, 10 mins; (North) additional 4.5km, 7 mins* *Note that R627 diversion would only be in place for a limited period of time (highlighted in light pink); however as a regional road this is a key link between Midleton and Dungourney, and therefore we would recommend that the contractor strives to minimise the time the junction is closed working either side independently along this section.*
L3627 and Shanty Path (L7620) Roxborough (Roxborough) to Churchtown North/N25 (Ballyedekin) (DC04-DC05)	 *Approximate period that diversion route will be in place = 6 weeks.* *Additional length of diversion route = (West) 3.7km shorter, (East) 0.8km* *Approximate additional traffic time = (West) no additional time, (East) 2 minutes* *Impact on Public Transport Route = No* *Length of cable section (including distance between route and decision points) – (West) 8.1km, 8 mins; (East) 5.6km, 6 mins. Diversion (West) – 4.4km, 8 mins; (East) – 6.4km, 8 mins.*

Road Section (Location) [Cable Route Section]	**Diversion Route Plan** ***Duration of diversion, length of diversion route (decision point to decision point) and associated typical additional travel time***
L3821 (between Transition Joint Bay at Claycastle Beach and R634) R634/ R908 (Summerfield) to North of Claycastle Beach car park (Summerfield) (DC11-DC12)	 *Approximate period that diversion route will be in place = 2 weeks.* *Additional length of diversion route = 2km* *Approximate additional traffic time = 4 mins* *Impact on Public Transport Route = No* *Length of cable section (including distance between route and decision points) – 500m, 1 min. Diversion – 2.5km, 5 mins. Note: Those coming from the east will have a decision point at where Front Strand meets the R634.*

Source: EirGrid / Mott MacDonald / OS OpenData

Table 11.20 indicates the estimated daily vehicle movements for the peak construction period of each road within the Study Area. This highlights the worst-case representation for each road section within the Study Area, however, it should be noted not all these peak periods will occur at the same time. A full breakdown across the entire construction period can be found in the Appendix 11.3.

An indication of the direct impact of construction activities and the estimated daily and monthly traffic movements generated by the Project against the programme along with predicted percentage increases on relevant roads are shown in Table 11.20: Summary Effects of Construction

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The number of vehicle movements for each month of construction has been calculated based on the indicative construction programme and the anticipated likely vehicle movements for each activity. These vehicle movements have then been distributed across the Study area and individual route sections as per the assumptions indicated in Section 11.3.7.2.

The peak daily traffic flow generated by the Ballyadam converter site is estimated as 486 movements, of which 286 movements will be HGV movements over the peak three-month period of construction.

The construction of the cable route will generate a daily traffic flow of 320 movements, of which 240 movements will be HGV movements over the peak period of construction. These movements will be distributed across the four daily work sites based along the cable route.

It should be noted that all construction traffic related effects are deemed ‘temporary effects’. The peak period of construction is all cases is estimated to be more than one day and less than one year and as such all effects are deemed temporary.

Table 11.20: Summary Effects of Construction

Route Section	Capacity (vph)	Baseline 2023 Flow AADT	Peak HGV Movement per Road	[% Increase - HGVs]	Peak Vehicle Movement per Road	[% Increase - All Vehicles]	Duration of Peak	{Significance of effect per traffic increase}	Construction activity on road section	Effect of construction activity
Unnamed road Knockraha Substation (Ballynanelagh) to crossroads	1000	256	30	117%	30	12%	7 months	Moderate (Significant)	This road will form part of AC01-AC02 – local road closures will be facilitated.	Rolling road closure will require traffic diversion, resulting in increased journey time of 4 minutes for 16 days. Diversions are to be in place, supported by mitigation measures of signage and web alerts.
Unnamed road East of Ballynanleagh, west of T-Junction (Killeena) to East of Ballynanleagh, east of T-Junction (Killeena)	1000	256	30	117%	30	12%	7 months	Moderate (Significant)	This road will form part of AC01-AC02 and AC02-AC03 – local road closures will be facilitated.	Rolling road closure will require traffic diversion, resulting in increased journey time of 10-13 minutes for 11 days. Diversions are to be in place, supported by mitigation measures of signage and web alerts.
Unnamed road East of Ballynanleagh, east of T-Junction (Killeena) to Garranes crossroads (Garranes)	1000	256	30	117%	30	12%	7 months	Moderate (Significant)	This road will form part of AC03-AC04 – local road closures will be facilitated.	Rolling road closure will require traffic diversion, resulting in increased journey time of 1 minute for 12 weeks. Diversions are to be in place, supported by mitigation measures of signage and web alerts.
Unnamed road Garranes crossroads (Garranes) to	1000	256	30	117%	30	12%	2 months	Moderate (Significant)	This road will form part of AC04-AC05 and AC05-AC06 –	Rolling road closure will require traffic diversion, resulting in increased journey time of 2 – 4

Route Section	Capacity (vph)	Baseline 2023 Flow AADT	Peak HGV Movement per Road	[% Increase - HGVs]	Peak Vehicle Movement per Road	[% Increase - All Vehicles]	Duration of Peak	{Significance of effect per traffic increase}	Construction activity on road section	Effect of construction activity
south of Woodstock (Woodstock)									local road closures will be facilitated.	minutes for 5 weeks. Diversions are to be in place, supported by mitigation measures of signage and web alerts.
Unnamed road Woodstock (Woodstock)/Gortnamucky to north of Ballyadam (Ballyadam)	1000	256	30	117%	30	12%	2 months	Moderate (Significant)	These roads will form part of AC05-AC06 and AC04 – AC05– local road closures will be facilitated.	Rolling road closure will require traffic diversion, resulting in increased journey time of up to 1 minute for 9 weeks. Diversions are to be in place, supported by mitigation measures of signage and web alerts.
North of Ballyadam (Ballyadam) to Ballyadam (Ballyadam)	1000	256	30	117%	30	12%	2 months	Moderate (Significant)	This road will form part of AC06-AC07 – local road closures will be facilitated.	Rolling road closure will require traffic diversion, resulting in increased journey time of 3 minutes for 6 days. Diversions are to be in place, supported by mitigation measures of signage and web alerts.
R626 and Castle Rock Avenue (Ballyadam (Ballyadam) to Carrigogna/R626 (Carrigogna))	1000	256	30	117%	30	12%	7 months	Moderate (Significant)	These roads will form part of DC01-DC02 – local road closures will be facilitated.	Rolling road closure will require traffic diversion, resulting in increased journey time of 3 – 7 minutes for 13 weeks. Diversions are to be in place, supported by mitigation measures of signage and web alerts.
L7617 and Broomfield Ridge (L7822) Carrigogna	1000	256	30	117%	30	12%	2 months	Moderate (Significant)	These roads will form part of DC02-DC03 – local road	Rolling road closure will require traffic diversion, resulting in increased

Route Section	Capacity (vph)	Baseline 2023 Flow AADT	Peak HGV Movement per Road	[% Increase - HGVs]	Peak Vehicle Movement per Road	[% Increase - All Vehicles]	Duration of Peak	{Significance of effect per traffic increase}	Construction activity on road section	Effect of construction activity
(Carrigogna) to Ballyspillane East (Ballyspillane East)									closures will be facilitated.	journey time of 7 minutes for 9 weeks. Diversions are to be in place, supported by mitigation measures of signage and web alerts.
Shanty Path (L7620 and L7617) Ballyspillane East (Ballyspillane East) to Roxborough (Roxborough)	1000	256	30	117%	30	12%	2 months	Moderate (Significant)	This road will form part of DC03-DC04 and DC04-DC05 – local road closures will be facilitated.	Rolling road closure will require traffic diversion, resulting in increased journey time of 5 minutes for 7 weeks. Diversions are to be in place, supported by mitigation measures of signage and web alerts.
L3627 and Shanty Path (L7620) Roxborough (Roxborough) to Churchtown North/N25 (Ballyedekin)	1000	256	30	117%	30	12%	2 months	Moderate (Significant)	These roads will form part of DC04-DC05 and DC03-DC04 – local road closures will be facilitated.	Rolling road closure will require traffic diversion, resulting in increased journey time of up to 2 minutes for 6 weeks. Diversions are to be in place, supported by mitigation measures of signage and web alerts.
Crossroads to Upper Killacloyne/Springfield Business Park/Fota Retail and Business Park to Killahora and N25	1000	256	30	117%	30	12%	7 months	Moderate (Significant)	N/A – road utilised for construction traffic access	None
Maple Lane	1000	256	30	117%	30	12%	9 months	Moderate (Significant)	N/A – road utilised for construction traffic access	None

Route Section	Capacity (vph)	Baseline 2023 Flow AADT	Peak HGV Movement per Road	[% Increase - HGVs]	Peak Vehicle Movement per Road	[% Increase - All Vehicles]	Duration of Peak	{Significance of effect per traffic increase}	Construction activity on road section	Effect of construction activity
Chestnut Crescent	1000	256	30	12%	30	12%	9 months	Moderate (Significant)	N/A – road utilised for construction traffic access	None
Forrestown-Terrysland-Main Street	1000	256	30	117%	30	12%	9 months	Moderate (Significant)	N/A – road utilised for construction traffic access	None
L7642	1000	256	30	117%	30	12%	9 months	Moderate (Significant)	N/A – road utilised for construction traffic access	None
Castle Rock Avenue	1000	256	30	117%	30	12%	9 months	Moderate (Significant)	N/A – road utilised for construction traffic access	None
L7848	1000	256	30	117%	30	12%	9 months	Moderate (Significant)	N/A – road utilised for construction traffic access	None
L7849	1000	256	30	117%	30	12%	7 months	Moderate (Significant)	N/A – road utilised for construction traffic access	None
L3811	1000	256	30	117%	30	12%	2 months	Moderate (Significant)	N/A – road utilised for construction traffic access	None
R634	2167	4799	30	6%	30	1%	2 months	None (Not Significant)	This road will form part of DC10 to DC11 – local road closures will be facilitated. Roads utilised for construction traffic access and serves as part of a diversion route	DC10-DC11 may require rolling lane closure with temporary traffic signals, incurring an increased journey time of 44 seconds for a duration of 2 weeks (plus any time for additional works e.g. joint bays as required).
New Line	1000	256	30	117%	30	12%	2 months	Moderate (Significant)	N/A – road utilised for construction traffic access	-None

Route Section	Capacity (vph)	Baseline 2023 Flow AADT	Peak HGV Movement per Road	[% Increase - HGVs]	Peak Vehicle Movement per Road	[% Increase - All Vehicles]	Duration of Peak	{Significance of effect per traffic increase}	Construction activity on road section	Effect of construction activity
Front Strand	1000	256	30	117%	30	12%	2 months	Moderate (Significant)	Road utilised for construction traffic access and serves as part of a diversion route	Diversions are to be in place, supported by mitigation measures of signage and web alerts.
N25 (Between R624 and Ballyadam/L7642)	6667	40967	60	3%	200	1%	7 months	None (Not Significant)	N/A – road utilised for construction traffic access	None
N25 (Between Ballyadam/L7642 and Healy Brothers exit)	6667	40967	286	15%	286	1%	3 months	None (Not Significant)	N/A – road utilised for construction traffic access	None
N25 (Between Healy Brothers exit and Castle Rock Ave)	6667	40967	30	2%	30	0%	9 months	None (Not Significant)	N/A – road utilised for construction traffic access	None
N25 (Between Rocky Road and Shanty Path)	6667	17917	30	4%	30	0%	9 months	None (Not Significant)	N/A - Road utilised for construction traffic access and serves as part of a diversion route	None
N25 (Between Shanty Path and Castlemartyr) – (DC05 – DC06)	2650	17917	30	4%	30	0%	9 months	None (Not Significant)	This road will form DC05-DC06 – local lane closures may be facilitated. Road also utilised for construction traffic access and serves as part of a diversion route.	DC05-DC06 may require rolling lane closure with temporary traffic signals incurring an increased journey time of 63 and 86 seconds for eastbound and westbound traffic respectively. Duration of lane closure on this section, as well as cable installation, is subject to any time for additional works e.g. joint bays as required.
N25 (Between Castlemartyr and L7849) – (DC07-DC08)	2650	17917	176	22%	176	1%	1 month	None (Not Significant)	This road will form DC07-DC08 – local	DC07-DC08 may require rolling lane closure with

Route Section	Capacity (vph)	Baseline 2023 Flow AADT	Peak HGV Movement per Road	[% Increase - HGVs]	Peak Vehicle Movement per Road	[% Increase - All Vehicles]	Duration of Peak	{Significance of effect per traffic increase}	Construction activity on road section	Effect of construction activity
									lane closures may be facilitated. Road also utilised for construction traffic access.	temporary traffic signals incurring an increased journey time of 63 and 86 seconds for eastbound and westbound traffic respectively. Duration of lane closure on this section, as well as cable installation, is subject to any time for additional works e.g. joint bays as required.
N25 (Between L7849 and L7848) – (DC07-DC08)	1500	17917	176	22%	176	1%	1 month	None (Not Significant)	This road will form DC07-DC08 – local lane closures may be facilitated. Road also utilised for construction traffic access.	DC07-DC08 may require rolling lane closure with temporary traffic signals incurring an increased journey time of 63 and 86 seconds for eastbound and westbound traffic respectively. Duration of lane closure on this section, as well as cable installation, is subject to any time for additional works e.g. joint bays as required.
N25 (Between L7848 and L3811) – (DC07-DC08)	1500	13304	147	25%	147	1%	1 month	None (Not Significant)	This road will form DC07-DC08 – local lane closures may be facilitated. Road also utilised for construction traffic access.	DC07-DC08 may require rolling lane closure with temporary traffic signals incurring an increased journey time of 63 and 86 seconds for eastbound and westbound traffic respectively. Duration of lane closure on this section, as well as cable installation, is subject to any time for additional works e.g. joint bays as required.

Route Section	Capacity (vph)	Baseline 2023 Flow AADT	Peak HGV Movement per Road	[% Increase - HGVs]	Peak Vehicle Movement per Road	[% Increase - All Vehicles]	Duration of Peak	{Significance of effect per traffic increase}	Construction activity on road section	Effect of construction activity
N25 (Between L3811 to R634 junction) – (DC09-DC10)	2650	13304	118	19%	118	1%	1 month	None (Not Significant)	This road will form DC09-DC10 – local lane closures may be facilitated. Road also utilised for construction traffic access.	DC09-DC10 may require rolling lane closure with temporary traffic signals incurring an increased journey time of 63 and 86 seconds for eastbound and westbound traffic respectively. Duration of lane closure on this section, as well as cable installation, is subject to any time for additional works e.g. joint bays as required.
R634 junction to Front Strand – (DC10-DC12)	2167	4799	59	12%	59	1%	1 month	None (Not Significant)	These roads will form part of DC10 to DC12 – local road closures will be facilitated. Roads utilised for construction traffic access and serves as part of a diversion route	DC10-DC11 may require rolling lane closure incurring an increased journey time of 44 seconds. Rolling lane closure will require temporary traffic signals, resulting in increased journey time of up to 1 minute for 2 weeks (plus any time for additional works e.g. joint bays as required). Diversions are to be in place, supported by mitigation measures of signage and web alerts.
R624	2167	4799	60	13%	60	1%	7 months	None (Not Significant)	N/A – road utilised for construction traffic access	None

Source: Mott MacDonald

11.5.1.2 Driver Delay

For all sections of the N25 itself the traffic volume increase will not exceed the significance threshold and the significance of the effect is assessed to be none and accordingly not significant. Since the 10% traffic increase threshold has not been exceeded on the N25 no detailed assessment has been undertaken for the N25 beyond traffic management requirements for lane closures.

A number of the rural roads within this traffic and transport assessment have been identified from the quantitative assessment to have traffic increases resulting in 'moderate' significant effects. It should be noted though that whilst these public road route sections see the 10% significance threshold exceed for traffic increases this increase is not estimated to result in the roads exceeding their operational capacity and where traffic increases are observed these roads still operate notably below their theoretical capacity.

The forecast baseline traffic flows on these roads is low; as such traffic increases present as relatively large and the associated significance is considered moderate however, these roads would still operate well below capacity and congestion is not foreseen to be an impact. Each of the roads noted within Table 11.20, as 'Moderate (Significant)' but has the residual capacity to readily accommodate the expected additional traffic flow is bulleted below:

- Unnamed road Knockraha Substation (Ballynanelagh) to crossroads;
- Unnamed road East of Ballynanleagh, west of T-Junction (Killeena) to East of Ballynanleagh, east of T-Junction (Killeena);
- Unnamed road East of Ballynanleagh, east of T-Junction (Killeena) to Garranes crossroads (Garranes);
- Unnamed road Garranes crossroads (Garranes) to south of Woodstock (Woodstock);
- Unnamed road Woodstock (Woodstock)/Gortnamucky to north of Ballyadam (Ballyadam);
- North of Ballyadam (Ballyadam) to Ballyadam (Ballyadam);
- R626 and Castle Rock Avenue (Ballyadam (Ballyadam) to Carrigogna/R626 (Carrigogna);
- L7617 and Broomfield Ridge (L7822) Carrigogna (Carrigogna) to Ballyspillane East (Ballyspillane East);
- Shanty Path (L7620 and L7617) Ballyspillane East (Ballyspillane East) to Roxborough (Roxborough);
- L3627 and Shanty Path (L7620) Roxborough (Roxborough) to Churchtown North/N25 (Ballyedekin);
- Crossroads to Upper Killacloyne/Springfield Business Park/Fota Retail and Business Park to Killahora and N25;
- Maple Lane;
- Chestnut Crescent;
- Forrestown-Terrysland-Main Street;
- L7642;
- Castle Rock Avenue;
- L7848;
- L7849;
- L3811;
- New Line, and;
- Front Strand.

With regard to diversion routes as cable sections are installed, diversions will be in place which will have an effect on driver journey times. Driver delay resultant from road or lane closure, using the rationale outlined in Table 11.5 is presented below in Table 11.22.

The assessment assumes a full road closure on cable sections given the rural nature of the roads. For sections of the cable route on the N25 and R634, it is envisioned that lane closures will be in place with local traffic management, such as temporary signals, rather than a full road closure.

Temporary traffic signals are likely to be required on the N25 and R634 to accommodate lane closures. An assessment of these signals has been undertaken to establish likely queue lengths and delay resulting from the lane closure. Table 11.21 outlines the results of this assessment for the peak construction period. Overall, the cycle time for the lights would require to be circa 3 minutes on the N25 and the R634. The queues observed in both directions would likely clear with each cycle of the lights resulting in no residual queue remaining.

Table 11.21: Lane Closure Delay

Road	Total Signal Cycle time (s)	Eastbound Traffic		Westbound Traffic	
		Ave Delay per Vehicle (s)	Average Queue (Veh)	Ave Delay per Vehicle	Average Queue (Veh)
N25	180	63	39	86	28
R634	60	44	5	44	5

Source: LinSig v3 / Mott MacDonald

The below, which summarises the values presented in Table 11.22, lists the diversions for vehicles coming from different directions and the impact to the journey.

Table 11.22: Driver Delay Impact Resultant from Road or Lane Closure

Road Section	Original Journey Time (mins)	Diversion Time (mins)	Journey Time Increase (mins)	Magnitude
Unnamed road Knockrahaha Substation (Ballynanelagh) to east of Ballynanleagh (Killeena) (AC01-AC02)	3	7	4	None (temporary)
Unnamed road East of Ballynanleagh, west of T-Junction (Killeena) to East of Ballynanleagh, east of T-Junction (Killeena) – in road (AC02-AC03) (from east and west)	4	14	10	None (temporary)
Unnamed road East of Ballynanleagh, west of T-Junction (Killeena) to East of Ballynanleagh, east of T-Junction (Killeena) – in road (AC02-AC03) (from north)	4	17	13	Minor (temporary)
Unnamed road East of Ballynanleagh, east of T-Junction (Killeena) to Garranes crossroads (Garranes) (AC03-AC04)	6	7	1	None (temporary)
Unnamed road Garranes crossroads (Garranes) to south of Woodstock (Woodstock) (AC04-AC05) (from east)	4	8	4	None (temporary)

Road Section	Original Journey Time (mins)	Diversion Time (mins)	Journey Time Increase (mins)	Magnitude
Unnamed road Garranes crossroads (Garranes) to south of Woodstock (Woodstock) (AC04-AC05) (from west and north)	4	6	2	None (temporary)
Unnamed road Woodstock (Woodstock)/Gortnamucky to north of Ballyadam (Ballyadam) (AC05-AC06) (from east)	8	7	-1	None (temporary)
Unnamed road Woodstock (Woodstock)/Gortnamucky to north of Ballyadam (Ballyadam) (AC05-AC06) (from west)	8	9	1	None (temporary)
North of Ballyadam (Ballyadam) to Ballyadam (Ballyadam) (AC06-AC07)	1	4	3	None (temporary)
R626 and Castle Rock Avenue (Ballyadam (Ballyadam) to Carrigogna/R626 (Carrigogna) (DC01-DC02) (from east and west)	5	8	3	None (temporary)
R626 and Castle Rock Avenue (Ballyadam (Ballyadam) to Carrigogna/R626 (Carrigogna) (DC1-DC02) (from north)	5	12	7	None (temporary)
L7617 and Broomfield Ridge (L7822) Carrigogna (Carrigogna) to Ballyspillane East (Ballyspillane East) (DC02-DC03)	4	11	7	None (temporary)
Shanty Path (L7620 and L7617) Ballyspillane East (Ballyspillane East to Roxborough) (DC03-DC04) (from east and west)	5	10	5	None (temporary)
L3627 and Shanty Path (L7620) Roxborough (Roxborough) to Churchtown North/N25 (Ballyedekin) (DC04-DC05) (from west)	8	8	0	None (temporary)
L3627 and Shanty Path (L7620) Roxborough (Roxborough) to Churchtown North/N25 (Ballyedekin) (DC04-DC05) (from east)	6	8	2	None (temporary)
L3821 (between Transition Joint Bay at Claycastle Beach and R634) R634/ R908 (Summerfield) to north of Claycastle Beach car park (Summerfield) (DC11-DC12)	1	5	4	None (temporary)
N25 (DC05-DC10)	-	-	1.5	None (temporary)
R634 (DC10-DC11)	-	-	1	None (temporary)

Source: Mott MacDonald. Note: N25 please refer to

From the above, and, with reference to Table 11.5 , all traffic diversions incur delays of less than 20 minutes. The duration of road diversions in place are less than a year, and are therefore ‘temporary’, with reference to section 11.3.4. Potential lane closures on the N25 and R634 during cable installation, with the application of local traffic management and on the basis of a rolling 50 metre road closure, would incur an average driver delay of 1 minute 30 seconds and 1 minute respectively from wait time in queue at temporary traffic signal installation.

One cable route section, AC02-AC03, triggers as 'moderate' in terms of driver delay, however this cable route section is short in length and would incur a road closure spanning approximately 11 days. As such, the effect is temporary in nature.

On this basis, the significance of effect of driver delay for users is considered to be minor and accordingly considered to be not significant in the context of the EPA Draft 2017 EIAR Guidelines.

As for public transport, bus services that use sections of the N25 and the R634 which are subject to cable installation (sections DC05-DC11) may therefore be affected by local traffic management. Driver delay attributed to public transport during the course of the Project's construction include those listed below in Table 11.23:

Table 11.23: Bus Routes potentially affected by closures/diversion/construction access route

Service Number	Route Summary	Service Operator	Road Closure	Diversion	Construction Access
40	Tralee Bus Station – Rosslare Harbour	Bus Éireann	-	✓	✓
214	Cork – Knockraha	Bus Éireann	-	✓	✓
240	Cork Bus Station – Ballycotton	Bus Éireann	-	✓	-
260	Cork - Ardmore	Bus Éireann	-	✓	✓

11.5.1.3 Community Effects (Severance, Pedestrian Delay, Pedestrian and Cycle Amenity, Fear and Intimidation)

The IEMA Guidelines define severance as 'the perceived division that can occur within a community when it becomes separated by a major traffic artery'. Severance may result from a road carrying large traffic flows or a physical barrier created by the road itself, and the IEMA guidelines suggest that consideration is given to the severity of existing severance and how this might be exacerbated by proposed construction traffic generated by a development. As shown in Table 11.20: Summary Effects of Construction

, the roads within the Study Area will continue to operate below capacity, even with the addition of traffic generated by construction of the Project. Severance should not occur when there is such a notable level of residual road capacity and traffic generated by the Project will be relatively low.

Furthermore, it is noted that the majority of community-based infrastructure in the Study Area is located on the N25 which is considered to have 'none' and not significant increase in traffic.

Pedestrian amenity is broadly defined by the IEMA as the 'relative pleasantness of a journey', and this definition also takes into account 'fear and intimidation'. The IEMA Guidelines suggest that 'a tentative threshold for judging the significance of changes in pedestrian amenity would be where traffic flows (or its lorry component) is halved or doubled'. The construction of the Project is predicted to generate increased HGV flows on the rural roads within the Study Area of approximately 30 HGV movements per day during the peak construction period. Several construction access routes overlap, intersect, and / or adjoin with existing recreational routes, these include the route sections outlined in Table 11.9.

As such, the CTMP will include a commitment to provide signage to warn drivers to the presence of public paths and cycling routes and appropriate signage advising of dates and hours of working will be installed on the ‘core path network’ in advance of road crossing points to warn users of the potential of construction traffic. On this basis, the significance of the effect on pedestrian amenity, is considered to be minor and accordingly considered to be not significant.

Cycling and walking routes (existing or future) that are potentially affected by construction access , road closure or diversion routes whether on the road or in proximity, include the following shown in Table 11.24.

Table 11.24: Walking and Cycling Routes potentially affected by closures / diversion / construction access route

Route Type	Name	Location	Road Closure	Diversion	Construction Access
Walking/ Cycling	Ballintotsis Loops – Lake Loop	Ballintotsis	✓		✓
Cycling	EuroVelo1 (Celtic Coast)	Various	✓	✓	✓
Walking/ Cycling	Midleton to Youghal Greenway	Midleton - Youghal	✓		✓
Walking	Youghal Eco Boardwalk between Youghal and Redbarn	Youghal/Redbarn			✓
Walking/ Cycling	Carrigtwohill Works (Station Bridge upgrade, road upgrade for pedestrian and cycle, Carrigtwohill Greenway)	Carrigtwohill		✓	
Cycling	Separate Cycle Routes (including Northern Bypass)	Midleton	✓		
Walking	Walkway/Amenity Walks/Pedestrain Routes	Midleton			✓
Walking/ Cycling	Ballinacurra to Midleton Pedestrian and Cycle Loop	Various		✓	✓
Walking	Pigeon Wood Loop	Castlemartyr			✓
Walking	Mitchells Wood Loop	Castlemartyr			✓
Walking/ Cycling	Bury's Bridge to Carrigtwohill Pedestrian/Cycle Route	Various			✓
Walking/ Cycling	Ballyadam Bridge upgrade for pedestrian and cycle	Carrigtwohill		✓	✓
Cycling	Lane between Chestnut Crescent and Maple Close	Carrigtwohill			✓
Cycling	Trail between An Tosach and An Guagá	Carrigtwohill		✓	
Cycling	Trail – Fota Rock throughroad	Carrigtwohill			✓
Cycling	Terrysland	Terrysland			✓
Walking/ Cycling	Pedestrian/cycle bridges	Carrigtwohill		✓	
Cycling	Separate cycle route at and near Maple Lane	Terrysland			✓
Walking/ Cycling	Carrigtwohill Greenway	Cararrigtwohill			✓

Route Type	Name	Location	Road Closure	Diversion	Construction Access
Walking/ Cycling	Wyse's Bridge upgrade for pedestrian and cycle	Carrigtwohill			✓
Walking	Public footpath extension	Killeagh			✓
Walking	Amenity Walk (Glenbower Wood)	Killeagh			✓
Walking	Amenity Walk and Pedestrian Access	Castlemartyr			✓

Castlemartyr and Killeagh, are the key locations along the construction access routes where pedestrian activity is most present, especially at the beginning and end of the school day and shopping related. In both these locations there is existing pedestrian infrastructure provision in place, including footways and traffic management features. Based on professional judgement the existing provision and low traffic increases on the N25 through these areas it is considered adequate to accommodate any potential pedestrian effects as a result of construction traffic engaged in the Project.

Further to this, with reference to Table 11.14: Cluster Analysis

, TMP measures are recommended to be put in place for safe access to the Pigeon Wood Loop walking route whilst road closure, diversion or construction access routes are in effect.

Overall, based on professional judgement, the construction traffic generated by Project Study Area will have a minor temporary effect upon community receptors and is therefore not significant in the context of the EPA 2017 Draft EIAR Guidelines.

11.5.1.4 Accidents and Safety

The UK Design Manual for Roads and Bridges Volume 15, Section 1, Part 6, Chapter 4 states that where traffic flow doubles, it can be expected that road traffic collisions will double (i.e. the increase in collisions is likely to be approximately proportional to the increase in traffic). It is acknowledged that the guidance source has now been superseded but based upon professional judgement and experience the statement is considered currently valid. Accordingly, if the number of collisions were to increase proportionally with the increase in traffic, the impact of the construction traffic on road safety per route section can be forecast. The results of this analysis are summarised in Table 11.25.

Table 11.25: Projected Collisions increase by Route Section and Serving Roads

Route Section	No. of Collisions 2023 Baseline Average	Projected average no. collisions due to predicted traffic increases
Cable Route along the N25:		
N25 (note this road also serves regional/local (off-N25) cable route and Ballyadam site)	5.4	5.5
N25 (from off-cable to M8 junction)	9.2	9.3
L3811	0.4	0.4
Cable Route along Regional / Rural Roads:		
Unnamed road East of Ballynanleagh, east of T-Junction (Killeena) to Garranes crossroads (Garranes)	0.2	0.2

Route Section	No. of Collisions 2023 Baseline Average	Projected average no. collisions due to predicted traffic increases
Unnamed road Woodstock (Woodstock)/Gortnamucky to north of Ballyadam (Ballyadam)	0.6	0.7
R626 and Castle Rock Avenue (Ballyadam (Ballyadam) to Carrigogna/R626 (Carrigogna)) DC01-DC02	0.4	0.4
L3627 and Shanty Path (L7620) Roxborough (Roxborough) to Churchtown North/N25 (Ballyedekin) DC04-DC05	0.2	0.2
R634 (between N25 and L3821) (DC10-DC11) and between L3821 and Front Strand	1.2	1.2
L3810/New Line/The Strand	0.4	0.4
Unnamed road (between the Strand and Clashadonna Roundabout):	0.2	0.2
Crossroads to Upper Killacloyne/Springfield Business Park/Fota Retail and Business Park to Killahora and N25	**0.4**	**0.3**

Using this basis of assessment, there would be a negligible increase in PICs in the Study Area during the construction period as a consequence of the increased traffic generated by the Project and the significance of the effect would be none and therefore not significant.

The above four assessment aspects are summarised below in Table 11.26.

Table 11.26: Construction Phase Impact Assessment

Phase	Description of likely impact	Duration of impact	Magnitude of impact	Significance of impact
Construction	Driver Delay – disruption and delay to users of roads from cable installation work in road corridors	13 weeks (worst case)	13 minutes (worst case)	Minor (Not Significant) Temporary - less than a year
	Driver Delay – disruption and delay to users of roads as a result of the additional traffic movements that will be generated by the Project	1st Peak - 3 months 2nd Peak – 11 months Or 9 months for a specific road	12% traffic increase on several roads	None (Not Significant) Temporary
	Community Effects (including Severance) - Disruption and delay of users of footpaths and cycle paths from cable installation work in or adjacent to active travel infrastructure	1st Peak - 3 months 2nd Peak – 11 months Or 9 months for a specific road	Potential temporary access arrangements	Minor (Not Significant) Temporary - less than a year
	Accidents and Safety - Detrimental impact on road safety as a result of the additional traffic movements that will be generated by the Project	1st Peak - 3 months 2nd Peak – 11 months	Less than 1	None (not significant)

Phase	Description of likely impact	Duration of impact	Magnitude of impact	Significance of impact
		Or 9 months for a specific road		

Source: Mott MacDonald

11.5.2 Operational Phase

Overall, it is ascertained that there are no discernible changes to traffic flows arising from operation of the Project. Traffic and transport impacts can, as a result, be stated as Negligible, thereby Not Significant given the temporary nature of the operational, maintenance-based traffic. Further details on the envisaged operational requirements of the Project with regard traffic generated are provided below.

11.5.2.1 Connection Point

No additional operating requirements will be required for the connection point compared to the existing bays in the substation. As such, traffic movements are anticipated to be negligible and are therefore not considered further.

Similarly, the maintenance regime will not differ from maintenance regimes of the existing bays at Knockraha 220 kV substation aside from a yearly inspection and maintenance to the 400 kV transformer. The maintenance regime for the interconnector's connection at bay F14 once constructed will be the responsibility of ESBN.

11.5.2.2 HVAC Onshore Circuits (AC01-AC07 & DC01 – DC12))

The HVAC cable route will require no specific maintenance requirements along the cable trench or joint bay locations. Access may be required at joint bays on rare occasions to facilitate cable replacement if a failure occurs.

Access to link boxes and communications chambers will be required on an annual basis for inspection and any necessary maintenance. It is expected that ESB Networks (ESBN) will own the HVAC assets and that ESBN will be responsible for maintenance of the HVAC cable.

11.5.2.3 Converter Station Site Compound

The converter station does not require any personnel for operation. Two types of maintenance regimes will be required on an annual basis for the Converter Station, these are scheduled and unscheduled maintenance.

Scheduled maintenance of the Converter Station will occur once a year and take approximately four days for a crew of 10 personnel.

Unscheduled maintenance of the converter station will typically occur at unknown times throughout the year. Unscheduled maintenance occurs due to unforeseen trips and emergency outages, but these will be infrequent.

Taking cognisance of the above, it is envisaged that traffic movements in the project's operational phase will be negligible and temporary in nature.

11.5.3 Do Nothing

The 'do-nothing' scenario will have no impact on roads and traffic.

11.5.4 Decommissioning Phase

The Project is expected to be fully operational by the end of 2026 and have a 40-year operational lifespan. As such it is assumed that the decommissioning phase of the Project will be in 2067. Traffic generation for this phase is assumed to be negligible as the cable can be removed via access chambers; as such, physical civil construction works are not expected.

11.5.5 Cumulative Effects

With reference to Table 4.2 of Volume 3C1, there are several planned developments that may have a cumulative impact in tandem with the construction of the Project. Youghal to Midleton Greenway is set to be complete by 2023 and will therefore not affect construction traffic. Given the levels of information available at the time of producing this EIAR means that a conclusive assessment of cumulative effects from construction traffic attributed to other projects has not been produced at this time, however this will be mitigated through continual liaison with the relevant stakeholders.

As such, there is a risk of cumulative construction roads and traffic impacts associated with the construction phases of the proposed development occurring at the same time as the construction phases of nearby committed developments (see 11.4.8 for further details of these developments). Committed developments with known information have been included within the assessment, however, some developments do not have traffic / construction information currently available. Under this scenario it is possible that the combined cumulative effect could exceed the traffic significance thresholds. In this case, it is important that plans are co-ordinated and any adverse roads and traffic impacts are minimised.

Prior to commencement of construction and during the construction phase engagement with these sites where there is potential for works to be carried out in parallel, appropriate mitigation measures will be implemented including the scheduling of works and regular liaison meetings between project teams to ensure that plans are co-ordinated and impacts are minimised.

Provided this and other appropriate mitigation measures are implemented, such as those outlined in Section 11.6 of this chapter, the cumulative roads and traffic impacts associated with the construction phase should not be significant.

11.6 Mitigation and Monitoring Measures

11.6.1 Construction Phase

11.6.1.1 Construction Traffic Management Plan (CTMP)

The temporary effects of construction (none of which have been assessed as 'significant') or otherwise) will be mitigated through adoption of a regulated and approved CTMP. A summary of key CTMP mitigation elements follow, however the framework CTMP is provided in full as Appendix 11.2.

The assessment of post mitigation effects has been undertaken on the assumption that key measures set out in the CTMP will be developed as appropriate by the appointed contractor and be implemented during the project construction phase.

The appointed contractor will agree temporary traffic management measures then adopt and monitor an appropriate way of working in consultation with Cork County Council, the appointed contractor, TII and/or their Agents and An Garda Síochána as appropriate. Construction activity generated vehicles (with the exception of site personnel in cars and vans) will travel on pre-defined routes to and from the relevant sites to reduce effects on existing local traffic.

The framework CTMP has been developed for the purposes of this assessment and will be further developed as necessary in consultation with Cork County Council and the Gardai prior to construction commencing. The CTMP will document outline measures to promote the efficient transportation of components and materials to site, whilst reducing congestion and disruption which might impact negatively on local communities or general traffic and in particular the emergency services. The CTMP will be considered a 'live' document and will be developed accordingly to include current information per the following:

- a programme of delivery types/numbers by month;
- a statement of which public roads are to be used by construction traffic;
- a statement of which public roads are not to be used by construction traffic;
- a statement of which local towns and villages are to be avoided (completely or on stated days and times);
- details of all proposed mitigation measures, list of contacts, and details of measures that will be implemented to limit the potential of vehicle stacking on any part of the public road network;
- if appropriate, details of speed restrictions through sensitive areas and procedures to ensure pedestrian safety adjacent to worksites; and
- details of temporary signage to be installed at defined locations.

To minimise inconvenience to the local community in terms of obstructive parking, adequate car parking for permanent site personnel, visitors and deliveries would be provided within the Ballyadam worksite compound. Adequate vehicle parking space would be provided on-site and car parking will not be permitted on any public road network adjacent to the site, so that sight lines would be maintained and to minimise potential for obstruction and delay for other road users.

Furthermore, only vehicles essentially required to facilitate construction will be allowed to attend cable route worksites. Car sharing would be promoted to construction personnel by the contractor during the induction process.

The appointed contractor could employ a number of sub-contractors and all would fall under the umbrella of the CTMP and would have an obligation to adhere to the Plan, this obligation would form part of the procurement process and would be written into any contract of employment.

Compliance would be monitored by the Project Manager, on behalf of the appointed contractor, via spot checks to ensure that vehicles follow the measures set out in the CTMP and recording of any complaints. The appointed contractor would stipulate that all contractors disseminate these rules to their sub-contractors.

In advance of undertaking abnormal load deliveries necessary permitting, approvals and infrastructure accommodation works will be agreed with relevant authority and implemented accordingly. Delivery vehicles will only follow agreed routes and will be delivered overnight to minimise potential for delay and obstruction to general traffic.

In liaison with EirGrid, the appointed contractors will be required to maintain close liaison with local community representatives, landowners and statutory consultees throughout the construction period. This is likely to include circulation of information about ongoing activities; particularly those that could potentially cause disturbance, including due to traffic.

The appointed contractor would nominate a person to be responsible for the co-ordination of all elements of traffic and transport during the construction process (Liaison Officer). This person would liaise with the local community so that the community has a direct point of contact within the developer organisation who they could contact for information purposes or to discuss matters pertaining to traffic management or site operation.

If the construction phase of any notably sized development(s) appears likely to overlap with the Project, the appointed contractor would seek to liaise with the appropriate developer organisation regarding the scheduling of deliveries to identify potential means of reducing the effects of combined construction.

Construction Access Arrangements

Transportation, including deliveries to and from the construction areas will be taken from the existing public road network. The local area road network is shown on Figure 11.1. Given the nature of construction of the cable route, there will be multiple work sites along the route throughout the construction programme.

The construction methodology, including construction access arrangements are provided within Chapters 2 and 3. The proposed programme of worksite locations will be confirmed by the appointed contractor as an integral part of their adopted CTMP, the framework of which is provided as Appendix 11.2. All construction vehicle drivers will be instructed to access their destination worksite via an approved route.

11.6.2 Operational Phase

It is to be noted that, during the operational phase of the Project negligible volumes of traffic generation are anticipated therefore, no mitigation is deemed necessary.

11.7 Residual Impacts

There are no significant residual traffic and road impacts predicted during the construction and operational phases with the successful incorporation of specific measures described in 11.7 and predominantly incorporated within the CTMP; see Appendix 11.2.

11.8 Transboundary Effects

Beyond the Study Area Project generated traffic will subdivide into smaller traffic volumes utilising the wider National Road network. Professional judgement therefore suggests that transboundary effects relating to roads and traffic across the wider road network outside of the Study Area presented in Figure 11.1 are unlikely to be significant.

During construction and operation there are no expected adverse transboundary effects.

11.9 Summary

Table 11.27 provides a summary of the impact assessment undertaken for both construction and operation.

Table 11.27: Impact Assessment Summary

Phase	Aspect	Embedded design, mitigation and enhancement measures	Duration of impact	Magnitude of impact (with mitigation)	Significance impact
Construction	Driver Delay – disruption and delay to users of roads from cable installation work in road corridors	Implementation of CTMP Co-ordination and engagement with relevant authorities	13 weeks (worst case)	13 minutes (worst case)	Minor (Not Significant) Temporary - less than a year
	Driver Delay – disruption and delay to users of roads as a result of the additional traffic movements that will be generated by the Project	Implementation of CTMP Co-ordination and engagement with relevant authorities	1st Peak - 3 months 2nd Peak – 11 months Or 9 months for a specific road	12% traffic increase on several roads	None (Not Significant) Temporary
	Community Effects (including Severance) - Disruption and delay of users of footpaths and cycle paths from cable installation work in or adjacent to active travel infrastructure	Implementation of CTMP Co-ordination and engagement with relevant authorities	1st Peak - 3 months 2nd Peak – 11 months Or 9 months for a specific road	Potential temporary access arrangements	Minor (Not Significant) Temporary - less than a year
	Accidents and Safety - Detrimental impact on road safety as a result of the additional traffic movements that will be generated by the Project	Implementation of CTMP Co-ordination and engagement with relevant authorities	1st Peak - 3 months 2nd Peak – 11 months Or 9 months for a specific road	Less than 1	None (not significant)
Operation	Driver Delay – disruption and delay to users of roads from cable installation work in road corridors	None	None	None	None
	Driver Delay – disruption and delay to users of roads as a result of the additional traffic movements that will be generated by the Project	None	None	None	None
	Community Effects (including Severance) - Disruption and delay of users of footpaths and cycle paths from cable installation work in	None	None	None	None

Phase	Aspect	Embedded design, mitigation and enhancement measures	Duration of impact	Magnitude of impact (with mitigation)	Significance impact
	or adjacent to active travel infrastructure				
	Accidents and Safety - Detrimental impact on road safety as a result of the additional traffic movements that will be generated by the Project	None	None	None	None
Decommission	Driver Delay – disruption and delay to users of roads from cable installation work in road corridors	None	None	None	None
	Driver Delay – disruption and delay to users of roads as a result of the additional traffic movements that will be generated by the Project	None	None	None	None
	Community Effects (including Severance) - Disruption and delay of users of footpaths and cycle paths from cable installation work in or adjacent to active travel infrastructure	None	None	None	None
	Accidents and Safety - Detrimental impact on road safety as a result of the additional traffic movements that will be generated by the Project	None	None	None	None

12 Material Assets

12.1 Introduction

This chapter considers the impacts on built services and infrastructure. The assessment predicts the impacts on the surrounding environment arising from the construction and operation of the proposed development and, where appropriate, specifies mitigation measures to reduce potential impacts. This chapter considers utility services, utility use and waste management. Impacts on roads and traffic are discussed in Chapter 11.

12.2 Methodology and Limitations

12.2.1 Methodology

This chapter has been prepared having regard to the following documents:

- Revised Guidelines on the Information to be Contained in Environmental Impact Assessment Reports (EPA, Draft August 2017);
- Advice Notes for Preparing Environmental Impact Statements (EPA, Draft September 2015;
- Guidelines on the Information to be contained in Environmental Impact Statements (EPA 2002); and
- Advice Notes on Current Practices in the Preparation of Environmental Impact Statements (EPA 2003).

The significance of effects has been determined in line with the methodology described in Volume 3C1 Chapter 4 *EIAR Methodology*.

12.2.2 Limitations

Identification of utility services has been based on publicly available datasets and mapping, consultation with utility providers and targeted investigations.

Unidentified utility services cannot be assessed; however, such services will be identified at construction stage and the embedded and additional mitigation detailed and proposed as part of this EIAR will be implemented.

There were no other limitations encountered in compiling the information required to carry out this assessment of likely significant impacts on the built services and waste management as a result of the Irish onshore components of the Celtic Interconnector project.

12.3 Receiving Environment

12.3.1 Utility Services

Existing utility services of varying diameters and depths are located along the routes and some will be required to be crossed. These crossings will be facilitated by either open cut trenching or by use of Horizontal Directional Drilling (HDD) as and when appropriate.

Where existing utilities / services are found, the works will be diverted around the service / utility or below them depending on the degree of complexity found.

Where existing utilities or other obstacles (e.g. culverts) need to be crossed the depth to the top of the power ducts can be reduced or, alternatively, the cable can be buried below the service.

In the case of shallow burial, steel plates will be installed above the ducts and the ducts will be encased in concrete.

In some cases, an existing utility service may be relocated to facilitate the installation of the cable. The works required to do so will be coordinated with the service / utility provider and a complete coordinated methodology will be mutually agreed between all parties prior to commencement of any diversions taking place. All proposed work methodologies will aim to prevent any outages or loss of service. If the risk cannot be avoided, prearranged agreements on outages will be set in place prior to works commencement.

The majority of the onshore cable routes follow existing road infrastructure. The following known utilities have been identified along these routes.

Table 12.1: Known Utilities

Route Section Reference	Crossing Detail
AC02-AC03	Utility (Eir)
AC05-AC06	Utility (Eir- several locations)
	Utility (Irish Water Supply – several locations)
AC06-AC07	Railway
DC01-DC02	Railway
	Utility (Irish Water Supply – several)
	Utility (Eir – several)
	Utility (ESB)
DC02-DC03	Utility (Eir - several)
	Utility (Gas Networks Ireland Transmission)
	Utility (Gas Networks Ireland Transmission)
	Utility (Irish Water Supply – several locations)
DC03-DC04	Utility (Eir)
	Greenway Midleton to Youghal (Historic Railway)
DC04-DC05	Utility (Water supply)
	Utility (Water foul drainage)
	Utility (Telecoms)
DC05-DC06	Utility (ESB)
	Utility (Water Supply)
	Utility (Telecoms)
DC06-DC07	Utility (Water Supply)
	Utility (Gas)
DC07-DC08	Utility (Telecoms)
DC08-DC09	Greenway Midleton to Youghal (Historic Railway)
DC09-DC10	Utility (Water Supply)
	Utility (Telecoms)
	Utility (ESB)
DC10-DC11	Utility (Water Supply)
	Utility (Telecoms)
	Utility (ESB)
DC11-DC12	Utility (Foul Drainage)
	Utility (Water supply)
	Utility (ESB)

Route Section Reference	Crossing Detail
	Greenway Midleton to Youghal (Historic Railway)

12.3.2 Utility Use

It is anticipated that the IDA will develop water, wastewater, electricity and telecommunications services for the wider Ballyadam site and that the converter station will connect directly to same, if available. Direct connections are also discussed below.

The Contractor will apply to ESBN for a supply during the construction phase, It is anticipated that this will be from the existing10kV overhead line to the north of Ballyadam. The supply will be sized to provide sufficient supply to the site offices and the converter station and the connection and will be transferred from the Contractor to EirGrid following handover

The proposed converter station will require a clean water supply for both fire-fighting and welfare purposes (i.e. hand-washing, toilet flushing etc). during the operational phase.

Permission will be sought from Irish Water for a new connection to an existing 150mm watermain located in the local road which forms the western boundary of the IDA lands. Although a single connection to the public main is proposed, separate connections and meters will be provided for control buildings located in the converter station and for those located in the reactor compound to facilitate separate billing. A looped ‘ring main’ with hydrants for fire-fighting purposes is also proposed to be provided within the converter station and reactor compounds.

The proposed converter station will also require welfare facilities (toilets, wash-hand basins, etc) in a number of the buildings for use by staff when present on site. As the station will generally be ‘unmanned’, wastewater will only be generated on days that maintenance crews are present on site. It is therefore proposed that wastewater will be collected in proprietary holding tanks which will be periodically emptied by a licensed waste disposal contractor. Separate holding tanks will be provided for control buildings located in the converter station and for those located in the reactor compound to facilitate separate billing. The holding tanks will be fully sealed to prevent discharge to ground and will include a high-level alarm and telemetry link to the converter station’s control system such that they can be monitored remotely and emptied when necessary.

A storm water drainage system incorporating SuDS (sustainable drainage systems) features will be constructed to manage the quantity and quality of runoff during rainfall events. All proposed surfaces and storm water drainage elements will be sealed to protect the soluble karst rock beneath the site. Runoff is proposed to be discharged to an existing 600mm diameter storm water drainage pipe which has been laid in the south-west corner of the existing IDA site. Discharge from the converter station site and the associated access roads is proposed to be restricted to pre-development ‘greenfield’ runoff rates in line with the recommendations of the Greater Dublin Strategic Drainage Study (GDSDS Vol. 2 – New Development) which have generally been adopted by Local Authorities across the country.

12.3.3 Waste Management

The Southern Region Waste Management Plan 2015-2021, which includes County Cork, outlines the strategy for waste management in the southern region. The Plan notes the following:

“To date the European Commission has not developed specific regulations governing the end of waste criteria for C&D waste, therefore the EPA is allowed to decide on a case by case basis.”

"Given the sharp decrease in the number of operational landfills nationally, which have been a significant outlet for C&D waste in the past, alternative recovery options will be required in future years".

A review of Environmental Protection Agency (EPA) datasets identified East Cork landfill in Carrigtwohill. The landfill licence (Registration Number W022) indicates a maximum of 13,800 tonnes of C&D waste permitted.

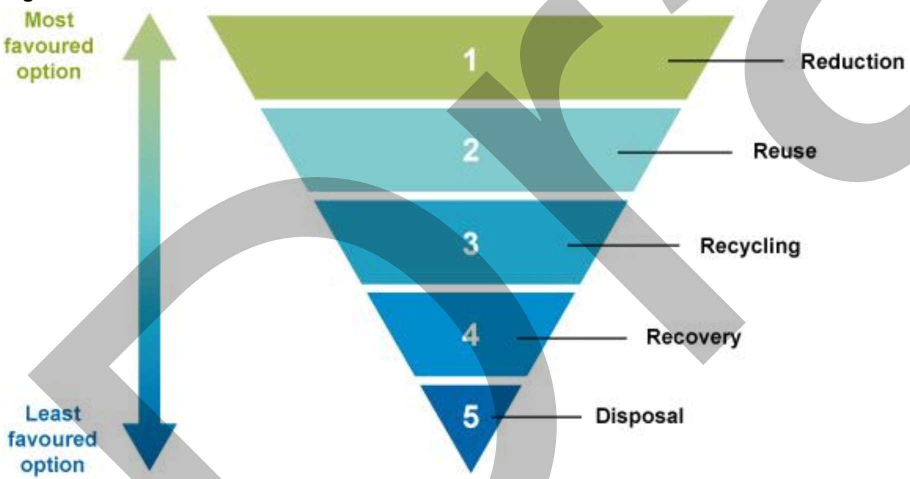
The Waste Framework Directive 2008/98/EC defines waste as *"any substance or object that the holder discards or intends to or is required to discard".*

The Waste Hierarchy described in the framework prioritises prevention over re-use, recycling recovery and disposal, as illustrated in Figure 12.1.

The framework also provides a target of 70% of non-hazardous, non-soil and stone construction and demolition (C&D) waste to be recovered, reused or recycled by 2020. According to the EPA press release in September 2020 (reference year 2018), Ireland achieved 77% material recovery in 2018.

96% of C&D waste underwent final treatment in Ireland in 2018; only 4% was exported abroad for final treatment. Most of the C&D waste finally treated in Ireland (89%) was backfilled in 2018, while only 9% of all C&D waste was recycled. Recycling was the main treatment operation for the smaller fractions of metal, plastic, glass and wood.

Figure 12.1: Waste Framework Directive



Source: OLCreate: UrbanSanWaste_1.0 Study Session 1 Introduction to Sanitation and Waste Management: Figure 1.4 The waste hierarchy. (open.edu)

12.4 Likely Significant Impacts

12.4.1 Construction Phase

12.4.1.1 Utility Services

All reasonable measures will be taken to avoid unplanned disruptions to any services during the proposed works. This will include thorough investigations to identify and reconfirm the location of all utility infrastructure within the works areas, and the implementation of robust procedures when undertaking works around known infrastructure services.

Service disruptions impacting the surrounding residential, social and commercial properties will be kept to a minimum, only occurring where unavoidable. Prior notification of disruptions will be given to all impacted properties. This will include information on when disruptions are scheduled to occur and the duration of the disruption. Consultation with relevant neighbouring parties will be undertaken prior to any proposed disruptions.

There is potential for disruption to services during construction works. Impacts would be localised and brief in duration, however, the measures detailed above will ensure that this will not result in significant impacts in the receiving environment.

12.4.1.2 Utility Use

During the construction phase temporary construction compounds will be required at the connection point (Knockraha substation), the converter station (Ballyadam) and the landfall (the area of the car park at Claycastle Beach). Welfare facilities will be provided at these locations and any discharges will be connected to a sealed holding tank to be emptied and disposed of off-site by a licenced contractor to an approved licenced facility. Water will be tankered onto site as required. Consequently, significant adverse impacts on utility services during the construction phase are not likely.

12.4.1.3 Waste Management

The volume of fill (stone) required to construct the converter station is estimated for worst-case assessment purposes at approximately 127,357m^3. The volume of cut required to construct the converter station is estimated at approximately 13,180m^3. These volumes can be reduced if cut ground can be reused on site. Ultimately, the estimations will de dependant on detailed ground investigations to be carried at pre-construction stage.

Excavated material will be re-used on site where possible. Waste will be managed in accordance with the Waste Management Hierarchy and *Guidance on Waste Acceptance Criteria at Authorised Soil Recovery Facilities* (EPA. 2020) and the Waste Management Act 1996, and associated Regulations. Consequently, significant adverse effects associated with waste management are not anticipated.

12.4.2 Operational Phase

12.4.2.1 Utilities

The converter station will generally be unmanned. No significant adverse operational phase impacts on utilities are anticipated.

12.4.2.2 Waste Management

Minimal waste will be generated during the operational phase of the proposals. Any waste generated will be managed in accordance with the Waste management Act 1996 and associated regulations. Consequently, no significant adverse impacts associated with waste management are anticipated.

12.4.3 Do-Nothing Assessment

There would be no waste generated and no impacts on utilities in a Do-Nothing scenario. Therefore, no further Do-Nothing assessment has been made.

12.4.4 Decommissioning Phase

The impacts associated with the decommissioning phase will be similar to the impacts associated with the construction phase. Therefore, provided that appropriate mitigation is used, the impact of the decommissioning phase should be reduced to a level that is not significant. Therefore, no further assessment of the decommissioning phase has been undertaken.

12.4.5 Cumulative Effects

12.4.5.1 Construction Phase

There is a risk of cumulative construction phase impacts associated with the construction phases of the proposed development occurring at the same time as the construction phases of nearby committed developments (see Table 4.2 of Volume 3C1 of this EIAR for further details of these developments). Consequently, there will be a need to ensure that where works are occurring in parallel that appropriate mitigation measures are considered, including the scheduling of works, regular liaison meetings between project teams to ensure plans are co-ordinated and impacts are minimised. With the implementation of these, and the subsequently identified mitigation measures, the cumulative impacts associated with the construction phase should not be significant.

12.4.5.2 Operational Phase

Significant adverse cumulative effects during the operational phase are not anticipated.

12.5 Mitigation and Monitoring Measures

12.5.1 Construction Phase

12.5.1.1 Utilities

All reasonable measures will be taken to avoid unplanned disruptions to any services during the proposed works. This will include thorough investigations to identify and reconfirm the location of all utility infrastructure within the works areas, and the implementation of robust procedures when undertaking works around known infrastructure services.

Service disruptions impacting the surrounding residential, social and commercial properties will be kept to a minimum, only occurring where unavoidable. Prior notification of disruptions will be given to all impacted properties. This will include information on when disruptions are scheduled to occur and the duration of the disruption. Consultation with relevant neighbouring parties will be undertaken prior to any proposed disruptions.

12.5.1.2 Waste Management

A Construction Waste Management Plan (as part of the CEMP) will be prepared by the appointed contractor and agreed with the Planning Authority prior to commencement of development. The plan will provide for the segregation of all construction wastes to facilitate optimum levels of re-use, recovery, and recycling operations.

The plan will be prepared in accordance with waste management guidance and the principles as outlined in *Design Out Waste: A design team guide to waste reduction in construction and demolition projects* (EPA, 2015) and *Best Practice Guidelines on the Preparation of Waste Management Plans for Construction and Demolition Projects*, Department of the Environment, Heritage and Local Government (DoEHLG), June 2006.

All operations at the site will be managed and programmed in such a manner as to prevent / minimise waste production and maximise upper tier waste management (i.e. re-use, recycle, and recovery) in line with the Waste Hierarchy where technically and economically feasible.

Waste arisings will be handled, stored, managed and re-used or recycled as close as practicable to the point of origin.

Wastes sent off site for recovery or disposal will only be conveyed by an authorised waste contractor and transported from the proposed development site to an authorised site of recovery / disposal in accordance with the Waste Management Act 1996 and associated amendments and regulations and in a manner which will not adversely affect the environment. All employees will be made aware of their obligations under the Plan.

The Plan will be available for inspection at the site of the proposed substation at all reasonable times for examination by the Local Authority.

12.5.2 Operational Phase

12.5.2.1 Utilities

As no significant adverse operational phase impacts on utilities are anticipated, no specific mitigation measures are proposed.

12.5.2.2 Waste Management

All waste generated during the operational phase will be managed in accordance with the relevant provisions of the Waste Management Act 1996 and associated amendments and regulations, particularly with regard to the use of appropriately permitted waste contractors and destinations for waste materials.

12.6 Residual Impacts

Once construction is complete significant adverse residual impacts associated with the proposed development on built services and waste management are unlikely.

The implementation of the mitigation measures detailed above, including a C&D Waste Management Plan, will reduce the environmental impact of the proposed development. Certain brief and temporary impacts such as relocation of utilities may be unavoidable but no significant impacts are anticipated provided the mitigation described herein are implemented.

12.7 Transboundary Effects

The embedded mitigation measures are sufficient to ensure that transboundary effects associated with the proposed development on built services and waste management will not occur.

12.8 Summary

The following table summarises the impacts assessment of built services and infrastructure on the surrounding environment.

Phase	Aspect	Embedded design, mitigation and enhancement measures	Sensitivity /value of receptor	Duration of impact	Magnitude of impact (with mitigation)	Significance impact
Construction	Utility Services	Co-ordination and engagement with service provided Implementation of CEMP	Low	Localised and Brief	Low	Not Significant
	Utility Use	As above	Low	Localised and Brief	Low	Not Significant
	Waste Management	Compliance with Waste Management Act and associated Regulations Implementation of a C&D Waste Management Plan	Low	Short-term	Low	Not Significant
Operation	Utility Services	Mitigation by design	Low	Long-term	Low	Not Significant
	Utility Use	Mitigation by design	Low	Long-term	Low	Not Significant
	Waste Management	Compliance with Waste Management Act and associated Regulations	Low	Long-term	Low	Not Significant

13 Noise and Vibration

13.1 Introduction

This chapter considers the impacts due to noise and vibration arising from the onshore section of the proposed development and the correspond effects on onshore receptors. Volume 3D considers noise and vibration impacts and effects of the proposed development on the marine environment.

The assessment predicts the potential noise and vibration impacts on the surrounding environment arising from the construction and operation of the proposed development and, where appropriate, specifies mitigation measures to reduce potential impacts.

The construction and operation of the proposed development will involve activities and equipment which emit noise. Some types of construction work will also result in ground-borne vibration.

The convertor station site at Ballyadam will lie within an area with scattered residential receptors to the north, east and west, within 190m of the converter station site at their nearest point. The Connection Point at Knockraha will lie within the existing Knockraha substation site which is located in a rural location with the closest residential receptors to the west, within 320m of the converter station site at their nearest point. The landfall area at Claycastle will lie adjacent to Summerfield Holiday Park.

Therefore, there is potential for the construction and operation of the proposed development to result in adverse noise effects on sensitive receptors.

13.2 Methodology and Limitations

13.2.1 Legislation and Guidance

The Environmental Noise Regulations (ENR)[147] transposes EU Directive 2002/49/EC[148] (commonly referred to as the Environmental Noise Directive (END)) for the strategic control of environmental noise in the Republic of Ireland.

Nuisance due to noise is dealt with by the Environmental Protection Agency Act S.I. No. 7/1992 (as amended), and the Environmental Protection Agency Act, 1992 (Noise) Regulations, 1994 S.I. No. 179/1994. and the Protection of the Environment Act 2003 S.I. No.27/2003 (as amended) require Best Available Techniques in controlling noise as a result of human activity "*which may be harmful to human health or the quality of the environment, result in damage to material property, or impair or interfere with amenities and other legitimate uses of the environment*". It clarifies that noise includes vibration.

The Environmental Protection Agency has not produced guidance relevant to the proposed development. EPA noise guidance[149] relates only to scheduled activities, and wind turbine operations. However, this chapter has had regard for relevant content of other guidance

[147] Environmental Noise Regulations, 2006 (S.I. No. 140/2006) and European Communities (Environmental Noise Regulations) 2018 (S.I. No. 549/2018).

[148] The European Parliament and the Council of the European Union, 2002. Directive 2002/49/EC of 25 June 2002 relating to the assessment and management of environmental noise.

[149] Environmental Protection Agency Office of Environmental Enforcement (2016). Guidance Note for Noise: Licence Applications, Surveys and Assessments in Relations to Scheduled Activities (NG4).

documents, including Transport Infrastructure Ireland's Good Practice Guidance for the Treatment of Noise during the Planning of National Road Schemes (TII, 2014)[150].

13.2.2 Desktop Studies

The potential noise impacts during the construction and operation of the proposed development have been predicted using three-dimensional acoustic models developed within DataKustik CadnaA software. The software implements the procedures described within:

- British Standard (BS) 5228 'Code of Practice for Noise and Vibration Control on Construction and Open Sites – Part 1 Noise' (2009+A1:2014)[151] Annex F for the prediction of construction noise impacts; and
- International Standard ISO 9613 'Acoustics - Sound Attenuation During Propagation Outdoors Part 2 General Method of Calculation' (1996)[152] for the prediction of noise from sources of operational noise.

The methodology and case studies described within 'BS 5228 - Part 2: Vibration (2009+A1:2014)'[153] have been used for the prediction of ground-borne vibration from some types of construction activity. It should be noted that the generation, transmission and reception of ground-bone vibration is affected by many parameters including energy input, boundary impedances and the properties of the intervening ground.

13.2.3 Field Studies

Background sound measurements were undertaken between 26 August 2020 and 27 January 2021 to represent the closest Noise Sensitive Locations (NSL) to the proposed Connection Point, Convertor Station Site Compound and the Landfall at Claycastle.

13.2.4 Methodology for Assessment of Effects

13.2.4.1 Construction Noise

BS 5228 Part 1:2009+A1:2014 has been adopted for the assessment of effects at noise sensitive receptors. It provides comprehensive guidance including details of typical noise levels associated with items of plant and activities, prediction methods, and options for mitigation measures, and therefore has been considered appropriate for use in this assessment.

Based on the BS 5228 Part 1 'Example method 1 – ABC Method' in BS 5228 Part 1:2009+A1:2014, noise levels generated by site activities are deemed to be potentially significant if the predicted construction noise level ($L_{Aeq,T}$) at the receptor exceeds the applicable threshold value. Table F.1 of the BS 5228 Part 1:2009+A1:2014 is reproduced in Table 13.1 and the levels at which a significant effect is indicated.

Table 13.1: Threshold of potential significant effects due to construction noise at sensitive receptors (residential)

Assessment category and threshold value period	Threshold value $L_{Aeq,T}$ dB		
	Category A	Category B	Category C
Night-time	45	50	55

[150] National Roads Authority (2014). Good Practice Guidance for the Treatment of Noise during the Planning of National Road Schemes.
[151] British Standards Institution (2009+A1:2014). Code of Practice for Noise and Vibration Control on Construction and Open Sites – Part 1 Noise.
[152] International Standard Organization (1996). ISO 9613 'Acoustics - Sound Attenuation During Propagation Outdoors Part 2 General Method of Calculation'
[153] British Standards Institution (2009+A1:2014). Code of Practice for Noise and Vibration Control on Construction and Open Sites – Part 2 Vibration

Assessment category and threshold value period	Threshold value $L_{Aeq,T}$ dB		
	Category A	Category B	Category C
(any day 11 p.m. – 7 a.m.)			
Evenings and Weekends (weekdays 7 p.m. – 11 p.m., Saturdays 1 p.m. – 11 p.m., and Sundays 7 a.m. – 11 p.m.)	55	60	65
Standard working hours (weekdays 7 a.m.- 7 p.m. and Saturdays 7 a.m. – 1 p.m.)	65	70	75

The threshold value is assigned based on the representative baseline ambient noise level for the receptor:

- Category A: Threshold value to use when ambient noise levels (when rounded to the nearest 5 dB) are less these threshold values;
- Category B: Threshold values to use when ambient noise levels (when rounded to the nearest 5 dB) are the same as Category A values; and,
- Category C: Threshold values to use when ambient noise levels (when rounded to the nearest 5 dB) are higher than Category A values.

If the (baseline) ambient noise level exceeds the Category C threshold value, a significant effect is identified if the contribution of site noise results in a 3 dB increase in the period ambient noise level.

BS 5228 states: "*The assessor then needs to consider other project-specific factors, such as the number of receptors affected and the duration and character of the impact, to determine if there is a significant effect*".

BS 5228 provides the following criteria for impact duration for the purposes of assessing eligibility for the provision of noise insulation and temporary rehousing due to the impact of construction noise:

- A period of 10 or more days of working in any 15 consecutive days; or
- A total number of days exceeding 40 in any 6 consecutive months.

13.2.4.2 Construction Vibration

BS 5228 provides comprehensive guidance on the assessment of vibration due to construction activity. It considers levels of vibration from construction in terms of peak particle velocity (ppv) defined as the instantaneous maximum velocity reached by a vibrating element as it oscillates about its rest position and is expressed in millimetres per second (mm/s).

BS 5228 provides guidance on the levels of vibration associated with human perception and disturbance and the onset of potential structural damage to different types of buildings.

Table 13.2 presents guidance on threshold values for the human perception of vibration arising during construction. For the purpose of this EIAR, the significance of effects is also given.

Table 13.2: BS 5228 Part 2 guidance on the human perception effects of vibration due to construction activity and significance of effect

Vibration level ppv mm/s	Effect	Significance
0.14	Vibration might be perceptible in most sensitive situations for most vibration frequencies associated with construction. At lower frequencies, people are less sensitive to vibration.	Not significant

Vibration level ppv mm/s	Effect	Significance
0.3	Vibration might be just perceptible in residential environments.	Not significant
1.0	It is likely that vibration of this level in residential environments will cause complaint but can be tolerated if prior warning has been given to the residents.	Significant
10.0	Vibration is likely to be intolerable for any more than a very brief exposure to this level in most building environments.	Significant

BS 5228 Part 2:2009+A1:2014 states that low frequency vibration at a ppv of 15mm/s may cause cosmetic damage in un-reinforced or light framed structures e.g. for residential / light commercial use. BS 5228 Part 2:2009+A1:2014 states that vibration at a ppv of 50mm/s may cause cosmetic damage in heavy commercial buildings. These values apply to transient vibration which does not induce a resonant response in structures and low-rise buildings. A source of continuous low frequency vibration may induce a vibration response in buildings or structures at their resonant frequencies. The building would then be subject to additional dynamic forces arising from its own motion. Therefore, BS 5228 Part 2:2009+A1:2014 recommends that the values given should be reduced by 50% to take into account for dynamic magnification due to resonances.

Table 13.3 presents guidance on threshold values for the potential onset of cosmetic damage to buildings due to vibration arising during construction. For the purpose of this EIAR, the significance of effects is also given.

Table 13.3: BS 5228 Part 2 guidance on potential cosmetic damage to buildings due to construction activity and significance of effect

Vibration level ppv mm/s	Effect	Significance
Less than 7.5	Low risk of cosmetic damage to un-reinforced or light framed structures / buildings (e.g. residential buildings)	Not significant
7.5 or more	Onset of increased risk of cosmetic damage to un-reinforced or light framed structures / buildings	Significant

13.2.4.3 Operational Noise

The British Standard BS 4142 'Method for rating and assessing industrial and commercial sound' (2014, amended 2019)[154] provides a methodology for assessing the impact of industrial noise sources on residential receptors as a process to assess sound from sources of an industrial nature.

The level of sound from an industrial source, the 'rating level', is expressed in terms of the $L_{Aeq,T}$ descriptor, and compared to the existing background sound level, expressed in terms of $L_{A90,T}$ descriptor. If the source is impulsive, intermittent or tonal in nature, then the 'rating level' includes a penalty, to account for the character of the sound. For the purpose of this assessment, a penalty of +5 dB is added to all predicted specific noise levels.

BS 4142 assesses the significance of noise impact based upon the difference between the rating level and background sound level:

- "*Typically, the greater this difference, the greater the magnitude of the impact;*

[154] British Standards Institution (2014+A1:2019). Method for rating and assessing industrial and commercial sound.

  - *A difference of around +10 dB or more is likely to be an indication of a significant adverse impact depending on the context;*
  - *A difference of around +5 dB is likely to be an indication of an adverse impact, depending on the context; and;*
  - *The lower the rating level is relative to the measured background sound level, the less likely it is that the specific sound source will have an adverse impact or a significant adverse impact.*
- *Where the rating level does not exceed the background sound level, this is an indication of the specific sound source having a low impact, depending on the context*."

For the purpose this EIAR, Table 13.4 sets out the assessment of operational nose impacts and significance of effects. It is assumed that predicted rating noise levels include a +5 dB penalty for acoustic features.

Table 13.4: BS 4142 assessment of operational noise and significance of effect

Excess of rating level over background sound level	BS 4142 assessment depending on context	Significance depending on context
2 dB or less	Low likelihood of adverse or significant impact	Not significant
3 dB to 7 dB	Likelihood of adverse impact	Not significant
8 dB or greater	Likelihood of significant adverse impact	Significant

13.2.4.4 Operational Vibration

Operational vibration due to the proposed developments is assumed to be negligible because:

- The plant to be installed does not generate significant vibration during operation; and
- Relatively long separation distance between plant and nearest sensitive receptors:
  - Connection Point – minimum 320m;
  - Convertor Station Site Compound – minimum 190m; and
  - Landfall at Claycastle – minimum 20m but comprises no equipment with moving parts.

Therefore, operational vibration is not considered further.

13.2.5 Limitations of this Chapter

13.2.5.1 COVID 19

Background sound level measurements were undertaken during COVID 19 pandemic restrictions. In general, this is likely to have reduced road traffic noise below typical levels. Consequently, background sound levels will be lower such that any predicted changes in ambient noise levels due to the proposed development will be larger. Therefore, the use of the background sound levels from period of Covid 19 restrictions is expected to result in a more conservative / precautionary assessment of noise impacts associated with the proposed development, relative to an assessment carried out using pre-COVID baseline levels.

13.2.5.2 Construction Information

The specific inventory of plant and working methods to be applied during the construction phase will be devised by the appointed construction contractor. The construction contractor is not yet appointed therefore, these specific details are not available to inform the assessment of potential noise and vibration impacts. However, the assessment has been undertaken based on the impacts of typical construction activities that are expected to be required, based on extensive experience of construction of these types of electricity and civil infrastructure development, and this is considered to be robust.

13.3 Receiving Environment

13.3.1 Connection Point

The proposed Connection Point lies within the existing 220kV substation at Knockraha and on the eastern part of the substation site. The closest receptors are five dwellings to the west / south-west of the substation site adjacent to the road. There are other scattered properties nearby in this rural location.

Background sound measurements comprised a combination of attended and unattended noise measurements undertaken from Monday 4 to Wednesday 27 January 2021. The measurement positions used are:

- U1 – unattended, continuous measurement at Whiteoaks, Ballinanleigh from 21 January 2021 to 27 January 2021
- AT1 – attended measurements adjacent to Woodrock House during the day, evening and night period 4 to 5 January 2021
- AT2 – attended measurement on the eastern edge of Knockraha village during the day, evening and night period 4 to 5 January 2021
- AT3 – attended measurement at Whiteoaks, Ballinanleigh during the day, evening and night period 4 to 5 January 2021
- AT4 – attended measurement in the area of The Brambles, Knockraha East, during the day, evening and night period 4 to 5 January 2021

The results of the measurements are included in the report[155] attached in Appendix 4.1.

The closest sensitive receptors are described in Table 13.5 and indicated in Figure 13.1 and are adopted as the NSLs for the assessment of potential impacts. The baseline measurement positions associated with each NSL are also indicated.

The background sound climate at the closest NSLs to the west of the existing substation site is dominated by existing substation transformer noise in the absence road traffic noise. At the other measurement positions, it was observed that distant and occasional local traffic, wind in the trees and corona discharge noise from a pylon near position AT4 contribute to the sound climate in the area.

[155] ICAN Acoustics (2021). Baseline Noise Survey at Knockraha and close to Knockraha 220 kV Substation, Cork City. Revision 1.5.

Figure 13.1: NSLs and baseline sound measurement positions considered in the area of the proposed Connection Point

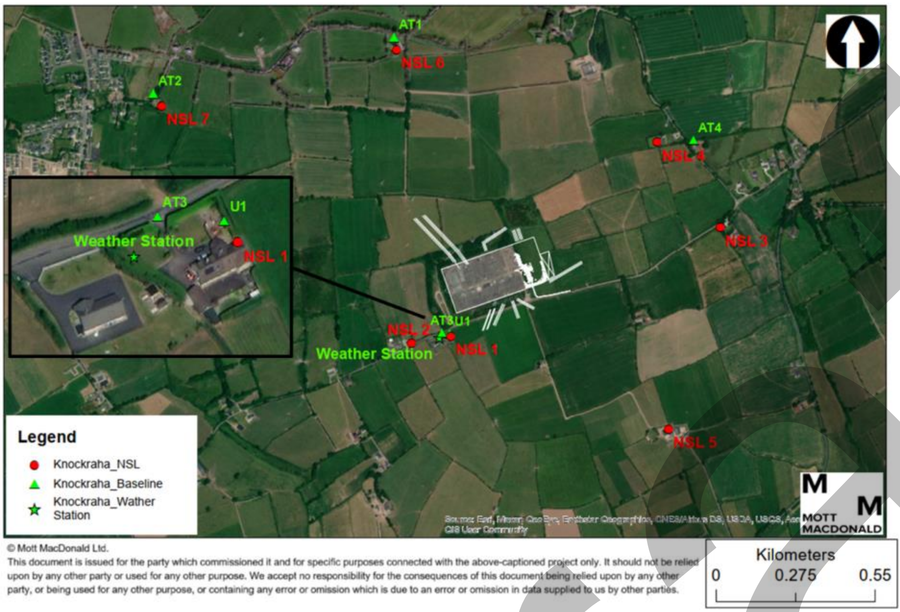


Table 13.5: Typical background sound levels for sensitive receptors in the area of the proposed Connection Point

NSL	Name	Background sound measurement position	Daytime $L_{Aeq,12h}$ dB	Evening $L_{Aeq,4h}$ dB	Night $L_{Aeq,8h}$ dB	Typical daytime L_{A90} dB	Typical night-time L_{A90} dB
NSL1	White Oaks, Ballinanleigh	U1 / AT3	54	39	38	39	34
NSL2	Stormy Heathers, Ballinanliegh	U1 / AT3	54	39	38	39	34
NSL3	Cariad, Killeena, Knockraha	AT4	48	38	42	38	33
NSL4	The Brambles, Knockraha East	AT4	48	38	42	38	33
NSL5	Reenaslough, Knockraha	AT4	48	38	42	38	33
NSL6	Woodrock House, Knockraha	AT1	47	40	39	40	38
NSL7	Knockraha West	AT2	51	37	33	35	30

13.3.2 HVAC and HVDC Onshore Cable Routes

The HVAC / HVDC cable routes lie predominantly along existing major and minor roads with some off-road sections, particularly in the case of the HVDC route (e.g. Castlemartyr and Killeagh). The baseline noise climate affecting receptors adjacent to the cable routes is mainly road traffic noise. Sensitive receptors immediately adjacent to the route are typically individual dwellings.

13.3.3 Converter Station Site Compound

The Convertor Station Site Compound is located at Ballyadam, Carrigtwohill in County Cork. The N25 dual carriageway road runs along the length of the southern perimeter of the site and is the main source of environmental noise affecting the closest sensitive receptors to the site. The Cork to Cobh commuter railway line runs adjacent to the length of the northern perimeter of the site. Road traffic on the N25 road, the railway and road traffic on local roads are the main contributors to the baseline noise climate.

Background sound measurements comprised a combination of attended and unattended noise measurements undertaken:

- Wednesday 26 August 2020 and Thursday 27 August 2020
- Wednesday 11 November 2020 and Thursday 12 November 2020

The measurement positions used are:

- UA1 – unattended, continuous measurement on the north side of the site close Ballyadam House 26 to 27 August 2020 and 11 to 12 November 2020
- UA2 – unattended, continuous measurement close the dwellings to the east of the site 11 November 2020 to 12 November 2020
- AT1A – attended measurements adjacent to the north side of Ballyadam House during the day, evening and night period 26 to 27 August 2020 and 11 to 12 November 2020
- AT1B – attended measurements adjacent to the southern side of Carrigane House during the day, evening and night period 26 to 27 August 2020 and 11 to 12 November 2020
- AT2 – attended measurements adjacent to Formosa Gardens, Ballyadam, during the day, evening and night period 26 to 27 August 2020 and 11 to 12 November 2020
- AT3 – attended measurements adjacent to dwellings adjacent to the N25 road and to the south-west of the site during the day, evening and night period 26 to 27 August 2020

The background sound measurement report[156] is attached in Appendix 4.1.

The closest sensitive receptors are described in Table 13.6 and indicated in Figure 13.2 and are adopted as the NSLs for the assessment of potential impacts. The baseline measurement positions associated with each NSL are indicated.

[156] ICAN Acoustics (2020). Baseline Noise Survey 1 & 2 at Ballyadam, Carrigtwohill, Co. Cork. Revision 1.6.

Figure 13.2: NSLs and baseline noise measurement positions considered in the area of the proposed Convertor Station Site Compound

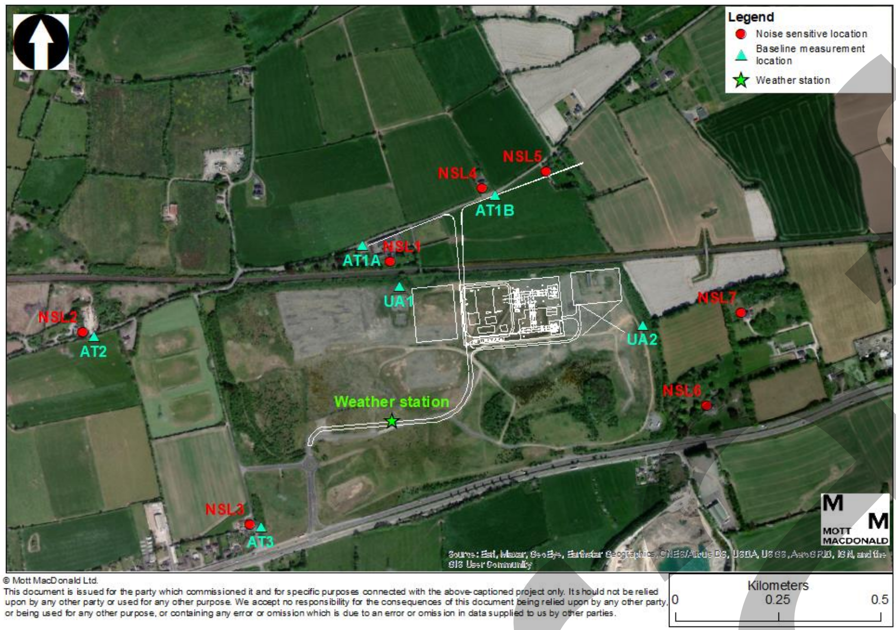


Table 13.6: Typical background noise levels for sensitive receptors in the area of the proposed Converter Station Site Compound

NSL	Name	Background sound measurement position	Day $L_{Aeq,12h}$ dB	Evening $L_{Aeq,4h}$ dB	Night $L_{Aeq,8h}$ dB	Typical daytime L_{A90} dB	Typical night-time L_{A90} dB
NSL1	Ballyadam House	AT1A	65	63	55	47	34
NSL2	Formosa Gardens	UA1	47	46	39	51	30
NSL3	Dwelling at Gortagousta	AT3	66	60	37	62	37
NSL4	Carrigane House	AT1B	67	62	36	51	36
NSL5	Dwelling close to Carrigane House	AT1B	67	62	36	51	36
NSL6	Greycourt House, Milebush	AT3	66	60	37	62	37
NSL7	Emohruo, Ballyrichard More	UA2	57	49	49	54	29

*NSL2 is also representative of the Carrigtwohill planned development/urban expansion

13.4 Landfall Area

Baseline surveys comprised a combination of attended and unattended noise measurements undertaken:

- Monday 31 August 2020 and Tuesday 1 September 2020
- Friday 13 November 2020 and Saturday 14 November 2020

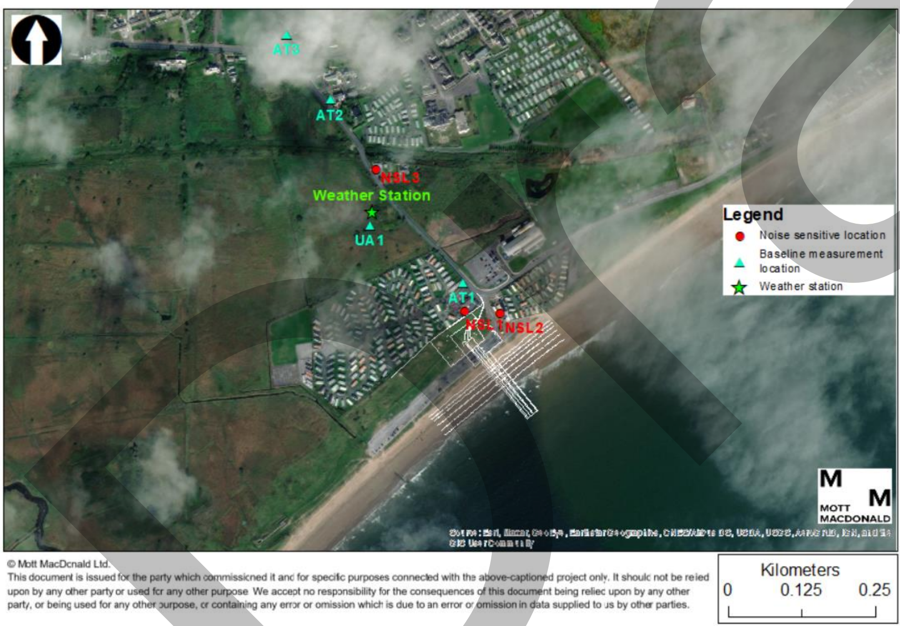
The measurement positions used are:

- UA1 – unattended, continuous measurement ~70m north of the Summerfield Holiday Park on 31 August 2020 to 1 September 2020 and 12 to 13 November 2020
- AT1– attended measurements close to the entrance to Summerfield Holiday Park during the day, evening and night period 31 August 2020 to 1 September 2020 and 12 to 13 November 2020
- AT2– attended measurements close to the southern edge of Atlantic Park, Summerfield, Youghal and adjacent to The Paddock during the day, evening and night period 31 August 2020 to 1 September 2020 and 12 to 13 November 2020
- AT3 – attended measurements close to Caple Island Village, Summerfield, Youghal during the day, evening and night period 31 August 2020 to 1 September 2020 and 12 to 13 November 2020

The background sound measurement report[157] is attached in Appendix 4.1.

The closest sensitive receptors are described in Table 13.7 and indicated in Figure 13.3 and are adopted as the NSLs for the assessment of potential impacts. The background sound measurement positions associated with each NSL are indicated.

Figure 13.3: NSLs and baseline sound measurement positions considered in the area of the proposed Landfall at Claycastle



[157] ICAN Acoustics (2020). Baseline Noise Survey 1 & 2 at Claycastle, Co. Cork. Revision 1.5.

Table 13.7: Typical background noise levels for sensitive receptors in the area of the proposed Landfall at Claycastle

NSL	Name	Background noise measurement position	Daytime $L_{Aeq,12h}$ dB	Evening $L_{Aeq,4h}$ dB	Night $L_{Aeq,8h}$ dB	Typical daytime L_{A90} dB	Typical night-time L_{A90} dB
NSL1	Summerfield Holiday Park	AT1	60	60	42	46	40
NSL2	Caravan Park (Front Strand)	AT1	60	60	42	46	40
NSL3	Aynsley Cottage	AT2	61	54	41	43	35

13.4.1 Construction Laydown Areas and Passing Bays

The construction laydown areas and passing bays lie predominantly along existing major and minor roads with some off-road sections, particularly in the case of the HVDC route (e.g. Castlemartyr and Killeagh). The baseline noise climate affecting receptors adjacent to the cable routes is mainly affected by road traffic noise but generally within rural areas. Sensitive receptors immediately adjacent to the route are typically individual dwellings.

13.5 Characteristics of the Development

13.5.1 Connection Point

13.5.1.1 Construction Noise

Table 13.8 presents a summary of the predicted noise impacts during the construction of the proposed Connection Point.

Table 13.8: Predicted noise impacts at NSLs due to the construction of the proposed Connection Point

NSL	Name	Assessment threshold value (day/eve/night) dB(A)*	Predicted typical and highest construction noise level dB(A)	Stage of work
NSL1	White Oaks, Ballinanleigh	65 / 55 / 45	44 / 45	Installation of mechanical and electrical services
NSL2	Stormy Heathers, Ballinanliegh	65 / 55 / 45	44 / 45	Installation of mechanical and electrical services
NSL3	Cariad, Killeena, Knockraha	65 / 55 / 45	<40 / <40	All stages
NSL4	The Brambles, Knockraha East	65 / 55 / 45	<40 / <40	All stages
NSL5	Reenaslough, Knockraha	65 / 55 / 45	<40 / <40	All stages
NSL6	Woodrock House, Knockraha	65 / 55 / 45	<40 / <40	All stages
NSL7	Knockraha West	65 / 55 / 45	<40 / <40	All stages

*Based on baseline ambient sound levels in Table 13.5

The results show that the typical and maximum noise levels from general construction activity on site are not expected to exceed the appropriate threshold values.

13.5.1.2 Construction Vibration

The shortest plan distance between the works and nearby dwellings is 290m. Vibration due to vibratory piling (if required) at the closest dwelling to the extent of the works is predicted using the empirical method presented in Annex E of BS 5228 Part 2:2009+A1:2014 and presented in Table 13.9.

Table 13.9: Assessment of vibration at the closest dwelling to the extent of the works arising during vibratory piling

	Predicted ppv due to vibratory piling at the closest dwelling (mm/s)	Significance	
		Human perception	**Cosmetic damage**
Start up and run down	0.1	Not significant	Not significant
Steady state	0.0	Not significant	Not significant

*Scaling factor kV = 126 with 33.3% probability of the predicted value being exceeded

This shows that if vibratory piling works are undertaken at the closest part of the works to the closest adjacent dwellings there it is unlikely that vibration levels will be perceptible or result in cosmetic damage to buildings. The levels of vibration during start and run down, and steady state piling are assessed as not significant.

13.5.1.3 Operational Noise

Operational noise originates from the various items of fixed plant to be installed at the proposed Connection Point site. The main noise-emitting items and noise emission values used to predict potential impacts are presented in Table 13.10.

Table 13.10: Sources of operational noise – Connection Point

Item	Sound Power Level dB(A) per unit	Quantity	Note
400kV three-phase power transformer	95	1	No specific mitigation

Table 13.11 presents a summary of the predicted rating noise impacts during the operation of the proposed Connection Point. Figure 13.4 presents the results as a noise contour plot. The predictions do not take into account the benefit of separate measures on the western boundary of the site to limit the spread of noise from the existing substation. It is proposed that these measures would be introduced in 2021.

Table 13.11: Predicted rating noise levels for the operation of the proposed Connection Point

NSL	Name	Predicted rating noise level dB(A)	Representative baseline L_{A90} dB		Largest excess dB
			Day	Night	
NSL1	White Oaks, Ballinanleigh	36	39	34	+2
NSL2	Stormy Heathers, Ballinanliegh	36	39	34	+2
NSL3	Cariad, Killeena, Knockraha	33	38	33	0
NSL4	The Brambles, Knockraha East	29	38	33	-4
NSL5	Reenaslough, Knockraha	32	38	33	-1

NSL	Name	Predicted rating noise level dB(A)	Representative baseline L_{A90} dB		Largest excess dB
NSL6	Woodrock House, Knockraha	25	40	38	-13
NSL7	Knockraha West	26	35	30	-4

The results show that the predicted rating noise level (inclusive of a +5 dB penalty for acoustic features) of the proposed Connection Point is below or slightly above the typical night-time background sound levels at all NSLs. This indicates that based on the magnitude of the predicted noise impact, the operation of the proposed Connection Point is unlikely to have an adverse impact.

The proposed transformer is expected to generate low-frequency tonal noise. Although this is an existing feature for the baseline sound climate in the area of the substation, it is recommended that measures are incorporated into the design to reduce transformer noise to a minimum. This should be considered during detail design and reduce the rating noise level below typical background sound level to avoid potential disturbance.

Figure 13.4: Predicted specific noise level of operational noise of the proposed Connection Point

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Kilometers
0 0.275 0.55

13.5.2 HVAC and HVDC Onshore Cable Route

13.5.2.1 Noise

Noise impacts arising during the construction phase for the in-road and off-road HVAC / HVDC cable route are considered as 'Not Significant'. These impacts would be temporary as for each 100m section of road, construction activities will last one to two days before moving on to the next section of route. Mitigation measures appropriate for the cable routes and the incorporation of such measures within the Construction Environmental Management Plan (CEMP) will be applied.

13.5.2.2 Vibration

Activities that are expected generate ground-borne vibration during the construction phase include:

- Breaking out of existing pavements;
- Excavation; and
- Vibratory compaction of fill materials and rolling of surfacing as part of reinstatement.

Annex E of BS 5228 Part 2:2009+A1:2014 includes an empirical method for the prediction of vibration arising from vibratory compaction. Using parameters corresponding with a moderate-size vibratory roller (one vibrating drum, 1m width and 1mm maximum amplitude of drum vibration), the distances at which the thresholds of significant effects are exceeded are given in Table 13.12.

Table 13.12: Predicted distances at which ground-borne vibration from vibratory compaction exceeds significance criteria

	Human perception (1mm/s)			Cosmetic damage (7.5mm/s)		
Probability that the predicted value is exceeded	50%	33.3%	5%	50%	33.3%	5%
Predicted distance at which the threshold is exceeded (metres)	16	26	42	3	6	10

This shows that vibration arising during vibratory compaction at distances within ~16m of surfacing works is likely to be of sufficient magnitude to cause complaint, and within 3m it may cause cosmetic damage to residential buildings or light-framed structures. Vibration due to excavation is expected to be generally lower in magnitude than vibratory compaction. Vibration during breaking-out may be greater but much shorter in duration.

13.5.3 Converter Station Site Compound

13.5.3.1 Construction Noise

Table 13.13 presents a summary of the predicted noise impacts during the construction of the proposed Convertor Station Site Compound.

Table 13.13: Predicted noise impacts at NSLs due to the construction of the proposed Convertor Station Site Compound

NSL	Name	Assessment threshold value (day/eve/night) dB(A)*	Predicted typical and highest construction noise level dB(A)	Stage of work
NSL1	Ballyadam House	70 / 65 / 55	48 / 54	Ground improvement / piling
NSL2	Formosa Gardens	65 / 55 / 50	<40 / <40	All stages
NSL3	Dwelling at Gortagousta	70 / 65 / 45	<40 / 41	All stages
NSL4	Carrigane House	70 / 65 / **45**	49 / **52**	Ground improvement / piling
NSL5	Dwelling close to Carrigane House	70 / 65 / **45**	47 / **51**	Ground improvement / piling
NSL6	Greycourt House, Milebush	70 / 65 / **45**	43 / **46**	Ground improvement / piling
NSL7	Emohruo, Ballyrichard More	65 / 55 / 55	42 / 45	Ground improvement / piling

*Based on baseline ambient sound levels in Table 13.6

The results show that the typical and maximum noise levels from general construction activity on site are not expected to exceed the appropriate threshold values except at NSL4, 5 and 6 (exceeded by 7 dB, 6 dB and 1 dB respectively) and only if ground improvement / piling works were to be undertaken during the night-time.

13.5.3.2 Construction Vibration

The shortest plan distance between the works and nearby dwellings is 175m. Vibration due to vibratory piling (if required) at the closest dwelling to the extent of the works is predicted using the empirical method presented in Annex E of BS 5228 Part 2:2009+A1:2014 and presented in Table 13.14.

Table 13.14: Assessment of vibration at the closest dwelling to the extent of the works arising during vibratory piling

	Predicted ppv due to sheet piling at the closest dwelling (mm/s)	Significance	
		Human perception	Cosmetic damage
Start up and run down	0.3	Not significant	Not significant
Steady state	0.1	Not significant	Not significant

*Scaling factor kV = 126 with 33.3% probability of the predicted value being exceeded

This shows that if vibratory piling works are undertaken at the closest part of the works to the closest adjacent dwellings, there is potential for vibration levels to be just perceptible during start up and run down. Levels are not expected to result in cosmetic damage to buildings. The levels of vibration during start and run down, and steady state piling are assessed as not significant.

13.5.3.3 Operational Noise

Operational noise originates from the various items of fixed plant to be installed on the site. The main noise-emitting items and noise emission values used to predict potential impacts are presented in Table 13.15. The noise emission levels of the specific items of equipment that will be procured is dependent on the supplier. However, the overall levels of noise at the NSLs due to the proposed facility are required to be equal to or less than those predicted here to ensure there are no significant adverse effects.

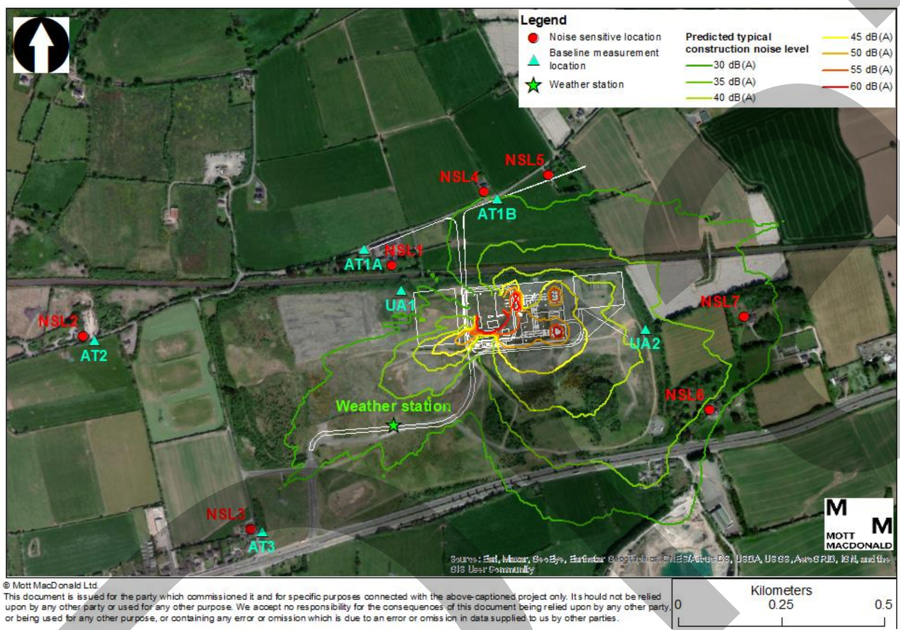
Table 13.15: Sources of operational noise – Convertor Station Compound

Item	Sound Power Level dB(A) per unit	Quantity	Note
Power transformer	68	3	With mitigation of acoustic enclosure
Power transformer cooling fans	74	3 x 12	With mitigation of silencers
Compensation reactor	75	6	With mitigation of acoustic enclosures with top hats
Harmonic filter capacitor	73	3	With mitigation of sound shield
Harmonic filter reactor	70	3	With mitigation of top hat and sound shield
DC smoothing reactor	75	3	With mitigation of top hat and sound shield

Item	Sound Power Level dB(A) per unit	Quantity	Note
Valve cooler	84	10	With mitigation of silencers and 4m acoustic barrier around the cooler bank
Air handling unit	84	2	No specific mitigation

Figure 4.5 presents the predicted operational noise contours due to the proposed Convertor Station Site Compound. Predicted noise levels at the NSLs are presented in Table 13.16.

Figure 13.5: Predicted specific noise level of operational noise



Source: Mott MacDonald

Table 13.16: Predicted rating noise levels for the operation of the proposed Convertor Site Station Compound

NSL	Name	Predicted rating noise level dB(A)	Representative baseline L_{A90} dB		Largest excess dB
			Day	Night	
NSL1	Ballyadam House	29	47	34	-4
NSL2	Formosa Gardens	18	51	30	-12
NSL3	Dwelling at Gortagousta	27	62	37	-10
NSL4	Carrigane House	30	51	36	-6
NSL5	Dwelling close to Carrigane House	28	51	36	-8
NSL6	Greycourt House, Milebush	33	62	37	-4

NSL	Name	Predicted rating noise level dB(A)	Representative baseline L_{A90} dB		Largest excess dB
NSL7	Emohruo, Ballyrichard More	32	54	29	+3

The results show that the predicted rating noise level (inclusive of a +5 dB penalty for acoustic features) of the proposed Convertor Station Site Compound is below typical night-time background sound levels at NSLs 1 to 6 inclusive. This indicates that the predicted noise impact is unlikely to have an adverse impact at these NSLs.

At NSL7, the predicted rating noise level exceeds the typical background sound level by 3 dB. This indicates the predicted impact is close to the level that would be considered likely to be adverse (but not significant) depending on context.

The baseline noise climate at this NSL is dominated by road traffic noise from the N25 main road to the south. The predicted noise at NSL7 due to the proposed facility is dominated by the contribution from the bank of valve coolers. This is expected to be relatively steady in nature. The absolute level of noise, based on the rating noise level, is 32 dB(A). This is below the threshold of 35 dB $L_{night,outside}$ corresponding with complaints given in the World Health Organization Night Noise Guidelines for Europe[158]. On this basis, it is concluded that the predicted magnitude of impact due to operational noise does not indicate a significant impact Nevertheless, given the tonal nature contributed by the dominant items of equipment, the level and quality of noise should be a priority in the selection and procurement of plant.

13.5.4 Landfall Area

13.5.4.1 Construction Noise

Table 13.17 presents a summary of the predicted noise impacts during the construction of the proposed landfall area at Claycastle.

Table 13.17: Predicted noise impacts at NSLs due to the construction of the proposed Landfall at Claycastle

NSL	Name	Assessment threshold value (day/eve/night) dB(A)*	Predicted typical and highest construction noise level dB(A)	Stage of work
NSL1	Summerfield Holiday Park	**65 / 60 / 45**	**64 / 75**	Clearance and levelling of the site
NSL2	Caravan Park (Front Strand)	**65 / 60 / 45**	**64 / 71**	Clearance and levelling of the site
NSL3	Aynsley Cottage	65 / 60 / **50**	**51 / 54**	Removal of excavated material

*Based on baseline ambient sound levels in Table 13.6

The results show that at NSL1, the typical and maximum noise levels from general construction activity on site exceeds the appropriate threshold values for evening and night periods. The

[158] World Health Organization (2009). Night Noise Guidelines for Europe.

highest noise level from the clearance and levelling of the site is predicted to exceed the thresholds for NSL1 for all periods.

At NSL2, the highest predicted noise levels during the clearance and levelling of the site exceed the threshold values for all periods. Typical levels are predicted to exceed the threshold during the evening and night-time.

At NSL3, the highest and typical predicted noise levels from the works exceed the threshold value for night-time during the removal of excavated materials.

Additionally, predicted noise levels due to sheet piling for the temporary cofferdam works are presented in Table 13.18 where the works are in the closest proximity to the NSLs. This shows that highest levels would exceed the night-time thresholds applicable to all NSLs, and the daytime and evening limits at NSL1 and NSL2. Typical levels would also exceed daytime and evening thresholds at NSL1 and NSL2. Figure 13.6 presents the noise contour plot for the stage of works with highest noise levels.

Table 13.18: Predicted noise impacts at NSLs due to the sheet piling of the proposed Landfall at Claycastle

NSL	Name	Assessment threshold value (day/eve/night) dB(A)	Predicted typical and highest construction noise level dB(A)
NSL1	Summerfield Holiday Park	**65 / 60 / 45**	**62 / 70**
NSL2	Caravan Park (Front Strand)	**65 / 60 / 45**	**63 / 68**
NSL3	Aynsley Cottage	65 / 60 / **50**	50 / **52**

Figure 13.6 presents a noise contour for the stage of work with highest noise impact.

Figure 13.6: Noise contours for the predicted level of construction noise at the proposed Landfall at Claycastle

Kilometers
0 0.125 0.25

13.5.4.2 Construction Vibration

The activity that is expected to generate the highest levels of ground-borne vibration is sheet piling for a temporary cofferdam. The shortest plan distance between the works and nearby dwellings is 41m. Vibration due to vibratory sheet piling at the closest dwelling to the temporary cofferdams works is predicted using the empirical method presented in Annex E of BS 5228 Part 2:2009+A1:2014 and presented in Table 13.19.

Table 13.19: Assessment of vibration at the closest dwelling to the temporary cofferdams arising during sheet piling

	Predicted ppv due to sheet piling at the closest dwelling (mm/s)	Significance	
		Human perception	**Cosmetic damage**
Start up and run down	1.5	Significant	Not significant
Steady state	0.7	Not significant	Not significant

*Scaling factor kV = 126 with 33.3% probability of the predicted value being exceeded

This shows that when sheet piling works are undertaken at the closest part of the works to adjacent dwellings, there is potential for vibration levels to be perceptible and cause complaint. The predicted level of vibration falls below 1mm/s at a distance of ~55m and is therefore likely to cause complaint at all dwellings within this range, without prior notification. Levels are not expected to result in cosmetic damage to buildings. Occupants may tolerate this level of exposure for short periods with prior notification on the reason for, timing and duration of the works.

13.5.4.3 Operational Noise

There are no operational noise impacts due to the infrastructure to be installed at the Landfall at Claycastle.

13.5.5 Construction Laydown Areas and Passing Bays

Activities within construction laydown areas and passing bays are expected to be relatively limited and intermittent. Following site set up, activities within construction laydown areas will mainly comprise the occasional movement of vehicles and the loading and unloading of materials and equipment. The set-up of passing bays is expected to involve small scale works and their use will be similar to existing traffic movements. The associated noise and vibration impacts are considered to be Not Significant.

13.6 Likely Significant Effects of the Development

13.6.1 Construction Phase

Table 13.20 presents a summary of the likely significant effects identified by the assessment of predicted noise and vibration impacts arising during the construction phase.

Table 13.20: Construction Phase Impact Assessment

Proposed Development	Construction Phase Impacts
Connection Point	**Noise:** Not significant. **Vibration:** Not significant.
HVAC Underground Cable Route (ca. 10km)/ HVDC Underground Cable Route (ca. 30km)	**Noise:** Not significant. **Vibration:** Human perception effects are predicted as likely to be Significant at occupied buildings with 16m of the vibratory compaction works. However, the likelihood of complaint can be reduced by giving prior notification and avoid undertaking the works during sensitive times of the day. Cosmetic damage to light-framed structures (e.g. dwellings) may arise within 3m of vibratory compaction works.
Converter Station Site	**Noise:** Not significant unless ground improvement / piling works are undertaken during the night-time. The associated noise impacts are predicted to exceed the night-time criterion at NSL5 and NSL6. **Vibration:** Not significant.

Proposed Development	Construction Phase Impacts
Landfall at Claycastle	**Noise:** Noise from general activities is predicted to be Significant at NSL1 if undertaken during the evening and night-time periods. Worst-case impacts at NSL1 arising during the clearance and levelling of the site are predicted to exceed the thresholds for all periods. Noise from general activities are predicted to be Significant at NSL2 if undertaken during the evening and night-time periods. Worst-case impacts at NSL2 arising during the clearance and levelling of the site are predicted to exceed the thresholds for all periods. Noise from general activities are predicted to be Significant at NSL3 if undertaken during the night-time. Worst-case impacts at NSL3 arising during the removal of excavated material are predicted to be Significant if undertaken during the night-time. **Vibration:** Not significant except when sheet piling for the temporary cofferdams is at the closest part of the extents to dwellings and within a range of 55m. Vibration is likely to be perceptible and cause complaint without prior notification.
Construction Laydown Areas and Passing Bays	**Noise:** Not Significant. **Vibration:** Not Significant.

13.6.2 Operational Phase

Table 13.21 presents a summary of the likely significant effects identified by the assessment of predicted noise and vibration impacts arising during the operational phase.

Table 13.21: Operational Phase Impact Assessment

Proposed Development	Operational Phase Impacts
Connection Point	Not Significant based on the magnitude of impact but low-frequency tonal noise may cause adverse effects at the closest NSLs.
HVAC Underground Cable Route (ca. 10km)/ HVDC Underground Cable Route (ca. 30km)	Not Significant
Converter Station Site	Not Significant based on the magnitude of impact but low-frequency tonal noise may cause adverse effects at NSL7.
Landfall at Claycastle	Not Significant.
Construction Laydown Areas and Passing Bays	Not applicable

13.6.3 Do Nothing

There would be no noise or vibration impacts in a Do-Nothing scenario. Therefore, no further Do-Nothing assessment has been made.

13.6.4 Decommissioning Phase

The Celtic Interconnector will be decommissioned once it ceases operation. The operational life is expected to be 40 years.

The HVAC and HVDC 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. All equipment for the converter station will be removed for recycling or disposal as required by the regulations are the time.

The activities associated with the decommissioning phase will be similar to those associated with the construction phase. Therefore, provided that appropriate mitigation is used, the impacts of the decommissioning phase should be, as a worst-case scenario, similar to those at construction phase. Any works required to remove infrastructure as part of the decommissioning phase, will however be subject to relevant consent applications, and associated environmental assessments. Therefore, no further assessment of the decommissioning phase has been undertaken.

Any works required to remove infrastructure as part of the decommissioning phase, will be subject to relevant consent applications, and associated environmental assessments.

13.6.5 Cumulative Effects

There is a risk of cumulative construction noise and vibration impacts associated with the construction phases of the proposed development occurring at the same time as the construction phases of nearby committed developments (see Table 4.2 of Volume 3C1 of this EIAR for further details of these developments). It is therefore recommended, in line with the recommendations of BS 5228:2009+A1:2014, regular liaison meetings are held with construction sites which could expose the NSLs described above to levels of construction noise that are less than 10 dB below the applicable noise category. Where the levels of construction noise from other sites are less than 10 dB below the applicable noise category, it is possible that combined impacts with the proposed development could exceed the threshold. In this case, it is important that plans are co-ordinated and any adverse noise and vibration impacts are minimised. Provided this and other appropriate mitigation measures are implemented, such as those outlined in Section 13.7.1 of this chapter, the cumulative noise and vibration impacts associated with the construction phase should not be significant.

13.7 Mitigation and Monitoring Measures

13.7.1 Construction Phase

The Contractor will prepare and implement a Construction Noise and Vibration Management Plan (CNVMP) as part of the CEMP.

Set out within the CNVMP, the Contractor will be obliged to comply with Local Authority controls on noise and vibration during construction. The guidance given in BS 5228:2009+A1:2014 Part 1 and Part 2 describes appropriate measures and limits for the control of noise and vibration from construction activities. These have been used for this assessment however the appointed contractor will consult the Local Authority to agree limits and measures of control to be applied. Where feasible, the transition pits for horizontal directional drilling will be screened to ensure that there is a barrier between the source and sensitive receptors. The location of the noise barrier will be set out and agreed in advance of the works. A comprehensive noise and vibration monitoring protocol will also be set out within the CNVMP.

For the CEMP, the Contractor will also develop and implement a stakeholder communications plan which will facilitate community engagement prior to the commencement of construction.

13.7.1.1 Mitigation applicable to the Connection Point

Further to the mitigation measures set out within the CNVMP, the Contractor:

- Limit all noise-emitting works to the daytime and evening periods only; and
- Where night works are required, provide prior notification to the occupiers of nearby dwellings.

Separate measures on the western boundary to limit the spread of operational noise are expected to offer benefits in reducing the impact of construction works on site.

13.7.1.2 Mitigation applicable to HVAC / HVDC Onshore Cabling Route

Further to the general mitigation measures set out within the CNVMP, the Contractor:

- Provide prior notification to the occupiers of dwellings within 16m of the works and limit vibratory compaction works in the proximity of these dwellings to the daytime period only;
- Where vibratory compaction work is required within 3m of any light-framed structure (e.g. residential building), and subject to the consent of relevant landowners:
  - Conduct a structural condition survey before and after works
  - Undertake measurements of vibration close to the foundation of closest part of the building to the works
  - Consider the use of a dead-weight roller where feasible to avoid vibratory methods

13.7.1.3 Mitigation applicable to the Convertor Station Site

Further to the general mitigation measures set out within the CNVMP:

- Limit all noise-emitting works to the daytime and evening periods only
- Where night works are required, provide prior notification to the occupiers of nearby dwellings.

13.7.1.4 Mitigation applicable to the proposed Landfall Area at Claycastle

Further to the general mitigation measures set out within the CNVMP (but with an exception for certain works restrictions proposed in Chapter 8 Biodiversity for wintering birds in Ballyvergan Marsh), the Contractor will:

- Limit all noise-emitting works to the daytime and evening periods only (but note restriction on winter-time morning work at Ballyvergan Marsh in Chapter 8 Biodiversity);
- Where night works are required, provide prior notification to the occupiers of nearby dwellings; and
- Provide prior notification to the occupiers of dwellings within 55m of the temporary cofferdams works and limit vibratory compaction works to the daytime period only.

13.7.1.5 Mitigation applicable to the Construction Laydown Areas and Passing Bays

There are no specific measures further to those set out within the CNVMP.

13.7.2 Operational Phase

13.7.2.1 Mitigation applicable to the Connection Point

The assessment is based on the layout of the transformer with the sound power level given in Table 13.10 and should not be exceeded. Given the low-frequency tonal noise characteristics of transformers, the selection and procurement process should prioritise low noise specification.

13.7.2.2 Mitigation applicable to the Converter Station Site

The assessment is based on the proposed layout of equipment, including the stated mitigation measures to give the unit sound power levels given in Table 13.15. The sound power levels of the selected equipment should not be exceeded. The measures include:

- Acoustic enclosure of the power transformer;
- Silencers applied to the power transformer cooling fans
- Acoustic enclosure of the compensation reactors and top hat attenuators;
- Sound shield fitted to the harmonic filter capacitors;
- Sound shield and top hat attenuator fitted to the harmonic filter reactors;
- Sound shield and top hat attenuator fitted to the DC smoothing reactors; and

- Silencers applied to the power valve cooling fans and surrounding 4m acoustic barrier.

Given the low-frequency tonal noise characteristics of electrical equipment, the selection and procurement process should prioritise low noise specification.

13.7.2.3 Mitigation applicable to the Landfall at Claycastle

Not required.

13.7.2.4 Mitigation applicable to the Construction Laydown Areas and Passing Bays

Not applicable.

13.8 Residual Impacts

There are no significant residual noise and vibration impacts predicted during the construction and operational phases with the successful incorporation of the specific mitigation measures described in Section 13.7.

13.9 Transboundary Effects

The spatial extents of potential noise and vibration impacts during construction and operation are not expected to result in adverse transboundary effects.

13.10 Summary

This chapter provides an assessment of predicted noise and vibration impacts arising during the construction and operation of the proposed development. This has been informed by the prediction of impacts using theoretical and empirical models and the results of background noise surveys conducted in 2020 and 2021.

Noise and vibration arising during construction will be controlled by the implementation of measures set out in the contractor's Construction Noise & Vibration Management Plan (included in the CEMP). In general, noise impacts arising during the construction of the Connection Point, Convertor Station Site Compound and Landfall are not predicted to result in significant effects provided the works are undertaken during normal daytime working hours.

A large proportion of the proposed route of the HVAC / HVDC underground cable follows the alignment of major and minor roads and consequently passes in close proximity to adjacent dwellings. Noise arising from works to install the HVAC / HVDC underground cable is not expected to be significant due to the its short-term, transient nature in any particular location. The level of ground-borne vibration due to vibratory compaction at residential distances (~16m) is predicted to exceed the threshold at which complaint is likely. However, potential cosmetic damage to light-framed structures (e.g. dwellings) is only likely at distances within about 3m of the works. Where this is likely then it is recommended that condition surveys are undertaken.

At the proposed Landfall at Claycastle, the use of vibratory sheet piling to construct the temporary cofferdams is predicted to generate vibration above the threshold associated with likely complaint at any occupied building within ~55m of the works.

Providing occupiers with prior notification and limiting the works to less sensitive times of the day are key measures to mitigate the human perception of vibration.

Operational noise impacts are expected to arise at the Connection Point and Convertor Station Site Compound only. In the case of the latter, mitigation of noise from the various items of equipment is required in the form of attenuators, noise shields and acoustic barriers. In both cases, the magnitudes of the predicted noise impacts, including a +5 dB penalty for acoustic features, are not assessed as significant. However, the tonal characteristics of electrical equipment may introduce a noticeable change to the area. It is strongly recommended that the specification of low noise equipment is given priority in the selection and procurement.

14 Major Accidents and / or Disasters

14.1 Introduction

This chapter considers the potential for significant adverse effects of the proposed development on the environment deriving from the vulnerability of the proposed development to risks of relevant major accidents and / or disasters.

14.2 Methodology and Limitations

14.2.1 Legislation

EIA Directive 2014/52/EC requires:

"A description of the expected significant adverse effects of the development on the environment deriving from the vulnerability of the development to risks of major accidents and / or disasters…

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".

14.2.2 Guidance

For the purpose of this assessment the following definitions, defined in the Institute of Environmental Management and Assessment (IEMA) document *Major Accidents and Disasters in EIA: A Primer* (September 2020), are used:

- Major Accidents: Events that threaten immediate or delayed serious environmental effects to human health, welfare and / or the environment and require the use of resources beyond those of the client or its appointed representatives to manage. Whilst malicious intent is not accidental, the outcome (e.g. train derailment) may be the same and therefore many mitigation measures will apply to both deliberate and accidental events.
- Disaster: May be a natural hazard (e.g. earthquake) or a man-made / external hazard (e.g. act of terrorism) with the potential to cause an event or situation that meets the definition of a major accident.
- Risk: For a risk to arise there must be hazard that consists of a 'source' (e.g. high rainfall); a 'receptor' (e.g. people, property, environment); and a pathway between the source and the receptor (e.g. flood routes).
- Vulnerability: Describes the potential for harm as a result of an event, for example due to sensitivity or value of receptors. In the context of the EIA Directive, the term refers to the 'exposure and resilience' of the development to the risk of a major accident and / or disaster. Vulnerability is influenced by sensitivity, adaptive capacity and magnitude of impact.

14.2.3 Methodology for Assessment of Effects

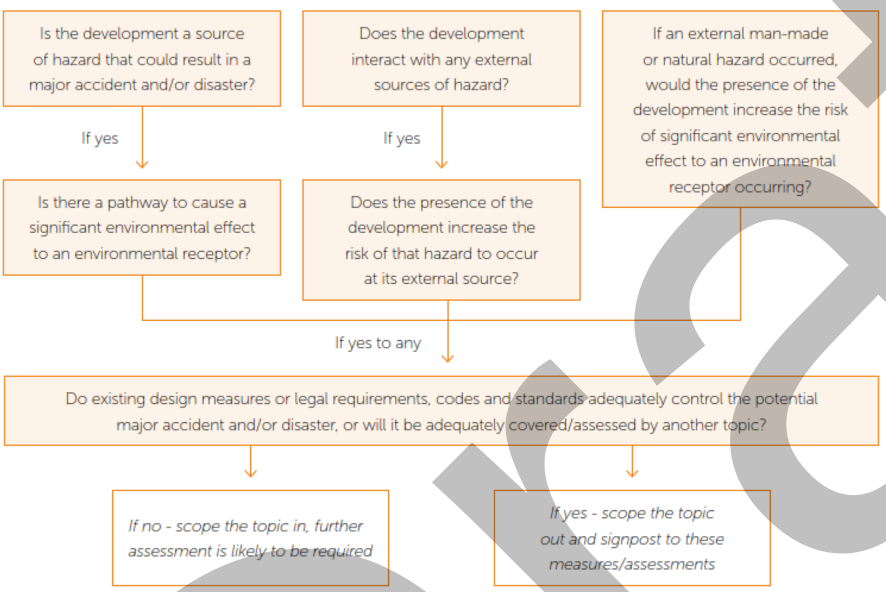
The methodology applied is based on the scoping decision process flow provided in Figure 14.1 *Scoping Decision Process Flow*.

The potential for source, pathway, receptor linkages is first established having regard to the location, type, context, existing and future constraints, and likely receptors relevant to the proposed development.

For established linkages, the risks of major accidents and / or disasters are low / unlikely where existing design measures or legal requirements, codes and standards adequately control the potential for major accident and / or disaster, or where such risks are adequately covered/assessed by another topic in this EIAR.

Where required, additional mitigation measures are proposed to manage the identified risks to the environment.

Figure 14.1: Scoping Decision Process Flow



Source: Major Accidents and Disasters in EIA: A Primer (IEMA, September 2020)

14.2.4 Limitations of this EIAR

There were no difficulties or limitations encountered gathering the information required to inform this Major Accidents and / or Disasters chapter of the EIAR.

14.3 Receiving Environment

This section presents an overview of the receiving environment associated with the onshore proposals, as detailed in Table 14.1 *Receiving Environment*.

Table 14.1: Receiving Environment

Proposed Development	Descriptor (and Townland)	Receiving Environment
Connection Point	Knockraha Substation (Ballynanelagh)	• Several high voltage overhead transmission lines radiate from the north, south, east and west of the substation

Proposed Development	Descriptor (and Townland)	Receiving Environment
		• The substation is located in a rural area. The immediate surrounding area is sparsely populated and the predominant land-use is agriculture • The substation is elevated and the immediate area undulating
HVAC Underground Cable Route (ca. 10.5km)/ HVDC Underground Cable Route (ca. 32km)	• HVAC: Between Knockraha Substation (Ballynanelagh) and Ballyadam (Ballyadam) • HVDC: Between Ballyadam (Ballyadam) and Transition Joint Bay (Summerfield)	• The HVAC / HVDC underground cable will predominantly be installed within roads. Sections of the route will also be located within agricultural lands
Converter Station Site	Ballyadam (Ballyadam)	• An active railway line is located to the north. • The converter station site is located within an area of known karst features • The site and surrounding areas are located in an area where between five and ten per cent of the homes in the 10km grid square are estimated to be above the Reference Level for radon • The site is low lying with elevated lands to the north • The proposed converter station is not at risk from fluvial or tidal sources. Infilling of existing excavated areas may however increase the risk of flooding elsewhere unless a specific mitigation measures in the form of dedicated flood water routing and compensatory storage are designed and constructed
Landfall	Transition Joint Bay (Summerfield) to HW mark at Claycastle Beach (Summerfield)	• Claycastle Beach is seaside tourist destination • It is a sandy beach with a narrow area of marsh/dunes (part of Ballyvergan Marsh). • Ballyvergan Marsh pNHA (Site Code 000078) is located to the west and east of the landfall point • Access to the beach can be gained via an approach road from the car park which will incorporate the transition joint bay and will be required to be closed during some of the construction phase • Claycastle Beach, and an extensive part of the surrounding area, have been identified as being within an area of Extreme Coastal Flood risk

14.4 Characteristics of the Development

Table 14.2 *Characteristics of the Proposed Development* presents an overview of the proposed development having regard to whether or not the proposals present a source of hazard that could result in major accident and / or disaster and / or interacts with external sources of hazard.

The Irish transmission network and the proposed development will be designed, constructed, operated and maintained in accordance with the highest safety standards complying with the provisions of guidelines published by the World Health Organisation (WHO) and the International Commission of Non-ionizing Radiation Protection (ICNIRP).

Table 14.2: Characteristics of the Proposed Development

Proposed Development	Descriptor (and Townland)	Characteristics of the Development
Connection Point	• Knockraha Substation (Ballynanelagh)	• The Celtic Interconnector will connect into existing electricity transmission infrastructure at Knockraha substation • High voltage electricity infrastructure connecting into

Proposed Development	Descriptor (and Townland)	Characteristics of the Development
		existing electricity transmission infrastructure • A construction compound in proximity to Knockraha substation will be required
HVAC Underground Cable Route (ca. 10.5km)/ HVDC Underground Cable Route (ca. 32km)	• HVAC: Between Knockraha Substation (Ballynanelagh) and Ballyadam (Ballyadam) • HVDC: Between Ballyadam (Ballyadam) and Transition Joint Bay (Summerfield)	• Linear development of high voltage infrastructure within public roads and cross-country • Laydown areas, passing bays and open cut and Horizontal Directional Drilling (HDD) will be required for water, service and rail crossings. The route will also cross the proposed Midleton to Youghal Greenway along the route
Converter Station Site	• Ballyadam (Ballyadam)	• Large scale construction phase civil works • Once constructed, the converter station will be unmanned
Landfall	• Transition Joint Bay (Summerfield) to HW mark at Claycastle Beach (Summerfield)	• Installation of the land cable and the submarine cable at a transition joint bay, north of the car park, at Claycastle Beach • Large scale construction phase civil works including installation of cofferdams and a causeway for access during construction • Permanent underground high voltage submarine cable • A construction compound will be required

14.5 Likely Significant Impacts of the Development

Table 14.3 considers the potential for significant adverse effects of the proposed land cable on the environment deriving from its vulnerability to risks of relevant major accidents and / or disasters. The potential for significant adverse effects of the proposed submarine cable on the environment deriving from its vulnerability to risks of relevant major accidents and / or disasters is discussed in Volume 3D.

Where sources / interactions and pathways have been established, an assessment is carried out as to whether or not embedded design measures, or legal requirements, codes and standards adequately control the potential major accident and / or disaster. Reference is made to other technical chapters of the EIAR as appropriate where further studies have been carried out, for example in the case of flood risk assessments.

Table 14.3: Likely Significant Adverse Effects

Type / Location	Source and / or Pathway / Receptor	Reasonable Worst-Case Consequence	Embedded Mitigation	Could this result in a major accident and / or disaster with mitigation in place?	Is the reasonable worst consequence managed to an acceptable level with existing mitigation in place?	Likely Significant Adverse Effects
Flooding						
Connection Point	The substation is elevated and has not been identified as being at risk of flooding	None. Given the nature of the proposals major accidents disasters are unlikely	Not applicable	Not applicable	Not applicable	Flood Risk is discussed in detail in Chapter 7 Surface Water, including Flood Risk
HVDC / HVDC Cable	Sections of the HVDC / HVAC route are at risk of flooding	Given the nature of the proposals major accidents and / or disasters are unlikely.	Mitigation by avoidance and / or design will be implemented at detailed design stage to avoid flood risk to link boxes	No	Yes	Flood Risk is discussed in detail in Chapter 7 Surface Water, including Flood Risk
Converter Station	Pluvial and surface water flooding	Infilling of existing excavated areas may increase the risk of flooding elsewhere unless specific mitigation measures are designed and constructed	Dedicated flood water routing and compensatory storage proposed to avoid increasing flood risk off site	No	Yes	Flood Risk is discussed in detail in Chapter 7 Surface Water, including Flood Risk
Landfall	Within an area of Extreme Coastal Flood risk.	Given the nature of the proposals major accidents	Not applicable	Not applicable	Not applicable	Flood Risk is discussed in detail in

		disasters are unlikely				Chapter 7 Surface Water, including Flood Risk
Fire						
Connection Point	New outdoor transformer at Knockraha will contain mineral oil and could fuel a fire which could be started by an internal electrical fault in combination with failure of the electrical protection systems.	A transformer fire resulting in emission of smoke and fumes and rupture of a transformer tank with loss of oil into the containment bund below.	The transformers will be physically separated from other major plant and buildings outside of the zone of damage. The transformers will have a containment bund which will retain any leaking oil. Large stones within the bund will suppress fire in the case of leaked oil burning. The likelihood of such an event is very rare. As the event is unlikely to occur for a long enough period of time to result in exceedances of the long or short-term averaging periods of the air quality standards, these events are not considered to be a significant source of emissions so have not been considered further. Should this event occur, any nearby sensitive receptors would be informed to take action such as closing their windows and remaining indoors until the fire is brought under control to further reduce the risk of adverse impacts.	No	Yes	No likely significant adverse effects.

HVDC / HVDC Cable	The cable and associated equipment are buried below ground and are therefore protected from fire. In the case of a cable fault, any combustion will be inherently suppressed.	None. Major accidents disasters are unlikely	Not applicable	Not applicable	Not applicable	No likely significant adverse effects.
Converter Station	There will be four outdoor transformers located at Ballyadam which will contain mineral oil.	A transformer fire resulting in emission of smoke and fumes and rupture of the transformer tank with loss of oil into the containment bund below.	The transformers will be physically separated from other major plant and buildings outside of the zone of damage. The transformers will have a containment bund which will retain any leaking oil. Large stones within the bund will suppress fire in the case of leaked oil burning. The likelihood of such an event is very rare. As the event is unlikely to occur for a long enough period of time to result in exceedances of the long or short-term averaging periods of the air quality standards, these events are not considered to be a significant source of emissions so have not been considered further. Should this event occur, any nearby sensitive receptors would be informed to take action such as closing their windows and remaining indoors until the fire is	No	Yes	No likely significant adverse effects.

			brought under control to further reduce the risk of adverse impacts			
	Within the new buildings an electrical fault could provide a source of Ignition for a fire. However, the new buildings will not contain sufficient combustible materials / fuel to sustain a fire. Fire barriers and fire zones will be provided throughout.	A minor fire in an electrical room which extinguishes in a short period of time	Design of building to comply with fire regulations and building code.	No	Yes	No likely significant adverse effects.
Landfall Area	The cable and associated equipment are buried below ground and are therefore protected from fire. In the case of a cable fault, any combustion will be inherently suppressed.	None. Major accidents disasters are unlikely	Not applicable	Not applicable	Not applicable	No likely significant adverse effects.
Extreme temperature (heat wave, cold snap)/ high winds/storm						
All	Design standards currently specified in EirGrid's Functional Design Specifications mitigate against extreme temperature Cable infrastructure will be insulated and protected from the extremes in temperature	None. Major accidents disasters are unlikely	Not applicable	Not applicable	Not applicable	No likely significant adverse effects.

Electro-magnetic Fields (EMF)						
All	Independent and authoritative international panels of scientific experts have reviewed studies on possible health effects from EMFs. These have concluded, based on the weight of the evidence available, that the power frequency electric and magnetic fields encountered in normal living and working conditions do not cause adverse health effects in humans when properly designed and constructed. These form the basis for guidelines published by the International Council on Non-Ionising Radiation Protection (ICNIRP) with regard to EMF, to which EirGrid and ESB Networks have strict regard in the design and operation of the transmission system	None. Major accidents disasters are unlikely	Not applicable	Not applicable	Not applicable	EMF is discussed in Chapter 13 Population and Human Health
Electricity failure						
All	Electricity failure can be caused by several factors such as extreme weather conditions.	Loss of power supply to the converter station resulting in disruption to the	The interconnector will have multiple power backup systems including emergency generators which will	No	Yes	No likely significant adverse effects.

		operation of the HVDC interconnector.	maintain supplies to the converter station and allow operation to continue			Loss of functionality to the proposed development only, no environmental impacts.
Exposure to High Voltage						
Connection Point & Converter Station	Construction workers and maintenance staff coming in contact with exposed live conductors.	Risk of damage or harm	All equipment to be designed in compliance with latest safety in design requirements. Access to live compounds will be carefully controlled and allowed only for trained competent persons.	No	Yes	No likely significant adverse effects.
HVDC / HVDC Cable & Landfall	Farmers for cross country routes and general construction workers for road works who may come in contact with live cables while excavating.	Risk of damage or harm	Cables will be insulated and buried 1.2m approx. underground, encased in concrete duct banks. Warning tape will be laid in the trench over the ducts as a visual aid to those excavating in the area.	No	Yes	No likely significant adverse effects.
Ground collapse/instability /subsidence/landslide						
Connection Point	Ground conditions at Knockraha are good with stable soils within a level site.	None. Major accident / disaster unlikely	Not applicable	Not applicable	Not applicable	Land, soils and Hydrogeology is discussed in detail in Chapter 6
HVDC / HVDC Cable	Due to the fact that the cables will be installed in a concrete duct bank with suitable compacted backfill and	None. Major accident / disaster unlikely	Not applicable	Not applicable	Not applicable	Land, soils and Hydrogeology is discussed in detail in Chapter 6

	permanent reinstatement subsidence is unlikely.					
Converter Station	The presence of karst could lead to soils movement due to the dissolution of soluble bedrock. Use of piling will prevent any effects on buildings or structures, however, other areas could be affected.	Localised collapse and subsidence of ground at surface	Geotechnical investigations will inform the foundation design and construction methods to ensure risk of subsidence is avoided.	No	Yes	Land, soils and Hydrogeology is discussed in detail in Chapter 6
Landfall	Due to the fact that the cables will be installed in a concrete duct bank with suitable compacted backfill and permanent reinstatement subsidence is unlikely.	None. Major accident / disaster unlikely	Not applicable	Not applicable	Not applicable	Land, soils and Hydrogeology is discussed in detail in Chapter 6
Major road traffic accident						
All	Working on or adjacent to public roads Movement of construction vehicles Debris striking traffic / member of public	Death and / or injury to a member of the public. Delays and congestion in surrounding area	Controls to be implemented through traffic management plan, construction planning, and method statements Road realignments designed in accordance with design codes and in consultation with Transport Infrastructure Ireland (TII) and the Roads Design Office (RDO) and Cork County Council	Yes	Yes	Roads and Traffic are discussed in Chapter 11
Industrial Accidents						

Connection Point	Knockraha substation is located within a rural area. There are no sites licensed under the Control of Major Accident Hazards (COMAH) regulation or industrial sites located in proximity	None. Major accident / disaster unlikely	Not applicable	Not applicable	Not applicable	No likely significant adverse effects
HVDC / HVDC Cable	The cables will be buried underground at a depth of 1.2m approx. They are also encased in concrete duct banks.	None. Major accident / disaster unlikely	Not applicable	Not applicable	Not applicable	No likely significant adverse effects
Converter Station	The converter station is located in a brownfield site. There are no COMAH / industrial sites located in proximity	None. Major accident / disaster unlikely	Not applicable	Not applicable	Not applicable	No likely significant adverse effects
Landfall	The landfall is located in a seaside tourist destination. There are no COMAH / industrial sites located in proximity	None. Major accident / disaster unlikely	Not applicable	Not applicable	Not applicable	No likely significant adverse effects
Earthquake						
All	An earthquake of sufficient intensity to inflict severe damage is unlikely	None. Major accident / disaster unlikely	Not applicable	Not applicable	Not applicable	No likely significant adverse effects
Tsunami / tidal wave						No likely significant adverse effects
All	A tsunami/tidal wave of sufficient intensity to inflict severe damage is unlikely	None. Major accident / disaster unlikely	Not applicable	Not applicable	Not applicable	No likely significant adverse effects

Biological hazard – epidemic, pandemic						
All	The Proposed Development is located within and adjacent to some densely populated areas, however apart from construction workers and maintenance staff the project does not generate human interaction. The project also does not generate interaction with animals. Construction phase activities will be carried out in accordance with Government guidelines	None. Major accident / disaster unlikely	Not applicable	Not applicable	Not applicable	No likely significant adverse effects
Malicious attacks/cyber-attack						
All	The proposed development will form part of Ireland's electrical transmission grid and could be subject to malicious physical or cyber-attacks.	Damage would likely be limited to disruption of the interconnector's ability to operate until the damage was repaired.	The transmission system will be designed to cater for the sudden loss of supplies from the Celtic Interconnector and reserve supplies will be secured from elsewhere on the grid. The new infrastructure and control systems will be designed to protect against malicious attack and will be in line with the latest standards for new transmission grid infrastructure,	No	Yes	No likely significant adverse effects
Rail disaster (crash/derailment)						

All	No works are planned to be carried out on or in close proximity to a railway. Any crossings of tracks will be undertaken by HDD and drive/receive pits will be set back appropriately from the Irish Rail boundaries.	None. Major accident / disaster unlikely	Not applicable	Not applicable	Not applicable	No likely significant adverse effects
Building collapse/design error						
Connection Point	There are no new significant buildings at Knockraha. There will be a small portable relay room (typical dimensions 7m x 2.5m) which will be a prefabricated single storey steel clad container.	None. Major accident / disaster unlikely	Not applicable	Not applicable	Not applicable	No likely significant adverse effects
HVDC / HVDC Cable	There are no new buildings required as part of the HVDC cable route	None. Major accident / disaster unlikely	Not applicable	Not applicable	Not applicable	No likely significant adverse effects
Converter Station	There are several large buildings proposed at Ballyadam. These will be steel frame structures with steel cladding. Design error could result in failure of a structural component causing weakening of the building and collapse.	Collapse of building, with resulting injury to any personnel on site and disruption to operations of the interconnector until repairs are made	Buildings will be designed in accordance with design codes and standards which have conservative factors of safety to oversize structural supports. Clients Representative will be onsite during works to ensure that buildings are constructed in	Yes	Yes	No likely significant adverse effects

			accordance with the design package			
Landfall	There are no buildings at the landfall site	None. Major accident / disaster unlikely	Not applicable	Not applicable	Not applicable	No likely significant adverse effects
Spillage or seepage of pollutants into watercourse/ground						
Connection Point	There will be mineral oil contained within in the new 400 / 220kV transformer at Knockraha.	Oil seepage into the ground which could lead to contamination of the soil and waterways.	The transformer will be located within a concrete bunded containment area which will be sized to collect the full volume of oil from the transformer. In addition, the bunded area will be connected to an oil/water separator to ensure that no oil will be allowed out of the bund. An oil level alarm will be present on the transformer alerting operators to leakage of oil from the transformer.	No	Yes	Land, Soils and Hydrogeology is discussed in detail in Chapter 6. Surface Water is discussed in Chapter 7
HVDC / HVDC Cable	As the cables are solid insulation type there are no sources of pollution and as they are buried, they will not offer a pathway to any receptors.	None. Major accident / disaster unlikely	Not applicable	Not applicable	Not applicable	Land, Soils and Hydrogeology is discussed in detail in Chapter 6. Surface Water is discussed in Chapter 7
Converter Station	There will be mineral oil contained within the new transformers at Ballyadam.	Oil seepage into the ground which could lead to contamination of the soil and waterways.	The transformer will be located within a concrete bunded containment area which will be sized to collect the full volume of oil	No	Yes	Land, Soils and Hydrogeology is discussed in detail in Chapter 6.

			from the transformer. In addition, the bunded area will be connected to an oil/water separator to ensure that no oil will be allowed to leave the bund. An oil level alarm will be present on the transformer alerting operators to leakage of oil from the transformer.			Surface Water is discussed in Chapter 7
Landfall	As the cables are solid insulation type there are no sources of pollution and as they are buried they will not offer a pathway to any receptors.	None. Major accident / disaster unlikely	Not applicable	Not applicable	Not applicable	Not applicable

15 Interaction of Effects

Commented [DH22]: WORK IN PROGRESS TO BE COMPLETED FOR FINAL APPLICATION

15.1 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 matrix presented in Table 15.1 has 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.

15.2 Interaction of Effects

Commented [DH23]: TO BE COMPLETED FOR FINAL APPLICATION

Table 15.1: Interaction of Effects

Interactions of Effects Between the Factors	Population and Human Health	Air Quality and Climate	Land, Soils and Hydrogeolog	Surface Water, including	Biodiversity	The Landscape	Archaeology and Cultural Heritage	Roads and Traffic	Material Assets	Noise and Vibration	Major Accidents and/or Disasters
Population and Human Health											
Air Quality and Climate											
Land, Soils and Hydrogeology											
Surface Water, including Flood Risk											
Biodiversity											
The Landscape											
Archaeology and Cultural Heritage											
Roads and Traffic											
Material Assets											
Noise and Vibration											
Major Accidents and/or Disasters											

16 Summary of Cumulative Effects and Transboundary Effects

Commented [DH24]: WORK IN PROGRESS TO BE COMPLETED FOR FINAL APPLICATION

16.1 Introduction

This chapter summarises the conclusions of the assessments of both cumulative effects and transboundary effects, details of which are provided in the preceding sections of this EIAR.

16.2 Cumulative Effects

Cumulative effects take account of the addition of many minor or significant effects to create larger, more significant effects.

As detailed in Volume 3C1, information on the combined impacts of the onshore and offshore elements of the Celtic Interconnector project within the shared ZoI are provided in the main impact assessment sections of this EIAR.

Information on the cumulative impacts of the Celtic interconnector project (as a whole) with other projects is provided in the cumulative effects sections of this EIAR.

All activities associated with the construction and operation and decommissioning of the Celtic Interconnector were assessed for the likely significant cumulative effects within the topic specific ZoI. Where likely significant cumulative effects are identified, discussion is provided on the contribution of the Celtic Interconnector (as a whole) to that cumulative effect. All activities associated with the construction and operation of the proposed development were assessed for. Table 16.1 summarises the conclusions of said cumulative effects assessments.

16.3 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 elements of the onshore interconnector are found in County Cork, Ireland and no international boundaries are crossed by the works, significant transboundary effects are not likely to occur as a result of the proposals. All activities associated with the construction and operation of the proposed development were however assessed for likely significant transboundary effects, and these were detailed in the preceding sections of this EIAR. Table 16.2 summarises the conclusions of said transboundary effects assessments.

Table 16.1: Cumulative Effects

Chapter	Cumulative Effects
Chapter 4 Population and Human Health	Prior to commencement of construction and during the construction phase engagement with the proponents of these developments (including TII, the IDA and Cork County Council will continue and where there is potential for works to be carried out in parallel, appropriate mitigation measures will be implemented including the scheduling of works and regular liaison meetings between project teams to ensure that plans are co-ordinated and impacts on population and human health are minimised. Cumulative impacts in relation to impacts on population and human health as they relate to various other aspects are considered in relevant chapters of this EIAR.
Chapter 5 Air Quality and Climate	There is a risk of cumulative construction dust impacts associated with the construction phases of the proposed development occurring at the same time as the construction phases of nearby developments (see Table 4.2 of Volume 3C1 of this EIAR for further details of these developments). It is therefore recommended, in line with Institute of Air Quality Management (IAQM) guidance, that regular liaison meetings are held with construction sites within 500m of the site boundary to ensure plans are co-ordinated and dust and particulate matter emissions are minimised. Provided this and other appropriate mitigation measures are implemented, such as those outlined in Volume 3C2 Section 5.6 the cumulative air quality impact associated with the construction phase should not be significant.
Chapter 6 Land, Soils and Hydrogeology	A number of developments are proposed within the immediate environs of the proposals, as detailed in Table 4.2. The proposed converter station compound, drainage and access and HVDC / HVAC routes have been developed independent of these other potential future proposals. Such future proposals do not affect the conclusions of the land, soils and hydrogeology chapter. Prior to commencement of construction and during the construction phase engagement with the proponents of these developments (including TII, the IDA and Cork County Council will continue and where there is potential for works to be carried out in parallel, appropriate mitigation measures will be implemented including the scheduling of works and regular liaison meetings between project teams to ensure that plans are co-ordinated and impacts are minimised.
Chapter 7 Surface Water, including Flood Risk	A number of developments are proposed within the immediate environs of the proposals, as detailed in Table 4.2 of Volume 3C1 of this EIAR. The proposed converter station compound. drainage and accesses, and the HVDC / HVAC routes have been developed independent of these other potential future proposals. The design of the Celtic Interconnector can readily connect into such proposals in the future without affecting the conclusions of this EIAR. Prior to commencement of construction and during the construction phase engagement with the proponents of these developments (including TII, the IDA and Cork County Council will continue and where there is potential for works to be carried out in parallel, appropriate mitigation measures will be implemented including the scheduling of works and regular liaison meetings between project teams to ensure that plans are co-ordinated and impacts are minimised.
Chapter 8 Biodiversity	Engagement with the proponents of other projects in the zone of influence of the Celtic Interconnector will continue and where there is potential for works to be carried out in parallel, appropriate mitigation measures will be implemented including the scheduling of works and regular liaison meetings between project teams to ensure that plans are co-ordinated, and impacts are minimised.
Chapter 9 The Landscape	The main potential for cumulative impacts to occur relate to other substantial scale developments in close proximity to the proposed Converter Station Compound. In particular, the adjacent ESB 110 kV substation, other future industrial / infrastructure developments that might occur within the industrial zoned IDA lands at Ballyadam and the proposed upgrade works to the N25. Also, potential residential expansion between Midleton and Carrigtwohill. In respect of the adjacent ESB 110kV substation the cumulative effect is likely to be one of intensification and scale of developments of a similar nature. Mitigation screen planting will help to reduce cumulative visual impacts, particularly for those residential receptors that occur uphill to the north of the IDA

Chapter	Cumulative Effects
	landholding. Cumulative impacts for these two developments will be noticeable, but are not likely to be significant. Similarly, other forms of industrial or commercial development within the overall IDA landholding will result in increased intensity, scale and extent of large and potentially bulky buildings. Internal landscaping similar to that set up as a precedent by measures proposed on the converter station site (southern boundary) will aid visual integration and consolidation of development within the wider IDA site (if implemented). Though likely to occur adjacent to the other side of the IDA site to the proposed converter station, the N25 upgrade and potential intersection with the IDA site is likely to also increase the scale and intensity of infrastructure development in the vicinity of the converter station. Together these developments would serve to reduce the integrity of the current rural hinterland setting of the IDA landholding and the visual amenity of those afforded views across the site, particularly from the slopes to the north. While the cumulative developments have the potential to generate moderate or even significant cumulative landscape and visual impacts in-combination with the proposed converter station, there is also strong potential to mitigate such impacts from considered siting and design. It is also important to consider such cumulative impacts in the context of a quickly evolving hinterland landscape that already hosts a rich variety of productive and infrastructural land uses in terms of its baseline context
Chapter 10 Archaeology and Cultural Heritage	A number of developments are proposed within the immediate environs of the Celtic Interconnector project as detailed in Table 4.2. The cumulative impacts of the proposed development and these projects on archaeology and cultural heritage are considered to be 'not significant'. Any projects already under construction or for which the appropriate permissions have already been successfully obtained will already have been appropriately evaluated for impacts to archaeology, architectural heritage and cultural heritage and appropriate mitigation, if required, set out in consultation with the National Monuments Service (DHLGH). For any planning applications still under application, Cork County Council retains a County Archaeologist and Conservation Officer to evaluate and advise on such applications, to ensure that they have been evaluated for impacts to archaeology, architectural heritage and cultural heritage and to recommend any appropriate mitigation measures to a uniform standard in consultation with the National Monuments Service (DHLGH).It should be noted, in particular, in relation to the IDA lands at Ballyadam that a previous phase of work at the site in 2006 resulted in the mitigation (through archaeological excavation or preservation by record) of impacts to (previously unknown) sub-surface archaeological sites/features across a substantial proportion of this site. As a result, any potential further direct impacts to archaeological sites or features within the IDA lands as a result of the proposed Celtic Interconnector Project or any other future development within its bounds have been minimised.
Chapter 11 Roads and Traffic	There are several planned developments that may have a cumulative impact in tandem with the construction of the Project. Youghal to Midleton Greenway is set to be complete by 2023 and will therefore not affect construction traffic. Given the levels of information available at the time of producing this EIAR a conclusive assessment of cumulative effects from construction traffic attributed to other projects has not been produced at this time, however this will be mitigated through continual liaison with the relevant stakeholders. As such, there is a risk of cumulative construction roads and traffic impacts associated with the construction phases of the proposed development occurring at the same time as the construction phases of nearby committed developments. Committed developments with known information have been included within the assessment, however, some developments do not have traffic / construction information currently available. Under this scenario it is possible that the combined cumulative effect could exceed the traffic significance thresholds. In this case, it is important that plans are co-ordinated and any adverse roads and traffic impacts are minimised. Prior to commencement of construction and during the construction phase engagement with these sites where there is potential for works to be carried out in parallel, appropriate mitigation measures will be implemented including the scheduling of works and regular liaison meetings between project teams to ensure that plans are co-ordinated and impacts are minimised. Provided this and other appropriate mitigation measures are implemented, such as those outlined in Chapter 11, the cumulative roads and traffic impacts associated with the construction phase should not be significant.

Chapter	Cumulative Effects
Chapter 12 Material Assets	There is a risk of cumulative construction phase impacts associated with the construction phases of the proposed development occurring at the same time as the construction phases of nearby developments. Consequently, there will be a need to ensure that where works are occurring in parallel that appropriate mitigation measures are considered, including the scheduling of works, regular liaison meetings between project teams to ensure plans are co-ordinated and impacts are minimised. With the implementation of these, and the subsequently identified mitigation measures, the cumulative impacts associated with the construction phase should not be significant.
Chapter 13 Noise and Vibration	There is a risk of cumulative construction noise and vibration impacts associated with the construction phases of the proposed development occurring at the same time as the construction phases of nearby developments (see Table 4.2). Regular liaison meetings will be held with construction sites which could expose the Noise Sensitive Locations described in Volume 3C Chapter 4 to levels of construction noise that are less than 10 dB below the applicable noise category. It is possible that combined impacts with the proposed development could exceed the threshold. It is important therefore that plans are co-ordinated and any adverse noise and vibration impacts are minimised. Provided this and other appropriate mitigation measures are implemented, such as those outlined in Volume 3C, the cumulative noise and vibration impacts associated with the construction phase should not be significant.
Chapter 14 Major Accidents and/or Disasters	In all instances the reasonable worst consequence is managed to an acceptable level with mitigation in place

Table 16.2: Transboundary Effects

Chapter Heading	Transboundary Effects
Chapter 4 Population and Human Health	The embedded mitigation measures are sufficient to ensure that transboundary effects associated with the proposed development on population and human health will not occur.
Chapter 5 Air Quality and Climate	The risk associated with construction dust impacts occurs up to 350m from a construction site or within 50m of the trackout routes, up to 500m from the proposed development. Beyond this distance, the risk is predicted to be negligible. The impacts associated with construction dust from the proposed development are anticipated to be negligible with the implementation of appropriate mitigation measures. Therefore, the risk of transboundary effects associated with construction dust are not significant. Greenhouse Gas (GHG) emissions from the proposed development will not result in a regional effect on climate and the nature of the effect on climate would not differ when considered from a transboundary perspective.
Chapter 6 Land, Soils and Hydrogeology	All elements of the onshore interconnector between the connection point at Knockraha substation and the submarine cable landfall to the north of the car park at Claycastle Beach near Youghal are found in County Cork, Ireland. The ZoI considered extended to a 500m buffer either side of the cable route, and up to a 1km radius from the proposed converter station site, connection point and landfall. There is no potential for transboundary effects associated with said works.
Chapter 7 Surface Water, including Flood Risk	All elements of the onshore interconnector are found in County Cork, Ireland. No international boundaries are crossed by the works and the nature of the onshore works is such that there are no transboundary effects to be discussed.
Chapter 8 Biodiversity	All elements of the onshore interconnector are found in County Cork, Ireland. Species identified in this EIAR as sensitive environmental receptors (SER) that may cross international boundaries include; raptor and wintering wader (bird) species (Sanderling and Bar-tailed godwit included). As outlined in this EIAR there are no likely significant effects to these SER. No significant transboundary effects are therefore likely.
Chapter 9 The Landscape	There are not considered to be any transboundary effects in respect of the onshore 'Landscape' factor in this instance as all material effects occur above the high water mark within County Cork
Chapter 10 Archaeology and Cultural Heritage	All elements of the onshore interconnector are found in County Cork, Ireland. No international boundaries are crossed by the works and therefore there are no transboundary effects to be discussed.
Chapter 11 Roads and Traffic	During construction and operation there are no expected adverse transboundary effects on roads and traffic
Chapter 12 Material Assets	Impacts associated with connections to utilities and the crossing of utilities will be localised in nature and therefore significant transboundary effects are no likely. Waste will be managed in accordance with the Waste Management Act and associated regulations, having regard to best practice guidelines. There are therefore no likely significant transboundary effects.
Chapter 13 Noise and Vibration	The spatial extents of potential noise and vibration impacts during construction and operation are not expected to result in adverse transboundary effects.
Chapter 14 Major Accidents and/or Disasters	In all instances the reasonable worst consequence is managed to an acceptable level with mitigation in place and no transboundary effects are likely

17 Summary of Monitoring and Mitigation Measures

Commented [DH25]: WORK IN PROGRESS TO BE COMPLETED FOR FINAL APPLICATION

This summary sets out the mitigation controls and other best practice measures identified in this volume of the EIAR and identifies the means by which those controls and measures will be secured. The following are provided:

- a unique reference number for each item;
- the section of the EIAR where the mitigation measure is referenced; and
- the monitoring and mitigation measures, as set out in the EIAR.

These measures and conditions set out as part of the planning and foreshore consent process will be incorporated in the CEMP.

A contractual obligation will be included within the tendering processes and implemented on appointment of the Contractor to ensure that the proposed works are developed in compliance with the requirements of the CEMP, and the methods, monitoring and mitigation included in this EIAR.

As detailed previously, the Developer will monitor the contractor(s) performance on a regular basis and will undertake compliance checks throughout the duration of the construction period, including:

- Review contractor documents against the requirements of the CEMP;
- Undertake regular audits;
- Continuously check records;
- Set up a contractor reporting structure; and
- Conduct regular meetings where Environmental Health and Safety is an agenda item.

Records of the implementation of the measures identified in the CEMP will be provided if required to the Planning Authority at a time scale to be agreed.

Table 17.1: Summary of Mitigation and Monitoring Measures

Reference	Aspect	Mitigation and / or Monitoring Measure
Chapters 1 to 3		
Not Applicable	Not Applicable	These chapters do not include any additional mitigation measures
Chapter 4 Population and Human Health		
4.1	Construction Phase	• All work will be carried out having regard to international and national legislation, and best practice guidance, including but not limited to guidance on preventing pollution from construction sites and pollution prevention guidance.
4.2	Construction Phase	• A CEMP will be prepared by the contractor in consultation with the Cork County Council and implemented during the construction phase to safeguard the environment, site personnel, and nearby sensitive receptors, i.e. occupiers of residential and commercial properties, from site activities which may cause harm or nuisance.
4.3	Construction Phase	• The appointed contractors (in collaboration with EirGrid) will be required to maintain close liaison with local community representatives, landowners and statutory consultees throughout the construction period. This is likely to include circulation of information about ongoing activities; particularly those that could potentially cause disturbance, including due to traffic. A telephone number will be provided and persons with appropriate authority to respond to calls and resolve or escalate any problems arising will be available.
4.4	Construction Phase	• Prior to commencement of the development, the appointed Contractor will prepare a Traffic Management Plan which will be developed and implemented to mitigate any potential construction traffic impacts on the public road network. All construction activities, including construction traffic, will be managed through the site CEMP.
4.5	Cumulative Effects	• Prior to commencement of construction and during the construction phase engagement with the proponents of other developments (including Transport Infrastructure Ireland, the IDA and Cork County Council will continue and where there is potential for works to be carried out in parallel, appropriate mitigation measures will be implemented including the scheduling of works and regular liaison meetings between project teams to ensure that plans are co-ordinated and impacts on population and human health are minimised.
Chapter 5 Air Quality (AQ) and Climate (C)		
5.1	AQ: Construction Phase	• The appointed Contractor will prepare and implement a Dust Management Plan (DMP) as part of the project CEMP. For the CEMP, the Contractor will also develop and implement a stakeholder communications plan which will facilitate community engagement prior to the commencement of construction.
5.2	AQ: Construction Phase mitigation applicable to HVAC / HVDC Onshore Circuits, Laydown Areas and Passing Bays	Construction activities associated with the installation of the HVAC / HVDC cables are predicted to have a ‘negligible to medium risk’ in terms of dust soiling and PM_{10} effects with no mitigation in place. Best practice mitigation measures for these activities are presented below: • Communication: – Display the name and contact details of person(s) accountable for air quality and dust issues on the site boundary; and – Display the head or regional office contact information. • Site Management: – Record all dust and air quality complaints, identify causes and take appropriate measures to reduce emissions in a timely manner and record the measures taken: and

Reference	Aspect	Mitigation and / or Monitoring Measure
		– Record any exceptional incidents that cause dust and or air emissions, either on or off site, and the action taken to resolve the situation in the log book. • Monitoring: – Carry out regular site inspections to monitor compliance with the DMP and record inspection results. • Preparing and maintaining the site – Avoid site runoff of water or mud. • Operating vehicles/ machinery and sustainable travel: – Ensure all vehicles switch off engines when stationary – no idling vehicles; and, – Avoid the use of diesel- or petrol-powered generators and use mains electricity or battery powered equipment where practicable. • Operations: – Only use cutting, grinding or sawing equipment fitted or in conjunction with suitable dust suppression techniques such as water sprays or local extraction; – Ensure an adequate water supply on the site for effective dust/ particulate matter suppression/ mitigation using non-potable water where possible and appropriate; and, – Use enclosed chutes and conveyors and covered skips. • Measures specific to demolition: – Ensure effective water suppression is used during demolition operations. • Measures specific to trackout: – Ensure vehicles entering and leaving sites are covered to prevent escape of materials during transport; – Inspect on-site haul routes for integrity and instigate necessary repairs to the surface as soon as reasonably practicable; and, – Record all inspections of haul routes.
5.3	AQ: Construction Phase mitigation applicable to Landfall at Claycastle	Construction activities associated with the landfall at Claycastle are predicted to have a 'negligible to medium risk' in terms of dust soiling and PM_{10} effects with no mitigation in place. Best practice mitigation measures for these activities are presented below: • Communication: – Display the name and contact details of person(s) accountable for air quality and dust issues on the site boundary; and, – Display the head or regional office contact information. • Site Management: – Record all dust and air quality complaints, identify causes and take appropriate measures to reduce emissions in a timely manner and record the measures taken; and, – Record any exceptional incidents that cause dust and or air emissions, either on or off site, and the action taken to resolve the situation in the log book. • Monitoring: – Carry out regular site inspections to monitor compliance with the DMP and record inspection results; and,

Reference	Aspect	Mitigation and / or Monitoring Measure
		– Increase the frequency of site inspections by the person accountable for air quality and dust issues on site when activities with a high potential to produce dust are being carried out and during prolonged dry or windy conditions. • Preparing and maintaining the site: – Avoid site runoff of water or mud; – Plan site layout so that machinery and dust causing activities are located away from receptors as far as possible: and – Erect solid screens or barriers around dusty activities or the site boundary that are at least as high as any stockpiles. • Operating vehicles / machinery and sustainable travel: – Ensure all vehicles switch off engines when stationary – no idling vehicles; and, – Avoid the use of diesel- or petrol-powered generators and use mains electricity or battery powered equipment where practicable. • Operations: – Only use cutting, grinding or sawing equipment fitted or in conjunction with suitable dust suppression techniques such as water sprays or local extraction; – Ensure an adequate water supply on the site for effective dust/ particulate matter suppression/ mitigation using non-potable water where possible and appropriate; – Use enclosed chutes and conveyors and covered skips. – Minimise drop heights from conveyors loading shovels hoppers and other loading or handling equipment and use fine water sprays on such equipment wherever available; and, – Bonfires and burning of waste materials will be prohibited. • Measures specific to demolition: – Ensure effective water suppression is used during demolition operations; and, – Avoid explosive blasting, using appropriate manual or mechanical alternatives. • Measures specific to earthworks: – Re-vegetate earthworks and exposed areas/ soil stockpiles to stabilise surfaces as soon as practicable; – Use hessian, mulches or trackifiers where it is not possible to re-vegetate or cover with topsoil as soon as practicable; and, – Only remove the cover in small areas during work and not all at once. • Measures specific to trackout: – Use water-assisted dust sweepers on the access and local roads, to remove as necessary any material tracked out of site; – Ensure vehicles entering and leaving sites are covered to prevent escape of materials during transport; – Inspect on-site haul routes for integrity and instigate necessary repairs to the surface as soon as reasonably practicable; – Record all inspections of haul routes; – Implement a wheel washing system (with rumble grids to dislodge accumulated dust and mud prior to leaving the site where reasonably practicable); and, – Ensure there is an adequate area of hard surfaced road between the wheel wash facility and the site exit and layout permits.

Reference	Aspect	Mitigation and / or Monitoring Measure
5.4	AQ: Construction Phase mitigation applicable to Ballyadam Converter Station	Construction activities associated with the Ballyadam Converter Station are predicted to have a 'low to medium risk' in terms of dust soiling and PM_{10} effects with no mitigation in place. Best practice mitigation measures for these activities are presented below: ● Communication: – Display the name and contact details of person(s) accountable for air quality and dust issues on the site boundary; and, – Display the head or regional office contact information. ● Site Management: – Record all dust and air quality complaints, identify causes and take appropriate measures to reduce emissions in a timely manner and record the measures taken; and, – Record any exceptional incidents that cause dust and or air emissions, either on or off site, and the action taken to resolve the situation in the log book. ● Monitoring: – Carry out regular site inspections to monitor compliance with the DMP and record inspection results; and, – Increase the frequency of site inspections by the person accountable for air quality and dust issues on site when activities with a high potential to produce dust are being carried out and during prolonged dry or windy conditions. ● Preparing and maintaining the site: – Avoid site runoff of water or mud; – Plan site layout so that machinery and dust causing activities are located away from receptors as far as possible; – Erect solid screens or barriers around dusty activities or the site boundary that are at least as high as any stockpiles; – Fully enclose site or specific operations where there is a high potential for dust production and the site is active for an extensive period; – Remove materials that have a potential to produce dust from site as soon as possible unless being re-used on site; if they are being reused on site cover as described below; and, – Cover seed or fence stockpiles to prevent wind whipping. ● Operating vehicles/ machinery and sustainable travel: – Ensure all vehicles switch off engines when stationary – no idling vehicles; – Avoid the use of diesel- or petrol-powered generators and use mains electricity or battery powered equipment where practicable; and, – Impose and signpost a maximum-speed limit of 15mph on surfaced and 10mph on unpaved surface haul roads and work areas. ● Operations – Only use cutting, grinding or sawing equipment fitted or in conjunction with suitable dust suppression techniques such as water sprays or local extraction; – Ensure an adequate water supply on the site for effective dust/ particulate matter suppression/ mitigation using non-potable water where possible and appropriate; – Use enclosed chutes and conveyors and covered skips;

Reference	Aspect	Mitigation and / or Monitoring Measure
		– Minimise drop heights from conveyors loading shovels hoppers and other loading or handling equipment and use fine water sprays on such equipment wherever available; – Avoid bonfires and burning of waste materials; and, – Ensure equipment is readily available on site to clean any dry spillages, and clean up spillages as soon as reasonably practicable after the event using wet cleaning methods. • Measures specific to demolition: – Ensure effective water suppression is used during demolition operations; and, – Avoid explosive blasting, using appropriate manual or mechanical alternatives. • Measures specific to construction: – Avoid scabbling (roughening of concrete surfaces) if possible: – Ensure sand and other aggregates are stored in bunded areas and are not allowed to dry out, unless this is required for a particular process, in which case ensure that appropriate additional control measures are in place; – Ensure bulk cement and other fine powder materials are delivered in enclosed tankers and stored in silos where suitable emission control systems to prevent escape of material and overfilling during delivery: and, – For smaller supplies of fine power materials ensure bags are sealed after use and stored appropriately to prevent dust. • Measures specific to earthworks: – Re-vegetate earthworks and exposed areas/ soil stockpiles to stabilise surfaces as soon as practicable; – Use hessian, mulches or trackifiers where it is not possible to re-vegetate or cover with topsoil as soon as practicable; and, – Only remove the cover in small areas during work and not all at once. • Measures specific to trackout: – Use water-assisted dust sweepers on the access and local roads, to remove as necessary any material tracked out of site; – Ensure vehicles entering and leaving sites are covered to prevent escape of materials during transport; – Inspect on-site haul routes for integrity and instigate necessary repairs to the surface as soon as reasonably practicable; – Record all inspections of haul routes; – Implement a wheel washing system (with rumble grids to dislodge accumulated dust and mud prior to leaving the site where reasonably practicable); – Ensure there is an adequate area of hard surfaced road between the wheel wash facility and the site exit and layout permits; – Install hard surfaced haul routes which are regularly damped down with fixed or mobile sprinkler system or mobile water bowsers and regularly cleaned; – Avoid dry sweeping of large areas; and, – Access gates to be located at least 10m from receptors where possible.
5.5	C: Construction Phase	It is important that the design seeks to limit GHG emissions from the earliest stage possible to ensure the greatest reductions can occur. The following high-level approach will be applied and developed when seeking to reduce GHG emissions (as stipulated within PAS 2080):

Reference	Aspect	Mitigation and / or Monitoring Measure
		• Build nothing: the design will evaluate the basic need for an asset and / or programme of works and will 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. The latter stages of the design should consider the hotspots as detailed in Section 5.4.1 as the focus for reductions of GHG emissions. The key idea to further consider is the increased reuse of site-won material as this would both reduce the off-site disposal of material and the import of material which currently, based on a worst-case assumption, accounts for 50% of the construction emissions.
5.6	C: Operational Phase	In relation to operational impacts on climate change, the following best practice will be implemented in order to prevent fugitive emissions of SF_6 during operation of the proposed development. • Staff or any sub-contractors involved in equipment installation, servicing or disposal will be trained to ensure they understand the techniques required to minimise the generation of fugitive emissions. The training will include best management practices for handling, managing and monitoring SF_6. • The supply and maintenance of the proposed equipment will comply with all relevant international standards and best practice: – *BS EN 62271-203:2004 High-voltage switchgear and control gear. Gas-insulated metal-enclosed switchgear for rated voltages above 52 kV*; – *BS EN 62271-4. High-voltage switchgear and control gear. Part 4. Use and handling of sulphur hexafluoride (SF6)*; – *PD CLC/TR 62271-303:2009 High-voltage switchgear and control gear. Use and handling of sulphur hexafluoride (SF6)*; – *BS EN 60376:2005 Specification of Technical Grade Sulphur Hexafluoride(SF6) for Use in Electrical Equipment;* – *BS EN 60480:2004 Guidelines for the checking and treatment of Sulphur Hexafluoride (SF6) taken from electrical equipment and specification for its re-use;* – *CIGRE 276: Guide for the Preparation of Customised 'Practical SF6 Handling Instructions.' Task Force B3.02.01 (2005); and* – *BS 6867:1987 Code of practice for maintenance of electrical switchgear for voltages above 36 kV*. • Leak detection methods, i.e. pressure or density monitoring device, will be used as necessary and on a regular basis to identify any sources of fugitive emissions of SF_6 from equipment at the proposed development.
5.7	AQ: Cumulative Effects	• Regular liaison meetings will be held with construction sites within 500m of the site boundary to ensure plans are co-ordinated and dust and particulate matter emissions are minimised.
Chapter 6 Land, Soils and Hydrogeology		
6.1	HVAC / HVDC Route (Embedded)	• Cables are mainly within existing road network. • Land and vegetation will be reinstated, where possible, following construction.

Reference	Aspect	Mitigation and / or Monitoring Measure
		• Trench crossings are proposed in dry works area isolated with an impermeable barrier from water courses/temporary concrete ducts. Site restoration post works provision such as riverbank stabilisation. • HDD trench using a comprehensive closed-loop drilling fluid mixing system to minimise volume of fluids required on site with constant monitoring of volume, pressure, pH and viscosity. • Land will be returned to original state following construction • Temporary shelter erected over joint bays during construction to protect from moisture and contamination during jointing. • Before cable installation chamber will be backfilled with appropriate material. Manholes constructed to facilitate maintenance. • Joint chambers will be installed in a staggered approach to reduce width required for installation. • Traffic control measures will be in place as appropriate, including road diversions, closures and stop/go traffic management to reduce temporary disruptions to traffic in the surrounding area.
6.2	Converter Station: (Embedded)	• The proposed internal road access for the Converter Station site has been developed to tie into the existing internal roads within the larger IDA owned Ballyadam site, independent of potential future development of access routes to the Ballyadam site, including a potential N25 interchange to the south west The design can however readily connect into such proposals in the future without affecting the conclusions of this EIAR. • Any contaminated ground identified during enabling works will be handled according to the contractors Construction Environment Management Plan and associated Risk Assessment Method Statements. Any such ground will be characterised according to Waste Acceptance Criteria and dealt with via a bespoke remediation strategy or materials management plan ground. Any waste arising will be managed in accordance with the Waste Management Act 1996, and associated Regulations. • Any fill that is required will consist of engineered stone that will be brought to site. • Any contaminated ground identified during enabling works will be handled according to the contractors Construction Environment Management Plan and associated Risk Assessment Method Statements. Any such ground will be characterised according to Waste Acceptance Criteria and dealt with via a bespoke remediation strategy or materials management plan ground. Any waste arising will be managed in accordance with the Waste Management Act 1996, and associated Regulations. • Any fill that is required will consist of engineered stone that will be brought to site • Specialist and experienced piling Contractors will be employed to carry out the works. Method statements, piling risk assessments and environmental management plans, specific for the area where the drilling is to take place, will be carried out / prepared in line with contractual agreements. • The piling risk assessments will include for example, groundwater / aquifer protection and the implementation of robustness monitoring of the works. These documents will be submitted by the Contractor to the planning authorities for discussion and acceptance prior to commencing piling operations. • The presence of voids would be recognised by an experienced piling operator during the boring of the piles, prior to concrete placement. In such cases, the piling Contractor would install a permanent casing (likely a thin steel sleeve) to retain concrete within the pile bore/shaft. This requirement will be clearly stated in the piling performance specification and contractual agreements. • Karst subsidence monitoring will form part of the Construction Environmental Management Plan for the Converter Station site. • The proposed storm water drainage/SuDS system will incorporate the following key features; – Traditional storm water collection and conveyance elements such as gutters, downpipes, gullies, channels and below ground pipework – Flow control devices ('hydrobrake' or equivalent) to restrict the rate of discharge from the site to pre-development runoff rates

Reference	Aspect	Mitigation and / or Monitoring Measure
		– Below ground attenuation tanks to balance incoming flows and prevent flooding in the event of an extreme storm event – Silt traps and hydrocarbon interceptors to remove any pollutants which may have become entrained in the runoff • Shut-off valve chambers to prevent discharge from the drainage network in the event of an emergency • An area of compensatory storage will be developed to replace this storage capacity as detailed in Section 2.3.3 Drainage Design and Wastewater Discharge. This 'cut' could potentially be used to 'fill' the depressions, subject to geotechnical and ground investigation studies. For the purposes of the assessments in this EIAR however it has been assumed that material will need to be imported as a worst-case scenario. • Although a single connection to the public main is proposed, separate connections and meters will be provided for control buildings located in the Converter Station and for those located in the reactor compound to facilitate separate billing. • A looped 'ring main' with hydrants for fire-fighting purposes is also proposed to be provided within the Converter Station and reactor compounds • Area of compensatory storage developed to collect rainwater with impermeable membrane - material will need to be imported. All storm water drainage elements sealed to protect soluble karst rock. • All storm water drainage elements sealed to protect soluble karst rock. Wastewater storing facilities in fully sealed holding tanks.
6.3	Landfall Area: (Embedded)	• Construction works will be conducted in two phases, to mitigate against beach access and disturbance to the public during the busy summer works: • Phase 1 will be conducted in the winter months and will consist of the construction of the transition joint bay chambers, the installation of the cable ducts within open cut trenches up the beach and into the beach car park. The areas will then be reinstated to their original condition prior to completion of this Phase. • Phase 2 will be conducted in the summer months and will consist of the installation of the cables through the Phase 1 ducts. This is achieved by pulling the cables from the cable lay vessel through the ducts by means of a cable winch located within the transition joint bay chambers. • The platform and the trench excavation will be formed by a cofferdam (sheet piling) to mitigate against sea erosion during the winter months. • Excavation works will be completed in winter months (Phase 1) to limit disruption to traffic accessing Claycastle Beach. • Steel piled cofferdams and a causeway for access will be constructed along Claycastle Beach in order to facilitate installation of the submarine cable and the beach and surrounding areas will be reinstated following construction.
6.4	Hydrogeology	• A pre-construction verification survey of the below boreholes will be carried out to confirm whether they remain in use, and the nature of use. If at the time they are used for drinking water purposes, water quality testing of boreholes will be carried out to ensure no degradation of water quality as a result of the construction activities. – 1 x borehole (1707SWW035) 33.5m. Source Use: Unknown – Woodstock – 1 x borehole (1707SWW017) 44.2m. Source Use: Unknown – Longstown – 1 x borehole (1707SWW034) 4.9m. Source Use: Unknown – Woodstock – 1 x borehole (1707SWW036) 25m. Source Use: Unknown – Woodstock – 1 x Dug Well (1707SEW045) 3.7m. Source Use: Unknown – Caherultan – 1 x borehole (1707SEW043) 21.3m. Source Use Unknown. – Lissacrue • One borehole in close proximity to the proposed works is used for public water supply and another for agricultural and domestic use. These two boreholes will be subject to pre-construction verification survey to confirm whether they remain in

Reference	Aspect	Mitigation and / or Monitoring Measure
		use, and the nature of use. If at the time they are in use for drinking water purposes, water quality testing of the boreholes will be conducted to ensure no degradation of water quality as a result of the construction activities. – 1 x borehole (2007SWW089) 18.3m Source Use: Agri and domestic use. – Knocknacally. – 1 x borehole (2007SWW041) 44.8m. Source Use: Public supply – Kennel.
6.5	Cumulative Effects	• Prior to commencement of construction and during the construction phase engagement with the proponents of these developments (including Transport Infrastructure Ireland, the IDA, Cork County Council and the OPW) will continue and where there is potential for works to be carried out in parallel, appropriate mitigation measures will be implemented including the scheduling of works and regular liaison meetings between project teams to ensure that plans are co-ordinated and impacts are minimised.
Chapter 7 Surface Water, including Flood Risk		
7.1	Converter Station: Construction Phase (Embedded)	• The converter station site will consist of a new engineered stone fill platform which will raise the proposed site level above its existing level. This will ensure that a sealed, below ground, gravity drainage system can be accommodated. • Rotary bored cast-in-place (socketed into rock) reinforced concrete piles will likely be adopted for all foundations on this site. Specialist and experienced piling Contractors will be employed to carry out the works. Method statements, piling risk assessments and environmental management plans, specific for the area where the drilling is to take place, will be carried out / prepared in line with contractual agreements. The piling risk assessments will include for example, groundwater / aquifer protection and the implementation of robust monitoring of the works. These documents will be submitted by the Contractor to the planning authorities for discussion and acceptance prior to commencing piling operations. • The presence of voids would be recognised by an experienced piling operator during the boring of the piles, prior to concrete placement. In such cases, the piling Contractor would install a permanent casing (likely a thin steel sleeve) to retain concrete within the pile bore/shaft. This requirement will be clearly stated in the piling performance specification and contractual agreements. • Construction of the below ground drainage system will commence on completion of the proposed platform. The access road below ground drainage system will commence on completion of the access road enabling works. • The construction of the proposed site access road will commence at the same time as the piling works. This will consist of removing all poor ground and any material from areas to be cut and removing this material from site. All fill for embankments will consist of engineered stone that will be brought to site. • A Contractors compound will be located within the site boundary and will be located on an area of ground that will be temporarily surfaced with engineered stone and levelled. The compound will house the Contractors cabins and areas for temporary storage of construction materials (excluding cut/fill ground, which will be brought directly to and from site with no need for temporary storage). • Construction of the reinforced concrete piled raft for all of the buildings and structures can commence once the piling is complete. The structures and building will then progress commensurate with typical construction practice. The site contains two depressions which act to reduce flood levels in the wider IDA site. These will be infilled during construction and replaced with a compensatory storage area. The transition of the depressions to the storage area will be managed on site so as not to increase flood risk elsewhere during construction.
7.2	Converter Station: Construction Phase (Embedded/Monitoring)	• The piling operator will be experienced in successful piling within Karst regions and clear lines of communication with defined roles and responsibilities will be maintained between the site team, the Contractors and the Design Engineers throughout the works.

Reference	Aspect	Mitigation and / or Monitoring Measure
		• A minimum of one Geotechnical Engineer and one Resident Engineer will supervise the piling works. Supervision of each piling rig may be required. • Monitoring of the concrete volumes poured into the pile against the estimated volume that the pile requires will be carried out, to ensure that concrete is not being lost into voids in the ground. • Piles will be monitored for potential vertical settlement of fresh concrete, an indicator of potential concrete loss.
7.3	HVAC / HVDC Route (Embedded)	• The cable route will be designed to not be vulnerable to flooding; this includes the avoidance of flood zones A and B where possible. In any case all joint bays and link boxes are designed with watertight connections as standard (as these installations are typically underground) Where it is impossible to avoid Flood Zones A and B the scheme includes embedded mitigation against flood risk.
7.4	Water Crossings by Open Cut (Embedded)	• Open cut water crossings have the potential to generate silt and suspended solids. In order to reduce the risk of discharging sediment it is proposed to carry out these works in a dry works area. • Unless otherwise agreed with IFI, instream works in watercourses with fisheries value will be restricted to the fisheries open season (i.e. July to September inclusive). • At a number of specific river crossing locations instream works may be required. At these locations electrofishing may be carried out to remove fish under licence from IFI. These locations will be agreed with IFI prior to works commencing. A detailed method statement for instream works specific to each river crossing will be prepared and the report authorised by a suitably experience aquatic ecologist. This will be finalised and agreed with IFI. • Where open trenching is proposed, site restoration works will be carried out following completion of the crossing, in agreement with IFI. These works may include riverbank stabilization, gravel replacements etc. In all cases, the site will be restored post installation.
7.5	Water Crossings by HDD (Embedded)	• Pumping of trenches and HDD could result in increased flow to surrounding watercourses if not managed correctly. This could then affect hydrological discharges and dilution, whilst the works could also release contaminants or sediment into the watercourse. • Competent specialist contractors with proven successful drilling experience working on projects within ground conditions similar to those expected within this project will be appointed to undertake the work. • As with all construction works proposed, no drilling works will be allowed to commence until the relevant RAMS and pertinent Health and Safety documents are received from the specialist Contractor and are reviewed and agreed by the Client's representative. These Contractor documents will include method statements, drilling risk assessments and environmental management plans specific to the area where the drilling is to take place. These documents will, as a minimum, list proposals to eradicate any risk or mitigate against them and would include for example utilities/services plans and avoidance measures, groundwater / aquifer protection measures, and implementation of robust monitoring of the works, including action plans to mitigate / rectify any environmental incident. This assessment / management plan is expected to be submitted by the Contractor to the Employers Representative on site for review and comment prior to commencing drilling operations.
7.6	Water Crossings by HDD (Monitoring)	• Constant monitoring by the specialist drilling team of fluid volume pressure, pH, weight and viscosity will be carried out during the proposed works. The volume of cuttings produced will also be monitored to ensure that no over cutting takes place and that hole cleaning is maintained. The mud returns will be pumped to the circulation system trailer by means of a bunded centrifugal pump. The nature of the cuttings will also be monitored to understand the ground conditions as the drilling progresses. • After the initial pilot hole is completed, it will be reamed in a number of passes to reach the required bore size to enable the duct lining to be pulled [usually High-Density Polyethylene (HDPE)]. To ensure that the prevailing geological conditions have

Reference	Aspect	Mitigation and / or Monitoring Measure
		suitable cohesion that can maintain the bore during the drilling and reaming process, close attention will be paid by the specialist drilling team to modelled drag forces during pullback with constant monitoring of load stress undertaken to ensure that modelled tensile stress, collapse pressures, hoop stress and buckling stress are not exceeded. In addition to the above measures, the rate of drilling progress will be monitored to assist with the identification of any voids or changes in strata. • Where directional drilling takes place within limestone bedrock beneath a watercourse, settlement will be monitored at the surface to provide an early warning of any unexpected stability issues. If visible settlement occurs the directional drilling contractor will cease boring, although drilling fluid may still be circulated if required to maintain the stability of the drilled hole, until remedial measures can be put in place to stabilise the ground. • In addition, river/stream flows will be monitored upstream and downstream of any directional drilling watercourse crossings. The flow monitoring will be undertaken on a daily basis for five working days prior to the directional drilling, during the directional drilling and for five working days following completion of the directional drilling. If a measurable increase in losses from the watercourse to ground is observed in the reach where the directional drilling took, place bed lining will be undertaken if required by IFI. The exact nature of any bed lining will be determined through consultation with IFI. •
7.7	Construction Compounds and Laydown Areas (Embedded)	• All temporary construction compounds will be secured with hoarding/fencing around the compound perimeters as appropriate. Where temporary construction areas are required and existing hardstanding is not available, engineering stone fill will be laid and compacted and maintained as required for the duration of the works. Once the works are completed, the engineered stone fill will be removed and the land will be reinstated to its original condition. • Temporary facilities will be provided at the construction compounds including construction phase car parking and welfare facilities and temporary material storage areas as necessary. 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 an approved licenced facility. • Storage of fuel and refuelling will be undertaken within bunded hardstanding areas. Water will be brought to site via tankers as required.
7.8	Connection Point and Converter Station Operational Phase (Embedded)	• The proposed oil filled transformers at the converter station site and at Knockraha substation will be bunded. The bunds will have the capacity to hold 110% of the volume of oil in each transformer.
7.9	Converter Station: Construction Phase (Embedded)	• Foul water will be collected in proprietary holding tanks which will be periodically emptied by a licensed waste disposal contractor. The holding tanks will be fully sealed to prevent discharge to ground and will include a high-level alarm and telemetry link to the converter station's control system such that they can be monitored remotely and emptied when necessary. • A storm water drainage system incorporating SuDS (sustainable drainage systems) features will be constructed to manage the quantity and quality of runoff during rainfall events. The system will operate by gravity and be sized to ensure that no internal property flooding occurs for the critical storm with a 1 in 100-year return period including a +20% allowance for climate change. All proposed surfaces and storm water drainage elements will be sealed. • An area of 'compensation storage' adjacent to the compound will be developed. The compensation storage area will be specifically designed to accept and store water during rainfall events and it will be sized to ensure that there is no significant increase in flood risk in the 'post-development' case when compared to the 'pre-development' case. This compensation storage area will consist of a below ground and covered storage tank, which will be emptied at a controlled rate via a pumped

Reference	Aspect	Mitigation and / or Monitoring Measure
		connection to the storm water drainage system which will serve the proposed converter station access road. Discharge from the compensation storage area will be restricted to 'greenfield' runoff rates to ensure that there is no significant increase in flood risk elsewhere. Flood water routing in the form of open channel drains and culverts will be installed around the perimeter of the proposed converter station to divert overland flow towards the dedicated compensation storage area, rather than towards the location of the infilled depressions. • Discharge from the converter station site and the associated access roads is proposed to be restricted to greenfield runoff rates in line with the recommendations of the Greater Dublin Strategic Drainage Study (GDSDS Vol. 2 – New Development) which have generally been adopted by Local Authorities across the country.
7.10	Construction Phase (General)	• A full-time on-site Environmental Clerk of Works (EnCoW) will be appointed prior to commencement of works. • Pre-construction surveys will be carried out and seasonal constraints will be confirmed in agreement with IFI and National Parks and Wildlife Service (NPWS) and Cork County Council, as appropriate. • Works will be carried out in accordance with the guidelines set out by IFI in 'Guidelines on Protecting Fisheries During Construction Works in and Adjacent to Waters' (IFI, 2016). • The IFI Biosecurity Protocol for Field Survey Works will be complied with.
7.11	Construction Phase Surface Water Quality Protection Measures	• Activities will be planned in advance and machinery will be managed to ensure that the number of trips is limited to the minimum required at each location i.e. the more times a piece of ground is tracked, the more likely it is that vegetative cover will be removed and ruts will be created that will act as miniature rivers where dirty water will flow. • Tracking beside streams and tracks will be avoided to avoid damage to the bankside. • Geotextile or timber matting will be used on soft ground, and in all protected areas • A buffer zone of 25-30m will be maintained between storage and working areas and watercourses, taking account of the minimum working area required to facilitate the works. • The time period over which areas of clearance are left open will be reduced insofar as is reasonably practicable. • Re-instatement method statements will be subject to approval by the Ecologist within the Employer's Representative Team • Concrete will be brought to site by covered truck. Wet concrete operations adjacent to watercourses will be avoided where possible. • The Contractor will ensure that all concrete truck wash watering / cleaning is undertaken offsite where possible and remote from watercourses. • In order to reduce the risk of contamination arising as a result of spills or leakages, measures including, but not limited to, the following will be employed. All collected waste will be managed in accordance with the Waste Management Act 1996, and associated Regulations: – Fuels, chemicals, liquid and solid waste will be stored on impermeable surfaces; – Refuelling of plant, equipment and vehicles will be carried out on impermeable surfaces; – All tanks and drums will be bunded in accordance with established best practice guidelines; and – Spill kits will be provided at all compound locations and carried by all crews during underground cable installation works. • Works will not be carried out during Weather Warnings. • Silt fences (to Hy-Tex Premium specification or similar) and silt traps will be installed prior to commencement of works and will be inspected daily to inform adaptive management as required. The locations of same will be determined by the EnCoW. • Site restoration post works will be carried out, in agreement with IFI These works may include riverbank stabilization, gravel replacements etc. In all cases, the site will be restored post installation.

Reference	Aspect	Mitigation and / or Monitoring Measure
7.12	Construction Phase Silt Control Measures	• Silt fences must be installed in the working areas and not at the watercourse. • Access routes will be delineated such that an appropriate set back distance from watercourses is maintained. Where works are to be undertaken adjacent to watercourses the setback distance will be delineated by the EnCoW on site. • Where distances between the works and watercourse allow, a minimum setback distance of 30m from the watercourse will be maintained. • Where the site is constrained, the best available set back distance will be employed taking account of the minimum working area required to facilitate the works. • Silt fences will be installed downslope of the area where silt is being generated on disturbed ground. • To be effective the silt curtain must contain the area where silt is generated and must terminate on high ground (i.e. an elevated area not in the watercourse). • Silt fences will be constructed using a permeable filter fabric (e.g. Hy Tex Terrastop Premium silt fence or similar) and not a mesh. • The base of the silt fence will be bedded at least 15-30 cm into the ground at 2 metre intervals. • Once installed the silt fence will be inspected regularly, daily during the proposed works, weekly on completion of the works for at least one month, but particularly after heavy rains and periodically thereafter. • The integrity of the silt fencing will be checked daily by the ENCoW and after poor weather conditions (rain or wind) and any failures rectified immediately. • Two lines of silt curtain / fence will be installed, where considered necessary, by the ENCoW. • Any build-up of sediment along the fence boundary will be removed daily. • Silt fences will be maintained until vegetation on the disturbed ground has re-established. Re-instatement method statements will be subject to approval by the Ecologist within the Employer's Representative Team. • The silt fencing must be left in place until the works are completed (which includes removal of any temporary ground treatment). • Silt fences will not be removed during heavy rainfall. • The silt fence will not be pulled from the ground but cutaway at ground level and posts removed. • A record of when it was installed, inspected and removed will be maintained by the EnCoW. • Silt traps will only be placed in drains downstream of working areas where the volume of water flow is expected to be low. • Silt traps will be made of terram or similar material, not mesh. • The trap will be staked into the banks of the drain / watercourse such that no water can flow around the sides. • The material will be bedded into the drain bed/watercourse to prevent water flowing beneath it. • The height of the trap will be lower than the bank heights. The upper edge will be fixed to a timber cross piece. This will allow water to overtop the silt trap and not burst through or around it. • Inspections will be carried out daily; during the proposed works, weekly on completion of the works for at least one month, and after heavy rains, and monthly thereafter until bare areas have developed new growth. • Any build-up of solids will be carefully removed without removing any vegetation growing on the bottom. • In sensitive areas a series of silt traps will be placed in the drain. • The silt trap will not be pulled from the ground but cutaway at ground level and posts removed. • A record of when it was installed, inspected and removed will be maintained by the EnCoW.

Reference	Aspect	Mitigation and / or Monitoring Measure
7.13	Converter Station: Operational Phase	• Emergency shut-off valves will be included near the downstream end of all storm water drainage networks such that discharge from the site can be prevented during an emergency situation (e.g. a fire or a significant oil / fuel spill). • Silt trap chambers will be included near the downstream end of all storm water drainage networks to remove silt, soil and any other settleable material that may become entrained in site runoff. • All external transformers will be bunded and drained via sump pumps fitted with oil-detection sensors. Stormwater from these sumps will only be pumped into the main collection system when the sensors confirm that the stored rainwater is not contaminated by an oil spill or leak. Storm water from these areas will also pass through a Class 1 'full retention' separator before entering the main site drainage network. • The compensation storage tank will require a pump set to empty and control its rate of discharge to the main site drainage network. This pump set will include a secondary back-up ('stand by') pump in case of failure of the primary ('duty') pump. The storage tank will also include a high-level alarm, SCADA control system and a telemetry link to the converter station's main control system such that it can be monitored and operated remotely. • A regular inspection and maintenance regime will be implemented for the drainage systems as part of the overall operational procedures of the site. This will involve periodic inspection of key elements to confirm that these are operating as intended and whether any cleaning or remedial maintenance works are required.
7.14	Cumulative Effects	• Prior to commencement of construction and during the construction phase engagement with the proponents of these developments (including Transport Infrastructure Ireland, the IDA, Cork County Council and the OPW) will continue and where there is potential for works to be carried out in parallel, appropriate mitigation measures will be implemented including the scheduling of works and regular liaison meetings between project teams to ensure that plans are co-ordinated and impacts are minimised.
Chapter 8 Biodiversity		
8.1	Construction Phase General	• Pre-construction surveys will be conducted for Sensitive Ecological Receptors outlined in the EIAR, so to tailor mitigation as relevant for specific works locations. This is of particular relevance given the dynamic nature in distribution of some biodiversity receptors and changes in habitat distribution (e.g. due to other land clearance works) that can arise between baseline surveys and commencement phase of projects. For example, bat roost locations in trees may change each year. • An Ecological Clerk of Works will be employed on behalf of the Employers Representative team to ensure all mitigations measures are implemented in full. This will include monitoring and auditing the works and contractor programmes and works method statements, to ensure mitigation is correctly implemented. The EcOW will also ensure any disturbance licenses are arranged based on relevant details outlined in this EIAR and any significant findings of updated pre-construction surveys outlined above. A separate site ECoW will be also employed by the site contractor to ensure on site mitigation is implemented. The EcoW will advise on mitigation measures implementation including the scheduling of works and will be included in regular liaison meetings between project teams to ensure that plans are co-ordinated and impacts are minimised.
8.2	Construction Phase Mitigation for Direct Impacts to Ballyvergan Marsh pNHA	• Prior to works commencing, the works area within the marsh will be fenced to keep the footprint of the works within the wetland habitat to the bare minimum required to achieve the works. • Noise attenuating hoarding will be installed around drilling areas to minimise noise effects out with the works areas. • Bog mats will be utilised throughout the works areas to reduce rutting and direct damage to the habitat. • Where excavation is required, any turves of phragmites will be removed and stored such that they can be reinstated following completion of works. Removal of the turves will be carried out during dry weather conditions and monitored by the site EcOW to ensure kept watered etc.

Reference	Aspect	Mitigation and / or Monitoring Measure
		• The turves will not be stored on top of each other as this will result in compaction of the soul. The duration of storage will be kept to the minimum time necessary to allow for the translocation works to complete. • Following the completion of the works bog mats will be removed from the works area and the habitat reinstated. Reinstatement will be to the satisfaction of the NPWS and Local Authority. • Where bare earth remains (for example due to the clearance of scrub within the site) these will be planted at an appropriate time of the year with reed shoots. These shoots will be no less than 20cm in length and will be planted at densities of 10-15 cuttings per square metre. • Any additional requirements as outlined by the NPWS or Local Authority relating to the reinstatement of Ballyvergan Marsh will be incorporated, in agreement with the Client's Representative Team.
8.3	Construction Phase Mitigation for the Protection of Sand Dune Habitat	• Works are required on the margin of and partially within Annex fixed dune habitat at Claycastle. • Prior to works commencing, the sand dune habitat will be fenced to keep the footprint of the works within the habitat to the bare minimum required to achieve the works. • Where works encroach on the sand dune habitat temporarily, bog mats will be utilised to reduce rutting and direct damage to the grassland habitat. Where works will take place over a longer period, turves of grassland may be removed and stored such that they can be reinstated following completion of works. • The vegetation will be cut as short as possible prior to removal of turves. • Removal of the turves will be carried out during dry weather conditions. • The turves will not be stored on top of each other as this will result in compaction of the soul. The duration of storage will be kept to the minimum time necessary to allow for the translocation works to complete. This will be monitored by the site EcOW with input from specialist botanic expert if required. • Prior to reinstatement of the grassland, the ground will be prepared such that impacts due to possible compaction by the construction plant will be ameliorated.
8.4	Construction Phase Mitigation for the Protection of Calcareous Grassland at Ballyadam	• Translocation of calcareous grassland will be carried out prior to the commencement of the construction of the Converter station site to a temporary storage area. • Prior to translocation works commencing, a Habitat and Plant Translocation and Enhancement Strategy for the calcareous grassland will be established. This will include details which will outline the timing and co-ordination of the works with reference to the overall construction timeline. The plan will also outline the full suite of management criteria required for the habitat. • A strip of land along the western edge of the proposed converter station site has been identified as a potential temporary receptor site for the calcareous grassland and greater knapweed, refer to Figure TBC. The area of calcareous grassland comprises approximately 2,000m^2 while the donor site is approximately TBC m^2 in size. • Prior to works commencing, temporary fencing will be established at both the temporary receptor and donor site to clearly mark out these areas. This will prevent accidental damage to either of the sites. The fencing will remain in place following translocation and during the construction of the converter station. • The underlying bedrock is the same across the site, and given that the donor site has already been stripped back and hardcore placed, there is limited work required in terms of preparation of the site. • Within the area of calcareous grassland there may be certain undesirable negative indicator species which have established. These will be removed prior to translocation. • Given that the donor site consists of sparsely vegetated bare ground, there will not be a requirement to strip topsoil.

Reference	Aspect	Mitigation and / or Monitoring Measure
		• Translocation of turves is proposed for the calcareous grassland. The top 15cm of soil will be used to include the rooting zone. Larger turves will have the best chance at successful translocation. • The vegetation will be cut as short as possible prior to translocation. • Translocation will be carried out during dry weather conditions. • The turves will be placed close to the donor site. The turves will not be placed on top of each other as this will result in compaction of the soul. The duration of storage will be kept to the minimum time necessary to allow for the translocation of the soil. • Dependant on weather conditions, watering of the turves may be necessary to prevent them from drying out. • Following removal of turves the earth embankment upon which the grassland has established will be translocated to the temporary donor site. • Once the earth bank has been re-created (i.e. mirrored depth of soil to the original bank) the turves will be placed on the bank. • Additionally, seeds from desirable positive indicator plant species within the converter station footprint will be collected and the bank will be seeded, to encourage establishment. Collection times for the seeds will be species dependant, and sowing will be undertaken by hand. • Following the completion of the translocation, permanent stock proof fencing will be placed surrounding the donor site. • Ashwood[159] outlines that grassland establishment can take between 3 and 5 years. Mowing may be required for the ongoing maintenance of the grassland. This will likely be required on a yearly basis to keep the sward fellow 10cm. • Mowing will take place on a yearly basis in the second and third years and will take place after grasses have set seed. All cuttings will be removed from the site to avoid nutrient enrichment of the sward and shading of seedlings (Croft & Jefferson, 1994; Ashwood, 2014). • A final translocation will take place of the grassland from the temporary translocation site between 3 and 5 years after the initial translocation (to the temporary site). The final translocation site is within the convertor station site. The final translocation and establishment methods will follow the approaches outlined above and as follows. • Long-term management through grazing and/or cutting is essential for maintaining species richness. A long-term management plan will be developed which includes a monitoring and evaluation programme. This will be developed in line with JNCC (2014) guidance and include at a minimum: – The extent of grassland establishment, including details on percentage ground cover, areas where establishment has failed, and the presence of leaf litter. – Sward composition including grass to her ratio, presence of positive indicator species, establishment of greater knapweed, and any negative indicator species present. • A regular evaluation of the management of the habitat will be undertaken, and where issues regarding the establishment are encountered, proposals will be made as to steps to be taken to improve the chances of re-establishment. • Engagement with the IDA will continue and where there is potential for works to be carried out in parallel, appropriate mitigation measures will be implemented including the scheduling of works and regular liaison meetings between project teams to ensure that plans are co-ordinated, and impacts are minimised.

[159] Ashwood, F (2014) Lowland Calcareous Grassland Creation and Management in Land Generation. Best Practice Guidance for Land Regeneration Note 18.

Reference	Aspect	Mitigation and / or Monitoring Measure
8.5	Construction Phase Mitigation for the protection of Oak Ash Hazel Woodland	• Where clearance is required of oak ash hazel woodland this will be kept to the absolute minimum area necessary to facilitate the works. Reinstatement will be carried out where woodland is removed to facilitate passing bays. Reinstatement will be carried out using suitable tree species which are being removed from the habitat. The area impacted will be replanted so no net permanent loss of this habitat arises.
8.6	Construction Phase Mitigation for the Protection Hedgerows, Treelines, and Grassland Verges at Passing Bays	• This measure applies to verges along public roadways. All passing bays will be removed on completion of the project. The passing bay will be in place for a period of up to 18 months. However, they will be removed sooner if possible. The contractor will be obliged both by the Client's Representative and by the local authority to reinstate all hedges and roadside verges, where practicable. • Unless otherwise agreed with the Client's Representative and the local authority, the Contractor will re-instate hedgerows, and treelines, to a species-rich condition (i.e. five woody species per 30 m), comprising only native species. • Unless otherwise agreed with the Client's Representative and the local authority, the Contractor will seed all grassland verges with a native wildflower mix (to specification of EC12 Wild Flora for Earth Banks, Bunds and Ditches; http://www.wildflowers.ie/mixes/ec/ec12.htm or similar. • All other sites will be returned as close as possible to their pre-existing condition, using the same woody species removed, or similar verge seed mixes, under the supervision and direction of the ECoW.
8.7	Construction Phase Mitigation for the Protection of Orange Foxtail	• Joint bays (and by proxy, the adjacent passing bays (c.60 m long), were, wherever possible, identified in places which minimised removal of hedgerows and mature trees • Prior to works commencing a detailed survey for the species within suitable habitat where direct impacts will arise, will be carried out by an experienced botanist during its flowering season (optimal survey season for grass is between June and August). The botanist, to be appointed by the Contractor, will coordinate with the Contractors ECoW and, report findings to the Ecologist with the Client's Representative Team. The botanist will be contracted for a period lasting at least one year following the cessation of potentially damaging construction works at the plant location(s) (see monitoring below). • A management plan will be drawn up by the appointed botanist, in consultation with a NPWS grassland specialist. The plan will be specific to the species which will outline the measures to protect the species by either avoiding and protecting the plant species in situ, or (only as a last resort) through the translocation of the plant species to new receptor locations nearby, under licence from the NPWS. Any additional measures as outlined under the terms of the license will also be included. • For a period lasting at least one year following the cessation of potentially damaging construction works at the plant location(s), the appointed botanist will undertake quarterly site visits to photograph and document the success of the mitigation measures, and discharge any conditions associated with any license(s). Where issues regarding the establishment are encountered, the botanist will consult with the NPWS, in agreement with the Contractor and the Ecologist within the Employer's Representative Team, to identify reasonable steps to improve the chances of re-establishment.
8.8	Construction Phase Mitigation for the Protection of Pennyroyal	• Prior to works commencing a detailed survey of suitable habitat (the sand dune habitat at Claycastle) for the species will be carried out by an experienced botanist during its flowering season (August to September). • A management plan will be drawn up specific to the species which will outline the measures to protect the species in the first instance by either avoiding and protecting the plant species in situ or (only as a last resort) through the translocation of the plant species to new receptor locations nearby, under licence from the NPWS. • Where the plant is located within the footprint of the works the temporary removal, storage and reinstatement of the turves of grass as outlined for the protection of the sand dune habitat will allow for the reinstatement of the plant species also. Any additional measures as outlined under the terms of the license will also be included.

Reference	Aspect	Mitigation and / or Monitoring Measure
		• Following completion of the works a regular evaluation of the success of the mitigation measures will be undertaken, and where issues regarding the establishment are encountered, proposals will be made as to steps to be taken to improve the chances of re-establishment.
8.9	Construction Phase Mitigation for the Protection of Tufted Feather Moss	• Prior to works commencing a detailed survey of suitable habitat for the species will be carried out by an experienced bryologist. • Where the species is confirmed within the red line boundary, a management plan will be drawn up specific to the species which will outline the measures to protect the species by either avoiding or protecting the plant species in situ, or through the translocation of the plant species to new receptor locations nearby. • Following completion of the works a regular evaluation of the success of the mitigation measures will be undertaken, and where issues regarding the establishment are encountered, proposals will be made as to steps to be taken to improve the chances of re-establishment. • Tufted feather moss is known to be associated with lowland streams and rivers, and can be found on roots of trees and on rocks, boulders, silt, also on tarmac. •
8.10	Construction Phase Mitigation for the Protection of Wild Clary	• Prior to works commencing a detailed survey of suitable habitat (the sand dune habitat at Claycastle) for the species will be carried out by an experienced botanist during its flowering season (August to September). • A management plan will be drawn up specific to the species which will outline the measures to protect the species in the first instance by either avoiding or protecting the plant species in situ. • Where the plant is located within the footprint of the works the removal and reinstatement of the turves of grass as outlined for the protection of the sand dune habitat will allow for the reinstatement of the plant species also. Any additional measures as outlined under the terms of the license will also be included. • Following completion of the works a regular evaluation of the success of the mitigation measures will be undertaken, and where issues regarding the establishment are encountered, proposals will be made as to steps to be taken to improve the chances of re-establishment.
8.11	Construction Phase Mitigation for the Protection of Greater Knapweed	• Prior to works commencing a detailed survey of suitable habitat (the grassland at the proposed Converter Station) for the species will be carried out by an experienced botanist during its flowering season (July to September). This will allow for the identification of any additional populations within the ZoI. • A management plan will be drawn up specific to the species which will outline the measures to protect the species. • A short term donor site has been identified TBC. This will allow for storage and protection of greater knapweed plants while the construction phase progresses. • A strip of land along the eastern edge of the proposed converter station site has been identified as a long-term donor site for the calcareous grassland. This will also be used to facilitate the translocation of greater knapweed. The donor site is approximately TBC m2 in size. The underlying bedrock is the same across both areas within the site and given that the donor site has already been stripped back and hardcore placed, there is limited work required in terms of preparation of the site. • Following the establishment of the long-term donor site the greater knapweed plants will be translocated once more from the short-term location. • Following completion of the works a regular evaluation of the success of the mitigation measures will be undertaken, and where issues regarding the establishment are encountered, proposals will be made as to steps to be taken to improve the chances of re-establishment. This will take place regularly in advance of any mowing of the calcareous grassland so as to protect plants from further damage associated with the management of the site.

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Reference	Aspect	Mitigation and / or Monitoring Measure
8.12	Construction Phase Mitigation for the Protection of Otter	• The Contractor will ensure an initial otter survey is undertaken in advance of the commencement of any works within 150m of the works areas as per Guidelines for the Treatment of Otters Prior to the Construction of National Road Schemes. This will allow for the identification of any holts have been established prior to commencement of works. • The pre-construction survey will be conducted no more than 10-12 months prior to construction commencing. A secondary inspection of the works areas immediately prior to site clearance will ensure that no new holts have been created in the intervening periods. • Should holts be identified within 150m of the proposed development the following will, at a minimum, be employed, unless otherwise agreed with the NPWS: – No works will be undertaken within 150m of holts where breeding females or cubs are present. – Works within 150m of such a holt can only take place following consultation and in agreement with the NPWS – No wheeled or tracked vehicles of any kind will be used within 20m of active but non breeding holts – No light work such as digging by hand or scrub will take place within 15m of such holts except under license from NPWS – The identified exclusion zones will be fenced and clearly marked on site prior to any invasive works. – All contractors on site will be made fully aware or the procedures in relation to the holts by the EcoW
8.13	Construction Phase Mitigation for the Protection of Badger	• Prior to any works commencing a preconstruction badger survey will be carried out. Surveys will be conducted having regard to *Surveying Badgers* (Harris et al.1989) and record signs of badgers including tracks, hair, latrines and setts. The extent of survey area will be defined with regard to Guidelines for the Treatment of Badgers during the Construction of National Road Schemes (NRA, 2006) as 150m beyond the all works areas within suitable habitat. • Prior to works commencing, sett activity at all identified setts within 150m will be confirmed. This may be confirmed through the use of camera monitoring, setting of footprint traps, soft blocking of the sett entrance or similar. Any risk of disturbance to badger will be subject to disturbance license requirements. • A description of the setts i.e. main sett, annex sett, or outlier sett will be provided by the EcoW along with the level of activity at the sett. This will allow for an understanding of the importance of the setts in the wider context of the local population. • As per the Guidelines for the Treatment of Badgers during the Construction of National Road Schemes (NRA, 2006), where setts have been confirmed, no heavy machinery will be used within 30m of badger setts (unless carried out under licence from the NPWS). Lighter machinery (generally wheeled vehicles) will not be used within 20m of a sett entrance; light work, such as digging by hand or scrub clearance will not take place within 10m of sett entrances. • Unless otherwise agreed, and under license from the NPWS, during the breeding season (December to June inclusive), none of the above works will be undertaken within 50m of active setts nor blasting or pile driving within 150m of active setts. An assumption that the sett is active will apply unless proven otherwise during the course of investigation. • All identified exclusion zones as outlined above will be clearly marked out on site and communicated to all site staff prior to works commencing. • Where works may interfere with the badger sett directly exclusion will take place as per NRA (2006) guidelines.
8.14	Construction Phase Mitigation for the Protection of Bats	• The Design and Construction of bat mitigation measures will be site specific, and comply with licensing requirements, having regard for relevant guidance including the NRA's "Guidelines for the Treatment of Bats During the Construction of National Road Schemes"[160], and the NPWS Bat Mitigation Guidelines for Ireland[161].

[160] https://www.tii.ie/tii-library/environment/construction-guidelines/Guidelines-for-the-Treatment-of-Bats-during-the-Construction-of-National-Road-Schemes.pdf

[161] Kelleher, Conor & Marnell, Ferdia. (2006). Bat Mitigation Guidelines for Ireland.

Reference	Aspect	Mitigation and / or Monitoring Measure
		• Trees will not be felled and removed in advance of surveying for bats. Prior to felling of any trees, an initial bat survey of trees to be felled will be undertaken, by a licensed qualified specialist, to assess the suitability of the tree to contain bat roosts as per Bat Surveys for Professional Ecologists: Good Practice Guidelines. • Trees identified with potential roost features of a Moderate to High value will be thoroughly examined, under licence from the NPWS, to ascertain the presence or absence of roosting bats. The trees will be examined for the presence or absence of bats / bat roosts immediately prior to felling. Where timing facilitates it (ie when felling is being undertaken during the active season for bats), emergence surveys may be carried out to determine presence or absence of roosting bats Where felling does not occur within one day of the examination, the trees will be re-assessed. • Where evidence of a roost, or roosting bats has been determined, a license for destruction of a roost and/or exclusion of bats will be required from the NPWS. The procedures for the exclusion of bats and destruction of roost as detailed in the license document will be obeyed, at all times, by the Contractor. • Where bat exclusions are required, they will be undertaken in accordance with the requirements of the bat specialist. They will not be carried out during the breeding season, between the months of June to August inclusive, or during hibernation in the months of November to March inclusive, unless under license from the NPWS. Where the felling of trees found to be suitable as bat roosts cannot be avoided, appropriate mitigation will be agreed with the NPWS and put in place at least one month in advance of any felling or disturbance. • If any bat roost sites are removed by the Works, appropriate replacement bat roost sites will be provided following consultation with the NPWS, and in consultation with the local authority, on public lands. • The Design and Construction of bat mitigation measures will be site specific, and comply with the requirements of the bat specialist, the Standards, the TII's "Guidelines for the Treatment of Bats During the Construction of National Road Schemes", the National Parks and Wildlife Services Bat Mitigation Guidelines for Ireland, the National Parks and Wildlife Service Circular 2/07 Guidance on Compliance with Regulation 23 of the Habitats Regulations 1997.
8.15	Construction Phase Mitigation for the Protection of Red Squirrel	• Prior to works commencing in areas of suitable habitat (i.e. hazel woodland) a targeted survey for the species will be carried out prior to any works taking place. Surveys may include observation surveys, drey counts and feeding remain searches. • Should the species be confirmed within the woodland an assessment of potential for direct impact will be undertaken. Any dreys to be removed will only be removed under license from NPWS. These dreys will be replaced using artificial dreys. Any additional measures outlined by the NPWS under the terms of their license will also be incorporated. • Reinstatement of habitat for the species will take place as outlined for Oak Ash Hazel Woodland in 8.7.1.5.
8.16	Construction Phase Mitigation for the Protection of Pygmy Shrew, Hedgehog, and Stoat	• Implementation of mitigation for breeding birds as outlined below will avoid vegetation removal during March-August inclusive. This existing mitigation will simultaneously avoid the majority of the main breeding season for pygmy shrew and hedgehog which run from April-October, and stoat, which breeds in May-June (Hayden and Harrington, 2001)
8.17	Construction Phase Mitigation for the Protection of Watercourses	• Mitigation specifically in relation to instream works and protection of fisheries will be conducted in agreement with IFI and follow appropriate guidelines including IFI (2016)[162]. The Contractor will prepare a detailed method statement for instream works specific to each river crossing under supervision and direction of the ECoW. This will be finalised and agreed with IFI, in agreement with the Employer's Representative.. • As the river water bodies hold fish species protected under the Wildlife Act and/or the EU Habitats Directive (e.g. Atlantic salmon, lamprey, brown trout, European eel) agreement will be required with IFI for dewatering of the water body reach as part of the instream works required for open trench crossing at stream locations outlined in Table 7.8. A fish salvage operation

[162] Inland Fisheries Ireland (2016). Guidelines on Protection of Fisheries during Construction Works in and Adjacent to Waters.

Reference	Aspect	Mitigation and / or Monitoring Measure
		will be undertaken. The fish salvage operation will be authorised and licensed by the IFI and carried out by either the IFI or by fully qualified, licensed and authorised freshwater ecologists. Instream works will only take place during the period July to September, unless otherwise agreed with IFI. All instream works, silt control measures, sanitising of equipment (to avoid spread of aquatic invasive species), fish salvage operations and habitat protection measures will be monitored by an appropriately experienced ECoW. All instream substrates (gravels, rocks and sand) will be retained during construction and reinstated post works. Bankside turves will also be retained and reinstated post works. Vegetation regrowth on banksides will be monitored for at least three years post works to ensure appropriate development of native semi natural riparian plant growth and where required replanting or control of invasive species will be carried out by the Contractor under the supervision and direction of the ECoW and in agreement with relevant authorities.
8.18	Construction Phase Mitigation for the Protection of Wintering Birds: Waterfowl	• The potential for impact through noise disturbance has been identified for birds at Claycastle landfall site, at Loughs Aderry and Ballybutler pNHA and within Ballyvergan Marsh pNHA. There is potential for works to take place during the wintering season for birds. • Prior to the commencement of the works, a sound reducing hoarding will be placed along work areas adjacent to Ballyvergan Marsh (and moved to follow the cable trenching crews within the marsh itself), at Claycastle beach and along the roadside adjacent to Loughs Aderry and Ballybutler (000446). • This will help to reduce the noise impacts associated with the construction phase of the works and also reduce visibility of personnel and machinery. • All plant used during the construction phase will be the quietest of its type practical for achieving the works. • All plant will be operated and maintained in accordance with the manufacturer's recommendations including the use and maintenance of any specific noise reduction measures. • At a minimum the following will be incorporated to reduce the impact further: – The use of mufflers on pneumatic tools. – Effective exhaust silencers. – Sound reducing enclosures. – Pumps and static mechanical plant will be enclosed by acoustic sheds or screens. – Machines in intermittent use will be shut down during periods where they are not required.
8.19	Construction Phase Winter Raptor Roosts	• The potential for disturbance to hen harriers has been identified for works at Claycastle, within Ballyvergan Marsh, and at the road alongside the marsh where works proceed at early morning or late afternoon between November and March inclusive. • Restrictions of high-noise level operations, (e.g. rock breaking and piling) to outside of arrival and departure times as outlined by O'Donoghue 2021 i.e. commencing work no earlier than 50 minutes before sunrise and concluding 90 minutes before sunset. • During the works monitoring for hen harrier will take place by the EnCow.. Should hen harrier be observed returning to a roost, works will cease until the bird has left. Details pertaining to hen harrier activities and subsequent requirements for work stoppage will be recorded daily and provided to the Developer's Ecologist and Local Authority on a weekly basis. • The potential for disturbance to winter raptor (hen harrier) roosts has been identified for works at Claycastle, within Ballyvergan Marsh, and at the road alongside the marsh where works proceed at late afternoon between November and March inclusive.

Reference	Aspect	Mitigation and / or Monitoring Measure
8.20	Construction Phase Mitigation for the Protection of Breeding Birds	• As outlined in the description of the development the clearance of trees, and scrub will take place outside of the breeding season for birds where possible or as determined by risk of disturbance to a nest site. A suitably qualified ecologist / EcOW will conduct pre-construction surveys to assess risk of disturbance to nesting birds to inform tree clearance activity. • The reinstatement of habitat for breeding birds will take place as outlined in section 8.9.1 in relation to the reed swamp at Ballyvergan Marsh, and in section 8.9.3 in relation to hedgerows, treelines and woodland reinstatement. Habitat reinstatement will be monitored by the site EnCoW. • Specialist surveys will be carried out for kingfisher in line with NRA guidance.These will incorporate a survey area of 500m upstream and downstream of the works where suitable habitat exists. Surveys will be carried out between March and July. Features likely to be of note to kingfisher will be recorded and watches of suitable nest areas undertaken. The loss of any potentially suitable nesting sites will be compensated through the addition of artificial nesting sites along nearby sections of watercourse and within the breeding territory. The provision of any new nesting sites for kingfisher will be undertaken in line with NPWS and IFI consultation.
8.21	Construction Phase Mitigation for the Protection of Amphibians	• A pre-construction survey for smooth newt and frogs species will be undertaken prior to works commencing at potential suitable breeding habitat (ditches ponds and drains impacted). • When surveying for the species biosecurity measures will be followed to ensure that there is no incidental spread of vector borne diseases between waterbodies. This includes the cleaning, disinfection and drying of all equipment and will have regard to guidelines from Inland Fisheries Ireland. • Should either species be recorded, translocation of the species to areas outside of the proposed development footprint will be undertaken, in consultation with the NPWS. Any translocation of these species will be under license by the NPWS. • Where common frog is recorded within the footprint of the works, any spawn or adult frogs recorded will be captured and removed from affected habitat by hand net and translocated to the nearest area of available suitable habitat. • Where smooth newt are recorded, juveniles or adults will be captured and translocated to the nearest suitable wetland feature outside of the works areas.
8.22	Construction Phase Mitigation for the Protection of Viviparous Lizard	• Prior to the commencement of works within suitable habitat a dedicated survey to ascertain the presence or absence of viviparous lizard within the works areas will be undertaken. Key areas include fixed sand dune habitat, Ballyadam and Ballyvergan marsh. Should their presence be confirmed viviparous lizard within the works area will be translocated under license by NPWS to prevent direct impact on the species. Any translocation will be suitable habitat. • Measures for the reduction of habitat loss are as outlined previously. •
8.23	Construction Phase Mitigation for the Prevention of Spread of Invasive Species	• Japanese knotweed, Himalayan balsam, three cornered leek, and sea buckthorn have all been recorded in proximity to the development. There is potential for additional stands of scheduled invasive species to be present within or adjacent to the works areas in accessible areas, or if populations establish between the completion of date of EIA surveys, and the commencement of construction. • Prior to works commencing a full invasive species survey will be carried out. The pre-construction invasive species survey will be carried out within the works areas, including compound locations and laydown areas, and along proposed access routes to identify the presence of all invasive species within and adjacent to works areas. • The findings of this invasive species survey will be incorporated into an Invasive Species Management Plan (ISMP) for the works.

Reference	Aspect	Mitigation and / or Monitoring Measure
		• The Invasive Species Management Plan will be in place prior to any works commencing. The Invasive Species Management Plan will be a live document, regularly reviewed and updated throughout the works to include for any additional invasive species encountered. • The Invasive Species Management Plan will set out site-specific and species-specific measures to manage invasive species. • Any stands of invasive species that are recorded within the site will be clearly marked out as restricted areas. This exclusion zone will incorporate a buffer such that below ground growth is accounted for, noting the reduced extents for Japanese knotweed based on recent research163 . No works will be carried out within the exclusion zones unless fully supervised by the EnCoW. • The appointed EnCoW will carry out a toolbox talk for all construction personnel which will provide information on how to identify and manage invasive species. • The EnCoW will also implement additional biosecurity measures on site such as the visual inspection of vehicles for evidence of attached plant or animal material prior to entering and leaving the works area. • A Check, Clean, Dry protocol will be undertaken with all equipment, machinery and vehicles entering and leaving the Proposed development site boundary. • Where works are carried out within watercourses, all machinery will be inspected and will be completely dry prior to works commencing to prevent the risk of pathogen translocation. All machinery will be cleaned following completion of the works. • Any fill that is required as part of the proposed development will be from a licensed facility
8.24	Operational Phase (Converter Station)	• The detailed design of outdoor lighting will incorporate in full design recommendations164 from Bat Conservation Ireland as follows: – Hours of illumination: provide some hours of darkness. – Light levels: install lighting that meets the lowest light levels permitted under health and safety. Specification and colour of light treatments: use low-pressure sodium lights instead of high-pressure sodium lights or mercury lamps. If mercury lamps are to be used, fit them with UV filters. – Column heights of lamp posts: reduce the amount of light spillage where it is not needed by restricting the height of lamp columns. – Type of lamps and luminaries to be installed: directional lighting means lighting is directed to where it is needed and thus prevents light spillage and light pollution. – Using modern light technology that restricts the horizontal plane of the luminaries thereby directing the lighting to where required ensuring light is not directed at an angle greater than 70 degrees from the vertical plane. • The final lighting plan will be reviewed by an experienced bat ecologist to ensure lighting levels are minimised for the site and excessive light spill is avoided at locations where lighting is not required and directed away from treelines and other retained habitat with some ecological value.
8.25	Construction Phase (Monitoring)	• During construction, monitoring will be carried out, and reported by the Contractrors Ecologist, in agreement with the Client' Representative Team, and having regard for relevant conditions and licenses where required. • Following completion of construction, the obligation for monitoring (e.g. of translocation and enhancement areas) will pass to the developer's Ecologist, with having regard for relevant conditions and licenses.

[163] Fennell, M., Wade, M., & Bacon, K. L. (2018). Japanese knotweed (Fallopia japonica): an analysis of capacity to cause structural damage (compared to other plants) and typical rhizome extension. PeerJ, 6, e5246.
[164] Bat Conservation Ireland (December 2010). Bats and Lighting Guidance for; Planners, engineers, architects and developers.

Reference	Aspect	Mitigation and / or Monitoring Measure
		• Monitoring will take place of areas of translocation within the converter station, any areas where turves were reinstated at the landfall site and at Ballyvergan Marsh. The monitoring of these sites will be carried out by a suitably qualified ecologist. This will enable the identification of potential barriers to successful establishment and determine the overall success of the process. • Where establishment has been found to fail, steps can be taken to boost the chances of establishment. This can include measures such as re-seeding of areas where there is die-back, and removal of negative indicator species such as bramble where the establishment of same will put the habitat at risk of degradation. • The intervals at which the monitoring will take place will be determined by the relevant ecologist, having regard for licenses, and planning conditions. However, at a minimum it is expected that annual monitoring take place for the initial five years following reinstatement/translocation. Following the five-year monitoring it may be reviewed to determine whether the monitoring period requires extension. There may be no requirement for extension should the habitats fully establish by that time. Monitoring reports will be provided to the Ecologist within the Employer's Representative Team. • As outlined in section 8.1.1.8 monitoring will also be conducted at river crossings where instream works, and river bankside disturbance works took place.
8.26	Mitigation for the Protection Hedgerows, Treelines, and Grassland Verges at Passing Bays	• This measure applies to verges along public roadways. – All passing bays will be removed on completion of the project. The passing bay will be in place for a period of up to 18 months. However, they will be removed sooner if possible. The contractor will be obliged both by the Client's Representative and by the local authority to reinstate all hedges and roadside verges, where practicable. – Unless otherwise agreed with the Client's Representative and the local authority, the Contractor will re-instate hedgerows, and treelines, to a species-rich condition (i.e. five woody species per 30 m), comprising only native species. – Unless otherwise agreed with the Client's Representative and the local authority, the Contractor will seed all grassland verges with a native wildflower mix (to specification of EC12 Wild Flora for Earth Banks, Bunds and Ditches; http://www.wildflowers.ie/mixes/ec/ec12.htm or similar. • All other sites will be returned as close as possible to their pre-existing condition, using the same woody species removed, or similar verge seed mixes, under the supervision and direction of the ECoW.
8.27	Cumulative Effects	• Prior to commencement of construction and during the construction phase engagement with Cork County Council and the Office of Public works (OPW) and ESB and Irish Water will continue and where there is potential for works to be carried out in parallel, appropriate mitigation measures will be implemented including the scheduling of works and regular liaison meetings between project teams to ensure that plans are co-ordinated and impacts are minimised.
Chapter 9 The Landscape		
9.1	Operational Phase	• The main focus of mitigation for landscape and visual impacts is in respect of the main buildings of the converter station, which are large in scale and prominently visible from some receptors within the surrounding landscape, particularly from the north. Two methods of mitigation will be utilised, which will work in combination. • The first mitigation measure is a dispersed colour pattern for the facades of the buildings that graduates from darker earthy / vegetation tones at the base of the buildings to lighter sky coloured tones towards the upper sections. The purpose of the colour scheme is to; – Break down the perceived scale and massing of the proposed converter station buildings – Provide a dark plinth to the base of the buildings to reduce the perceived vertical height

Reference	Aspect	Mitigation and / or Monitoring Measure
		– To provide earthy / vegetation tones through the base and mid sections of buildings to tie into surrounding existing and proposed vegetation patterns. This has been done in a blocky geometric manner that balances the obvious industrial nature of the development without appearing as an overt attempt to camouflage it. – To provide a light-tone recessive colour scheme for upper sections of buildings likely to be viewed against a backdrop of sky: • The second mitigation measure is the provision of a band of screen planting along the northern and western sides of the main converter station building and a more formal treeline along the southern boundary of the site. It is intended that this reach a height of around 8-10m over the course of approximately 5-7 growing seasons and will consist of some advanced nursery stock (semi-mature trees) at planting stage in combination with a majority of whip transplants. Optimisation of the ecological function of this planting will also be a consideration though the use of pollinator species insofar as possible. • The mitigation measures outlined above have been incorporated into a post-mitigation establishment set of photomontages to aid the assessment of residual visual impacts. • Landscape and visual mitigation measures are not considered necessary in relation to the landfall area and HVDC/HVAC UGC routes as there will be no material effects from the operational stage above ground elements. Likewise, for temporary / short term elements of the project, including the construction compounds laydown Areas and passing bays, specific landscape and visual mitigation measures are not considered necessary.
9.2	Cumulative Effects	• Internal landscaping similar to that set up as a precedent by measures proposed on the converter station site (southern boundary) will aid visual integration and consolidation of development within the wider IDA site (if implemented).
Chapter 10 Archaeology and Cultural Heritage		
10.1	Construction Phase	• An underwater archaeological survey and evaluation will be undertaken for all watercourses along the scheme route with particular regard to the Disour River (CH120), Kiltha River and associated demesne landscape (CH122), Dungourney River (CH123) and Owenacurra River (CH137) and its tributary (CH124). This survey and evaluation should – Be carried out by a suitably qualified and suitably experienced underwater archaeologist under licence – Incorporate appropriate dive and wade survey as well as metal detection survey – 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). • Note, where a HDD methodology is proposed to facilitate a crossing, this should avoid any direct impact on the subject river or water course at that location. • A combination of advance geophysical survey and advance archaeological test trenching should be carried out for all off-road sections of the cable routes as well as the proposed Laydown Areas. This advance prospection should: – Be carried out by a suitably qualified archaeologist under licence – 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). • Where a section of an upstanding townland boundary must be removed then: – A representative cross-section of the townland boundary should be investigated and recorded by a suitably qualified archaeologist prior to removal. • 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*.

Reference	Aspect	Mitigation and / or Monitoring Measure
		• 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. • The site of the metal object (CA3001) 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 establish its relationship to the peat deposits further to the SW. • The exact location of milestone CH053 should be identified on the ground by an archaeologist and demarcated precisely on all drawings for this section of the scheme. An exclusion zone a minimum of 15m in diameter should be established around the location of the site. It should be fenced off for the duration of construction works on that section of the scheme and while Laydown Area LDA-DC05 is in use/operation. • All sub-surface groundworks associated with the proposed development works will be subject to a programme of archaeological monitoring. – This should be carried out by a suitably qualified archaeologist under license and in accordance with the provisions of the National Monuments Acts 1930-2004. – If significant archaeological material is encountered during the course of archaeological monitoring, then resolution of any such significant material will be determined in consultation with the National Monuments Service (DHLGH). – Where possible, every reasonable effort should be made to preserve in situ or reduce the impact on any identified archaeological material. Where preservation in situ cannot be achieved, either in whole or in part, then a programme of full archaeological excavation should be implemented to ensure the preservation by record of the portion of the site that will be directly impacted upon. This work should be carried out by a suitably qualified archaeologist under license and in accordance with the provisions of the National Monuments Acts 1930-2004. – A written report will be prepared detailing the results of all archaeological work undertaken.
Chapter 11 Roads and Traffic		
11.1	Construction Traffic management Plan	• The temporary effects of construction (none of which have been assessed as ‘significant’) or otherwise) will be mitigated through adoption of a regulated and approved CTMP. A summary of key CTMP mitigation elements follow, however the framework CTMP is provided in full as Appendix 11.2. • The assessment of post mitigation effects has been undertaken on the assumption that key measures set out in the CTMP will be developed as appropriate by the appointed contractor and be implemented during the project construction phase. • The appointed contractor will agree temporary traffic management measures then adopt and monitor an appropriate way of working in consultation with Cork County Council, the appointed contractor, TII and/or their Agents and An Garda Síochána as appropriate. Construction activity generated vehicles (with the exception of site personnel in cars and vans) will travel on pre-defined routes to and from the relevant sites to reduce effects on existing local traffic. • The framework CTMP has been developed for the purposes of this assessment and will be further developed as necessary in consultation with Cork County Council and the Gardai prior to construction commencing. The CTMP will document outline measures to promote the efficient transportation of components and materials to site, whilst reducing congestion and disruption which might impact negatively on local communities or general traffic and in particular the emergency services. The CTMP will be considered a ‘live’ document and will be developed accordingly to include current information per the following: – a programme of delivery types/numbers by month; – a statement of which public roads are to be used by construction traffic; – a statement of which public roads are not to be used by construction traffic;

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Reference	Aspect	Mitigation and / or Monitoring Measure
		– a statement of which local towns and villages are to be avoided (completely or on stated days and times); – details of all proposed mitigation measures, list of contacts, and details of measures that will be implemented to limit the potential of vehicle stacking on any part of the public road network; – if appropriate, details of speed restrictions through sensitive areas and procedures to ensure pedestrian safety adjacent to worksites; and – details of temporary signage to be installed at defined locations. • To minimise inconvenience to the local community in terms of obstructive parking, adequate car parking for permanent site personnel, visitors and deliveries would be provided within the Ballyadam worksite compound. Adequate vehicle parking space would be provided on-site and car parking will not be permitted on any public road network adjacent to the site, so that sight lines would be maintained and to minimise potential for obstruction and delay for other road users. • Furthermore, only vehicles essentially required to facilitate construction will be allowed to attend cable route worksites. Car sharing would be promoted to construction personnel by the contractor during the induction process. • The appointed contractor could employ a number of sub-contractors and all would fall under the umbrella of the CTMP and would have an obligation to adhere to the Plan, this obligation would form part of the procurement process and would be written into any contract of employment. • Compliance would be monitored by the Project Manager, on behalf of the appointed contractor, via spot checks to ensure that vehicles follow the measures set out in the CTMP and recording of any complaints. The appointed contractor would stipulate that all contractors disseminate these rules to their sub-contractors. • In advance of undertaking abnormal load deliveries necessary permitting, approvals and infrastructure accommodation works will be agreed with relevant authority and implemented accordingly. Delivery vehicles will only follow agreed routes and will be delivered overnight to minimise potential for delay and obstruction to general traffic. • In liaison with EirGrid, the appointed contractors will be required to maintain close liaison with local community representatives, landowners and statutory consultees throughout the construction period. This is likely to include circulation of information about ongoing activities; particularly those that could potentially cause disturbance, including due to traffic. • The appointed contractor would nominate a person to be responsible for the co-ordination of all elements of traffic and transport during the construction process (Liaison Officer). This person would liaise with the local community so that the community has a direct point of contact within the developer organisation who they could contact for information purposes or to discuss matters pertaining to traffic management or site operation. • If the construction phase of any notably sized development(s) appears likely to overlap with the Project, the appointed contractor would seek to liaise with the appropriate developer organisation regarding the scheduling of deliveries to identify potential means of reducing the effects of combined construction.
11.2	Construction Access Arrangements	• Transportation, including deliveries to and from the construction areas will be taken from the existing public road network. The local area road network is shown on Figure 11.1. Given the nature of construction of the cable route, there will be multiple work sites along the route throughout the construction programme. • The construction methodology, including construction access arrangements are provided within Chapters 2 and 3. The proposed programme of worksite locations will be confirmed by the appointed contractor as an integral part of their adopted CTMP, the framework of which is provided as Appendix 11.2. All construction vehicle drivers will be instructed to access their destination worksite via an approved route

Reference	Aspect	Mitigation and / or Monitoring Measure
11.3	Cumulative Effects	• Prior to commencement of construction and during the construction phase engagement with these sites where there is potential for works to be carried out in parallel, appropriate mitigation measures will be implemented including the scheduling of works and regular liaison meetings between project teams to ensure that plans are co-ordinated and impacts are minimised.
Chapter 12 Material Assets		
12.1	Construction Phase: Utilities	• All reasonable measures will be taken to avoid unplanned disruptions to any services during the proposed works. This will include thorough investigations to identify and reconfirm the location of all utility infrastructure within the works areas, and the implementation of robust procedures when undertaking works around known infrastructure services. • Service disruptions impacting the surrounding residential, social and commercial properties will be kept to a minimum, only occurring where unavoidable. Prior notification of disruptions will be given to all impacted properties. This will include information on when disruptions are scheduled to occur and the duration of the disruption. Consultation with relevant neighbouring parties will be undertaken prior to any proposed disruptions.
12.2	Construction Phase: Waste Management	• A Construction Waste Management Plan (as part of the CEMP) will be prepared by the appointed contractor and agreed with the Planning Authority prior to commencement of development. The plan will provide for the segregation of all construction wastes to facilitate optimum levels of re-use, recovery, and recycling operations. • The plan will be prepared in accordance with waste management guidance and the principles as outlined in Design Out Waste: A design team guide to waste reduction in construction and demolition projects (EPA, 2015) and Best Practice Guidelines on the Preparation of Waste Management Plans for Construction and Demolition Projects, Department of the Environment, Heritage and Local Government (DoEHLG), June 2006. • All operations at the site will be managed and programmed in such a manner as to prevent / minimise waste production and maximise upper tier waste management (i.e. re-use, recycle, and recovery) in line with the Waste Hierarchy where technically and economically feasible. • Waste arisings will be handled, stored, managed and re-used or recycled as close as practicable to the point of origin. • Wastes sent off site for recovery or disposal will only be conveyed by an authorised waste contractor and transported from the proposed development site to an authorised site of recovery / disposal in accordance with the Waste Management Act 1996 and associated amendments and regulations and in a manner which will not adversely affect the environment. All employees will be made aware of their obligations under the Plan. • The Plan will be available for inspection at the site of the proposed substation at all reasonable times for examination by the Local Authority.
12.3	Construction Phase: Waste Management	• All waste generated during the operational phase will be managed in accordance with the relevant provisions of the Waste Management Act 1996 and associated amendments and regulations, particularly with regard to the use of appropriately permitted waste contractors and destinations for waste materials.
12.4	Cumulative Effects	• There will be a need to ensure that where works are occurring in parallel that appropriate mitigation measures are considered, including the scheduling of works, regular liaison meetings between project teams to ensure plans are co-ordinated and impacts are minimised.
Chapter 13 Noise and Vibration		
13.1	Construction Phase	• The Contractor will prepare and implement a Construction Noise and Vibration Management Plan (CNVMP) as part of the CEMP.

Reference	Aspect	Mitigation and / or Monitoring Measure
		• Set out within the CNVMP, the Contractor will be obliged to comply with Local Authority controls on noise and vibration during construction. The guidance given in BS 5228:2009+A1:2014 Part 1 and Part 2 describes appropriate measures and limits for the control of noise and vibration from construction activities. These have been used for this assessment however the appointed contractor will consult the Local Authority to agree limits and measures of control to be applied. Where feasible, the transition pits for horizontal directional drilling will be screened to ensure that there is a barrier between the source and sensitive receptors. The location of the noise barrier will be set out and agreed in advance of the works. A comprehensive noise and vibration monitoring protocol will also be set out within the CNVMP. • For the CEMP, the Contractor will also develop and implement a stakeholder communications plan which will facilitate community engagement prior to the commencement of construction.
13.2	Construction Phase Mitigation applicable to the Connection Point	Further to the mitigation measures set out within the CNVMP, the Contractor: • Limit all noise-emitting works to the daytime and evening periods only; and • Where night works are required, provide prior notification to the occupiers of nearby dwellings. Separate measures on the western boundary to limit the spread of operational noise are expected to offer benefits in reducing the impact of construction works on site.
13.4	Construction Phase Mitigation applicable to HVAC / HVDC Onshore Cabling Route	Further to the general mitigation measures set out within the CNVMP, the Contractor: • Provide prior notification to the occupiers of dwellings within 16m of the works and limit vibratory compaction works in the proximity of these dwellings to the daytime period only; • Where vibratory compaction work is required within 3m of any light-framed structure (e.g. residential building), and subject to the consent of relevant landowners: – Conduct a structural condition survey before and after works – Undertake measurements of vibration close to the foundation of closest part of the building to the works – Consider the use of a dead-weight roller where feasible to avoid vibratory methods
13.5	Construction Phase Mitigation applicable to the Convertor Station Site	Further to the general mitigation measures set out within the CNVMP: • Limit all noise-emitting works to the daytime and evening periods only • Where night works are required, provide prior notification to the occupiers of nearby dwellings.
13.6	Construction Phase Mitigation applicable to the proposed Landfall Area at Claycastle	Further to the general mitigation measures set out within the CNVMP (but with an exception for certain works restrictions proposed in Chapter 8 Biodiversity for wintering birds in Ballyvergan Marsh), the Contractor will: • Limit all noise-emitting works to the daytime and evening periods only (but note restriction on winter-time morning work at Ballyvergan Marsh in Chapter 8 Biodiversity); • Where night works are required, provide prior notification to the occupiers of nearby dwellings; and • Provide prior notification to the occupiers of dwellings within 55m of the temporary cofferdams works and limit vibratory compaction works to the daytime period only.

Reference	Aspect	Mitigation and / or Monitoring Measure
13.7	Construction Phase Mitigation applicable to the Converter Station Site	The assessment is based on the proposed layout of equipment, including the stated mitigation measures to give the unit sound power levels given in Table 13.15. The sound power levels of the selected equipment should not be exceeded. The measures include: • Acoustic enclosure of the power transformer; • Silencers applied to the power transformer cooling fans • Acoustic enclosure of the compensation reactors and top hat attenuators; • Sound shield fitted to the harmonic filter capacitors; • Sound shield and top hat attenuator fitted to the harmonic filter reactors; • Sound shield and top hat attenuator fitted to the DC smoothing reactors; and • Silencers applied to the power valve cooling fans and surrounding 4m acoustic barrier. Given the low-frequency tonal noise characteristics of electrical equipment, the selection and procurement process should prioritise low noise specification.
13.8	Cumulative Effects	• In line with the recommendations of BS 5228:2009+A1:2014, regular liaison meetings are held with construction sites which could expose the NSLs described above to levels of construction noise that are less than 10 dB below the applicable noise category. Where the levels of construction noise from other sites are less than 10 dB below the applicable noise category, it is possible that combined impacts with the proposed development could exceed the threshold. In this case, it is important that plans are co-ordinated and any adverse noise and vibration impacts are minimised.
Chapter 14 Major Accidents and / or Disasters		
Not applicable	Not Applicable	This chapter does not include any additional mitigation measures

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Appendices

1. Alternatives Considered

1.1 Feasibility Study - Converter Station Site & Route Identification in Ireland (ESBI, 2016)

1.2 Network Analysis Celtic Interconnector Feasibility Study (EirGrid, November 2016)

1.3 Step 3 Onshore Constraints Report (Mott MacDonald, April 2019)

1.4 Step 3 - Performance Matrix Assessments (EirGrid, Spring 2019)

1.5 Offshore Constraints Report (Wood, April 2019)

1.6 Step 3 Preferred Options Report (Mott MacDonald, August 2019)

1.7 Step 4 Consultation Report (Traverse, April 2020)

1.8 Step 4A Consultant's Development Options Report (Mott MacDonald, November 2019)

1.9 Step 4 Project Update Document (EirGrid, Spring 2020)

1.10 Step 4B Consultant's Development Options Report (Mott MacDonald, November 2020)

4. Population and Human Health

4.1 The Electricity Grid and Your Health

5. Air Quality and Climate

5.1 Construction Dust Assessment

Table 5.1: Determination of Dust Raising Magnitude

Source	Large	Medium	Small
Demolition	Total building volume > 50,000m3, potentially dusty construction material (e.g. concrete), on site crushing and screening, demolition activities > 20m above ground	Total building volume 20,000m3 - 50,000m3, potentially dusty construction material, demolition activities 10-20m above ground level	Total building volume <20,000m3, construction material with low potential for dust release (e.g. metal cladding or timber), demolition activities <10m above ground, demolition during wetter months
Earthworks	Total site area >10,000m2, potentially dusty soil type (e.g. clay, which will be prone to suspension when dry to due small particle size), >10 heavy earth moving vehicles active at any one time, formation of bunds >8m in height, total material moved >100,000 tonnes	Total site area 2,500m2 – 10,000m2, moderately dusty soil type (e.g. silt), 5-10 heavy earth moving vehicles active at any one time, formation of bunds 4m – 8m in height, total material moved 20,000 tonne – 100,000 tonne	Total site area <2,500m2, soil type with large grain size (e.g. sand), <5 heavy earth moving vehicles active at any one time, formation of bunds <4m in height, total material moved <10,000tonne, earthworks during wetter months
Construction	Total building volume >100,000m3, piling, on site concrete batching; sandblasting	Total building volume 25,000m3 – 100,000m3, potentially dusty construction material (e.g. concrete), piling, on site concrete batching	Total building volume <25,000m3, construction material with low potential for dust release (e.g. metal cladding or timber)
Track out	>100 HDV (>3.5t) trips in any one day, potentially dusty surface material (e.g. high clay content), unpaved road length >100m	25-100 HDV (>3.5t) trips in any one day, moderately dusty surface material (e.g. high clay content), unpaved road length 50m – 100m	<25 HDV (>3.5t) trips in any one day, surface material with low potential for dust release, unpaved road length <50m

Source: IAQM

Table 5.2: Receptor Sensitivity

Source	High	Medium	Low
Sensitivities of people to dust soiling effects	Users can reasonably expect an enjoyment of a high level of amenity; or The appearance, aesthetics or value of their property would be diminished by soiling; and the people or property would reasonably be expected to be present continuously, or at least regularly for extended periods, as part of the normal pattern of use of the land. Indicative examples include dwellings, museums and other culturally important collections, medium and long term car parks (See note B) and car showrooms.	Users would expect a to enjoy a reasonable level of amenity, but would not reasonably expect to enjoy the same level of amenity as in their home; or The appearance, aesthetics or value of their property could be diminished by soiling; or The people or property wouldn't reasonably be expected to be present here continuously or regularly for extended periods as part of the normal pattern of use of the land. Indicative examples include parks and places of work.	The enjoyment of amenity would not reasonably be expected (See note A); or Property would not reasonably be expected to be diminished in appearance, aesthetics or value by soiling; or There is transient exposure, where the people or Property would reasonably be expected to be present only for limited periods of time as part of the normal pattern of use of the land. Indicative examples include playing fields, farmland (unless commercially-sensitive horticultural), footpaths, short term car parks (See note B) and roads.
Sensitivities of people to the health effects of PM10	Locations where members of the public are exposed over a time period relevant to the air quality objective for PM10 (in the case of the 24-hour objectives, a relevant location	Locations where the people exposed are workers (See note D), and exposure is over a time period relevant to the air quality objective for PM10 (in the case of the 24-hour	Locations where human exposure is transient (See note E) Indicative examples include public footpaths, playing

Source	High	Medium	Low
	would be one where individuals may be exposed for eight hours or more in a day - See note C) Indicative examples include residential properties. Hospitals, schools and residential care homes should also be considered as having equal sensitivity to residential areas for the purposes of this assessment.	objectives, a relevant location would be one where individuals may be exposed for eight hours or more in a day). Indicative examples include office and shop workers, but will generally not include workers occupationally exposed to PM10, as protection is covered by Health and Safety at Work legislation.	fields, parks and shopping streets.
Sensitivities of receptors to ecological effects (See note F)	Locations with an international or national designation and the designated features may be affected by dust soiling; or Locations where there is a community of a particularly dust sensitive species such as vascular species included in the Red Data List For Great Britain (See note G). Indicative examples include a Special Area of Conservation (SAC) designated for acid heathlands or a local site designated for lichens adjacent to the demolition of a large site containing concrete (alkali) buildings.	Locations where there is a particularly important plant species, where its dust sensitivity is uncertain or unknown; or • Locations with a national designation where the features may be affected by dust deposition. • Indicative example is a Site of Special Scientific Interest (SSSI) with dust sensitive features.	Locations with a local designation where the features may be affected by dust deposition. Indicative example is a local Nature Reserve with dust sensitive features.

A The public's expectations will vary depending on the existing dust deposition in the area

B Car parks can have a range of sensitivities depending on the duration and frequency that people would be expected to park their cars there, and the level of amenity they could reasonably expect whilst doing so. Car parks associated with work place or residential parking might have a high level of sensitivity compared to car parks used less frequently and for shorter durations, such as those associated with shopping. Cases should be examined on their own merits.

C This follows Defra guidance as set out in LAQM.TG(16).

D Notwithstanding the fact that the air quality objectives and limit values do not apply to people in the workplace, such people can be affected to exposure of PM10. However, they are considered to be less sensitive than the general public as a whole because those most sensitive to the effects of air pollution, such as young children are not normally workers. For this reason workers have been included in the medium sensitivity category.

E There are no standards that apply to short-term exposure, e.g. one or two hours, but there is still a risk of health effects, albeit less certain.

F A Habitat Regulation Assessment of the site may be required as part of the planning process, if the site lies close to an internationally designated site i.e. Special Conservation Areas (SACs), Special Protection Areas (SPAs) designated under the Habitats Directive (92/43/EEC) and RAMSAR sites.

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Table 5.3: Sensitivity of the area to dust soiling effects on people and property

Receptor Sensitivity	Number of Receptors	Distance from the source (m)			
		<20	<50	<100	<350
High	>100	High	High	Medium	Low
	10-100	High	Medium	Low	Low
	1-10	Medium	Low	Low	Low
Medium	>1	Medium	Low	Low	Low
Low	>1	Low	Low	Low	Low

Table 5.4: Sensitivity of the area to human health effects

Receptor Sensitivity	Annual Mean PM10 Concentration	Number of Receptors	Distance from the source (m)				
			<20	<50	<100	<200	<350
High	>32 µg/m3	>100	High	High	High	Medium	Low
		10-100	High	High	Medium	Low	Low
		1-10	High	Medium	Low	Low	Low
	28-32 µg/m3	>100	High	High	Medium	Low	Low
		10-100	High	Medium	Low	Low	Low
		1-10	High	Medium	Low	Low	Low
	24-28 µg/m3	>100	High	Medium	Low	Low	Low
		10-100	High	Medium	Low	Low	Low
		1-10	Medium	Low	Low	Low	Low
	<24µg/m3	>100	Medium	Low	Low	Low	Low
		10-100	Low	Low	Low	Low	Low
		1-10	Low	Low	Low	Low	Low
Medium	>32 µg/m3	>10	High	Medium	Low	Low	Low
		1-10	Medium	Low	Low	Low	Low
	28-32 µg/m3	>10	Medium	Low	Low	Low	Low
		1-10	Low	Low	Low	Low	Low
	24-28 µg/m3	>10	Low	Low	Low	Low	Low
		1-10	Low	Low	Low	Low	Low
	<24µg/m3	>10	Low	Low	Low	Low	Low
		1-10	Low	Low	Low	Low	Low
Low	-	>1	Low	Low	Low	Low	Low

Table 5.5: Sensitivity of the area to ecological effects

Receptor Sensitivity	Distance from the source (m)	
	<20	<50
High	High	Medium
Medium	Medium	Low
Low	Low	Low

Table 5.6: Risk of Dust Effects – Demolition

Sensitivity of Area	Dust Emissions Magnitude		
	Large	Medium	Small
High	High Risk	Medium Risk	Medium Risk
Medium	High Risk	Medium Risk	Low Risk
Low	Medium Risk	Low Risk	Low Risk

Table 5.7: Risk of Dust Effects - Earthworks

Sensitivity of Area	Dust Emissions Magnitude		
	Large	Medium	Small
High	High Risk	Medium Risk	Medium Risk
Medium	High Risk	Medium Risk	Low Risk
Low	Medium Risk	Low Risk	Low Risk

Table 5.8: Risk of Dust Effects - Construction

Sensitivity of Area	Dust Emissions Magnitude		
	Large	Medium	Small
High	High Risk	Medium Risk	Medium Risk
Medium	High Risk	Medium Risk	Low Risk
Low	Medium Risk	Low Risk	Low Risk

Table 5.9: Risk of Dust Effects – Trackout

Sensitivity of Area	Dust Emissions Magnitude		
	Large	Medium	Small
High	High Risk	Medium Risk	Medium Risk
Medium	High Risk	Medium Risk	Low Risk
Low	Medium Risk	Low Risk	Low Risk

6. Land Soils and Hydrogeology

6.1 Summary of the Receiving Environment

Proposed Development Location	Location Descriptor (and Townland)	Land Use	Surrounding land Use	Topography and Geohazards	Soils (Teagasc soils)	Subsoils (Quaternary sediments)	Bedrock Geology (bedrock geology 1:100,000)	Geological heritage sites within 1000m	Aquifer designation (superficial deposits)	Aquifer designation (bedrock) (GSI, IE)
Connection Point	Knockraha Substation (Ballynanelagh)	Electricity transmission infrastructure	Electricity transmission infrastructure, agriculture and rural settlements	Flat	Man Made – 100%	Man Made – 100%	Ballytrasna Formation (mudstones/siltstones) –100% Groundwater Rock Unit - Devonian Old Red Sandstones) Extreme groundwater vulnerability (200mm/year recharge)	None	N/A	Locally Important Aquifer - Bedrock which is Moderately Productive only in Local Zones GW WFD Status – Good
AC01-AC02	Knockraha Ballytrasna Formation (B Station (Ballynanelagh) to east of Ballynanleagh (Killeena)	Electricity transmission infrastructure	Electricity transmission infrastructure, agriculture and rural settlements	Mostly Flat Pastures/ slightly sloping N-S	Man Made (5%) Deep well drained mineral (acidic)-95%	Man Made (5%) Sandstone Till (95%) Medium subsoil permeability	Ballytrasna Formation (mudstones/siltstones) –100% Groundwater Rock Unit - Devonian Old Red Sandstones) Extreme groundwater vulnerability (200mm/year recharge)	None	N/A	Locally Important Aquifer - Bedrock which is Moderately Productive only in Local Zones GW WFD Status – Good
AC02-AC03B	East of Ballynanleagh, west of T-Junction (Killeena) to East of Ballynanleagh, east of T-Junction (Killeena) – off road	Corine 231 - Pastures 100% Small (>20m) treeline	Small Rural Settlements/Roads	Mostly Flat Pastures/ slightly sloping N-S	Deep well drained mineral (acidic) - 100%	Sandstone Till – Devonian (100%) Medium Subsoil Permeability	Ballytrasna Formation (mudstones/siltstones) –100% Groundwater Rock Unit - Devonian Old Red Sandstones) Extreme groundwater vulnerability (200mm/year recharge)	None	N/A	Locally Important Aquifer - Bedrock which is Moderately Productive only in Local Zones GW WFD Status – Good
AC03-AC04	East of Ballynanleagh, east of T-Junction (Killeena) to Garranes crossroads (Garranes)	Corine 231- Pastures 95% 211 - Non-irrigated arable land - 5%	Small Rural Settlements Areas of woodland within 1km of Route Lackenbehy Quarry within 1km of the Garranes Crossroads	Reduction in height above sea level (asl) from Ballynanleagh to Garranes of 30m. Appears to be two small local scale valleys either side of Garranes (Ballynakilla and Lackenbehy). Moderate-High landslide susceptibility.	Shallow well drained mineral mainly acidic (10%) Deep well drained mineral (acidic) - 90%	Bedrock close to surface - 10% Sandstone Till – Devonian (90%) Medium subsoil Permeability	Ballytrasna Formation (mudstones/siltstones) – 100% Groundwater Rock Unit - Devonian Old Red Sandstones) High-Extreme groundwater vulnerability (200mm recharge/year)	None	N/A	Locally Important Aquifer - Bedrock which is Moderately Productive only in Local Zones GSI wells1km – Ballynakilla GW WFD Status – Good
AC04-AC05	Garranes crossroads (Garranes) to south of Woodstock (Woodstock)	Corine – 211 - Non-irrigated arable land – 20% 231 - Pastures - 65% 242 - Complex cultivation patterns - 15%	Route runs through narrow tree line (100m width approx.)	Route contained within a gentle valley Moderate-High landslide susceptibility	Shallow well drained mineral mainly acidic- 10% Deep well drained mineral (acidic) - 90%	Bedrock close to surface - 10% Sandstone Till – Devonian (90%) Medium Subsoil Permeability	Ballytrasna Formation (mudstones/siltstones) – 100% Groundwater Rock Unit - Devonian Old Red Sandstones) High-Extreme groundwater vulnerability (200mm recharge/year)	None		Locally Important Aquifer - Bedrock which is Moderately Productive only in Local Zones GW WFD Status – Good

Proposed Development Location	Location Descriptor (and Townland)	Land Use	Surrounding land Use	Topography and Geohazards	Soils (Teagasc soils)	Subsoils (Quaternary sediments)	Bedrock Geology (bedrock geology 1:100,000)	Geological heritage sites within 1000m	Aquifer designation (superficial deposits)	Aquifer designation (bedrock) (GSI, IE)
AC05-AC06A 400kV Poulaniska	Woodstock (Woodstock)/Gortnamucky to north of Ballyadam (Ballyadam)	Corine – 112 - Discontinuous urban fabric - 10% 211 - Non-irrigated arable land - 15% 31 - Pastures - 75%	Farmland interspersed with small rural settlements. Rail line to the South (North of Ballyadam)	South of Woodstock -Flat low-lying topography. Karst Landforms – including a Swallow Hole and 2 Enclosed depressions south of the Rail Line (Ballyadam)	Shallow well drained mineral acidic – 5% Deep well drained mineral (mainly acidic) - 90% Shallow rocky peaty - 3% Shallow well drained mineral (basic) – 2%	Bedrock close to surface - 10% Occasional outcrop Karstified bedrock Sandstone Till - 90% Medium Subsoil Permeability	Ballysteen Formation (bioclastic limestone) -20% Old Head Sandstone Formation (flaser-bedded sandstones) -5% Kinsale Formation (sandstones with conglomeratic beds) - 25% Gyleen Formation (sandstones/siltstones/mudstones)- 20% Waulsortian limestone (unbedded calcilutite facies) - 25% High to extreme groundwater vulnerability with areas of Karst (400-600mm recharge/year)	None	N/A	Locally Important Aquifer - Bedrock which is Moderately Productive only in Local Zones GW WFD Status – Good
AC05-AC06B – 220kV	Woodstock (Woodstock)/Woodstock to north of Ballyadam (Ballyadam)	Corine – 112 - Discontinuous urban fabric - 10% 211 - Non-irrigated arable land - 15% 231 - Pastures - 75%	Farmland interspersed with small rural settlements. Rail line to the South (North of Ballyadam)	South of Woodstock -Flat low-lying topography. Karst Landforms – Swallow Hole and 2 Enclosed depressions south of the Rail Line (Ballyadam)	Shallow well drained mineral acidic – 5% Deep well drained mineral (mainly acidic) - 90% Shallow rocky peaty - 3% Shallow well drained mineral (basic) – 2%	Bedrock close to surface - 10% Occasional outcrop Karstified bedrock Sandstone Till (Devonian) - 90% Medium Subsoil Permeability	Waulsortian limestone (unbedded calcilutite facies) - 25% Ballysteen Formation (bioclastic limestone)- 20% Old Head Sandstone Formation (flaser-bedded sandstones) - 5% Kinsale Formation (sandstones with conglomeratic beds)- 25% Gyleen Formation (sandstones/siltstones/mudstones) - 25% High to extreme groundwater vulnerability with areas of Karst (400-600mm recharge/year)	None	N/A	Locally Important Aquifer - Bedrock which is Moderately Productive only in Local Zones - Regionally Important Aquifer - Karstified (diffuse) GW WFD Status – Good GSI Wells1km - Woodstock
AC05-AC06C – 400kV	Woodstock (Woodstock)/ to north of Ballyadam (Ballyadam) parallel to railway line	Corine – 112 - Discontinuous urban fabric - 10% 211 - Non-irrigated arable land - 15% 231 - Pastures - 75%	Farmland interspersed with small rural settlements. Rail line to the South (North of Ballyadam)	South of Woodstock -Flat low-lying topography. Karst Landforms – Swallow Hole and 2 Enclosed depressions south of the Rail Line (Ballyadam) Moderate -high areas of landslide susceptibility	Shallow well drained mineral acidic – 5% Deep well drained mineral (mainly acidic) - 90% Shallow rocky peaty - 3% Shallow well drained mineral (basic) – 2%	Bedrock close to surface - 10% Occasional outcrop Karstified bedrock Sandstone Till - 90% Medium Subsoil Permeability	Waulsortian limestone (unbedded calcilutite facies) - 25% Ballysteen Formation (bioclastic limestone) - 20% Old Head Sandstone Formation (flaser-bedded sandstones) - 5% Kinsale Formation (sandstones with conglomeratic beds) - 25% Gyleen Formation (sandstones/siltstones/mudstones)- 20% High to extreme groundwater vulnerability with areas of Karst (400-600mm recharge/year)	None	N/A	Locally Important Aquifer - Bedrock which is Moderately Productive only in Local Zones - Regionally Important Aquifer - Karstified (diffuse) GW WFD Status – Good

Proposed Development Location	Location Descriptor (and Townland)	Land Use	Surrounding land Use	Topography and Geohazards	Soils (Teagasc soils)	Subsoils (Quaternary sediments)	Bedrock Geology (bedrock geology 1:100,000)	Geological heritage sites within 1000m	Aquifer designation (superficial deposits)	Aquifer designation (bedrock) (GSI, IE)
AC05-AC06D – 400kV	Woodstock (Woodstock)/ to north of Ballyadam (Ballyadam) partially parallel to railway line	Corine – 112 - Discontinuous urban fabric - 10% 211 - Non-irrigated arable land - 15% 231 - Pastures - 75%	Farmland interspersed with small rural settlements. Rail line to the South (North of Ballyadam)	South of Woodstock -Flat low-lying topography. Karst Landforms – Swallow Hole and 2 Enclosed depressions south of the Rail Line (Ballyadam) Moderate -high areas of landslide susceptibility	Shallow well drained mineral acidic – 5% Deep well drained mineral (mainly acidic) - 90% Shallow rocky peaty - 3% Shallow well drained mineral (basic) – 2%	Bedrock close to surface - 10% Occasional outcrop Karstified bedrock Sandstone Till - 90% Medium Subsoil Permeability	Waulsortian limestone (unbedded calcilutite facies) - 25% Ballysteen Formation (bioclastic limestone) - 20% Old Head Sandstone Formation (flaser-bedded sandstones) - 5% Kinsale Formation (sandstones with conglomeratic beds) - 25% Gyleen Formation (sandstones/siltstones/mudstones)- 20% High to extreme groundwater vulnerability with areas of Karst (400-600mm recharge/year)	None	N/A	Locally Important Aquifer - Bedrock which is Moderately Productive only in Local Zones - Regionally Important Aquifer - Karstified (diffuse) GW WFD Status – Good
AC06-AC07	North of Ballyadam (Ballyadam) to Ballyadam (Ballyadam)	Corine – 211 - Non-irrigated arable land - 40% 242 - Complex cultivation patterns - 30 231 - Pastures - 30%	Electricity transmission infrastructure, agriculture/ rural settlements and rail infrastructure. Flood Water compensation areas to the east of the Converter Station	Flat low-lying topography. Karst Landforms – Swallow Hole and 2 Enclosed depressions south of the Rail Line (Ballyadam)	Deep well drained mineral- 95% Shallow well drained mineral (basic) - 5%	Karstified limestone bedrock -5% Sandstone Till – Devonian - 95% Medium Subsoil Permeability	Waulsortian limestone (unbedded calcilutite facies) - 70% Ballysteen Formation (bioclastic limestone)- 20% Kinsale Formation (sandstones with conglomeratic beds)- 10% Groundwater Rock Unit - Dinantian Pure Unbedded Limestones Extreme groundwater vulnerability with areas of Karst (<600mm recharge/year)	None	N/A	Regionally Important Aquifer - Karstified (diffuse) GW WFD Status – Good
Converter Station Site	Ballyadam (Ballyadam)	Corine 211 - Non-irrigated arable land - 100%	Electricity transmission infrastructure, agriculture/ rural settlements and rail infrastructure. Flood Water compensation areas to the east of the Converter Station and 2 potential ponds on site. Concrete suppliers/industrial estate to the south of the rail line.	Flat low-lying topography. Karst Landforms – Swallow Hole and 2 Enclosed depressions south of the Rail Line (Ballyadam)	Deep well drained mineral (acidic)- 100%	Sandstone Till - 100% Medium subsoil permeability	Waulsortian limestone (unbedded calcilutite facies) - 100% Groundwater Rock Unit - Dinantian Pure Unbedded Limestones Extreme groundwater vulnerability with areas of Karst (<600mm recharge/year)	None	N/A	Regionally Important Aquifer - Karstified (diffuse) GW WFD Status – Good
DC01-DC02	Ballyadam (Ballyadam) to Carrigogna/R626 (Carrigogna)	Corine – 112 - Discontinuous urban fabric - 5% 142 - Sport and leisure facilities - 10% 211 - Non-irrigated arable land - 60% 231 - Pastures -	Farmland/interspersed with rural settlements. Route circles Water Rock Gold course Long Established woodland less than 1 km north of Water Rock golf course. Crosses the Owennacurra River	Low lying flat topography. Golf course – minor undulating topography and pond features. Area of high landslide susceptibility (359m)	Alluvial (mineral) - 10% Deep well drained mineral - 75% Shallow well drained mineral (acidic) - 5% Man Made - 10%	Alluvium - 10% Bedrock close to surface (karstified) – 5% Man Made - 10% Sandstone Till - 75% Medium – High Subsoil	Ballysteen Formation (bioclastic limestone)- 15% Waulsortian limestone (unbedded calcilutite facies) - 35% Old Head Sandstone Formation (flaser-bedded sandstones) - 5% Gyleen Formation (sandstones/siltstones/mudstones) - 20%	None	N/A	Regionally Important Aquifer - Karstified (diffuse) Locally Important Aquifer - Bedrock which is Moderately Productive only in Local Zones

Proposed Development Location	Location Descriptor (and Townland)	Land Use	Surrounding land Use	Topography and Geohazards	Soils (Teagasc soils)	Subsoils (Quaternary sediments)	Bedrock Geology (bedrock geology 1:100,000)	Geological heritage sites within 1000m	Aquifer designation (superficial deposits)	Aquifer designation (bedrock) (GSI, IE)
		25%				permeability (high towards Carrigogna near the Owennacurra River)	Kinsale Formation (sandstones with conglomeratic beds)- 20% High to Extreme groundwater vulnerability (>100, <400 mm recharge/year)			GW WFD Status – Good
DC02-DC03	Carrigogna (Carrigogna) to Ballyspillane East (Ballyspillane East)	Corine – 112 - Discontinuous urban fabric – 5% 142 - Sport and leisure facilities – 10% 211 - Non-irrigated arable land - 20% 231 - Pastures - 65%	Agricultural land interspersed with rural settlements and leisure facilities including East Cork Golf club and driving range.	Low lying flat topography. Two river crossings. Areas of high landslide susceptibility (425m)	Deep well drained mineral (acidic) - 80% Shallow well drained mineral (acidic) - 10% Man Made - 10%	Bedrock close to surface - 10% Man Made - 10% Sandstone Till - 80% High subsoil permeability	Ballysteen Formation (bioclastic limestone) - 5% Old Head Sandstone Formation (flaser-bedded sandstones) - 10% Gyleen Formation (sandstones/siltstones/mudstones)- 30% Ballytrasna Formation (mudstones/siltstones) - 10% Kinsale Formation (sandstones with conglomeratic beds)- 40% High groundwater vulnerability (<200mm recharge/year)	None	N/A	Locally Important Aquifer - Bedrock which is Moderately Productive only in Local Zones GW WFD Status – Good
DC03-DC04	Ballyspillane East (Ballyspillane East) to Roxborough (Roxborough)	Corine – 211 - Non-irrigated arable land - 55% 231 - Pastures - 45%	Agricultural land. 2 river crossings. OWENNACURRA_040 and DUNGOURNEY_020	Low lying flat topography. Two river crossings Two Karst Cave landforms to the east of Roxborough. Small area of high landslide susceptibility (40m)	Alluvial (mineral) - 10% Deep well drained mineral mainly acidic - 85% Shallow well drained mineral (acidic)- 5%	Alluvium - 10% Bedrock close to surface - 5% Sandstone Till - 85% Medium subsoil permeability	Waulsortian limestone (unbedded calcilutite facies) - 10% Ballysteen Formation (bioclastic limestone) -10% Gyleen Formation (sandstones/siltstones/mudstones)- 20% Kinsale Formation (sandstones with conglomeratic beds)- 50% Old Head Sandstone Formation (flaser-bedded sandstones) - 15% Groundwater Rcok Unit: Dinantian Mudstones and Sandstones (Cork Group) High – extreme groundwater vulnerability with areas of Karst (200mm recharge/year)	None	N/A	Locally Important Aquifer - Bedrock which is Moderately Productive only in Local Zones - Regionally Important Aquifer - Karstified (diffuse) GW WFD Status – Good
DC04-DC05	Roxborough (Roxborough) to Churchtown North/N25 (Ballyedekin)	Corine – 211 - Non-irrigated arable land - 25% 231 - Pastures - 75%	Agricultural land. Few small rural settlements/businesses	Minor - reduction in land surface height asl from N-S	Alluvial (mineral) - 30% Deep well drained mineral mainly acidic- 40% Acidic poorly drained mineral -	Alluvium - 30% Sandstone Till – 70% Medium – Low subsoil permeability	Ballysteen Formation (bioclastic limestone) - 20% Kinsale Formation (sandstones with conglomeratic beds)- 5% Waulsortian limestone (unbedded calcilutite facies) - 75% Groundwater Rock Unit: Dinantian Pure Unbedded Limestones	None	N/A	Regionally Important Aquifer - Karstified (diffuse) GW WFD Status – Good

Proposed Development Location	Location Descriptor (and Townland)	Land Use	Surrounding land Use	Topography and Geohazards	Soils (Teagasc soils)	Subsoils (Quaternary sediments)	Bedrock Geology (bedrock geology 1:100,000)	Geological heritage sites within 1000m	Aquifer designation (superficial deposits)	Aquifer designation (bedrock) (GSI, IE)
					30%		High Groundwater vulnerability (<500mm recharge/year)			
DC05-DC06	Churchtown North (Ballyedekin) to West of Castlemartyr (Killamucky)	Corine – 211 - Non-irrigated arable land - 30% 231 - Pastures - 60% 311 - Broad leaved forest - 10%	Agricultural land. Two Loughs less than 1km from proposed route and a couple of smaller pond features. Pigeon Wood Broad Leaved Forest Urban landscape (Castlemartyr) Proposed Natural heritage site - Loughs Aderry And Ballybutler	Low lying flat topography Two karst Cave Landforms up to 1km North of the proposed route.	Deep well drained mineral mainly acidic– 30% Acidic poorly drained mineral - 65% Water - 5%	Sandstone Till - 95% Water - 5% Low subsoil permeability	Little Island Formation (crinoidal calcilutite limestones) - 75% Waulsortian limestone (unbedded calcilutite facies) - 25% Groundwater Rock Unit: Dinantian Pure Unbedded Limestones Low-Moderate groundwater vulnerability (200mm recharge/year)	None	N/A	Regionally Important Aquifer - Karstified (diffuse) GW WFD Status – Good
DC06-DC07A	West of Castlemartyr (Killamucky) to East of Castlemartyr (Clasharinka) in road	Corine – 112 - Discontinuous urban fabric - 15% 142 - Sport and leisure facilities - 5% 211 - Non-irrigated arable land - 15% 231 - Pastures - 50% 311 - Broad leaved forest - 10%	Urban Landscape (Castlemartyr) Proposed Natural Heritage area - Clasharinka Pond	Relatively flat topography despite Several Karst Landforms including caves and enclosed depressions within 1km of DC07. Area at high risk of landslides (126m)	Alluvial (mineral) - 5% Deep well drained mineral (acidic)- 45% Acidic poorly drained mineral - 30% Deep well drained mineral (basic)- 5% Shallow well drained mineral – (basic) 5% Man Made - 10%	Alluvium - 5% Man Made – 10% Bedrock close to surface - 5% Sandstone Till - 70% Till derived from Limestone - 5% Medium subsoil permeability	Little Island Formation (crinoidal calcilutite limestones) - 30% Cork red marble Formation (mudstone matrix, limestone and pseudo breccias) -10% Waulsortian limestone (unbedded calcilutite facies) - 60% Groundwater Rock Unit: Dinantian Pure Unbedded Limestones Moderate – high groundwater vulnerability (greater recharge east of Castlematyr)	None	N/A	Regionally Important Aquifer - Karstified (diffuse) GW WFD Status – Good
DC06-DC07B	West of Castlemartyr (Killamucky) to East of Castlemartyr (Clasharinka) – off road	Corine – 112 - Discontinuous urban fabric - 15% 142 - Sport and leisure facilities - 5% 211 - Non-irrigated arable land - 15% 231 - Pastures - 50% 311 - Broad leaved forest - 10%	Agricultural land. Urban nearby. Proposed Natural Heritage area - Clasharinka Pond	Relatively flat topography despite Several Karst Landforms including caves and enclosed depressions within 1km of DC07.	Alluvial (mineral) - 5% Deep well drained mineral (acidic)- 45% Acidic poorly drained mineral - 30% Deep well drained mineral (basic)- 5% Shallow well drained mineral – (basic) 5% Man Made - 10%	Alluvium - 5% Man Made – 10% Bedrock close to surface - 5% Sandstone Till - 70% Till derived from Limestone - 5% Medium subsoil permeability	Little Island Formation (crinoidal calcilutite limestones) 30% Cork red marble Formation (mudstone matrix, limestone and pseudo breccias) - 5% Waulsortian limestone (unbedded calcilutite facies) - 60% Groundwater Rock Unit: Dinantian Pure Unbedded Limestones Moderate – high groundwater vulnerability (greater recharge east of Castlematyr)	None	N/A	Regionally Important Aquifer - Karstified (diffuse) GW WFD Status – Good

Proposed Development Location	Location Descriptor (and Townland)	Land Use	Surrounding land Use	Topography and Geohazards	Soils (Teagasc soils)	Subsoils (Quaternary sediments)	Bedrock Geology (bedrock geology 1:100,000)	Geological heritage sites within 1000m	Aquifer designation (superficial deposits)	Aquifer designation (bedrock) (GSI, IE)
DC07-DC08	East of Castlemartyr (Clasharinka) to West of Killeagh (Mountbell)	Corine – 211 - Non-irrigated arable land - 5% 231 - Pastures - 95%	Predominantly agricultural land until urban landscape at Killeagh. Two River crossings	Flat topography Several Karst Landforms including caves and enclosed depressions within 1km of DC07. Areas Moderately – High Landslide Susceptibility (215m)	Deep well drained mineral (acidic) - 50% Acidic poorly drained mineral - 40% Deep well drained mineral (basic) - 5% Shallow well drained mineral - 5%	Bedrock close to surface - 5% Sandstone Till – 90% Till derived from Limestone - 5% Low-Medium subsoil permeability	Little Island Formation (crinoidal calcilutite limestones) - 35% Waulsortian limestone (unbedded calcilutite facies) - 60% Cork red marble Formation (mudstone matrix, limestone and pseudo breccias) - 5% Groundwater Rock Unit: Dinantian Pure Unbedded Limestones Mixed groundwater vulnerability.	None	N/A	Regionally Important Aquifer - Karstified (diffuse) GW WFD Status – Good
DC08-DC09A	West of Killeagh (Mountbell) to east of Killeagh (Ballymakeagh More) – in road (N25)	Corine – 112 - Discontinuous urban fabric - 20% 211 - Non-irrigated arable land - 40. % 231 - Pastures - 40%	Urban Landscape (Killeagh) surrounded by agricultural pastures. Two River Crossings	Killeagh Lies at the base of area 100m Higher above sea level approx. Low-lying land indicative of coastal margins leading to Youghal Bay.	Deep well drained mineral(acidic) - 20% Acidic poorly drained mineral - 70% Man Made - 10%	Man Made - 10% Sandstone Till - 90% Low subsoil permeability	Little Island Formation (crinoidal calcilutite limestones) - 5% Waulsortian limestone (unbedded calcilutite facies) - 60% Ballysteen Formation (bioclastic limestone) - 5% Kinsale Formation (sandstones with conglomeratic beds) 10% Gyleen Formation (sandstones/siltstones/mudstones)- 15% Groundwater Rock Unit: Dinantian Mudstone and Sandstone/unbedded limestones Low groundwater Vulnerability.	None	N/A	Regionally Important Aquifer - Karstified (diffuse) GW WFD Status – Good
DC08-DC09B	west of Killeagh (Mountbell) to east of Killeagh (Ballymakeagh More) – off road	Corine – 112 - Discontinuous urban fabric - 20% 211 - Non-irrigated arable land - 40% 231 - Pastures - 40%	Agricultural land surrounded closely by an urban landscape (Killeagh) Two River Crossings	Killeagh Lies at the base of area 100m Higher above sea level approx. Low-lying land indicative of coastal margins leading to Youghal Bay.	Deep well drained mineral - 20% Acidic poorly drained mineral - 70% Man Made - 10%	Man Made - 10% Sandstone Till - 90% Low subsoil permeability	Little Island Formation (crinoidal calcilutite limestones) - 5% Waulsortian limestone (unbedded calcilutite facies) - 60% Ballysteen Formation (bioclastic limestone) - 5% Kinsale Formation (sandstones with conglomeratic beds) 10% Gyleen Formation (sandstones/siltstones/mudstones)- 15% Groundwater Rock Unit: Dinantian Mudstone and Sandstone/unbedded limestones	None	N/A	Regionally Important Aquifer - Karstified (diffuse) GW WFD Status – Good

Proposed Development Location	Location Descriptor (and Townland)	Land Use	Surrounding land Use	Topography and Geohazards	Soils (Teagasc soils)	Subsoils (Quaternary sediments)	Bedrock Geology (bedrock geology 1:100,000)	Geological heritage sites within 1000m	Aquifer designation (superficial deposits)	Aquifer designation (bedrock) (GSI, IE)
							Low groundwater Vulnerability.			
DC09-DC010	Killeagh (Ballymakeagh More) to N25/west of R634 (Ballyvergan West)	Corine – 211 - Non-irrigated arable land - 5% 231 - Pastures - 95% 412 - Peat bogs- 1%	Predominantly agricultural land with small rural settlements . Proposed natural heritage site Ballyvergan Marsh runs parallel with proposed route for approximately 1km. 4 river crossings	Killeagh Lies at the base of area 100m Higher above sea level approx. Low-lying land indicative of coastal margins leading to Youghal Bay Area at high risk of landslides (200m)	Deep well drained mineral acidic - 5% Acidic poorly drained mineral - 90% Marine/Estuarine Sediments - 5%	Estuarine sediments - 5% Sandstone Till - 95% Low subsoil permeability with small fringe areas with medium permeability	Little Island Formation (crinoidal calcilutite limestones) - 5% Waulsortian limestone (unbedded calcilutite facies) - 95% Groundwater Rock Unit: Devonian Old Red Sandstones Predominately low groundwater vulnerability (<100mm recharge/year)	None	N/A	Regionally Important Aquifer - Karstified (diffuse) Locally Important Aquifer - Bedrock which is Moderately Productive only in Local Zones GW WFD Status – Good
DC10-DC011	• Ballyvergan West (Ballyvergan West) to R634/ R908 (Summerfield)	Corrine – 112 - Discontinuous urban fabric - 10% 231 - Pastures - 50% 412 - Peat bogs - 40%	Agricultural land leading to urban settlement. Proposed natural heritage site Ballyvergan Marsh runs parallel with proposed route (entire route section)	Killeagh Lies at the base of area 100m Higher above sea level approx. Low-lying land indicative of coastal margins leading to Youghal Bay Area at high risk of landslides (200m)	Deep well drained mineral acidic- 35% Acidic poorly drained mineral - 20% Shallow well drained mineral (acidic) - 5% Man Made - 5% Marine/Estuarine Sediments - 35%	Man Made - 5% Estuarine sediments - 35% Bedrock close to surface - 5% Sandstone Till - 55% Low subsoil permeability	Ballytrasna Formation (mudstones/siltstones) - 15% Waulsortian limestone (unbedded calcilutite facies) - 60% Gyleen Formation (sandstones/siltstones/mudstones) - 25% Groundwater Rock Unit: Dinantian Pure Unbedded Limestones Predominately low groundwater vulnerability (<100mm recharge/year	None	N/A	Regionally Important Aquifer - Karstified (diffuse) GW WFD Status – Good
DC11-DC012	R634/ R908 (Summerfield) to north of Claycastle Beach car park (Summerfield)	Corine – 112 - Discontinuous urban fabric - 40% 412 - Peat bogs - 20% 523 - Sea and ocean - 35%	Holidays parks. Proposed natural heritage site Ballyvergan Marsh runs parallel with proposed route for approximately 1km Tidal marsh	Flat topography leading to the coast	Acidic poorly drained mineral - 5% Man Made - 25% Marine Sand and Gravels - 10% Marine/Estuarine Sediments - 40%	Sandstone and Shale Till- 5% Man Made - 25% Beach Sands - 10% Estuarine sediments - 40% Low subsoil permeability	Waulsortian limestone (unbedded calcilutite facies) - 80% Gyleen Formation (sandstones/siltstones/mudstones)- 20% Groundwater Rock Unit: Dinantian Pure Unbedded Limestones Low Groundwater Vulnerability (<50mm recharge/year)	None	N/A	Regionally Important Aquifer - Karstified (diffuse) GW WFD Status – Good
Landfall	Transition Joint Bay (Summerfield) to HW mark at Claycastle Beach (Summerfield)	Corine – 523 - Sea and ocean - 100%	Holiday Parks Tidal marsh - Beach	Flat (coastal)	Marine Sand and Gravels - 100%	Beach Sands - 50% Man Made - 50%	Waulsortian limestone (unbedded calcilutite facies) - 100% Groundwater Rock Unit: Dinantian Pure Unbedded Limestones Low Groundwater Vulnerability (<50mm recharge/year)	Youghal (under lighthouse) CGS designation - unaudited	N/A	Regionally Important Aquifer - Karstified (diffuse) GW WFD Status – Good

7. Surface Water, including Flood Risk

7.1 Flood Risk Assessment (Proposed Converter Station Site)

Commented [DH28]: TO BE SUBMITTED WITH FINAL APPLICATION

7.2 Photographs

Figure 7.1: Site 1: Lisheenroe Stream (facing downstream)

Source: Triturus Environmental Ltd, July 2020

Figure 7.2: Site 2: Tibbotstown Stream (facing downstream).

Source: Triturus Environmental Ltd, July 2020

Figure 7.3: Site 3: Owenacurra River (facing downstream)

Source: Triturus Environmental Ltd, July 2020

Figure 7.4: Site 4: Owenacurra River (facing downstream).

Source: Triturus Environmental Ltd, July 2020

Figure 7.5: Site 5: Glenathonocash River (facing downstream from underneath R626 bridge)

Source: Triturus Environmental Ltd, July 2020

Figure 7.6: Site 6: Elfordstown Stream (facing downstream from road bridge towards main stream confluence)

Source: Triturus Environmental Ltd, July 2020

Figure 7.7: Site 7: Ballyspillane West Stream (facing downstream)

Source: Triturus Environmental Ltd, July 2020

Figure 7.8: Site 8: Dungourney River (facing downstream from road bridge towards defunct weir)

Source: Triturus Environmental Ltd, July 2020

Figure 7.9: Site 9: Harrisgrove Stream (facing downstream from near the N25 crossing)

Source: Triturus Environmental Ltd, July 2020

Figure 7.10: Site 10: Lough Aderra (looking southwest from the N25)

Source: Triturus Environmental Ltd, July 2020

Figure 7.11: Site 11A: A branch of the Womanagh River, ca. 0.15km upstream of the N25 road crossing

Source: Triturus Environmental Ltd, July 2020

Figure 7.12: Site 11B: A branch of the Womanagh River at the proposed cable route crossing (facing downstream towards Castlemartyr Woods)

Source: Triturus Environmental Ltd, July 2020

Figure 7.13: Site 12A: Womanagh River (facing downstream)

Source: Triturus Environmental Ltd, July 2020

Figure 7.14: Site 12B: Womanagh River (facing downstream)

Source: Triturus Environmental Ltd, July 2020

Figure 7.15: Site 13: Annistown Stream showing a 100% dry channel and a karstic limestone cave system in the vicinity of the N25 road crossing (north side of road)

Source: Triturus Environmental Ltd, July 2020

Figure 7.16: Site 14: Moanlahan River (facing downstream)

Source: Triturus Environmental Ltd, July 2020

Figure 7.17: Site 15A: Dissour River (EPA code: 19D03), showing a historical weir structure immediately downstream of the N25 crossing

Source: Triturus Environmental Ltd, July 2020

Figure 7.18: Site 15B: Dissour River at the old railway crossing, site 15B (now part of Middleton to Youghal Greenway)

Source: Triturus Environmental Ltd, July 2020

Figure 7.19: Site 16: Inchanapisha River at Lagile, downstream of N25 road crossing

Source: Triturus Environmental Ltd, July 2020

Figure 7.20: Site 17: Lagile Stream (EPA code: 19L47)

Source: Triturus Environmental Ltd, July 2020

Figure 7.21: Site 18: Gortnagark Stream (EPA code: 19G72)

Source: Triturus Environmental Ltd, July 2020

Figure 7.22: Site 19: Inchiquin Stream (EPA code: 19I14)

Source: Triturus Environmental Ltd, July 2020

Figure 7.23: Site 20: East Ballyvergan (EPA code: 19E04)

Source: Triturus Environmental Ltd, July 2020

8. Biodiversity

8.1 Consultation Responses

8.2 Location of Proposed Development in Relation to Designated Sites

8.3 Habitat Mapping

8.4 Field Survey Reports

8.5 Confidential Appendix: Badger Sett Locations

9. Landscape

9.1 Visual Impact Assessments at selected Viewpoints

On the basis of the baseline study, examination of ZTV mapping and fieldwork, a selection of representative viewpoints (VPs) were selected for the purposes of the visual impact assessment. This appendix contains the assessment of visual impacts at each of the selected representative viewpoints. These include VP locations that represent the Landfall, Converter Station Compound and Connection Point as set out in Table 9.1.

VP No.	Location	Relevant project element	Viewing Distance	Viewing Direction
VP1	Designated scenic route on local road north of Carrigtwohill	Converter Station	3.24km	W
VP2	Local road north of site at Ballyadam	Converter Station	200m	S
VP3	Local road intersection at Carrigane	Converter Station	850m	S
VP4	Local road and housing cluster near entrance to Water Rock Golf Course	Converter Station	1.97km	SW
VP5	Local Road at Lysaghtstown	Converter Station	1.91km	S
VP6	N25 at entrance to IDA landholding	Converter Station	600m	NE
VP7	N25 south of site	Converter Station	300m	N
VP8	N25 near entrance to residential housing cluster	Converter Station	1.16km	W
VP9	Local road at Ballinanleigh	Connection Point	270m	W
VP10	Knockraha Village	Connection Point	1.55km	E
VP11	Local road adjacent to the south of Knockraha substation	Connection Point	72m	N

9.1.1 Sensitivity of Visual Receptors

Strong association	Moderate association	Mild association	Negligible association

Values associated with the view	VP1	VP2	VP3	VP4	VP5	VP6	VP7	VP8	VP9	VP10	VP11
Susceptibility of viewers to changes in views											
Recognised scenic value of the view											
Views from within highly sensitive landscape areas											
Primary views from residences											
Intensity of use, popularity (number of viewers)											
Viewer connection with the landscape											
Provision of vast, elevated panoramic views											
Sense of remoteness / tranquillity at the viewing location											
Degree of perceived naturalness											
Presence of striking or noteworthy features											
Sense of Historical, cultural and / or spiritual significance											
Rarity or uniqueness of the view											
Integrity of the landscape character within the view											
Sense of place at the viewing location											
Sense of awe											
Overall sensitivity assessment	**M**	**ML**	**M**	**ML**	**M**	**L**	**L**	**ML**	**L**	**ML**	**L**

N = Negligible; **L** = low sensitivity; **ML** = medium-low sensitivity **M** = medium sensitivity; **HM** = High-medium sensitivity; **H** = high sensitivity; **VH** = very high sensitivity

9.1.2 Magnitude of Visual Impacts

The assessment of visual impacts at each of the selected viewpoints is aided by either 'outline' montages - used for illustrative purposes, where the proposed development is likely to be screened from view, or photomontages - where of the proposed development is likely to be visible. Where mitigation is visible, a post-mitigation establishment view is also provided assuming an establishment period for vegetation of around 5-7 years. Thus, the photomontage set includes two or more of the following;

1. Existing View
2. Outline View
3. Montage View (pre-mitigation establishment)
4. Montage View (post-mitigation establishment)

Viewshed Reference Point		**Viewing distance**	**Direction of View**
VP1	Designated scenic route on local road north of Carrigtwohill	3.24km	W

Representative of:	• A Designated Scenic Route • Local community views		
Receptor Sensitivity	**Medium**		
Existing View	Despite this being a designated scenic route, the local road is relatively enclosed by vegetation. This is a brief gateway view to the southeast across a sloping field defined by tree-lined hedgerows. Through a gap in the field boundary in the opposite corner of the field is a window of visibility across marginal farmland around the settlement of Carrigtwohill with rolling field in the distance beyond.		
Pre-mitigation Visual Impact of proposed development	The proposed converter station will not be visible from here due to dense intervening screening by a hedgerow on the opposite side of the field. The magnitude of visual impact is Negligible by default. This has been used as an illustrative view – to illustrate the absence of impact on a designated scenic route.		
Residual Visual Impact of proposed development (post-mitigation)	Proposed mitigation will not be visible from here.		
Summary	Based on the assessment criteria and matrices outlined at **Section 6.2.4.2** the significance of residual visual impact is summarised below.		
	Visual Receptor Sensitivity	Visual Impact Magnitude	**Significance of Visual Impact**
Pre-mitigation	Medium	Negligible	**Imperceptible**
Post-mitigation	Medium	Negligible	**Imperceptible**

Viewshed Reference Point		**Viewing distance**	**Direction of View**
VP2	Local road north of site at Ballyadam	200m	S

Viewshed Reference Point			Viewing distance	Direction of View

Representative of:	• Local Community Views		
Receptor Sensitivity	**Medium low**		
Existing View	This is a slightly elevated view from a local road a short distance to the north of the site, which is lined on its northern side by two rural dwellings. The roadside is defined by a masonry stone wall, beyond which a broad field descends gently towards a section railway line. Immediately beyond this is the expansive IDA industrial site which presents as overgrown and partly derelict but not contrastingly so relative to the surrounding farmland. It also has scrubby wooded areas on its higher slopes within the south-eastern quadrant. These vegetated mounds serve to screen much of the N25 national road from view except to the south where lowland settled farmland stretches further into the distance.		
Pre-mitigation Visual Impact of proposed development	The main proposed converter station building will appear as a large and bulky feature from here which will truncate more distant views beyond, whilst penetrating well above the skyline with a blocky profile. Although it occupies a derelict industrial site the converter station represents a substantial intensification in built development and marked visual change for viewers in this locality. The array of external vertical electrical components in the eastern side of the site are less noticeable that the main building, but are of a substantial scale and intensity in their own right. They will also contribute to a sense of visual clutter within the site which contrasts against the simple form of the main converter station building. A broad vista is still afforded and the longer distance aspect to the southwest is maintained, albeit with a substantial intrusion offered by the main converter station building, which must be looked past. Although the converter station will be a dominant feature of this view, it does not appear spatially overbearing. In terms of compatibility with its surroundings, there is slightly more contrast against the predominantly rural landscape fabric in view from here than its location within an industrial zoned and primed site would suggest. Nonetheless, this is clearly a diverse hinterland landscape with major transport corridors visible but not prominent and considerable settlement in the direction of Carrigtwohill. Overall, the magnitude of visual impact prior to the establishment of mitigation is deemed to be **High**.		
Residual Visual Impact of proposed development (post-mitigation)	Once the proposed dispersed earthy colour tone pattern is added to the main converter station building and the mitigation screen planting atop the northern landscape berm has become established the perceived bulk and massing of the building will be noticeably reduced. Much of the cluttered external electrical componentry ancillary buildings and ground based activity will be substantially screened from view. Although effective, these mitigation measures will not hide the development or disguise it as a non-industrial facility, but they will combine to integrate it into the surrounding landscape more readily and reduce the visual impact to **High-medium**.		
Summary	Based on the assessment criteria and matrices outlined at **Section 6.2.4.2** the significance of residual visual impact is summarised below.		
	Visual Receptor Sensitivity	Visual Impact Magnitude	**Significance of Visual Impact**
Pre-mitigation	Medium low	High	**Substantial moderate**
Post-mitigation	Medium low	High medium	**Moderate**

Viewshed Reference Point		Viewing distance	Direction of View
VP3	Local road intersection at Carrigane	850m	S

Viewshed Reference Point			Viewing distance	Direction of View
Representative of:	• Local Community Views			
Receptor Sensitivity	**Medium**			
Existing View	This is an expansive and elevated view to the south from the intersection of quiet local roads. It is backed by a larger working farmyard and a similar farmyard can be seen downslope in the foreground of the depicted view. Otherwise, the view descends across farmed fields defined by low scrubby hedgerows and fence lines as well as more substantial treelined hedgerows in some areas, particularly to the southeast. The primed IDA site can be seen in the middle distance as area of bare and regenerating ground and wooded mounds. The low profile of the ridgeline at Great Island can be seen in the far distance beyond the harbour estuary, which is not apparent form here. Other than the nearby farmstead, the view contains only a modest degree of notable built development.			
Pre-mitigation Visual Impact of proposed development	Whilst the external electrical componentry at the eastern end of the Converter Station Compound benefits from a reasonable degree of visual absorption with the tones and textures of its surrounding landscape setting, the main building stands as a distinctive and substantial scale block within the lower middle ground. It is not a visually dominating feature in the context of this broad panoramic vista, but it is an eye catching one. Its blank vertical façade and general bulk contrasts against the finer texture and more natural, darker tones of surrounding fields and hedgerows as well as their predominantly horizontal layering. The proposed converter station compound will notably increase the intensity of built development whilst knitting an industrial patch into the predominantly rural landscape fabric that can be seen from here. However, it does not undermine key values associated within this broad view across a working hinterland landscape or obstruct the visibility of any important components of the view. Overall, the magnitude of visual impact prior to the introduction of landscape and visual mitigation measures is deemed to be **Medium**.			
Residual Visual Impact of proposed development (post-mitigation)	Following the introduction of a dispersed tone colour pattern onto the facades of the main building and the establishment of vegetation bands on the landscape berm to the north of the site the perceived bulk and massing of the building will be considerably reduced. It will bed into the surrounding landscape setting more readily in terms of tone, texture and vegetation structure and will not draw the eye to the same degree. It will still appear as a sizeable industrial facility, but much of the ground level activity and external electrical components will be screened from view and it will impart less industrial influence on the character of the landscape in view. For these reasons, the magnitude of visual impact following mitigation is deemed to be **Medium low**.			
Summary	Based on the assessment criteria and matrices outlined at **Section 6.2.4.2** the significance of residual visual impact is summarised below.			
	Visual Receptor Sensitivity	Visual Impact Magnitude	**Significance of Visual Impact**	
Pre-mitigation	Medium	Medium	**Moderate**	
Post-mitigation	Medium	Medium-low	**Moderate-slight**	
Viewshed Reference Point			**Viewing distance**	**Direction of View**
VP4	Local road and housing cluster near entrance to Water Rock Golf Course		1.97km	SW
Representative of:	• Local Community Views			
Receptor Sensitivity	**Medium low**			

Viewshed Reference Point			Viewing distance	Direction of View
Existing View	This is a reasonably expansive window of visibility from a slightly elevated location at the southern end of a line of rural residential dwellings. Visibility is aided by the low-clipped hedges and the absence of tall vegetation within the adjoining property. Beyond this property is a gently descending landscape of fields and hedgerows in pasure and cropping. There is a low wooded hilltop on the horizon and numerous electricity pylons running away from the viewer. Through a small saddle in the middle ground ridge can be seen a glimpse of a more distant ridge.			
Pre-mitigation Visual Impact of proposed development	Only the proposed converter station main building is likely to be discernible from here with its upper sections appearing just beyond the saddle of the middle distance ridge. The taller external electrical components such as insulator poles and lightening masts tend to recede against the backdrop due to their fine construction and the viewing distance. They are also substantially screened and camouflaged amongst intervening tree branches and pylons. The converter station building is also nestled between sections of ridgetop vegetation and substantially below the distant skyline ridge. Whilst visible it is not prominent. There is a minor degree of contextual ambiguity associated with the appearance of the upper sections of a large industrial building on the saddle of a farmed ridge within a predominantly rural scene though it may be perceived as a large farm shed on the ridge itself. Overall, the view of the partial view of the converter station building at this distance and in the context of a relatively extensive vista will not result in a marked reduction in visual amenity. Thus the magnitude of impact is deemed to be Low.			
Residual Visual Impact of proposed development (post-mitigation)	Mitigation measures in the form of a dispersed tone colour pattern for the building façade and screen planting will only have a minor effect from here as the upper sections of the building are deliberately left with a light tone to reduce visual contrast against the sky for closer views and only the tops of prosed screen vegetation will emerge into view after a period of approximately 5 years. These will marginally reduce the visual presence of the proposed building and help to integrate it into the surrounding landscape fabric. However, the magnitude of visual impact remains Low.			
Summary	Based on the assessment criteria and matrices outlined at **Section 6.2.4.2** the significance of residual visual impact is summarised below.			
	Visual Receptor Sensitivity	Visual Impact Magnitude	**Significance of Visual Impact**	
Pre-mitigation	Medium low	Low	**Slight**	
Post-mitigation	Medium low	Low	**Slight**	

Viewshed Reference Point		Viewing distance	Direction of View
VP5	Local Road at Lysaghtstown	1.91km	S
Representative of:	• Local community views		
Receptor Sensitivity	**Medium**		
Existing View	This is a gateway view from an otherwise enclosed section of narrow laneway on higher ground to the northeast of the site. It is a vast panoramic view across gently declining plateau farmland, which gives way to patchwork farmland on the lowland landscape below. Faint glimmers of the Cork Harbour estuary can be seen in the far distance beneath the long, low farmed ridge of Great Island. A high voltage overhead		

Viewshed Reference Point			Viewing distance	Direction of View
	line also crosses the near middle ground and a plume of steam can be seen rising from a large quarry operation in the middle ground lowlands.			
Pre-mitigation Visual Impact of proposed development	There will be a partial glimpse of the main Converter Station building from here through a tree-lined hedgerow on the near brow of the hill. It is the broad and blank tone of the building that may draw attention to it in this section of the view due to a contrast with more richly textured and natural toned fields, hedgerows and woodlands. The external electrical components at the eastern end of the site are less conspicuous because the blend more readily with their surroundings. There is a minor degree of ambiguity associated with the full scale and form of the proposed development appearing as an apparently continuous structure across different gaps in the intervening treeline. Nonetheless, it is still a modest scale feature of a broad vista that takes in a richly diverse and productive hinterland landscape, within which it will not appear out of place. On balance, the magnitude of visual impact is deemed to be **Low** from here.			
Residual Visual Impact of proposed development (post-mitigation)	Mitigation in the form of a dispersed tone pattern for the main building façade will allow it to visually recede against the similar tones and colour dispersal of the surrounding landscape. This will be further aided by the proposed planting atop perimeter landscape berms. The proposed development will be less noticeable and will, therefore, have a reduced impact on visual amenity when viewed from here. The magnitude of visual impact is deemed to reduce to **Low-negligible** in a post-mitigation establishment scenario.			
Summary	Based on the assessment criteria and matrices outlined at **Section 6.2.4.2** the significance of residual visual impact is summarised below.			
	Visual Receptor Sensitivity	Visual Impact Magnitude	**Significance of Visual Impact**	
Pre-mitigation	Medium	Low	**Slight**	
Post-mitigation	Medium	Low-negligible	**Slight-imperceptible**	

Viewshed Reference Point		Viewing distance	Direction of View
VP6	N25 at entrance to IDA landholding	600m	NE
Representative of:	• A major route		
Receptor Sensitivity	**Low**		
Existing View	This is a view from the northern side of the busy N25, approx. 1.7km east of Carrigtwohill. In terms of context, the green, roadside chain-link fence in the foreground runs for several hundred metres along this section of the national road, allowing the most attainable views across the IDA landholding. In the middle distance, a low hill range rises to the north, which is primarily covered in pasture, and some tillage, followed by intermittent breaks of woodland. The view across the IDA site is framed to the east by a wooded mound nearer the road corridor and there is a lower and flatter section of substantially vegetated skyline between.		

Viewshed Reference Point			
Pre-mitigation Visual Impact of proposed development	The proposed converter station building will rise in silhouette above the lower section of skyline between the farmed slopes to the north and the nearer wooded mound to the east. It is a substantial and bulky building when viewed from here and its geometric profile draws the eye relative the softer skyline elements to either side. It will be a distinctive but not spatially dominating feature when viewed from here. The external electrical components at the eastern end of the compound are much less noticeable by comparison due to their lesser scale, finer form, dispersed tone and the fact that they recede against the foreground fence and backdrop of vegetation. Compositionally, the proposed converter station does not appear out of place within a site that reads as primed from industrial development and is zoned as such. Aside from the perimeter fencing and partially completed internal road network, it is situated alongside the N25 national route in the peri-urban hinterland of Carrigtwohill and Midleton. It will add marginally to the degree of enclosure, but does not obstruct the view of any important elements of the view. Overall, the pre-mitigation view of the proposed development is considered to give rise to a Medium-low visual impact magnitude.		
Residual Visual Impact of proposed development (post-mitigation)	In the context of established screen planting along the nearest perimeter of the compound as well as the incorporation of a dispersed tone pattern on the façades of the main converter station building, its bulk and massing will appear reduced. It will also appear more consolidated within the site and surrounding landscape context and much of the external electrical components and ground level activity will be screened from view. Thus, the residual magnitude of visual impact will be reduce to Low-negligible.		
Summary	Based on the assessment criteria and matrices outlined at **Section 6.2.4.2** the significance of residual visual impact is summarised below.		
	Visual Receptor Sensitivity	Visual Impact Magnitude	**Significance of Visual Impact**
Pre-mitigation	Low	Medium-low	**Slight**
Post-mitigation	Low	Low-negligible	**Slight-imperceptible**

Viewshed Reference Point		Viewing distance	Direction of View
VP7	N25 south of site	300m	N
Representative of:	• Major route		
Receptor Sensitivity	**Low**		
Existing View	This view represents a fleeting glimpse beyond the roadside fencing and vegetation that occurs along much of the IDA landholding roadside boundary. It is from a more elevated section of the N25 and the IDA site, which hosts a wooded area allowing only a small window of visible towards the framed slopes to the north.		
Pre-mitigation Visual Impact of proposed development	There will be a potential glimpse of the roof profile of the main converter station building between sections of intervening vegetation and set against a backdrop of farmed slopes. Furthermore, this fleeting and oblique view is only available to west bound road users across westbound traffic lanes. There is little visual amenity to be had and little effect on it. Consequently, the magnitude of visual impact is deemed to be Negligible.		
Residual Visual Impact of proposed	Mitigation will not be apparent from here.		

Viewshed Reference Point			Viewing distance	Direction of View
development (post-mitigation)				
Summary	Based on the assessment criteria and matrices outlined at **Section 6.2.4.2** the significance of residual visual impact is summarised below.			
	Visual Receptor Sensitivity	Visual Impact Magnitude	**Significance of Visual Impact**	
Pre-mitigation	Low	Negligible	**Imperceptible**	
Post-mitigation	Low	Negligible	**Imperceptible**	

Viewshed Reference Point		Viewing distance	Direction of View
VP8	N25 near entrance to residential housing cluster	1.16km	W

Representative of:	• A major route		
Receptor Sensitivity	**Medium low**		
Existing View	Although this view is afforded from a busy arterial route it is a relatively open vista across farmed and wooded slopes to the north from a slightly elevated section of the road. There is also a small residential enclave to the right of the viewer where similar views may be afforded. Numerous road side signs detract from the visual amenity somewhat.		
Pre-mitigation Visual Impact of proposed development	The proposed converter station will be fully screened from here by the terrain and dense woodland vegetation on the middle distance hill. Consequently, the magnitude of visual impact will be negligible by default.		
Residual Visual Impact of proposed development (post-mitigation)	Mitigation will not be visible from here.		
Summary	Based on the assessment criteria and matrices outlined at **Section 6.2.4.2** the significance of residual visual impact is summarised below.		
	Visual Receptor Sensitivity	Visual Impact Magnitude	**Significance of Visual Impact**
Pre-mitigation	Medium low	Negligible	**Imperceptible**
Post-mitigation	Medium low	Negligible	**Imperceptible**

Viewshed Reference Point			Viewing distance	Direction of View
VP9	Local road at Ballinanleigh		270m	W

Representative of:	• Local Community Views		
Receptor Sensitivity	**Low**		
Existing View	This is a strongly contained view along the narrow local road that serves Knockraha substation as well as a modest number or rural residences in the vicinity. The substation, or at least the taller lattice structure pylons and structures can be seen rising above the containing hedgerows in the near middle distance. Due to the level of screening the substation is noticeable, but is not a prominent feature.		
Pre-mitigation Visual Impact of proposed development	The proposed extension to the substation will not be discernible from here as all but the tips of a couple of masts is screened by roadside vegetation. Consequently, the magnitude of visual impact is deemed to be **Negligible**.		
Residual Visual Impact of proposed development (post-mitigation)	Mitigation planting will not be visible from here.		
Summary	Based on the assessment criteria and matrices outlined at **Section 6.2.4.2** the significance of residual visual impact is summarised below.		
	Visual Receptor Sensitivity	Visual Impact Magnitude	**Significance of Visual Impact**
Pre-mitigation	Medium low	Negligible	**Imperceptible**
Post-mitigation	Medium low	Negligible	**Imperceptible**

Viewshed Reference Point		Viewing distance	Direction of View
VP10	Knockraha Village	1.55km	E

Representative of:	• A centre of population • Local community views		
Receptor Sensitivity	**Medium low**		
Existing View	This is a view from the southern end of the small village of Knockraha and one of the few open views in the direction of the existing Knockraha substation from within the public realm of the village. The existing substation can be seen on a low hill in the middle distance to the east, but only as a cluster of lattice tower tops and a general convergence of high voltage lines and associated pylons rising above the intervening hedgerow / treeline vegetation.		
Pre-mitigation Visual Impact of proposed development	The proposed extension to the substation to facilitate the Celtic Interconnector project will not be discernible from here due to the high degree of screening from intervening vegetation. Thus, the magnitude of visual impact will be Negligible.		
Residual Visual Impact of proposed development (post-mitigation)	Proposed mitigation will not be visible from here.		
Summary	Based on the assessment criteria and matrices outlined at **Section 6.2.4.2** the significance of residual visual impact is summarised below.		
	Visual Receptor Sensitivity	Visual Impact Magnitude	**Significance of Visual Impact**
Pre-mitigation	Medium low	Negligible	**Imperceptible**
Post-mitigation	Medium low	Negligible	**Imperceptible**

Viewshed Reference Point			Viewing distance	Direction of View
VP11	Local road adjacent to the south of Knockraha substation		72m	N
Representative of:	• Local community views			
Receptor Sensitivity	**Low**			
Existing View	This is a relatively contained view from a gateway access to the Knockraha substation at the eastern end of the facility. Through the gateway is a close view of the a portion of the existing substation beyond a post and rail fence and then a low masonry wall and palisade security fence. The eastern end of the substation is the dominant feature of this scene or more particular a large pylon that rises over the viewer at this location. The majority of the substation is screened to the north and west by a dense roadside stand of conifers within the substation site. It should be noted that this is not a vista afforded to local residences, which are all further to the east or west of the substation or downhill to the south.			
Pre-mitigation Visual Impact of proposed development	The proposed substation extension will occur to the fore of other existing aspects of the substation, albeit beyond the perimeter palisade fence. It will add to the intensity of electrical infrastructure within view as well contributing subtly to an increase in the sense of enclosure and complexity of componentry. Context is key to the view and although the proposed extension is a noticeable feature of this view, it is nonetheless a modest increase to the scale and intensity of the overall substation facility and of a consistent nature. Consequently, the impact on the visual amenity of passers-by is limited and the overall magnitude of impact is deemed to be Medium-low.			
Residual Visual Impact of proposed development (post-mitigation)	There is no mitigation screen planting proposed between the gateway and the proposed extension to the substation facility so there will be no reduction in visual impact.			
Summary	Based on the assessment criteria and matrices outlined at **Section 6.2.4.2** the significance of residual visual impact is summarised below.			
	Visual Receptor Sensitivity	Visual Impact Magnitude	**Significance of Visual Impact**	
Pre-mitigation	Low	Medium low	**Slight**	
Post-mitigation	Low	Medium low	**Slight**	

9.2 Landscape Mitigation Plan – Converter Station Compound

9.3 Verifiable Photomontages

10.Noise and Vibration

10.1 Noise Survey Reports

11.Roads and Traffic

11.1 Supporting Maps

11.2 Framework Construction Traffic Management Plan

11.3 Construction Traffic Flow Data

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