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# EirGrid and SONI

## Proposed Interconnector

An Bord Pleanála Reference: PCI0001

Volume 4

### Joint Environmental Report

(Updated DAF)



DRAFT

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NB In response to the submitted Draft Application File (December 2014), which included a Draft JER, An Bord Pleanála (by letter dated 16<sup>th</sup> December 2014) has requested that the “*consolidated Environmental Statement lodged in conjunction with planning applications for that section of the proposed development in Northern Ireland be provided and accompany the JER as an Appendix*”. EirGrid and SONI have therefore included the Consolidated ES as Appendix C of this JER. The JER is being submitted to the planning authorities in both Ireland and Northern Ireland. In circumstances in which the Consolidated ES has already been submitted to Planning NI, the Consolidated ES has not been appended to the version of the JER submitted to Planning NI as to do so would be unnecessary duplication of a report previously submitted and consulted upon in Northern Ireland.

## Figures

Overall Scheme Location Plan Drawing Number 60032220/JER/0

Scheme Location Plan (Sheets 1 – 4)

Turleenan Substation Layout

Woodland Substation Layout

Drawing Number 60032220/JER/1-4

Drawing Number 60032220/JER/5

Drawing Number 60032220/JER/6

# Non-Technical Summary

## Introduction

1. EirGrid and System Operator for Northern Ireland (SONI) (the respective applicants) are jointly planning a major cross-border electricity development between the existing high-voltage transmission networks of Ireland<sup>1</sup> and Northern Ireland. The proposed interconnector is a 138 km 400 kV overhead line between a planned substation<sup>2</sup> in Turleenan, County Tyrone and the existing 400 kV substation in Woodland, County Meath. It is described in greater detail in paragraph 22 of the Joint Environmental Report (“JER”) which this Non-Technical Summary (NTS) summarises.
2. The proposed interconnector will provide a second electricity interconnector between Ireland and Northern Ireland, and is planned to be constructed within the counties of Tyrone, Armagh, Monaghan, Cavan and Meath. The existing interconnector is a 275 kV overhead line and connects the existing Tandragee and Louth substations.
3. As the proposed interconnector is being developed in Ireland and Northern Ireland, separate planning applications have been submitted in each jurisdiction for the EirGrid section of the proposed interconnector (the EirGrid Proposal) and SONI's section of the proposed interconnector (the SONI Proposal). The applications are accompanied by an Environmental Impact Statement (EIS) and Environmental Statement (ES)<sup>3</sup> respectively, prepared in accordance with European Union (EU) and national requirements for Environmental Impact Assessment (EIA).
4. EirGrid and SONI and their consultants have closely coordinated their activities to ensure an integrated approach has been undertaken to the design of the proposed interconnector and to the appraisal of its environmental impacts (EIA), including transboundary<sup>4</sup> and cumulative effects<sup>5</sup>.
5. This is the NTS of the JER for the proposed interconnector.

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<sup>1</sup> Often referred to as 'Republic of Ireland'.

<sup>2</sup> Substations act as connection points for overhead lines to allow them to connect to the electricity network.

<sup>3</sup> The Environmental Statement that was submitted in Northern Ireland in 2013 was submitted by Northern Ireland Electricity (NIE). For the purposes of this JER, it will be referred to as the 'Consolidated ES'. The Environmental Impact Statement that was submitted in Ireland in 2015 will be referred to herein as the 'EIS'.

<sup>4</sup> Cross-border

<sup>5</sup> Overall impacts including those occurring between different environmental topics within the proposed interconnector, and those occurring as a result of the likely impacts of the proposed interconnector project interacting with the impacts of other projects in the relevant localities.



## The Joint Environmental Report

6. The basic requirement of the EIA process is to ensure that, before development consent is given, projects likely to have significant environmental effects are fully assessed. This requires an assessment of effects regardless of their location or of national borders.
7. International agreements such as the “Espoo Convention” on the assessment of transboundary projects have been taken into account in European Directives and in the EIA legislation in Ireland and Northern Ireland.
8. In May 2013, the European Commission (EC) published Guidance on the Application of the Environmental Impact Assessment Procedure for Large-scale Transboundary Projects (“the Commission Guidance”). This document, which provides guidance on large-scale transboundary projects (such as the proposed interconnector), states:

*“For large-scale transboundary projects, the developer must comply with the requirements of the national EIA requirements of each country in which the project will be implemented. The developer should prepare individual national EIA reports and a joint environmental report that covers the whole project and assesses its overall effects, in particular cumulative and significant adverse transboundary effects (page 10)”*
9. Whilst the Commission Guidance in no way creates any obligation for Member States or project developers, EirGrid and SONI have decided to prepare the JER so as to take account of the Commission Guidance.
10. Accordingly, the JER sets out an appraisal of the proposed interconnector as a whole i.e., ‘from A to Z’. EirGrid and SONI have prepared this evaluation of the proposed interconnector’s overall impact in order to enable an assessment to be undertaken of the overall effects of the proposed interconnector and, in particular, cumulative and significant adverse transboundary effects.
11. The proposed interconnector has been developed over a number of years. Much of the design and appraisal was undertaken before the EC Transboundary guidance document was published in May 2013. Despite this, EirGrid and SONI agree that the planning processes for the proposed interconnector would benefit from the preparation of a JER.
12. The Consolidated ES and EIS for the proposed interconnector have taken full account of the requirements of EIA legislation. Because of differing national legislation and procedure, it would not be possible to submit a single application for planning approval for the entire proposed interconnector, given the location of its constituent elements in Ireland and Northern Ireland. However, the preparation of the Consolidated ES and EIS have been closely coordinated and the cumulative effects and transboundary effects of the proposed

interconnector have been appropriately considered, so that a full and coherent EIA process in Ireland and Northern Ireland may be undertaken.

13. The JER has been prepared in addition to the published Consolidated ES and EIS submitted to the relevant planning authorities, taking account of the information which has already been provided within those documents. It is recommended that the JER is read together with the Consolidated ES and EIS for the proposed interconnector.
14. The structure of the JER is similar to that of the published Consolidated ES and EIS, with some differences due to differing guidance. However, the basic approaches are considered to be consistent as a result of the high degree of coordination between the proposed interconnector teams.
15. The overall assessment of the effects of the proposed interconnector is presented in Chapters 4 – 17 of the JER. The chapters have been prepared based on the project consultants' professional experience and with regard to relevant national and international assessment guidelines. The chapter headings are: 4 – Population - Socio-economics; 5 – Population - Tourism; 6 – Population - Land Use; 7 – Material Assets; 8 – EMF; 9 – Traffic ; 10 - Noise; 11 – Ecology (Fauna and Flora); 12 – Soils, Geology and Hydrogeology; 13 – Water; 14 – Air and Climatic Factors; 15 – Cultural Heritage; 16 – Landscape; and, 17 – Cumulative Impacts and Interactions.
16. Each assessment chapter follows the same general format as follows:
  - **Introduction:** a brief summary of what is considered in the chapter;
  - **Methodology:** a description of the methodology that has been used in the assessment of the environmental topic;
  - **The Receiving Environment:** a description of the existing environmental conditions against which the predicted environmental effects have been assessed;
  - **Mitigation Measures:** measures that have been, or will be, implemented to ensure that the effects are avoided, eliminated or minimised;
  - **Residual Impacts:** assessment of significance of effects after implementation of mitigation measures during construction and operation of the proposed interconnector;
  - **Transboundary Effects:** assessment of significance of cross border effects; and
  - **Conclusions:** a summary of the assessment.
17. A separate chapter (Chapter 17) considers the likely significant impacts and interactions of the overall proposed interconnector.
18. The route selection, design and appraisal of the proposed interconnector commenced in 2005 and so predated the publication of the EC Transboundary guidance document (May

2013). Despite this, it is considered that EirGrid and SONI have, so far as is practicable, followed the principles of the methodology, suggested by the European Commission, as best practice.

## Project Need

19. The proposed interconnector is an electricity transmission development of long-term strategic importance for the island of Ireland and will deliver benefits for electricity customers in three key areas:
- Improving competition and reducing existing constraints which currently restrict the efficient performance of the electricity market, thereby putting downward pressure on electricity prices;
  - Supporting the development of renewable power generation – by enhancing the flexible exchange of power flows over a large area of the island. This will facilitate the connection and operation of larger volumes of renewable power generation (especially wind powered generation) throughout the island; and
  - Improving security of supply – by providing an additional, dependable, high-capacity link between the two transmission systems on the island of Ireland.
20. The proposed interconnector is supported by European Union (EU) Directives which require enhanced electricity interconnection between EU member states and improved conditions for energy competition throughout Europe. The development of the proposed interconnector has been part funded by the EU Trans-European Networks (TEN-E) programme, in which it has been listed as a “priority project” or “Project of Common Interest”.

## Overall Project Description

21. The proposed interconnector will comprise a 138km overhead line between substations in Turleenan, County Tyrone and Woodland, County Meath and can be summarised as follows:
- **Turleenan Substation:** the construction and operation of a new 275kV / 400kV substation at Turleenan townland, north-east of Moy, County Tyrone;
  - **The 275kV Towers:** the removal of an existing 275kV suspension tower and the construction and operation of two new 275kV terminal towers, including the temporary diversion of the 275kV line, to provide for connection of the Turleenan substation to the existing network;
  - **The 400kV Towers and Overhead Line:** The construction and operation of a single circuit 400kV overhead transmission line supported by 401 new towers for a distance of

approximately 138km from the substation (at Turleenan) to an existing double circuit tower (Tower 402) in the townland of Bogganstown, County Meath. The overhead line (conductors) will be positioned at a minimum of 9.0m above ground level;

- Use of **existing 400kV Double Circuit Towers**: It also includes the addition of a new 400 kV circuit for some 2.85km along the currently unused (northern) side of the existing double circuit 400 kV overhead transmission line (the Oldstreet to Woodland 400 kV transmission line) extending eastwards from Tower 402 in the townland of Bogganstown, County Meath to Tower 410 and the Woodland Substation in the townland of Woodland, County Meath;
  - **Associated Works**: Works to include, where appropriate, site levelling, site preparation works, modifying existing access points, construction of new access points, construction of new access lanes, construction of working areas, stringing areas, guarding, site boundary fencing, related mitigation works, access tracks and other associated works at the substation and at the tower locations.
22. The proposed interconnector is illustrated in a series of figures – refer to the **Figures** section at the end of the report.
23. Within counties Tyrone and Armagh there will be 102 (no.) 400kV towers constructed to support the overhead line and the line will run for approximately 34km from Turleenan to the border between the townland of Doohat or Crossreagh in County Armagh and the townland of Lemgare in County Monaghan. The overhead line will, in addition, over-sail an additional portion of land within the Northern Ireland townland of Crossbane for approximately 0.2km (between Towers 106 and 107, both of which are located in the townland of Lemgare, County Monaghan).
24. Within counties Monaghan, Cavan and Meath, there will be 299 (no.) 400kV towers constructed to support the overhead line. In addition the proposed interconnector will utilise 9 (no.) existing towers for the final section into Woodland substation. These towers which are located along a section of approximately 103.35km from Tower 103 (which is located just south of the border in the townland of Lemgare, County Monaghan) the most southerly tower (Tower 410) at the Woodland substation in County Meath.
25. The proposed 138km overhead line will comprise towers and support structures (including temporary support structures) ranging in overall height from 26m – 61m over ground level (61m towers are existing towers). The footprint of the towers will vary based on ground conditions and the design of the towers. The maximum foundation size is 6m deep and 25m in length x 25m in width (proposed 275kV tower at Turleenan substation). The majority of towers will be smaller than this size.
26. The construction period for the proposed interconnector has been estimated as three years from the start of the site works, but the construction period at any particular location along

- the overhead line route would be in the order of four to six months. The construction of Turleenan Substation will take up to three years, and will be undertaken in parallel with the overhead line construction activity. Turleenan Substation will be constructed in several stages including site entrance, access roads, site clearance, installation of drainage, construction of roads, installation of equipment/construction of building and completion of access roads.
27. The construction methodology will be implemented in-line with international best practice and will fully comply with all relevant health and safety requirements. The ground conditions encountered vary along the route of the proposed interconnector hence the construction techniques and machinery/equipment required will vary to accommodate these variations in ground conditions.
  28. There will be two construction depots for the proposed interconnector: NIE's existing depot at Carn Industrial Estate, Craigavon, County Armagh; and a proposed site to the south east of Carrickmacross, County Monaghan. The depots will be used to store construction vehicles and equipment. Materials for the construction phase (overhead line and towers) will also be stored at the depots.
  29. Carn is NIE's main regional depot in the southern half of Northern Ireland. It is adjacent to the M12 Carn roundabout and 15 miles (24km) from the proposed Turleenan substation. The proposed Carrickmacross site is located to the west of the N2 and is accessed by a local road (the L4700). The existing access into the storage yard is located adjacent to a junction on the public road network and has restricted visibility. As such, it is proposed to construct a new site entrance onto the L4700 further south of the existing entrance.
  30. During the construction phase, temporary access tracks and other ancillary works will be required at the Turleenan substation site and at each of the tower locations. Temporary access routes capable of taking construction plant, construction materials and personnel are required for the construction of the proposed interconnector. Temporary access routes include access tracks, access to stringing locations, access to guarding locations and access to low voltage crossing locations.
  31. The proposed works at the Woodland Substation include a western extension of the existing compound; modifications to the existing fence and the addition of electrical equipment/apparatus.
  32. Associated works for the proposed interconnector include environmental mitigation measures, stringing of the line, guarding locations over road and some rivers, service diversions and other measures that are necessary to minimise the construction phase impacts.

33. Outline Construction Environmental Management Plans (outline CEMP) have been prepared for SONI's and EirGrid's sections of the proposed interconnector. The outline CEMP will ensure that all mitigation measures which are considered necessary to protect the environment, prior to construction, during construction and/or during operation of the proposed interconnector, are fulfilled. (EIS Appendix 7.1, **Volume 3B Appendices** and in the **Consolidated ES** Appendix 5A).

## Alternatives

### Introduction

34. In terms of alternatives there are two key variables that have been assessed – the technological alternatives and the alternative locations and routeing (i.e. the route that the line could take).
35. The process also included the assessment of the “Do Nothing” or “No Action” alternative (i.e. the circumstance where the proposed interconnector is not constructed). Under the Do Nothing alternative, the requirement for additional interconnection between the two electricity transmission systems on the island of Ireland would not be addressed and so EirGrid and SONI have both rejected it.

### Technological Alternatives

36. The examination of technological alternatives included reference to studies and reports produced by internationally recognised consultants, some commissioned by the respective applicants and others commissioned by Government. The conclusions from these reports have informed the respective applicants' assessment of the alternatives, and helped to confirm their view that the most practical solution to meet the need for interconnection would be a high voltage alternating current (HVAC or AC) overhead transmission line.
37. The key conclusions confirming the selection of an overhead line for the proposed interconnector are as follows:
- Undersea technology was rejected because of risk, environmental impact and cost;
  - High voltage direct current (HVDC) offers no significant technical or environmental advantages, but has considerable additional significant technical complexity, cost and risk in comparison with HVAC technology;
  - Worldwide, HVAC overhead lines for transmission applications are chosen over HVDC. Also, there are no examples in the world of an underground HVAC cable of the same length and designed voltage as the proposed interconnector;

- Underground high voltage cables have increased construction impacts, significant additional lifetime cost; and,
  - AC overhead line technology has superior reliability and performance.
38. The overall conclusion drawn in relation to both the EirGrid and SONI proposals is that the assessment of the transmission alternatives fully supports their proposals to construct the proposed interconnector by means of a 400kV AC single circuit overhead transmission line.

## **Location and Routeing Alternatives**

39. The EirGrid and SONI proposals have undertaken a process to evaluate alternative locations for transmission system connection, viable route corridors for an overhead transmission line between the selected connection points and the two transmission systems on the island of Ireland, as well as detailed overhead line route selection. The process has been undertaken in accordance with the objective to minimise the environmental impact of the proposed interconnector in accordance with published Guidelines and best practice.
40. Numerous alternatives have been considered for the connection, design, location and routeing of the proposed interconnector:
- Alternative system connection options. The identification of five possible and technically feasible solutions. Of these five, two (the Western Option and the Multiple 110kV Option) were rejected at a relatively early stage since they were considered to present poor power transfer capabilities in comparison with other feasible options;
  - Alternative study areas were identified in association with the remaining three connection options, two alternative “Mid-Country” connection options (including the eventually selected option of a connection between Drumkeel, County Tyrone and Kingscourt, County Cavan) and an Eastern connection option that would have duplicated the existing interconnector connection between Tandragee and Louth;
  - Identification and assessment, having regard to the likely significant environmental impacts, of alternative route corridor options within the Mid-Country and Eastern study areas, leading to the choice of a preferred route corridor between Drumkeel and Kingscourt;
  - Assessment of alternative tower designs to determine the best available option;
  - The identification and evaluation of alternatives to the detailed overhead line routeing within the preferred route corridor, and the application of established overhead line routeing principles (including land owner consultation and a combination of environmental and practical considerations) to the identification of a finalised route for the proposed overhead line;

- The identification and evaluation of three alternative substation locations in the vicinity of the chosen transmission system connection point, leading to the choice of Turleenan near Moy, County Tyrone (rather than the initial location near Drumkee); and,
  - The evaluation of alternatives for the Turleenan substation design and layout, and the final choice of technology used in order to reduce the overall footprint and environmental impact of the proposed substation.
41. The proposed interconnector has been subject to an extensive examination of alternatives. The mitigation of environmental impacts by design has been a fundamental aspect of EirGrid and SONI's development process. This has also been the approach for the selection of the location of the proposed Turleenan substation. The routeing and site location selection are considered to represent the best overall options amongst the many alternatives considered throughout the development process.

## **JER Appraisal of the Proposed Interconnector**

### **Population – Socio-economics**

42. The likely impacts during both the construction and operational phases have been evaluated. The construction phase will result in a significant capital spend that it is likely to benefit the assessed area and the wider area in terms of equipment purchased, employment and indirect impacts (e.g. accommodation for construction workers and spending in the hospitality industries).
43. The routeing of the proposed overhead line and location of the proposed substation is considered to present the best overall option amongst the many alternatives considered throughout the development process. In terms of minimising the potential for impacts on the amenities of existing and future populations, the principal mitigation measure has been incorporated into the design stage by maximising the distance between the proposed interconnector and larger urban settlements, local villages, clustered settlements, individual one-off dwellings, schools, churches and community facilities. Therefore it is considered that the proposed interconnector will not result in any significant negative socio-economic effects.
44. There will be wider economic benefits arising from these improvements to the electricity grid in the island of Ireland.

### **Population – Tourism**

45. Impacts to tourism will not be direct as no tourist sites will be physically impacted by the proposed interconnector. Negative impacts are anticipated to be limited to construction impacts of noise and traffic, setting impacts at cultural heritage sites, and landscape and



visual impacts. Tourism impacts arising as a result of visual and cultural impacts at key tourism sites including the Argory, Navan Fort, Benburb, the Monaghan Way, Bective Abbey and the Boyne Valley Driving Route will not be significant.

## Population – Land Use

46. The construction activity will affect individual farms along the proposed interconnector at different times for a period of approximately 4 – 6 months. The disturbance impacts on farm enterprises from construction activity will generally be temporary and therefore will not give rise to residual effects. The construction activity will cause short to medium term residual effects on approximately 124 hectares (ha) of land where damage to soil is predicted and long term damage to soil on the 1.4 ha Carrickmacross construction materials storage yard. An area of 22.2 ha will be required for the Turleenan substation and associated works. Most of the 22.2 ha can return to agricultural use following the construction phase, however there will be a residual impact to the affected land. There will be residual effects due to the restriction of land utilisation at the base of the towers (10.5 ha) and the towers will be an obstacle to machinery operations. Approximately 14.8 ha of commercial forestry will be cleared under and adjoining the proposed overhead line. The presence of the overhead line will be an additional safety risk on farms and may restrict the construction of some agricultural buildings.
47. The residual impacts are either Imperceptible or Slight Adverse on 95% of the land parcels along the proposed interconnector. Twenty six Moderate Adverse impacts (4.5%) are predicted. Three Major Adverse impacts (0.5% of total) are predicted and one Major / Profound adverse impact (0.1% of total) will arise at the site of the substation in Turleenan, Co Tyrone.
48. In the context of the relatively small area where direct land take impacts, land restriction impacts (at the base of the towers) and soil damage impacts occur, the short term nature of construction impacts and the prediction that land utilisation will not change significantly under and adjoining the overhead lines, overall, the impact is Imperceptible.

## Material Assets

49. Extensive consultation took place with the authorities responsible for transmissions associated with radio (domestic and commercial), television, aviation and the emergency services that have telecommunications assets.
50. No objections or potential impacts were highlighted by the telecommunication or aviation consultees. It is concluded that there will be no significant impacts to telecommunications or aviation assets as a result of the proposed interconnector.

51. The proposed interconnector will meet all electromagnetic compatibility requirements as set out by legislation.
52. Mitigation measures will be implemented at the construction and operational phase to minimise and/or eliminate impacts on material assets in the receiving environment. The mitigation measures included in the outline CEMP will be implemented as part of the construction management. Adherence to the mitigation measures will ensure there are no residual impacts associated with the proposed interconnector.
53. It is considered that the operation of the proposed interconnector will have no significant impacts on material assets. The proposed interconnector will not provide an obstacle for aircraft, particularly those operating at Trim Airfield. The IAA confirmed that the proposed interconnector will be below the obstacle limitation surface for Trim Airfield.

## Electric and Magnetic Fields (EMF)

54. The proposed transmission lines operating at 400 kV will produce, for the majority of their length including all of the length within Northern Ireland, a maximum 50 Hz electric field of approximately 7.9 kV/m and a maximum magnetic field of approximately 47.9  $\mu$ T beneath the transmission line. For the short section (between towers 118 to 121 in Ireland) carried on transposition towers<sup>6</sup>, the maximum fields will be approximately 8.0 kV/m and 48.5  $\mu$ T. For the short section (between towers 402 to 410) carried on the existing double circuit towers<sup>7</sup>, the maximum fields will be approximately 7.1 kV/m and 41.6  $\mu$ T.
55. In more than 30 years of study researchers in various scientific disciplines have conducted studies to investigate potential health effects of EMF exposure. Authoritative health and scientific agencies have not concluded that exposures to Extremely Low Frequency (ELF) EMFs at levels encountered in our daily life are a health hazard.
56. Guidelines developed by International Commission on Non-Ionizing Radiation Protection (ICNIRP) form the basis for the European Union's (EU) Recommendation (1999/519/EC) which sets out guidelines for member states on limiting the exposure of the public to EMFs in locations where people spend significant time. The EU Recommendation is the guideline applicable in both Northern Ireland and Ireland and has been taken into account for the proposed interconnector.
57. The calculated levels of EMFs provided above demonstrate that even the maximum field levels produced by the proposed 400 kV line, which would be produced only rarely if ever in practice, are below the EU (1999) exposure limits (basic restrictions).

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<sup>6</sup> These types of towers are required to ensure the efficient operation of the circuit.

<sup>7</sup> For the final 2.8km run into Woodland Substation, the proposed interconnector is carried on existing double circuit towers. The existing Oldstreet-Woodland OHL is installed on the southern side of these towers. The northern side is currently unused and therefore available for use by the proposed interconnector.

58. In summary, even the maximum EMF levels from the proposed 400 kV line are still below EMF guidelines of both Ireland and Northern Ireland, and also the EU. Authoritative reviews of scientific research on topics relating EMFs to health of humans and other species do not show that EMFs at these levels would have adverse effects on these populations.

## Traffic

59. The operational stage of the proposed interconnector will generate minimal volumes of traffic. The construction stage of the proposed interconnector will generate more traffic, albeit temporary, because the primary means of transporting materials and labour to / from site will be via the existing public road network.
60. Due to the nature of the proposed interconnector, the construction phase will consist of multiple separate construction sites. Access to the individual sites will generally be achieved via existing field accesses and existing internal tracks where available. A total of 362 temporary accesses are required from the public road network to construct the proposed interconnector.
61. Despite the scale of the proposed interconnector, the volumes of vehicles required to attend each individual construction location along the length of the linear development will be relatively low and this traffic will be spread out over several weeks (the duration it will take to construct individual towers). Due to the length of the proposed line, traffic will be dispersed over a large area during the construction phase; also construction will occur in any one location for a relatively short duration.
62. The construction of the proposed substation in Turleenan, County Tyrone, the extension of the existing substation in Woodland, County Meath and the operations at the proposed construction material storage yards, located at Carn Industrial Estate, Craigavon and also to the south east of Carrickmacross, County Monaghan will result in higher volumes of traffic over longer periods however these traffic flows will not result in congestion on the road network.
63. Heavy Goods Vehicles (HGVs) will be used to construct the transmission line. Local and minor roads are particularly sensitive to the increase in heavy vehicles as these roads are typically not designed to accommodate large numbers of these types of vehicles. With the proposed mitigation measures, the residual impacts in terms of disturbance caused to the local community in relation to noise, vibration, dust and air quality impacts will be minimised or eliminated.
64. A Construction Traffic Management Plan shall be prepared prior to the commencement of construction operations. The objective of this plan will be to minimise the impact caused by the construction stage of the proposed interconnector.

## Noise

65. Extensive noise surveys have been conducted around the area of the proposed interconnector to establish the existing noise levels. The area is predominantly rural and the noise levels which reflect this are generally low.
66. Potential noise levels from the construction and operation of the proposed interconnector have been evaluated.
67. It is predicted that the highest noise levels from the proposed interconnector will be from the construction noise of the substation and the overhead line. However, this impact will be short term and of a limited nature. Mitigation measures have been provided to reduce the potential 'worst case' impact from construction noise and the contractor will be required to liaise with the Local Authority and residents throughout the construction period. The impact of construction noise and vibration with mitigation measures will not be significant.
68. The overhead line will be subject to an annual survey by helicopter patrol. Helicopter inspections will be announced in advance in local newspapers and through landowner consultations. This is not expected to cause any significant noise impact, will be short term in nature and advance notice will be given to landowners.
69. Once complete the operational noise impact of the proposed overhead line route, towers, and substation will be limited to occasional corona noise<sup>8</sup> and continuous plant noise at the substation. There will be no operational vibration impacts to sensitive receptors for the proposed interconnector.
70. The overhead line and substation noise emissions during operation will be below the recommended levels and targets set by the World Health Organisation (WHO) and are within acceptable limits.
71. The proposed interconnector will not result in any significant noise and vibration effects.

## Ecology

72. The proposed interconnector will not adversely impact upon European and/or Nationally protected sites; however it does have potential to impact upon local populations of protected fauna.
73. Mitigation measures will be implemented at the construction and operation phase to minimise and/or eliminate identified impacts.

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<sup>8</sup> Corona noise comprises two sound components: one is irregular (random crackling noise) sound, and the other is the pure sound (corona hum noise) of buzzing.

74. The level of impacts were assessed from an entire project perspective with the highest impact being minor negative to hedgerows / treelines, Wintering birds (Whooper Swans) and Breeding birds (Lapwing). All other impacts are considered negligible. The term “minor negative” in this context means a change in the ecology of the effected site which has noticeable consequences outside the development boundary, but these consequences are not considered to significantly affect the distribution or abundance of species or habitats of conservation importance.

### Soils, Geology and Hydrogeology

75. Mitigation measures will be implemented at the construction phase to minimise and/or eliminate impacts.
76. The construction phase of the proposed interconnector will impact on the ground and geological conditions through the use of temporary access routes and excavations required for the tower bases and the excavations required for the Turleenan substation.
77. The tower locations have been selected to avoid known areas of intact peat and cutover peat where possible. Intact peat was not identified at any tower location along the line route. Accordingly, it is considered that the excavations required for the proposed interconnector will have no adverse impacts on the more sensitive peat ecosystem.
78. It is considered no significant impacts will occur on the geology and groundwater conditions; accordingly, it is concluded that the proposed interconnector will have no significant transboundary impacts on soils, geology and hydrogeology. With regard to the operational phase of the development, no significant impacts on groundwater are predicted. Any predicted impact on the soils and geology is considered to be Imperceptible.

### Water

79. The construction phase of the proposed interconnector will impact on the water conditions through the use of temporary access routes and excavations required for the tower bases.
80. During construction, mitigation measures will be put into place to prevent impacts to the water environment.
81. The tower locations have been selected to avoid known areas of flood plains and river banks where possible. No significant adverse effects are predicted on the water environment as a result of the construction phase of the proposed overhead line.
82. With regard to the operational phase of the development, no significant impacts on the local water environment are predicted with the proposed mitigation measures. The predicted impact on the water environment is considered to be long term and Imperceptible.

## Air and Climatic Factors

83. The proposed interconnector will have positive long term residual impacts on greenhouse gas emissions as it will facilitate further development and connection of renewable energy sources thereby reducing the dependence on fossil fuels with consequent reduction in greenhouse emissions.
84. In terms of dust, no significant impacts are predicted following the implementation of good construction practice and implementing appropriate mitigation measures.
85. Traffic emissions themselves will not give rise to significant air quality effects from vehicular emissions.
86. With the implementation of mitigation measures no significant local air quality effects are predicted.

## Cultural Heritage

87. Mitigation measures will be implemented at the construction phase to minimise and/or eliminate impacts to previously recorded features and to resolve any unknown features discovered during construction.
88. While the proposed interconnector will not have a direct physical impact on the upstanding remains of any known archaeological sites or architectural features, it will have such an effect on a number of demesne landscapes<sup>9</sup>. The impact on one of the demesne landscapes, Brittas (County Meath) was found to be significant. A further four demesne sites will experience a moderate negative impact in terms of setting.
89. There will be likely significant effects to the setting of a number of features. In summary there will be 24 moderate negative, seven moderate to significant negative and six significant negative impacts to archaeological sites. In addition, there will be three moderate negative and one moderate to significant negative impacts to architectural sites.
90. All other sites in the receiving environment will not be affected by the proposed interconnector or have a slight negative impact.

## Landscape

91. Considerable efforts have been made in the routeing and design processes to avoid or minimise landscape and visual impacts as much as possible. Detailed routeing of the line has sought to achieve the best fit with the landscape using landform and vegetation whilst recognising the technical constraints of the construction and operation of an overhead line.

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<sup>9</sup> Areas associated with manor estates.

92. The proposed overhead line and substation will be located within an area that is primarily agricultural, consisting of low rolling hills, shallow valleys and structured fields, which often have overgrown hedgerows and many mature trees.
93. After construction, the towers and overhead lines would remain as significant visual elements in the landscape.
94. Over time, any vegetation cut back during construction will re-grow and any new replacement planting will become established. Clearance of vegetation that could fall on the overhead line, inspections and repairs are activities that will be undertaken on occasions, however, the level of activity in the landscape would be greatly reduced.
95. Mitigation measures will reduce visual impacts of the proposed Turleenan substation and would see the earthworks and entrance road heavily planted with woodland. Over time, as the mitigation landscape matures, views of the substation would be reduced.
96. There will be significant impacts on the landscape of some parts of the assessed area. There would also be significant visual effects from many locations from within the immediate area of the overhead line route. However, it is considered that the landscape and visual resource of the wider assessed area along the proposed interconnector would not be impacted to a significant degree and the overall landscape and visual impact in general will be limited to those receptors/areas within close proximity to the towers and overhead line.

## Cumulative Impacts and Interactions

97. During the assessment process, coordination took place between assessment specialists to ensure that interacting impacts arising from the proposed interconnector were identified, assessed and, where appropriate, mitigated.
98. The assessment of cumulative impacts between the proposed interconnector and other developments has included identification of the other planned developments which have not yet been constructed. This has led to the identification of other overhead line projects. Other developments also include proposed chicken sheds and wind turbines.
99. The cumulative effects are generally predicted to be Not Significant. However there will be separate significant landscape and visual cumulative impacts with the proposed interconnector and the proposed wind turbines at Teevurcher, Raragh, Old Mill Wind Farm (Lisduff), Emlagh Wind Farm and the future Kingscourt substation.

# 1. Introduction

## 1.1 The Proposed Interconnector

1. EirGrid plc (EirGrid) and System Operator for Northern Ireland Ltd (SONI)<sup>10</sup> are jointly planning a major cross-border electricity transmission development between the existing high-voltage transmission networks of Ireland<sup>11</sup> and Northern Ireland. The overall interconnector project (which is termed the 'proposed interconnector'<sup>12</sup>, for the purposes of this Joint Environmental Report (JER)), is a 400kV overhead line between the existing 400 kV substation in Woodland, County Meath with a planned substation in Turleenan, County Tyrone. The proposed interconnector will provide a second high capacity electricity interconnector between Ireland and Northern Ireland, and is planned to be constructed within the counties of Tyrone, Armagh, Monaghan, Cavan and Meath. The existing interconnector, i.e. a 275 kV double circuit overhead line, connects the existing Tandragee and Louth substations.
2. As the proposed interconnector is being developed in two jurisdictions, separate planning applications for those elements of the proposed interconnector within Ireland and within Northern Ireland are being submitted, by EirGrid and SONI respectively, to the competent authorities in each jurisdiction. The application in each jurisdiction is accompanied by an Environmental Impact Statement (EIS) and Environmental Statement (ES) respectively<sup>13</sup>, prepared in accordance with the requirements of the EIA Directive and the respective applicable national legislation and guidelines.
3. As the project has developed over a number of years, the terminology used to describe the proposed interconnector has also developed. For clarity, the following terms have been used:
  - The **proposed interconnector**: The overall project from Turleenan to Woodland (i.e. both the SONI and EirGrid sections), including all proposed works;
  - The **Tyrone – Cavan Interconnector**: That portion of the proposed

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<sup>10</sup> The planning of that portion of the proposed interconnector within Northern Ireland was originally undertaken by Northern Ireland Electricity (NIE). However, NIE was obligated by the European Commission to transfer its investment planning function (the "Planning Function") to SONI. The SONI transmission system operator licence (the "Licence") was amended on 28th March 2014 to take account of the transfer of the Planning Function following a consultation process by the Northern Ireland Authority for Utility Regulation (NIAUR). The Licence amendments took effect on 30th April 2014. Accordingly, responsibility for the pursuance of the planning application in respect of the proposed interconnector within Northern Ireland has been transferred from NIE to SONI.

<sup>11</sup> Often referred to as 'Republic of Ireland'.

<sup>12</sup> The term 'proposed interconnector' in this JER extends the description of the proposed interconnector in the Tyrone-Cavan Interconnector Consolidated ES to include the area between the location of the (previously proposed) substation in the vicinity of Kingscourt, County Cavan, and the existing substation at Woodland, County Meath, as described in this JER.

<sup>13</sup> The Environmental Statement that was submitted in Northern Ireland in 2013 was submitted by Northern Ireland Electricity (NIE). For the purposes of this JER, it will be referred to as the 'Consolidated ES'. The Environmental Impact Statement that was submitted in Ireland in 2014 will be referred to herein as the 'EIS'.



interconnector located in Northern Ireland being proposed by SONI; and,

- The **North-South 400 kV Interconnection Development**: That portion of the proposed interconnector located in Ireland being proposed by EirGrid.
4. The respective applicants and their consultants have closely coordinated their activities to ensure an integrated approach has been undertaken to the design of the proposed interconnector and to the appraisal of its environmental impacts, including transboundary and cumulative effects.

## 1.2 Guidance and Legislation on Transboundary Projects

### 1.2.1 Espoo Convention on Environmental Impact Assessment

5. The basic requirement of the EIA process is to ensure that, before development consent is given, projects likely to have significant effects on the environment are made subject to an assessment with regard to their effects. This requires an assessment of effects regardless of their location or of national borders.
6. As early as 1972, at the Stockholm Conference on the Human Environment, the international community recognised that States are responsible for ensuring that activities within their jurisdiction or control do not cause damage to the environment of other States or of areas beyond their control. This conference was followed by the establishment of an experts' group and the drafting of a Convention on EIA in a transboundary context, which was adopted at Espoo in Finland in 1991 (and amended in 2001 and 2004). The Espoo Convention entered into force on 10 September 1997 and has been ratified by the European Union, Ireland and the United Kingdom. The Espoo Convention sets out the obligations of parties to assess the environmental impact of certain activities at an early stage of planning. It also lays down the general obligation of States to notify and consult each other on all major projects under consideration that are likely to have a significant adverse environmental impact across boundaries.
7. The Espoo Convention is aimed at preventing, mitigating and monitoring environmental damage by ensuring that explicit consideration is given to transboundary environmental factors before a final decision is made as to whether to approve a project.
8. The provisions of the Espoo Convention are reflected in amendments which have been made to the EIA Directive and to national legislation.

## 1.2.2 European Commission Guidance on Transboundary Projects

9. In May 2013, the European Commission published *Guidance on the Application of the Environmental Impact Assessment Procedure for Large-scale Transboundary Projects* (herein referred to as the 'EC Transboundary Guidance document'), which provides guidance for applying the legal provisions related to EIA of large-scale projects. However, as stated in the document, this guidance does not create any obligation for Member States or project developers. Nonetheless, as the guidance explains, "user-friendly information" is provided to competent authorities, developers, EIA practitioners and other stakeholders. The substantive aim of the EC Transboundary Guidance document is to provide an outline of how to apply "transboundary EIA procedure" to "large-scale transboundary projects", which are defined in the EC Transboundary Guidance document as those which are "*physically located in more than one country*" (such as the proposed interconnector).
10. The EC Transboundary guidance document defines "Large scale transboundary projects" as projects which are implemented in at least two Member States or having at least two Parties of Origin, and which are likely to cause significant effects on the environment or significant adverse transboundary impact. The EC Transboundary guidance document then describes seven key steps in a Transboundary EIA for such projects:
- 1. Notification and transmittal of information;*
  - 2. Determination of the content and extent of the matters of the EIA information – scoping;*
  - 3. Preparation of the EIA information/report by the developer;*
  - 4. Public participation, dissemination of information and consultation;*
  - 5. Consultation between concerned Parties;*
  - 6. Examination of the information gathered and final decision; and,*
  - 7. Dissemination of information on the final decision." (Page 4)*
11. In terms of the scope of any prepared EIA report, the EC Transboundary Guidance document states that the following should be included:
- a description of the proposed project and its purpose;*
  - a description, where appropriate, of reasonable alternatives (e.g. in terms of location, technology to be employed, etc.) and also the no-action alternative;*
  - a description of the environment likely to be significantly affected by the proposed project and its alternatives;*
  - a description of the potential environmental impact of the proposed project and its alternatives and an estimate of its significance;*

- a description of the mitigating measures considered and an indication of the predictive methods, assumptions and data on which they are based; and
- an outline of monitoring and management programmes and any plans for post-project analysis.

*In addition, when determining the EIA report's scope and level of detail, it should be kept in mind that EIA has a wide scope and broad purpose and it should be carried out in a way that takes into account the specific character and effects of each project.” (page 9)*

12. The EC Transboundary guidance document further states:

*“For large-scale transboundary projects, the developer must comply with the requirements of the national EIA requirements of each country in which the project will be implemented. The developer should prepare individual national EIA reports and a **joint environmental report that covers the whole project and assesses its overall effects, in particular cumulative and significant adverse transboundary effects.**” (Emphasis added) (page 10)*

13. It is considered that the EC Transboundary guidance document provides a useful consolidation of current best practice for projects such as the proposed interconnector.

14. Finally, in this context, it should be noted that the EC Transboundary guidance document should be read in conjunction with Regulation EU/347/2013 on guidelines for trans-European energy infrastructure (‘the new TEN-E Regulation’), which sets out a number of provisions designed to streamline permitting procedures for energy infrastructure projects of common interest (PCI) contained in an EU list established pursuant to the Regulation. Pursuant to the provisions of EU Regulation 347/2013 and Commission Delegated Regulation 1391/2013 of 14 October 2013, the “Ireland – United Kingdom interconnection between Woodland (IE) and Turleenan (UK – Northern Ireland)”, is specifically listed under the heading “Priority corridor North–South electricity interconnections in Western Europe (“NSI West Electricity”)”<sup>14</sup>.

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<sup>14</sup> In this respect the European Commission has issued a Guidance Document entitled *Streamlining Environmental Assessment Procedures for Energy Infrastructure ‘Projects of Common Interest’ (PCIs)* (24 July 2013).

## 1.3 This Report

### 1.3.1 Report Context

15. The Consolidated ES and EIS submitted in respect of the proposed interconnector to the respective competent authorities have taken full account of the requirements of EIA legislation in both jurisdictions and as far as appropriate, the EC Transboundary Guidance.
16. Certain aspects of the EIA process in respect of the proposed interconnector predate the publication of the EC Transboundary guidance document. Despite this, EirGrid and SONI are of the view that the planning processes for the proposed interconnector would benefit from the preparation of a Joint Environment Report, with the approach suggested in the EC Transboundary guidance document. Accordingly, this report has been prepared in addition to the published Consolidated ES and EIS, submitted to the relevant competent authorities, taking account of the information which has already been provided within those documents.
17. The environmental information set out herein comprises an appraisal of the proposed interconnector as a whole i.e., 'from A to Z' (as suggested in the EU Transboundary Guidance document). Thus, EirGrid and SONI, as the project developers, have prepared an appraisal of the proposed interconnector's overall impact, in a holistic manner, in order to enable an assessment of the overall effects of the proposed interconnector and, in particular, cumulative and significant adverse transboundary effects.
18. Because of differing national legislation and procedure, it was apparent that it would not be possible to submit a single application for development consent for the entire project in both jurisdictions. However, the preparation of the Consolidated ES and EIS has been closely coordinated and the cumulative effects and transboundary effects of the proposed interconnector have been considered appropriately, so that a coherent EIA process by each competent authority has been facilitated.

### 1.3.2 Report Structure

19. This Joint Environment Report is structured along similar lines to the published Consolidated ES and EIS for the proposed interconnector except that the report addresses the proposed interconnector in its entirety and assesses its overall effects, in particular cumulative and any potentially significant adverse transboundary effects.
20. The chapter structure of this report mirrors, to a significant extent, the chapter titles of the published Consolidated ES and EIS, with some differences due to differing

guidance as between the two jurisdictions. However, the fundamental issues and EIA approach are considered to be consistent as a result of the high degree of coordination between the project teams. **Appendix A** provides reference to the relevant chapters of the Consolidated ES and EIS.

21. The structure of this JER is as show in **Table 1.1**.

**Table 1.1: Chapter Structure of the Joint Environment Report**

Joint Environment Report Chapter	Overview
Non-Technical Summary	A summary of the Joint Environmental Report
1 – Introduction	General overview of report.
2 – Project Description and Purpose	A description of the Project Need and the Project Description.
3 – Alternatives	A description of the assessed Location and Technological Alternatives for the proposed interconnector.
4 - Population - Socio-economics	An overall assessment of the effects of the proposed interconnector.
5 - Population – Tourism	
6 - Population - Land Use	
7 - Material Assets	
8 – EMF	
9 – Traffic	
10 – Noise	
11 – Ecology (Fauna and Flora)	
12 – Soils, Geology and Hydrogeology	
13 – Water	
14 – Air and Climatic Factors	
15 – Cultural Heritage	
16 – Landscape	
17 – Cumulative Impacts and Interactions	
18 – Conclusions	Summary of findings of the Joint Environmental Report.

### 1.3.3 JER Chapter Structure

22. The overall assessment of the effects of the proposed interconnector is presented in Chapters 4 – 17 of this JER. The chapters have been prepared based on the project consultants' professional experience and having had regard to relevant national and international assessment guidelines. Details of the methodology used in the assessment of each environmental topic have been included in the individual chapters.
23. Each assessment chapter follows the same general format as follows:
- **Introduction:** a brief summary of what is considered in the chapter;
  - **Methodology:** a description of the methodology that has been used in the assessment of the environmental topic;
  - **The Receiving Environment:** a description of the existing environmental conditions against which the predicted environmental effects have been assessed;
  - **Mitigation Measures:** measures that will be implemented to ensure that the effects are minimised or eliminated;
  - **Residual Impacts:** assessment of significance of effects during construction and operation after implementation of mitigation measures;
  - **Transboundary Effects:** assessment of significance of cross border effects; and
  - **Conclusions:** a summary of the assessment.
24. Cumulative impacts and interactions in respect of each topic have been compiled and are considered in Chapter 17.
25. The potential impacts of the proposed interconnector are not reported in the assessment chapters of this JER. The potential impacts are identified in the Consolidated ES and EIS for the proposed interconnector. For the purposes of this JER, it is considered that the potential impacts are those identified in the EIS and Consolidated ES and that the mitigation measures described in each of these documents are an integral part of the character of the proposed interconnector, and that the reported residual impacts described herein (i.e. after implementation of mitigation measures) demonstrate the likely significant effects of the proposed interconnector. The term "assessed area" is used in this report to describe that area which has been evaluated in both the Consolidated ES and the EIS for the proposed interconnector. The assessed area refers to the location of the proposed substation at Turleenan, County Tyrone and the overhead line which extends to Woodland,

County Meath and the wider vicinity. The assessed area will vary for each particular environmental topic.

### 1.3.4 Change of Applicant in Northern Ireland

26. EirGrid and System Operator for Northern Ireland (SONI) are jointly planning a major cross-border electricity transmission development between the existing transmission networks of Ireland and Northern Ireland. The planning of that portion of the proposed interconnector within Northern Ireland was originally undertaken by Northern Ireland Electricity (NIE). However, NIE was obligated by the European Commission<sup>15</sup> to transfer its investment planning function (the “Planning Function”) to SONI. The SONI transmission system operator licence (the “Licence”) was amended on 28th March 2014 to take account of the transfer of the Planning Function following a consultation process by the Northern Ireland Authority for Utility Regulation (NIAUR). The Licence amendments took effect on 30<sup>th</sup> April 2014. Accordingly, responsibility for the pursuance of the planning application in respect of the proposed interconnector within Northern Ireland has been transferred from NIE to SONI.
27. Following the transfer of its Planning Function to SONI, NIE will continue to be responsible for the construction, ownership and maintenance of the transmission system in Northern Ireland. Subject to planning consents being obtained for the proposed interconnector within Northern Ireland, NIE will be responsible for its construction, in accordance with said consents.
28. For the avoidance of doubt in this regard, any reference to NIE in the plans and particulars of this application for approval specifically regarding the planning and consenting of the proposed interconnector, and whether accidental or deliberate, should be understood as now referring to SONI in the context of its newly acquired statutory responsibility for the pursuance of the planning application in respect of the proposed interconnector. However, certain references to NIE within the application particulars refer to matters undertaken by NIE in accordance with its statutory functions prior to the transfer of the planning function to SONI. This includes certain documents prepared by NIE, and indeed, the current application for statutory consent of that portion of the proposed interconnector within Northern Ireland.

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<sup>15</sup> In accordance with European Commission Decision of 12th April 2013 made pursuant to Article 3(1) of Regulation (EC) No 714/2009 and Article 10(6) of Directive 2009/72/EC - United Kingdom (Northern Ireland) - SONI/NIE.

## 2. Project Description and Purpose

### 2.1 Project Need

1. The proposed interconnector is an electricity transmission development of long-term strategic importance for the island of Ireland and will deliver benefits for electricity customers in three key areas:
  - Improving competition and reducing existing constraints which currently restrict the efficient performance of the electricity market, thereby putting downward pressure on electricity prices;
  - Supporting the development of renewable power generation – by enhancing the flexible exchange of power flows over a large area of the island. This will facilitate the connection and operation of larger volumes of renewable power generation (especially wind powered generation) throughout the island; and,
  - Improving security of supply – by providing an additional, dependable, high-capacity link between the two transmission systems on the island of Ireland.
2. The proposed interconnector is supported by European Union Directives which require enhanced electricity interconnection between EU member states and improved conditions for energy competition throughout Europe. Indeed, the development of the proposed interconnector has been part funded by the EU Trans-European Networks (TEN-E) programme, in which it has been listed as a “priority project” or “Project of Common Interest”. The proposal is jointly supported by the Governments of both the UK and Ireland and is fully compliant with energy policy in both jurisdictions, having received support from the Department of Communications, Energy and Natural Resources (DCENR – Ireland) and the Department of Enterprise, Trade and Investment (DETI – Northern Ireland). The proposed interconnector is also supported by the Commission for Energy Regulation and the Northern Ireland Utility Regulator.

### 2.2 Overall Project Description

3. The proposed interconnector comprises a 138km overhead line between substations in Turleenan, County Tyrone and Woodland, County Meath and can be summarised as follows:
  - **Turleenan Substation:** the construction and operation of a new 275kV / 400kV substation at Turleenan townland, north-east of Moy, County Tyrone;



- **The 275kV Towers at Turleenan Substation:** the removal of an existing 275kV suspension tower and the construction and operation of two new 275kV terminal towers, including the temporary diversion of the 275kV line, to provide for connection of the Turleenan substation to existing network;
  - **The 400kV Towers and Overhead Line:** The construction and operation of a single circuit 400kV overhead transmission line supported by 401 new towers for a distance of approximately 138km from the substation (at Turleenan) to an existing double circuit tower (Tower 402) in the townland of Bogganstown, Meath. The overhead line will be a minimum of 9.0m above ground level;
  - **Use of existing 400kV Double Circuit Towers:** It also includes the addition of a new 400 kV circuit for some 2.85km along the currently unused (northern) side of the existing double circuit 400 kV overhead transmission line (the Oldstreet to Woodland 400 kV transmission line) extending eastwards from Tower 402 in the townland of Bogganstown, County Meath to Tower 410 and the Woodland Substation in the townland of Woodland, County Meath;
  - **Associated Works:** Works to include, where appropriate, site leveling, site preparation works, modifying existing access points, construction of new access points, construction of new access lanes, construction of working areas, stringing areas, guarding, site boundary fencing, related mitigation works, formation of access tracks and other associated works at the substation and at the tower locations.
4. The proposed interconnector is illustrated in a series of figures – refer to the **Figures** section at the end of the report.
  5. Within counties Tyrone and Armagh there will be 102 (no.) 400kV towers constructed to support the overhead line and the line will run for approximately 34km from Turleenan to the border between the townland of Doohat or Crossreagh in County Armagh and the townland of Lemgare in County Monaghan. Owing to the delineation of the jurisdictional border, the overhead line will, in addition, over-sail an additional portion of land within the Northern Ireland townland of Crossbane for a short distance of approximately 0.2km (between Towers 106 and 107, both of which are located in the townland of Lemgare, County Monaghan).
  6. Within counties Monaghan, Cavan and Meath, there will be 299 (no.) new 400kV towers constructed to support the overhead line. In addition the proposed interconnector will utilise 9 existing towers for the final section into Woodland Substation. These 308 (no.) towers are located along a section of approximately 103.35km from Tower 103 (which is located just south of the border in the townland

of Lemgare, County Monaghan) to the most southerly tower (Tower 410) at Woodland Substation in County Meath.

7. The proposed 138km transmission line will comprise towers and support structures (including temporary support structures) ranging in overall height from 26m – 61m over ground level (61m towers are existing towers) incorporating both jurisdictions. The maximum foundation size is 6m deep and 25m in length x 25m in width (proposed 275kV tower at Turleenan substation). The majority of towers will be smaller than this size.
8. The construction period for the entire proposed interconnector has been estimated as three years from the start of the site works, but the construction period at any particular location along the overhead line route would be in the order of four to six months. The construction of the Turleenan substation will take up to three years, and will be undertaken in parallel with the overhead line construction activity. The Turleenan substation will be constructed in several stages including site entrance, access roads, site clearance, installation of drainage, construction of roads, installation of equipment/construction of building and completion of access roads.
9. The construction of each tower in the overhead line will be undertaken in five general stages, according to the following sequence, on a rolling programme of estimated durations: These stages are not necessarily consecutive due to the work required at adjoining tower bases and construction process. For example 21 days curing time will be required between stages 2-3. Likewise between stages 3-4 periods of time will lapse to allow for constructing the suspension towers between each angle tower. This could typically be 2-4 months. Final land reinstatement can be up to a year following the completion of all works allowing for ground consolidation and reseeded land damage.
  - Stage 1 - Preparatory Site Work (1 - 7 working days);
  - Stage 2 - Tower Foundations (3 - 6 working days);
  - Stage 3 - Tower Assembly and Erection (3 - 4 working days);
  - Stage 4 - Conductor/ Insulator Installation (7 working days); and
  - Stage 5 - Reinstatement of Land (1 - 5 working days).
10. The construction methodology will be implemented in line with international best practice and will fully comply with all relevant health and safety requirements. The ground conditions encountered vary along the proposed interconnector hence the construction techniques and machinery/equipment required will vary to accommodate these variations in ground conditions.

11. There will be two construction depots for the proposed interconnector: NIE's existing depot at Carn Industrial Estate, Craigavon, County Armagh; and a proposed site to the south east of Carrickmacross, County Monaghan. The depots will be used to store construction vehicles and equipment. Materials for all of the construction phase (overhead line and towers) will be stored there also.
12. Carn is NIE's main regional depot in the southern half of Northern Ireland. It is adjacent to the M12 Carn roundabout and 15 miles (24km) from the proposed Turleenan substation. The proposed Carrickmacross site is located to the west of the N2 and is accessed by a local road (the L4700). The existing access into the storage yard is located adjacent to a junction on the public road network and has restricted visibility. As such, it is proposed to construct a new site entrance onto the L4700 further south of the existing entrance.
13. During the construction phase, temporary access tracks and other ancillary works will be required at the Turleenan substation site and at each of the tower locations. Temporary accesses capable of taking construction plant, construction materials and personnel are required for the construction of the proposed interconnector. Temporary accesses include access tracks, access to stringing locations, access to guarding locations and access to low voltage crossing locations.
14. The proposed works at Woodland Substation include a western extension of the existing compound; modifications to the existing palisade fence and the addition of electrical equipment/apparatus. Other modifications include installation of current transformers, inductive voltage transformers, disconnectors, pantograph disconnecting switches, surge arresters, support insulators and support insulator bars; gantry structures; and a lightning monopole; and all associated ancillary construction and site development works.
15. Ancillary works include environmental mitigation measures, stringing of the line, guarding locations over roads, overhead lines, and some rivers, service diversions and other measures that are necessary to minimise the construction phase impacts.
16. Outline Construction Environmental Management Plans (outline CEMP) have been prepared for the SONI and EirGrid Proposals. These outline CEMPs ensure that all mitigation measures which are considered necessary to protect the environment, prior to construction, during construction and/or during operation of the proposed interconnector, are fulfilled. The outline CEMPs have been prepared following close co-ordination and are consistent in their approach with minor differences to take account of the respective national legislation and guidance.

## 3. Alternatives

### 3.1 Introduction

1. The examination and evaluation of alternatives that have been undertaken for the proposed interconnector have been performed in accordance with EU and national EIA legislation for both jurisdictions, which require that an ES and EIS should contain “*An outline of the main alternatives studied by the developer and an indication of the main reasons for this choice, taking into account the environmental effects*” (Codified EIA Directive 2011/92/EU, Annex IV, Point 2).
2. In terms of alternatives there are two key variables that have been assessed – the technological alternatives (i.e. the type of system that could be used, e.g., HVAC or HVDC) and the alternative locations and routeing (i.e. the route that the line could take).
3. The process also included the assessment of the “Do Nothing” or “No Action” alternative (i.e. the circumstance where no development occurs). In this case, under a Do Nothing alternative, no changes or alterations would be made to the existing strategic transmission infrastructure. Under the Do Nothing alternative, the interrelated strategic needs for additional interconnection between the two electricity transmission systems on the island of Ireland would not be addressed. Doing nothing would fail to address the need to improve the efficiency of the electricity market, as required by the “Third Energy Package” of existing European Union Directives and Regulations, and would impede the realisation of all-island government policies to increase renewable energy generation. Also, it would not deliver the additional electricity transfer capacity needed to deliver improvements in the security of electricity supply within the island of Ireland in general. Given that the extent of the existing electricity interconnection between the transmission systems of Northern Ireland and Ireland is insufficient to achieve these key objectives, the Do Nothing alternative is not acceptable, and so the respective applicants have both rejected it.
4. The respective applicants have co-ordinated closely to rigorously assess all viable alternatives. Both parties examined and identified alternatives for achieving enhanced transmission system interconnection between Northern Ireland and Ireland meeting the specific performance requirements and having regard to key environmental issues. The process involved a number of separate elements including the consideration of options for the initial design capacity, an assessment of available transmission methods, and the identification of critical performance features required of the proposed interconnector.

## 3.2 Technological Alternatives

5. The examination of technological alternatives included reference to studies and reports produced by internationally recognised consultants, some commissioned by the respective applicants, and others commissioned by Government. The conclusions from these reports have informed the respective applicants' assessment of the alternatives, and helped to confirm their view that the most practical solution to meet the need for interconnection would be a high voltage alternating current (HVAC or AC) overhead transmission line.
6. The principal conclusions confirming the selection of an overhead line as the selected method for delivery of the proposed interconnector are as follows:
  - The rejection of undersea technology as presenting unnecessary elements of risk, environmental impact and significant additional cost where practical overland transmission system connection alternatives exist;
  - Recognition that high voltage direct current (HVDC) offers no significant technical or environmental advantages, but presents considerable additional significant complexity, cost and risk in comparison with HVAC technology;
  - The worldwide predominance of HVAC overhead lines for transmission applications, and the absence of any transmission application worldwide of an underground HVAC cable circuit approaching the length of the proposed interconnector at the designed voltage;
  - The significant additional lifetime cost and technical complexity associated with the adoption of underground cable technology for high voltage transmission circuit applications, together with the increased impacts during the construction stage; and,
  - The superior reliability and performance of AC overhead line technology when applied to integrated transmission systems.
7. The overall conclusion drawn by the respective applicants is that the assessment of the transmission alternatives fully supports their proposal to construct the proposed interconnector by means of a 400kV AC single circuit overhead transmission line.

### 3.3 Location and Routeing Alternatives

8. The respective applicants have undertaken a process to evaluate alternative positions for transmission system connection, viable route corridors for an overhead transmission line between the selected connection points and the two transmission systems on the island of Ireland, as well as detailed overhead line route selection. The process has been undertaken in accordance with the respective applicant's objective to minimise the environmental impact of the proposed interconnector in accordance with published Guidelines and best practice.
9. Numerous alternatives have been considered for the connection, design, location and routeing of the proposed interconnector:
  - Alternative system connection options. The identification of five possible and technically feasible solutions. Of these five, two (the Western Option and the Multiple 110kV Option) were rejected at a relatively early stage since they were considered to present poor power transfer capabilities in comparison with other feasible options;
  - Alternative study areas were identified in association with the remaining three connection options, two alternative "Mid-Country" connection options (including the eventually selected option of a connection between Drumkee, County Tyrone and Kingscourt, County Cavan) and an Eastern connection option that would have duplicated the existing interconnector connection between Tandragee and Louth;
  - Identification and assessment, having regard to the likely significant environmental impacts, of alternative route corridor options within the Mid-Country and Eastern study areas, leading to the choice of a preferred route corridor between Drumkee and Kingscourt;
  - Assessment of the tower design to determine the best available option;
  - The identification and evaluation of alternatives to the detailed overhead line routing within the preferred route corridor, and the application of established overhead line routeing principles (including land owner consultation and a combination of environmental and practical considerations) to the identification of a finalised route for the proposed overhead line;
  - The identification and evaluation of three alternative substation locations in the vicinity of the chosen transmission system connection point, leading to the choice of Turleenan near Moy, County Tyrone (rather than the initial location near Drumkee); and

- The evaluation of alternatives for the substation design and layout, and the final choice of technology used in order to reduce the overall footprint and environmental impact of the proposed substation.
10. The proposed interconnector has been subject to an extensive examination of alternatives. The mitigation of environmental impacts by design has been a fundamental aspect of the respective applicants' development process. This has also been the approach for the selection of the location of the proposed Turleenan substation. The routeing and site location selection are considered to represent the best overall options amongst the many alternatives considered throughout the development process.

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## 4. Population – Socio-Economic

### 4.1 Introduction

1. This section considers the likely significant impacts of the proposed interconnector, (from Turleenan, County Tyrone to Woodland, County Meath) on the socio-economic aspects in the receiving environment.
2. The relevant chapter of the published Consolidated ES is Chapters 14 (Community Amenity and Land Use) and Chapter 15 (Socio-Economics). The relevant chapter of the EIS is Chapter 2 (Human Beings – Population and Economic) of Volumes 3C and 3D.

### 4.2 Methodology

3. The baseline conditions in relation to demographics were determined from a review of relevant population and demographic data, published by the Central Statistics Office (CSO) of Ireland and the Northern Ireland Statistics and Research Agency (NISRA), as well as national, regional and local statutory development plans. Demographic data and profiles of settlements in the assessed area are provided in the Consolidated ES and the EIS. The purpose of this evaluation is to identify all settlements in the assessed area and to provide an overview of differing settlement patterns throughout the assessed area and how the proposed interconnector could potentially affect demographics and settlement patterns. Consideration of the potential for economic and employment impacts arising as a result of the proposed interconnector are also considered.
4. The assessment of impacts for the proposed interconnector is based on the professional expertise of the project consultants and takes into account relevant guidance such as:
  - EPA Guidelines on the Information to be Contained in Environmental Impact Statements (2002); and,
  - Department of the Environment Community and Local Government (2013) Guidelines for Planning Authorities and An Bord Pleanála on carrying out Environmental Impact Assessment
5. The impact assessment methodologies used in both the Consolidated ES and EIS are broadly similar.
6. For further details please see Consolidated ES Chapter 14 (Community Amenity and Land Use), Section 14.2, Chapter 15 (Socio-Economics), Section 15.2 and EIS



Volumes 3C and 3D, Chapter 2 (Human Beings – Population and Economic)  
Section 2.2.

## 4.3 The Receiving Environment

### 4.3.1 Demographics

7. Population statistics published by the CSO and NISRA show an increase of over 14% in population on the island of Ireland between 2002 and 2011, increasing from approximately 5.6 million to 6.4 million during that period. Population projections for both Ireland and Northern Ireland anticipate further long-term population growth with a forecast population in excess of 7 million people on the island of Ireland by 2034.
8. There are a number of larger towns located in the assessed area including Armagh, Dungannon, Carrickmacross, Castleblayney, Ballybay, Shercock, Kingscourt, Navan, Dunsoughlin and Trim. Smaller towns in the assessed area include Moy, Benburb, Blackwatertown, Tullysaran, Artasooly, Killylea, Drumsallen, Aghahvilly, Maddan, Derrynoose, Nobber, Summerhill, Kilmainhamwood and Kilmessan. Below this settlement level there are other smaller settlements located throughout the assessed area. Individual rural dwellings are a feature of settlement patterns throughout the assessed area.
9. The proposed interconnector avoids larger settlements and smaller towns. However, due to the prevalence of individual rural dwellings throughout the assessed area, the positioning of the proposed infrastructure is affected by this type of settlement. In considering individual rural dwellings one of the design criteria for routing transmission infrastructure seeks to maximise the distance from the overhead line to such dwellings in so far as is practicable.
10. Community facilities, such as schools, churches and sports clubs, where large numbers of people frequently visit, are often found outside of the settlements referred to previously. Similarly to dwellings, an additional design criterion seeks to maximise the distance to such community facilities.

### 4.3.2 Employment and Economic Activity

11. The economic base in the assessed area has traditionally focussed on the following sectors; manufacturing, agriculture and food production, service industry (including education, health, professional services and retail), rural development and tourism. While there are some internationally traded services located in the assessed area, particularly in the larger urban centres, inward investment levels have to date been relatively low when compared to large cities such as Dublin and Belfast.

12. While employment and economic activity is dispersed throughout the assessed area, it is concentrated in the main towns, with the exception of farm based employment, which is dispersed. Given the concentration of employment in larger urban areas such as the Greater Dublin Area (GDA) and the Belfast Metropolitan Area (BMA), a significant proportion of the population commutes for work to areas outside the assessed areas.
13. While the economic downturn in recent years has resulted in an increase in unemployment throughout the assessed area, border counties have suffered more than larger urban areas which have a more diverse economic base. Employment trends anticipate a continued contraction in the traditional sectors of the economy. It is therefore the aim of both economic development authorities in both Ireland and Northern Ireland counties to diversify and increase employment and economic activity across a wide range of sectors including agri-food, internationally traded services, renewable energy, life sciences and tourism.
14. In this regard it is necessary that adequate infrastructure and services are available to support economic development.
15. For further details please see Consolidated ES Chapter 14 (Community Amenities and Land Use), Section 14.3, Chapter 15 (Socio-Economics), Section 15.3 and EIS Volumes 3C and 3D, Chapter 2 (Human Beings – Population and Economic) Section 2.4.

#### **4.4 Mitigation Measures**

16. Population demographics are influenced by wider social and economic factors and will continue to change in future years irrespective of whether this proposed interconnector proceeds. Therefore, no mitigation measures are required.
17. In terms of minimising the potential for impacts on the amenities of existing and future populations, the principal mitigation measure has been incorporated into the design stage by maximising the distance between the proposed interconnector and larger urban settlements, local villages, clustered settlements, individual one-off dwellings, schools, churches and community facilities.
18. For further details please see Consolidated ES Chapter 14 (Community Amenities and Land Use), Section 14.5, Chapter 15 (Socio-Economics), Section 15.5 and EIS Volumes 3C and 3D, Chapter 2 (Human Beings – Population and Economic) Section 2.6.

## 4.5 Residual Impacts

### 4.5.1 Construction Phase

19. The construction phase of the proposed interconnector will not have any significant impacts on population demographics.
20. In economic terms, the capital value of the proposed interconnector is estimated to be in the region of €286 million. The construction phase will involve the provision of direct and indirect jobs both on and off site, over the construction period. Like other major construction projects, this project will be put out for competitive tender. Therefore, it is not possible to state what volume of construction materials, services etc. will be purchased in the assessed area. Materials such as concrete and other standard materials may be sourced locally, where possible. Other more specialised electrical materials such as steel towers, conductors, insulators and other line hardware are likely to be sourced outside the assessed area. Indirect employment and economic activity in local shops, restaurants and hotels is likely to be sustained as a result of the construction project and its employees being located in the assessed area.
21. Therefore, during the construction phase of the proposed interconnector there are likely to be some local positive economic benefits in the assessed area.
22. For further details please see Consolidated ES Chapter 14 (Community Amenity and Land Use), Section 14.6, Chapter 15 (Socio-Economics), Section 15.6 and EIS Volumes 3C and 3D, Chapter 2 (Human Beings –Population and Economic) Section 2.7.

### 4.5.2 Operational Phase

23. When operational, the proposed interconnector will contribute towards ensuring that the electricity grid is not a barrier to further significant investment in employment generating activities in the island of Ireland. The proposed interconnector will result in wider economic benefits as assessed in Section 5.7 (Transboundary Effects).
24. By maximising the distance between the proposed interconnector and larger urban settlements, local villages, clustered settlements, individual one-off dwellings, schools, churches and community facilities during the Routeing stages, significant negative effects have been avoided.
25. For further details please see Consolidated ES Chapter 14 (Community Amenity and Land Use), Section 14.6, Chapter 15 (Socio-Economics), Section 15.6 and EIS

Volumes 3C and 3D, Chapter 2 (Human Beings –Population and Economic) Section 2.7.

## 4.6 Transboundary Effects

26. There will be wider economic benefits arising from the improvements to the electricity grid in the island of Ireland, which will be experienced in both jurisdictions. Studies by the Transmission Systems Operators have calculated annualised benefits to the market from the delivery of the proposed interconnector in the order of €20m per annum in 2020 rising to a range of between €40m and €60m by 2030. This is a significant positive economic transboundary impact.
27. For further details please see Consolidated ES Chapter 20 (Transboundary Impacts) and EIS Volumes 3C and 3D, Chapter 2 (Human Beings –Population and Economic) Section 2.9.

## 4.7 Conclusions

28. The likely impacts during both the construction and operational phases have been evaluated. The construction phase will result in a significant capital spend that is likely to benefit the assessed area and the wider area in terms of equipment purchased, employment and indirect impacts (e.g. accommodation for construction workers and spending in the hospitality industries).
29. The routing of the proposed overhead line is considered to present the best overall option amongst the many alternatives considered throughout the development process. In terms of minimising the potential for impacts on the amenities of existing and future populations, the principal mitigation measure has been incorporated into the design stage by maximising the distance between the proposed interconnector and larger urban settlements, local villages, clustered settlements, individual one-off dwellings, schools, churches and community facilities. Therefore it is considered that the proposed interconnector will not result in any significant negative socio-economic effects.
30. There will be wider economic benefits arising from the improvements to the electricity grid in the island of Ireland; these will be experienced in both jurisdictions.

## 5. Population – Tourism

### 5.1 Introduction

1. This section considers the likely significant impacts of the proposed interconnector, (from Turleenan, County Tyrone to Woodland, County Meath) on the tourism and amenity aspects in the receiving environment.
2. The relevant chapter of the published Consolidated ES is Chapters 14 (Community Amenity and Land Use) and Chapter 15 (Socio-Economics). The relevant chapter of the EIS is Chapter 4 (Human Beings – Tourism and Amenity) of Volumes 3C and 3D.

### 5.2 Methodology

3. The baseline conditions in relation to tourism and amenity were determined primarily from a review of relevant data published by Fáilte Ireland and Northern Ireland Tourist Board. This was supplemented by data sourced from local tourist agencies, available tourism promotion materials and data and visits to the assessed area. The baseline information was used to establish the location and uses of tourism sites in proximity to the proposed interconnector. The evaluation of the potential for impacts was considered, and a judgment of the significance of this impact was made was taken from the detailed assessments contained elsewhere in the Consolidated ES and EIS. Guidelines on the treatment of tourism in an EIS, provided by Fáilte Ireland were used to assist the evaluation in the EIS.
4. The purpose of this evaluation is to address specifically the impact of the proposed interconnector on tourism and amenity within the assessed area, and any resulting effect on the economy.
5. The assessment of potential impacts for the proposed interconnector is based on the professional expertise of the project consultants and takes into account relevant guidance such as:
  - Guidelines on the Treatment of Tourism in an EIS (2011), provided by Fáilte Ireland; and,
  - Department of the Environment Community and Local Government (2013) Guidelines for Planning Authorities and An Bord Pleanála on carrying out Environmental Impact Assessment.

6. While specific guidelines were available from Fáilte Ireland in relation to the EIS, the impact assessment methodologies used in both the Consolidated ES and EIS are broadly similar.
7. A common feature of both the Consolidated ES and EIS is that where the tourist attraction is related, for example to the landscape or cultural heritage features, those specific chapters evaluate the potential for impacts on the particular environmental topic. The findings of the evaluation are then used to assist in the tourism evaluation. This is consistent with the approach suggested by Fáilte Ireland in their guidelines (Fáilte Ireland (2011)) which advises that in the area likely to be affected by the proposed development, the attributes of tourism, or the resources that sustain tourism, should be described under the headings of context, character, significance and sensitivity. The detailed description and analysis will usually be covered in the section dealing with the relevant environmental topic – such as ‘Landscape’. Only the relevant finding as to the likely significance to, or effect on, tourism needs to be summarised in the tourism section.
8. For further details please see Consolidated ES Chapter 15 (Socio-Economics), Section 15.2 and EIS Volumes 3C and 3D Chapter 4 (Human Beings – Tourism and Amenity), Section 4.2.

## **5.3 The Receiving Environment**

### **5.3.1 Tourist Attractions**

9. Tourist attractions in the assessed area are identified and profiled. The key attractions identified in the assessed area include:
  - Navan Fort in County Armagh (located approximately 2.4km east of the overhead line);
  - Benburb Priory in County Tyrone (located approximately 1.4km east of the overhead line);
  - The Argory in County Armagh (located approximately 1.5km east of the overhead line);
  - The Monaghan Way (intersected by the overhead line);
  - Lough an Leagh in County Cavan (located approximately 1.5km west of the overhead line);
  - Dun a Rí Forest Park in County Cavan (located approximately 2.5km east of the overhead line);

- Trim Castle in County Meath (approximately 6km west of the overhead line);
  - Hill of Tara in County Meath (approximately 6km east of the overhead line);
  - Bective Abbey in County Meath (approximately 800m north-east of the overhead line); and
  - Boyne Valley Drive and surrounding attractions (traversed by the overhead line).
10. Other key tourist attractions include: Lough Muckno in County Monaghan, the UNESCO World Heritage site at Brú na Bóinne in County Meath and the Battle of the Boyne site – Oldbridge Estate in County Meath, these lie outside the assessed area but were considered during the route selection process. Avoidance of these sites at route selection stage was design criterion.

### 5.3.2 Tourist Accommodation

11. Tourism accommodation in the assessed area is identified and profiled in both the Consolidated ES and EIS. It has been determined within 2km of the proposed interconnector there are three accommodation providers, which are generally holiday cottage accommodation located in rural areas.

### 5.3.3 Tourist and Amenity Activities

12. As the proposed interconnector is a linear development over a distance of approximately 138km, many tourist activities take place along its length within the assessed areas. Significant activities include the annual Fair of Muff in County Cavan and Dunderry Fair in County Meath. Other tourist and amenity activities which take place within the assessed area include: road bowling, angling, shooting, equestrian cycling, canoeing and walking. These are typical activities that take place in rural areas throughout Ireland and Northern Ireland.

### 5.3.4 Tourist Revenue and Economic Activity

13. Information is not available in relation to tourist revenue and related activity for the assessed area as this type of information is only collected for larger areas such as regions or counties. Based on available information it is possible to conclude that visitor numbers to the assessed area are low when compared with other regions in Ireland and Northern Ireland. However, it is recognised that tourism revenue is an important source of income and employment to local areas where it is earned and is likely to become more important as rural tourism products develop in the future.

14. For further details please see Consolidated ES Chapter 15 (Socio-Economics), Section 15.3 and EIS Volumes 3C and 3D Chapter 4 (Human Beings – Tourism and Amenity), Section 4.4.

## **5.4 Mitigation Measures**

15. Route selection has been the main mitigation measure used to reduce the potential for adverse impacts on tourism and amenity.
16. For further details please see Consolidated ES Chapter 15 (Socio-Economics), Section 15.5 and EIS Volumes 3C and 3D Chapter 4 (Human Beings – Tourism and Amenity), Section 4.6.

## **5.5 Residual Impacts**

### **5.5.1 Construction Phase**

17. Negative impacts are anticipated to be limited to construction impacts of noise and traffic, setting impacts at cultural heritage sites, and landscape and visual impacts. These temporary impacts could have an indirect impact on the local tourist economy; however, this will not be significant.
18. For further details please see Consolidated ES Chapter 15 (Socio-Economics), Section 15.6 and EIS Volumes 3C and 3D Chapter 4 (Human Beings – Tourism and Amenity), Section 4.7.

### **5.5.2 Operational Phase**

19. There will be no direct impacts for tourism as no tourist sites will be physically impacted upon by the proposed interconnector. Tourism impacts arising as a result of visual and cultural impacts at key tourism sites including the Argory, Navan Fort, Benburb Priory, the Monaghan Way, Bective Abbey and the Boyne Valley Driving Route will not be significant.
20. For further details please see Consolidated ES Chapter 15 (Socio-Economics), Section 15.6 and EIS Volumes 3C and 3D Chapter 4 (Human Beings – Tourism and Amenity), Section 4.7.

## **5.6 Transboundary Effects**

21. The most significant tourism attractions in Northern Ireland are located in counties that are a significant distance from the proposed interconnector. Significant



attractions in Counties Monaghan, Cavan and Meath including; the UNESCO World Heritage site at Brú na Bóinne in County Meath and the Battle of the Boyne site – Oldbridge Estate in County Meath are located approximately 20km from the proposed interconnector. Therefore, these attractions do not need to be considered further due to the distance from the proposed interconnector.

22. The Armagh / Monaghan border area is not in one of the Fáilte Irelands or the Northern Ireland Tourism Boards established tourism regions and no specific tourist attractions or amenities are identified in this area.
23. Due to the intervening distance from significant tourist attractions in Ireland and Northern Ireland it is not anticipated that the proposed interconnector will have any significant adverse transboundary impacts.
24. For further details please see Consolidated ES Chapter 20 (Transboundary Impacts) and EIS Volumes 3C and 3D Chapter 4 (Human Beings – Tourism and Amenity), Section 4.7.

## **5.7 Conclusions**

25. There will be no direct impacts to tourism caused by the proposed interconnector. Negative impacts are anticipated to be limited to construction impacts of noise and traffic, setting impacts at cultural heritage sites, and landscape and visual impacts. Tourism impacts arising as a result of visual and cultural impacts at key tourism sites including the Argory, Navan Fort, Benburb, the Monaghan Way, Bective Abbey and the Boyne Valley Driving Route will not be significant.

## 6. Population – Land Use

### 6.1 Introduction

1. This section considers the likely significant impacts of the proposed interconnector (from Turleenan, County Tyrone to Woodland, County Meath) on Land Use in the receiving environment.
2. The relevant chapter of the published Consolidated ES is Chapter 14 (Community Amenity and Land Use) and the relevant chapters of the EIS are Chapter 3 (Human Beings- Land Use) of Volumes 3C and 3D.

### 6.2 Methodology

3. The methodology of evaluation in this appraisal is as follows:
  - A baseline appraisal is carried out;
  - An appraisal of impact magnitude during construction, operation and decommissioning phases is carried out; and
  - The significance of impacts is determined by evaluating the base line environment and magnitude of impact.
4. In this evaluation the following data sources are referred to:
  - Land Registry data<sup>16</sup> for land holdings along the proposed interconnector in receiving environment;
  - Road side surveys;
  - Aerial photography along the entire development;
  - Agricultural and horticultural statistics;
    - Ireland - Central Statistics Office (CSO) data from the 2010 Census of Agriculture; and
    - Northern Ireland – Agricultural Census of Northern Ireland – Results for June 2012;
  - Aerial photography and LiDAR along the proposed interconnector.

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<sup>16</sup> Property Registration Authority (Ireland) and Department of Finance and Personnel – Land and Property Services (Northern Ireland)

## 6.2.2 Baseline Evaluation

5. The baseline evaluation involves describing the Land Use environment (agriculture, horticulture and forestry (including willow plantations)) in the assessed area of Counties Tyrone, Armagh, Monaghan, Cavan and Meath. Reference to published statistics provides information on the types of land holdings in the five counties. Road side surveys were conducted between the periods of 2011 and 2013. The character of the Land Use environment along the proposed interconnector is expressed in terms of sensitivity. Sensitivity in this evaluation is a measure of the likelihood of a land enterprise to change as a result of the proposed interconnector and it also reflects the importance, uniqueness and the difficulty of replacing a land enterprise. Table 6.1, which identifies the criteria for categorising sensitivity, is a guideline based on EPA (Ireland) guidelines 2002 and the Design Manual for Roads and Bridges (DMRB UK) 2008. The EPA guidelines 2002 define sensitivity as the “*Potential of a receptor to be significantly changed*”. The concepts of Importance, Rarity and Potential for Substitution are introduced in Table 2.1 Volume 2, Section 2, Part 5 of DMRB 2008. This is the same methodology as employed in the Consolidated ES (Chapter 14 - Community Amenity and Land Use) and the EIS (Chapters 3 - Human Beings – Land Use, of Volumes 3C and 3D).

**Table 6.1: Criteria for Categorisation of Sensitivity<sup>17</sup>**

Sensitivity Category	Enterprise Type	Characteristics
Very High	<p>Experimental Husbandry Farms. Stud Farms (large scale equine, breeding regionally and nationally important horses). Race Horse Training Enterprises.</p> <p>Intensive Livestock enterprises (pigs and poultry Intensive Horticultural enterprises.</p> <p>Commercial Forestry and Commercial tree plantations (including Willow)</p>	<p>Rare and important on a regional or national basis. There is limited potential for substitution due to specific facilities and internal farm layout.</p> <p>Very high potential for change if a tower or overhead line is located on these enterprises. In the case of pig and poultry farms where there is a limited potential for substitution due to difficulty in obtaining suitable alternative sites.</p> <p>Very high potential for change where a clear wayleave corridor is maintained under the overhead line</p>
High	<p>Dairy farms.</p> <p>Equine enterprises (Significant enterprise on the farm but not including intensive Stud Farms).</p>	<p>Any impact that restricts the movement of livestock to and from the farm hub will have a high potential to cause change. These farms generally have a specific grazing paddock layout to allow access to the farm yard – which is difficult to substitute.</p>

<sup>17</sup> Evaluation of sensitivity is subject to professional judgment

Sensitivity Category	Enterprise Type	Characteristics
Medium	Beef farms, Sheep farms. Equine Enterprises (not a significant enterprise on the farm).  Tillage and field cropping, grass cropping farms (hay or silage)	The potential for change is lower than dairy farms because livestock generally do not have to be moved on a daily basis and the grazing layout requirement is less rigid than on dairy farms. Crops and cropping programmes are less sensitive to change in the longer term.  There is less restriction on substituting the land in these enterprises.
Low	Rough Grazing and Commonage, Low Stocking rate.	The potential for change is low because the scale or intensity of enterprise is so low that there is a low response to impacts.
Very Low	Little or no agricultural activity e.g. Woodland, Bog.	The potential for change is very low because the scale or intensity of enterprise is so low that there is a very low response to impacts.

### 6.2.3 Evaluation of Magnitude of Impacts

6. The criteria for evaluating the magnitude of impact in this evaluation have set out in Table 6.2. This table replicates the methodology employed in the Consolidated ES (Chapter 14 - Community Amenity and Land Use) and the EIS (Chapters 3 - Human Beings – Land Use, of Volumes 3C and 3D).

**Table 6.2: Criteria and Methodology for Assessment of Impact Magnitude**

Magnitude	Determining Criteria
Very High	A permanent restriction on the operation of a land parcel or site, for example, a permanent change in land or cropped area of approximately 15% (or more). The removal of critical buildings or the restricting of access to an intensive enterprise (e.g. pigs, poultry, horticulture) would result in a very high magnitude of impact.
High	A permanent restriction on the operation of a land parcel or site, for example, a permanent change in land or cropped area of approximately 10-15%. The removal of standard cattle or sheep buildings in a conventional farmyard would result in a high magnitude. Construction phase impacts without mitigation could in rare situations have a high magnitude of impact (e.g. significant damage to land drainage, allowing livestock to stray onto public roads).
Medium	A permanent restriction on the operation of a land parcel or site, for example, a permanent change in land or cropped area of approximately 5-10%. Where access to land or farmyard is restricted but there is alternative access. Where the development of, or expansion of, a farmyard is restricted but there is alternative land available for this development. Construction phase impacts without mitigation will generally result in medium magnitude impacts (for example poor reinstatement of fences of land, rutting along access tracks not being re-instated or levelled).

Magnitude	Determining Criteria
Low	A permanent restriction on the operation of a land parcel or site where for example a permanent change in land or cropped area of approximately 1-5%. The presence of multiple tower sites and a central section of the overhead line will tend to give a low impact.
Very Low	A permanent restriction on the operation of a land parcel or site for example a permanent change in land or cropped area. Where there are no towers and the overhead line oversails the land parcel the impact tends to be very low or where there are one or two towers and the section of the overhead line is at the edge of the land parcel.

## 6.2.4 Evaluation of Significance of Impacts

7. The EPA Advice Notes on Current Practice (in the preparation of Environmental Impact Statements) (September 2003) and Design Manual for Roads and Bridges (UK) (Vol 11 Section 2 – Part 5) contain guidelines for describing the significance of impacts. The significance of impact is determined by evaluating, using professional judgment, the magnitude of the impact and the sensitivity of the affected land parcel.
8. The significance of the impacts is described as follows:
  - An 'Imperceptible' impact is either an impact so small that it cannot be measured or is capable of measurement but without noticeable consequences;
  - A 'Slight Adverse' impact causes noticeable changes in the operation of an enterprise on a land parcel in a minor or slight way;
  - A 'Moderate Adverse' impact changes a land parcel causing operational difficulties that require moderate changes in the management and operational resources;
  - A 'Major Adverse' impact changes a land parcel so that the enterprise cannot be continued, or if continued will require major changes in management and operational resources; and
  - A 'Major Adverse / Profound Impact' changes the land parcel in a way that it obliterates the land parcel enterprise.

## 6.3 The Receiving Environment

### 6.3.1 Land Use within the Assessed Area

9. Analysis of the statistics data for the assessed area indicates that the following farm enterprises will occur along the proposed interconnector:

- 76% of all farms are a combination of beef, sheep, and grass cropping farms;
  - 11.2% of all farms are dairy farms;
  - 9.2% of all farms are cereal and other field arable crops;
  - 1.9% of all farms are mixed crops and livestock farms; and
  - 1.7% of farms involve other activities (including equine, pigs & poultry & horticulture).
10. The average size of farms along the proposed interconnector is approximately 34ha<sup>18</sup>.

### 6.3.2 Land Use in Land Holdings

11. An appraisal<sup>19</sup> of 579 individual land holdings along the proposed interconnector indicates:
- 80.5% of the land parcels are Grassland - Cattle & Sheep & Grass Cropping;
  - 7.5% of the land parcels are Grassland – Dairy;
  - 7% of the land parcels are Tillage and Mixed Cropping (Crops & Livestock);
  - 3% of the land parcels are Other Enterprises (including Equine, Pigs & Poultry & Horticulture); and
  - 2% of the land parcels are Forestry plots or Commercial Tree Plantations (including Willow).
12. This appraisal also indicates the following sensitivity of land parcels along the proposed interconnector<sup>20</sup>:
- 2.5% are Very High Sensitive land parcels (No 15). These include;
    - One stud farm in County Monaghan (Ref No LCT-091);
    - One equine enterprise in County Armagh (Ref No 091);
    - One orchard in County Tyrone (Ref No 040);
    - One intensive horticultural enterprise in County Meath (Ref No LMC-029);

<sup>18</sup> Source: 2010 Census of Agriculture (IRL) and Department of Agriculture and Rural Development (DARD) 2012 Agricultural Statistic (NI).

<sup>19</sup> Using the data from the EIS - **Appendix 3.1 of Volumes 3C and 3D**; and **Appendix 14A** of the Consolidated ES.

<sup>20</sup> Refer to Figures 3.2 – 3.9 of Volume 3C, Figures, and Figures 3.2 – 3.12 of Volume 3D Figures of the EIS and Figure 14.10 Sheets 1 – 10 of the Consolidated ES. LCT prefix indicates Volume 3C of EIS, LMC prefix indicates Volume 3D of EIS and no prefix indicates Consolidated ES.

- One Teagasc Experimental Husbandry Farm in County Meath (Ref No LMC-022);
  - Seven forestry plantations (Ref Nos 1028, LMC-067, LMC-110, LMC-157, LMC-170, LMC-171 and LMC-196);
  - One bioremedial willow plantation in County Armagh (Ref No 100);
  - One forestry and equine enterprise in County Meath (Ref No LMC-135); and
  - One intensive agriculture enterprise in County Monaghan (pig or poultry) (Ref Nos LCT-011&012&013).
- 10.5% are High Sensitive land parcels (No 60). These include:
    - Twelve dairy farms in Northern Ireland and twenty nine dairy farms in Ireland;
    - One orchard & grassland enterprise in Co Tyrone (Ref No 021);
    - Eight equine enterprises (Ref Nos LCT-107, LCT-149, LCT-223A, LCT232, LMC-023, LMC-046, LMC-059, & LMC-132);
    - Five unconfirmed grassland enterprises (Ref Nos LCT-089, LCT-147A, LMC-065&079, LMC-120 & LMC137);
    - Two poultry & livestock enterprises (Ref Nos LMC-111 and LMC-116);
    - Two beef and forestry farms (Ref Nos LMC-105 and LMC-158)
  - 86% are Medium Sensitive land parcels (No 497). These are mainly beef, sheep and tillage farms; and
  - 1% are Low or very Low Sensitive land parcels (No 7). These include rough grazing plots, scrub and very small parcels of land (Ref Nos LCT-025, LCT-109, LCT-122, LCT-177, LCT-235A, LCT-242 and LMC-096).

## 6.4 Mitigation Measures

13. Careful routing of the proposed interconnector has sought to avoid or reduce impacts by avoiding farm yards. Minimising the number of towers having regard to requirements imposed by technical and environmental constraints and constructing an overhead line infrastructure that is structurally sound and safe, also reduces impacts on Land Use. A minimum ground clearance of 9.0m for the overhead line will be maintained and will minimise the safety risk.
14. Prior to commencement of works the construction contractors will prepare method statements and work programmes that show detailed phasing of work in-line with the requirements of the outline CEMPs (EIS Appendix 7.1, Volume 3B Appendices and in the Consolidated ES Appendix 5A). A wayleave agent will be appointed by

- the contractor to liaise with the landowners along the proposed interconnector and ensure that their requirements for entry are met so far as is possible and that landowners are made aware of the schedule of works to be carried out on their land.
15. All personnel involved in the construction phase will receive adequate training, in particular in relation to issues pertaining to livestock safety and bio-security on farms.
  16. The contractor will ensure that landowners are notified in advance of commencement of works and that they have reasonable access to all parts of their farm during the construction phase.
  17. Disease protocols will be adhered to and the construction contractor and the Network System Operator will comply with any Department of Agriculture, Food and the Marine (DAFM) or Department of Agriculture and Rural Development (DARD) regulations pertaining to crops and livestock diseases.
  18. Where required, fencing will be erected to exclude livestock from construction sites.
  19. In most situations mitigation measures for noise effects on livestock will not be required during the construction phase because farm animals will quickly adapt to changes in their noise environment. In rare situations where rock breaking or pilling are required livestock owners in adjoining fields will be notified in advance.
  20. Excavations will be minimised and the locally excavated material will be reinstated surrounding the base following construction. All unused excavated fill will be removed from the site and disposed of at a licensed waste facility. Affected land drains will be re-directed in a manner that maintains existing land drainage. Where top soil is stripped back it will be replaced and all disturbed field surfaces will be reinstated.
  21. Mitigation relating to potential effects on water quality and soil contamination due to run-off or due to fuel or concrete spillages is outlined in Chapters 12 and 13 of this JER.
  22. Statutory compensation will be paid where appropriate.
  23. The overhead line infrastructure will be inspected and maintained to ensure it is safe. During any maintenance works which require access on to farms disease protocols will be adhered to and the Network System Operator will comply with any DAFM or DARD regulations pertaining to crops and livestock diseases. Land owners will be notified in advance of any routine maintenance works.



24. Helicopter inspections will be announced, in advance, in local and national newspapers.

## 6.5 Residual Impacts

25. The land loss impact at the site of the Turleenan substation occurs during the construction phase and is a permanent residual impact approximately 22ha.
26. The impact on land quality at the Carrickmacross construction materials storage yard will be long term – 1.4 ha.
27. The utilisation of land at the base of the towers (i.e. directly under the tower) is permanently restricted. The total area restricted at tower bases along the proposed interconnector is approximately 10.5 ha.
28. The damage caused to soil along temporary access routes and at construction sites is evaluated to be a short to medium term effect. Therefore there will be a residual effect on the land quality. With mitigation, which would involve ploughing, and reseeded (and in certain situations sub soiling) the land can be restored to its original condition. The residual effect is assumed to occur along all temporary access routes and at temporary construction sites – 124ha in total along the proposed interconnector.
29. The disturbance impacts caused to livestock, crops and farm enterprises during the construction phase are generally short term and do not give rise to residual long term effects.
30. The presence of the overhead line on farms will not cause a significant change in land utilisation along the proposed interconnector. It will be an additional safety risk and an inconvenience which will need to be taken into account in-line with published safety guidelines from EirGrid and SONI Proposals for landowners. In general most farm machinery activities can take place safely under these electricity lines (e.g. fertilising, land cultivation, low trajectory slurry spreading, spraying (including orchards), crop harvesting) but there may be unacceptable risks associated with transporting high loads (e.g. bales), irrigating crops with rain guns, high trajectory spreading of slurry and using machinery with loader attachments under the overhead lines. It is noted that there are several thousand kilometres of existing high voltage overhead lines across the island of Ireland and farming is practised safely underneath those overhead lines. The maintenance works required for the necessary upkeep of the infrastructure will cause intermittent disturbance impacts on farm enterprises, however it is also noted that maintenance work crews operate throughout the island of Ireland to maintain several thousand kilometres of existing network without causing a significant effect.

31. The presence of the overhead line would not automatically restrict the construction of agricultural and horticultural buildings; however safety clearances during their construction and operation would need to be observed. Landowners would be required to consult with the network owner prior to developing any construction proposal that may interfere with the overhead line.
32. The presence of the overhead line will cause a permanent reduction in the area of forestry and tree plantations – approximately – 14.8ha
33. Along the proposed interconnector, 579 land parcels have been evaluated for impacts. The impacts on these land parcels is summarised as follows:
- 59% (343 No) will have Imperceptible residual impacts;
  - 35.8% (206 No) will have Slight Adverse residual impacts;
  - 4.5% (26 No) will have Moderate Adverse residual impacts;
    - Potential restriction of farm yard development (18 No – Ref Nos<sup>21</sup> NI 005, NI165, NI068, LCT-051, LCT-064, LCT-076, LCT-089, LCT-118, LCT-141, LCT-129, LCT-136, LCT-150, LCT-174&174A, LCT-214, LMC (132 &214 &215), LMC-088 and LMC-(065 & 079)
    - Residual soil damage at the construction materials storage yard (1 No);
    - Land take at the substation site in Turleenan (1 No – Ref No 1036 in Northern Ireland);
    - Moderate impacts on the management of one orchard (1 No – Ref No 040 in Northern Ireland)
    - Moderate impact on bioremedial willow plantation (1 No – Ref No 100 in Northern Ireland)
    - Clearance of commercial forest (4 No Ref No LMC-105, LMC-110, LMC157 and LMC171).
  - 0.5% (3 No) will have Major Adverse residual impacts;
    - Clearance of commercial forest (LMC-170 and LMC 067)
    - Oversailing of one intensive horticultural enterprise (LMC 029); and
  - 0.2% (Ref No 001) will have Major Adverse / Profound Residual Impacts i.e. a land parcel at the site of the substation in Turleenan, Co Tyrone.

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<sup>21</sup> Refer to Figures 3.2 – 3.9 of Volume 3C Figures; Figures 3.2 – 3.12 Volume 3D Figures of the EIS and Figure 14.10 Sheets 1 – 10 of the Consolidated ES. LCT prefix indicates Volume 3C of the EIS, LMC prefix indicates Volume 3D of the EIS and no prefix indicates the Consolidated ES.

## 6.6 Transboundary Effects

34. As the overhead line traverses South Armagh and approaches the border crossing at Doochat or Crossreagh land parcel LCT-001 is located on the southern side of the border in County Monaghan. Similarly as the overhead line oversails land north of the border at Crossbane, County Armagh, land parcels LCT-(006 & 007) and LCT-008&008A are located on the southern side of the border in County Monaghan. A farm yard on land parcel LCT-008&008A is 25 meters south of the centre of the Overhead Line. The impacts from the overhead line in Northern Ireland on land parcels LCT-001 and LCT-(006 & 007) are Imperceptible and the impact on LCT-008A is Slight Adverse.
35. From the border crossing point (between Tower 102 and Tower 103) at Lemgare, County Monaghan and Tower 106, six land parcels are located on the northern side of the border in County Armagh (reference numbers 165, 173, 174, 176, 177 and the combined 045 & 166 – see EIS, Volume 3C, Figure 3.2). The impact from the overhead line located in County Monaghan on those land parcels in County Armagh is Imperceptible.

## 6.7 Conclusions

36. Construction and stringing of towers and the re instatement works will affect individual landholdings at different times for a period of approximately 4 - 6 months. The disturbance impacts on farm enterprises from construction activity will generally be temporary and will not give rise to residual effects. The construction activity will cause short to medium term residual effects on approximately 124ha of land where damage to soil is predicted and long term damage to land on the 1.4ha Carrickmacross construction materials storage yard. An area of 22.2 ha will be required for the Turleenan substation and associated works. Most of the 22.2 ha can return to agricultural use following the construction phase, however there will be a residual impact to the affected land. There will be residual effects due to the restriction of land use at the base of the towers (10.5ha) and the towers will be an obstacle to machinery operations. Approximately 14.8ha of commercial forestry will be cleared under and adjoining the proposed interconnector. The presence of the overhead line will be an additional limited safety risk on farms and may restrict the construction of some agricultural buildings.
37. The residual impacts are either Imperceptible or Slight Adverse on 95% of the land parcels along the proposed interconnector. Twenty six Moderate Adverse impacts (4.5%) are predicted. Three Major Adverse impacts (0.5% of total) are predicted and one Major / Profound adverse impact (0.1% of total) will arise at the site of the substation in Turleenan, Co Tyrone.

38. In the context of the relatively<sup>22</sup> small area where direct land take impacts, land restriction impacts (at the base of the towers) and damage impacts occur, the short term nature of construction impacts and the prediction that land utilisation will not change significantly under and adjoining the overhead lines, overall, the impact is Imperceptible.

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<sup>22</sup> The area of the 669 land parcels along the proposed interconnector is approximately 9,380ha. The area upon which direct impacts occurs (10.5ha + 22.2ha + 124ha + 1.4ha + 14.8ha) is 1.8% of the total area.

## 7. Material Assets

### 7.1 Introduction

1. This section considers the likely significant impacts of the proposed interconnector, (from Turleenan, County Tyrone to Woodland, County Meath) on material assets, such as utilities, telecommunications, aviation and waste in the receiving environment.
2. The relevant chapters of the published Consolidated ES are Chapter 5 (Project Description), Chapter 16 (Telecommunication and Aviation Assets) and the relevant chapters of the EIS are Chapter 12 (Material Assets – General) of Volumes 3C and 3D.

### 7.2 Methodology

3. The assessment of material assets general impacts for the proposed interconnector is based on the professional expertise of the project consultants and takes into account relevant legislation and (where applicable) published guidance such as:
  - EPA (2002). Guidelines on the Information to be Contained in Environmental Impact Statements;
  - EPA (2003). Advice Notes on Current Practice (in the preparation of Environmental Impact Statements);
  - Department of the Environment Community and Local Government (2013) Guidelines for Planning Authorities and An Bord Pleanála on carrying out Environmental Impact Assessment;
  - Environmental Protection Agency (EPA) (September 2003). Advice Notes on Current Practice (in Preparation of Environmental Impact Statements);
  - Meath County Council. Waste Management Plan for the North East Region 2005-2010;
  - Department of the Environment. 2012. Development Control Advice Note 10 (Revised): Environmental Impact Assessment; and
  - Department of the Environment. 2002. Planning Policy Statement 10 (PPS 10): Telecommunications.

4. The respective applicants are required to make separate applications for development consent in each of the jurisdictions in which the proposed interconnector will be located. The scope of the impact assessment varied slightly between applications but the methodologies were broadly similar.
5. Extensive consultation took place with prescribed bodies in Ireland and Northern Ireland to obtain background information and comment on the proposed interconnector in each jurisdiction. The following prescribed bodies were consulted as part of the Material Assets appraisal: Irish Aviation Authority (IAA); Meath County Council; Monaghan County Council; Cavan County Council; Bord Gáis; ESB; NIE; NIEA; Phoenix and Firmus Gas; Civil Aviation Authority (CAA); broadcasting and telecommunication authorities; and, Ministry of Defence.
6. Based on the responses from prescribed bodies and investigation of relevant data sources such as websites ([www.trimflyingclub.ie](http://www.trimflyingclub.ie) and [www.balloon.ie](http://www.balloon.ie)) and consultation with other groups (e.g. Belfast Flying Club Ltd), the amount and types of material assets in proximity to the proposed interconnector were identified, before the effect on these assets was assessed.
7. For further details please see Consolidated ES Chapter 5 (Project Description), Chapter 16 (Telecommunication and Aviation Assets), Section 16.2 and EIS, Volumes 3C and 3D Chapter 12 (Material Assets – General) Section 12.2.

## **7.3 The Receiving Environment**

### **7.3.1 Gas Pipelines**

8. In the assessed area, there are a number of gas pipelines; including running between Drogheda and Bailieborough, Kingscourt, Carrickmacross and Lough Egish and around the main settlements of Navan, Trim, Dunshaughlin, Kells and Kingscourt. These pipelines are all outside of the area of construction for the proposed interconnector and will not be affected by the works.

### **7.3.2 Electricity Lines and Telecommunications Links**

9. Because of the settlement pattern in the assessed area and wider area, there is a network of existing electricity lines ranging from low-voltage 10kV lines that serve individual properties to high voltage 400kV lines. The most significant electricity lines are Tandragee 275kV line, Oldstreet to Woodland 400 kV line, Flagford-Louth 220 kV overhead line. In addition there is a dense network of telephone overhead lines throughout the assessed area. There are no buried fibre optic lines that would be affected by the proposed interconnector. There are no known

telecommunication or radio links in the assessed area that would be affected by the proposed interconnector.

### 7.3.3 Aviation

10. There are no known established flightpaths within the assessed area that would be affected by the proposed interconnector. However, it is possible for any aircraft pilot to fly a flightpath (subject to IAA and CAA restrictions) across any section of the assessed area.
11. Aircraft could operate from any airport outside the assessed area, however there are three licensed airfields in proximity to the assessed area; Trim Airfield, Trevet Airfield and Athboy Airfield. The IAA has indicated that there may be a number of unlicensed airfields and landing strips in the counties Monaghan, Cavan and Meath.
12. A company called Irish Balloon Flights Ltd. operates in the Trim area of County Meath, flying from a number of launch sites, including Trim Castle, Athboy, Slane, the Hill of Tara and others depending on the wind direction on the day of the flight. For further details please see Consolidated ES Chapter 16 and Section 12.4.2 of the EIS.

### 7.3.4 Waste

13. The closest licensed waste facility to the assessed area is the Scotch Corner Landfill in County Monaghan. Other existing and licensed landfills and waste facilities are in operation in the wider area and would be accessible through the existing road network. A list of the Waste facilities can be seen in the EIS Appendix 7.2 Volumes 3C and 3D Appendices and Consolidated ES Appendix 18A.
14. For further details please see Consolidated ES Chapter 5 (Project Description), Chapter 16 (Telecommunication and Aviation Assets), Section 16.3 and EIS, Volumes 3C and 3D Chapter 12 (Material Assets – General) Section 12.4.

## 7.4 Mitigation Measures

### 7.4.1 Overview

15. Careful Routeing of the proposed interconnector has sought to avoid or reduce impacts on known material asset constraints. These areas have been identified through consultation with the operators and site visits.

## 7.4.2 Gas Pipelines

16. A pre-construction survey will be undertaken during the construction phase to confirm the conditions and utilities which have been predicted to be encountered in the Consolidated ES, EIS and this JER. This is a standard requirement for all construction projects and it conforms to health and safety requirements.

## 7.4.3 Electricity Lines and Telecommunications Links

17. A site specific risk assessment must be completed for electricity and telephone lines. Further consultation will take place with service providers prior to any construction works in the proximity of existing telecoms services likely to be impacted, as required. Where the crossing of existing overhead line electricity and telephone lines is necessary during construction, any disruptions to the service will be minimised. Care will be taken when stringing cables. Obstacles along a straight (road or railway crossings and other transmission or distribution lines) will be guarded by way of temporary guard poles.
18. In certain areas it will be necessary to underground some of the existing electricity and telephone lines where they are crossed by the proposed interconnector. This will be undertaken to avoid any likely significant effects. Telephone lines are found at roadside locations and will be placed under public roads before construction of the proposed interconnector takes place. These works will likely result in temporary lane or road closures and will be scheduled to be undertaken in advance of the proposed interconnector construction phase.
19. The equipment to be used in connection with the proposed interconnector has been used on other similar projects throughout Europe and has been rigorously tested for Electromagnetic Compatibility. The requirements of electromagnetic compatibility will be fully met by the proposed interconnector.

## 7.4.4 Waste

20. It will be a requirement of the contractor appointed to construct the development to further develop the outline CEMP, as provided in the Consolidated ES and EIS. The objective of this plan will be to minimise the impact caused by the construction stage of the development. A Construction Waste Management Plan (CWMP) will form part of the CEMP and it will be implemented to minimise waste and ensure correct handling and disposal of construction waste streams in accordance with best practice guidelines. The key principles underlying the CWMP will be to minimise waste generation and to segregate waste at source. Facilities for segregation of



waste will be made available to optimise reuse and recycling of construction waste and correct disposal of domestic waste.

#### 7.4.5 Aviation

21. The IAA and CAA have confirmed that overhead line and supporting structures would not constitute aviation en-route obstructions for civil aviation purposes. However updates to aviation documentation and mapping will be initiated so that all pilots are aware of the presence of the proposed interconnector.
22. The proposed line route has been selected taking into account the presence of Trim Airfield in County Meath and the relevant Obstacle Limitation Surfaces for the airfield. Landing aircraft would need to be visually aware of where the pylons are located and a formal approach procedure of '*visual contact of pylons / cables required before starting field approach*' should be introduced even though there is a clear margin between the top of the pylons and the obstacle limitation surface. The overhead lines will be below the obstacle limitation surfaces for Trim Aerodrome, but they will be made more conspicuous through the fitting of marker spheres between Towers 355 and 357.
23. Consultation with the IAA revealed that ballooning activity should not be a reason to prevent changes to the existing landscape, including the construction of power transmission lines. The potential presence of power lines in the area will have to be considered by the balloon pilots as part of their flight planning.
24. For further details please see Consolidated ES Chapter 5 (Project Description), Chapter 16 (Telecommunication and Aviation Assets), Section 16.5 and EIS, Volumes 3C and 3D Chapter 12 (Material Assets – General) Section 12.6.

### 7.5 Residual Impacts

25. Adherence to the mitigation measures for utilities and aviation enterprises will ensure there are no residual impacts associated with the proposed interconnector. Where undergrounding of existing electricity line and telephone lines are required in certain areas, these works will not result in any significant impacts.
26. Following good waste management practices it is not expected that waste arising from the proposed interconnector will give rise to any significant impacts. There will be no significant impact to existing waste facilities and it is anticipated that any waste generated by the proposed interconnector will be accommodated within existing facilities (see Chapter 12 Soils, Geology and Hydrogeology of this JER for further details of surplus material arising from the construction phase).

27. The location of the proposed interconnector has been selected to avoid key telecommunication links (and other constraints). It was confirmed that none of the broadcast operation consultees had any objection to the proposed interconnector and did not raise any potential impacts to the services for which they are responsible.
28. For further details please see Consolidated ES Chapter 5 (Project Description), Chapter 16 (Telecommunication and Aviation Assets), Section 16.6 and EIS, Volumes 3C and 3D Chapter 12 (Material Assets – General) Section 12.7.

## 7.6 Transboundary Effects

29. There will be a positive transboundary impact associated with providing a high capacity electricity transmission line between Ireland and Northern Ireland. This will lead to improvements in the efficiency of the all-island electricity market, ensure a secure supply of electricity and will allow more renewable energy to be connected to the network.
30. The proposed interconnector will have no transboundary impacts on utilities or telecom services. Where telecom services traverse the border, consultation will take place as required with service providers prior to any construction works in the proximity of existing telecoms services.
31. The proposed interconnector will not involve any transboundary waste shipments during the construction phase as adequate waste management facilities are located in each jurisdiction.
32. Aircraft flights originating in Northern Ireland with Trim Airfield as their destination, would need to be visually aware of tower positions and a formal approach procedure of *'visual contact of pylons / cables required before field approach'* should be introduced, even though there is a clear margin between the top of the towers and the obstacle limitation surface for Trim Airfield. Updates to aviation documentation and mapping in Northern Ireland and Ireland by the CAA and IAA will be initiated so that all pilots are aware of the presence of the proposed interconnector.
33. For further details please see Consolidated ES Chapter 20 (Transboundary Impacts) and EIS, Volumes 3C and 3D Chapter 12 (Material Assets – General) Section 12.9.

## 7.7 Conclusions

34. An assessment of the proposed interconnector has been undertaken in accordance with the requirements of the EIA Directive and the respective legislation applicable in Northern Ireland and Ireland.
35. As part of the EIA process, extensive consultation has taken place with the authorities responsible for transmissions associated with radio (domestic and commercial), television, aviation and the emergency services that have telecommunications assets.
36. No objections or potential impacts were highlighted by the telecommunication or aviation consultees. It is concluded that there will be no significant impacts to telecommunications or aviation assets as a result of the proposed interconnector.
37. The proposed interconnector will meet all electromagnetic compatibility requirements as set out by legislation.
38. Mitigation measures will be implemented at the construction and operational phase to minimise and/or eliminate impacts on material assets in the receiving environment. The mitigation measures included in the outline CEMP will be implemented as part of the construction management. Adherence to the mitigation measures will ensure there are no residual impacts associated with the proposed interconnector.
39. It is considered that the operation of the proposed interconnector will have no significant impacts on material assets. The proposed interconnector does not provide an obstacle for aircraft, particularly those operating at Trim Airfield. The IAA confirmed that the overhead lines will be below the obstacle limitation surface for Trim Airfield.

## 8. EMF

### 8.1 Introduction

#### 8.1.1 Scope

1. This section considers the proposed interconnector, from Turleenan, County Tyrone to Woodland, County Meath) in relation to electric and magnetic fields (EMFs).
2. The relevant chapters of the published Consolidated ES are Chapter 7 (EMF) and the relevant chapters of the EIS are Chapter 8 (EMF) of Volume 3B and Chapter 5 in Volume 3C and Volume 3D).

#### 8.1.2 Introduction to Electric and Magnetic Fields

3. EMFs (also sometimes referred to as electromagnetic fields) and the electromagnetic forces they represent are an essential part of the physical world. Electric and magnetic fields occur naturally within the body in association with nerve and muscle activity. People also experience the natural magnetic field of the Earth (to which a magnetic compass responds) and natural electric fields in the atmosphere.
4. The basic elements for describing all types of electrical activity are voltage and current. "Voltage" is a measure of intensity, and is often described as being similar to pressure within gases or liquids. Voltages are measured in volts, with the symbol "V". For very small or very large measurements, mV indicating one thousandth of a volt or kV indicating one thousand volts may be used. Electrical "current" relates to the quantity or rate of electricity flowing through an electrical conductor, and is measured in amperes (symbol "A").
5. An "electric field" is created in any space between points that are at different levels of voltage. The intensity of the field is dependent upon the voltage difference, and upon the size and nature of the space. "Magnetic fields" are created whenever currents flow through conductors. The intensity of a magnetic field is dependent upon the amount of current flowing in the conductor and upon distance away from the conductor. Both electric and magnetic fields fall in intensity as the distance from the source increases.
6. Electric-field strengths are measured in volts per metre (V/m or  $\text{Vm}^{-1}$ ) or kilovolts per metre (kV/m or  $\text{kVm}^{-1}$ ). The atmospheric electric field at ground level is normally about 100V/m in fine weather and may rise to many thousands of volts per metre during thunderstorms.

7. Magnetic fields are usually measured in microteslas ( $\mu\text{T}$ ). The Earth has a natural magnetic field, which is approximately  $50\mu\text{T}$  in the island of Ireland.
8. The Earth's fields are normally in the same direction, varying in size only slowly over time, and are referred to as static or "DC" fields. Other fields alternate both in magnitude and direction and are referred to as alternating or "AC" fields. Due to this variation, AC fields are often reported with an averaging calculation known as "root mean square" or RMS measurement. Future mention of AC field strengths in this chapter will mean the RMS amplitude of the power-frequency modulation of the total field, which is the conventional scientific way of expressing these quantities.
9. The advent of modern technology and the wider use of electricity and electrical devices have inevitably introduced changes to the naturally occurring EMF patterns. Energised high-voltage power-transmission equipment is a source of power-frequency or extremely-low-frequency (ELF) alternating electric and magnetic fields, which add to (or modulate) the Earth's steady natural fields. The strength (or amplitude) of the AC electric field depends on the voltage of the equipment, which remains more or less constant as long as the equipment is energised. The strength of the AC magnetic-field depends on the current (often referred to as the load) carried by the equipment, which varies according to the demand for power at any given time.

### 8.1.3 The Electromagnetic Spectrum

10. The frequency of the EMFs produced by the power system on the island of Ireland is 50 hertz (Hz) and this frequency falls under the ELF category.
11. The electromagnetic spectrum stretches from ELF, through radio and microwaves, infrared, visible and ultra violet light to X-rays and gamma rays.
12. EMFs at much higher frequencies than 50 Hz can be generated by other devices, e.g. radio, television transmissions and microwaves. These higher frequencies interact with objects and people in a different way to electric power frequencies, for example by heating of the body, and it is important to make the distinction.
13. At the highest frequencies, X-rays and gamma rays are capable of ionising, that is, dislodging electrons from individual molecules or atoms. Such disruption can sometimes damage living material.
14. For visible light and all lower frequencies, this process of ionisation by individual photons cannot happen. Overhead lines produce fields only at frequencies well below those of visible light. The term "non-ionising" radiation is often applied to these frequencies.

#### 8.1.4 Established or “Acute” Effects of EMFs

15. A power-frequency magnetic field induces a small current in a person exposed to it. In a magnetic field of strength 100  $\mu\text{T}$ , the total induced current could reach approximately 30 microamperes ( $\mu\text{A}$ ). By contrast, the current required to light a typical small torch bulb is 100,000  $\mu\text{A}$ , and the smallest current which most people can perceive is around 500  $\mu\text{A}$ . Magnetic fields at environmental levels have no directly perceptible effects on the body.
16. A person standing in the electric field beneath a 400 kV overhead line would have an alternating surface charge induced on their body and an associated alternating current induced within the body. The induced surface charge could interact with the electric field to cause vibration of body hair, although the vibration would generally be too feeble to notice. In a power-frequency electric field of about 9 kV/m, the induced current in the body could reach approximately 150  $\mu\text{A}$ .
17. In certain circumstances, a person exposed to a high electric field could experience small spark discharges (microshocks) when touching other objects, similar to that of commonly experienced “carpet shocks” caused by static electricity. Normally, any sensation is confined to the momentary spark discharge as contact is made or broken. Microshocks are not regarded as harmful.

#### 8.1.5 Summary of Evidence for Effects of EMFs at Lower Fields

18. Research on potential health effects related to ELF EMFs has been conducted for several decades. Studies prior to the 1970s mostly focused on direct effects of short term exposures. Concerted research effort on potential health effects of low level, long-term exposure to ELF EMFs started following the publication of an epidemiology study that suggested a statistical association between childhood cancer and distribution power-line characteristics near the children’s homes (Wertheimer and Leeper, 1979). This study was followed by a large number of research studies including human epidemiology studies and experimental studies of both humans and laboratory animals (in vivo studies), and studies of potential effects on cells and tissues (in vitro studies). Over the past four decades, potential effects of ELF EMFs on a number of health endpoints were suggested, but to date no causal link has been confirmed with any health outcome.
19. Scientific agencies and organisations have developed standard scientific methods to guide systematic evaluations of research and promote unbiased assessments of potential risk for developing exposure limits to protect human health. Adherence to standard scientific methods helps to minimise or eliminate subjectivity in the evaluation and interpretation of scientific data. These methods require a systematic

identification of relevant peer-reviewed literature including three types of studies; human epidemiology studies, studies in laboratory animals (in vivo), and studies in cells and tissues (in vitro). Each study then undergoes a review to assess the quality of study design and methods of analysis and evaluation. Flaws in the design or completion of a study may affect its reliability. Since no study is perfect, more weight is given to studies of higher quality, and to studies confirmed by other scientists—thus, the term weight-of-evidence review.

20. For proper health risk assessments, national and international scientific and health agencies put together multidisciplinary panels of scientists with the relevant expertise (e.g., epidemiology, neurophysiology, exposure assessment, and toxicology) to conduct weight-of-evidence reviews. Each of the three types of research studies has complementary strengths and limitations, thus the integration of the results of the different approaches are important in weighing evidence by the expert panels.
21. Conclusions by multi-disciplinary review panels are reached considering the cumulative body of research, giving more weight to studies of higher quality. The conclusions of these reviews typically represent a consensus opinion of the experts participating in the panel.
22. One of the problems faced by scientists reviewing EMFs is that over the years, there have been a large number of studies that have reported responses to EMFs, but which have failed to be independently replicated by independent scientists. This is why review panels assembled by scientific and health agencies consider the entire body of evidence when assessing the potential risk of exposure to EMFs.

## 8.1.6 Reviews by Authoritative Bodies

### 8.1.6.1 Overview

23. The question of possible health effects of environmental power-frequency fields has been thoroughly reviewed in recent years by a number of national and international bodies. The principal bodies that have authoritative relevance are, in the UK, the National Radiological Protection Board/Health Protection Agency/Public Health England, and in both jurisdictions, the International Agency for Research on Cancer and the World Health Organization, and the official scientific advisory committee for the EU, SCENIHR (Scientific Committee on Emerging and Newly Identified Health Risks). In setting their guidelines, the International Commission on Non-Ionizing Radiation Protection (ICNIRP) also performs its own reviews of the science.

24. When the Government in either the UK or Ireland forms EMF policy, it takes into account the relevant reviews of the science by authoritative bodies.

#### 8.1.6.2 The NRPB and HPA

25. Non-ionising radiation in the UK originally fell within the remit of the National Radiological Protection Board (NRPB). On 1 April 2005 the NRPB became part of the Health Protection Agency (HPA), forming the Radiation Protection Division (HPA-RPD). The HPA in turn became part of Public Health England (PHE) in 2013. This JER refers to whichever body was relevant at the time of the statement being referred to.

26. In 2004 the NRPB published new “Advice on Limiting Exposure to Electromagnetic Fields (0-300GHz)” (NRPB 2004a) and accompanied it with a “Review of the Scientific Evidence for Limiting Exposure to Electromagnetic Fields (0-300GHz)” (NRPB 2004b). The former summarises epidemiological evidence as follows (p15):

*“In the view of NRPB, the epidemiological evidence that time-weighted average exposure to power frequency magnetic fields above 0.4  $\mu$ T is associated with a small absolute raised risk of leukaemia in children is, at present, an observation for which there is no sound scientific explanation. There is no clear evidence of a carcinogenic effect of ELF EMFs in adults and no plausible biological explanation of the association that can be obtained from experiments with animals or from cellular and molecular studies. Alternative explanations for this epidemiological association are possible: for example, potential bias in the selection of control children with whom leukaemia cases were in some studies and chance variations resulting from small numbers of individuals affected. Thus any judgments developed on the assumption that the association is causal would be subject to a very high level of uncertainty.”*

27. With respect to other health outcomes, including adult cancer, neurodegenerative diseases, suicide and depressive illness, cardiovascular disease, or adverse pregnancy outcomes, the NRPB found the available epidemiologic evidence inconclusive, weak, or inconsistent, and concluded that

*“the results of epidemiological studies, taken individually or as collectively reviewed by expert groups, cannot currently be used as a basis for restrictions on exposure to EMFs.”*

#### 8.1.6.3 IARC

28. The International Agency for Research on Cancer (IARC) is an agency of the World Health Organization. Its Unit of Carcinogen Identification and Evaluation has, since 1972, periodically published Monographs, which assess the evidence that various agents are carcinogenic and classify the agents accordingly. In June 2001, a Working Group met to consider static and extremely-low-frequency electric and magnetic fields (IARC 2002). Power-frequency magnetic fields were classified as



“possibly carcinogenic”, on the basis of “limited” evidence from humans concerning childhood leukaemia, “inadequate” evidence from humans concerning all other cancer types, and “inadequate” evidence from animals. Power-frequency electric fields were judged “not classifiable” on the basis of “inadequate” evidence from both humans and animals.

#### 8.1.6.4 WHO

29. The World Health Organization published an Environmental Health Criteria Monograph in 2007 on ELF EMFs (WHO 2007), produced by a Task Group that met in 2005. This concluded, in part:

*“Chronic effects”*

*Scientific evidence suggesting that everyday, chronic low-intensity (above 0.3-0.4 $\mu$ T) power-frequency magnetic field exposure poses a health risk is based on epidemiological studies demonstrating a consistent pattern of increased risk for childhood leukaemia. Uncertainties in the hazard assessment include the role that control selection bias and exposure misclassification might have on the observed relationship between magnetic fields and childhood leukaemia. In addition, virtually all of the laboratory evidence and the mechanistic evidence fail to support a relationship between low-level ELF magnetic fields and changes in biological function or disease status. Thus, on balance, the evidence is not strong enough to be considered causal, but sufficiently strong to remain a concern.*

*A number of other diseases have been investigated for possible association with ELF magnetic field exposure. These include cancers in both children and adults, depression, suicide, reproductive dysfunction, developmental disorders, immunological modifications and neurological disease.*

*The scientific evidence supporting a linkage between ELF magnetic fields and any of these diseases is much weaker than for childhood leukaemia and in some cases (for example, for cardiovascular disease or breast cancer) the evidence is sufficient to give confidence that magnetic fields do not cause the disease.”*

## 8.1.6.5 SCENIHR

30. On January 19 2009 SCENIHR published a report on EMFs, "Health Effects of Exposure to EMF" (SCENIHR 2009). The section of the abstract concerned with ELF fields states:

*"The few new epidemiological and animal studies that have addressed ELF exposure and cancer do not change the previous assessment that ELF magnetic fields are a possible carcinogen and might contribute to an increase in childhood leukaemia. At present, in vitro studies did not provide a mechanistic explanation of this epidemiological finding.*

*No new studies support a causal relationship between ELF fields and self-reported symptoms.*

*New epidemiological studies indicate a possible increase in Alzheimer's disease arising from exposure to ELF. Further epidemiological and laboratory investigations of this observation are needed.*

*Recent animal studies provided an indication for effects on the nervous system at flux densities from 0.10-1.0 mT. However, there are still inconsistencies in the data, and no definite conclusions can be drawn concerning human health effects.*

*Very few recent in vitro studies have investigated effects from ELF fields on diseases other than cancer and those available have very little relevance. There is a need for hypothesis-based in vitro studies to examine specific diseases.*

*It is notable that in vivo and in vitro studies show effects at exposure levels (from 0.10 mT and above) to ELF fields that are considerably higher than the levels encountered in the epidemiological studies ( $\mu$ T-levels) which showed an association between exposure and diseases such as childhood leukaemia and Alzheimer's disease. This warrants further investigation."*

31. An updated preliminary opinion<sup>23</sup> by the SCENIHR was released for consultation on February 4, 2014 and its conclusions, despite consideration of new research studies, are consistent overall with its conclusions in 2009. Specifically, the Committee reported that new epidemiology studies do not shed light on a previously reported association with childhood leukaemia and that shortcomings in these studies and a lack of experimental support from animal studies or cellular evidence for mechanisms prevent a causal interpretation of this statistical association. In addition, the Committee reported that recent results do not provide convincing evidence of neurodegenerative diseases or dementia, or show evidence of adverse pregnancy outcomes, related to EMF. Epidemiology studies of symptoms reported by persons describing themselves as sensitive to EMF exposure were evaluated as having weaknesses and do not provide convincing evidence for an effect of EMF on symptoms in the general population, a conclusion supported by most experimental evidence. The available evidence did not suggest to the Committee that combined exposure to different fields or signals caused significant effects for total exposures

<sup>23</sup> [http://ec.europa.eu/health/scientific\\_committees/emerging/docs/scenihr\\_o\\_041.pdf](http://ec.europa.eu/health/scientific_committees/emerging/docs/scenihr_o_041.pdf)

below international guideline values. The SCENIHR opinion contained no recommendations for precautionary measures to limit exposure to EMF.

### 8.1.7 Effect of EMFs on Farming, Flora & Fauna

32. Although the majority of scientific studies of the possible effects of EMFs have concerned effects on humans, there have also been a considerable number of studies into possible effects on animals, principally farm animals, and plants, principally agricultural crops.
33. Whilst some studies do report minor changes possibly attributable to EMFs, there appears to be no single effect that can be regarded as established, and the preponderance of the evidence has failed to find any effects. This is reflected in the conclusions of those authoritative bodies that have examined this question e.g., SCENIHR (2009).
34. There can be an effect on bees if the hive is in a strong electric field. The mechanism is either heating of the hive by induced currents or small shocks due to small induced charges. Both these effects are readily eliminated by screening the hive by means of a grounded metal cover. Bees have not been found to be adversely affected by exposure to ELF magnetic fields or to direct effects of ELF electric fields.
35. There is a large body of literature about how various animals, birds or fish use the Earth's magnetic field as an aid to navigation, including suggestions that overhead lines might disrupt the ability of some animals to detect the Earth's field. The authoritative review bodies have clearly been aware of this literature, but have not concluded that it is a relevant consideration in their assessment of power-frequency EMFs, presumably because the fields that such species use are static fields, as opposed to the alternating fields produced by power systems.
36. The respective applicants and their advisors are not aware of any evidence suggesting that EMFs would have any impact on human food produced by or from animals exposed to EMFs.

## 8.2 Methodology

### 8.2.1 Summary of Controls on EMFs

37. The basis for control of EMFs, and therefore for assessing whether the proposed interconnector has significant residual effects, is quantitative exposure guidelines produced by relevant authoritative international bodies.

38. International guidelines for both public and occupational exposure to ELF EMFs were issued by the International Commission on Non-Ionizing Radiation Protection (ICNIRP) in 1998 and updated in 2010 (ICNIRP 1998, 2010). The EU Council Recommendation of 12 July 1999 on the limitation of exposure of the general public to electromagnetic fields (0 Hz to 300 GHz) used the 1998 guideline as the basis for guidelines on human exposure to ELF EMFs from power sources that they incorporated into their recommendation for locations where people spend significant time (EU, 1999). Numerous countries worldwide have also adopted or follow the ICNIRP guidelines.
39. A new directive on occupational exposure to ELF EMF, Directive 2013/35/EU of the European Parliament and of the Council of 26 June 2013 which is based on the 2010 ICNIRP guidelines, has been passed by the EU (EU, 2013). The exposure limits are designed to protect against known, direct and indirect effects of ELF EMF.
40. In determining its guidelines, ICNIRP's main objective was "*to establish guidelines for limiting exposure to electric and magnetic field (EMF) that will provide protection against all established adverse health effects.*" ICNIRP conducted a thorough weight-of-evidence review of the cumulative research at the time (in both 1998 and 2010) and concluded that the epidemiologic data were too weak and not sufficient to establish any guidelines. The evidence on chronic effects of long-term exposures did not conclusively indicate that ELF EMF exposure contributed to any health effect, including cancer. They did determine, however, that short-term, neurostimulatory effects could occur at very high field levels and established guidelines to protect against these effects, which include perception, annoyance, small electrical discharges (microshocks), and the stimulation of nerves and muscles. These responses to exposure are transitory and non-life threatening. To allow for uncertainties that may be present in scientific data, further reductions in limits by safety factors have also been applied when exposure guidelines were established.

## 8.2.2 Applicable National Policy in UK

### 8.2.2.1 EMF Exposure Guidelines in the UK

41. There are no statutory regulations in the UK that limit the exposure of people to power-frequency electric or magnetic fields. However, responsibility for implementing appropriate measures for the control of EMFs lies with Government, and Government has put in place a set of policies to this end, based on quantitative exposure guidelines.

42. The policies that exist in the UK for the control of EMFs are described in detail in section 8.2.2.1 of the Consolidated ES.
43. In summary, in 2004, the National Radiological Protection Board (NRPB), which had statutory responsibility for advising Government on non-ionising radiation protection, including power-frequency fields, recommended to Government (NRPB 2004a) the adoption in the UK of guidelines published in 1998 by ICNIRP (ICNIRP 1998). Government accepted this recommendation, stating in 2004 (DH 2004) that public exposures should be limited by the 1998 ICNIRP Guidelines in the terms of a 1999 EU Recommendation (EU 1999). This policy was restated and made more explicit in a 2009 Written Ministerial Statement (DH 2009), and the necessary details for the practical implementation of this policy were set out in a Code of Practice on Compliance (DECC 2012a) first issued in 2011. The Northern Ireland Executive explicitly adopted this Code of Practice in 2012 at which point a revised version was issued to include Northern Ireland, and there is no separate policy in Northern Ireland relating to EMFs from overhead lines.
- 8.2.2.2 Policy of Compliance with Exposure Guidelines (Northern Ireland)
44. SONI's policy is that the proposed interconnector must comply with Government policy on EMFs and in particular with the Government's EMF exposure guidelines. SONI believes that compliance with Government policy on EMF exposure levels ensures the appropriate level of protection for the public from these fields.
45. In developing the proposed interconnector, the SONI proposal has designed the proposed new 400kV overhead line to comply fully with the 1999 EU Recommendation, and also with the only other relevant Government policy, which relates to a concept called "phasing" (see section 8.2.5 below). This action complies with Government policy and with the specific advice of PHE, who act as the Government's independent scientific adviser in relation to EMFs.
46. SONI has committed itself to the provisions of the Codes of Practice through its membership of the Energy Networks Association, and following the 2012 revision, these Codes of Practice explicitly apply in Northern Ireland and therefore to the proposed interconnector. National Policy Statement (NPS) EN-5 was created in the context of the planning system as it exists only in England and Wales, but the principles it sets out are of relevance to the whole UK, and in the absence of any Northern Ireland planning policy addressing EMF issues, SONI has regard to the policies in NPS EN-5. NPS EN-5 endorses the policies explained here, including the Code of Practice on Compliance.

## 8.2.3 Applicable National Policy in Ireland

### 8.2.3.1 EMF Exposure Guidelines in Ireland

47. The Expert Group on the Health Effects of Electromagnetic Fields that was appointed by the Government found that the “*ICNIRP guidelines are employed by governments and health advisory authorities worldwide to ensure the protection of citizens from any adverse health effects that might arise from exposure to EMF*”. The Expert Group recommended “*strict compliance with ICNIRP guidelines*” and concluded that such compliance will provide “*adequate protection for the public from any EMF sources*” (DCMNR, 2007).

### 8.2.3.2 EirGrid Policy of Compliance with Exposure Guidelines

48. EirGrid regards the protection of the health, safety, and welfare of its staff and the general public as a core company value in all of its activities. It is EirGrid's policy to design and operate the network to the highest safety standards and to continually review and update its standards in light of new developments and research findings. EirGrid will continue to implement the following mitigation measures:
- Design and operate the transmission system in accordance with the most up-to-date EU recommendations and guidelines of the various independent authoritative international expert bodies;
  - Closely monitor and support engineering and scientific research in this area, and;
  - Provide information to the general public and to staff on the issue of ELF EMF.
49. In addition, EirGrid's standard route planning criteria generally seeks to avoid heavily populated areas and to route the proposed interconnector line as far from existing homes as is reasonably possible, which has the effect of minimising potential exposure to ELF EMF.
50. EirGrid's position on ELF EMFs and health is based solely on the conclusions and recommendations of established national and international health and scientific agencies that have reviewed the body of literature. These panels have consistently concluded that the research does not suggest that ELF EMFs causes any adverse health effects at the levels encountered in our everyday environment and compliance with the existing standards from ICNIRP provides sufficient public health protection.

## 8.2.4 Numerical Values of Exposure Guidelines

51. This section concerns the values of the exposure limits at 50Hz, the relevant frequency for the proposed interconnector.
52. The ICNIRP guidelines recommend that the general public are not exposed to levels of EMFs able to cause a current intensity of more than two thousandths of an ampere per square metre ( $2 \text{ mA/m}^2$ ) within the human central nervous system. This recommendation is described as “the basic restriction”. The external fields that have to be applied to the body to cause this current density have to be calculated by numerical dosimetry.
53. The ICNIRP guidelines also contain values of the external fields called “reference levels”. The reference level for an electric field is 5 kV/m, and the reference level for a magnetic field is 100  $\mu\text{T}$ .
54. The 1999 EU Recommendation uses the same values as ICNIRP (1998) but specifies that the values apply to locations where people spend significant time.
55. In the ICNIRP guidelines and the EU Recommendation, the actual limit is the basic restriction. The reference levels are not limits, but are guides to when detailed investigation of compliance with the actual limit, the basic restriction, is required. If the reference level is not exceeded, the basic restriction cannot be exceeded and no further investigation is needed. If the reference level is exceeded, compliance with the basic restriction has to be assessed using numerical dosimetry.
56. The most widely accepted numerical dosimetry is that performed by Dimbylow. In the UK, the values calculated by Dimbylow are incorporated into the Code of Practice on Compliance and therefore have formal status:

*“The 1998 ICNIRP exposure guidelines specify a basic restriction for the public which is that the induced current density in the central nervous system should not exceed  $2 \text{ mA m}^{-2}$ . The Health Protection Agency specify that this induced current density equates to uniform unperturbed fields of 360  $\mu\text{T}$  for magnetic fields and  $9.0 \text{ kV m}^{-1}$  for electric fields. Where the field is not uniform, more detailed investigation is needed. Accordingly, these are the field levels with which overhead power lines (which produce essentially uniform fields near ground level) shall comply where necessary. For other equipment, such as underground cables, which produce non-uniform fields, the equivalent figures will never be lower but may be higher and will need establishing on a case-by-case basis in accordance with the procedures specified by HPA. Further explanation of basic restrictions, reference levels etc is given by the Health Protection Agency.”*

57. Therefore, if the fields produced by an overhead line at places where people spend significant time (EU, 1999), are lower than 9kV/m and 360 $\mu\text{T}$ , the fields required to

produce the ICNIRP basic restriction, it can be taken as compliant with the ICNIRP guidelines and hence with Government policy in both countries.

## 8.2.5 Additional Precautionary Measures

### 8.2.5.1 Overview

58. Where there are suggestions of possible but unproven adverse effects, as is the case with EMFs, it is appropriate to consider precautionary approaches.

59. The WHO EMF Task Group which published an Environmental Health Criteria (EHC) monograph in June 2007 (WHO 2007) commented on the costs of precautionary approaches to limiting ELF EMF exposure. The Task Group noted that:

*“electric power brings obvious health, social and economic benefits, and precautionary approaches should not compromise these benefits. Furthermore, given both the weakness of the evidence for a link between exposure to ELF magnetic fields and childhood leukaemia, and the limited impact on public health if there is a link, the benefits of exposure reduction on health are unclear. Thus the costs of precautionary measures should be very low.”*

### 8.2.5.2 Precautionary measures in the UK

60. As explained above, EMF policy in the UK is based on compliance with quantitative exposure guidelines. But EMF policy also takes account of the need to consider possible precautionary measures in addition to the exposure guidelines.

61. A Stakeholder Advisory Group on ELF EMFs (SAGE) operated in the UK in the 2000s. SAGE published its First Interim Assessment in April 2007 (SAGE 2007) (and subsequently a Second Interim Assessment, SAGE 2010, which is however not directly relevant to overhead lines). It made a number of recommendations for relatively low-cost precautionary measures that it considered to be in the best interests of society as a whole. It considered, but did not recommend, the option of introducing “corridors” round overhead lines whereby no new overhead lines would be permitted within specified distances of existing homes and no new homes would be permitted within the same specified distance of existing overhead lines.

62. On 16 October 2009, the Government gave its response to the SAGE recommendations in a Written Ministerial Statement (DH 2009). In summary, Government decided that one precautionary measure would apply to high-voltage overhead lines, a measure relating to a design feature of some lines called “optimum phasing”, but that other precautionary measures, notably “corridors” or



minimum separations of overhead lines from properties, were not appropriate and would not apply.

63. The SONI proposal has followed best practice, as encapsulated in the Holford Rules, for Routeing and minimising the visual and landscape impact of the proposed line. This has resulted in the line being routed away from heavily populated areas and as far away from individual dwellings as possible. As a consequence of this, EMF exposures in existing homes are also minimised.

#### 8.2.5.3 Precautionary Measures in Ireland

64. In the review conducted by an expert scientific panel for the Department of Communications, Marine and Natural Resources, specific precautionary recommendations were made in relation to the siting of power lines and community input:

*“Where possible new power lines should be sited away from heavily populated areas so as to minimise 50 Hz field exposure. Where major new power lines are to be constructed, there should be stakeholder input on the Routeing. This could take the form of public hearings or meetings with interested parties”* (DCMNR, 2007, p. 5).

65. The above precautionary measures have been implemented by reducing the fields from the adjacent 400 kV lines by recommending (for the existing double-circuit section) a line phasing that reduces the magnetic field away from the lines, and constructing the transmission line on existing towers where possible. Other actions by EirGrid during siting have resulted in the new lines of the proposed interconnector being routed away from heavily populated areas and as far away from existing residences as is reasonably practicable and incorporation of stakeholder input during the consultation process as described in the *Planning Report*, Volume 2A of the application documentation. (Details of consultation in Northern Ireland are provided in Chapter 6 of the Consolidated ES).

## 8.3 The Receiving Environment

66. Electric and magnetic fields both occur naturally. The Earth's magnetic field, which is caused mainly by currents circulating in the outer layer of the Earth's core, varies between about 30 $\mu$ T at the equator and about 60  $\mu$ T at the poles.
67. At the Earth's surface there is also a natural electric field, created by electric charges high up in the ionosphere, of about 100 V/m in fine weather. Below a storm cloud containing large quantities of electric charge, the field may reach intensities up to 20 kV/m over flat surfaces, while above hillocks or other irregularities or near the tops of objects such as trees, the field strength can be considerably higher.

68. Such naturally occurring electric and magnetic fields are generally referred to as static or DC fields. In the island of Ireland, the electric and magnetic fields produced by electric power are AC (or power frequency) fields of 50 Hz.
69. Electricity increasingly has become part of daily life over the past 100 years and modern life could not be imagined without it. Sources of common exposure are the wiring in homes and buildings, electrical appliances and equipment used in the home or in work environments, the transmission lines that carry electricity from generating stations to substations, and the distribution lines that deliver power locally.
70. In many cases domestic electrical appliances and tools can generate higher magnetic and electric fields in their close proximity than do transmission lines. However, typically such fields are experienced only for the relatively short duration that the appliance or tool is in use and close to the body.
71. Distribution lines have a lower voltage and carry less current, but are more common and can be a greater source of ELF EMFs because of their closer proximity to homes than transmission lines. The equipment within substations is not a common source of exposure because EMF levels drop off quickly with distance, so the exposure levels at the fence lines around substations, generally, are close to background levels (i.e. the levels typically measured at distances from all sources in one's environment). The dominant sources near substations are the power lines that connect to them.
72. There are no surveys of background levels of magnetic fields that have been conducted in Ireland, but several have been conducted in the United Kingdom. Since the power grid and household characteristics are similar to that of Ireland, the information is useful to evaluate typical background levels. The Health Protection Agency (HPA) estimates background magnetic field levels in the United Kingdom are between 0.01  $\mu\text{T}$  and 0.2  $\mu\text{T}$ . An evaluation of three studies in which spot measurements were recorded in 684 homes in Great Britain, computed a geometric mean magnetic field level of 0.038  $\mu\text{T}$  (Swanson and Kaune, 1999). Based on limited data, they calculated that personal exposure of most persons is approximately 40% higher than these spot measurements, which is consistent with the HPA's determination.

## 8.4 Mitigation Measures

73. The proposed overhead line has been designed using tower structures that ensure that the fields produced are compliant with the relevant exposure guidelines.

74. Where the line forms part of a double-circuit structure, the phasing of the two circuits has been chosen so as to minimise the fields produced.
75. In addition, the normal best-practice line routing procedures followed in both the EirGrid and SONI Proposals ensure that the line is routed away from existing homes, where reasonably practicable, further reducing the fields.

## 8.5 Residual Impacts

### 8.5.1 Construction Phase

76. There are no significant EMFs produced by the construction of the proposed interconnector, so this appraisal is principally concerned with the operational phase.

### 8.5.2 Operational Phase

#### 8.5.2.1 Magnitudes of Fields

77. The EMFs produced by the voltage and current in a conductor fall rapidly with distance from the conductor. Where there is more than one conductor forming part of one or more electrical circuits, there is also partial cancellation between the EMFs produced by the individual conductors. Overall, the EMFs at ground level are generally highest directly beneath the conductors and fall quite rapidly with distance.
78. The EMFs from the proposed interconnector are determined by the particular configuration and tower type used in different portions of the route rather than by reference to a particular study area. The discussion of the EMFs from the proposed transmission line therefore is divided into these separate transmission line tower cases, with three separate cases being considered:
- Over the vast majority of the proposed interconnector route, including all of the route within Northern Ireland, the proposed transmission line will be supported on standard single-circuit lattice steel towers;
  - A short length of single-circuit transposition towers, comprising just two towers, (Towers 119 and 120) in the townland of Cashel, County Monaghan
  - A length of double-circuit lattice towers in Ireland.
79. Calculations are presented here for these proposed designs of the overhead line for both electric fields and magnetic fields. Calculations are the best way of assessing fields in these circumstances and are acceptably accurate.

80. The calculations of fields presented here follow industry-standard conventions, which, in the UK, are prescribed in the Code of Practice on Compliance. In particular, the calculations of magnetic fields ignore zero-sequence currents, that is, they assume the currents in each circuit are perfectly balanced. This approximation does not affect the accuracy of the calculations of larger fields at closer distances to the overhead line, but means that smaller fields at larger distances are underestimated.
81. Calculations were performed using specialised computer software. The respective software used by EirGrid and the SONI proposals give identical answers to within the expected accuracy, and both software packages have been validated against direct measurement (Swanson 1995; Chartier and Dickson, 1990<sup>24</sup>).
82. Calculations are presented here for, broadly, the maximum fields the line is capable of producing under normal operating conditions, that is, when the line is at design minimum clearance and is carrying the maximum possible continuous current. This gives the theoretical maximum fields, which are used for assessing compliance with exposure guidelines. Use of this maximum field for assessing compliance is a requirement in Northern Ireland as specified in the Code of Practice on Compliance.
83. The specific conditions used for this calculation are a voltage of 400 kV (the nominal voltage), a load of 1500 MVA (the "highest rating that can be applied continuously in an intact system" specified in the SONI proposal, in accordance with the Code of Practice, and equivalent to 2166A), and a ground clearance of 9.0 m (the minimum clearance to which the line has been designed).
84. However, fields this high would be encountered rarely if ever in practice, as in normal operations, the line carries lower currents, and the clearance is higher than the minimum. Calculations are therefore also presented in the Consolidated ES (for Northern Ireland) and the EIS (for Ireland) for indicative typical or average conditions, using a current one third of the maximum loading, and therefore producing magnetic fields roughly one third of the maximum values presented here.
85. A summary of the maximum fields produced by each of the three tower designs is provided in Table 8.1. For the standard single-circuit lattice steel towers, which comprise the great majority of the route, Table 8.1 also provides the values at various distances to the sides of the line. These results are discussed in more detail in the Consolidated ES and EIS.

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<sup>24</sup> Chartier VL and Dickson LD. Results of Magnetic Field Measurements Conducted on Ross-Lexington 230-kV Line. Report No. ELE-90-98. Bonneville Power Administration, 1990

**Table 8.1 Predicted EMF values from proposed 400kV line.**

Exposure Characteristics	Electric Field Strength kV/m	Magnetic Field Strength $\mu\text{T}$
Maximum values directly under the line		
Standard single-circuit	7.9	47.9
Transposition single-circuit	8.0	48.5
Double-circuit	7.1	41.6
Values to sides of route (for standard single-circuit lattice steel towers)		
25m from the centre-line	1.7	12.1
50m from the centre-line	0.2	3.1
100m from the centre-line	0.03	0.8
Limit value for comparison		
derived from ICNIRP 1998	9.0	360

#### 8.5.2.2 Assessment of Compliance of Overhead Line with Guidelines

86. Table 8.1 also shows the exposure limits from ICNIRP 1998. It can be seen that the theoretical maximum magnetic field underneath the 400kV line is 47.9  $\mu\text{T}$  for the great majority of the length, or 48.5  $\mu\text{T}$  for the short transposition-tower section. This is less than the ICNIRP reference level and less than 15% of the field corresponding to the basic restriction and therefore the magnetic field complies with the ICNIRP guidelines. It is also less than the magnetic fields encountered close to some common household electrical appliances.
87. For the standard single-circuit lattice steel towers, at 50m from the line centre the magnetic field is about 3.1  $\mu\text{T}$  at maximum load, which is approximately 1% of the field corresponding to the ICNIRP basic restriction of 360  $\mu\text{T}$  or 3% of the reference level of 100  $\mu\text{T}$ , and is comparable with the levels produced by everyday office and domestic electrical appliances. At average or typical loads the field at 50 m from the line centre is even lower, about 1  $\mu\text{T}$ .
88. The peak electric field is 7.9 kV/m for the great majority of the length of the line, or 8.0 kV/m for the short transposition-tower section. Although this is more than the ICNIRP reference level, 5 kV/m, it is less than the field corresponding to the basic restriction, 9 kV/m. Therefore the electric fields produced by this line comply with the ICNIRP guidelines.
89. For the standard single-circuit lattice steel towers, at 50 m from the line centre, the electric field is 0.20 kV/m which is approximately 2% of the field corresponding to the ICNIRP basic restriction of 9kV/m or 4% of the reference level of 5 kV/m.

90. As explained in Section 8.2.1 above, the public exposure limits, as incorporated into the EU Recommendation, apply only where the time of exposure is significant and therefore only to certain land uses. But in fact, the fields produced by the 400 kV overhead line are compliant with the guidelines regardless of land use.

#### 8.5.2.3 Fields Produced by the Proposed Substation

91. Due to the complex physical arrangement of electrical equipment, the EMFs produced by an electrical substation are not readily calculable; however, the highest field levels at and outside the perimeter of a substation are usually those produced by the overhead lines entering the substation. The fields produced by equipment within the substation are generally smaller at or beyond the perimeter and decrease with distance more quickly than fields generated by overhead lines.

#### 8.5.2.4 Compliance of the Substation

92. Section 8.5.2.3 above concluded that the fields from the proposed substation at and beyond its perimeter were likely to be smaller than those from the overhead line. Therefore, as the overhead line is compliant, the substation will also be compliant with the guideline levels.
93. In the UK, the Code of Practice on Compliance (DECC 2012a) confirms this, spelling out explicitly that there are certain classes of equipment which inherently produce fields below the guideline levels, and can therefore be assumed to comply without producing case-by-case specific assessments of the field. Substations are one such type of equipment.

#### 8.5.2.5 Nearby Properties

94. Section 8.5.2.2 above shows that the proposed line is compliant with the relevant exposure guidelines, even directly under the line. There is no minimum lateral distance from the line required in order to achieve compliance.
95. The assessment of compliance is not dependent on the exact location of the nearest existing residential property to the line, or the nearest proposed dwelling house granted planning permission, or the nearest property that might in future be granted planning permission, because the field from the line is compliant everywhere, not just compliant outside some specified distance.

#### 8.5.2.6 Compliance of Phasing

96. As stated in section 8.2.5 above, optimum phasing of double-circuit transmission lines is a formal policy in the UK and is adopted as a matter of best practice in

Ireland. The only section of the proposed line which is double-circuit, in Woodland, County Meath, has been designed with optimum phasing, as discussed in more detail in Section 8.7.4, Volume 3B of the EIS. There is no requirement, either stemming from the UK policy or from best practice, to change from a single-circuit design to a double-circuit design for the rest of the route purely to be able to take advantage of optimum phasing.

#### 8.5.2.7 Occupational Exposure

97. The ICNIRP guidelines for occupational exposure are higher than the guidelines for public exposure, by, broadly, a factor of five. Therefore all occupational activities will also be compliant with the relevant guidelines.

#### 8.5.2.8 New ICNIRP Guidelines

98. As discussed, current policy in both jurisdictions is based on the limits from the 1998 ICNIRP Guidelines, as set out in the 1999 EU Recommendation. In 2010, ICNIRP published new exposure guidelines (ICNIRP 2010) for the range of frequencies including power frequencies. These new guidelines do not apply in either country unless and until the relevant Government decide to adopt them, presumably following their adoption by the EU.
99. In fact, ICNIRP's intention in its new guidelines does not appear to be to make the guidelines either more or less onerous. The respective applicants' assessment is that the overhead line would in fact be compliant with those Guidelines were they ever to be adopted.

#### 8.5.2.9 EMF Assessment of Underground Cables

100. Underground cables produce no external electric field, but they do still produce magnetic fields. With an underground cable, the conductors are closer together than for an overhead line, leading to greater cancellation of the fields produced by each conductor, and, distance for distance, a lower resultant field. However, underground cables are usually buried around 1 m below ground, whereas the proposed overhead line has its lowest conductors 9 m or more above ground. This means it is possible to approach the conductors of the underground cable more closely, resulting in a larger magnetic field. The overall result of these two factors is that in many circumstances, directly above the route at 1 m above ground level, the magnetic field from an underground cable can be higher than from the equivalent overhead line, though still compliant with the relevant exposure guidelines, but it falls more rapidly with distance and is lower to the sides of the route.

101. This is true for typical installations. If, however, the underground cable is buried more deeply, or its conductors placed even more closely together than is normal, or the load split between more than one group of cables separated horizontally, then the field directly above the underground cable may not be as high as that from the overhead line. Conversely, if the cable is not buried as deeply, or the assessment is, contrary to best practice, performed for a height lower than 1m above ground, the field from the cable would tend to come out as significantly higher than the overhead line. In any event, well to the sides of the route, the underground cable always produces lower magnetic fields than the equivalent overhead line.
102. There is no special significance in whether the maximum field is higher from the underground cable or the overhead line, given that both would be required to comply with the exposure guidelines.
103. For an underground cable, just as for an overhead line, the actual magnetic field produced depends on the detailed geometry of the conductors, depth of burial (equivalent to the height above ground for an overhead line), etc. It is not possible to calculate the actual magnetic field that would be produced by an underground cable until these details are fixed.
104. Just as for overhead lines, any proposal for the installation of underground cables would ensure that the fields they produce would be completely compliant with the relevant exposure guidelines. There is thus no basis from EMF considerations for preferring underground cables to overhead lines. Placing of lines underground cannot be justified on EMF grounds.

#### 8.5.2.10 Other Mitigation Options

105. As discussed in section 8.2.5 above, there are no further specific precautionary measures required of overhead lines in either Northern Ireland or Ireland.
106. Standard route planning criteria, as used in both the SONI and EirGrid proposals and which comply with all authoritative international and national guidelines for ELF EMF exposure, generally seek to avoid heavily populated areas and the proposed line is routed as far from existing homes as is reasonably possible, as discussed in more detail in the Consolidated ES and EIS submitted to the respective competent authorities.
107. As the proposed interconnector is compliant with all relevant policies for the control of EMFs, specifically with the relevant quantitative exposure guidelines, no additional mitigation measures are required.



#### 8.5.2.11 Active Implantable Medical Devices

108. The most common Active Implantable Medical Devices (AIMDs) are pacemakers and implantable cardioverter defibrillators (ICD). Pacemakers are designed to maintain a regular heart rate, which they achieve by delivering electric impulses to the heart muscle to trigger regular heartbeats. ICDs are designed to deliver an electric impulse or shock to control life-threatening arrhythmias.
109. These devices typically contain a metallic casing, a built-in battery, electronic circuitry, and electric leads leading to the heart tissue. Detection and sensing of the heart's intrinsic electric activity is an integral part of both pacemakers and ICDs to ensure that electric impulses are delivered at the right time, but external electric signals may potentially interfere with or disrupt the normal functioning and operation of pacemakers and ICDs, a phenomenon called electromagnetic interference (EMI). While most external sources of EMF are too weak, interference may potentially occur from various electric appliances, medical and industrial equipment (e.g. magnetic resonance imaging), radio communication technologies (e.g. cell phones), and magnets. Patients are advised to keep these sources away from their implants.
110. The probability of interference and the mode of response depend on the strength of the interference signal, the distance from the signal, signal duration, its frequency and the patient's orientation in the electromagnetic field, the type and design of the device, and the variable parameters and settings of the device. Modern devices incorporate various technological safeguards (e.g. shielding by titanium casing and electrical filtering) to minimise the potential for electromagnetic interference (EMI).
111. The relevant regulatory body in the UK, the Department of Health's Medicines and Healthcare Products Regulatory Agency (MHRA), has stated that it "*does not consider that transmission line EMFs constitute a significant hazard to the operation of pacemakers.*" and is not aware of an instance of a patient having their electronic implantable device, such as a pacemaker or ICD, interfered with by a high-voltage overhead line.
112. In addition, National Grid, which operates the high-voltage electricity network in England and Wales, runs a helpline for the public to report concerns about overhead lines, and is aware of no instances of interference with correctly fitted devices. Furthermore, National Grid and other electricity companies have staff with implanted heart devices, some of whom are occupationally exposed to rather higher fields than can be experienced by the public underneath overhead lines, again with no instances of interference.
113. Thus, based upon the absence of reported incidents, overhead lines do not appear to interfere with implanted heart devices.

114. AIMDs are required to be designed to be immune to most levels of EMI likely to be encountered in the environment. Some high-voltage overhead lines can sometimes produce electric fields high enough to create, in theory, scope for interference. In practice, this interference has not been observed to occur, and the reason seems to be a combination of two factors. Firstly, although some manufacturers have guaranteed immunity only up to 6 kV/m, in practice, the immunity levels of many AIMDs are somewhat higher, depending upon their design and operational settings. Secondly, although overhead lines can sometimes exceed 6 kV/m, and the calculations of Section 8.5.2.1 above indicate this is true in principle for this proposed overhead line, the circumstances where they do so are not that common in either space or time.
115. Manufacturers of implanted devices often provide information on electromagnetic interference. Advice often includes avoiding letting the implanted device get too close to certain sources of fields such as some household appliances, some walkie-talkies and similar transmitting devices, etc. Some manufacturers' literature does not mention high-voltage overhead lines, some gives a fairly low-key warning. No manufacturer that the respective applicants or their advisors are aware of appears to regard any hazard as sufficient to require a prohibition on approaching high-voltage overhead lines.
116. In practice, interference with implanted heart devices from overhead lines does not appear to occur. MHRA does not regard overhead lines as a significant risk to the operation of implanted heart devices given the absence of any reports of interference occurring to date. However, there is, in principle, scope for interference in some circumstances. Some of the possible consequences if interference did occur would constitute a potentially serious hazard. Because the likelihood of interference may vary from individual to individual, for example depending on the installation of the leads and the sensitivity settings of the device, and because the clinical consequences of any interference would also vary from individual to individual, MHRA, SONI and EirGrid all recommend any patient with concerns to consult their own cardiologist, just as for any of the many other potential sources of interference in everyday life..

## 8.6 Transboundary Effects

117. As the proposed line is everywhere compliant with the relevant exposure guidelines, there are no relevant transboundary effects.

## 8.7 Conclusions

118. This chapter provides information on calculated levels of ELF EMFs that can be anticipated in the vicinity of the proposed 400 kV transmission line and summarises the results of scientific research that has been conducted to investigate potential health effects related to ELF EMF. It provides a summary of the conclusions of reviews and exposure guidelines developed by national and international scientific and health agencies to protect the health of workers and the general public and it demonstrates by calculations that the proposed interconnector will comply with the relevant exposure guidelines. This information addresses both regulatory requirements and responds to issues raised by stakeholders during the public consultation.
119. The proposed transmission lines operating at 400 kV will produce, for the majority of its length including all of the length within Northern Ireland, a maximum 50Hz electric field of approximately 7.9 kV/m and a maximum magnetic field of approximately 47.9  $\mu$ T beneath the transmission line. For the short section of transposition (between towers 118 to 121), the maximum fields will be approximately 8.0 kV/m and 48.5  $\mu$ T. For the short section (between towers 402 to 410) carried on the existing double circuit towers<sup>25</sup>, the maximum fields will be approximately 7.1 kV/m and 41.6  $\mu$ T.
120. For more than 30 years, researchers in various scientific disciplines have conducted studies to investigate potential health effects of EMF exposure. These studies include both epidemiology studies and laboratory studies of humans, animals, tissues, and cells. Authoritative health and scientific agencies have not concluded that exposures to ELF EMFs at levels encountered in our daily life are a health hazard. While some of the epidemiology studies have reported statistical associations between higher average long-term exposure to magnetic fields and, in particular, childhood leukaemia, the role of chance, systematic error, and confounding by other factors cannot be ruled out as explanations. Moreover, a biological basis for these statistical associations is not supported by studies involving lifelong exposures of laboratory animals to magnetic fields. Similarly, studies of cells and tissues have not confirmed a mechanism by which weak ELF magnetic fields commonly encountered in our environment could have harmful effects by either initiating or promoting cancer.
121. Numerous national and international scientific and health organisations, including the WHO, the IARC, ICNIRP, SCENIHR, and PHE in the United Kingdom, have

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<sup>25</sup> For the final 2.8km run into Woodland Substation, the proposed interconnector is carried on existing double circuit towers. The existing Oldstreet-Woodland OHL is installed on the southern side of these towers. The northern side is currently unused and therefore available for use by the proposed interconnector.

reviewed the existing scientific literature to assess the potential health risks arising from this widespread exposure to EMF. Following its most comprehensive in-depth review of the scientific literature on potential health effects related to EMF, the WHO made the following statement “*Based on recent in-depth review of the scientific literature, the WHO concluded that current evidence does not confirm the existence of any health consequences from exposure to low level electromagnetic fields*” (WHO, 2014).

122. Scientifically-based exposure guidelines have been recommended by ICNIRP to protect the public and workers from known effects of EMFs that occur at high levels of exposure, such as nerve and muscle stimulation and annoyance due to micro-shocks. The guidelines incorporate large safety factors to ensure that allowable exposures are far lower than the lowest threshold for confirmed potentially adverse biological effects. ICNIRP also determined that evidence from studies with exposures below these guidelines and from studies of long-term health outcomes “*is too weak to form the basis for exposure guidelines.*” The guidelines developed by ICNIRP form the basis for the EU’s Recommendation (1999/519/EC) which sets out guidelines for member states on limiting the exposure of the public to EMFs in locations where people spend significant time. The EU Recommendation is the guideline applicable in both Northern Ireland and Ireland.
123. The calculations of EMFs provided above demonstrate that even the maximum field levels produced by the proposed 400 kV line, which would be produced only rarely if ever in practice, are below the EU (1999) exposure limits (basic restrictions).
124. In Ireland, consideration of low-cost precautionary measures to minimise exposure to EMFs in siting or line design has been recommended (DCMNR, 2007; WHO, 2007b) and followed in the case of this proposed interconnector (i.e. avoiding residences to the greatest extent possible and minimising EMFs by optimal phasing of the transmission line where it is supported on double-circuit structures). In Northern Ireland, the specific precautionary measures to be followed are specified in policy and have been followed.
125. In summary, even the maximum EMF levels from the proposed 400 kV line are still below EMF guidelines of both Ireland and Northern Ireland and the EU. Authoritative reviews of scientific research on topics relating EMFs to health of humans and other species do not show that EMFs at these levels would have adverse effects on these populations.

## 9. Traffic

### 9.1 Introduction

1. This chapter considers the likely significant impacts of the proposed interconnector, (from Turleenan, County Tyrone to Woodland, County Meath) on the traffic and transportation within the receiving environment.
2. The relevant chapter of the published Consolidated ES is Chapter 18 (Transport) and the relevant chapter of the EIS is Chapter 13 (Material Assets - Traffic) of Volumes 3C and 3D.

### 9.2 Methodology

3. The scope of this assessment is based on a review of legislation, guidance documents, other environmental reports, feedback from public consultation, consultation with prescribed authorities, pre-application consultation with An Bord Pleanála in Ireland and Roads Service in Northern Ireland, and a consideration of the likelihood for significant impacts arising, having regard to the nature of the receiving environment and the nature and extent of the proposed interconnector. The following guidance and policy documents were reviewed during the preparation of this chapter:
  - Institute of Environmental Management and Assessment (1993) Guidelines for the Environmental Assessment of Road Traffic;
  - Department of the Environment Planning Service (1993 revised 2005) Planning Policy Statement 3 (PPS 3): Access, Movement and Parking;
  - Department of the Environment Planning Service (1993 revised 2005) Planning Policy Statement 3 (PPS 3): Access, Movement and Parking. Clarification of Policy AMP3: Access to protected Routes, October 2006;
  - DRD NI Department of Regional Development, Northern Ireland (2005) Planning Policy Statement 13 (PPS 13): Transportation and Landuse;
  - Department of the Environment Planning Service and Roads Service Development Control (1999) Development Control Advice Note 15 (DCAN 15): Vehicular Access Standards;
  - Department of Regional Development & Department of the Environment (2006) Transport Assessment Guidelines for Development Proposals in Northern Ireland;

- DMRB The Design Manual for Roads and Bridges (1995), Vol. 6 Road Geometry, Section 2 Junctions, Part 6 - TD42/95 Geometric Design of Major/Minor Priority Junctions;
  - DMRB The Design Manual for Roads and Bridges (1995), Vol. 6 Road Geometry, Section 2 Junctions, Part 6 - TD 41/95 Vehicular Access to All-Purpose Trunk Roads;
  - DfT Department for Transport (2009), ISBN 978-0-11-553051-7, Traffic Signs Manual, 2nd Edition, Chapter 8 - Traffic Safety measures and Signs for Road Works and Temporary Situation, Part 1 Design HMSO;
  - DfT Department for Transport (2009), ISBN 978-0-11-553051-7, Traffic Signs Manual, 2nd Edition, Chapter 8 - Traffic Safety measures and Signs for Road Works and Temporary Situation, Part 2 Operations HMSO;
  - DfT Department for Transport (1997), NRTF National Road Traffic Forecast (Great Britain);
  - National Roads Authority's Traffic and Transport Assessment Guidelines (September 2007);
  - Monaghan County Development Plan 2013 – 2019;
  - Cavan County Development Plan 2014 – 2020;
  - Meath County Development Plan 2013 – 2019;
  - National Roads Authority Design Manual for Roads and Bridges TD 27 (November 2011) Cross Sections and Headroom;
  - National Roads Authority Design Manual for Roads and Bridges TD 41-42 (November 2011) Geometric Design of Major / Minor Priority junctions and Vehicular Access to National Roads; and
  - National Roads Authority Project Appraisal Guidelines (January 2011).
4. The operational phase of the proposed interconnector will generate minimal traffic flows as towers and substations (proposed Turleenan and existing Woodland) are unmanned. Maintenance of the proposed interconnector will generate some traffic but this will be rare and the volumes involved would be negligible. The operational phase of the proposed interconnector, therefore, has been considered to have no significant effects.
5. The construction phase of the proposed interconnector will generate larger volumes of traffic compared to the operational phase, including long / heavy vehicles, concentrated over a shorter time span. This allied with the largely rural nature of the surrounding road network, means the impact of the construction traffic needs to be

considered. However, as discussed further in this section, that is not to say that the construction of the proposed interconnector will generate significant volumes of construction traffic.

6. Locations where access to tower locations and stringing areas (areas used to install conductors onto the towers) have been identified including likely haul routes that will be used by construction traffic to travel to these access locations. An assessment of the capacity of the roads that will be used during construction to accommodate the construction generated traffic has also been undertaken.
7. Data collection, in the form of Automated Traffic Counts, was carried out to ascertain the typical existing traffic volumes currently using the roads that will be impacted by the construction of the proposed interconnector.
8. The proposed construction methodology was used to estimate the number and type of vehicles (both light and heavy vehicles) that will be generated by the construction of towers and the associated access tracks for accessing tower locations, the construction of the Turleenan Substation in County Tyrone and the extension to the existing substation in Woodland, County Meath. This information was then used to further estimate the volumes of traffic that will be generated at the construction material storage yard near Carrickmacross, County Monaghan and the NIE depot at Carn Industrial Estate, Craigavon, County Armagh.
9. By considering the proposed construction methodology and phasing, the location of the identified construction access locations and the haul routes that will be used to access these locations, estimates of the volumes of construction traffic that will use individual roads within the assessed area were generated. These estimates were then used to evaluate the impact on individual roads within the road network in numerical terms (i.e. numbers of vehicles) by comparison to existing background traffic levels on the roads.

## **9.3 The Receiving Environment**

### **9.3.1 Existing Road Network**

10. The road network in the assessed area consists of National / A Class and Regional / B Class roads, which act as key transport routes, supplemented by local / unclassified roads. Typically the National / A Class and Regional / B Class roads are to a higher standard in terms of horizontal alignment, vertical alignment and pavement condition. As such, the use of these roads will be maximised when transporting materials to the construction sites that will be used to construct the proposed interconnector.

11. Full lists of the roads that will be impacted upon by the construction of the proposed interconnector are provided in Consolidated ES Section 18.3, Chapter 18 (Transport) and EIS Section 13.4, Chapter 13 Volumes 3C and 3D (Material Assets - Traffic). The National / A Class and Regional / B Class roads that will be used to distribute construction traffic to the individual construction sites are listed below:

- A26 Killylea Road
- A29 Moy Road
- A3 Monaghan Road
- B3 Fergort Road
- B115 Battleford Road
- B106 Trew Mount Road / Benburb Road
- R103 Clonfeacle Road
- B132 Madden Road
- N2
- M3
- N51
- N52
- R125
- R147
- R154
- R161
- R162
- R163
- R164
- R165
- R178
- R179
- R180
- R181
- R183
- R184

### 9.3.2 Existing Traffic Flows

12. A total of 148 traffic count surveys were carried out on the roads identified as likely to be used to haul materials to and from construction sites in order to determine background traffic flows. These surveys consisted of Automated Traffic Counts and were undertaken in May 2012, January 2013, September 2013 and January 2014. These counts provided average daily traffic flows and heavy goods vehicle percentages which were used as the baseline on which to determine the predicted increases in flows during the construction phase.
13. Further background traffic data was acquired by consulting the Roads Service Traffic and Travel Information 2006 – 2010 Annual Traffic Census for Northern Ireland and traffic counter data published by the National Roads Authority on their website ([www.nra.ie](http://www.nra.ie)) for Ireland.



14. Details of the traffic flows along the roads that will be impacted upon by the construction of the proposed interconnector are included Consolidated ES Section 18.3, Chapter 18 (Transport) and EIS Section 13.4, Chapter 13 (Material Assets - Traffic).

### 9.3.3 Site Access

#### 9.3.3.1 Overhead Line and Tower Access

15. The overhead line and towers will include a total of 401 new towers and the stringing of 9 existing double circuit towers prior to tying into the existing substation in Woodland, County Meath. A total of 361 temporary construction accesses are to be used to construct and string the 401 proposed towers and install the line along the existing double circuit towers. The vast majority of these temporary accesses will use either existing field gates or laneways.

#### 9.3.3.2 Turleenan Substation Access

16. There is an existing dwelling (No. 152 Trew Mount Road – owned by NIE) located within the confines of the development site for the proposed Turleenan Substation. The development proposals involve initially allowing the dwelling to remain during the construction phase (to be used as a site office), with a temporary access located to the northern edge of the site. It should be noted that this access is located within the flood plain and therefore it is intended, once the majority of the construction work is completed, to demolish the dwelling and locate the permanent access to the site in this location, which is not in the flood plain.

#### 9.3.3.3 NIE Depot at Carn Industrial Estate Access

17. NIE's existing depot at Carn Industrial Estate, Craigavon, will be used as the depot for the construction of the northern section of the overhead line and towers. The depot will be used to store construction vehicles and equipment. Materials for all of the construction phase (overhead line and towers) will be stored there also. Carn is NIE's main regional depot in the southern half of Northern Ireland. It is adjacent to the M12 Carn roundabout and 15 miles (24km) from the proposed Turleenan substation which will link the proposed new 400kV line to the existing Network. The existing access arrangements are suitable to accommodate all the vehicles anticipated to be required for the proposed interconnector.

#### 9.3.3.4 Carrickmacross Construction Material Storage Yard Access

18. It is proposed that a site to the south east of Carrickmacross will be used as a construction material storage yard. This yard is located to the west of the N2 and is accessed by a local road (the L4700). The existing access into the storage yard is located adjacent to a junction on the public road network and has restricted visibility. As such, it is proposed to construct a new site entrance onto the L4700 further south of the existing entrance.

#### 9.3.3.5 Woodland Substation Access

19. Access to the existing substation in Woodland, County Meath is via an access road that connects to the L-6207-0. It is not proposed to alter the current access arrangements at this location.

### 9.3.4 Collision Data

20. A review of collision data has been undertaken for roads that will be used during the construction of the proposed interconnector. The data used was from 2008 – 2010 in Northern Ireland and 2005 – 2012 in Ireland. A summary of the serious and fatal accidents recorded in these periods are presented in Table 9.1 below:

**Table 9.1: Collision Data**

Road Name	No. of Serious Accidents	No. of Fatal Accidents
Monaghan Road	2	0
Clonfeacle Road	1	0
R184	0	1
LS07502	0	1
LP03510	1	0
Old N2	3	0
R183	2	1
R181	5	0
R178	3	0
R179	3	1
R162	12	4

Road Name	No. of Serious Accidents	No. of Fatal Accidents
R165	1	0
L-3534-0	1	0
N2	6	8
N52	4	1
R154	2	1
L-2207-44	1	1
L-6202-32	1	0
1. R161	2	1
2. R147	9	4
3. L-8001-0	1	0
4. L-3402-17	1	0
M3	0	2

21. Of the collisions presented above, a number of these occurred in close proximity to the locations of proposed temporary accesses to construction sites including accidents along the following roads:

- Monaghan Road
- LS07502
- R181
- R162
- N52
- L-2207-44
- L-3402-17

## 9.4 Mitigation Measures

### 9.4.1 Construction Phase

22. A Construction Traffic Management Plan shall be prepared prior to the commencement of construction operations. The objective of this plan will be to

minimise the impact caused by the construction stage of the proposed interconnector. Included in this report shall be:

- A construction programme detailing the sequence of tower construction which shall aim to minimise the likelihood of peaks in traffic flows and inform Local Authorities of proposed activities in the area;
- Details of the roads to be used to transport materials to and from site;
- Identification of areas requiring temporary traffic management and designs of these measures;
- Efforts to minimise debris from construction impacting on the road network;
- Arrangements for road maintenance and monitoring of road conditions as necessary;
- Communication plans for ensuring relevant stakeholders are kept up to date on construction scheduling and any proposed traffic management measures;
- Details of road signage to be erected to provide warning of the temporary access locations to construction sites' entrances or other operations requiring the provision of warning signs; and
- Details of measures to accommodate emergency services.

23. Please see Section 18.5 of the Consolidated ES and Section 13.6 of the EIS.

#### 9.4.2 Operational Phase

24. Due to the negligible impact that will be associated with the operational phase of the development, no mitigation measures are proposed for this phase of the development.

### 9.5 Residual Impacts during Construction Phase

#### 9.5.1 Overview

25. The proposed interconnector will effectively result in a long linear construction site with multiple isolated areas where construction activities will take place. In order to facilitate construction at the areas where construction activities will be occurring, materials, personnel and equipment will be transported to these sites.

26. Transportation of these materials personnel and equipment will primarily be achieved using the existing public road network. The types of vehicles that will be

transporting materials and equipment to site are crane(s), excavators, dump trucks, 4x4s, tractor and trailers and concrete delivery vehicles.

27. Refer to Consolidated ES Section 18.6, Chapter 18 (Transport) and EIS Section 13.7, Chapter 13 (Material Assets - Traffic).
28. Despite the scale of the development, the volumes of vehicles required to attend each individual construction location along the length of the linear development will be relatively low and this traffic will be spread out over several weeks which is the duration it will take to construct individual structures.
29. Due to the length of the proposed overhead line, traffic will be dispersed over a large area during the construction phase, notwithstanding the fact that construction will occur in any one location for a relatively short duration. Exceptions to this are the construction of the Turleenan Substation, County Tyrone, the extension to the existing substation in Woodland, County Meath and at a temporary construction material storage yard located to the south east of Carrickmacross, County Monaghan. Higher volumes of traffic are anticipated at these locations and for a more prolonged period compared to the individual sites along the overhead line.

## 9.5.2 Traffic Generation

### 9.5.2.1 Overhead Line

30. An estimate of the traffic that will be generated at each tower site has been developed based on the different phases of construction and the activities that will be taking place on site during these phases. The peak daily traffic generated at the proposed temporary accesses varies between 15 and 58 vehicles per day depending on the tower type and associated ground conditions. Refer to Consolidated ES Section 18.4, Chapter 18 (Transport) and EIS Section 13.5, Chapter 13 (Material Assets - Traffic) for details of how the volumes of traffic generation were estimated.

### 9.5.2.2 Turleenan Substation

31. The predicted peak daily volumes of traffic that will be generated during the construction of the Turleenan substation are 200 vehicles per day (maximum).

### 9.5.2.3 NIE Depot, Carn Industrial Estate

32. Traffic associated with the northern section of the route at the NIE depot in Carn will include traffic associated with staff, meeting here to be taken to the construction sites in work vans and also construction vehicles e.g. Fastrac/Tractor with low

loader trailer carrying conductor drums etc. (however no vehicles associated with stone and concrete, which will be delivered to the construction sites directly from the supplier). The worst case for traffic generation at the depot would be when the two proposed teams (including workers associated with work phases 1, 2 and 3) and one stringing team operate at peak levels resulting in an estimated maximum of 180 movements per day. This figure includes the delivery of construction materials to the depot at a similar rate to the departure of vehicles supplying the individual construction sites.

#### 9.5.2.4 Carrickmacross Construction Materials Storage Yard

33. The Carrickmacross construction material storage yard will serve the section of the proposed interconnector within Ireland. This will be a focal point for traffic in this section of the proposed interconnector. It is assumed that 7 construction teams will be operating simultaneously out of the yard to facilitate construction of this section of the proposed interconnector within 3 years.
34. The “worst case” scenario for traffic generation at the storage yard would be if each of the 7 teams were operating at peak levels resulting in an estimated 378 movements (i.e. 189 arrivals and 189 departures) into and out of the storage yard per day. This figure includes the delivery of construction materials to the site at a similar rate to the departure of vehicles supplying the individual construction sites.
35. It should be noted that the figure presented here is unlikely to be realised as careful scheduling of operations will ensure that the levels of traffic do not reach this worst case. Instead, traffic generated by the yard is likely to fluctuate throughout the construction phase dependent on construction activities.

#### 9.5.2.5 Woodland Substation

36. Traffic will be generated due to the proposed extension works at Woodland Substation. It is estimated that these works will result in approximately 1,612 movements. Assuming a 6 month construction period for these civil works results in approximately 13 movements per day. Allowing for site operatives and other miscellaneous trips, the peak period of traffic generation would be approximately 30 vehicle movements per day

#### 9.5.2.6 Guarding

37. Guarding will be required at locations where the proposed interconnector passes over roads and other sensitive areas. The volume of traffic generated at each guarding location is expected to be 1 to 2 vehicles per day over a 5 day period.

#### 9.5.2.7 Stringing Locations

38. Stringing location accesses are expected to be used over a maximum of 5 days and will have a maximum daily traffic flow of 20 vehicles per day.

### 9.5.3 Traffic Distribution

39. The use of local / C Class roads by larger construction vehicles will be minimised where practical. Traffic associated with the construction of the proposed interconnector will therefore make as much use of National / A Class and Regional / B Class roads as possible before transferring to lower quality roads only where necessary to access individual construction sites.
40. Due to the location of the access into the proposed construction materials storage yard near Carrickmacross, County Monaghan, two local roads (namely the L-4700 and the L4700 – N2 Link Road) will unavoidably experience a significant increase in traffic throughout the 3 year construction phase. These two roads and the junctions linking them to the national road network have been assessed in EIS Chapter 13 Volume 3C (Material Assets - Traffic).

### 9.5.4 Traffic Impact

41. IEMA guidelines identify general thresholds for traffic flow increases of 10% (sensitive receptors such as areas adjacent to schools etc.) and 30% (for all other areas). Where the predicted increase in traffic flows is lower than the thresholds, the guidelines suggest the significance of effects can be stated to be low or insignificant and further details are not warranted.
42. Traffic on the road network will increase for the duration of the construction phase. While some of the percentage increases are quite high (37 roads are expected to experience a temporary increase over 30% of existing flows), this is reflective of the low number of vehicles using these roads and not the volumes of generated traffic predicted to be using them. From a capacity perspective, the road network will be able to cater for the flows predicted. The roads with a predicted percentage increase greater than or equal to 30% are shown in Table 9.2.

**Table 9.2: Roads and Percentage Impacts**

<b>Road Name</b>	<b>Background Daily Traffic (Vehs)</b>	<b>Peak Construction Development Daily Traffic (Vehs)</b>	<b>Peak Impact (%)</b>
Major Lane	34	15	44.4%
Rhone Road	40	54	135.3%
Culverog Road	67	54	80.6%
Bracknagh Road	46	42	91.2%
Navan Fort Road	57	34	59.3%
Unclassified Road (for access AT57-58)	73	40	55.1%
Ballyhoy Road	26	18	70.4%
Monaghan Road (spur)	92	36	39.1%
Cavanagarvan Road	68	48	71.7%
Sheetrim Road	28	36	130.3%
Tivenacree Road	35	44	126.5%
Glassdummond Road	92	30	32.6%
Unclassified Road (for access AT102A and AT102B)	12	30	244.4%
L-7557-0	124	46	37.1%
L-8010	99	46	46.5%
L-40121	47	23	48.9%
L-40052	71	46	64.8%
L-40312	22	46	209.1%
L-4004	112	46	41.1%
L-4011	91	46	50.5%
L-40103	8	46	575%
L-40441	32	17	53.1%



Road Name	Background Daily Traffic (Vehs)	Peak Construction Development Daily Traffic (Vehs)	Peak Impact (%)
L-3201	133	46	34.6%
L-7211	143	46	32.2%
L-34211	86	46	53.5%
L-75031	98	46	46.9%
L7503	65	46	70.8%
L-4700	952	378	39.7%
L-4700 – N2 Link Road	340	378	111.1%
L-22051	116	46	39.7%
L-40063-0	133	46	34.6%
L-80091-16	108	46	42.6%
L-74115-0	77	46	59.7%
L-74113-0	67	46	68.7%
L-74051-7	77	46	59.7%
L-6801-0	111	46	41.4%
L-68011-17	40	46	115%

43. Local / C Class roads are particularly sensitive to the increase in heavy vehicles as these roads are typically not designed to accommodate large numbers of these types of vehicles. The potential for impacts to the pavement structure, verges, boundary treatments etc are all increased as is disturbance caused to the local community in relation to noise, vibration, dust and air quality impacts.
44. The mitigation measures described in Section 10.4 above, and the short-term nature of the increase in traffic, would result in minimal residual environmental effects in terms of traffic and transport. This conclusion is supported by:
- Use of a construction traffic management plan and Routeing agreements to minimise any impacts during construction;

- Specific traffic management arrangements for specific sections of road i.e. tailored for existing conditions; and
- Site access improvements, where applicable,

## 9.6 Residual Impacts during Operational Phase

45. It is predicted during the operational phase for the proposed substation in Turleenan, County Tyrone, there would be a maximum increase in traffic of 10 vehicle movements per day (over a single 7 day period during the calendar year). In the majority of cases, the increase would be only 4 movements per day (all light vehicles). For the maximum value of 10 vehicles per day, 4 of these would be light vehicles and the remainder would be HGVs. This constitutes a negligible increase in traffic movements, hence, traffic movements associated with the operational phase of the proposed substation are considered to be of negligible significance.
46. Minimal traffic volumes will be generated by the overhead line and towers during the operational phase as power lines are not manned. An inspection of the line will be carried out every 2 years on the section of the line within counties Tyrone and Armagh, and every 5 years on the section of the line within Monaghan, Cavan and Meath whereupon each structure on the line is visited. This will result in one to two 4x4 vehicles travelling to each landholding along the proposed interconnector to facilitate this inspection.
47. No further traffic would be generated except in exceptional circumstances, such as a fault occurring. Hence, traffic movements associated with the operational phase of the proposed substation, overhead line and towers are considered to be of negligible significance.

## 9.7 Transboundary Effects

48. The proposed interconnector will be constructed in separate sections with the section from Turleenan, County Tyrone jurisdictional border consisting of one section and the section from the border to Woodland, County Meath comprising the other.
49. Each tower site will be, in effect, a separate construction site which will be accessed by road. Access locations have been identified for each site and the routes used to travel to these sites will remain within the same jurisdiction as the towers under construction. Thus, towers under construction near the border in County Armagh will be accessed using routes in County Armagh and towers under construction near the border in County Monaghan will be accessed using routes in County Monaghan.

Thus, despite the proposed interconnector crossing the jurisdictional border, it is not expected that traffic delivering materials to site will cross the border.

50. The possibility remains, however, that some construction materials used when constructing either section may be sourced from suppliers based in the other jurisdiction. Similarly, the location where construction workers reside is not known and they may also commute to construction sites from the other jurisdiction.
51. In any event, the volumes of traffic associated with materials and/or workers crossing the border would not be large and as such the transboundary traffic impact as a result of the proposed interconnector is considered to be minimal.

## 9.8 Conclusions

52. The operational stage of the proposed interconnector will generate minimal volumes of traffic. The construction stage of the proposed interconnector will generate more traffic, albeit temporary in nature, because the primary means of transporting materials and labour to / from site will be via the existing public road network.
53. Due to the nature of the proposed interconnector, the construction phase will consist of multiple discrete construction sites. Access to the individual sites will generally be achieved via existing field accesses and existing internal tracks where available. A total of 362 temporary construction accesses are required from the public road network to construct the proposed interconnector.
54. Despite the extent of the linear development comprised in the proposed interconnector, the volumes of vehicles required to attend each individual construction location along the length of the development will be relatively low and this traffic will be spread out over several weeks (which is the time it will take to construct individual structures). Due to the length of the proposed line, traffic will be dispersed over a large area during the construction phase, notwithstanding the fact that construction will occur in any one location for a relatively short duration.
55. The construction of the proposed substation in Turleenan, County Tyrone, the extension of the existing substation in Woodland, County Meath and the operations at the proposed construction material storage yards, located at Carn Industrial Estate, Craigavon and also to the south east of Carrickmacross, County Monaghan will result in higher volumes of traffic over longer periods however these traffic flows will not result in congestion on the road network.
56. Heavy vehicles will be used to construct the transmission line. Local and minor roads are particularly sensitive to the increase in heavy vehicles as these roads are typically not designed to accommodate large numbers of these types of vehicles.

With the proposed mitigation measures, the residual impacts in terms of disturbance caused to the local community in relation to noise, vibration, dust and air quality impacts will be minimised or eliminated.

57. A Construction Traffic Management Plan shall be prepared prior to the commencement of construction operations. The objective of this plan will be to minimise any impact caused by the construction stage of the proposed interconnector.

DRAFT

## 10. Noise

### 10.1 Introduction

1. This section considers the likely significant noise and vibration impacts of the proposed interconnector, (from Turleenan, County Tyrone to Woodland, County Meath) on noise sensitive receptors.
2. The relevant chapter of the Consolidated ES is Chapter 11 (Noise) and the relevant chapters of the EIS are Chapter 9 (Air – Noise and Vibration) of Volumes 3C and 3D.

### 10.2 Methodology

3. This noise and vibration evaluation has been prepared in accordance with relevant EU and national legislation and guidance, including the requirements of Annex IV of the codified EIA Directive. The scope of the evaluation is based on a review of legislation, guidance documents, professional judgment of the authors, and on a consideration of the likelihood for significant impacts arising, having regard to the nature of the receiving environment and the nature and extent of the proposed interconnector.
4. A number of factors can influence the potential for noise and vibration impact from the proposed interconnector such as the duration of the works, noise characteristics and perception. In order to minimise the impact on sensitive receptors, the potential for noise and vibration impact has been evaluated, and a range of mitigating measures has been developed, which will ensure that acceptable guidance limits are met.
5. Noise sensitive receptors are comprised of houses, schools, hospitals, places of worship, heritage buildings, special habitats, amenity areas in common use and designated quiet areas.
6. Extensive background noise measurements were recorded along the proposed line route and at the proposed substation location, during daytime and night time. The locations chosen are receptor locations near to the Turleenan substation, towers and overhead line along the route to represent the quiet rural area and are described in the EIS and Consolidated ES.
7. Potential for noise and vibration impact in both the construction and operational phases of the proposed interconnector have been assessed and specific noise and

vibration mitigation measures have been proposed as described in the EIS and Consolidated ES.

8. Construction phase impacts have been principally assessed using standards and guidance documents, as described below.
9. Various standards and guideline documents covering the impact of external noise sources and the introduction of industrial and construction noise have been used in this evaluation.
10. The standards and guidelines appropriate for this appraisal include:
  - World Health Organisation's (WHO) Guidelines for Community Noise (1999),
  - BS5228 Code of Practice for Noise and Vibration Control on Construction and Open Sites – Part 1: Noise (2009),
  - BS4142 Method of Rating Industrial Noise Affecting Mixed Residential and Industrial Areas (1997); and
  - National Roads Authority – Guidelines for the Treatment of Noise and Vibration in National Road Schemes (2005).
11. Operational phase noise levels for the proposed Turleenan Substation have been evaluated using a CadnaA computer based noise prediction model. This model used measured noise levels from the Oldstreet 500MVA air insulated substation in County Galway. The Oldstreet substation is a modern installation and is similar in scale to the proposed substation. It should be noted that the proposed Turleenan substation will make use of GIS (Gas Insulated Substation). GIS facilities are designed to be smaller and typically quieter than air insulated substations
12. Operational Phase noise emission levels for the overhead line were taken from the EPRI AC "Transmission Line Reference Book – 200kV and Above", Third Edition AN1 Applet software.
13. This provides noise levels at varying distances from the centreline of the overhead line under varying climatic conditions. The software provides the noise level during rainfall in terms of dB  $L_{A50}$  which represents the A-weighted sound pressure level (in decibels, dB) obtained using "Fast" time-weighting that is exceeded for 50% of the given time interval.

### **10.3 The Receiving Environment**

14. The proposed interconnector is located in a predominantly rural area. Ambient noise levels at the properties located close to the majority of the proposed

interconnector are characterised by rural environmental noise (i.e. wind in trees, agricultural activities and livestock) and transportation noise on the local roads. However, there are sections of the proposed interconnector, near to busier roads, where transportation noise becomes the predominant noise source.

15. All measurements were recorded in suitably calm conditions using appropriately calibrated Type 1 instrumentation which is in-line with current appropriate standards and methodology. The sound level meter and the acoustic calibrator were at the time of measurement calibrated to the appropriate national standards. No significant drift was noted during the field calibration process.
16. The noise monitoring locations as described in the EIS and Consolidated ES are considered to be representative for all residential properties potentially impacted by the proposed interconnector.

## 10.4 Mitigation Measures

### 10.4.1 Overview

17. Careful Routing of the proposed interconnector has sought to avoid or reduce impacts on potentially sensitive receptors through distance separation. This mitigation by design is preferable to mitigating individual noise impacts on a less optimal route.
18. Notwithstanding the design led noise mitigation provided by distance separation, there remains the potential for noise and vibration impact in the construction phase and for noise impact in the operational phase.

### 10.4.2 Construction Phase

19. Appropriate mitigation measures are included to provide instruction to the contractor to control the noise impact of construction activity close to existing residential properties.
20. *BS5228 Code of practice for Noise and Vibration Control on Construction and Open Sites – Part 1: Noise* (2009) includes a number of guidelines and recommendations which are considered appropriate and of good working practice for all construction contracts. These are summarised below.

#### General Measures

21. The contractor will be contractually obliged to take note of the control measures for relevant plant listed in BS5228 and apply the appropriate measures, including

temporary screening or enclosure of noisy plant, control of “on times” for noisy plant, and positioning of plant as far as possible from noise sensitive locations and properties. Also:

- Use of good well maintained plant and where possible new plant manufactured under recent EC guidelines for manufacturers;
- Substitution of unsuitable plant;
- Maintenance of silencers and moving components.

22. The above measures as outlined in the Consolidated ES and EIS will serve to minimise noise impact to sensitive receptors.

#### Vibration

23. On site vibration monitoring is recommended when construction activities will occur in close proximity to any buildings. The use of on-site vibration monitoring will allow the impact of piling to be controlled to within the recommended guideline levels as outlined in Guidance documents listed above. Low vibration piling methods (such as auger types) are available and may be used to limit any vibration impact.

#### Monitoring

24. Given the limited impact it would not be appropriate to require regular noise monitoring of the construction sites. However occasional measurement of noise levels generated using a Type 1 sound level meter will be conducted to check on the continuing impact of the works.

#### Night Works

25. In the unlikely event of an emergency need for pumps and/or generators to be in use during night-time hours, plant will be chosen, sited and screened / enclosed such that levels at the nearest residential properties do not exceed the background level.

### 10.4.3 Operational Phase

26. The distance of the proposed interconnector from sensitive receptors is predicted to sufficiently mitigate operational phase noise levels to meet the requirements of EU and National guidance limit values.
27. The overhead line will be subject to an annual survey by helicopter patrol. Helicopter inspections will be announced in advance in local newspapers. The steady rise in noise level as the helicopter is approaching any given point (while following the line



route) should minimise any surprise element to the onset of the helicopter noise. Notification will be given of the inspections. This is not expected to cause any significant noise impact, due to the short term and transient nature of the annual survey. Advance notice will be given to landowners.

## 10.5 Residual Impacts

### 10.5.1 Construction Phase

#### 10.5.1.1 Substation and Overhead line

28. It is predicted that the highest level of noise emissions will be from construction noise. However, this impact will be short term and of a limited nature at any one location. Mitigation measures are provided to reduce the potential 'worst case' impact from construction noise. Following the implementation of the mitigation measures proposed, construction noise impacts are not deemed to be significant given that the construction noise at the nearest properties would not be greater than 3dB above the threshold values set out in National Guidelines, as described in Section 11.2 above.
29. A temporary Construction Material storage yard will be used during the construction phase of the overhead line. The noise and vibration impacts of this yard are assessed in the EIS, following the implementation of the mitigation measures proposed, construction noise impacts from the yard are not deemed to be significant.

### 10.5.2 Operational Phase

#### 10.5.2.1 Turleenan Substation

30. The operation phase noise impact of the proposed Turleenan substation will be limited to intermittent corona noise and operational transformer/plant noise. The impact of this is not deemed to be significant as the noise levels predicted are less than those likely to comprise a nuisance according to the established WHO and British Standard Guidance. The proposed target level, set with regard to BS4142, will not be exceeded at the nearest noise sensitive properties.

#### 10.5.2.2 Woodland Substation Extension

31. An extension to the existing Woodland Substation to accommodate a section of double circuit OHL at the southern terminus of the OHL is proposed. This is not predicted to have any significant residual operational phase noise sources

associated with it. The noise impact from the double circuit OHL itself has been assessed separately.

#### 10.5.2.3 Overhead line and Towers

32. The noise from the overhead line has been predicted at varying distances using the measured noise levels and the noise prediction applet as presented in the Consolidated ES and EIS. The predicted noise levels have been found to be within the guidelines presented within BS8233:1999 for internal noise levels and within the WHO guidelines for external amenity spaces. Therefore the potential noise impact from both corona discharge and the continuous noise, whilst it may be perceptible under certain climactic conditions, will fall within the guidelines.
33. 'Aeolian noise' also known as turbulent wind noise may be created due to high wind speeds affecting the towers and conductors. The amount of Aeolian noise is directly linked to wind speed and direction. This type of noise impact is not considered as significant as the ambient noise levels are also higher (affected by occurrences such as wind in trees) therefore minimising and masking any possible impact.

## 10.6 Transboundary Effects

34. No significant transboundary impacts associated with noise and vibration are predicted. Construction and operational phase impacts are predicted to meet the relevant noise and vibration limits at the nearest sensitive receptors in both jurisdictions.
35. Predicted noise and vibration impacts at all sensitive receptors in both jurisdictions for the construction and operational phases are predicted to meet the relevant guidance limit values. Accordingly sensitive receptors located in one jurisdiction will not be adversely impacted by noise and vibration sources attributable to the proposed interconnector on the other side of the border. Hence there is no predicted transboundary noise and vibration impact to any sensitive receptor in either jurisdiction that would exceed the relevant guideline limit values for noise and vibration.

## 10.7 Conclusions

36. Extensive noise surveys have been conducted along the proposed overhead line route and substation sites to establish the existing noise levels. The receiving environment is predominantly rural and the background and ambient noise levels reflect this.

37. Potential noise levels from the construction and operation of the proposed interconnector have been evaluated.
38. It is predicted that the highest noise emissions levels from the proposed interconnector will be those of substation and the overhead line construction. However, this impact will be short term and of a limited nature. Mitigation measures have been provided to reduce the potential 'worst case' impact from construction noise and the contractor will be required to liaise with the Local Authority and residents throughout the construction period.
39. The residual impact of construction noise and vibration following the implementation of mitigation measures is not predicted to be significant.
40. The overhead line will be subject to an annual survey by helicopter patrol. Helicopter inspections will be announced in advance in local newspapers. The steady rise in noise level as the helicopter is approaching any given point (while following the line route) should minimise any surprise element to the onset of the helicopter noise. This is not expected to cause any significant noise impact, due to the short term and transient nature of the annual survey and the advance notice to landowners.
41. Once complete the operational noise impact of the proposed overhead line route, towers, and substations will be limited to intermittent corona noise and continuous transformer/plant noise at the substations. There will be no operational phase vibration impacts to sensitive receptors for the proposed interconnector.
42. The line and substation noise emissions have been predicted and assessed and no mitigation is proposed for noise emissions arising from the operational stage of these elements. The predicted levels are below the recommended levels and targets set by the WHO and are thus within acceptable limits with regard to residual impacts for noise and vibration.
43. It has therefore been predicted that the proposed interconnector will not result in any significant noise and vibration effects.

## 11. Ecology (Flora and Fauna)

### 11.1 Introduction

1. This section considers the likely significant impacts of the proposed interconnector, (from Turleenan, County Tyrone to Woodland, County Meath) on the Flora and Fauna in the receiving environment.
2. The relevant chapter of the published Consolidated ES is Chapter 10 (Ecology) and the relevant chapters of the Environmental Impact Statement (EIS) are Chapter 6 (Flora and Fauna) of Volumes 3C and 3D.

### 11.2 Methodology

3. Information on baseline conditions were collated from data supplied by and in consultation with:
  - BirdWatch Ireland (BWI);
  - British Trust for Ornithology (BTO);
  - Cavan County Council;
  - Centre for Environmental Data and Recording (CEDaR);
  - Meath County Council;
  - Monaghan County Council;
  - National Parks and Wildlife Services (NPWS);
  - Northern Ireland Environment Agency;
  - Northern Ireland Whooper Swan Study Group (NIWSSG);
  - Raptor Study Group;
  - Royal Society for the Protection of Birds (RSPB);
  - Ulster Wildlife Trust (UWT);
  - Wildfowl and Wetlands Trust (WWT); and
  - Woodland Trust.

4. In addition to this consultation exercise, aerial photography, LiDAR<sup>26</sup> and other published and unpublished sources were reviewed to inform the baseline flora and fauna.
5. Where access was permitted to lands, site walkover surveys were undertaken to survey flora and fauna based on standard methodologies in each jurisdiction. Non-accessible land was surveyed from the nearest accessible land or public roads where possible.
6. Extensive multi-year ecological studies were conducted of fauna including winter bird, breeding bird, bats, smooth newt and protected mammal species.
7. The appraisal of ecological impacts arising from the proposed interconnector is based on the professional expertise of the project consultants and gives consideration to relevant legislation and (where applicable) to published guidance such as:
  - Bibby, C.J., Burgess, N.D., Hill, D.A. and Mustoe, S.H (2000). Bird Census Techniques. Second Edition. Academic Press London;
  - CBD (2010). Updated Global Strategy for Plant Conservation, 2011-2020. Parties to the Convention on Biological Diversity;
  - DoECLG (2013), Guidelines for Planning Authorities and An Bord Pleanála on carrying out Environmental Impact Assessment;
  - DoEHLG (2009). Appropriate Assessment of Plans and Projects in Ireland;
  - EHS (2003). Northern Ireland Habitat Action Plan Species-Rich Hedgerows Final Draft – April 2003. Environment and Heritage Service, Belfast;
  - EHS (2005). Northern Ireland Habitat Action Fens March 2005. Environment and Heritage Service, Belfast;
  - EHS (2005a). Northern Ireland Species Action Plan Marsh Fritillary *Euphydryas aurinia* March 2005. Environment and Heritage Service, Belfast;
  - EHS (2005b). Northern Ireland Habitat Action Plan Lowland Meadow March 2005. Environment and Heritage Service, Belfast;
  - EirGrid (2012). Ecology Guidelines for Transmission Projects - A Standard Approach to Ecological Impact Assessment of High Voltage Transmission Projects;

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<sup>26</sup>LiDAR is a remote sensing technology that provides detailed information on assessed area from aerial surveys.

- EPA (2002). Guidelines on the information to be contained in Environmental Impact Statements;
- EPA (2003). Advice notes on current practice (in the preparation of Environmental Impact Statements);
- European Commission (2002). Assessment of plans and projects significantly affecting Natura 2000 sites;
- European Commission (2013). Guidance on Integrating Climate Change and Biodiversity into Environmental Impact Assessment;
- IEEM (2006). Guidelines for Ecological Impact Assessment in the United Kingdom;
- Joint Nature Conservation Committee (1990 (revised reprint 2007)). Handbook for Phase 1 habitat survey. A technique for environmental audit. JNCC Peterborough;
- NIEA (2012). Badger Survey – Specific Requirements. Northern Ireland Environment Agency, Belfast.
- NRA (2005). Guidelines for the Crossing of Watercourses During the Construction of National Road Schemes;
- NRA (2006a). Best Practice Guidelines for the Conservation of Bats in the Planning of National Road Schemes;
- NRA (2006b). Guidelines for the Treatment of Badgers prior to the Construction of National Road Schemes;
- NRA (2006c). Guidelines for the Treatment of Otters prior to the Construction of National Roads Schemes;
- NRA (2006d). Guidelines for the Treatment of Bats during the Construction of National Roads Schemes;
- NRA (2009a). Ecological Surveying Techniques for Protected Flora and Fauna during the Planning of National Road Schemes;
- NRA (2009b). Guidelines for Assessment of Ecological Impacts of National Road Schemes;
- Preston, J., Prodöhl, P. Portig, A. & Montgomery I., (2004). Reassessing Otter *Lutra lutra* distribution in Northern Ireland. Environment and Heritage Service, Belfast; and

- Shawyer, C. R. (2011). Barn Owl *Tyto alba* Survey Methodology and Techniques for use in Ecological Assessment: Developing Best Practice in Survey and Reporting. IEEM, Winchester.
  - Smith, G.F, O'Donoghue, P., O'Hora, K., Delaney, E. (2011) Best Practice Guidance for Habitat Survey and Mapping. The Heritage Council, Ireland.
8. Due to the requirement for the respective applicants to make separate applications for development consent in each of the jurisdictions in which the proposed interconnector will be located, the description of habitats and impact assessment methodologies varies, to some degree, between the sections of the proposed interconnector located in Northern Ireland (counties Tyrone and Armagh) and Ireland (counties Monaghan, Cavan and Meath). Full details of the methodologies used are set out in the Consolidated ES (Section 10.2) and EIS (Section 6.2).
9. However, broadly similar approaches were taken in both the Consolidated ES and the EIS in relation to the evaluation of ecological receptors and the subsequent impact appraisal. The evaluation of ecological receptor significance was based on geographical scale (i.e. local, county, regional, national, and international), conservation value of habitat, protected status, rarity etc. The evaluation can vary slightly between jurisdictions depending on ecological receptor. The assessment of impacts and impact significance broadly followed guidance issued by the Chartered Institute of Environmental and Ecological Management (IEEM, 2006) whereby impacts are evaluated in relation to impact type (positive, neutral or negative), character and sensitivity of the affected feature, magnitude, duration, timing and frequency. These features were considered when determining the significance of impacts. Based on the above, Tables 11.1 - 11.3 present the criteria applied in this chapter.

**Table 11.1 Criteria used in Evaluating the Ecological Importance of Sites**

Site Importance	Site Description
Internationally important sites (very high conservation value)	<ul style="list-style-type: none"> <li>• World Heritage Sites identified under the Convention for the Protection of World Cultural &amp; Natural Heritage, 1972;</li> <li>• Biosphere Reserves identified under the UNESCO Man &amp; Biosphere Programme;</li> <li>• Wetlands of International Importance designated as Ramsar Sites under the terms of the Convention on Wetlands of International Importance Especially as Waterfowl Habitat (the Ramsar Convention) formulated at Ramsar, Iran, in 1971;</li> <li>• Special Protection Areas (SPAs) designated in accordance with Council Directive 2009/147/EC (the Birds Directive). This Directive requires member states to take measures to protect birds, particularly rare or endangered species as listed in Annex I of the Directive, and regularly occurring migratory birds;</li> <li>• Special Areas of Conservation and candidate Special Areas of Conservation (SACs and cSACs) designated in accordance with Directive 92/43/EEC (the Habitats Directive). This Directive requires member states to establish a network of sites that will make a significant contribution to conserving habitat types and species identified in Annexes I and II;</li> <li>• Features essential to maintaining the coherence of the Natura 2000 Network;</li> <li>• Site containing 'best examples' of the habitat types listed in Annex I of the Habitats Directive;</li> <li>• Resident or regularly occurring populations (assessed to be important at the national level) of the following: <ul style="list-style-type: none"> <li>• Species of bird, listed in Annex I and/or referred to in Article 4(2) of the Birds Directive; and/or</li> <li>• Species of animal and plants listed in Annex II and/or IV of the Habitats Directive.</li> </ul> </li> <li>• Ramsar Site (Convention on Wetlands of International Importance Especially Waterfowl Habitat 1971);</li> <li>• World Heritage Site (Convention for the Protection of World Cultural &amp; Natural Heritage, 1972).</li> <li>• Biosphere Reserve (UNESCO Man &amp; The Biosphere Programme);</li> <li>• Site hosting significant species populations under the Bonn Convention (Convention on the Conservation of Migratory Species of Wild Animals, 1979);</li> <li>• Site hosting significant populations under the Berne Convention (Convention on the Conservation of European Wildlife and Natural Habitats, 1979);</li> <li>• Biogenetic Reserve under the Council of Europe;</li> <li>• European Diploma Site under the Council of Europe; and</li> <li>• Salmonid water designated pursuant to the European Communities (Quality of Salmonid Waters) Regulations, 1988, (S.I. No. 293 of 1988).</li> </ul>
Nationally important sites (high conservation value)	<ul style="list-style-type: none"> <li>• Areas of Special Scientific Interest notified under Section 28 of the Environment (NI) Order 2002, which represent the best national and regional example of natural habitat, physical landscape features or sites of importance for rare or protected species;</li> <li>• National Nature Reserves (NNRs) and Marine Nature Reserves (MNRs) designated under the Environment Order;</li> <li>• Sites maintaining UK Red Data Book species that are listed as being either of unfavourable conservation status in Europe, of uncertain conservation status or of global conservation concern;</li> <li>• Sites maintaining species listed in Schedules 1, 5 and 8 of The Wildlife (NI) Order 1985.</li> <li>• Site designated or proposed as a Natural Heritage Area (NHA);</li> <li>• Statutory Nature Reserve;</li> <li>• Refuge for Fauna and Flora protected under the Wildlife Acts;</li> <li>• National Park;</li> <li>• Undesignated site fulfilling the criteria for designation as a Natural Heritage Area (NHA); Statutory Nature Reserve; Refuge for Fauna and Flora protected under the Wildlife Acts; and/or a National Park;</li> <li>• Resident or regularly occurring populations (assessed to be important at the national level) of the following: <ul style="list-style-type: none"> <li>• Species protected under the Wildlife Acts; and/or</li> <li>• Species listed on the relevant Red Data list; and</li> </ul> </li> <li>• Site containing 'viable areas' of the habitat types listed in Annex I of the Habitats</li> </ul>



Site Importance	Site Description
Regionally / County important sites (medium conservation value)	<p>Directive.</p> <ul style="list-style-type: none"> <li>• Sites that reach criteria for Local Nature Reserve but do not meet ASSI selection criteria;</li> <li>• Sites of Local Importance for Nature Conservation (SLNCIs) recognised by DOE Planning Service and intended to complement the network of nationally and regionally important sites. SLNCIs receive special consideration in relation to local planning issues;</li> <li>• Sites supporting viable areas or populations of priority habitats/species identified in the UK Biodiversity Action Plan or smaller areas of such habitat that contribute to the maintenance of such habitat networks and /or species populations;</li> <li>• Sites maintaining habitats or species identified in Regional Biodiversity Action Plans on the basis of national rarity or local distribution: and</li> <li>• Other sites of significant biodiversity importance (e.g. sites relevant to Local Biodiversity Action Plans).</li> <li>• Area of Special Amenity;</li> <li>• Area subject to a Tree Preservation Order;</li> <li>• Area of High Amenity, or equivalent, designated under the County Development Plan;</li> <li>• Resident or regularly occurring populations (assessed to be important at the County level) of the following: <ul style="list-style-type: none"> <li>• Species of bird, listed in Annex I and/or referred to in Article 4(2) of the Birds Directive;</li> <li>• Species of animal and plants listed in Annex II and/or IV of the Habitats Directive;</li> <li>• Species protected under the Wildlife Acts;</li> <li>• Species listed on the relevant Red Data list;</li> </ul> </li> <li>• Site containing area or areas of the habitat types listed in Annex I of the Habitats Directive that do not fulfil the criteria for valuation as of International or National importance;</li> <li>• County important populations of species, or viable areas of semi-natural habitats or natural heritage features identified in the National or Local BAP, if this has been prepared;</li> <li>• Sites containing semi-natural habitat types with high biodiversity in a county context and a high degree of naturalness, or populations of species that are uncommon within the county; and Sites containing habitats and species that are rare or are undergoing a decline in quality or extent at a national level.</li> </ul>
Local Importance (Higher Value)/ Other sites with local conservation interest (lower conservation value)	<ul style="list-style-type: none"> <li>• Sites not in the above categories but with some biodiversity interest.</li> <li>• Locally important populations of priority species or habitats or natural heritage features identified in the Local BAP, if this has been prepared;</li> <li>• Resident or regularly occurring populations (assessed to be important at the Local level) of the following: <ul style="list-style-type: none"> <li>• Species of bird, listed in Annex I and/or referred to in Article 4(2) of the Birds Directive;</li> <li>• Species of animal and plants listed in Annex II and/or IV of the Habitats Directive;</li> <li>• Species protected under the Wildlife Acts;</li> <li>• Species listed on the relevant Red Data list.</li> </ul> </li> <li>• Sites containing semi-natural habitat types with high biodiversity in a local context and a high degree of naturalness, or populations of species that are uncommon in the locality; and</li> <li>• Sites or features containing common or lower value habitats, including naturalised species that are nevertheless essential in maintaining links and ecological corridors between features of higher ecological value.</li> </ul>
Local Importance (Lower Value) Negligible conservation value	<ul style="list-style-type: none"> <li>• Sites with little or no local biodiversity interest.</li> <li>• Sites containing small areas of semi-natural habitat that are of some local importance for wildlife; and</li> <li>• Sites or features containing non-native species that are of some importance in maintaining habitat links.</li> </ul>

**Table 11.2 Criteria used in Determination of Magnitude of Impacts**

Magnitude	Description
High / Major	Major loss or alteration to key features of the baseline condition.
Medium/ Moderate	Loss or alteration to a key feature(s) of the baseline condition, such that the feature(s) will be partially changed.
Low / Minor	Minor but perceptible change to baseline conditions.
Imperceptible/ Negligible	Very slight or imperceptible change to baseline conditions.

**Table 11.3 Significance of Impacts**

Significance	Description
Positive	The proposal has a positive impact on the integrity of a defined site or ecosystem and/or the conservation status of habitats or species within a given geographical area.
Substantial/ Negative	Major The proposal (either on its own or with other proposals) is likely to adversely affect the integrity of a European or nationally designated site, in terms of coherence of its ecological structure and function, across its whole area, that enables it to sustain the habitat, complex of habitats and/or the population levels of species of interest, or is likely to adversely affect the numbers, distribution or viability of a species or population of conservation concern. A major change in a site or feature of local importance may also enter this category.
Moderate Negative	The integrity of a European or nationally designated site will not be adversely affected, but the effect on the site is likely to be significant in terms of its ecological objectives. If, in the light of full information, it cannot be clearly illustrated that the proposal will not have an adverse effect on integrity, then the impact should be assessed as major negative. The proposal may adversely affect the integrity of a locally important conservation site, or may have some adverse effect on the numbers, distribution or viability of a species or population of conservation concern.
Minor Negative	Neither of the above applies, but some minor negative impact is evident. (In the case of Natura 2000 sites a further appropriate assessment may be necessary if detailed plans are not yet available).
Imperceptible/ Negligible	No / minimal observable impact in either direction.

## 11.3 The Receiving Environment

### 11.3.1 Overview

10. Land use / management is the primary influence on ecological receptors in the assessed area. The proposed interconnector passes through an intensively managed farming landscape dominated by enclosed fields with boundary hedgerows. Large flat fields are typical of County Meath passing north into a hilly (drumlin) landscape in Counties Cavan, Monaghan, Tyrone and Armagh.

Numerous small wetlands including lakes and fens are a feature of drumlin valley bottoms along certain sections. The largest rivers crossed are the Rivers Boyne and Blackwater (Kells) in County Meath. In general, the managed nature of the landscape mean ecological features (including protected species and semi-natural habitats) tend to concentrate on field boundaries and at rivers. Wetland sites are notable semi-natural habitat in County Monaghan specifically. The vast majority of the area traversed by the proposed interconnector consists of highly managed farmland and is of negligible ecological value.

11. Following a review of the existing environment, key ecological receptors were identified along the proposed interconnector which required consideration regarding potential impacts and mitigation and are summarised below in the following sections.

### 11.3.2 Designated Sites

12. Special Areas of Conservation (SACs), candidate Special Areas of Conservation (cSACs), Special Protection Areas (SPAs) and Ramsar sites within 30km of the proposed interconnector were considered for their potential to be affected by the proposed interconnector. A summary of all European sites within 5km of the proposed interconnector has been produced in Table 11.4 below, with the EIS and Consolidated ES for each jurisdiction containing a list and designation features of all sites.
13. A total of one international site (Ramsar) three European sites (cSAC, SAC and SPA) and sixteen nationally designated sites are within 5km (Natural Heritage Areas (NHAs), proposed Natural Heritage Areas (pNHA) and Areas of Special Scientific Interest (ASSI), with a further eight with locally relevant designations (Sites of Local Nature Conservation Importance (SLNCIs)). These are listed below in Table 11.4.

**Table 11.4 Designated Sites within 5km of the proposed interconnector/proposed interconnector**

Site	Site Code	Designation	Approximate Distance From The proposed interconnector
<b>Internationally Designated Sites</b>			
Lough Neagh and Lough Beg	N/A	Ramsar	3.4km North
<b>European Designated Sites</b>			
River Boyne and River Blackwater	IE002299	cSAC	0km (Oversailed by overhead line)
River Boyne and River Blackwater	IE04232	SPA	0km (Oversailed by overhead line)
Peatlands Park	UK0030236	SAC	4km North East
<b>National Designated Sites (Northern Ireland and Ireland)</b>			
Tassan Lough	001666	pNHA	0.25km South
Drumcarn Fen ASSI (Drumgallan Bog pNHA)	ASSI182	ASSI / pNHA	0.6km East
Lough Egish	001605	pNHA	0.6km East
Breakey Loughs	IE001558	pNHA	1.3km South
Cordoo Lough	001268	pNHA	1.3km West
Crossbane Lough	ASSI183	ASSI	1.4km East
Drumcarn	ASSI 182	ASSI	2.2km East
Trim (included in River Boyne and Blackwater SAC/SPA)	IE001357	pNHA	2.3km East

Site	Site Code	Designation	Approximate Distance From The proposed interconnector
Jamestown Bog	IE001324	NHA	2.9km West
Straghans Lough	ASSI179	ASSI	2.9km East
Lough Bawn House Loughs	001595	pNHA	3.9km West
Caledon and Tynan	ASSI342	ASSI	4km West
Kiltubbrid Loughs	ASSI031	ASSI	4.5km West
Lough Smiley	001607	pNHA	5km East
<b>Locally Designated Sites (Northern Ireland)</b>			
Milltown Benburb	N/A	SLNCI	1.2km West
Mowillin South West	N/A	SLNCI	2.4km East
Carryhugh Fen	N/A	SLNCI	2.7km East
Navan Fort	N/A	SLNCI	2.9km East
Derryore	N/A	SLNCI	3.5km East
Carnagh Forest and Lakes	N/A	SLNCI	3.8km East
Clay Lake	N/A	SLNCI	4.1km East
Derryhubbert/Derryardy	N/A	SLNCI	4.5km North East

14. There are no proposed works within any European, national or locally-designated sites works. The proposed interconnector will traverse only two European, national

or locally designated sites: the proposed interconnector will oversail the River Boyne and Blackwater cSAC and SPA, at two locations in County Meath. However, no structures are located within that European sites, or indeed in any other European, national or locally-designated sites. The proposed Turleenan substation in County Tyrone is over 3km from any designated site. Accordingly, no direct impacts have been identified to designated sites from the proposed interconnector.

15. Detailed consideration was conducted of European sites in particular. Separate Appropriate Assessments will be undertaken by the competent authorities for both the jurisdictions (referred to as “Stage 2: Statement to Inform Appropriate Assessment” and “Natura Impact Statement”, respectively). The purpose of these statements prepared pursuant to the provisions of the Habitat Directive is to address any potential impacts of the proposed interconnector on designated European sites. No significant adverse effects to any European sites were recorded in either report. Therefore it is the considered view of the authors of those reports that that no significant adverse effects to the integrity of any European Sites, in view of their conservation objectives, will arise from the proposed interconnector, either alone or in-combination with other plans or projects. Refer to the Stage 2: Statement to Inform Appropriate Assessment and Chapter 7 of the Natura Impact Statement (Volume 5 of the EirGrid application).

### 11.3.3 Existing Habitats and Flora

16. Methods for describing habitats are slightly different between the Consolidated ES and EIS, based on respective guidance for each jurisdiction. However for both jurisdictions, habitats of “high local value” or greater in the assessed area were identified. These included fens, bogs, wetlands, semi natural woodland, lakes and rivers. Care was taken during the design and routeing of the proposed interconnector to avoid these specific areas as so far as was practical. No direct habitat loss will arise to any habitats evaluated as being of International, National or County level value.
17. The vast majority of tower locations and access tracks are located in negligible value habitats including improved grassland, existing tracks, species poor semi-improved and wet (marshy) grassland. Habitats of local ecological value (whether high local value and/or low local value) identified as likely to be impacted include: hedgerows, treelines and broadleaved woodland. Further detail is provided for each section below.
18. The proposed substation site at Turleenan, County Tyrone is located on a mixture of grazed, improved grassland and rush-dominated neutral grassland of negligible conservation value.

19. The habitats for the greatest part of the proposed interconnector consist of agricultural grassland that has been improved to a variable extent. Improved grassland is generally dominated by a single grass species, usually perennial ryegrass, or by a small number of common grass species. The main variable is the relative proportion of agricultural grasses and rush species and this habitat includes rush pasture in which rushes, mainly soft rush, may be spatially dominant but where there is clear evidence of improvement in the past. This habitat is of negligible conservation value.
20. Other habitats encountered less frequently are those traversed by the proposed interconnector, where towers will be located or woody vegetation cutting may be required and include:
- Arable - Much of the County Meath section of the proposed interconnector crosses arable farmland of Negligible conservation value;
  - Semi-improved/unimproved neutral grassland – A small number of more diverse grassland communities and occasional rush pasture occur along the proposed interconnector. All these grasslands crossed by the proposed interconnector are of local importance (lower) value. Species rich examples are very rare in the wider assessed area. Some notable examples which correspond with the EU Annex 1 listed habitats (\*important orchid sites) (6210) were identified in County Monaghan and are avoided altogether by the proposed interconnector;
  - Semi natural Woodland/ ashwood/ wet woodland - A number of smaller streams with riparian woodland and areas of bog woodland are traversed by the proposed interconnector. No towers are located in this habitat and trimming impacts are avoided in the vast majority of cases. Trimming impacts are limited to the following: a small wet woodland near Tower 26 (Local Importance, i.e. Lower Value); a small ash dominated woodland oversailed by the proposed interconnector close to Tower 49; and wet woodland between Towers 175 and 176 (local importance, i.e. lower value).
  - Marshy/Wet grassland: The proposed interconnector crosses areas of marshy grassland of local importance (i.e., lower value). No high value examples of this habitat will be affected by the proposed interconnector;
  - Fen/swamp/wetland mosaics. A large number of wetlands were identified, in particular in County Monaghan, at the line design stage for proposed interconnector. Impacts to wetland identified as being of Local Importance (Higher Value) or greater are avoided by the fact that the proposed interconnector will oversail these habitat types;

- Bog/Degraded bog - Areas of bog/degraded bog were identified in particular as part at the routeing stage for the proposed interconnector. These habitats are avoided altogether by the proposed interconnector;
  - Coniferous/deciduous woodland forestry plantation – The proposed interconnector crosses areas of managed plantation woodland in counties Tyrone and Meath. These woodlands consist of relatively immature trees (less than 10m high). In addition, examples of newly planted immature woodland are traversed by the proposed interconnector in County Meath where no significant tree growth is evident as yet (per 2013 aerial imagery from various sources and LiDAR data). This habitat is considered to be of local importance (lower value).
  - Hedgerows/ treelines – The proposed interconnector crosses numerous field boundaries throughout the five counties through which the proposed interconnector will be located, which are discussed in more detail below.
  - Old plantation deciduous woodland/ scattered trees – A notable example of mature deciduous woodland (local importance, i.e. higher value) is crossed between Towers 267 and 269. Five smaller blocks are also crossed where relatively mature trees will be lopped.
21. Hedgerows/ treelines within the assessed area vary in their conservation value, with species diversity of woody plants and management regimes the most important factors. Hedgerows dominated by a single species are frequent, but most functional hedgerows contain four or more woody species, with blackthorn, hawthorn, dog-rose, ash and holly the most frequently occurring species. The proposed interconnector crosses numerous examples of locally important (i.e., higher value) hedgerows, although it should be noted that no towers will be located in this higher value habitat.
22. The vast majority of towers will be placed in improved grassland and other negligible value habitats. Access tracks and stringing areas will utilise existing farm access, where possible, and will otherwise cross low value habitats.
23. Forty-four hedgerows were identified where it is proposed to locate a tower within the hedgerow with a resultant loss of short lengths of hedges. None of the hedgerows affected will be species-rich hedgerow (evaluated as being of local importance, i.e. higher value) or greater.
24. Hedgerows crossed by the proposed interconnector will be trimmed such that a minimum 5m clearance is retained between the lowest conductor sag and woody vegetation. Hedgerows/treelines crossed by the proposed interconnector that will likely require mature tree lopping/ trimming where identified, thus reducing the structural diversity of affected hedgerows. One area of mature deciduous woodland



(local importance higher value) was identified in County Meath where tree cutting may be required within a standard corridor.

25. The proposed interconnector crosses numerous small rivers and streams. No instream works or other direct impacts will arise to streams and rivers and, in particular, to the most important identified such as; the River Blackwater (Bann) and associated tributaries, River Rhone, the Tynan River, and the tributary of the Clontibret Stream, River Blackwater (Kells), Kilmainham Stream, River Boyne and its associated tributaries and Boycetown River (see Water Environment Chapter of the EIS and Consolidated ES for further details). All towers are located away from streams and rivers and associated riparian areas. Stringing of conductors which cross streams/rivers do not require direct impacts to these habitats.
26. No rare or protected flora species were recorded during the course of field surveys in the vicinity of the proposed interconnector.

### 11.3.4 Fauna

#### 11.3.4.1 Birds

27. Whooper Swan are a species potentially vulnerable to collision with overhead electricity transmission lines, when moving between feeding and/or roosting sites during the winter months. Early in the proposed interconnector design phase, surveys were undertaken to identify locations throughout winter months (late October to early April inclusive) and to help inform the routeing process through avoiding areas of high Whooper Swan activity. Winter activity and distribution surveys commenced in 2006 and have been ongoing yearly along the proposed interconnector and wider assessed area (the extent of which has been determined by local conditions where Whooper Swans are known to be active). The aim of these surveys was to identify Whooper Swan movements and distribution relative to the proposed interconnector so as to inform potential impacts and appropriate mitigation. Whooper Swan have been a key target species for consideration regarding potential effects of the proposed interconnector from an early stage in the design process and avoidance by design, where practicable, has been the key mitigation approach. Field studies for the proposed interconnector considered potential transboundary impacts on this and other wintering and breeding bird species.
28. Regarding Whooper Swan, the key findings of the surveys were:
  - A regular group of up to 170 birds (Nationally Important Site) using feeding and roosting sites in the Blackwater Valley (County Armagh) which is more than 5km

from the proposed interconnector. No flightline was identified as crossing the proposed interconnector;

- A relatively regular site (up to 2011) at Ballintra area (County Monaghan) – This was regarded to be of County Importance. This site is close to the proposed interconnector (c.a. 800m) and a flightline was identified as crossing the proposed interconnector;
  - Lough Egish area (County Monaghan) - This was considered a County important site. Relevant lakes are close to the proposed interconnector (c.a. 250 - 650m). Occasional Whooper Swan flightline consisting of low numbers cross the proposed interconnector. In addition relevant Mute Swan flightlines were determined of small numbers in the same location;
  - Loughs Comertagh and Rafteragh area (County Monaghan): This is considered a county important site. Relevant lakes are close to the proposed interconnector (c.a. 150 - 700m). Movements of Whooper Swan were confirmed between a cluster of small lakes bisected by the proposed interconnector;
  - Cruicetown (County Meath): This site is occasionally used by nationally important numbers of Whooper Swan and regularly by much lower numbers of County importance. In addition, a flightline by low numbers (not nationally significant) was identified as crossing the proposed interconnector to Whitewood Lough. Cruicetown is approximately 1.3km from the proposed interconnector and Whitewood Lough is c.a.650m). The vast majority of sites used and flightlines are located at a distance from the proposed interconnector and do not cross it;
  - Cloony Lough Area (County Meath): This is considered a county important foraging area (various fields). A flightline was identified as crossing the proposed interconnector towards Cloony Lough c.a. 500m from the proposed interconnector;
  - Yellow River Area (County Meath). This is a regular foraging area for Whooper Swan with numbers that reach close to National Importance. No flightline was identified as crossing the proposed interconnector with a flightline confirmed as running parallel (north to south) approximately 500m to 1km east of the proposed interconnector; and
  - River Blackwater (County Meath). No Whooper Swan have been observed in this area. This larger river area is used by Mute Swan and Cormorant which are collision prone species (with conductors/ earth wire).
29. For all sites, appropriate precautionary mitigation has been detailed to minimise and eliminate possible disturbance effects and ongoing operational collision effects (as relevant) to Whooper Swans, and other waterfowl, at relevant locations.

30. Other breeding and wintering birds of conservation significance were identified and no adverse impacts are expected from the proposed interconnector.
31. Breeding bird surveys identified the following breeding species of conservation concern, or those potentially sensitive to the proposed interconnector breeding in the wider vicinity of proposed interconnector, including: Great Crested Grebe, Mute Swan, Water Rail, Kingfisher and Yellowhammer. Lapwing, Curlew and Common Snipe were also noted at specific locations in counties Armagh, Meath and Monaghan. Since 2008 only two locations were identified, at some distance removed from the proposed interconnector, where Curlew possibly bred. One of these possible breeding sites has since been removed by land drainage activities. Peregrine Falcon, Merlin and Long-eared Owl breed in small numbers breeding more than 3km from the proposed interconnector. Barn Owl are very scarce in the assessed area (Balmer *et al.*, 2013)<sup>27</sup>. The passerine assemblage was generally impoverished with few notable records limited to Spotted Flycatcher, Linnet and House Sparrow. Impacts identified to more sensitive species identified are considered Moderate to Imperceptible. Appropriate mitigation has been detailed to consider possible disturbance effects and ongoing operational effects (such as indirect increased disturbance/ predatory bird effects).

#### 11.3.4.2 Bats

32. Two potential bat roosts may be affected where tree cutting is required in Northern Ireland. Both roosts (one close to Tower 60 and the other in the substation area) supported two or less Common or Soprano Pipistrelle bats at the time of survey and did not support features likely to harbour maternity or major roosts. The other roost identified was in an old tin-roofed shed at the substation site and supported two Common Pipistrelle bats. No roosts sites were identified in counties Monaghan, Cavan or Meath, at which there is a potential of disturbance to bat maternity roosts.
33. Activity surveys revealed occasional hotspots of activity located close to mature hedgerows and woodlands within 500m of the proposed interconnector but only commonly encountered species typical of the region were recorded (Daubenton's bat, Whiskered bat, Natterer's bat, Leisler's bat, Nathusius' Pipistrelle, Common Pipistrelle, Soprano Pipistrelle and Brown Long-eared bat). Overall, the pattern of bat activity across the proposed interconnector was typical of habitat and region with the majority of bat activity concentrated around treelines, rivers, ponds and hedgerows.

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<sup>27</sup> Balmer D, Gillings S, Caffrey B, Swann B, Downie I and Fuller R. (2013) Bird Atlas 2007-11: The Breeding and Wintering Birds of Britain and Ireland (British Trust for Ornithology)

34. Typical maternity roost sites e.g. old buildings, newer buildings, bridges, souterrains and caves are avoided. All trees at tower locations were assessed for their potential for bat roosts and no significant sites were identified. Appropriate precautionary mitigation has been identified and will be implemented to minimise risks of disturbance to possible bat roost specifically during the construction (woody vegetation lopping) phase.

#### 11.3.4.3 Badgers

35. Thirty-two badger setts were identified during field surveys in Northern Ireland and all but two will be avoided completely during construction. Any known setts that have potential to be impacted by the proposed interconnector will be surveyed prior to construction. Mitigation measures as outlined below in this chapter and in the Consolidated ES and EIS will be implemented to prevent likely significant effects. Small numbers of badgers may be temporarily displaced during construction but this will not adversely affect the local conservation status or distribution of the species. Badger setts identified during surveys and in consultation with the appropriate authorities will be avoided. Where no surveys were conducted all towers have been offset from hedgerows/ treelines where badgers potentially breed to minimise risks of disturbance to unidentified setts. Appropriate mitigation has been proposed to ensure disturbance to badger setts is avoided.

#### 11.3.4.4 Otter

36. No riparian habitats where otter breeding sites occur will be directly impacted during construction and/or operation of the proposed interconnector. Otters are present at low densities throughout the assessed area, in particular around the rivers Boyne and Blackwater (County Meath) and associated tributary rivers. Otters will be unaffected by the proposed interconnector as Towers are not located or near potential breeding sites (rivers, riparian areas, lakes, wetlands and ditches). Appropriate mitigation has been proposed to ensure disturbance to Otter breeding sites and rest areas is avoided.

#### 11.3.4.5 Amphibians (Smooth Newt and Common Frog)

37. Surveys were carried out for Smooth Newt and frogs at potentially suitable habitat (wetlands, ditches and ponds) although no evidence was found. These habitats are avoided and no adverse impacts will arise to amphibians and breeding sites.

#### 11.3.4.6 Other Fauna

38. Desk top and field surveys revealed the potential presence of a number of other protected species including White-clawed Crayfish and Marsh Fritillary. Suitable habitat including rivers, wetlands, unimproved wet grassland/ fens (with *Succisa pratensis*) for these species will be avoided and no impacts will arise to these species from the proposed interconnector.

#### 11.3.4.7 Faunal Summary

39. *Birds:* Whooper Swan have been identified as using specific areas in the vicinity of the proposed interconnector. In this regard appropriate mitigation has been detailed for specific relevant areas.
40. *Bats:* Two potential bat roosts may be affected where tree cutting is required. These are non-maternity roosts. Mitigation and enhancement measures have been identified to minimise potential impacts in particular tree clearance disturbance to possible roost sites.
41. *Badger and Otter:* Habitats potentially suitable for badger and otter (and other protected mammals) are largely avoided or confirmation surveys have confirmed breeding sites will not be affected. No works associated with the proposed interconnector construction will directly impact protected mammals. Where potential disturbance risks were identified mitigation and updated monitoring is detailed.
42. *Other Fauna:* Protected faunal breeding sites and potential breeding habitat have been identified and these are avoided where possible. Appropriate precautionary mitigation / monitoring has been detailed to ensure appropriate protection of species given possible temporal / spatial changes in species distribution between planning consent and construction.
43. To summarise, habitats of local ecological value were identified and where impacts from the proposed interconnector were predicted, precautionary mitigation has been identified and will be implemented for identified relevant ecological receptors.
44. For further details please see Consolidated ES Section 10.3 and EIS Volumes 3C and 3D, Section 6.4.

## 11.4 Mitigation Measures

45. Careful routeing of the proposed interconnector has sought to avoid or reduce impacts on known ecological receptors. However, potential impacts have been identified in particular for the River Boyne and Blackwater cSAC and SPA, bats,

Whooper Swans and habitats (in particular hedgerows and woodlands) at specific locations along the proposed interconnector.

46. Mitigation strategies have been developed in consultation with NIEA and NPWS. Full details are contained within the Consolidated ES (Section 10.5) and EIS (Section 6.6) respectively. In summary the mitigation measures proposed include:

- As far as possible, mitigation by avoidance of identified habitats was implemented where protected faunal breeding sites were concentrated namely rivers, riparian area, hedgerows, tree lines and woodlands. The proposed interconnector development footprint has been designed to avoid all areas of notable ecological value (e.g. hedgerows) except where it could be determined through field survey that protected species were absent from such locations. All areas where protected species or notable habitats were identified were avoided and any potentially valuable habitats that were not subject to field survey were not considered for infrastructure. Designated sites are avoided altogether, with the exception of the River Boyne and Blackwater cSAC and SPA which is oversailed only by the conductors. Precautionary mitigation measures are detailed in Volume 5 of the EirGrid application documentation;
- A key approach for minimising risks such as disturbance to wildlife and protection of water quality during construction works is the appointment of an appropriately experienced Ecological Clerk of Works (ECoW) to advise on the detailed design approach and ecological mitigation;
- In addition to the construction phase, it is recommended that a ECoW also be appointed during the pre-construction (landowner liaison stage) and post construction phases (minimum 5 years) to monitor mitigation measures, with in particular regard to wintering birds;
- Other specific measures are detailed in the Consolidated ES and EIS; and
- Monitoring is an important consideration for the proposed interconnector post-consent to ensure the described mitigation is properly implemented and effective.

## 11.5 Residual Impacts

47. Indirect risks to designated sites (European and National) are identified and precautionary mitigation is outlined which, when implemented, will ensure negligible residual impacts on the integrity or conservation objectives of all of these sites. European Sites are specifically considered in the Natura Impact Statement (Volume 5) of the EirGrid application documentation and Draft HRA Stage 1 Screening report Appendix 10I of the Consolidated ES). Both reports conclude that there will be no

adverse effects on the integrity of the European sites concerned, as defined by the conservation objectives and status of those sites.

48. Residual impacts are identified to mature treelines and specific woodlands identified, as there will be a permanent removal of trees below the conductors and wider corridor to ensure no woody vegetation infringement with the conductors. The ecological structure and function of hedgerows under the conductors and associated fauna will however be retained.
49. The proposed interconnector crosses a number of identified locations where Whooper Swans potentially fly over. Flight diverters are proposed in these locations and, based on Whooper Swan existing interactions with transmission lines and a review of flight deflector effectiveness (at reducing collisions), it is concluded that an overall low residual impact will arise. Full details are provided in Consolidated ES; Chapter 10 (Ecology – Section 10.6) and the relevant chapters of the EIS; Chapter 6 (Flora and Fauna – Section 6.7) of Volumes 3C and 3D.
50. Lapwing (red listed species of high conservation concern) are very scarce in the assessed area and highly clustered in distribution. Proposed mitigation (perch prevention design modifications) are proposed to reduce risk of indirect impacts e.g. from perching predatory birds to minimise the residual impacts at relevant sites identified. Where proposed this is detailed in Consolidated ES, Chapter 10 (Ecology – Section 10.6) and the relevant chapter of the EIS; Chapter 6 (Flora and Fauna – Section 6.7) of Volume 3D.
51. A summary of the residual impacts following implementation of mitigation measures to potentially relevant ecological receptors is detailed below in Table 11.5 and Table 11.6. Table 11.5 deals with the construction phase and Table 11.6 deals with the operation phase.
52. In summary the residual adverse impacts of the proposed interconnector on significant ecological receptors identified within the assessed area range from negligible to minor negative in significance.

**Table 11.5: Summary of Residual Construction Phase Impacts**

Receptor	Value	Residual Impact
<b>Designated Sites (European and National)</b>		
Lough Neagh and Lough Beg SPA/Ramsar/ IBA	Internationally Important/ Very High	Negligible – No adverse effects
River Boyne and Blackwater SAC/ SPA	Internationally Important / Very High	Negligible– No adverse effects
Lough Neagh ASSI	Nationally Important/ High	Negligible
Lough Beg ASSI	Nationally Important/ High	Negligible
Other designated sites identified in Table 11.4	Nationally Important/ High	Negligible
<b>Habitats and Flora</b>		
Rivers	Nationally Important/ High	Negligible
Fens/ Wetlands	Nationally Important/ High	Negligible
Hedgerows / Treelines and Scattered Trees	Regionally Important/ Medium (cumulatively)	Minor Negative
Semi Natural Woodland	Local Importance (Higher Value)/ Low (cumulatively)	Negligible
Mature Deciduous Woodland	Local Importance (Higher Value)/ Low (cumulatively)	Minor Negative
<b>Fauna</b>		
Wintering birds (Whooper Swans)	Nationally Important/ High	Minor Negative
Wintering birds (General)	Local Importance (Higher Value)/ Low (cumulatively)	Negligible
Breeding birds (General including Curlew)	Local Importance (Higher Value)/ Low (cumulatively)	Negligible
Breeding birds (Lapwing)	Regionally Important/ Medium (cumulatively)	Minor Negative
Bats	Regionally Important/ Medium (cumulatively)	Negligible
Badgers	Regionally Important/ Medium (cumulatively)	Negligible
Otter	Regionally Important/ Medium (cumulatively)	Negligible
Other Fauna	Local Importance (Higher Value)/ Low (cumulatively)	Negligible



**Table 11.6: Summary of Residual Operational Impacts**

Receptor	Value	Residual Impact
<b>Designated Sites (European and National)</b>		
Lough Neagh and Lough Beg SPA/Ramsar/ IBA	Internationally Important/ Very high	Negligible
River Boyne and Blackwater SAC/ SPA	Internationally Important / Very high	Negligible
Lough Neagh ASSI	Nationally Important/ High	Negligible
Lough Beg ASSI	Nationally Important/ High	Negligible
Other designated sites identified in Table 11.4	Nationally Important/ High	Negligible
<b>Habitats and Flora</b>		
Rivers	Nationally Important/ High	Negligible
Fens/ Wetlands	Nationally Important/ High	Negligible
Hedgerows / Treelines and Scattered Trees	Regionally Important/ Medium (cumulatively)	Minor Negative
Semi Natural Woodland	Local Importance (Higher Value)/ Low (cumulatively)	Negligible
Mature Deciduous Woodland	Local Importance (Higher Value)/ Low (cumulatively)	Minor Negative
<b>Fauna</b>		
Wintering birds (Whooper Swans)	Nationally Important/ High	Minor Negative
Wintering birds (General)	Local Importance (Higher Value)/ Low (cumulatively)	Negligible
Breeding birds (General including Curlew)	Local Importance (Higher Value)/ Low (cumulatively)	Negligible
Breeding birds (Lapwing)	Regionally Important/ Medium (cumulatively)	Minor Negative
Bats	Regionally Important/ Medium (cumulatively)	Negligible
Badgers	Regionally Important/ Medium (cumulatively)	Negligible
Otter	Regionally Important/ Medium (cumulatively)	Negligible
Other Fauna	Local Importance (Higher Value)/ Low (cumulatively)	Negligible

## 11.6 Transboundary Effects

53. There will be no significant adverse impacts on designated sites for their conservation interest at either European, National level or local level within either jurisdiction. As previously noted, potential impacts to European sites and their Qualifying interests are considered by SONI and EirGrid<sup>28</sup>.
54. Following the implementation of prescribed mitigation, it is considered that works on the proposed interconnector in one jurisdiction will not result in any significant adverse impacts (direct, indirect) on habitats or species in the other jurisdiction (Northern Ireland or Ireland). There is potential for localised impacts on faunal species which may have territories or staging areas that straddle the jurisdictional border between Northern and Ireland, however, based on surveys implemented the level of movements and associated possible impacts are not considered significant.
55. In particular, potential impacts on Whooper Swans and other mobile bird species that may use sites on both sides of the border have been considered, and the residual impact of the proposed interconnector has been assessed as Imperceptible, in terms of both population numbers and on availability of feeding sites. This assessment is informed by extensive surveys undertaken during the appraisal of the proposed interconnector, which did not identify any flightlines between the two jurisdictions. Indeed, Whooper Swans sites are well removed from the border area. Mitigation measures to render the overhead line more visible in those parts considered to present the greatest localised risk will be implemented as relevant in both jurisdictions, and will reduce the overall collision risk at identified local areas.
56. Further details are provided in Chapter 20 of the Consolidated ES and Section 6.9 of the EIS, Volumes 3C and 3D.

## 11.7 Conclusions

57. An assessment of the proposed interconnector has been undertaken in accordance with the requirements of the EIA Directive and the respective legislation applicable in Northern Ireland and Ireland, and the Commission Guidance etc.
58. The proposed interconnector will have no adverse effects on European sites. In addition no adverse impacts will arise to nationally protected habitats/ species in

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<sup>28</sup> SONI: Refer to Tyrone-Cavan Interconnector Habitats Regulations Assessment Draft Stage 2: Statement to Inform Appropriate Assessment for SONI element of the proposed interconnector as relevant to described SPA site. EIRGRID: Refer to North-South 400 kV Interconnection Project Natura Impact Statement. (Volume 5 of the application documentation).

both jurisdictions; however it does have potential to impact upon local populations of protected fauna.

59. Mitigation measures will be implemented at the construction and operation phase to minimise and/or eliminate identified impacts. Where impacts are minimised, the residual impact is outlined.
60. The level of residual impacts was assessed from an entire project perspective with the highest impact being minor negative to hedgerows / treelines, Wintering birds (Whooper Swans) and Breeding birds (lapwing). All other impacts are considered negligible.

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## 12. Soils, Geology and Hydrogeology

### 12.1 Introduction

1. This section considers the likely significant impacts of the proposed interconnector, (from Turleenan, County Tyrone to Woodland, County Meath) on the Soils, Geology and Hydrogeology in the receiving environment and identifies any constraints posed by these conditions on the proposed interconnector.
2. The relevant chapter of the published Consolidated ES is Chapter 9 (Soils, Geology and Hydrogeology) and the relevant chapters of the EIS are Chapter 7 (Soils, Geology and Hydrogeology) of Volumes 3C and 3D. In relation to agricultural soil impacts, these were dealt in Chapters 9 and 14 of the Consolidated ES and Chapter 3 Land Use, Volume 3B of the EIS.

### 12.2 Methodology

3. The assessment considers the geology and the ground and groundwater conditions of the proposed interconnector and the adjacent area, based on published and other publically available information that was collated. The data obtained has been used to prepare a detailed description of the existing conditions on and in the immediate vicinity of the proposed interconnector. The existing conditions form the baseline against which the impact assessment will be determined.
4. Impacts on geology, soils and groundwater were considered within an assessed area approximately 500m wide either side of the route of the proposed interconnector (from the centre line of the overhead line and the edge of the Turleenan and Woodland substation boundaries). In addition, the locations of any designated sites of geological/geomorphological/physiographical significance and sites of potentially contaminated land in the vicinity of the proposed interconnector were identified.
5. The assessment was designed to identify the rock and soil types and structures and the groundwater conditions along the route of the proposed interconnector, in particular to identify sensitive geological and hydrogeological locations and any areas of poorly consolidated ground that could adversely affect the stability of the towers or adjacent land. Reference was made to the following sources of information:
  - Ordnance Survey (Northern Ireland) and Geological Survey of Northern Ireland (GSNI) mapping and databases;

- NIEA Land Use Database and mapping;
  - Observations made during site walkovers and vantage point surveys from 2009 to 2013;
  - The results of the ground investigation at the proposed Turleenan substation site, Stratex 2006;
  - British Geological Survey report, entitled '*Hydrogeology of Northern Ireland*' 1996;
  - Ordnance Survey (Ireland) and Geological Survey of Ireland (GSI) mapping;
  - An Foras Talúntais (1980). *Soil Map of Ireland*; and
  - Environmental Protection Agency and Geological Survey of Ireland (2009). *Historic Mine Sites - Inventory and Risk Classification*.
6. The GSNI and GSI were consulted with regard to the possible impact of the proposed interconnector on geological features.
  7. The assessment of the severity of any predicted impacts is based on the sensitivity of the identified soil, geology and hydrogeology features.
  8. The baseline conditions were collated from the historic records, information held by government agencies including GSNI, GSI, Northern Ireland Environment Agency (NIEA), Environmental Protection Agency (EPA), Monaghan County Council, Department of Environment, Community and Local Government, Department of Arts, Heritage and the Gaeltacht, Cavan County Council, and Meath County Council and from analysis of historic mapping, aerial photography and LiDAR and other published and unpublished sources. Where access was permitted, site walkover surveys were undertaken, while non-accessible land was surveyed from the nearest accessible land or roads where possible.
  9. Due to requirement for the respective applicants to make separate applications for development consent in each of the jurisdictions in which the proposed interconnector will be located, the impact assessment methodologies are considered consistent between the sections of the proposed interconnector located in Northern Ireland (counties Tyrone and Armagh) and Ireland (counties Monaghan, Cavan and Meath).
  10. The approach to determining the significance of the predicted impacts is broadly similar. The degree or scale of significance of impacts to geology/hydrogeology receptors can be defined as:

- Negligible (or Neutral) Impact: An impact capable of measurement but without noticeable consequences;
  - Minor Impact: An impact, which causes noticeable changes in the character of the environment without affecting its sensitivities / value;
  - Moderate Impact: An impact that alters the character of the environment in a manner that is consistent with existing and emerging trends;
  - High Impact: An impact, which, by its character, magnitude, duration or intensity alters a sensitive / valuable aspect of the environment; and,
  - Very High Impact: An impact, which obliterates sensitive/valuable characteristics.
11. The sensitivity of the receptor is as high, moderate, minor or negligible.
12. A qualitative approach was used in the evaluation, generally following the significance classification in **Table 12.1** and through professional judgment. The significance of a predicted impact is based on a combination of the sensitivity or importance of the attribute and the predicted magnitude of any effect. Effects are identified as beneficial, adverse or negligible, temporary or permanent and their significance as major, moderate, minor or not significant (negligible).

**Table 12.1: Significance Criteria**

Sensitivity	Magnitude				
	Very High	High	Moderate	Minor	Negligible
High	Major	Major	Moderate	Moderate	Minor
Moderate	Major	Moderate	Moderate	Minor	Negligible
Minor	Moderate	Moderate	Minor	Negligible	Negligible
Negligible	Minor	Minor	Negligible	Negligible	Negligible

13. In order for a potential impact to be realised, three factors must be present. There must be a source or a potential effect; a receptor which can be affected; and, a pathway or connection which allows the source to impact the receptor. Only when all three factors are present can an effect be realised.
14. Further details are provided in Section 9.2 of the Consolidated ES and Section 7.2 of the EIS, Volumes 3C and 3D.

## 12.3 The Receiving Environment

### 12.3.1 Geomorphology

15. The proposed interconnector passes a variety of geomorphological settings. The geomorphology was shaped principally during the last glacial age (the Midlandian), with subsequent modification throughout the post-glacial Holocene period. Most of the Quaternary sediments were deposited during the last glaciation, by ice sheets that moved from northwest to southeast or from the meltwater from ice sheets.
16. At the northern end of the proposed interconnector, in counties Tyrone and Armagh, the proposed interconnector passes through upland areas, areas of drumlins in Armagh and Monaghan and a number of river valleys. As the proposed interconnector moves further southwards it crosses Cavan and Monaghan. The geomorphology in this area is predominantly made up of drumlins and ribbed (Rogen) moraines. Drumlins take a variety of forms with the majority elongated in the direction of ice flow. The southern limestone lowland is generally characterised by gently undulating lowlands underlain by diamictos<sup>29</sup>, with occasional gravel hillocks, eskers and alluvial flats.

### 12.3.2 Soils

17. The assessment presented in this Chapter is based on the available data and is considered to be an accurate assessment of the likely significant effects of the proposed interconnector.
18. In general, the proposed interconnector is underlain by a sequence of Quaternary deposits (boulder clay and sand and gravel) and more recent peat, lacustrine and alluvial deposits, associated with the river valleys and lowlying areas. Till derived from various rock formations is the principal material encountered along the proposed interconnector. Till is an unsorted sediment. Glacial till is composed of a heterogeneous mixture of clay, sand, gravel and boulders derived from the transportation and deposition of, by or from a glacier. Limited areas of alluvial soils, lacustrine deposits and peat occur along the proposed interconnector. Shallow soils overlying bedrock occur in areas particularly on the crest and shoulders of hills in counties Monaghan and Armagh.
19. Peat deposits occur locally in inter-drumlin hollows, but the proposed interconnector largely avoids or oversails known intact peat deposits including Cashel Bog, County Monaghan, between Towers 117 and 118 and Brootally Bog between Towers 64

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<sup>29</sup> Tills or Boulder clays

and 65. Moreover, these locations are invariably limited in area, on flat ground or on very low angle slopes, where movement of peat would not be expected. Accordingly, there is little potential for the excavations to cause downslope movement of adjacent peat bodies. Instability of superficial deposits on the island of Ireland is most frequent in peat, but there are no known peat deposits along the proposed interconnector that might render towers unstable during construction or operation. Peat slope failures occur in upland blanket bogs and the lowland blanket bogs, neither of which is impacted by the proposed interconnector.

20. Peat was not found at the proposed Turleenan substation site or at the existing Woodland Substation site.

### 12.3.3 Geology

21. The superficial deposits overlie a bedrock geology of variable age, ranging from Ordovician to Tertiary. Some locations are covered by a significant thickness of drift deposits, which obscure the bedrock and hence reduce the precision of the bedrock mapping due to the absence of bedrock exposures (Figure 9.2 of the Consolidated ES and Figures 7.1– 7.4, Volume 3C and 3D Figures of the EIS).
22. Lower Palaeozoic greywackes and slates underlie the central part of the route of the proposed interconnector, from Tower 66 to Tower 237. Greywackes comprise sandstones formed in deep water conditions by turbidity currents generated down the margins of a subsiding geosyncline, the Iapetus suture. These deposits are widespread across the central section of the proposed interconnector and it is difficult to differentiate between deposits of Silurian or Ordovician age. Occasional dolerite and basalt dykes of Tertiary age, trending north west to south east, have been mapped within the Lower Palaeozoic bedrock. Mineral development within the Acton Group indicates low grade metamorphism.
23. To the west of Armagh the proposed interconnector crosses the Carboniferous Limestone of the Tyrone and Armagh Groups approximately between Towers 49 and 65. The Armagh Group comprises principally limestone with occasional thin beds of shale and gritstone. The overlying Tyrone Group comprises a more variable sequence of alternating limestone, shale, mudstone and sandstone with thin coal seams.
24. The Carboniferous Limestone strata are overlain unconformably (at different angles of bedding) by sandstones of the Triassic (formerly Bunter) Sherwood Sandstone Group, represented by the basal Milltown Conglomerate and the overlying Derryreevy Sandstone Formation. The Sherwood Sandstone underlies the majority of the northern section of the route of the proposed interconnector between



Towers 1 and 48, apart from a section west of Moy where a faulted area of limestone of the Tyrone Group underlies approximately 3km of the proposed interconnector. The Sherwood Sandstone consists principally of the Derrycreevy Sandstone, a thick sequence of red sandstone with occasional siltstone and mudstone.

25. Geological plan Sheet 35 shows that the Sherwood Sandstone strata extend past the proposed Turleenan substation at the northern end of the proposed interconnector. However, the findings of a ground investigation carried out at the substation site in 2006 showed that the bedrock consists of the Triassic Mercia Mudstone Group rather than the Sherwood Sandstone as shown on the published geological plan. The Mercia Mudstone Group comprises red and green mudstone with gypsum bands and overlies the Sherwood Sandstone.
26. Carboniferous deposits primarily underlie the southern section of the line in County Meath between Towers 260-290 and 304-410. The Lucan (Calp) Formation underlies the mid-section of the proposed interconnector. The term 'Calp' is used to refer to the various basinal limestones and shales occurring in these successions. The Calp units generally consist of dark grey, fine grained, impure limestone with interbedded shales and veins of white calcareous spar. The variation in bed thickness, grain size, colour and proportion of shale is a feature of the depositional environment.
27. The Meath Formation is typically comprised of varied lithologies including micrite, oolite, sandstone, argillaceous limestone, and shale. The Meath Formation is the main host ore body to the Tara Mines Lead Zinc ore body. The Navan Group is primarily comprised of argillaceous limestones, shales and sandstones. Within the Navan Group a number of members are present including the Rockfield Sandstone Member.
28. The Cruisetown Group and Fingal Group occur in the Moynalty Basin (between Moynalty, Carlanstown and Nobber) and underlie the section between Towers 260 and 285. The Cruisetown and Fingal Group are structurally controlled by a syncline present within the Moynalty Basin trending northeast/southwest. The Cruisetown Group is primarily comprised of Ballysteen and Waulsortian Limestones. The Fingal Group is primarily comprised of Calp limestones.
29. Thick sequences of Namurian sandstones, siltstones and marine shales were deposited later during the Upper Carboniferous Period (approximately 340 million years ago). Several different lithologies are present within the Namurian Sandstones and Shales, but due to poor exposure a general classification is given to the rocks in the area. The Namurian strata typically consist of siltstones,

mudstones interbedded with fine – medium grained sandstones, calcareous mudstone/siltstone and argillaceous limestone and are inferred between Towers 387 and 404.

#### 12.3.4 Hydrogeology

30. Soils and bedrock along the assessed area are widely variable in their hydrogeological characteristics. Ordovician greywackes and shales are generally of low permeability, and lack groundwater except at shallow depth. Groundwater is present in these strata but it is likely that quantities are low and groundwater generally is limited to fractures and to the upper weathered zone of the strata. A groundwater dependent terrestrial ecosystem (GWDTE), the Boyne and Blackwater cSAC is oversailed at two locations in County Meath.
31. In contrast, the Sherwood Sandstone beneath the northern part of the proposed interconnector (Towers 2-10, 12 and 22-48) forms a highly productive aquifer. Viséan limestones around Armagh are also productive aquifers, although flow in these strata is dominantly through fissures. Alluvium has limited potential as an aquifer, and does not contain significant groundwater. The alluvial and sand and gravel parent materials that occur along parts of the assessed area are moderately permeable. Glacial clays are generally of low permeability, although they may be locally interspersed with more permeable granular deposits.
32. Groundwater is present in the granular units of the superficial deposits and it is likely that the groundwater generally is in hydraulic continuity with the local surface water system.
33. The Carboniferous strata, consisting principally of limestone, with sandstone and shale bands are considered to be moderately permeable with local importance as a groundwater resource.
34. The northern section of the proposed interconnector to the proposed Turleenan substation (approximate Towers 1 to 48) is underlain locally by further Carboniferous strata but principally by Triassic rocks. The Triassic strata comprise mainly the Sherwood Sandstone, represented by the Derrycreevy Sandstone and the Mercia Mudstone Formation, the former Keuper Marl. The Sherwood Sandstone typically has a high intergranular permeability and a significant secondary permeability, imparted by the presence of fractures, which facilitates groundwater movement. The Sherwood Sandstone is a major aquifer of regional importance. The Mercia Mudstone, which overlies the Sherwood Sandstone and is present beneath the proposed substation, has a low permeability which restricts groundwater flow and has negligible importance for water supply. There are no

existing public water supply boreholes or springs in close proximity to the proposed interconnector.

35. Other than at the substation sites there have been no ground investigations of the proposed interconnector. However, it can be inferred that where the towers would be in the valley floor, it is likely that the groundwater is shallow. On the higher ground, it is likely that the groundwater level is deeper and may be below the base of any excavations required for the tower foundations.
36. Information from the ground investigation at the Turleenan substation site in 2006 indicates that locally perched groundwater (isolated pockets of groundwater above the level of the main groundwater table) in the superficial deposits would be above the level of the proposed excavations.

### 12.3.5 Areas of Geological Heritage Importance

37. Important sites that are capable of being designated for geological purposes are known as Natural Heritage Areas (NHA) and County Geological Sites (CGS) in Ireland and as Areas of Special Scientific Interest (ASSI) and Earth Science Conservation Review (ESCR) sites in Northern Ireland. There are 11 such sites located within 5km of the proposed interconnector. It is proposed to locate Tower 261 within the boundary of the Altmush Stream CGS and Tower 381 will be located within the Galtrim Moraine CGS. Additionally Towers 355 and 356 are located adjacent to the eastern boundary of the Boyne River CGS. Tassan CGS is located 170m south-east of Tower 117 and Lemgare CGS is located 60m north-east of Tower 108.
38. Altmush Stream comprises a continuous section of natural rock outcrops of the Lower Carboniferous limestone and shale along the banks of a stream over a distance of 1.5km, and has been proposed under IGH8 Lower Carboniferous and IGH9 Upper Carboniferous Themes as a CGS. Galtrim Moraine comprises an example of an esker crossing a moraine. The site has been proposed under the IGH7 Quaternary theme for designation as a CGS as it is unique in Ireland. The Boyne River CGS is a section of the Boyne River comprising one of the few example of anatomising (distributary) channel system in Meath, has been proposed under IGH14 Fluvial/Lacustrine. The line route oversails the CGS. No towers are located in the Boyne CGS. Consultation with the GSI on potential impacts and mitigation measures was undertaken in relation to the CGS sites.
39. There are no other geological designated sites are within 500m of the proposed interconnector and it is considered that there will be no likely significant effects to these distant sites.

### 12.3.6 Current and Historical Mining Sites

40. The main mining area adjacent to the proposed interconnector is Tara Mines, near Navan, County Meath. Tara Mines have been actively mining Lead and Zinc for over 30 years. The current mining area extends to the west of Navan and is present beneath the proposed interconnector particularly in the Irishtown, Betaghstown and Ongenstown area between towers 330 and 332. This area is referred to as the “SWEX B” extension. The SWEX B mineralisation is a significant depth below surface approximately 650m to 900m below ground level (mbgl). The geology of this area has been extensively investigated as a consequence of mining. No other major mines are located along the proposed interconnector. The proposed interconnector does not cross the Kingscourt Gypsum Formation, which is located approximately 1km to the east of the proposed interconnector. There are no active quarries or sand and gravel pits directly affected by the proposed interconnector.

### 12.3.7 Contaminated Land

41. Contaminated land is land where substances are present in sufficient quantities or concentrations to cause or are likely to be causing harm, directly or indirectly, to humans or the environment, in particular surface water or groundwater.
42. An assessment to determine the presence and extent of potentially contaminated land in the assessed area is based on the following approach:
- Identification of potential sources of contamination;
  - Identification of potential receptors that might be adversely affected by the contaminants; and,
  - Identification of potential pathways between the source(s) and the receptor(s).
43. If all three elements (source, pathway and receptor) are present, there is a contaminant linkage and there is a potential for the contamination to represent a risk to the receptor(s) and for the site to be considered as contaminated.
44. A number of sites in Northern Ireland have been identified from the NIEA Contaminated Land database as having a potential for land contamination in the immediate area of the proposed interconnector. Additionally no database of contaminated land is available for counties Monaghan, Cavan or Meath. The NIEA sites have not been fully validated and it is considered likely that they represent worst case conditions, where a potential for contamination has been identified but no evidence of actual contamination has been confirmed, such as a former mineral working/quarry which may or may not have been infilled. In the absence of site-

specific information on the ground conditions, a worst case appraisal has been undertaken on the assumption that all of the sites are contaminated.

45. There are 16 sites on the NIEA Contaminated Land database within the assessed area of the proposed interconnector, seven of which are in close proximity to the proposed interconnector. These include former railway land, former quarries and chemical works. A preliminary assessment was carried out of the risk posed by these sites to human health, surface water and groundwater. It is concluded that these potentially contaminated land sites identified on the NIEA database in close proximity to the route of the proposed interconnector do not pose a significant risk of contamination or a constraint to the proposed interconnector. None of the towers are located on areas of potential contaminated land. In summary, it is concluded that impacts related to the presence of contaminated land are negligible.
46. In counties Monaghan, Cavan and Meath, potentially contaminated land sites were identified based on historical mapping, aerial photographs, LiDAR and site visits. There are 21 identified sites within the assessed area of the proposed interconnector, seven of which are in close proximity to the proposed interconnector. These include a number of former railways and quarries/pits along the line. A preliminary assessment was carried out of the risk posed by these sites to human health, surface water and groundwater. However it is concluded that the potentially contaminated land sites identified in close proximity to the route of the proposed interconnector do not pose a significant risk of contamination or a constraint to the proposed interconnector. The construction works will not disturb any potential contamination and the works will not alter the existing ground conditions. As the construction of the towers would not affect the areas of potentially contaminated land, it is considered that any contaminant pathways will not be realised as part of the proposed interconnector.
47. Further details are provided in Section 9.5 of the Consolidated ES and Section 7.6 of the EIS, Volumes 3C and 3D.

## **12.4 Mitigation Measures**

48. In identifying the route of the proposed interconnector, 'avoidance of impact' measures were employed.

### **12.4.1 Construction Phase**

49. Measures to minimise the impact of the development on local geology include reuse of in situ material and importation of additional material from local sources. The placement of towers has avoided areas of intact peat; therefore the hydrology of

peat masses in the general vicinity of the proposed interconnector will not be affected. Measures will be included in an outline CEMP being developed for the proposed interconnector for the protection of groundwater and surface water and for the management of any contaminated materials unexpectedly discovered during the construction phase. The outline CEMP is provided in the EIS Appendix 7.1, Volume 3B Appendices and in the Consolidated ES Appendix 5A.

50. It is proposed to mitigate the potential impacts on the Altmush Stream CGS, Galtrim Moraine CGS and the Boyne River CGS. Soils and bedrock will be encountered during the site investigation works/construction of the towers. The GSI have been consulted at all stages of the application. The mitigation measures agreed with the GSI include the following:
- Continued consultation with the GSI;
  - Limiting excavation by only excavating the required tower footprint at Galtrim Moraine and Altmush Stream CGS;
  - Maintaining an adequate distance from the Altmush Stream; and
  - The GSI will be notified by the developer about any significant new geological section / feature that is exposed within the tower footprint.
51. All construction waste will be stored, managed, moved, reused or disposed of in an appropriate manner by appropriate contractors in accordance with the Waste Framework Directive and relevant national legislation. Excess soils/subsoils will be disposed of at licensed /permitted waste management facilities. All waste material will require the necessary waste permits and documentation as part of the construction programme and CEMP.
52. Ground investigations have been undertaken at the proposed Turleenan substation where substantial earth movements would be required. A ground investigation will be undertaken at each tower location to confirm the predicted geology and hence clarify the foundation design required.
53. The tower construction phase will generate approximately 42,740m<sup>3</sup> of material, of which 14,210m<sup>3</sup> will be re-used at the tower sites. There would be an excess of approximately 28,530m<sup>3</sup> of materials arising from the tower construction process, which will be disposed of outside of the working area. The precise volume of excess material would depend on the type of foundations used at each of the proposed tower locations, which is dependent on the ground conditions at each tower location and whether the excess material can be beneficially re-used by the landowner. The excess material, comprising naturally excavated soils and rocks

would be uncontaminated and removed for disposal to a suitably-licensed waste disposal/management site.

54. The estimated total volume of cut material from the proposed Turleenan substation is 250,000m<sup>3</sup>. Approximately 156,000m<sup>3</sup> will be re-used on site for regrading the substation platform and for screening bunds. The excess material of approximately 94,000m<sup>3</sup> will be disposed of at suitability licensed waste disposal/management sites. As the proposed interconnector will use the existing Woodland Substation, only minor excavation will take place. A total of 3,500m<sup>3</sup> will be excavated at this location and used either in bunds on site or disposed of to an appropriate waste licensed facility. In total, approximately 126,000m<sup>3</sup> of surplus material will be re-used, recycled or disposed of offsite. Excavated soil and subsoil will be stored adjacent to the excavation within the application area. Excavated material will be reused in situ where possible. Surplus material will be disposed of at licensed waste facilities.
55. It is considered that the greatest potential impact on groundwater will be associated with the construction of the Turleenan substation where a much larger excavation of approximately 250,000 m<sup>3</sup> will be necessary. However the proposed design for the substation would not involve any significant excavation below the groundwater table and hence it is considered that the construction of the proposed substation would not impact on the groundwater level or on flow as no substantial dewatering would be required. Accordingly any impacts on groundwater will be negligible and no mitigation measures would be required as part of the construction of the substation.
56. The majority of the tower locations are remote from properties and hence it is unlikely that short term dewatering of the excavations will impact on existing wells and boreholes.
57. Water pumped from the excavations may contain suspended solids. Standard methods of dewatering including ejectors, well points or submersible pumps will be used. Settlement may be required to reduce the suspended solids concentrations to protect the quality of the receiving water system. Settlement will be undertaken by a standard water filtration system to control the amount of sediment in surface water runoff. Direct discharge to stream or rivers will not be permitted.
58. The contractor will contact the relevant authorities regarding the safe disposal or replacement of soils affected by Potato Wart Disease (PWD). Where off-site removal of infested soil is unavoidable, the contractor would seek advice on the selection of suitable disposal sites and agree a methodology for the works prior to the issue of the necessary movement licence, which would include the measures to be adopted to prevent the spread of the disease. Even if affected soils are not

removed off-site, the contractor will implement measures to minimise the risk of spreading of the disease, such as cleaning the wheels of all lorries leaving the construction areas prior to accessing the public road and cleaning of all tools and earth-moving equipment after use in infested areas to avoid carrying infested soil onto unaffected agricultural land.

59. Although there is no evidence that contaminated materials will be disturbed during the construction works, all excavated materials will be evaluated for signs of possible contamination such as staining or strong odours. Should any unusual staining or odour be noticed, samples of this soil will be analysed for the presence of possible contaminants in order to ensure that historical pollution of the soil has not occurred. Should it be determined that any of the soil excavated is contaminated, this will be dealt with appropriately in accordance with the waste management regulations current at the time.
60. None of the proposed towers or the proposed substation are located on known areas of contaminated ground. Whilst it is considered that the construction of the towers and the substation would not pose a risk in respect of contaminated ground, there always will be a risk of discovering ground contamination during the construction of the development. Any contaminated material unexpectedly excavated as part of the construction of the development would be managed in accordance with a Discovery Strategy which will be included in the CEMP.
61. To minimise any impact to the underlying subsurface strata from material spillages, all oils and fuels used during construction will be stored on temporary proprietary bunded surfaces (i.e. contained bunded plastic surface). These will be moved to each tower location as construction progresses. Refuelling of construction vehicles and the addition of hydraulic oils or lubricants to vehicles will take place away from surface water gullies or drains. No refuelling will be allowed within 50m of a stream/river. Spill kits and hydrocarbon absorbent packs will be stored in this area and operators will be fully trained in the use of this equipment. Any contaminated soils will be removed off-site to a licensed waste management site for treatment and/or disposal.
62. Any vehicles utilised during the construction phase will be maintained on a weekly basis and checked daily to ensure any damage or leakages are corrected. The potential impacts are limited by the size of the fuel tank of the largest plant / vehicles used on the site. Precautions will be taken to avoid spillages. These will comprise where appropriate of:
- Use of secondary containment, e.g. bunds around oil storage tanks;
  - Use of drip trays around mobile plant;



- Supervising all deliveries and refuelling activities; and
  - Designating and using specific impermeable refuelling areas isolated from surface water drains.
63. Controlling working practices by minimising land take, avoiding repetitive handling of soils, minimising vehicle movements off road and limiting the size of stockpiles will reduce the compaction and erosion of material. Once all works are complete, the access route and the working areas around the overhead line structures will be reinstated as close as possible to their original condition. Any impacts are considered likely to be minor and of short term nature.
64. Temporary access tracks will only be built or laid where there may be poor ground conditions, a sensitive receptor or sensitive land use. While the terrain is generally favourable ground conditions for a vast majority of the proposed route, construction techniques and machinery/equipment may vary to accommodate localised ground conditions along specific parts of the route and/or as a result of weather conditions during the construction period.
65. The presence of the proposed interconnector in Bohermeen will not impact on the operation of Tara Mines. All mining in the SWEX 2 deposit is at a depth of more than 750m below ground level. The impact of the proposed interconnector is predicted to be negligible. The developer will liaise with Tara Mines during the construction/operational phase to confirm no conflicts arise.
66. The mitigation measures outlined in relation to soils, geology and hydrogeology will be implemented as part of the CEMP. As referenced previously, an outline CEMP can be found in the EIS Appendix 7.1, Volume 3B Appendices and in the Consolidated ES Appendix 5A.
67. The construction of the towers has the potential to cause a temporary modification in the groundwater level and flow. Additionally there is a potential impact on water quality through dewatering and the discharge of the pumped water to the surface and/or groundwater systems. However, it is concluded that any potential impacts can be managed by implementation of the recommended mitigation measures. Measures for the management of water arising from the construction sites are included in Section 9.5 of the Consolidated ES and Chapter 7, Volume 3C and Volume 3D of the EIS and outline CEMP for the proposed interconnector.
68. The exact design of the foundations for the towers and the need for any groundwater dewatering to facilitate construction can only be confirmed following a review of the ground investigations which will be carried out at each tower location. However, the ground conditions at each tower have been predicted and mitigation

measures have been prepared to address the anticipated range of geological and hydrogeological site conditions. The predicted ground conditions for each individual site shall be confirmed by suitable ground investigation prior to commencement of construction.

69. It is anticipated that dewatering will be necessary at a number of tower locations to facilitate construction. The ground investigation undertaken prior to construction will confirm if dewatering is needed. Where there is considered to be a risk of derogation of an existing water supply spring, well or borehole, an appropriate alternative supply will be provided for the period of dewatering.

#### 12.4.2 Operational Phase

70. Once the infrastructure (towers and substation) for the proposed interconnector has been constructed, it is considered that there would be no subsequent impact on the geological conditions during the operational phase.
71. The proposed interconnector will utilise the existing substation at Woodland thereby minimising the impact on the existing environment. It is not proposed to discharge wastewater to groundwater as part of this development.
72. Impacts on groundwater following construction of the proposed interconnector would be limited to issues associated with the storage and use of contaminants at the proposed Turleenan substation and the use of a septic tank soakaway for the management of foul water at the substation. These substances will be stored and used in accordance with standard guidelines and manufacturer's instructions. Accordingly, it is concluded that potential risks to and impacts on groundwater and surface water quality would be negligible.

### 12.5 Residual Impacts

#### 12.5.1 Overview

73. The nature of the proposed interconnector means that the greatest potential impact for geological impact (including soil, subsoil and bedrock) associated with the development will be in the construction phase. It is considered that the construction of the proposed interconnector will have no significant impacts on the soils and geology.

### 12.5.2 Construction Phase

74. An evaluation was undertaken based on the identification of potential sources (or impacts) pathways and receptors along the line route. If all three elements (source, pathway and receptor) are present, there is a linkage and there is a potential impact to the receptor(s). In term of surface water and ecology, a groundwater dependent terrestrial ecosystem (GWDTE), the Boyne and Blackwater cSAC is over sailed by the line route. However, no significant predicted impacts are likely to occur as part of the proposed interconnector.
75. The implementation of the proposed treatment measures for water discharged from the sites will ensure that there would be no significant deterioration in groundwater quality in the vicinity of the excavations for the towers and substation. The adoption of the proposed mitigation measures will ensure that groundwater is not contaminated. Accordingly, it is concluded there will be no significant hydrogeological impacts as a result of the construction of the proposed interconnector and no residual adverse impacts.

### 12.5.3 Operational Phase

76. It is considered that the operation of the proposed interconnector would have no significant impacts on soils and geology.
77. No significant adverse effects are predicted on the hydrogeological environment as a result of the operation of the proposed overhead line or substation. Once the proposed interconnector has been constructed, there will be no pumping of groundwater and hence no impacts on groundwater levels or flow. Standard measures, detailed in Section 9.5 of the Consolidated ES and Section 7.6 of the EIS, will be implemented in accordance with current guidance to manage potential contaminants, in particular oils, stored and used on the substations. Foul water disposal via a septic tank at the Turleenan substation will be managed to minimise impacts on water quality. It is concluded that residual impacts on groundwater quality would be negligible.
78. The nature of the proposed interconnector means that the greatest potential impact for geological impact (including soil, subsoil and bedrock) associated with the development will be in the construction phase. It is considered that the construction of the proposed interconnector will have no significant impacts on the soils, geology and groundwater.
79. With regard to the operational phase of the development, no significant residual impacts on the local geological or hydrogeological environment are predicted with

the implementation of mitigation measures. The predicted residual impact on soils and geology is considered to be negligible.

## 12.6 Transboundary Effects

80. Impacts on the soils and geology along the border are limited due to the limited scale of excavations and associated works. Towers 98-102 are located in Northern Ireland adjacent to the border, with Towers 103-107 located in County Monaghan within 200m of the border.
81. It is considered that no significant impacts will occur on the geology and groundwater conditions from the section of the proposed interconnector in County Monaghan on the receiving environment in Northern Ireland and vice versa. Accordingly, it is concluded that the proposed interconnector would have no transboundary impacts on soils, geology or groundwater.
82. It has been concluded that there will be no transboundary shipments of soils and so no transboundary impacts will occur.
83. Further details are provided in Chapter 20 of the Consolidated ES and Section 7.9 of the EIS, Volumes 3C and 3D.

## 12.7 Conclusions

84. An appraisal of the proposed interconnector in respect of the ground, geological and hydrogeological conditions has been undertaken in accordance with the requirements of the EIA Directive and the respective applicable national legislation in both jurisdictions.
85. The nature of the proposed interconnector means that the greatest potential impact on geology (including soil, subsoil and bedrock) associated with the development will be in the construction phase. Mitigation measures, as proposed in the Consolidated ES and EIS (and summarised above) will be implemented during the construction phase to minimise and/or eliminate impacts.
86. The subsoil underlying the proposed interconnector is primarily composed of unsorted till deposits while minor quantities of soft sediments including peat and alluvial deposits are also located along the proposed interconnector. The construction phase of the proposed interconnector will pose a potential impact on the ground and geological conditions through the use of temporary access routes for tower construction and excavations required for the tower bases and the excavations required for the construction material storage yard, Turleenan and Woodland substations.

87. The tower locations have been selected to avoid known areas of lacustrine deposits, intact peat and cutover peat where possible. Accordingly, it is considered that the excavations required for the construction of the proposed interconnector would have no adverse impacts on the more sensitive peat ecosystem.
88. It is considered that no significant impacts will occur on the geology and groundwater conditions in the assessed area. Accordingly, it is concluded that the proposed interconnector will have no significant transboundary impacts on soils, geology and hydrogeology. With regard to the operational phase of the development, no significant impacts on the local hydrogeological environment are predicted. Any predicted impact on the soils and geology is considered to be negligible.
89. It is concluded that there are no significant residual impacts on the soil, geology or groundwater conditions as a result of the construction and operation of the proposed interconnector.

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## **13. Water**

### **13.1 Introduction**

1. This section considers the likely significant impacts of the proposed interconnector, (from Turleenan, County Tyrone to Woodland, County Meath) on the surface water in the receiving environment.
2. The relevant chapter of the published Consolidated ES is Chapter 8 (Water) and the relevant chapters of the EIS are Chapter 8 (Water) of Volumes 3C and 3D. In relation to flood risk assessment, these were dealt in Chapter 17 of the Consolidated ES and within Chapter 8 Volume 3C and 3D of the EIS.

### **13.2 Methodology**

3. The scope of assessment and methodology has been determined through a baseline study to fully understand the existing water environment within the assessed area coupled with an evaluation of the risks posed by the proposed interconnector, and confirmed through consultation with prescribed bodies.
4. This surface water quality impact assessment focuses on the construction phase as it is during this phase of the proposed interconnector that there is the greatest potential for significant adverse effects to occur to surface water bodies. Potential effects without mitigation may include direct physical impacts to watercourses along with silt and chemical pollution. Potential receptors may be impacted directly or via pollution that has travelled downstream. The assessment has considered the construction works relating to the proposed substation at Turleenan, works at the existing Woodland substation, the installation of each tower together with any associated temporary infrastructure, such as access tracks etc.
5. The ecology chapters and interaction chapters of this JER contain further details on the ecological sensitivity of the surface waters. This includes information on peatlands, wetlands and European protected sites and habitats.
6. Determining the appropriate spatial assessed area is important to ensuring that this water quality impact assessment is robust and accurately predicts the potential effects on surface water bodies. There is no formal published guidance and thus the zone within which there is the potential for significant effects has been determined based on the professional judgment of the chapter authors.

7. Two of the main surface water features in the assessed area are both known as the River Blackwater. For the purposes of this report they will be identified as the River Blackwater (Bann) and the River Blackwater (Kells).
8. Based on the professional judgment of the chapter authors, an assessed area of 500m (either side of the centreline of the overhead line and from the boundary of the substation) surrounding all development (temporary and permanent) has been assessed, which is sufficiently distant to ensure that all watercourses that may be directly affected are identified.
9. The Water Framework Directive, i.e. Directive 2000/60/EC (WFD), classification of surface water bodies has been referred to in this assessment. The relevant River Basin Districts and current status have been identified, the potential impacts have been assessed with a description of mitigation measures proposed to ensure deterioration in water quality or ecological status is avoided.
10. Construction working areas and stringing areas are all relevant design details when determining the risk posed to any nearby water features. Wherever possible, temporary access tracks, towers and stringing areas have been located away from watercourses, or the working area orientated to avoid watercourses. Where this is not possible, recommendations have been made to mitigate against the risk of, and to prevent, pollutants running off into the watercourse.
11. The impact assessment methodologies between the sections of the proposed interconnector are considered to be broadly similar. Full details of the methodologies used can be seen in the Consolidated ES and EIS.
12. A qualitative assessment was undertaken considering the potential interactions between the proposed interconnector and existing baseline conditions. The assessment was based on a combination of professional judgment, experience of similar developments, the requirements of relevant legislation and statutory policy, and best practice guidance. Best practice guidelines used include the '*Guidelines for Environmental Impact Assessment*' (IEMA 2004), and the Highways Agency's Volume 11, Section 3, Part 10 of the Design Manual for Roads and Bridges (DMRB), NRA (2009) *Guidelines on Procedures for Assessment and Treatment of Geology, Hydrology and Hydrogeology for National Road Schemes* and the EPA *Guidelines on the Information to be Contained in Environmental Impact Statements* (2002).
13. A Flood Risk Assessment (FRA) has considered the route of the Overhead Line and Turleenan Substation (see Chapter 17 of the Consolidated ES). The assessment considers the development process through construction to the permanent development proposals. Due to the limited development at Woodland Substation a

full FRA was not required. Woodland Substation is not located in a flood zone and development will not change or itself be affected by flood levels.

### 13.3 The Receiving Environment

14. Using OSNI mapping, OSi mapping, LiDAR, historical mapping and the site surveys, the larger and more important watercourses have been identified in the Consolidated ES (Chapter 8) and the EIS (Chapter 8 of Volume 3C and 3D). The most significant surface water feature in Northern Ireland upon which the proposed interconnector could have a potential impact is the River Blackwater (Bann). At the northern end of the proposed overhead line, east of Benburb the River Blackwater (Bann) crosses the assessed area from west to east, before flowing northwards and eventually draining into Lough Neagh (approximately 8 km downstream of the assessed area).
15. The River Rhone is located north of the Turleenan substation site and flows in a south-easterly direction ultimately discharging into the River Blackwater (Bann).
16. The Ballymartrim Water originates south of the A3 road and flows north along the eastern side of the proposed overhead line, within the assessed area, draining into the River Blackwater (Bann) south of Blackwatertown.
17. The Tynan River (otherwise known as the Balteagh Stream) flows in a northwesterly direction along the eastern side of the proposed overhead line before crossing the assessed area south of the A3 road. This watercourse flows into River Blackwater (Bann) east of Tynan.
18. A tributary of Clontibret Stream flows in a northwesterly direction along the border between Northern Ireland and Ireland. The Clontibret Stream ultimately discharges into Cor River, which then flows into River Blackwater (Bann) east of Tynan.
19. The headwater of the River Fane is located along the Armagh / Monaghan Border and drains towards Lough Muckno. The River Fane flows to the south-east before eventually discharging to Dundalk Bay and the Irish Sea.
20. The Annalee River and its tributaries which are part of the River Erne catchment, flows through the central section of the proposed interconnector in counties Monaghan and Cavan. The Dromore River and Annalee River flow in a westerly direction towards Butlers Bridge and Lough Erne before entering Donegal Bay at Ballyshannon.



21. The Dee / Glyde / Lagan River<sup>30</sup> and their tributaries are crossed at the southern section of the proposed line route in north County Meath (as shown in Figures 8.1-8.4, Volume 3C and 3D Figures of the EIS).
22. The River Boyne, River Blackwater (Kells) and River Dee dominate the natural surface water of County Meath. The River Dee flows in an easterly direction from Nobber in County Meath to Ardee in County Louth. The River Dee along with its tributary, the Kilmainham River, forms a large element of the drainage network towards the northern section of County Meath. The River Kilmainham flows (between Towers 251 and 252) in a west north-west to east south-east direction towards Kilmainham.
23. The River Blackwater (Kells) flows through the central section of the proposed interconnector (between Towers 310 and 311) in a north-west to south-east direction from Kells, before entering the River Boyne at Navan. The Yellow River joins the Blackwater River approximately 4km north-west of Navan.
24. The River Boyne crosses the southern section of the proposed interconnector between Towers 355 and 356. It flows in a south-west to north-east direction between the towns of Trim and Navan.
25. A number of small streams comprising of the Clady River, Bective River, Skane River, Derrypatrick River, Boycetown River and River Tolka are located in the southern section of the proposed interconnector. There are also a large number of field drains / ditches (many of which are ephemeral) and storm drains throughout the assessed area, predominantly along field boundaries and often within hedgerows. Where possible, these were identified and examined during field surveys. It should be noted that <10% of Towers are located on hedgerows/field drains.
26. The major lakes present in or in close proximity to the assessed area include the following:
  - Boraghy Lake (200m NW of Tower 163);
  - Bocks Lough (210m E of Tower 175);
  - Lough Egish (H) (600m SE of Tower 161 and 162);
  - Crinkill (Toome) Lough (S-E) (c. 500m NE of Tower 146);
  - Corlin Lough (890m W of Tower 134);

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<sup>30</sup> The upper reaches of the Glyde in County Louth are known as the Lagan River. This is a separate catchment to the River Lagan in County Down and Antrim.

- Lough Morne (250m W of Tower 166);
- Drumgristin, Coogan's and Ghost Lough (220m E of Tower 130); and,
- Whitewood Lough (0.6km E of Tower 141).

### 13.3.1 Water Framework Directive

27. The European Communities Directive 2000/60EC, which established a framework for community action in the field of water policy (commonly known as the Water Framework Directive (WFD)), requires 'good water status' for all European waters by 2015.
28. The WFD has resulted in the identification of the River Basin Districts (RBDs) for which River Basin Management Plans (RBMPs) have been prepared. When a RBD is transboundary it is termed an International River Basin District (IRBD). The proposed interconnector is located within the Neagh Bann IRBD, North West IRBD and the Eastern RBD. The River Basin Management Plan for the Neagh Bann IRBD identifies the existing condition of the water environment, the pressures placed upon it, the risk of water bodies not achieving the targets of the WFD, and sets out targets and measures to improve the water environment. The majority of waters are of less than good status and a minimum objective of achieving good status has been set for many of these water bodies. A programme of measures was identified for each water body addressing the specific issues of that water body. This is to be achieved through a system of river basin management planning and extensive monitoring. Extended deadlines were included in the *River Basin Management Plans for 2021 or 2027*, based on basic judgments about cost-effective combinations of measures. Many of the water bodies along the route of the proposed interconnector have extended deadlines of 2021 and 2027 with the exception of bodies already achieving good status.
29. The River Blackwater (Bann), Tynan Water, River Rhone, Ballymartrim Water and Clontibret Stream, Ery Lough Stream Upper, Magheraclone Upper stream, Rahans Upper stream, Knappagh Lower, Corrybrannan stream, Corfin stream, Lambertstown stream, Bective River, Blackwater (Kells) River, Gibstown stream and Fane River are all classified as Poor or Bad Ecological Status (based on 2008 river assessments).
30. The River Blackwater (Bann) from Benburb to Ballymartrim Water, Batterstown stream, Boycetown River, Boyne Lower, Clady River, Blackwater (Kells) Lower, Drakestown Lower, Upper Shantonagh Lough stream, Aghmakerr stream, and Annalee Upper are classified as Moderate Ecological Status (based on 2008 river assessments). The Major Lough Stream Lower, Toome Stream, Magheraclone

Lower, Glyde Upper and Kilmainham Wood Stream are achieving Good Status (based on river 2008 assessments).

### 13.3.2 Protected Areas and Fisheries

31. As part of the implementation of the WFD a Register of Protected Areas (RPA) has been compiled by Northern Ireland Environment Agency (NIEA) and Environmental Protection Agency (EPA). Protected areas are those requiring special protection under existing national or European legislation, to protect surface or groundwater, or to conserve habitats or species that directly depend on those waters.
32. The River Blackwater (Bann), River Rhone, Ballymartrim Water and Tynan Water are all designated under codified Directive 2006/44/EC on the quality of fresh waters needing protection or improvement in order to support fish life. River Blackwater (Bann), Ballymartrim Water and Tynan Water are designated salmonid rivers whilst River Rhone is a cyprinid designated fishery under this directive. The whole of Northern Ireland has been designated as a Nitrate Vulnerable Zone. There are no SPAs or SACs present within the Northern Ireland assessed area. The River Blackwater (Bann) discharges into Lough Neagh (approximately 8 km downstream from the assessed area) which is an SPA.
33. The River Boyne and its tributaries are designated 'Registered Protected Areas'(RPA) salmonid rivers. The River Blackwater (Kells) (which is designated as part of the River Boyne and River Blackwater cSAC) is over sailed between Towers 310 and 311. The River Boyne (also part of the River Boyne and River Blackwater cSAC) is over sailed between towers 355 and 356. There are no RPA nutrient sensitive rivers in the counties Monaghan, Cavan and Meath assessed area, with the exception of the River Proules, located 1km east of the Carrickmacross material storage yard. There are no RPA nutrient sensitive lakes and estuaries along the proposed line route and there are no RPA shell fish areas along the proposed line route.

### 13.3.3 Water Resources

34. An abstraction is located just beyond the 500m assessed area to the east of tower 51 and the overhead line. This abstraction is from the Ballymartrim Water near Ballydoo and the water is used for a hydroelectric scheme and as such it is not considered a water sensitive receptor. The scale of impacts of the proposed interconnector means that there will be no likely significant effects to the hydroelectric scheme. Two surface water abstractions (Lough Egish and Toome Lough) are located outside the 500m assessed area however the scale of the development means that there will be no likely significant effects to surface water

abstractions. Therefore, it will not be necessary to consider these abstractions any further.

### 13.3.4 Flood Risk

35. The main areas of consideration for the permanent development proposals are associated with the proposed Turleenan Substation, existing Woodland substation and tower locations. In addition, for the construction phase, the assessment considers proposed access routes and associated temporary construction requirements.
36. It should be noted that flood risk was a significant consideration within the design of the Turleenan Substation. The main elements of development associated with flood risk are associated with the Turleenan Substation, construction and permanent development, including access, working areas, earthworks and proposed drainage, which have all been considered within the detailed Flood Risk Assessment, Surface Water Management Strategy (as presented in the Consolidated ES, Appendix 17A). Although the Turleenan substation boundary includes land recognised as being in the 1% Annual Exceedance Probability (AEP) floodplain, there is no permanent built development at the substation within this area.
37. The Rivers Agency 'Strategic Flooding Mapping' and the Office of Public Works (OPW) 'Flood Hazard Database' was used in order to obtain information on historical flooding events. This information was used to establish the current baseline conditions in terms of what sections of the assessed area are liable to flood. Additional sources of information including internet searches, historical maps, data from CFRAMs and flood risk assessments were also consulted. No incidents of flooding were noted at Woodland Substation which was constructed in 1983. The proposed works at the existing Woodland substation: are not located within the 0.1% or 1% AEP Preliminary Flood Risk Assessment area; are less than 1 hectare and will not result an increase in site levels.
38. In addition, there are aspects of the tower construction that may have a bearing on flood risk considerations, due to the proposed tower locations, base construction, and working areas and access tracks.
39. Substantial areas of the River Boyne and Dee catchments have been artificially drained from the 1960s to 1980s to drain agricultural lands and reduce local flood frequency. An estimated 656km of stream channels in the Boyne catchment have been modified to prevent flooding, improve agricultural fields and allow for urban development. During this period, one tributary, and a section of the River Boyne itself, on average, were drained annually, O'Connor (2006). The River Dee and its

tributaries have been artificially drained since the 1950s. Areas historically prone to flooding include areas of mapped alluvial sediments however OPW flood relief works have decreased the frequency of flood events.

40. Further details are provided in Section 8.3 of the Consolidated ES and Section 8.4 of the EIS, Volumes 3C and 3D.

## **13.4 Mitigation Measures**

### **13.4.1 Overview**

41. In identifying the route of the proposed interconnector, 'avoidance of impact' measures were employed. Where this was not possible, site specific mitigation to adequately protect watercourses has been recommended. These are detailed in this chapter. In addition, following all good practice guidance, the outline CEMP (please see EIS Appendix 7.1, Volume 3B Appendices and in the Consolidated ES Appendix 5A) will be implemented by the contractor (to be appointed) to ensure adequate protection of the water environment. The terms of the construction contract will require the Contractor to deliver all the mitigation measures contained within the Consolidated ES and EIS which are outlined in this JER.
42. In order to mitigate likely significant impacts during the construction phase, all works associated with the construction of both substations and the proposed overhead line will be undertaken with due regard to the good practice guidance (PPGs) documents and other good practice guidance such as that published by Construction Industry Research and Information Association (CIRIA), NIEA, DCAL, Eastern Regional Fisheries Board and Department of the Marine and Natural Resources (now DCENR).

### **13.4.2 Construction Phase**

43. All personnel working on the proposed interconnector will be responsible for the environmental control of their work and will perform their duties in accordance with the requirements and procedures of the outline CEMP. In terms of wastewater generated during the construction phase, wastewater facilities on site will include self-contained chemical toilets.
44. To prevent any impact on the underlying subsurface strata from material spillages, all oils and fuels used during construction will be stored on temporary proprietary bunded surface (i.e. contained bunded plastic surface). These will be moved to each tower location as construction progresses. Refuelling of construction vehicles and the addition of hydraulic oils or lubricants to vehicles will take place away from

surface water gullies or drains. No refuelling will be allowed within 50m of a stream / river. Spill kits and hydrocarbon absorbent packs will be stored in this area and operators will be fully trained in the use of this equipment.

45. Any vehicles utilised during the construction phase will be maintained on a weekly basis and checked daily. Precautions will be taken to avoid spillages, which include:
- Use of secondary containment, e.g. bunds around oil storage tanks;
  - Use of drip trays around mobile plant;
  - Supervising all deliveries and refueling activities;
  - Designating and using specific impermeable refueling areas isolated from surface water drains; and
  - Oil water separators will be used at construction compounds.
46. The surface water drainage system at the substation locations takes into account the recommendations of the SuDS (sustainable drainage systems) devices where appropriate. Runoff from hardstand areas at substations will be limited to greenfield runoff rates.

#### Felling of Forestry

47. Commercial forestry is located along the line route, primarily in County Meath. Where the clearance of forested areas is required, works will be undertaken in accordance with the *Forestry and Water Quality Guidelines* (Department of the Marine and Natural Resources, 2000). In areas where tree felling is to be undertaken, the use of buffer zones and drainage ditches will be employed during felling, particularly on sloping ground, in order to mitigate the effects of increased surface run-off and associated sedimentation.
48. Consultation will be undertaken with relevant authorities before commencing felling operations in areas of importance to fisheries and wildlife. Sediment traps will be installed prior to felling and maintained on a daily basis throughout operations. Felling operations will be conducted with the shortest possible extraction routes, designed to be compatible with the avoidance of sedimentation. Trees will be felled away from the aquatic zone. Machine extraction will not occur in the riparian zone.
49. On sites where risk of erosion is high (steep slopes and /or adjacent to rivers), brash mats will be used to avoid soil damage, erosion and sedimentation. The forest felling effects of the overhead transmission line will be short-term during the construction phase.

### Works near Watercourses

50. Any proposals that involve interference with any watercourses, such as diversion, culverting or bridging, or the temporary discharge of site drainage to any watercourse, require written consent from the relevant authorities. The relevant authorities will be further consulted prior to construction where works are required near a watercourse.
51. The line route has been designed in order to locate temporary access tracks and tower locations away from sensitive rivers where possible or to provide mitigation measures to minimise/eliminate any likely significant effects. In relation to the River Boyne and River Blackwater cSAC<sup>31</sup> the towers are located a minimum of 60m and 100m respectively from these cSAC rivers. As with all tower locations, existing access tracks where present will be utilised.
52. Sediment and pollution control measures will be undertaken in all work areas but, in particular, where towers are located near rivers. Stockpiles will be located away from the watercourses and drainage ditches. Stockpile top surfaces shall be shaped and profiled to prevent erosion from run-off. Erosion protection mats will be applied to stockpile surfaces, as required.
53. Silt barrier / silt curtains will be used where towers or works are undertaken near watercourses. Correct installation of silt fences is vital and will be supervised by the construction manager and on site ecologist. The silt barrier / silt curtain will be shaped and installed so that it will catch runoff, without the water flowing underneath or around the edge. The silt barrier will be located downgradient of the works and inspected on a regular basis as well as during and after rainfall events. For steep slopes, more than one silt curtain will be used. The edges of the silt curtain will be turned upslope to prevent water going around the edges. Grips, sumps, straw bales and sediment traps can be installed to capture silt where applicable. Each of these should be maintained daily by the contractor to ensure that they remain effective and do not increase the likelihood of an incident occurring.<sup>32</sup> Certain site activities including concrete pouring near water courses will be postponed during heavy rainfall events (<5mm/hour) to prevent pollution entering watercourses.
54. Where groundwater dewatering is required the resultant water will be filtered before discharge. Dewatering if required will be limited in duration. Groundwater can be filtered using bunds / tanks filled with filter material. Single sized aggregates 5–10 mm, Geotextiles or straw bales can be used as a filter. Monitoring will be

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<sup>31</sup> Blackwater (Kells)

<sup>32</sup> CIRIA Document 650.

undertaken on the discharge water quality to ensure the effectiveness of the implementation of the mitigation measures recommended.

55. Precautions will be taken to avoid spillages. These include:
- use of secondary containment, e.g. bunds around oil storage tanks,
  - use of drip trays around mobile plant;
  - supervising all deliveries and refueling activities; and
  - Designating and using specific impermeable refueling areas isolated from surface water drains.
56. With regard to on site storage facilities and activities, any raw materials and fuels, will be stored within bunded areas, if appropriate to guard against potential accidental spills or leakages. All equipment and machinery will have regular checking for leakages and quality of performance.
57. All site personnel will be trained and aware of the appropriate action in the event of an emergency, such as the spillage of potentially polluting substances. Spill kits are retained to ensure that all spillages or leakages are dealt with immediately and staff are trained in their proper use. Any servicing of vehicles will be confined to designated and suitably protected areas. In the extremely unlikely event of any pollution incident or spill, the CEMP protocol will be followed, the incident will be reported to the appropriate authorities and the receiving watercourse will be remediated to its original condition.

#### Construction of Temporary Access Tracks and Tower Foundations

58. Low bearing pressure vehicles are primarily used along with using the Derrick pole and cranes in some locations to erect the metal structure. Maximum use will be made of both existing farm entrances and also farm tracks or roads. Temporary access tracks will comprise of aluminium tracks, stone roads, rubber matting or timber sleepers (as set out in the respective outline CEMPs, please see EIS Appendix 7.1, Volume 3B Appendices and in the Consolidated ES Appendix 5A).
59. In sensitive locations silt barriers will be used to prevent direct runoff to local watercourses. All temporary access tracks will be removed at the end of the construction phase and the land will be restored to its original condition. The solution to maintaining low suspended solids is preventing silt / clay from entering the surface water at source. Preventative measures will ensure that input suspended solids concentrations will be minimised at source. This will be achieved by ensuring that all silt / clay and topsoil is properly stored during the construction



phase of the development and so a major source of silt due to runoff will have been reduced.

60. Wash down and washout of concrete transporting vehicles will not be permitted at the location of construction. Such wash down and washout activities will take place at an appropriate facility offsite or at the location where concrete was sourced. The washing-down area should be contained and washings channelled into a batcher washings treatment facility. For smaller machinery, local wash down areas should be created within the tower works area. These will take the form of a steel skip or tank. All approved washing areas should be documented with training provided for site workers.
61. Water quality monitoring will be undertaken prior to the commencement of construction to confirm baseline data and ensure there is no deterioration in water quality. This will be targeted on watercourses considered to be at a higher risk of pollution (i.e. towers where there are watercourses within 20m of the construction works). Water quality monitoring will include daily inspection of adjacent watercourses. Regular sampling for pH and conductivity will be undertaken, with sampling for suspended solids and hydrocarbons if any change in the appearance is identified. Daily observations of watercourses close to construction works will be taken and detailed records of observations including photographs will be made. If pollution is suspected, samples will be collected upstream and downstream of this point, and sent to an appropriately accredited laboratory for analysis. All works will halt until the source has been identified, controlled and any remediation undertaken.

#### Stringing of Cables

62. It is not envisaged that temporary access tracks will be required to be laid for the stringing of the cables. Low bearing pressure vehicles are primarily used for the stringing of the line. Mitigation measures will be implemented for the proper use of fuel on site. In addition, the risk can be effectively controlled by good working practices and conditions and the implementation of an effective pollution prevention plan all as outlined in the outline CEMP.

#### Flood Risk

63. Although the Turleenan substation boundary includes land recognised as being in the 1% AEP floodplain, there is no permanent built development at the substation within this area. The construction of the Turleenan substation and works at the Woodland substation will incorporate the elements of the Surface Water Management Strategy (SWMS) to attenuate flows. This strategy also includes appropriate levels of treatment in accordance with the SuDS Manual to provide

treatment to the runoff. The development has been assessed with source and site controls to develop an outline strategy.

64. The runoff from the future development will be controlled and limited to ensure that it does not exceed the runoff from the existing undeveloped site. The assessment has been carried out for all rainfall events up to and including the 1% AEP event, including an allowance for future climate change of a 20% increase in rainfall intensity.
65. During the construction period of the substation, the temporary alignment of the access road will encroach onto the floodplain. A SWMS has been developed to assess the requirements of SuDS to mitigate the effects of the development on the increased surface water runoff and also to provide adequate treatment.
66. The design of the tower bases has been developed to ensure that there is limited requirement for foundations to extend above ground level, so as to ensure that there is no loss of floodplain storage. Temporary flooding at the bases of the towers will not have a detrimental effect on the operation of the proposed interconnector.
67. Further details are provided in Section 8.6 of the Consolidated ES and Section 8.5 of the EIS, Volumes 3C and 3D.

### **13.5 Residual Impacts**

68. The nature of the proposed interconnector dictates that the greatest potential impact for the water environment will be in the construction phase. The implementation of the mitigation measures as outlined herein and in more detail in the ES / EIS will result in no significant impacts on water arising as a result of the proposed interconnector. The predicted impact on the environment is considered to be short term and minor to negligible.
69. There are no likely significant residual flood risk effects as a result of the construction or operation of the proposed interconnector. The loss of flood plain during the temporary access at the substation and towers and access tracks is not considered significant and will not result in significant impacts to or from the proposed interconnector.
70. With regard to the operational phase of the development, no significant impacts on the water environment are predicted with the implementation of SuDS and other mitigation measures outlined above. The WFD is concerned with non-temporary long term impacts at the water body level. The impact assessment demonstrates that the proposed interconnector will not have any direct, non-construction related adverse effects on any WFD water body (i.e. there will be no new crossing

structures, outfalls, abstractions or diversions etc.). Therefore, it is considered that the proposed interconnector is compliant with the objectives of the WFD. The predicted impact on the water is considered to be negligible.

71. Further details are provided in Section 8.6 of the Consolidated ES and Section 8.7 of the EIS, Volumes 3C and 3D.

### **13.6 Transboundary Effects**

72. Impacts on the water environment along the border are limited due to the limited scale of excavations and associated works. Part of the proposed interconnector is located in the River Bann International River Basin District (IRBD) and the North West IRBD (River Erne System).
73. Towers 98-102 located in Northern Ireland adjacent to the border, and towers 103-107 located in County Monaghan adjacent to the border, are within the catchment of the Clontibret River. The Clontibret River which delineates the border between Tower 102 and 107 ultimately flows into the Northern Ireland section of the River Bann Catchment at Ardgonnell Bridge, 11km down-gradient. The Annalee and Knappagh Rivers in Counties Monaghan and Cavan ultimately flow into the Northern Ireland section of the River Erne Catchment to the north of Belturbet, County Cavan, 40km down-gradient.
74. Based on an evaluation of predicted impacts, it is considered that no significant impacts will be caused by that part of the proposed interconnector located in Ireland on the surface water environment in Northern Ireland and vice versa. Accordingly, it is concluded that the proposed interconnector will have no significant transboundary impacts on the surface water environment.
75. Further details are provided in Chapter 20 of the Consolidated ES and Section 8.9 of the EIS, Volumes 3C and 3D.

### **13.7 Conclusions**

76. An appraisal of the proposed interconnector has been undertaken in accordance with the requirements of the EIA Directive and the respective legislation applicable in both jurisdictions.
77. The construction phase of the proposed interconnector will impact on the water conditions through the use of temporary access tracks and excavations required for the tower bases.

78. Mitigation measures will be implemented at the construction phase to minimise and/or eliminate impacts to previously recorded features and to resolve any unknown features discovered during construction.
79. The tower locations have been selected to avoid known areas of flood plains and river banks where possible. No significant adverse effects are predicted on the water environment as a result of the construction phase of the proposed overhead line.
80. With regard to the operational phase of the development, no significant impacts on the local water environment are predicted with the implementation of the proposed mitigation measures. The predicted impact on the water environment is considered to be negligible.

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## 14. Air and Climatic Factors

### 14.1 Introduction

1. This section considers the likely significant impacts of the proposed interconnector, (from Turleenan, County Tyrone to Woodland, County Meath) on the air quality and climate aspects in the receiving environment.
2. The relevant chapter of the published Consolidated ES is Chapter 6 (Scoping and Consultation). The relevant chapter of the EIS is Chapter 10 (Air – Quality and Climate) of Volumes 3C and 3D.

### 14.2 Methodology

3. The methodology used to prepare the air and climate assessment was based on a review of existing air quality data, air quality bulletins and applicable national legislation and guidance.
4. Potential localised air pollution impacts arising from construction of the proposed interconnector were assessed based on the experience of similar construction projects of this nature and with reference to the Environmental Protection UK (EPUK) guidance document *Development Control: Planning For Air Quality* (2010 Update).
5. The EU Guidance on *Integrating Climate Change and Biodiversity into Environmental Impact Assessment*<sup>33</sup> was also taken into account. This guidance recognises the need for action on climate change and biodiversity loss across Europe and around the world. It identifies the need to fully integrate the combating of, and adaptation to, climate change, to halt the loss of biodiversity and the degradation of ecosystems. Potential national impacts of climate change on the island of Ireland's biodiversity have been identified in a Met Éireann led study report (*Ireland's Climate: The Road Ahead* (2013)). The overall beneficial impact of the proposed interconnector in providing infrastructure to facilitate displacement of greenhouse gas emission thereby combating climate change is considered.

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<sup>33</sup>European Union, Guidance on Integrating Climate Change and Biodiversity into Environmental Impact Assessment, 2013

## 14.3 The Receiving Environment

### 14.3.1 Climate Change

6. Global warming, and the management of emissions with the potential to contribute to global warming, is increasingly important on a national and international basis. Global warming has numerous potential implications for the environment, including:
  - Greater risk of intense rainfall events leading to greater potential for flooding;
  - Changes to habitats and eco-systems;
  - Effects on sea levels and river levels;
  - Increased stress on water resources and potential for over exploitation; and
  - Increased summer temperatures can also impact human health among susceptible sectors of the community, particularly the elderly.
7. Increased atmospheric levels of greenhouse gases are now widely recognised as the leading cause of climate change.
8. The most important long lived greenhouse gases are CO<sub>2</sub>, N<sub>2</sub>O, and Methane (CH<sub>4</sub>). CO<sub>2</sub> arises from a range of sources including the combustion of fossil fuels. According to the Environmental Protection Agency (EPA), agriculture remains the single largest contributor to overall greenhouse gas emissions in Ireland, at 32.1% of the total, followed by energy (power generation and oil refining) at 20.8% and transport at 19.7%. The remainder is made up by industry and commercial at 14.0%, the residential sector at 11.5%, and waste at 1.8%. A similar situation exists in Northern Ireland where transport, agriculture and energy are the three main contributors to greenhouse gas emissions, contributing over two-thirds (68%) of Northern Ireland's total greenhouse gas emissions in 2008 (DOE, 2011).
9. Key objectives for reductions in greenhouse gases across the agriculture, energy, transport, industrial, forestry and built environment sectors, which will ensure that Ireland can meet its international commitments, are set out in the *National Climate Change Strategy 2007–2012*. This Strategy includes the Irish Government's target of achieving 40% of electricity consumption on a national basis from renewable energy sources by 2020. Achieving this target will potentially contribute significantly to limiting the increase of greenhouse gases in Ireland. In Northern Ireland, DOE takes the lead on climate change through the Climate Change Unit; their target is to work towards a reduction in greenhouse gas emissions by at least 35% on 1990 levels by 2025. Much of this reduction will be achieved through transferring to renewable energy generation.

### 14.3.2 Air Quality

10. The proposed interconnector area falls into the area classified as a predominately rural area. Ambient air quality is influenced principally by agricultural activity, domestic heating and vehicle emissions. The rural character of the area and existing air quality monitoring indicates the area is of “good” quality and is below relevant Air Quality threshold standards.

## 14.4 Mitigation Measures

11. The main potential for impact relates to dust emissions during the construction phase of the proposed interconnector. The most effective way to manage and prevent particulate releases is through effective site management and control of the potential source. Mitigation measures designed to ensure that emissions from these sources are minimised are set out in the outline CEMP submitted with the planning application (found in the EIS Appendix 7.1, Volume 3B Appendices and in the Consolidated ES Appendix 5A). A suite of mitigation measures have been recommended in the ES and EIS, with specific details of the implementation of mitigation measures being agreed with the relevant authorities in the context of the finalisation of the CEMP. Mitigation measures will be employed on a site-specific basis, based on confirmation of the construction activities involved and their proximity to nearby receptors in each location.
12. The mitigation measures presented in the outline CEMP are ‘good practice’ measures and are designed to ensure that the construction activities do not generate excessive dust or particulate material release. Employment of such measures will ensure that no significant dust effects occur during project construction of the proposed interconnector.

## 14.5 Residual Impacts

### 14.5.1 Construction Phase

13. In terms of dust no significant impacts are predicted following the implementation of good construction practice and the mitigation measures. During adverse weather conditions, some residual impacts will occur, dependent on wind speed and turbulence during construction, however, it is likely that the impact will be localised in the area immediately surrounding the source and will be of short duration and temporary in nature.
14. Traffic emissions themselves will not give rise to significant air quality effects from vehicular emissions. Construction traffic will contribute to existing traffic levels on

the surrounding road network and will have the potential to generate dust. The greatest potential for this to occur will be in the areas immediately adjacent to the principal means of access for construction traffic. In these areas increases in dust generated by vehicle movements and local air pollutant emissions from vehicles may be temporarily elevated during the busiest periods of construction activity, however with the implementation of mitigation measures no significant local air quality effects are predicted.

15. The nature of the proposed interconnector means that there will be no construction sites that would generate large HGV flows (>200 movements per day) over a period of a year or more with the exception of the construction materials storage yard in Carrickmacross, County Monaghan. Flows would generally be below 200 movements per day.
16. Construction traffic will use local roads to access the working areas. It is predicted that there will be relatively large percentage increases of traffic flow on some local roads, although this is predominantly due to the very low existing flow volumes. Furthermore, according to the EPUK document 'Development Control: Planning For Air Quality' (EPUK, 2010), an air quality assessment is required for 'large, long term construction sites that would generate HGV flows of more than 200 movements per day over a period of a year or more'. Therefore, as the numbers of construction vehicles are considered to be low and temporary in nature, it is considered that there will be no likely significant air quality effects.
17. In terms of sensitive receptors, the proposed interconnector is not located in any existing air quality sensitive areas. It is considered that because the construction traffic does not meet any of the criteria for an air quality assessment and the traffic impacts will be temporary in nature, there are no likely significant air quality effects to the potentially air quality sensitive areas and designated ecological sites.

#### 14.5.2 Operational Phase

18. The proposed interconnector will have positive long term residual impacts on greenhouse gas emissions as it will facilitate further development and connection of renewable energy sources thereby reducing the dependence on fossil fuels with consequent reduction in greenhouse gas emissions. Beneficial local air quality impacts may also be anticipated in the vicinity of power plants as fossil fuel consumption decreases.



## 14.6 Transboundary Effects

19. The proposed interconnector will contribute positively to a reduction in transboundary impact on climate through facilitating a reduction in greenhouse gas emissions in compliance with EU emission targets, and Irish and UK policy. Ireland and the UK have committed to achieving the EU's integrated approach to climate and energy policy that aims to combat climate change through achieving the climate and energy targets (a 20% reduction in GHG below 1990 levels, 20% of energy consumption to come from renewable energy targets and a 20% reduction in primary energy use). This is a key climate change mitigation identified in the EU's Guidance on Integrating Climate Change and Biodiversity into Environmental Impact Assessment.
20. An Imperceptible negative impact on transboundary air quality will arise during the construction of the proposed interconnector with the level of impact being reduced by the implementation of the mitigation measures outlined in the EIS and Consolidated ES.
21. The provision of the proposed interconnector will increase the availability of renewable energy contributing to further reductions of SO<sub>2</sub> and NO<sub>x</sub> emissions from Ireland and Northern Ireland, associated with displaced fossil fuelled power generation and through provision of an efficient transmission system.

## 14.7 Conclusions

22. The proposed interconnector will have positive long term residual impacts on greenhouse gas emissions as it will facilitate further development and connection of renewable energy sources thereby reducing the dependence on fossil fuels with consequent reduction in greenhouse emissions.
23. In terms of dust no significant impacts are predicted following the implementation of good construction practice and implementing appropriate mitigation measures.
24. Traffic emissions themselves will not give rise to significant air quality effects from vehicular emissions.
25. With the implementation of mitigation measures no significant local air quality effects are predicted.

## 15. Cultural Heritage

### 15.1 Introduction

1. This section considers the likely significant impacts of the proposed interconnector, (from Turleenan, County Tyrone to Woodland, County Meath) on the architectural, archaeological, and cultural heritage in the receiving environment.
2. The relevant chapters of the published Consolidated ES are Chapter 12 (Cultural Heritage) and the relevant chapters of the EIS are Chapter 14 (Cultural Heritage) of Volumes 3C and 3D.

### 15.2 Methodology

3. For details of the methodologies employed, refer to Consolidated ES Section 12.2 and EIS Section 14.2 of Volumes 3C and 3D
4. The baseline conditions were collated from the historic records held by Northern Ireland Environment Agency, Ulster Museum, National Museum of Ireland, Monaghan County Council, Department of Environment, Community and Local Government, Department of Arts, Heritage and the Gaeltacht, Cavan County Council, and Meath County Council and from analysis of historic mapping, aerial photography and LiDAR and other published and unpublished sources. Where access was permitted, site walkover surveys were undertaken, while non-accessible land was surveyed from the nearest accessible land or roads where possible. The project consultants recognise that the official mapping supplied does not contain all potential sites of archaeological, architectural or cultural heritage importance and any new archaeological, architectural or cultural heritage sites identified during fieldwork were recorded.
5. The appraisal of archaeological, architectural and other cultural heritage impacts for the proposed interconnector is based on the professional expertise of the project consultants and takes into account relevant legislation and published guidance including:
  - English Heritage “The Setting of Heritage Assets”;
  - Historic Scotland “Managing Change in the Historic Environment: Setting”;
  - Design Manual for Roads and Bridges (DMRB) Volume 11, Section 3, Part 2 Cultural Heritage, HA208/07;
  - National Planning Policy Framework (NPPF);

- Department of Arts, Heritage and the Gaeltacht (DAHG) (April 2011). National Landscape Strategy for Ireland – Strategy Issues Paper for Consultation;
  - Department of the Environment, Heritage and Local Government (April 2009). Code of Practice between the Department of the Environment, Heritage and Local Government and ESB Networks;
  - Department of the Environment, Heritage and Local Government (April 2009). Code of Practice between the Department of the Environment, Heritage and Local Government and EirGrid;
  - Department of Arts, Heritage, Gaeltacht and the Islands (1999). Framework and Principles for the Protection of the Archaeological Heritage;
  - Institute for Archaeologists (2008). Setting Standards: A Review;
  - Department of Environment, Heritage & Local Government (2011). Architectural Heritage Protection Guidelines for Planning Authorities;
  - Cork County Council (2006). Guidance Notes for the Appraisal of Historic Gardens, Demesnes, Estates and their Settings;
  - EPA (2002). Guidelines on the Information to be Contained in Environmental Impact Statements; and,
  - Department of the Environment Community and Local Government (2013) Guidelines for Planning Authorities and An Bord Pleanála on carrying out Environmental Impact Assessment
6. The impact assessment methodologies between the sections of the proposed interconnector located in Northern Ireland (counties Tyrone and Armagh) and Ireland (counties Monaghan, Cavan and Meath) are considered to be consistent.
7. The Consolidated ES has assigned a value or sensitivity to heritage assets, as well as a magnitude of change. These are combined to give a significance of the impact. Whereas, in the EIS, a sensitivity to change has been assigned and this is assessed against a magnitude of change to give the significance of impact.

8. The sensitivity to change levels are broadly comparable with the value levels in Northern Ireland and are as follows:
- Negligible (or None) Sensitivity/Sensitivity to change;
  - Low Sensitivity/Sensitivity to change;
  - Medium (or Moderate) Sensitivity/Sensitivity to change;
  - High Sensitivity/Sensitivity to change; and,
  - Very High Sensitivity/Sensitivity to change.
9. The magnitude of change levels can be defined as follows:
- No change – No change;
  - Negligible/Minor – Very minor changes to elements;
  - Minor/Modest – Changes to key heritage elements, such that the asset or its setting is slightly altered;
  - Moderate/Substantial – Changes to many key heritage elements or their setting, such that the resource is clearly modified; and,
  - Major – Change to most or all key heritage elements or their setting, such that the resource is totally altered
10. The significance of impacts was categorised in a broadly similar manner. Impacts to architecture and archaeological heritage receptors were defined as follows:
- Imperceptible/Neutral Impact: An impact capable of measurement but without noticeable consequences;
  - Slight Impact: An impact, which causes noticeable changes in the character of the environment without affecting its sensitivities / value;
  - Moderate Impact: An impact that alters the character of the environment in a manner that is consistent with existing and emerging trends;
  - Significant/Large Impact: An impact, which, by its character, magnitude, duration or intensity alters a sensitive / valuable aspect of the environment; and,
  - Profound/Very Large Impact: An impact, which obliterates sensitive/valuable characteristics.

11. Different terminology has been used with regards to the description of impacts in the two reports, in the Consolidated ES the term 'adverse' has been used whereas in the EIS the term 'negative' has been used. These terms are interchangeable and for the purposes of this JER 'negative' has been used.

## 15.3 The Receiving Environment

### 15.3.1 Historic Landscape

12. The proposed interconnector passes through 17 landscape character areas. These include drumlin landscapes, upland areas, lowland areas and river valleys (Refer to Consolidated ES Section 12.3 and EIS Section 14.4 of Volumes 3C and 3D).
13. At the northern end of the proposed interconnector, in counties Tyrone and Armagh, the proposed interconnector passes through a landscape typified by an area of rolling drumlin hills formed by glacial action. The area predominantly consists of a rural, pastoral landscape, with fields separated by hedgerows which were probably established in the early Christian period (7th or 8th centuries). This type of character area is interspersed with isolated settlements and small hamlets. There have been relatively few changes to the drumlin landscape over the last two hundred years, although the number of dwellings in the countryside has increased. However, the historic landscape pattern has been retained. Most of the other changes that have occurred relate to the changing practices of modern agriculture particularly the removal of field boundaries to create larger fields.
14. As the proposed interconnector moves southwards, through South Armagh and across County Monaghan, it crosses through an agricultural upland areas with a variable topography, including plateaux and drumlin hills. Hedgerows are, for the most part, uncut and contain many mature deciduous trees.
15. As the proposed interconnector moves further southwards it crosses the Highlands of East Cavan, a highland landscape that contains areas of drumlins. A number of lakes are located in this area, as the proposed interconnector passes further south into a wetter drumlin landscape. The landscape character tends to be a patchwork of small pastoral fields. The area between Nobber and Kilmainhamwood, County Meath contains more visible historic references, such as stone walls and vernacular buildings. West of Nobber, there are a number of fine country estates with period houses and associated parkland.
16. From here, the proposed interconnector passes into lowland areas in County Meath, which include a mixture of pasture and arable fields that have been enlarged by loss or removal of old boundaries. In the Blackwater River valley the topography

changes from low undulating drumlins north of Kells to being relatively flat around Navan. This is a landscape rich in visible historic features including churches, earthworks and vernacular features such as stone bridges.

17. Thereafter, the proposed interconnector continues through lowland landscapes typified by a farmland landscape and areas of rolling drumlins interspersed with numerous large estates and associated parkland. The most southerly section of the proposed interconnector passes through broad rolling hills separated by a mixture of well managed small and large fields which are enclosed by thick thorn hedgerows and mature trees, again interspersed with estate landscapes with associated parkland.

### 15.3.2 Archaeological Heritage

18. The archaeological designations in both jurisdictions are broadly similar. World Heritage Sites are found in both jurisdictions, though none will be impacted upon by the proposed interconnector. In County Meath, there are also a number of candidate World Heritage Sites, which it is hoped will become World Heritage Sites in the future.
19. State Care Monuments (Northern Ireland) or National Monuments in State Care (Ireland) include many of the pre-eminent archaeological monuments within both jurisdictions. Within Northern Ireland, Scheduled Monuments are archaeological monuments considered to be of national importance. Archaeological monuments in the ownership of a local authority and sites subject to preservation orders are afforded specific protection in Irish legislation.
20. All other archaeological monuments are recorded in the Northern Ireland Sites and Monuments Record (Northern Ireland SMR), and the Industrial Heritage Record (IHR) maintained by the Northern Ireland Environment Agency and within Ireland, the Archaeological Survey Database (ASD) compiled by the National Monuments Service of the Department of the Arts Heritage and the Gaeltacht (DAHG).
21. Other potential sites were revealed through analysis of historic mapping, aerial photography and LiDAR, and site surveys.
22. Within the assessed area (i.e., the study areas comprised along the corridor of the proposed interconnector in all five counties from Turleenan to Woodland), there are no World Heritage Sites, however there are two candidate World Heritage Sites, the early medieval monastic site of Kells and the Tara Complex, located approximately 7km and 6.3km from the proposed interconnector respectively.

23. There are four Northern Ireland Monuments in State Care and seven Ireland National Monuments in State Care within the assessed area. Notable, in relation to the proposed interconnector, are Navan Fort/Eamhain Mhacha/Emain Macha in County Armagh, which is also an area of archaeological potential, the former Royal seat of the Kings of Ulster and Bective Abbey, an early Cistercian monastery on the banks of the Boyne River in County Meath. A further 40 Scheduled Monuments, the majority of which are raths, were noted in the assessed area, and there are several forts of Iron Age date. In counties Monaghan, Cavan and Meath, there are 25 religious sites in the assessed area, many of which are in the ownership of the relevant local authorities and three archaeological monuments which are the subject of preservation orders.
24. The total number of previously recorded archaeological sites in the assessed area is 619, including 47 sites from the Northern Ireland SMR, 503 from the ASD and 69 from other sources (such as the industrial heritage record) (Refer to Consolidated ES Section 12.3 and EIS Section 14.4 of Volumes 3C and 3D).
25. The known archaeological record in the area assessed as part of the proposed interconnector begins in the Mesolithic period when hunter-gatherers navigated the coast and waterways of the area foraging for food and living in temporary camps. Evidence for a Mesolithic presence (8000BC – 4000BC) in the area is relatively scant, but a few sites are known, such as the lakeside platforms at Moynagh Lough in County Meath. Recent excavations for the M3 motorway in Meath, recovered microliths at Blundelstown and Castletown. A series of well-preserved wooden baskets and a butt trimmed Bann flake were also discovered on the M3 scheme.
26. Evidence of human occupation in the Neolithic period (4000BC – 2500BC) is more prominent and is characterised by the development of a ritual landscape with large megalithic monuments built as communal tombs or for ceremonial purposes. In Meath this megalithic tradition is exemplified by the Brú na Bóinne World Heritage site containing the three large passage tombs of Knowth, Newgrange and Dowth dating from around 3300BC. By this time, the area had developed into an open farmed landscape with evidence for domestic houses and occupation scattered throughout. Other significant megalith sites in Meath include Fourknocks, Loughcrew and the passage tomb at Tara. Throughout the area assessed there are a number of court, portal and wedge tombs. In terms of settlement evidence Neolithic or possible Neolithic buildings have been found in Kilmainham, Cookstown Great near Kells, Townparks, Gardenrath and at Phoenixtown on the M3 between Navan and Kells, County Meath. Find spots of Neolithic material have been identified in the townlands of Ballybrocky and Lisbane, which are both in County Armagh. These townlands are both crossed by the proposed interconnector.

27. The main evidence for Bronze Age (2500BC – 500BC) settlement within the assessed area, is at Haughey's Fort near the Navan complex in County Armagh, c.1.6 km from the nearest point of the proposed interconnector. Associated with this site is the ritual site at Kings Stable. In County Meath, Bronze Age houses have been uncovered in advance of road construction, with notable examples excavated along the Kells - Navan section of the M3 in the Kilmainham / Cookstown Great area. Evidence of activity in the period is well represented with the presence of a range of monuments throughout the area assessed including stone circles, standing stones, stone alignments, henges, tumuli, cairns, barrows and flat cemeteries. Other monuments associated with the Bronze Age include burnt mounds and Fulachtaí Fia, sites used to heat water and which consist of a low horseshoe shaped mound centred on a sunken trough. Find spots of Bronze Age date are also recorded and a number of artefacts have been recovered from dredging of the River Blackwater (Kells) in the townland of Derryoghill.
28. One of the more significant Iron Age (500BC – 400AD) sites in the vicinity of the area assessed is Navan Fort/Eamhain Mhacha/Emain Macha in County Armagh. This site was the Seat of the Kings of Ulster. Further south and of significance is the linear earthwork known as the Black Pig's Dyke. Parts of the earthwork have been identified in County Cavan just east of Bellanagh and in County Monaghan. In Meath the primary focus of Iron Age activity is associated with the Royal site of Tara. This complex was both the seat of the kings of Meath and the High King. The site is strongly linked to myth and legend and is associated with the transformation of Ireland from paganism to Christianity. The proposed interconnector also traverses the Teltown Zone of Archaeological Amenity (ZAA), which incorporates the location of the Aonach Tailteann.
29. With an expansion in population, the Early Christian period (400AD – 800AD) witnessed the introduction of a new settlement type generally known as the ringfort or rath. These sites are by far the most numerous within the assessed area with a notable decrease in numbers towards the southern end of the proposed interconnector. Other habitation site types from this period include crannógs. Crannógs may date to both the prehistoric and Early Christian period but the excavation and discovery of early medieval finds (such as at Ervey Lough, County Meath) indicate that the majority date to this period. The site of a battle dating to 745 AD is also recorded in the assessed area at the River Blackwater (Bann) to the south east of Benburb.
30. Between the 6<sup>th</sup> and 8<sup>th</sup> centuries the influence of the church continued to grow. Patrick and his disciples are closely associated with the old royal sites of the Hill of Slane, Tara and Donaghpatrick in Meath. Churches of potential early date are found at Clonfeacle near Blackwatertown, Listrakelt in County Armagh, and at Tailtin and



Donaghpatrick County Meath. Other ecclesiastical activity includes holy wells, cross slabs and bullaun stones.

31. The 8<sup>th</sup> century saw the arrival of the Viking Age. At this stage the country consisted of a patchwork of petty kingdoms vying with each other to establish local power bases all under the nominal rule of a High King. As with monasteries throughout the country, annals record Viking attacks at Lough Ramor and Tullean in Cavan, at Mucnam near Castleblayney and Clones and Donaghmore County Monaghan, Brú na Bóinne, Donaghpatrick and Navan, County Meath to mention a few.
32. The start of the medieval period is defined by the arrival of the Anglo-Normans in 1169. There was limited Anglo-Norman settlement in the Cavan/Monaghan area and only three motte and baileys are recorded. An example of one of the most important Norman military castles in the general area of Meath is Trim, built on the site of a motte. There are a number of other examples of mottes in County Meath. Ecclesiastical centres representing the various orders were also prolific during medieval times. Religious houses are represented by, among others, a monastery at Ardraccan and a well preserved Cistercian abbey at Bective. In later years, constant attacks on Anglo-Norman lands led by the local population provoked the English government to offer grants to build tower houses of which there are a few examples throughout the area assessed.
33. One of the earliest battles of the Nine Year War was fought just outside Clontibret in County Monaghan in 1595. A memorial to the battle is located at a crossroads approximately 1.8km to the west of the proposed interconnector. The plantation of Ulster began in the mid-16<sup>th</sup> and into the early 17<sup>th</sup> century, with evidence in the assessed area limited to a fort on the River Blackwater. The plantation of Ulster led to the plantation of County Cavan, while Monaghan was not planted and the lands were left in the control of the local chiefs. The Ulster Rebellion in the mid-17<sup>th</sup> century led to a number of conflicts, including the Battle of Benburb in 1646, and sites such as Mullan Fort were built nearby.
34. The Williamite victory in Ireland ensured British and Protestant dominance over the island of Ireland. Until the 19<sup>th</sup> century, the island of Ireland would be ruled by what became known as the 'Protestant Ascendancy', the mostly English Protestant ruling class. This legacy is evident in the many large country homes of the Anglo-Irish landed gentry in County Meath and, to a lesser extent, Counties Cavan and Armagh. These big houses and demesnes were usually encompassed by large estates with small plots rented out to the native Irish tenants. Of these houses, some, like The Argory, Slane Castle, Headfort House, Brittas and Mountainstown are still in use for various different purposes.

35. During the 18<sup>th</sup> to the early 20<sup>th</sup> century small scale farming continued to dominate the area. Small farmsteads were dotted over the landscape, which was been increasingly modified with the enclosure of the land into smaller fields. The growth of the linen trade also played a significant role in the local economy. Several flax mills are recorded on early maps of the assessed area. In addition a number of these mills were used as corn mills and in some case small settlements developed around them.

### 15.3.3 Architectural Heritage

36. As with the archaeological designations there are similarities between the architectural designations of both Northern Ireland and Ireland. Conservation Areas in Northern Ireland are broadly similar to Architectural Conservation Areas (ACAs).
37. Within Northern Ireland sites of architectural importance are nationally designated as Listed Buildings, and are listed in the Buildings Database held by the NIEA. Whereas architectural sites in Ireland are protected through listing in the Records of Protected Structures (RPS), which are compiled by the relevant local authorities as part of their County Development Plans. Moreover, studies have been undertaken to assist local authorities in their compilation of the RPSs through the National Inventory of Architectural Heritage (NIAH) surveys. In counties Cavan and Monaghan the NIAH surveys have only recently been completed and have not been incorporated into their lists of Protected Structures. It should be noted that there is a large degree of overlap between the RPS and NIAH listings.
38. A study has previously been undertaken in Northern Ireland to highlight and protect important historic parks, gardens and demesnes, the result of this work is the Register of Historic Parks, Gardens and Demesnes which is held by NIEA. A similar study is underway within Ireland, though to date only a desktop assessment has been completed of demesnes and historic gardens for those counties through which the proposed interconnector passes. The basis for this study is the demesne landscapes and historic gardens highlighted on the first edition Ordnance Survey (OS) maps.
39. There are a total of six areas of architectural importance in the assessed area, one Conservation Area in Northern Ireland (County Tyrone) and five ACAs in Counties Meath and Monaghan. Ardraccon in County Meath is the closest, at approximately 600m to the east of the proposed interconnector, but is encircled by an imposing stone wall and stately trees (Refer to Consolidated ES Section 12.3 and EIS Sections 14.4 of Volumes 3C and 3D).

40. The assessed area contains 244 Listed Buildings, 105 Protected Structures and 119 structures that are listed in the NIAH (Refer to Consolidated ES Section 12.3 and EIS Sections 14.4 of Volumes 3C and 3D).
41. The grounds of the Argory, a National Trust property, are located approximately 1.4km from the proposed interconnector in County Armagh. A second site, The Manor House, Benburb is also listed in the Register of Historic Parks, Gardens and Demesnes in the assessed area, along with four additional Parks, Gardens and Demesnes. A detailed study of demesne landscapes and historic gardens in counties Monaghan, Cavan and Meath was undertaken which located a total of 60 indicated on the first edition OS maps within the assessed area. Of particular note with regard to the proposed interconnector are a number of demesne landscapes and historic gardens in County Meath which are crossed by the proposed interconnector, including Brittas, Mountainstown and Philpotstown. Also of note is Whitewood with its associated Georgian house located at an elevation approximately 1.6km to the east of the proposed interconnector.
42. The architectural site types of the assessed area include a variety of sites from mainly post-medieval and later periods. These include small private residences, farms and associated infrastructure, churches and ecclesiastical sites, bridges and large country houses and manors with their associated grounds and structures.

#### 15.3.4 Other Cultural Heritage

43. The proposed interconnector passes through Baile Ghib, an Irish speaking or Gaeltacht area located to the north of the Blackwater River between Navan and Kells in County Meath. It is a primary objective of the DAHG to support the implementation of the 20 Year Strategy for the Irish Language 2010-2030 and it attaches particular importance to the preservation and promotion of Irish in the Gaeltacht in relation to conserving and protecting the heritage, culture and richness of the language where it remains as a household and community language.
44. Also close to the proposed interconnector is the site of an historic fair, the Fair of Muff. Now a horse fair the event is held annually at a crossroad in the townland of Muff to the west of Kingscourt, County Cavan and approximately 200m to the south of the proposed interconnector.

### 15.4 Mitigation Measures

45. Careful routeing of the proposed interconnector has sought to avoid or reduce impacts on known archaeological and architectural heritage sites. However, the

proposed interconnector will impact on the setting of several archaeological and architectural sites.

46. Mitigation strategies have been developed in consultation with NIEA and the National Monuments Service of the DAHG. Full details are contained within the EIS and Consolidated ES. In summary the mitigation measures proposed consist of:

- Archaeological Testing – this has been recommended in areas of high archaeological potential such as the Teltown Zone of Archaeological Amenity, in order to confirm the nature of the predicted impacts;
- Archaeological Monitoring / Watching Brief, in order to confirm the nature of the predicted impacts;
- Review of Access - in areas where there is a potential that features of archaeological or architectural potential could be impacted on in facilitating access for construction to tower sites and guarding areas, then a further confirmatory review of those areas prior to and during construction of the proposed interconnector will be undertaken by a suitably qualified archaeologist. Sensitive features will be highlighted and appropriate machinery or protective sheeting, such as bog mats or aluminum trackway, used to confirm the assessed impacts;
- Demarcation – where there are sites of archaeological or architectural potential that are in close proximity to the line and there is the potential that these sites could be inadvertently impacted on during the construction phase then these sites will be demarcated by a suitably qualified archaeologist with an appropriate buffer to ensure their protection; and,
- Monitoring of Tree Surgery.

## 15.5 Residual Impacts

### 15.5.1 Construction Phase

#### 15.5.1.1 Archaeological Impacts

47. With mitigation in place it has been predicted that there will be no direct physical impacts on the upstanding remains of previously recorded archaeological sites, resulting in a neutral significance of effect (Refer to Consolidated ES Section 12.6 and EIS Section 14.7.1 of Volumes 3C and 3D).

48. Archaeological testing has been recommended in areas of high archaeological potential, such as the Teltown ZAA, to ensure, in the event that currently unknown

archaeological deposits are discovered, that they are dealt with in accordance with professional best practice (Refer to EIS Section 14.6.1 of Volumes 3C and 3D).

49. Analysis of historic mapping and aerial photography highlighted a number of sites where there is the potential for direct physical impacts during the construction phase. These sites include houses and farmsteads that have been in existence since the first edition OS survey, which have temporary access tracks passing through their yards, and guarding that is to be located in areas where houses and other structures which are no longer extant are indicated on historic mapping (Refer to EIS Sections 14.5.3 and 14.6.1 of Volumes 3C and 3D).
50. There is also the potential that other previously unrecorded archaeological sites may be discovered during monitoring / watching brief associated with construction works; however, the potential for discovery is considered relatively low.

#### 15.5.1.2 Architectural Impacts

51. With mitigation in place it is predicted that there will be no direct physical impacts on the previously recorded architectural sites contained in the NIEA Historic Buildings Database, the Records of Protected Structures of Monaghan, Cavan and Meath County Councils or the published NIAH surveys, resulting in a neutral significance of effect. The proposed interconnector will have a direct, physical impact on eight demesne landscapes and historic gardens indicated on the first edition Ordnance Survey maps, consisting of those associated with Shantonagh House, Tully House, Brittas, Rahood, Mountainstown, Gibstown Demesne, Teltown and Philpotstown (Refer to EIS Section 14.5.3 of Volumes 3C and 3D). Further analysis of historic mapping and aerial photography highlighted a number of sites where there is the potential for direct physical impacts during the construction phase. These sites include houses and farmsteads that have been in existence since the first edition OS survey, which have temporary access tracks passing through their yards, and guarding that is to be located in areas where houses and other structures are indicated on historic mapping but are now no longer extant (Refer to EIS Sections 14.5.3 and 14.6.1 of Volumes 3C and 3D).

### 15.5.2 Operational Phase

#### 15.5.2.1 Archaeological Impacts

52. Impacts on setting of cultural heritage features are best mitigated through sensitive routeing of the proposed interconnector to avoid impacts on particularly sensitive archaeological, architectural and cultural heritage sites, structures, monuments, features or landscapes. From the earliest phases of this project every attempt has

been made to minimise the impacts that it will have on the setting on the archaeological, architectural and cultural heritage of the region. Despite this, it has not been possible to avoid all impacts, given the length and linear nature of the proposed interconnector.

53. The majority of operational effects will be impacts on the setting of archaeological, architectural or cultural heritage sites, structures monuments or features. Setting can be defined as the place in which an asset is experienced. Given the upstanding linear form of the proposed interconnector, it has the potential to alter the appreciation or enjoyment of a site, structure, monument, feature or cultural heritage landscape even when these are located at a remove from the development.
54. Effects on archaeological, architectural or cultural heritage sites, monuments, structures or features during maintenance or upgrade works that may be required during the operational phase of the proposed interconnector are considered to be not significant and of a similar or lesser impact to the construction phase.
55. In Ireland, in line with the recommendations of the EPAs *Guidelines on the information to be contained in Environmental Impact Statements (2002)*, only sites where it was considered that the significance of the impact would be moderate or greater are included in the assessment, whereas assets with slight negative/adverse significance of impacts were included in the Northern Ireland ES.
56. Impacts on archaeological sites in the assessed area throughout the operational phase of the proposed interconnector can be seen in Table 15.1. For further details refer to Consolidated ES Section 12.4 and EIS Sections 14.5.4 of Volumes 3C and 3D.

**Table 15.1 Operation Impacts on Archaeological Sites**

Site Name	County	Sensitivity /Sensitivity to Change	Magnitude of Change	Significance of Effect on Setting
Possible enclosure at Ballydoo. Scheduled Monument	Armagh	High	Minor Negative	Slight Negative
Rath and souterrain at Lisglynn. Scheduled Monument	Armagh	High	Minor Negative	Slight Negative
Rawes Fort. Scheduled Monument	Armagh	High	Intermediate negative	Moderate Negative
Rath. Scheduled Monument	Armagh	Medium	Intermediate negative	Moderate Negative
Rath	Armagh	Medium	Intermediate negative	Moderate Negative
Mullan Fort. Scheduled Monument	Tyrone	High	Moderate negative	Moderate Negative
Enclosure in Crossbane	Armagh	Moderate	Substantial	Moderate Negative
Ringfort - Rath incorporating a possible building in Lemgare	Monaghan	Moderate	Major	Significant Negative
Megalithic Tomb - Court Tomb in Lemgare	Monaghan	Moderate	Substantial	Moderate Negative
Megalithic Tomb - Portal Tomb In Lennan	Monaghan	High	Substantial to Major	Significant Negative
Megalithic Tomb - Court Tomb in Cornamucklagh South	Monaghan	Moderate to High	Substantial	Moderate Negative
Ringfort - Rath in Cornamucklagh South	Monaghan	Moderate	Major	Significant Negative
Megalithic Structure - Possible in Derryhallagh	Monaghan	Moderate to high	Substantial	Moderate Negative
Ringfort - Rath in Aghmakerr	Monaghan	Moderate	Substantial	Moderate Negative
Church in Lattonfasky	Monaghan	High	Modest to Substantial	Moderate Negative
Ringfort - Rath in incorporating a	Monaghan	Moderate	Substantial	Moderate Negative

Site Name	County	Sensitivity /Sensitivity to Change	Magnitude of Change	Significance of Effect on Setting
hut site in Ummerafree				
Ringfort - Rath in Cornalaragh	Monaghan	Moderate to High	Major	Significant Negative
Ringfort - Rath in Scalkill	Monaghan	High	Substantial	Significant Negative
Enclosure in Corrinenty	Monaghan	Moderate	Substantial	Moderate Negative
Teltown Zone of Archaeological Amenity	Meath	High	Modest	Moderate Negative
Enclosure in Tullyweel	Meath	High	Substantial	Moderate Negative
Ringfort - Rath in Boherlea	Meath	High	Substantial	Significant Negative
Ringfort - Rath incorporating a Standing Stone in Boherlea	Meath	High	Substantial	Moderate to Significant Negative
Ringfort Rath in Lislea	Meath	Moderate	Substantial	Moderate Negative
Enclosure in Aghamore	Meath	Low	Major	Moderate Negative
Ringfort - Rath in Aghamore	Meath	Moderate	Substantial to Major	Moderate Negative
Enclosure in Ardmaghbreague	Meath	High	Substantial	Moderate to Significant Negative
Ringfort - Rath incorporating a cross in Brittas -	Meath	High	Substantial	Moderate to Significant Negative
Ringfort - Rath in Brittas	Meath	High	Substantial	Moderate to Significant Negative
Ringfort - Rath in Brittas	Meath	High	Substantial	Moderate to Significant Negative
Ringfort - Rath in Brittas	Meath	High	Substantial	Moderate to Significant
Enclosure in Cruicetown	Meath	High	Modest to Substantial	Moderate Negative
Ringfort - Rath in Rahood	Meath	Moderate to High	Substantial	Moderate Negative
Enclosure in Ballbrigh	Meath	Moderate	Substantial	Moderate Negative
Religious House and Tower House in Bective - National Monument in State care	Meath	Very High	Modest	Moderate



Site Name	County	Sensitivity /Sensitivity to Change	Magnitude of Change	Significance of Effect on Setting
Ringfort - Rath in Branganstown	Meath	Low to Moderate	Substantial to Major	Moderate Negative
Earthwork in Branganstown	Meath	Low to Moderate	Substantial to Major	Moderate Negative
Ringfort - Rath in Branganstown	Meath	Low to Moderate	Substantial to Major	Moderate Negative
Castle - Motte and 17th Century House in Culmullin	Meath	High	Substantial	Moderate to Significant Negative

### 15.5.2.2 Architectural Impacts

57. Direct physical impacts during the construction phase of the proposed interconnector are noted in relation to a number of demesne landscapes, as indicated in the first edition Ordnance Survey maps. As noted previously a study to highlight the importance of such landscapes is ongoing in Ireland and has not been completed for the counties through which the proposed interconnector passes. The significance of the direct physical impacts that can be expected is outlined in Table 15.2.

**Table 15.2 Construction Phase Impacts on Demesne Landscapes**

Name	County	Townland	Significance of Impact
Shantonagh	Monaghan	Tooa	Slight Negative
Tully House	Monaghan	Tullyglass	Slight Negative
Brittas	Meath	Brittas	Significant Negative
Rahood	Meath	Rahood	Moderate Negative
Mountainstown House	Meath	Mountainstown	Moderate Negative
Gibstown	Meath	Gibstown Demesne	Slight Negative
Teltown House	Meath	Teltown	Slight Negative
Dunderry House	Meath	Philpotstown	Moderate Negative

58. Impacts on architectural sites in the assessed area throughout the operational phase of the proposed interconnector can be seen in Table 15.3.

**Table 15.3 Operation Impacts on Architectural Sites**

Site Name	County	Sensitivity /Sensitivity to Change	Magnitude of Change	Significance of Effect
164 & 166 Trew Mount Road. Listed Building	Tyrone	High	Minor negative	Slight Negative
142 Moy Road. Grade B1 listed building	Tyrone	High	Minor negative	Slight Negative
Tullydowey House. Listed Building	Tyrone	High	Minor negative	Slight Negative
Mullyloughan house/ Glenaul House. Listed Building	Armagh	High	Minor negative	Slight Negative
The Argory. Registered Garden	Armagh	High	Minor negative	Slight Negative
The Argory. Listed Building Grade B+	Armagh	High	Negligible	Slight Negative
Stone Tower, Grade B1 listed building	Tyrone	High	Minor negative	Slight Negative
The Grange, Grade B listed building	Tyrone	High	Minor negative	Slight Negative
Gate Lodge for Tullydowey House. Listed Building	Tyrone	High	Intermediate negative	Moderate Negative
St Patrick's Church in Ardragh	Monaghan	High	Substantial	Moderate to Significant Negative
Whitewood House in Whitewood	Meath	High	Modest	Moderate Negative
Bective Abbey in Bective	Meath	Very High	Modest	Moderate Negative

**Table 15.4 Operation Impacts on Demesne Landscapes and Historic Gardens**

Site Name	County	Sensitivity /Sensitivity to Change	Magnitude of Change	Significance of Effect
Whitewood	Meath	High	Modest to Substantial	Moderate to Significant
Brittas	Meath	Very High	Substantial	Significant
Rahood	Meath	Low	Major	Moderate
Mountainstown	Meath	High	Substantial	Moderate
Churchtown	Meath	Moderate	Substantial	Moderate
Philpotstown	Meath	Moderate	Substantial	Moderate

### 15.5.2.3 Other Cultural Heritage Features

59. It is not envisaged that the proposed interconnector will impact on the heritage of the Irish language within the Gaeltacht area of Baile Ghib therefore the impact will be neutral.
60. The impact of the proposed interconnector on the historical and cultural heritage associations of the Fair of Muff was likewise found to be neutral. It is noted that the landscape chapter contains a visual impact assessment of the proposed interconnector on the Fair of Muff.

## 15.6 Transboundary Effects

61. It was found that following mitigation there will be no direct physical impacts on previously recorded archaeological, architectural or cultural heritage sites, structures, monuments or features located on either side of the jurisdictional border as a result of the construction of the proposed interconnector.
62. There is a single archaeological monument, an enclosure (Northern Ireland SMR No. ARM023-004) located in County Armagh, where it was found that the site would experience an impact on setting of moderate negative from the proposed interconnector within Ireland throughout the operational phase of the proposed interconnector.

## 15.7 Conclusions

63. An assessment of the proposed interconnector has been undertaken in accordance with the requirements of the EIA Directive and the respective applicable national legislation.
64. Mitigation measures will be implemented at the construction phase to minimise and/or eliminate impacts to previously recorded archaeological, architectural and cultural heritage features and to deal with any unknown features discovered during construction.
65. While the proposed interconnector will not have a direct physical impact on the upstanding remains of any known archaeological sites or architectural features, it will have such an effect on a number of demesne landscapes. The impact on one of the demesnes landscapes, Brittas, was found to be significant. A further four demesne sites will experience a moderate negative impact in terms of setting.
66. There will be likely significant effects to the setting of a number of features. In summary there will be 24 moderate negative, seven moderate to significant negative and six significant negative impacts to archaeological sites. In addition there will

be three moderate negative and one moderate to significant negative impacts to architectural sites.

67. All other sites in the receiving environment will either not be affected by the proposed interconnector or will experience a slight negative impact.

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## 16. Landscape

### 16.1 Introduction

1. This section considers the likely significant impacts of the proposed interconnector, (from Turleenan, County Tyrone to Woodland, County Meath) on the landscape character and visual amenity of the receiving environment.
2. The relevant chapters of the Consolidated ES are Chapter 13 (Landscape and Visual) and the relevant chapters of the EIS are Chapter 11 (Landscape) of Volumes 3C and 3D.

### 16.2 Methodology

#### 16.2.1 Scope of the Evaluation

3. The scope of the evaluation is based on a review of legislation, guidance documents, professional judgment, feedback from public consultation, landowner consultation, consultation with prescribed authorities (including local authorities, An Bord Pleanála, DOE and NIEA), consultation with other stakeholders and a consideration of the likelihood for significant impacts arising, having regard to the nature of the receiving environment and the nature and extent of the proposed interconnector.
4. The landscape and visual assessment has been undertaken with regard to the guidance contained within the following documents:
  - Guidelines for Planning Authorities and An Bord Pleanála on carrying out Environmental Impact Assessment, Department of the Environment, Community and Local Government (2013);
  - Advice Notes on Current Practice in the preparation of EIS, Environmental Protection Agency (2003);
  - Guidelines for Landscape and Visual Impact Assessment (GLVIA), 3rd edition, Landscape Institute and Institute of Environmental Management and Assessment (2013);
  - Photography and Photomontage in Landscape and Visual Impact Assessment, Landscape Institute, Advice Note 01/11 (2011);

- GLVIA 2nd Edition, Landscape Institute and Institute of Environmental Management and Assessment, 2002<sup>34</sup>; and,
  - Landscape Character Assessment, Guidance for Scotland and England, Scottish Natural Heritage & The Countryside Agency, 2002<sup>35</sup>.
5. The GLVIA acknowledges the relationship between the perception of landscape character and the experience of visual receptors which include residents, visitors, people in their workplace, users of recreational facilities, people travelling through an area and other groups of viewers.
6. The principles of LVIA involve an appreciation of the existing landscape and its visual form, analysis of its condition and an assessment of its sensitivity to change, a thorough understanding of the development proposals, the magnitude of change that would result from the construction and operation of the proposals and the potential to mitigate impacts. There are three key stages to the assessment:
- Recording and analysis of the baseline environment, the value/condition of the landscape and the sensitivity/capacity of the landscape and the visual receptors within the assessed area to accommodate change;
  - An assessment of the magnitude of change likely to result from the development; and,
  - An assessment of the significance of impacts based on a combination of sensitivity of receptors and magnitude of change (including an assessment of mitigation and residual impacts).
7. Due to requirement for the respective applicants to make separate applications for development consent in each of the jurisdictions in which the proposed interconnector will be located, over different timescales, there is some variance in impact assessment methodologies. The LVIA for the SONI section preceded the assessment of the EirGrid line and adheres to the Guidelines for Landscape and Visual Impact Assessment (GLVIA) 2nd Edition, Landscape Institute and Institute of Environmental Management and Assessment, 2002; and, makes reference to

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<sup>34</sup> The release date for Guidelines for Landscape and Visual Impact Assessment (GLVIA) 3rd Edition, was April 2013. Landscape Institute guidance on transition to using GLVIA3 reads 'An assessment started using GLVIA2 should be completed using that edition.' GLVIA2 has therefore been used for Northern Ireland as that assessment started and finished before the release of GLVIA3.

<sup>35</sup> In the absence of specific complete Northern Irish and Irish guidance on landscape and visual assessment, the guidance referenced here is best practice and applicable to Northern Ireland and Ireland.

Landscape Character Assessment, Guidance for Scotland and England, Scottish Natural Heritage & The Countryside Agency, 2002.

8. This methodology and approach was approved by the NIEA Landscape Architects Branch as being acceptable and accordingly, the Consolidated ES has continued to adhere to GLVIA 2nd Edition.
9. Subsequently, Guidelines for Landscape and Visual Impact Assessment, 3rd edition, Landscape Institute and Institute of Environmental Management and Assessment (2013) have been published, which EirGrid landscape consultants have adhered to for their assessment. The broad approach to and the fundamentals of Landscape and Visual Impact Assessment is similar in both editions of the guidance.
10. The EirGrid and SONI Landscape specialists have liaised to establish common ground between the methodologies, allowing the assessment conclusions from both the NIE and SONI LVIA to be comparable for the purposes of the JER.

### 16.2.2 Specific Assessment Tasks

11. A baseline study has been undertaken with the aim of describing and classifying the existing development area and surrounding context. This has included desk studies and detailed site surveys. The baseline context of the development area is described in terms of:
  - Landscape Planning Policy Context set out in national, regional and local policy;
  - Landscape Character which encompasses topography, water features, vegetation, public routes, the built environment and the existing character, quality and value of the landscape in which the proposals are sited; and,
  - Visual Context which is determined with reference to potential visual receptors and their sensitivity
12. A desktop study was carried out to identify the landscape sensitivities within the assessed area.
13. The desktop study was undertaken drawing upon published National and Regional level publications, assessments and guidance to establish the broad planning and landscape context within which the existing development area is located.

14. Information was also gathered from the following sources:
- Northern Ireland Landscape Character Assessment (DOE, 2001);
  - Ordnance Survey of Northern Ireland and Ordnance Survey of Ireland mapping;
  - Cavan County Council, Cavan County Development Plan 2014-2020;
  - Monaghan County Council, Monaghan County Development Plan 2013-2019;
  - Monaghan County Council, Monaghan Landscape Character Assessment 2008;
  - Meath County Council, Meath Landscape Character Assessment (2007);
  - Meath County Council, Meath County Development Plan 2013-2019;
  - National Inventory of Architectural Heritage (Gardens), Department of Arts Heritage and the Gaeltacht;
  - Use was made of aerial photographs of the assessed area provided by the respective applicants; and,
  - Site surveys as described below.
15. Data available from the Irish Trails Office, Discover Ireland and Fáilte Ireland was taken into account, providing information about tourist attractions and various driving, walking and cycling routes.
16. Initially, the theoretical visibility of the development area was determined through desktop analysis. Field visits have assisted in the verification and recording of the extent of visibility of the development at different times of the year.
17. Site visits to public locations were carried out to confirm the nature and extent of the landscape constraints identified during the desktop appraisal, and to ascertain the general characteristics of the landscape through which the proposed interconnector passes. This evaluation included identifying the existing landscape elements, the principal viewpoints which are accessible to the public and the sensitive receptors within the landscape. Observations were supported by a photographic survey from typical viewpoints. Site visits also determined the most appropriate locations for viewpoints for photographs on which to base photomontages.
18. Multiple field assessments were undertaken between 2004 and 2014 and were undertaken at various times of year and in various weather conditions, which represent a comprehensive set of field visits, and have provided the landscape and visual assessors with a thorough knowledge and understanding of the landscape context of the assessed area.



19. Representative viewpoint photography was taken during various field visits from publicly accessible locations.
20. Full details of the methodologies used for the assessment of potential landscape and visual impacts of elements of the proposed interconnector can be seen in the Consolidated ES (Section 13.2) and EIS (Section 11.2, Volume 3C and 3D).

### 16.2.3 Landscape and Visual Assessment Methods

#### 16.2.3.1 Zone of Theoretical Visibility

21. The ZTV mapping is a desktop component of the visibility analysis, which shows those areas from which the proposed interconnector would theoretically be visible. The ZTV assumes a bare land surface taking no account of the screening effects of trees, hedgerows or buildings and is based upon theoretical visibility of the proposed interconnector.
22. Whilst the ZTV may show that the development is theoretically visible from a location, this is not in itself indicative of the type of impact or magnitude of effect. The ZTV is therefore augmented by field work to consider the nature and composition of existing views, local landform and vegetation that may shield visibility of the proposed overhead line, and further analysis of potential extents of visibility.

#### 16.2.3.2 Landscape Character, Quality and Value

23. **Landscape Character** is a composite of physical and cultural elements. Landform, geology, hydrology, vegetation, land cover, land use pattern, cultural and historic features and associations combine to create a common 'sense of place' and identity which can be used to categorise the landscape into definable units (character areas). The level of detail and size of unit can be varied to reflect the scale of definition required. It can be applied at national, regional and local levels.
24. **Landscape Quality** or Condition relates to the intrinsic aesthetic appeal demonstrated by a character area, feature or component within the landscape. It may include the extent to which typical character is represented in individual areas, the intactness of the landscape and the condition of individual elements.
25. **Landscape Value** can be determined by referring to international, national, regional and local designations by statutory and planning agencies. Absence of such a designation, however, does not infer a lack of value. The determination of Value includes an understating of Landscape Quality, amongst other factors, including;

- Scenic Quality – The term used to describe landscapes that appeal primarily to the senses (primarily but not wholly the visual senses);
- Rarity – The presence of rare elements or features in the landscape or the presence of a rare Landscape Character Type;
- Representativeness – Whether the landscape contains a particular character and/or features or elements which are considered particularly important examples;
- Conservation Interests – The presence of features of wildlife, earth science or archaeological or historical and cultural interest can add to the value of the landscape as well as having value in their own right;
- Recreation Value – Evidence that the landscape is valued for recreational activity where experience of the landscape is important;
- Perceptual Aspects – A landscape may be valued for its perceptual qualities, notable wildness and/or tranquility; and
- Associations – Some landscapes are associated with particular people, such as artists or writers, or events in history that contribute to perceptions of the natural beauty of the area.

#### 16.2.3.3 Sensitivity to change

26. The assessment of the landscape sensitivity to change remains specifically related to the proposal and is described as High, Moderate or Low. The extent to which the landscape components would accommodate and tolerate the type of change which would be caused by the development proposed both during construction and during operation of the proposed interconnector is assessed by consideration of the following factors:

- the change proposed;
- the ability of the landscape components which are physically affected to accommodate the change proposed; and,
- the ability of the wider landscape and its components to accommodate the change proposed.

**Table 16.1: Landscape Sensitivity Criteria**

Sensitivity	Criteria
High	A landscape of particularly distinctive character susceptible to relatively small changes of the type proposed
Moderate	A landscape of moderately valued characteristics reasonably tolerant of change of the type proposed
Low	A very robust or degraded landscape which is potentially tolerant of substantial change of the type proposed

#### 16.2.3.4 Assessment of Physical Effects

27. Physical landscape effects are considered to be direct effects to the landscape fabric as a result of the proposed interconnector, such as the removal of trees and hedges, field boundaries, earthworks, alteration of ground vegetation, trimming or alteration of existing planting.
28. The objective of the assessment of physical effects is to determine what the likely potential impact of the proposed interconnector will be, which landscape elements will be affected, and whether these effects will be significant or not significant.
29. In this context, the sensitivity, quality and value of the physical landscape elements were assessed.

#### 16.2.3.5 Sensitivity of Landscape Elements

30. The sensitivity of a physical landscape element is evaluated using a combination of landscape quality and value.
31. The value of a physical landscape element would tend towards a higher value if:
- It provides an important component part of the local landscape character;
  - It lies within a landscape-related planning designation; and/or
  - A landscape element is particularly rare, unusual or historic.
32. The quality of a physical landscape element is related to the existing condition of the element or feature and the quality could reduce for example if:
- Landscape elements are the components of a degraded landscape; or
  - Landscape elements together are considered unattractive or visually conflicting.

#### 16.2.3.6 Visual receptors

33. Visual receptors are the people who experience visual amenity and include residents, visitors, vehicle travellers and other groups of viewers. The assessment has involved three stages:

- Identification of the zone of theoretical visibility (ZTV) for the proposed overhead line;
- Field assessment of visual amenity, visual receptors and ground-truthing of ZTV; and,
- Assessment of magnitude of change and significance of effect on visual receptors.

#### 16.2.3.7 Field assessment of visual amenity

34. Viewpoints representing a range of receptors were visited and surveyed.

#### 16.2.3.8 Assessed area

35. The general assessed area for the landscape and visual impact assessment (LVIA) was determined by a 5km buffer.

36. The ZTVs indicate theoretical visibility beyond 5km from the proposed interconnector. It is important to note that the ZTV mapping does not indicate areas from which the proposed interconnector will be actually visible. Vegetation, local variations in topography, inclement weather and lighting would shield or partially interrupt or obscure views of the proposed interconnector. Visual assessment work carried out during field surveys have shown it is unlikely that potential impacts of the proposed interconnector would be significant at distances beyond 5km. The ZTV mapping should therefore be used in conjunction with photomontages in order to ascertain the difference between theoretical and actual visibility.

37. In addition, at distances of 5km or greater, the overhead line tower structures would not be prominent features or become focal points within views due to reduced perceptibility.

38. The assessment was undertaken from publicly accessible locations such as roads, tracks and footpaths. Where physical access to a receptor was not possible, an assessment of potential impacts was derived from desk-based research, including mapping information, aerial photography and field visits to the nearest accessible point. In accordance with GLVIA 2002/2013, where key data on project characteristics was lacking, explicit assumptions were based on a reasonable scenario of maximum effects.

## 16.2.4 Sensitivity of Visual Receptors

### 16.2.4.1 Overview

39. Visual assessment concerns people's perception and response to visual amenity. Visual receptors consist of people who would potentially have views of the proposed interconnector. The sensitivity of visual receptors depends upon:
- The location and character of the viewpoint;
  - The activity of the receptor; and,
  - The importance of the view (which may be inferred by its inclusion as a viewpoint on an Ordnance Survey map, Guidebook or as identified in a Development Plan).
40. Sensitivity to change considers the nature of the receptor, for example a residential dwelling is generally more sensitive to change than a factory unit. The importance of the view experienced by the receptor also contributes to an understanding of how sensitive that receptor is to change.

**Table 16.2: Visual Sensitivity Criteria**

Sensitivity	Criteria
High	Where the changed landscape is an important element in the view – this may include residential properties and areas of settlement, viewpoints within valued or sensitive landscapes
Moderate	Where the changed landscape is a moderately important element in the view – this might include road users, other transportation routes and rights of way as well as recreation and tourist areas/routes and areas of public open space
Low	Where the changed landscape is a less important element in the view – this might include users of main roads and other arterial transportation routes, places of work and industrial zones

### 16.2.4.2 Landscape and Visual Magnitude of Change

41. Landscape magnitude of change is a measure of the degree of change within the landscape, the nature of the effect, and its duration. The magnitude of change upon landscape receptors is assessed using the criteria listed in Table 16.3 below:

**Table 16.3: Landscape Impact Magnitude Criteria**

Magnitude	Criteria
High	Notable change in landscape characteristics over an extensive area ranging to a very intensive change over a more limited area
Medium	Moderate change in localised areas
Low	Virtually Imperceptible change in landscape components
Negligible	No discernible change in any component

42. Visual magnitude of change considers the extent of development visible, the percentage of the existing view newly occupied by the development, the influence of the development within the view and viewing distance from the receptor to the development. The magnitude of change upon visual receptors is assessed using the criteria listed in Table 16.4 below.

**Table 16.4: Visual Impact Magnitude Criteria**

Magnitude	Criteria
High	The development would cause a considerable change in the existing view over a wide area or an intensive change over a limited area
Medium	The development would cause minor changes to the existing view over a wide area or noticeable change over a limited area
Low	The development would cause very minor changes to the view over a wide area or minor changes over a limited area
Negligible	The development would cause a barely discernible change in the existing view

### 16.2.5 Assessment of Significance of Effect

43. The significance of impact is judged from a combination of sensitivity and magnitude of impact (as demonstrated in Tables 17.1 and 17.4) for each of the landscape and visual receptors affected by the proposed overhead line. The thresholds of magnitude or sensitivity used in this assessment are High, Medium, Low, Negligible and None (magnitude only).
44. The findings are represented using a descriptive scale ranging from major - moderate - minor adverse through negligible to ascending scale of minor - moderate - major beneficial. This is summarised in Table 16.5 below which also illustrates the degree of significance for intermediate classes of magnitude of change.

**Table 16.5: Significance of Landscape Impacts Matrix**<sup>36</sup>

Significance of effects (effects rated Moderate and above are considered significant)		Sensitivity		
		High	Moderate	Low
Magnitude of change	High	Major	Moderate-Major	Moderate
	Medium-High	Moderate-Major	Moderate	Minor-Moderate
	Medium	Moderate	Moderate	Minor
	Low-Medium	Moderate	Minor-Moderate	Minor-Negligible
	Low	Minor-Moderate	Minor	Negligible
	Low-Negligible	Minor-Moderate	Minor-Moderate	Negligible
	Negligible	Negligible to minor	Negligible	Negligible

45. Explanation of the landscape and visual impact ratings for each degree of significance is provided in Table 16.6 below:

**Table 16.6: Categories of Landscape and Visual Significance of Effect**

Degree of effect	Description of landscape effect	Description of visual effect
Major Beneficial (positive) impact	The proposals form an essential part of a strategy to redevelop a major area leading to the establishment of a new and attractive landscape.	Where the proposed interconnector would cause a very noticeable improvement in the existing view. This will typically apply where the proposed interconnector leads to the removal of a significant eyesore such as a derelict site or buildings and incorporate landscape improvements which substantially remodel and enhance the outlook for a large number of people.
Moderate Beneficial (positive) impact	The proposed interconnector significantly enhances the form and pattern of the landscape; It furthers national objectives to regenerate degraded areas of landscape; and, There is potential through mitigation, to establish a comprehensive landscape design which enhances the existing character of the area or introduces a new attractive character/identity.	Where the proposed interconnector would cause a noticeable improvement in the existing view. This will typically apply where the proposed interconnector incorporates landscape improvements which would largely reduce the visual impact of the proposals and enhance the outlook for a moderate number of people.
Minor Beneficial (positive) impact	The proposed interconnector fits well with the scale, landform and pattern of the existing landscape; It incorporate measures for mitigation to ensure it would blend in well with the surrounding landscape or complement, restore or extend partially formed landscape character/framework; and, Maintain or enhance existing landscape character in an area.	Where the proposed interconnector would cause a barely perceptible improvement in the existing view.

<sup>36</sup> Note that the matrix is a guide - the determination of significance of effects also requires an element of professional judgment

Degree of effect	Description of landscape effect	Description of visual effect
Negligible Effect	<p>The development is well designed to complement the scale, landform and pattern of the landscape</p> <p>It incorporates measures for mitigation to ensure that the development would blend in well with surrounding landscape features and elements</p> <p>It avoids conflict with national policies towards protection of the landscape</p>	<p>Where there is no discernible improvement or deterioration in the existing view</p>
Minor Adverse Effect	<p>The development is out of scale with the existing landscape</p> <p>It is partially visually obtrusive</p> <p>It detrimentally affects an area of recognised landscape quality</p>	<p>Where the proposed interconnector would cause a barely perceptible deterioration in the existing view</p> <p>This will typically occur where the viewer is at some distance from the development and the development newly appears in the view, but not as a point of principal focus. It would also occur where the proposed interconnector is closely located to the viewpoint but are seen at an acute angle and at the extremity of the overall view</p>
Moderate Adverse Effect	<p>The development is out of scale with the landscape</p> <p>It is visually obtrusive and would have an adverse effect on the landscape</p> <p>Mitigation would not prevent the development from adversely affecting the landscape in the longer term as some features of interest would be partly destroyed or their setting diminished.</p> <p>It would have an adverse effect on a landscape of recognised quality</p>	<p>Where a development would cause a noticeable deterioration in the existing view</p>
Major Adverse Effect	<p>The development would be clearly incompatible with the scale and pattern of the landscape</p> <p>It would be visually intrusive and would disrupt valued views of the area</p> <p>It is likely to degrade, diminish or even destroy the integrity of a range of characteristic features and elements or their setting</p> <p>It would be substantially damaging to a high quality or highly vulnerable landscape causing it to change and be considerably diminished in quality and, it cannot be adequately mitigated for</p>	<p>Where the development would cause a very noticeable deterioration in the existing view</p> <p>This will typically occur where the development obstructs an existing view of local landscape and the development would dominate the future view</p>

46. Where overall effects are predicted to be Moderate or higher, these are considered to be Significant for the purposes of the appraisal required pursuant to the Environmental Impact Assessment Directive. Effects of less than Moderate are not predicted to result in significant effects and are termed Not Significant. In terms of



ratings for sensitivity, magnitude and significance of impacts, the thresholds represent points on a continuum. Intermediate ratings are used where appropriate to indicate impacts at the higher or lower end of a particular threshold.

## 16.3 Baseline Conditions

### 16.3.1 Baseline Landscape Situation

#### 16.3.1.1 Overview of Assessed area

47. The proposed interconnector passes through 19 landscape character areas between Turleenan, County Tyrone and Woodland, County Meath. These LCAs include drumlin landscapes, upland areas, lowland areas and river valleys. Further detail on the characteristics of each LCA is contained in the ES and EIS.

**Table 16.7: Landscape Character Areas Crossed by the Proposed Interconnector**

Landscape Character Areas
LCA 66: Armagh Drumlins
LCA 46 Blackwater Valley
LCA 45:Dungannon Drumlins and Hills
LCA 64:Lough Neagh Peatlands
LCA 68:Carrigatuke Hills
LCA 6 Mullyash Uplands;
Mullyash Uplands
Monaghan Drumlin Uplands
Ballybay Castleblayney Lakelands
Drumlin and Upland Farmland of South Monaghan
Highlands of East Cavan
North Meath Lakelands
North Navan Lowlands
Blackwater Valley
West Navan Lowlands
Boyne Valley
Central Lowlands
Tara Skryne Hills
South East Lowlands

48. The northern end of the assessed area lies primarily within County Armagh and includes the western fringe of Armagh City. A portion of the assessed area north of the Blackwater River is within County Tyrone. The linear corridor runs west from the proposed substation at Turleenan before turning south, to the east of Moy, passing through generally open, rural countryside to the east of Keady, prior to connecting to the southern corridor at the border with Ireland. Here it includes an upland area which forms part of the Mullyash uplands continuing southwest into the extensive drumlin and lake landscape of Monaghan. The assessed area in Monaghan

includes the landscape between Ballybay and Castleblayney and between Shercock and Carrickmacross. The assessed area in Cavan includes the East Cavan Highlands and Lough an Leagh Mountain as well as the lower lying drumlin influenced landscape to the east. Moving into Co. Meath, the drumlin landscape of the north of the county gradually gives way to more low lying agricultural lands north of Navan. The assessed area in central Meath lies between Navan, Trim and Kells. The most southern part of the assessed area lies between the Hill of Tara and Trim, and extends almost to the M3 south of Dunshaughlin.

49. Within the assessed area, the line route avoids hilltops with prominent skylines, where possible, and takes as direct a route as possible, limiting the length of overhead line required and reducing the requirement for larger angle towers.

#### 16.3.1.2 Transportation corridors

50. The community is well served by a good transport network including A and B class roads, National Roads and a Motorway:

- The M1 connecting Belfast and the west runs through the north of the assessed area;
- The M3 links the major towns to Dublin and runs through the south of the assessed area,
- The A28 runs in an east west direction between Caledon and Armagh;
- The A3 runs north-east between Middletown and Armagh;
- The A29 runs north south between Moy and Armagh;
- The B115 runs north-west south-east between Egish and Armagh;
- The B106 runs north-west to south-east between Tamlaght and Keady;
- The B3 runs east west between Monaghan and Keady;
- The N2 running north-west southeast between Monaghan and Castleblayney;
- The R183 connecting Ballybay and Castleblayney;
- The R180 connecting Ballybay and Carrickmacross;
- The R181 connecting Castleblayney and Shercock;
- The R178 connecting Shercock and Carrickmacross;
- The R162 connecting Shercock and Kingscourt;
- The R165 connecting Bailieborough and Kingscourt;
- The R164 connecting Kingscourt and Kells;

- The R162 connecting Kingscourt and Navan;
  - The N52 connecting Kells and Ardee;
  - The R163 connecting Kells and Slane;
  - The R147 connecting Kells and Navan;
  - The M3 running north-west, south-east through the assessed area;
  - The N51 connecting Athboy and Navan;
  - The R161 connecting Trim and Navan;
  - The R154 connecting Trim and Dunshaughlin;
  - The R125 running southwest from Dunshaughlin; and
  - Many minor roads and country lanes link rural communities to the wider transport network.
51. In the north, a disused railway route runs from Armagh to Glaslough (Co Monaghan). All that remains of the railway line within the assessed area are the main cuttings and bridge ramparts that enabled it to cut its way through the rolling countryside. A dismantled railway route runs from Dunboyne to Navan in County Meath.
52. The River Blackwater (Bann), which includes part of the disused Ulster Canal, flows through part of the assessed area. The River Callan flows north through Armagh City before connecting to the River Blackwater (Bann), north east of Moy. The proposed interconnector crosses a number of rivers in Ireland, the most significant of these being the rivers Blackwater (Kells) and Boyne in County Meath.
53. There are already numerous small-scale telephone and electrical distribution lines that connect to the many scattered dwellings and settlements. This is typical of rural locations in the assessed area and in the wider landscape.

#### 16.3.1.3 Landscape Designations

54. Landscape Designations are the parts of the landscape considered to be of value by statutory or national agencies. These designations often include recommendations for management of change and can include areas of land or routes.
55. The former green belts of Armagh and Dungannon lie within the assessed area. A Countryside Policy Area had been designated, and extends east from Armagh City to Tandragee. It lies out with the 5km assessed area so is not considered further within this assessment.

56. The former Green Belts around Dungannon and Armagh are designated in the South Tyrone Area Plan 2010 and the Armagh Area Plan 2004.
57. The purpose of these policies is to protect areas of the countryside from development pressure, maintain their rural character and protect the visual amenity of areas of landscape value. The sensitivity to change of the former Green Belts therefore is guided by the sensitivity of the Landscape Character Areas and urban fringes that they occupy.
58. There are a number of Registered Historic Parks, Gardens and Demesnes occurring within the assessed area of Northern Ireland, which are listed in The Register of Parks, Gardens and Demesnes of Special Historic Interest, Northern Ireland. These comprise of:
- The Argory;
  - The Manor House, Benburb;
  - Armagh Palace; and,
  - Tynan Abbey.
59. The relevant Landscape Designations in the assessed area of Ireland include:
- The Landscape Character Areas as described in the Monaghan and Meath Landscape Character Assessments;
  - Areas of Primary and Secondary Special Amenity in County Monaghan;
  - River/lakeside amenities and parks in County Cavan;
  - High Landscape Areas and Major lakes in County Cavan;
  - Major lakes and lakes environs in County Cavan;
  - Areas of Special Landscape Interest in County Cavan;
  - County Heritage Sites in County Cavan;
  - Walking Routes in County Cavan;
  - Landmarks in County Meath (MLCA);
  - Meath Tourist Driving Routes, as set out in the MLCA and by Fáilte Ireland;
  - Existing and proposed way-marked paths and cycle routes (MLCA); and
  - Historic Designed landscapes with main features substantially present.

#### 16.3.1.4 A Summary of the Sensitivity to Change of the Assessed area

60. The assessed area can be described as rural agricultural countryside with small to medium sized farm holdings; historic designed landscapes; scattered private dwellings; village settlements; small pockets of recreational development and, commercial and industrial development. Routeing for this type of development is made difficult due to the number of scattered dwellings within the context of this landscape area.
61. The scale of the overall landscape within the assessed area is small to medium and the landscape character of all 19 character areas within the assessed area is valued by local residents, landowners and passers-by. In Northern Ireland, the landscape features within both the Loughgall Orchard Belt and the Armagh Drumlins LCAs, through which the proposed overhead line and substation would be situated, are also widely valued. In Counties Monaghan, Cavan and Meath, the more valued landscape character areas (reflected in the level of recreation use and recognition in statutory documents) are the Mullyash Uplands, Highlands of East Cavan and the Boyne and Blackwater River Valleys.
62. The following features or elements of the landscape as defined in the Northern Ireland Landscape Character Assessment (2000) are sensitive to change
- Agricultural fields - due to loss of agricultural fields to housing;
  - Rural character - due to loss of rural character for example as a result of increased ribbon development and poor siting of new buildings;
  - Traditional hedge enclosures - due to loss of traditional hedge enclosures to the introduction of inappropriate materials such as fences and railings; and
  - Roadside vegetation - due to loss of roadside hedges and trees as a result of road widening schemes and improvement of sight-lines at junctions.
63. The Monaghan and Meath Landscape Character Assessments provide descriptions of the sensitive characteristics of each landscape character area and landscape character type. These sensitive characteristics include:
- the setting of heritage features;
  - the openness of drumlin tops and upland areas;
  - lough and lough shore settings;
  - the scenic value, recreation, ecology, history and culture of river corridors;
  - elevated views from hills across lowland areas and towards landmarks;
  - the remote character of hills and upland;

- 18th century estate landscapes; and,
  - views towards upland areas.
64. The landscape pattern of hedgerow and field is also cited as an important contributor to landscape character in the assessed area.

### 16.3.2 Visual Baseline

#### 16.3.2.1 Overview

65. This section describes the visual character and amenity of the assessed area within which the proposed interconnector would be located. It provides a general description of the existing visual amenity.

#### 16.3.2.2 General visual amenity of the assessed area

66. The land within the assessed area is primarily agricultural, consisting of low rolling hills, shallow valleys and structured fields, which often have overgrown hedgerows and many mature trees. Drumlins are a prominent feature of the assessed area. The visual amenity of the assessed area varies and views are dependent on the amount of openness or enclosure that the drumlin landscape creates.
67. The assessed area is populated with many scattered farms, dwellings, small commercial buildings, built heritage features, sports fields, and a dense road network. A few small villages are located along secondary and minor roads and around local educational or commercial centres. The larger and busier roads in the assessed area link cities, towns and villages. Dispersed settlement tends to be denser in the vicinity of the towns.
68. Throughout the assessed area there are single and small clusters of residential properties and farm buildings. Where the proposed overhead line passes in close proximity to, or where there would potentially be uninterrupted views of, the proposed interconnector the potential visual impact has been assessed.
69. The land is primarily agricultural, consisting of low rolling hills, shallow valleys, areas of lowland and structured fields, which often have overgrown hedgerows and many mature trees. Parts of the assessed area in Cavan, Monaghan and Meath are more elevated with open panoramic views available. Drumlins are a prominent feature of the northern part of the assessed area, extending from County Armagh to the northern part of County Meath. The visual amenity of the part of the assessed area characterised by drumlins varies and views are dependent on the amount of

openness or enclosure that the drumlin landscape creates. Open views are possible from the upper parts of drumlins where accessible.

70. The lower lying parts of the assessed area tend to contain higher vegetation, so that while open views over the landscape are possible, views are generally enclosed by either roadside or hedgerow vegetation. Where hedgerows are lower than average, open views are possible, particularly in areas with large fields. An important feature of this generally low-lying landscape is the intervisibility between the small hills and the significance of this intervisibility over the millennia. There are also some bog areas in County Meath that are particularly open.
71. The River Blackwater (Bann), which includes part of the disused Ulster Canal, flows through part of the assessed area. The River Callan flows north through Armagh City before connecting to the River Blackwater. The Rivers Blackwater (Kells) and Boyne contribute to visual amenity as well as the smaller rivers such as Kilmainhamwood and Claudy in Co. Meath.
72. There are already numerous small-scale telephone and electrical distribution lines that connect to the many scattered dwellings and settlements, as well as a number of 110 kV, 220 kV and 400 kV lines. This is typical of rural locations in Northern Ireland and Ireland.

#### 16.3.2.3 Settlements

73. Settlements within the 5km assessed area include: Armagh City, Dungannon, Moy, Blackwatertown, Benburb, Killylea, Milford, Middletown, Keady and Derrynoose, Clontibret, Creaghanroe, Annayalla, Doohamlet, Kingscourt, Castleblayney, Ballybay, Shercock, Teevurcher, Nobber, Kilmainhamwood, Carlanstown, Wilkinstown, Donaghpatrick, Gibstown, Dunderry, Robinstown, Bective, Kilmessan, Oristown, Bohermeen, Dunsany, Summerhill, Drumree and Castletown.

#### 16.3.2.4 Residential Properties

74. Throughout the assessed area there are single and small clusters of residential properties and farm buildings.
75. Extensive field study of the characteristics of the landscape has shown that, due to the scale and topography of the landscape types that occur along the route, properties that lie within approximately 500m of the overhead line route are more likely to have clear views of the proposals. This has informed the approach to assessing residential visual amenity.

### 16.3.2.5 Transport Corridors and Paths

76. The key transport corridors and paths potentially affected by the proposed interconnector are outlined in the Table 16.8 below.

**Table 16.8: Key Transport Corridors in Assessed area**

<b>Motorway</b>
M1, M3
<b>National Road/A Road</b>
N2 , N51, N52, A2 , A3, A29, A45
<b>Regional Roads/ B Road</b>
B115, B106, B3, R214, B34, B517, B45, B128, B28, B130, B210, B361, B32, R147, R180, R181 , R183, R184, R178, R161, R162, R163, R164, R165, R147, R154, R125, R156,
<b>Corridors of visual quality</b>
Boyne Valley Driving Route, Co Meath.
<b>Way-marked walks and cycle routes</b>
National Cycle route 91, National Cycle Route 95, Regional Cycle Route 11, River Blackwater Canoe Trail, The Ulster Way, The Monaghan Way , Beetlers Trail., Lough an Leagh walk, County Cavan, Dun na Rí Forest park walks, County Cavan, Castle walk, Balieboro, County Cavan, Boyne Valley Driving Route, County Meath, Proposed walking route along the river Blackwater, County Meath, Lough an Leagh walk, County Cavan, Dun na Rí Forest park walks, County Cavan, Boyne Ramparts Heritage Walks, County Meath, Trim Slí na Sláinte

### 16.3.2.6 Scenic Viewpoints

77. Particular viewpoints in the assessed area have been designated for their visual quality, rarity or representativeness. These can be of local, regional, national or international importance and include:
- Views from Scenic Routes in County Monaghan
  - Scenic Viewing Points and Scenic Routes in County Cavan
  - Protected Views and Prospects in County Meath

### 16.3.2.7 Viewpoint Locations

78. The guidelines provided within “Guidelines for Landscape and Visual Impact Assessment” 2nd Edition were confirmed by DOE as the agreed method of approach for the assessment and the viewpoints in Northern Ireland were selected following the methods provided within this guidance. The viewpoints showing the effects of the proposed interconnector in Counties Monaghan, Cavan and Meath



were agreed with the three County Councils and are representative of a range of viewing experiences along the line route, focusing on the opportunities for open views of the proposed interconnector.

79. The assessment of impacts from key viewpoints within the assessed area is an important tool in landscape and visual assessment. For the SONI section of the proposed interconnector, 34 viewpoints have been identified for inclusion in the assessment. For the section, 77 viewpoints were selected to visually demonstrate the effects of the interconnector in different types of location. A number of these have been used to illustrate the nature of visual effect at varying distances (0 to 500m, 500m to 1km, 1km to 1.5km and beyond 1.5km) and to show the effects at key locations within each Landscape Character Area.
80. The viewpoints are representative of existing and potential views that may be obtained by a range of different receptors along the route of the overhead line and provide information on general visual amenity within the assessed area. The viewpoints are from fixed locations and, if read in conjunction with the ZTV and landscape character analysis, provide an indication of the potential impacts from the viewpoint and immediate surrounding area.
81. A full description of the selected viewpoints is provided in both the Consolidated ES and EIS LVIA Chapters and summarised later in this chapter. For the purposes of this JER, the viewpoints have been numbered sequentially from Turleenan Substation in the North (N1) to viewpoint S77 in the South. All those prefixed with a 'N' can be viewed in the Consolidated ES (Chapter 13) and those with a 'S' can be viewed in the EIS (Chapter 11, Volumes 3C and 3D).

**Table 16.9: Viewpoint Locations**

<b>Viewpoint</b>	<b>Location</b>	<b>Direction of View</b>
N1	Clonteevy Bridge over River Rhone on Trewmount Road (B106) - View towards substation	South
N2	Derrygally Way to east of Turleenan Substation - View towards substation	North West -
N3	Derrygally Way to south of Turleenan Substation – View towards substation	North
N4	Trewmount Road (B106) near site access road.	South
N5	Bonds Bridge over River Blackwater near the Argory	South West -
N6	Moy Road (A29) crossing	South
N7	Culkeeran Road	North East -
N8	Gorestown Road	North East -
N9	Benburb Road	South
N10	Benburb Road south of Ninewell Bridge	South East -
N11	Clonfeacle Road (B128) crossing	South East -
N12	Benburb Priory	East
N13	Artasooly Road looking towards Blackwater River Crossing	North West -
N14	Artasooly Road at Tullymore Bridge	North East -
N15	Artasooly Road and Maydown Road junction at Artasooly	East
N16	Battleford Road (B115) crossing	South East -
N17	Killylea Road (A28) crossing	South East -
N18	Killylea settlement (Fellows Grange Court)	East
N19	Navan Fort	South West -
N20	Monaghan Road (A3) east of Norton's Cross Roads	North West -
N21	Monaghan Road (A3) crossing	South West -
N22	Maddan Road south of Norton's Cross Roads	North
N23	Cavanagarvan Road and Sheetrim Road Junction	North East -
N24	Drumhillery Road crossing	North
N25	Lagan Road west of Keady	West
N26	Fergort Road (B3) crossing	South East -
N27	East of Derrynoose	South West -
N28	Derrynoose Road at Curragh Lane looking north	North
N29	Derrynoose Road at Curragh Lane looking south	South
N30	Crossbane Road	South West -
N31	Crossaghy Road	North East -
N32	Minor road north-east of Castleshane	East
N33	Scenic view from Tullybuck (Clontibret)	East

Viewpoint	Location	Direction of View
N34	Mullyash Mountain	North West -
S1	junction of local roads L3530 / L33101 & L7510 northeast of the 'Battle of Clontibret' site in the townland of Crossaghy	South East
S2	local road L7502 in the townland of Coolartragh	South East
S3	Crossbane Road in the townland of Crossbane, Northern Ireland	South West
S4	local road L7511 across the townland of Tassan, located approximately 3km southeast of Clontibret	South East
S5	local road L7503 in the townland of Lisdrumgormly	West South West -
S6	local road L7631 (Scenic Road SV12) west of the Mullyash Mountains	West
S7	local road (former N2) in the townland of Cashel at junction with L7422	North North East -
S8	Along the N2 - Castleblayney Bypass in the townland of Annagh (ED Cremorne By)	North West
S9	N2 - Castleblayney Bypass from a layby in the townland of Carrickanure	South East
S10	local road L3420 across the townland of Cornamucklagh North, located approximately 4km south of Clontibret	East
S11	local road L7411 at a junction with an access track across the townland of Drumroosk, passing Clarderry and Derryhallagh (Monaghan By), located approximately 3.5km northwest of Doohamlet	North North East -
S12	local road L7411 in the townland of Drumroosk approximately 2.5km northwest of Doohamlet	West South West -
S13	N2 Castleblayney Bypass roundabout in the townland of Lislanly	North West
S14	local road L3700 (Scenic Road SV15) in the townland of Annyart	South West
S15	local road L3430 in the outskirts of Doohamlet	West
S16	R183 at the junction with local road L7200 in the townland of Ballintra	North East
S17	Across Lough Major from car park along a local access road situated along the northern edge of the lake, south of the R183	South East
S18	local road L3200 across the townland of Clogher, located approximately 4.5km southeast of Ballybay	East
S19	local road L4221 (Scenic Road SV21) in the townland of Lattonfasky partially overlooking Lough Egish	West North West -
S20	R180 north of the townland of Brackly (Cremorne By)	North
S21	Junction R180 / L4210 across the townland of Greagh (Cremorne By) and Tullynahinnera	East South East -
S22	local road L4210 across the townland of Lough Morne, located approximately 7km southeast of Ballybay	South South East -
S23	local hill (Waterworks Reservoir), north in the townland of Kilkit -	South East
S24	local road L7113 across Lough Morne	South
S25	R181 at the entrance of a graveyard in the vicinity of Aghmakerr townland	South West

Viewpoint	Location	Direction of View
S26	local road L40431 (Scenic Route SV 22) located in the townland of Tooa, located approximately 7km northeast of Shercock	South – South East
S27	local road L40431 (Scenic Viewpoint 22) in the townland of Tullyglass	South East
S28	The Ouvry Cross Roads, located approximately 3.5km northeast of Shercock	East – South East
S29	local road L4031 at the northern boundary of Corduff, located approximately 5.5km northeast of Shercock	North – North West
S30	R178 at road junction with local road L4020 in the townland of Corvally (Farney By)	West – South West
S31	R178 approximately 2.5km east of Shercock, en Route to Carrickmacross	East
S32	Local road L49051 across the townland of Raferagh, located approximately 4.5km east of Shercock	South West
S33	R162 at the cross roads with L7554 and L7553 in the townland of Taghart North or Closnabradan	South East
S34	Local road L49033 in the vicinity of Lavagilduff townland, located approximately 6km southeast of Shercock and east of the R162	North – North West
S35	R162 at cross roads with local road L8920 between the townland of Drumiller and Lavagilduff	North West
S36	R162 at elevated ground between the townland of Tullybrick and Drumbrackan	North West
S37	R165 at junction with local road L3526, northwest and just outside of Kingscourt	North West
S38	R165 at junction with local road L3532 in the townland of Cornaman, east of Muff Lough	North West
S39	Local road L7567 near the site of the Fair of Muff	West
S40	Local road L3531 southeast in the townland Moyer	South East
S41	Picnic area beside local road L7567 near scenic view point (SV8) Lough an Leagh Gap	East
S42	Local road L3533 in the townland of Drumbar (ED Enniskeen) east of Moyhill Bridge	East
S43	Local road L68012 in the townland of Ervey	South West
S44	R164 in the townland of Corrananagh	North East
S45	Car park at Whitewood Lough	West
S46	Local road L7404 across the main entrance gate of Brittas Estate	North East
S47	Vicinity of Scenic Viewpoint 17 located at local road L7405 in the townland of Cruicetown	North – North East
S48	N52 approximately 1km west of Raffin Cross	North East
S49	Local road L74112 (Cul de Sac) in the townland of St. Johns Rath	South East
S50	Local road L74115 in the townland of Red Island	North West

Viewpoint	Location	Direction of View
S51	Cemetery from local road L7414 at the Crasulthan Cross Roads (R163), when standing near the gates of the former Gibstown Demesne	West
S52	R163 west of the Crasulthan Cross Roads.	South West
S53	Local road L34097 (Cul de Sac) across the townland of Teltown	South East
S54	Hill at People's Park Lighthouse / Tower of Lloyd (Scenic Viewpoint 13) located approximately 1.8km west of Kells	East
S55	R147 (Boyne Valley Driving Route) opposite the fuel station across the Blackwater Valley	North East
S56	Local road L7413 at Donaghpatrick Bridge	North West
S57	South-western boundary of Donaghpatrick Church and graveyard	West
S58	Local road L3409 near the T-Junction with local road L34091 in the townland of Donaghpatrick	South West
S59	Blackwater Valley from Teltown Church	South East
S60	Bridge on local road L8009 crossing M3 motorway in the townland of Ardraccan	South West
S61	Local road L4024 overlooking graveyard at Dunderry	East
S62	Local road L4008 east of Dunderry in the townland of Philpotstown	East
S63	R161 at the gates of the Meath GAA centre	North East
S64	Upper landing of the steps at Bective Abbey across the Boyne Valley	South – South East
S65	Upper landing of the steps at Bective Abbey across the Boyne Valley	West – South West
S66	River Boyne from local road L4010 (Boyne Valley Driving Route) at Bective Bridge (Scenic Viewpoint 86)	South West
S67	Local road L2203 (Boyne Valley Driving Route) approximately 500m southwest of Bective	South West
S68	Hill of Tara (Scenic Viewpoint 44) at the Lia Fáil	West-South West
S69	Local road L22051 across the townland of Creroge	East – South East
S70	Local road L2205 across the townland of Crumpstown or Marshallstown	East
S71	Top of Trim Castle	East
S72	Local road L6202 in the townland of Foxtown	North East

Viewpoint	Location	Direction of View
S73	Local road L2207 in the townland of Derrypatrick	South East
S74	R125 at entrance gate of Culmullin Parish Church at T-Junction with local road L6206	South West
S75	R125 at a farm gate across the townland of Bogganstown	East – North East
S76	R125 in the townland of Leonardstown	North East
S77	R156 across the townland of Leonardstown approximately 500m southeast of the Mullagh Cross Roads	North East

## 16.4 Mitigation

### 16.4.1 General Landscape Mitigation

82. Routeing was the primary means of mitigation and was based on principle of avoiding *inter alia* higher ground, ridgelines and areas of landscape or amenity value.
83. The respective applicants have a committed approach to environmental management and the requirements that the principal contractor is expected to meet are identified in the Outline CEMP – see Appendix 5A of the Consolidated ES and EIS Appendix 7.1, Volume 3B).
84. The detailed CEMP, which will be based on the outline CEMP, is the practical means by which the contractor will implement the environmental commitments made in the ES and EIS and which will cover the construction of the proposed interconnector.
85. Further details are provided in Section 13.5 of the Consolidated ES and Section 11.6 of the EIS, Volumes 3C and 3D.

### 16.4.2 Substation Landscape Mitigation

#### 16.4.2.1 Turleenan Substation

##### Construction mitigation

86. Proposed planting will be implemented in the first planting season following completion of the earth works to allow the planting to become established in advance of the substation construction. Plant species chosen will be fast growing

native species to complement existing planting in the local area. Detailed planting proposals have taken cognisance of existing hedges and local pockets of woodland to deliver visual and environmental benefits as the proposals mature.

#### Operational Mitigation

87. The proposed planting will in time effectively screen views for receptors and road/path users and integrate the site into the local landscape character. A range of plant sizes will be used to give a degree of maturity to the planting. Areas of open space will become meadow areas, created with grassland cut on a low maintenance regime to encourage species diversity.
88. The planting will be protected by rabbit proof fencing and will be subject to a management program to ensure objectives are met. The site will be maintained according to a five year maintenance schedule.

#### 16.4.2.2 Carrickmacross Construction Materials Storage Yard Landscape Mitigation

##### Construction Mitigation

89. Existing site boundary vegetation will be protected and retained (monitored by a Landscape Architect) during site construction.

##### Operational Mitigation

90. Existing site boundary vegetation will be protected and retained during operation. On completion of the construction phase (approximately 3 years), the site will be fully reinstated and returned to agricultural use.

### 16.4.3 Overhead Line Landscape Mitigation

#### 16.4.3.1 Construction mitigation

91. Earthworks associated with the erection of towers and foundation construction would be limited to specific areas around the base of each tower. The maximum size of working area for construction of a tower is 1,225m<sup>2</sup>.
92. Wherever possible existing vegetation removed during construction will be replaced and grass areas reinstated.
93. The lands on which temporary access routes and trackways are located will be returned to their pre-construction state, following construction of the line.

#### 16.4.3.2 Operational mitigation

94. An appraisal of alternatives with a view to the reduction of landscape impacts was undertaken. Avoidance has been the main form of mitigating the permanent and operational effects of the proposed interconnector.
95. The preferred route corridor was refined through a line routeing process, which identified a proposed overhead line route including specified tower locations. Landscape architects had input during the line routeing process, and where possible, line routeing decisions were made to reduce landscape and visual impacts. The principal objective was to keep the line route as straight as possible, in order to reduce the actual length of the final line route and avoid the use of angle towers, which are generally larger than intermediate towers. However, due to technical and environmental constraints, including particularly the number of houses scattered throughout the assessed area, this was not always possible and the overhead line route has had to include deviations.

### 16.4.4 Visual Mitigation

#### 16.4.4.1 Substation Visual Mitigation

##### Turleenan Substation Construction mitigation

96. Mitigation measures to reduce visual impacts of the proposed substation will involve the embankments, earth bunds and entrance road being heavily planted with native woodland, so that in time, the substation will be screened from view and assimilated back into the local landscape setting. Advance planting of these new woodlands will reduce the potential adverse visual impacts of construction activity.

##### Turleenan Substation Operational mitigation

97. Selection of the most environmentally, technically and economically preferable site for the proposed substation was a priority. The proposed site has been carefully chosen to limit its impact on the landscape and views.
98. The proposed earth bunds and extensive planting proposals play an important role in limiting the visual impact of the substation.
99. Planting will also help to reduce the impact of perimeter fencing and, wherever possible, existing hedgerows will be retained. Planted embankments and earth bunds 1 metre high will surround three sides of the site, helping to complete the visual enclosure of the site. It is accepted that the steep profile of earth bunds may create visual impacts however, once planted, their profiles will be softened as the planting matures and provides visual screening.



100. Mitigation of the subsequent residual visual effects of the completed development will be aided by the use of appropriate materials and finishes for the built elements, a combination of surrounding earthworks, to include earth mounding, around the site, and suitable hedge and tree screening.
101. Further detail on visual substation mitigation is provided by Chapter 5 of the Consolidated ES.

#### 16.4.4.2 Carrickmacross Construction Materials Storage Yard Visual Mitigation

##### Construction

102. The retention of existing site boundary vegetation along the adjacent N2 and L4700 will reduce visibility of the compound from those roads.

##### Operational

103. The reinstatement of the site after three years will restore views of the site to, or close to their current nature.

#### 16.4.5 Overhead Line Visual Mitigation

##### 16.4.5.1 Construction mitigation

104. The mitigation measures to minimise physical landscape effects (including retention of a maximum amount of existing vegetation, reinstatement/new planting and monitoring) will also minimise adverse effects on views.

##### 16.4.5.2 Operational mitigation

105. An assessment of alternatives with a view to the reduction of visual impacts was undertaken. Avoidance has been the main form of mitigating the permanent and operational visual effects of the proposed interconnector.
106. The selection of the preferred lattice tower structure was informed by a separate study undertaken by landscape architects. A further study compared the preferred lattice tower option with a monopole option. The conclusion was that the lattice tower is the most suitable for this proposed interconnector.

## 16.5 Residual Landscape Impacts

### 16.5.1 Overview

107. Residual landscape impacts resulting from the proposed interconnector are described in detail in both the Consolidated ES (Section 13.6) and EIS (Section 11.7, Volume 3C and 3D), and are summarised below.
108. Physical landscape effects will be experienced at:
- Permanent Tower Bases;
  - Permanent area under the overhead line –vegetation under the conductors will be trimmed so that the height does not exceed 2m in Northern Ireland. In Counties Monaghan, Cavan and Meath, hedgerow vegetation will be inspected and trimmed at five year intervals to ensure that heights do not interfere with conductors. Maintained heights will depend on topography and conductor sag;
  - Permanent area adjacent to the overhead line – all vegetation adjacent to the conductors with the potential to fall onto the conductors will be trimmed to ensure safety clearances. This will form part of the ongoing maintenance of the proposed overhead line. Vegetation within a 30m zone either side of the overhead line will be largely unaffected but for safety reasons, any branches, etc with the potential to fall on the overhead line will be trimmed; and,
  - Where the proposed interconnector passes through areas of commercial woodland a maximum 74m corridor is required.
109. A detailed assessment of residual effects on Designated Landscapes is provided by the respective applicants' LVIA Chapters and cross referenced with the respective Cultural and Heritage Chapters.
110. Likely long term residual effects on landscape character resulting from the proposed interconnector are as follows:
- Loss of land currently in agricultural use;
  - Loss of natural landscape elements such as landform, hedgerows and trees;
  - Introduction of an overhead line, a large substation and associated towers to an existing rural landscape character type;
  - Creation of the permanent substation access road;
  - Loss and reduction of vegetation to accommodate necessary electrical clearances; and,
  - Loss of the open character of drumlin ridgelines in some locations.

## 16.5.2 Residual Landscape Impacts during Operational Phase

111. Landscape impacts will arise from effects on landscape character and on landscape features. Effects will occur, for example, where vegetation is removed or where the character of the landscape is altered by the proposed interconnector. The appraisal of the landscape impacts arising from the two elements of the proposed interconnector has been described in detail in the LVIA chapters of the Consolidated ES (refer to Chapter 13) and EIS (refer to Chapter 11).

**Table 16.10: Residual Landscape Impacts**

Receptor Type	Sensitivity	CONSTRUCTION		OPERATION (Year 1)		Significance
		Magnitude of Change	Impact	Magnitude of Change	Impact	
Armagh City Former Green Belt	High	Negligible	Minor Adverse	Negligible	Minor Adverse	Not Significant
Dungannon Green Former Belt	Medium - High	Low - Negligible	Minor Adverse	Low - Negligible	Minor Adverse	Not Significant
The Argory	Medium	Low – Medium	Minor - Moderate Adverse	Low - Medium	Minor - Moderate Adverse	Not Significant
The Manor House, Benburb	High	Low – Medium	Moderate Adverse	Low - Medium	Moderate Adverse	Significant
Armagh Palace	Medium	Negligible	Negligible	Negligible	Negligible	Not Significant
Tynan Abbey	Medium	Negligible	Negligible	Negligible	Negligible	Not Significant

Receptor Type	Sensitivity	CONSTRUCTION		OPERATION (Year 1)		Significance
		Magnitude Change	of Impact	Magnitude Change	of Impact	
LCA 47 Loughgall Orchard Belt	Medium	High	Moderate - Major Adverse	Medium - High	Moderate Adverse	Significant
LCA 66 Armagh Drumlins	High	Medium – High	Moderate - Major Adverse	Medium - High	Moderate - Major Adverse	Significant
LCA 45 Dungannon Drumlins and Hills	Medium	Low	Minor Adverse	Low	Minor Adverse	Not Significant
LCA 64 Lough Neagh Peatlands	Medium	Low - Negligible	Negligible - Minor Adverse	Low - Negligible	Negligible - Minor Adverse	Not Significant
LCA 68 Carrigatuke Hills	Medium	Negligible	Negligible	Negligible	Negligible	Not Significant
LCA 46 Blackwater Valley	High	Negligible	Minor Adverse	Negligible	Minor Adverse	Not Significant
Mullyash Uplands	Moderate/High	Medium-high	Moderate-major	Moderate-high	Moderate-major	Significant
Monaghan Drumlin Uplands	Moderate	Medium-high	Moderate	Moderate-high	Moderate	Significant
Ballybay Castleblaney Lakelands	Moderate	Medium-high	Moderate	Moderate-high	Moderate	Significant
Drumlin and Upland Farmland of South Monaghan	Moderate	Medium-high	Moderate	Moderate-high	Moderate	Significant
Highlands of East Cavan	Moderate/High	Medium-high	Moderate-major	Moderate-high	Moderate-major	Significant
North Meath Lakelands	Moderate	Medium-high	Moderate	Medium-high	Moderate	Significant
North Navan Lowlands	Moderate	Medium-high	Moderate	Medium-high	Moderate	Significant
Blackwater Valley	Moderate/High	Medium-high	Moderate-major	Medium-high	Moderate-major	Significant
West Navan Lowlands	Moderate	Medium-high	Moderate	Medium-high	Moderate	Significant
Boyne Valley	Moderate/High	Medium-high	Moderate-major	Medium-high	Moderate-major	Significant
Central Lowlands	Moderate	Medium-high	Moderate	Medium-high	Moderate	Significant
Tara Skryne Hills	Moderate	Medium-high	Moderate	Medium-high	Moderate	Significant
Lough Muckno and environs	High	No change	No impact	No change	No impact	Not significant
Billy Fox Memorial Park and environs	High	No change	No impact	No change	No impact	Not significant

Receptor Type	Sensitivity	CONSTRUCTION		OPERATION (Year 1)		Significance
		Magnitude Change	of Impact	Magnitude Change	of Impact	
Dromore River and lake system including White Lake and Bairds Shore	High	No change	No impact	No change	No impact	Not significant
Lough Major and environs	High	No change	No impact	No change	No impact	Not significant
Lisanisk lake	High	No change	No impact	No change	No impact	Not significant
Lough Naglack	High	No change	No impact	No change	No impact	Not significant
Rahan's lake	High	No change	No impact	No change	No impact	Not significant
Dun na Ri forest park, Co. Cavan	High	No change	No impact	No change	No impact	Not significant
Lough an Leagh Mountain, Co. Cavan	High	Low-negligible	Minor-moderate	Low-negligible	Minor-moderate	Not significant
Dun na Ri forest park, Co. Cavan	High	No change	No impact	No change	No impact	Not significant
Lough an Leagh Mountain, Co. Cavan	High	Low-negligible	Minor-moderate	Low-negligible	Minor-moderate	Not significant
Dunsany Castle, Co. Meath	High	No change	No impact	No change	No impact	Not significant
Kilkeen Castle, Co. Meath	High	No change	No impact	No change	No impact	Not significant
Talbot Castle, Co. Meath	High	No change	No impact	No change	No impact	Not significant
Trim Castle, Co. Meath	High	Negligible	Negligible	Negligible	Negligible	Not significant
People's Park Lighthouse, Co. Meath	High	No change	No impact	Negligible	No impact	Not significant
Whitewood Estate House, Co. Meath	High	Low	Minor-moderate	Low	Minor-moderate	Not significant
Beech Copse, Co. Meath	High	Negligible	Negligible	Negligible	Negligible	Not significant
Tower, Co. Meath	High	Low	Minor-moderate	Low	Minor-moderate	Not significant
Bective Abbey, Co. Meath	High	Low	Minor-moderate	Low	Minor-moderate	Not significant
Yellowsteeple, Co. Meath	High	No change	No impact	No change	No impact	Not significant
Skryne Church, Co. Meath	High	No change	No impact	No change	No impact	Not significant

### 16.5.3 Residual Visual Impacts during Operational Phase

113. Visual impacts on the landscape would arise from the construction of the Turleenan substation, the extension to Woodland substation, the temporary storage yard, overhead line and associated towers. There would be a direct impact on available views, which would affect viewers (receptors) and the overall visual amenity. Effects would occur, for example, where towers will break the horizon and will appear as a new feature within the local landscape setting, or where receptors are in close proximity to the proposed interconnector. The appraisal of the visual impacts arising from the two elements of the proposed interconnector has been described in detail in the LVIA chapters of the Consolidated ES and EIS.

114. The Table below provides a Summary of Residual Visual Impacts during Operational Phase

**Table 16.11: Residual Visual Impacts**

Receptor Type	Sensitivity	CONSTRUCTION		OPERATION (Year 1)		Significance
		Magnitude Change	of Impact	Magnitude Change	of Impact	
Settlements						
Armagh City	Medium	Negligible	Negligible	Negligible	Negligible	Not Significant
Dungannon	Medium	Negligible	Negligible	Negligible	Negligible	Not Significant
Moy	High	Low-Medium	Moderate	Low-Medium	Moderate	Significant
Blackwatertown	High	Low-Medium	Moderate	Low-Medium	Moderate	Significant
Benburb	High	Medium-High	Moderate – Major	Medium	Moderate	Significant

Receptor Type	Sensitivity	CONSTRUCTION		OPERATION (Year 1)		Significance
		Magnitude of Change	Impact	Magnitude of Change	Impact	
Killylea	High	Low-Medium	Moderate	Low-Medium	Moderate	Significant
Milford	Medium	Low-Medium	Minor - Moderate	Low-Medium	Minor - Moderate	Not Significant
Middletown	Medium	Negligible	Negligible	Negligible	Negligible	Not Significant
Keady	Medium	Negligible	Negligible	Negligible	Negligible	Not Significant
Derrynoose	High	High	Major	Medium-High	Moderate - Major	Significant
Clontribret	High	Negligible	Negligible	Negligible	Negligible	Not significant
Creaghanroe	High	Negligible	Negligible	Negligible	Negligible	Not significant
Annayalla	High	Negligible	Negligible	Negligible	Negligible	Not significant
Doohamlet	High	Low	Minor-moderate	Low	Minor-moderate	Not significant
Ballybay	High	Negligible	Negligible	Negligible	Negligible	Not significant
Castleblayney	High	Negligible	Negligible	Negligible	Negligible	Not significant
Shercock	High	No change	No impact	No change	No impact	Not significant
Kingscourt	High	No change	No impact	No change	No impact	Not significant
Teevurcher	High	No change	No impact	No change	No impact	Not significant
Nobber	High	Low	Minor-moderate	Low	Minor-moderate	Not significant
Kilmainhamwood	High	Low	Minor-moderate	Low	Minor-moderate	Not significant
Carlanstown	High	Negligible	Negligible	Negligible	Negligible	Not significant
Wilkinstown	High	Negligible	Negligible	Negligible	Negligible	Not significant
Donaghpatrick	High	Low	Minor-moderate	Low	Minor-moderate	Not significant
Navan	High	No change	No impact	No change	No impact	Not significant
Castletown	High	No change	No impact	No change	No impact	Not significant

Receptor Type	Sensitivity	CONSTRUCTION		OPERATION (Year 1)		Significance
		Magnitude of Change	Impact	Magnitude of Change	Impact	
Bohermeen	High	Negligible	Negligible	Negligible	Negligible	Not significant
Summerhill	High	No change	No impact	No change	No impact	Not significant
Drumree	High	No change	No impact	No change	No impact	Not significant
Dunsany	High	No change	No impact	No change	No impact	Not significant
Oristown	High	No change	No impact	No change	No impact	Not significant
Trim	High	No change	No impact	No change	No impact	Not significant
Gibstown	High	Low	Minor-moderate	Low	Minor-moderate	Not significant
Dunderry	High	Medium	Moderate	Medium	Moderate	Significant (outskirts of settlement)
Robinstown	High	Medium	Moderate	Medium	Moderate	Significant (outskirts of settlement)
Bective	High	Low	Minor-moderate	Low	Minor-moderate	Not significant
Kilmessen	High	Negligible	Negligible	Negligible	Negligible	Not significant
Transport Corridors and Paths						
M1	Low	Negligible	Negligible	Negligible	Negligible	Not Significant
N2	Low	Negligible	Negligible	Negligible	Negligible	Not Significant
A28	Low	Low	Negligible	Low	Negligible	Not Significant
A3	Low	Medium	Minor	Medium	Minor	Not Significant



Receptor Type	Sensitivity	CONSTRUCTION		OPERATION (Year 1)		Significance
		Magnitude Change	of Impact	Magnitude Change	of Impact	
A29	Low	Low	Negligible	Low	Negligible	Not Significant
A45	Low	No Change	No Impact	No Change	No Impact	Not Significant
B115	Medium	Low-Medium	Minor - Moderate	Low-Medium	Minor – Moderate	Not Significant
B106	Medium	Medium	Moderate Adverse	Medium	Minor - Moderate	Not Significant
B3/R214	Medium	Low-Medium	Minor - Moderate	Low-Medium	Minor - Moderate	Not Significant
B34	Medium	No Change	No Impact	No Change	No Impact	Not Significant
B517	Medium	No Change	No Impact	No Change	No Impact	Not Significant
B45	Medium	No Change	No Impact	No Change	No Impact	Not Significant
B128	Medium	Low	Minor Adverse	Low	Minor Adverse	Not Significant
B28	Medium	Negligible	Negligible	Negligible	Negligible	Not Significant
B130	Medium	Negligible	Negligible	Negligible	Negligible	Not Significant

Receptor Type	Sensitivity	CONSTRUCTION		OPERATION (Year 1)		Significance
		Magnitude of Change	Impact	Magnitude of Change	Impact	
B210	Medium	Negligible	Negligible	Negligible	Negligible	Not Significant
B361	Medium	Negligible	Negligible	Negligible	Negligible	Not Significant
B32/R181	Medium	Negligible	Negligible	Negligible	Negligible	Not Significant
R184	Medium	Negligible	Negligible	Negligible	Negligible	Not Significant
National The Ulster Way/Cycle Route 91	Medium	Low-Medium	Minor - Moderate	Low-Medium	Minor - Moderate	Not Significant
National Cycle Route 95	Low	Negligible	Negligible	Negligible	Negligible	Not Significant
Regional Cycle Route 11	Low	Medium-Low	Negligible -Minor	Low	Negligible	Not Significant
River Blackwater Canoe Trail	Medium	Medium	Moderate	Medium-Low	Minor - Moderate	Not Significant
The Monaghan Way	Medium	Medium-Low	Minor - Moderate	Medium-Low	Minor - Moderate	Not Significant
The Beetlers Trail	Medium	Negligible	Negligible	Negligible	Negligible	Not Significant
N2	Low	Medium	Minor	Medium-high	Minor-moderate	Not significant
R183	Low	Medium	Minor	Medium-high	Minor-moderate	Not significant
R180	Low	Medium	Minor	Medium	Minor	Not significant
R181	Low	Medium	Minor	Medium	Minor	Not significant

Receptor Type	Sensitivity	CONSTRUCTION		OPERATION (Year 1)		Significance
		Magnitude of Change	Impact	Magnitude of Change	Impact	
R178	Low	Medium	Minor	Medium	Minor	Not significant
R162	Low	Medium	Minor	Medium	Minor	Not significant
R165	Low	Medium	Minor	Medium	Minor	Not significant
R164	Low	Medium	Minor	Medium	Minor	Not significant
R162	Low	Low	Minor	Low	Minor	Not significant
R165	Low	No change	No impact	No change	No impact	Not significant
N52	Low	Medium	Minor	Medium	Minor	Not significant
R163	Low	Medium	Minor	Medium	Minor	Not significant
R147	Low	Medium	Minor	Medium	Minor	Not significant
M3	Low	Medium	Minor	Medium	Minor	Not significant
N51	Low	Medium	Minor	Medium	Minor	Not significant
R161	Low	Medium	Minor	Medium	Minor	Not significant
R154	Low	Medium	Minor	Medium	Minor	Not significant
R125	Low	Medium	Minor	Medium	Minor	Not significant
R156	Low	Low	Negligible	Low	Negligible	Not significant
The Monaghan Way	Moderate	Medium	Moderate	Medium	Moderate	Significant (localised)
Lough an Leagh walk, Co. Cavan	Moderate	Low-negligible	Minor-moderate	Low-negligible	Minor- moderate	Not significant
Dun na Ri Forest park walks, Co. Cavan	Moderate	No change	No impact	No change	No impact	Not significant
Castle walk, Balieboro, Co. Cavan	Moderate	No change	No impact	No change	No impact	Not significant
Boyne Valley Driving Route, Co Meath	Moderate	Medium	Moderate	Medium	Moderate	Significant (localised)
Proposed walking route along the river Blackwater, Co. Meath	Moderate	Medium	Moderate	Medium	Moderate	Significant (localised)
Lough an Leagh walk,	Moderate	Low-negligible	Minor-moderate	Low-negligible	Minor- moderate	Not significant

Receptor Type	Sensitivity	CONSTRUCTION		OPERATION (Year 1)		Significance	
		Magnitude of Change	Impact	Magnitude of Change	Impact		
Co. Cavan							
Dun na Ri Forest park walks, Co. Cavan	Moderate	No change	No impact	No change	No impact	Not significant	
Boyne Ramparts Heritage Walks, Co. Meath	Moderate	No change	No impact	No change	No impact	Not significant	
Trim Slí na Sláinte	Moderate	No change	No impact	No change	No impact	Not significant	
<b>Viewpoints</b>							
N 1	Clonteevy Bridge over River Rhone on Trewmount Road (B106)	Medium	High	Moderate - Major	High	Moderate - Major	Significant
N 2	Derrygally Way to east of Turleenan Substation	Medium	High	Moderate - Major	High	Moderate - Major	Significant
N 3	Derrygally Way to south of Turleenan Substation	Medium	High	Moderate - Major	High	Moderate - Major	Significant
N 4	Trewmount Road (B106) near site access road.	Medium	High	Moderate - Major	Medium - High	Moderate	Significant
N 5	Bonds Bridge over River Blackwater near the Argory	Medium	Low – Medium	Minor - Moderate	Low - Medium	Minor - Moderate	Not Significant
N 6	Moy Road (A29) crossing	Medium	Medium - High	Moderate	Medium	Moderate	Significant
N 7	Culkeeran Road	Medium	Medium - High	Moderate	Medium	Moderate	Significant

Receptor Type		Sensitivity	CONSTRUCTION	Impact	OPERATION (Year 1)	Impact	Significance
			Magnitude of Change		Magnitude of Change		
N 8	Gorestown Road	Medium	Medium - High	Moderate	Medium	Moderate	Significant
N 9	Benburb Road	Medium	High	Moderate - Major	High	Moderate - Major	Significant
N 10	Benburb Road south of Ninewell Bridge	Medium	High	Moderate - Major	High	Moderate - Major	Significant
N 11	Clonfeacle Road (B128) crossing	Medium	Medium	Moderate	Low - Medium	Minor - Moderate	Not Significant
N 12	Benburb Priory	High	Medium	Moderate	Medium	Moderate	Significant
N 13	Artasooly Road looking towards Blackwater River Crossing	Medium	Medium	Moderate	Low - Medium	Minor - Moderate	Not Significant
N 14	Artasooly Road at Tullymore Bridge	Medium	Medium	Moderate	Medium	Moderate	Significant
N 15	Artasooly Road and Maydown Road junction at Artasooly	High	Low	Moderate	Low - Negligible	Minor - Moderate	Not Significant
N 16	Battleford Road (B115) crossing	High	High	Major	High	Major	Significant
N 17	Killylea Road (A28) crossing	Medium	Medium	Moderate	Low - Medium	Minor - Moderate	Not Significant
N 18	Killylea settlement (Fellows Grange Court)	High	Low - Medium	Moderate	Low - Medium	Moderate	Significant

Receptor Type		Sensitivity	CONSTRUCTION		OPERATION (Year 1)		Significance
			Magnitude of Change	Impact	Magnitude of Change	Impact	
N 19	Navan Fort	High	Negligible	Minor	Negligible	Minor	Not Significant
N 20	Monaghan Road (A3) east of Norton's Cross Roads	Medium	High	Moderate - Major	Medium - High	Moderate	Significant
N 21	Monaghan Road (A3) crossing	Medium	High	Moderate - Major	Medium - High	Moderate	Significant
N 22	Maddan Road south of Norton's Cross Roads	Medium	Medium - High	Moderate	Medium	Moderate	Significant
N 23	Cavanagarvan Road and Sheetrim Road Junction	Medium	Medium	Moderate	Low - Medium	Minor - Moderate	Not Significant
N 24	Drumhillery Road crossing	Medium	Medium - High	Moderate	Medium	Moderate	Significant
N 25	Lagan Road west of Keady	High	Low	Moderate	Low - Negligible	Minor - Moderate	Not Significant
N 26	Fergort (B3) Road crossing	Medium	Medium - High	Moderate	Medium - High	Moderate	Significant
N 27	East of Derrynoose	High	High	Major	Medium - High	Moderate - Major	Significant
N 28	Derrynoose Road at Curragh Lane looking north	Medium	Medium - High	Moderate	Medium - High	Moderate	Significant
N 29	Derrynoose Road at Curragh Lane looking south	Medium	Medium - High	Moderate	Medium - High	Moderate	Significant

Receptor Type		Sensitivity	CONSTRUCTION		OPERATION (Year 1)		Significance
			Magnitude of Change	Impact	Magnitude of Change	Impact	
N 30	Crossbane Road (Consolidated ES)	Medium	Low - Negligible	Negligible - Minor	Low - Negligible	Negligible - Minor	Not Significant
N 31	Crossaghy Road	Medium	Medium - High	Moderate	Medium - High	Moderate	Significant
N 32	Castleshane Brae	Low	Negligible	Negligible	Negligible	Negligible	Not Significant
N 33	Tully buck	High	No change	No Impact	No change	No Impact	N/A
N 34	Mullyash Mountain	High	Negligible	Minor	Negligible	Minor	Not Significant
SV11 (Monaghan)		High	No change	No impact	No change	No impact	Not significant
SV12 (Monaghan)		High	Negligible	Negligible	Negligible	Negligible	Not significant
SV13 (Monaghan)		High	No change	No impact	No change	No impact	Not significant
SV14 (Monaghan)		High	Negligible	Negligible	Negligible	Negligible	Not significant
SV15 (Monaghan)		High	No change	No impact	No change	No impact	Not significant
SV16 (Monaghan)		High	No change	No impact	No change	No impact	Not significant
SV17 (Monaghan)		High	No change	No impact	No change	No impact	Not significant
SV18 (Monaghan)		High	No change	No impact	No change	No impact	Not significant
SV19 (Monaghan)		High	No change	No impact	No change	No impact	Not significant
SV21 (Monaghan)		High	Low	Minor-moderate	Low	Minor-moderate	Not significant
SV22 (Monaghan)		High	Low	Minor-moderate	Low	Minor-moderate	Not significant
SV23 (Monaghan)		High	No change	No impact	No change	No impact	Not significant
SV 8 (Cavan)		High	Low	Minor-moderate	Low	Minor-moderate	Not significant
SV 8 (Cavan)		High	Low	Minor-moderate	Low	Minor-moderate	Not significant
13 (Meath)		High	Low	Minor-moderate	Low	Minor-moderate	Not significant
15 (Meath)		High	Negligible	Negligible	Negligible	Negligible	Not significant

Receptor Type	Sensitivity	CONSTRUCTION		OPERATION (Year 1)		Significance
		Magnitude of Change	Impact	Magnitude of Change	Impact	
16 (Meath)	High	No change	No impact	No change	No impact	Not significant
17 (Meath)	High	Low	minor-moderate	Low	minor-moderate	Not significant
18 (Meath)	High	No change	No impact	No change	No impact	Not significant
19 (Meath)	High	No change	No impact	No change	No impact	Not significant
20 (Meath)	High	No change	No impact	No change	No impact	Not significant
21 (Meath)	High	No change	No impact	No change	No impact	Not significant
40 (Meath)	High	No change	No impact	No change	No impact	Not significant
42 (Meath)	High	No change	No impact	No change	No impact	Not significant
44 (Meath)	High	Negligible	Negligible	Negligible	Negligible	Not significant
47 (Meath)	High	No change	No impact	No change	No impact	Not significant
50 (Meath)	High	No change	No impact	No change	No impact	Not significant
52 (Meath)	High	Negligible	Negligible	Negligible	Negligible	Not significant
77 (Meath)	High	No change	No impact	No change	No impact	Not significant
80 (Meath)	High	No change	No impact	No change	No impact	Not significant
85 (Meath)	High	No change	No impact	No change	No impact	Not significant
86 (Meath)	High	Medium	Moderate	Medium	Moderate	Significant



**Table 16.12: Views from unscreened individual properties**

Views from unscreened individual properties						
Receptor	Sensitivity	Construction		Operation		Significance
		Magnitude of change	Impact	Magnitude of change	Impact	
Unscreened properties with direct views within in 500m	High	Between Low/Negligible and High	Between Minor-moderate and Major	Between Low/Negligible and High	Between Moderate and Major	Significant
Unscreened properties within 500m-1km	High	Between Negligible and Medium	Between Negligible and Moderate	Between Negligible and Medium	Between Negligible and Moderate	Varying in significance and reducing to not significant beyond approximately 600-800m
Unscreened properties within 1km-1.5km	High	Between No impact and Negligible	Between No impact and Minor-moderate	Between No change and Negligible	Between No impact and Minor-moderate	Not significant
Unscreened properties further than 1.5km	High	Negligible	Negligible	Negligible	Negligible	Not significant

## 16.6 Transboundary Effects

115. Based on the assessments carried out in the Consolidated ES (Chapter 13 - Landscape and Visual) and the EIS (Chapter 11 - Landscape of Volumes 3C and 3D), transboundary impacts are predicted to range from negligible to minor adverse apart from landscape impacts (on the Mullyash Uplands LCA) and visual impacts (SONI Viewpoints 30 and 31), primarily due to visual receptors in close proximity to the proposed interconnector. Significant adverse transboundary effects will be limited to four properties in County Armagh during construction, in the winter year of commissioning and in summer 15 years after commissioning.
116. Further details are presented in Chapter 20 of the Consolidated ES and Chapter 11 (Section 11.9), Volume 3C of the EIS.

## 16.7 Conclusions

117. An overhead line of the length and nature of the proposed interconnector will inevitably have landscape and visual impacts. However, considerable efforts have been made in the routeing and design processes to avoid or minimise these impacts as much as possible. Based on the detailed consideration of alternative routes, the respective applicants have developed a route for the proposed interconnector which has minimised impacts to the landscape and visual resource of the assessed area, given the nature of an infrastructure project of this type.
118. The route and location of the proposed interconnector was selected based on the results of a number of alternatives studies which examined the environmental, technical and economic constraints present between various route corridors, line route options, and design details. Landscape and visual impacts were two major environmental constraints that influenced the selection of the preferred route corridor, the line route, and the components of (what became) the proposed interconnector.
119. The alternatives studies were therefore the principal means by which the permanent and operational effects of the overhead line and substation have been mitigated. Whilst the proposed interconnector would give rise to some adverse impacts it is considered to result in the least damaging impacts when compared to alternative overhead line routes and lattice tower design examined as part of the alternative studies.

120. Detailed routeing of the line has sought to achieve the best fit with the landscape using landform and vegetation whilst recognising the technical constraints of the construction and operation of an overhead line.
121. The proposed interconnector will be located within an area that is primarily agricultural, consisting of low rolling hills, shallow valleys and structured fields, which often have overgrown hedgerows and many mature trees.
122. After construction, the towers and overhead lines would remain as significant visual elements in the landscape.
123. Over time, any vegetation cut back affected by construction works will generally re-grow and any new replacement planting will become established. Clearance of vegetation that could fall on the overhead line, general inspections and repairs are activities that will periodically be undertaken; however, the level of activity in the landscape would be greatly reduced to a required minimum.
124. Mitigation measures will reduce visual impacts of the proposed Turleenan substation and will see the embankments, earth bunds and entrance road heavily planted with predominantly native woodland. Over time, as the mitigation landscape matures, views of the substation will be filtered and assimilated back into the local landscape setting.
125. The landscape appraisal indicates that there will be significant adverse impacts upon the landscape of some parts of the assessed area. There will also be significant adverse effects on the visual amenity afforded from many locations from within the immediate area following the line route. However, notwithstanding these conclusions, it is considered that the landscape and visual resource of the wider assessed area along the proposed interconnector will not deteriorate to a significant degree and the overall impact upon landscape and visual amenity in general is therefore restricted to those receptors/areas within close proximity to the towers and overhead line.

## 17. Cumulative Impacts & Interactions

### 17.1 Introduction

1. This chapter considers the potential for cumulative impacts arising from the proposed interconnector in association with other development, as well as the interaction between potential impacts on the environment arising from the proposed interconnector. The chapter is set out in two main sections - Cumulative Impacts and Interactions of Impacts.
2. The relevant chapter of the published Consolidated ES is Chapter 19 (Cumulative and Interactions of Impacts) and the relevant chapter of the EIS is Chapter 10 (Cumulative Impacts and Impact Interactions) of Volumes 3B.

### 17.2 Cumulative Impacts

#### 17.2.1 Methodology

3. The European Commission's Guidelines for the Assessment of Indirect and Cumulative Impacts as well as Impact Interactions (EC, 1999) refer to the following in its consideration of cumulative impacts:
4. **Cumulative Impacts:** The impacts that result from incremental changes caused by other past, present or reasonably foreseeable actions together with the proposed interconnector, for example:
  - Incremental noise increase from a number of separate developments;
  - Combined effect of individual impacts e.g. noise, dust and visual from one development on a particular receptor; and,
  - Several developments with insignificant impacts individually but which together have a cumulative effect e.g. development of a golf course may have an insignificant impact, but when considered with several nearby golf courses there could be a significant cumulative impact on local ecology and landscape.
5. For this JER the methodology and approach is informed by the 1999 EU Guidelines for the Assessment of Indirect and Cumulative Impacts.

6. For the purposes of the proposed interconnector, the categories of other developments included in the cumulative impact assessment has been taken to include:
- All overhead line developments currently in the planning process with the potential for cumulative impacts with the proposed interconnector; and,
  - Any planning permissions (including those for overhead line developments) which have been granted and are still extant with the potential for significant cumulative effects with the proposed interconnector.
7. The following proposed overhead lines have been considered within the cumulative assessment:
- Tamnamore to Omagh 110 kV network reinforcement project (planning permission approved). This is a 50 km 110 kV overhead electricity line and substation between existing NIE substations at Tamnamore (Dungannon) and Omagh. Tamnamore substation is located approximately 4.7 km to the north west of the proposed interconnector at its closest point. The Tamnamore to Omagh line is located approximately 1.6 km from the proposed interconnector at its closest point;
  - Future Substation in the Vicinity of Kingscourt: the future substation (which is not part of the proposed interconnector) is also included within the cumulative impact appraisal for the proposed interconnector. This is addressed at a strategic level as the exact nature or location of such development is not clear, except insofar as an appropriate location for an intermediate substation, and associate tie-in would be in the vicinity of the point of intersection of the north-south oriented proposed development and the existing east-west oriented Flagford-Louth 220 kV overhead line, near Kingscourt, County Cavan;
  - A permitted 38 kV OHL from Shercock substation (Cavan) to Tullynamalra substation (Monaghan) a distance of 12km. It is not yet built but it is crossed by the OHL between straight 169 to 174;
  - A permitted 38 kV OHL from a substation in Lisduff to Killycard, County Monaghan. It will link to a permitted windfarm near Lisduff, County Monaghan; and,
  - 110 kV Circuit From Mullingar 110 kV Station, County Westmeath To Kinnegad 110 kV Station At Killaskillen Townland, County Meath This proposed 24km long overhead line is located in counties Westmeath and Meath and is located approximately 31 km from the proposed interconnector at its closest point.

8. Other permitted and proposed developments with the potential for significant cumulative effects with the proposed interconnector and included within the cumulative assessment are outlined in **Appendix B** of this JER.

## 17.2.2 Cumulative Impact Assessment

### 17.2.2.1 Population (Socio-Economics, Tourism and Land Use)

9. It has been assessed that there are no other developments which could have significant cumulative effects to community and land use including agriculture. This is due to the distance, scale and nature of the other developments.
10. It has therefore been determined that the cumulative community and land use effects are Not Significant.
11. It has been assessed that there are no other developments which could have significant cumulative impacts on socio-economics in the area due to the distance, scale and nature of these other developments therefore effects are Not Significant.

### 17.2.2.2 Material Assets

12. It has been determined that the proposed interconnector will have no impacts on utilities, waste, telecommunications and aviation assets; and it has been assessed that cumulative impacts with other developments will be Not Significant.

### 17.2.2.3 EMF

13. The nature of Electric and Magnetic Fields (EMF) means that there is unlikely to be a cumulative impact with other developments. The Tamnamore to Omagh, Kingscourt, Shercock, Lisduff to Killycard and Mullingar to Kinnegad projects will produce an EMF. However all the projects including the proposed interconnector and existing lines will operate within national and international standards for EMF. Additionally it has been assessed that there will be no significant cumulative effect from any of the projects.
14. It has therefore been determined that the potential cumulative EMF impacts are Not Significant.

### 17.2.2.4 Traffic

15. The timing of construction, the proposed construction routes likely to be used and geographical distances from the working areas means that there are unlikely to be any significant cumulative impacts with the other assessed overhead line and substation projects and the proposed interconnector. Due to the geographical

distances and the proposed construction routes likely to be used to access the working areas, the other assessed committed development projects are not of the scale and nature to result in significant transport impacts.

16. It has been determined that the cumulative traffic transport impacts are Not Significant.

#### 17.2.2.5 Noise

17. Due to the distance between the identified developments with the potential to cause cumulative noise effects and the proposed interconnector, it is considered that significant cumulative noise impacts will not occur. Accordingly, it is concluded that cumulative noise effects would be Not Significant.

#### 17.2.2.6 Ecology

18. The appraisal of the proposed overhead line projects (including the proposed interconnector) determined that there are low numbers of wintering birds (swans and geese) that would be affected and that, impacts would not be significant. With standard mitigation measures applied by both developments, there will be no significant cumulative effects to wintering birds. Overall, it has been determined that there will be no significant cumulative ecological impacts between the other overhead line and substation projects and the proposed interconnector.
19. It has been determined that the nature and scale of the other identified developments means that there are unlikely to be significant cumulative ecological impacts.
20. For these reasons it has been assessed that the potential cumulative ecology impacts are Not Significant.

#### 17.2.2.7 Soil

21. Impacts arising from the proposed interconnector on soils, geology and groundwater are site-specific and would be limited to the immediate area of the proposed towers. It is considered that none of the other developments pose a significant risk to the ground and/or groundwater conditions. Those developments are sufficiently distant from the proposed interconnector to prevent any cumulative effects from occurring. As a result, the other developments will not increase the potential effects on the ground and groundwater conditions. Accordingly, it is concluded that cumulative effects on the soils, geology and groundwater conditions would be Not Significant.

#### 17.2.2.8 Water

22. Cumulative effects are only likely during the construction phase, where one or more other developments are expected to affect a watercourse that may also be affected by the construction of the proposed interconnector. The other developments are unlikely to have any effect on the same watercourses and at the same time to have any significant effects. In addition, robust and effective mitigation measures have been set out in this JER and once implemented significant impacts from construction site runoff or spillages from the proposed interconnector will be avoided. Similarly long term cumulative effects on hydrological patterns will not be significant as any identified changes will not be significant.
23. In terms of flood risk, it has been concluded that there will be no cumulative effects because of the scale of the project, avoidance of flood plain and likely standard mitigation measures. Therefore cumulative flood risk effects are Not Significant.
24. In the context of other development proposals in the vicinity of the proposed overhead line, the proposed mitigation will ensure that cumulative impacts are Not Significant.

#### 17.2.2.9 Air and Climatic Factors

25. There are unlikely to be any significant cumulative air quality impacts with the other assessed overhead line and substation projects and the proposed interconnector. This is because of the likely timing of construction, the scale of the proposed works and industry standard mitigation measures and geographical distances from the working areas.
26. It has been assessed that none of the assessed projects and the proposed interconnector will have a likely significant effect on climatic factors and they will not have a cumulative effect. It is concluded that cumulative air effects would be Not Significant.

#### 17.2.2.10 Cultural Heritage

27. There are no identified developments that have a potential to cause significant cumulative effects on cultural heritage. This is because of the distance, scale and nature of the other developments therefore cumulative effects are considered Not Significant.



### 17.2.2.11 Landscape

28. The landscape and visual cumulative assessment identified a number of developments which had the potential for cumulative effects with the proposed interconnector:
- Tamnamore to Omagh 110kV network reinforcement project;
  - Poultry Houses (App No M/2010/0717/F);
  - Proposed wind turbines at Teevurcher (County Meath), Raragh (County Cavan) and in the vicinity of Lisduff, County Monaghan (known as the Old Mill Wind Farm);
  - Future Kingscourt substation; and,
  - The proposed Emlagh Wind Farm.
29. It has been determined that there would be slight increases in magnitude for some of the landscape and visual resource when the proposed interconnector is considered in combination with Tamnamore to Omagh and Poultry Houses (App No M/2010/0717/F). However, there would be no significant additional or cumulative impacts.
30. Cumulative landscape effects will arise from the construction of the proposed 5 wind turbines at Teevurcher, intensifying the industrialised character of the rural landscape in this location to the south and east of Lough an Leagh mountain. Cumulative landscape effects will also arise from the construction of the proposed turbines at Raragh and Lisduff. Similar but higher effects will occur in the vicinity of the proposed Emlagh Wind Farm in County Meath. Details are contained in Chapter 11 **Volume 3D** of the EIS.
31. There is potential for cumulative landscape and visual effects arising from the future construction of a substation at the point of intersection of the proposed interconnector and the existing Flagford Lough 220 kV overhead line near Kingscourt. The cumulative landscape and visual effects will depend on the exact location of the substation but will most likely be locally significant after construction, reducing as the screening effects of planting come into effect.

## 17.3 Interactions of Impacts

### 17.3.1 Methodology

32. For this JER the methodology and approach is informed by the 1999 EU *Guidelines for the Assessment of Indirect and Cumulative Impacts*. These effects are typically interactive. The interaction of impacts arises from the combined action of a number of different environmental topic-specific impacts upon a single receptor/resource. For example, the removal of trees can have landscape, visual and ecological effects, or an individual residential receptor can be affected by noise and visual impacts. Cumulative effects can also arise from different types of impact within a single topic on a receptor, such as the cumulative visual impact of vegetation removal and erection of an electricity tower on a single receptor.
33. The assessments in this JER (Chapters 4 – 17) contain assessments of the likely significant cumulative effects arising from the proposed interconnector singularly. During the assessment process, coordination of appraisal took place between assessment specialists to ensure that interacting impacts arising from the proposed interconnector individually were identified, assessed and, where appropriate, mitigated. These impacts are reported in the individual chapters, where relevant.
34. The likely significance of these combined and interrelated impacts has been assessed within the individual assessment chapters.
35. Key interactive effects are:
- Ecology and Water – interactive impacts could potentially occur to the surface water environment. They could include potential impacts on aquatic species, requiring mitigation measures;
  - Ecology and Landscape – interactive impacts could potentially occur as a result of loss of habitats (hedgerows, trees, grassland, etc);
  - Cultural Heritage and Landscape – interactive impacts could potentially occur in relation to the landscape character and setting of cultural heritage assets; and,
  - Socio Economics, Tourism and Landscape - interactive impact which arises from the visual impacts, where dwellings and amenities are located in close proximity to the proposed interconnector.

## 17.4 Conclusions

36. An assessment of the likely significant cumulative effects of the proposed interconnector with other developments has been undertaken. Also included in the assessment is a summary of interacting effects of the proposed interconnector between assessment topics.
37. The assessment chapters in this JER (Chapters 4 – 17) contain assessments of the likely significant interacting effects arising from the proposed interconnector. During the assessment process, coordination took place between assessment specialists to ensure that interacting impacts arising from the proposed interconnector were identified, assessed and, where appropriate, mitigated.
38. The assessment of cumulative impacts between the proposed interconnector and other developments has included identification of the other planned developments which have not yet been constructed. This has led to the identification of other overhead line projects. Other developments also include proposed chicken sheds and wind turbines.
39. The cumulative effects are generally predicted to be Not Significant. However there will be separate significant landscape and visual cumulative impacts with the proposed interconnector and the proposed wind turbines at Teevurcher, Raragh, the Old Mill Wind Farm (Lisduff), Emlagh Wind Farm, and the future Kingscourt substation.

## **18. Conclusions**

### **18.1 Population – Socio-economics**

1. The likely impacts during both the construction and operational phases have been evaluated. The construction phase will result in a significant capital spend that is likely to benefit the assessed area and the wider area in terms of equipment purchased, employment and indirect impacts (e.g. accommodation for construction workers and spending in the hospitality industries).
2. The routing of the proposed overhead line is considered to present the best overall option amongst the many alternatives considered throughout the development process. In terms of minimising the potential for impacts on the amenities of existing and future populations, the principal mitigation measure has been incorporated into the design stage by maximising the distance between the proposed interconnector and larger urban settlements, local villages, clustered settlements, individual one-off dwellings, schools, churches and community facilities. Therefore it is considered that the proposed interconnector will not result in any significant negative socio-economic effects.
3. There will be wider economic benefits arising from the improvements to the electricity grid in the island of Ireland; these will be experienced in both jurisdictions.

### **18.2 Population – Tourism**

4. Impacts to tourism will not be direct as no tourist sites will be physically impacted by the proposed interconnector. Negative impacts are anticipated to be limited to construction impacts of noise and traffic, setting impacts at cultural heritage sites, and landscape and visual impacts. Tourism impacts arising as a result of visual and cultural impacts at key tourism sites including the Argory, Navan Fort, Benburb, the Monaghan Way, Bective Abbey and the Boyne Valley Driving Route will not be significant.

### **18.3 Population – Land Use**

5. The construction activity associated with the proposed interconnector will generally affect individual landholdings for the period of construction. The disturbance impacts on farm enterprises from construction activity will generally be temporary and will not give rise to residual effects. The construction activity will cause short to medium term residual effects on approximately 124ha of land where damage to soil is predicted and long term damage to land on the 1.4ha Carrickmacross

construction materials storage yard. An area of 22.2 ha will be required for the Turleenan substation and associated works. Most of the 22.2 ha can return to agricultural use following the construction phase, however there will be a residual impact to the affected land. There will be residual effects due to the restriction of land use at the base of the towers (10.5ha) and the towers will be an obstacle to machinery operations. Approximately 14.8ha of commercial forestry will be cleared under and adjoining the proposed interconnector. The presence of the overhead line will be an additional limited safety risk on farms and may restrict the construction of some agricultural buildings.

6. The residual impacts are either Imperceptible or Slight Adverse on 95% of the land parcels along the proposed interconnector. Twenty six Moderate Adverse impacts (4.5%) are predicted. Three Major Adverse impacts (0.5% of total) are predicted and one Major / Profound adverse impact (0.1% of total) will arise at the site of the substation in Turleenan, Co Tyrone.
7. In the context of the relatively<sup>37</sup> small area where direct land take impacts, land restriction impacts (at the base of the towers) and land damage impacts occur, the short term nature of construction impacts and the prediction that land utilisation will not change significantly under and adjoining the overhead lines, overall, the impact is Imperceptible.

## 18.4 Material Assets

8. An assessment of the proposed interconnector has been undertaken in accordance with the requirements of the EIA Directive and the respective legislation applicable in Northern Ireland and Ireland.
9. As part of the EIA, extensive consultation took place with the authorities responsible for transmissions associated with radio (domestic and commercial), television, aviation and the emergency services that have telecommunications assets.
10. No objections or potential impacts were highlighted by the telecommunication or aviation consultees. It is concluded that there will be no significant impacts to telecommunications or aviation assets as a result of the proposed interconnector.
11. The proposed interconnector will meet all electromagnetic compatibility requirements as set out by legislation.

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<sup>37</sup> The area of the 669 land parcels along the proposed interconnector is approximately 9,380ha. The area upon which direct impacts occurs (10.55ha5 + 22.2ha + 124ha + 1.4ha + 14.8ha) is 1.8% of the total area.

12. Mitigation measures will be implemented at the construction and operational phase to minimise and/or eliminate impacts on material assets in the receiving environment. The mitigation measures included in the EIS and Consolidated ES will be implemented as part of the construction management. Adherence to the mitigation measures will ensure there are no residual impacts associated with the proposed interconnector.
13. It is considered that the operation of the proposed interconnector will have no significant impacts on the material assets. The proposed interconnector does not provide an obstacle for aircraft, particularly those operating at Trim Airfield. The IAA confirmed that the proposed interconnector will be below the obstacle limitation surface for Trim Airfield.

## 18.5 EMF

14. This chapter provides information on calculated levels of ELF EMFs that can be anticipated in the vicinity of the proposed 400 kV transmission line and summarises the results of scientific research that has been conducted to investigate potential health effects related to ELF EMF. It provides a summary of the conclusions of reviews and exposure guidelines developed by national and international scientific and health agencies to protect the health of workers and the general public and it demonstrates by calculations that the proposed interconnector complies with the relevant exposure guidelines. This information addresses both regulatory requirements and responds to issues raised by stakeholders during the public consultation.

The proposed transmission lines operating at 400 kV will produce, for the majority of its length including all of the length within Northern Ireland, a maximum 50Hz electric field of approximately 7.9kV/m and a maximum magnetic field of approximately 47.9  $\mu$ T beneath the transmission line. For the short section (between towers 118 to 121 in Ireland) carried on transposition towers, the maximum fields will be approximately 8.0 kV/m and 48.5  $\mu$ T. For the short section (between towers 402 to 410) carried on the existing double circuit towers<sup>38</sup>, the maximum fields will be approximately 7.1 kV/m and 41.6  $\mu$ T.

15. In more than 30 years of study researchers in various scientific disciplines have conducted studies to investigate potential health effects of EMF exposure. These studies include both epidemiology studies and laboratory studies of humans,

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<sup>38</sup> For the final 2.8km run into Woodland Substation, the proposed interconnector is carried on existing double circuit towers. The existing Oldstreet-Woodland OHL is installed on the southern side of these towers. The northern side is currently unused and therefore available for use by the proposed interconnector.

animals, tissues, and cells. Authoritative health and scientific agencies have not concluded that exposures to ELF EMFs at levels encountered in our daily life are a health hazard. While some of the epidemiology studies have reported statistical associations between higher average long-term exposures to magnetic fields and, in particular, childhood leukaemia, the role of chance, systematic error, and confounding by other factors cannot be ruled out as explanations. Moreover, a biological basis for these statistical associations is not supported by studies involving lifelong exposures of laboratory animals to magnetic fields. Similarly, studies of cells and tissues have not confirmed a mechanism by which weak ELF magnetic fields commonly encountered in our environment could have harmful effects by either initiating or promoting cancer.

16. Numerous national and international scientific and health organisations, including the WHO, the IARC, ICNIRP, and PHE in the United Kingdom have reviewed the existing scientific literature to assess the potential health risks arising from this widespread exposure to EMF. Following its most comprehensive in-depth review of the scientific literature on potential health effects related to EMF, the WHO made the following statement “*Based on recent in-depth review of the scientific literature, the WHO concluded that current evidence does not confirm the existence of any health consequences from exposure to low level electromagnetic fields*” (WHO, 2013).
17. Scientifically-based exposure guidelines have been recommended by ICNIRP to protect the public and workers from known effects of EMFs that occur at high levels of exposure, such as nerve and muscle stimulation and annoyance due to micro-shocks. The guidelines incorporate large safety factors to ensure that allowable exposures are far lower than the lowest threshold for confirmed potentially adverse biological effects. ICNIRP also determined that evidence from studies with exposures below these guidelines and from studies of long-term health outcomes “*is too weak to form the basis for exposure guidelines.*” The guidelines developed by ICNIRP form the basis for the EU’s Recommendation (1999/519/EC) which sets out guidelines for member states on limiting the exposure of the public to EMFs in locations where people spend significant time. The EU Recommendation is the guideline applicable in both Northern Ireland and Ireland.
18. The calculations of EMFs provided above demonstrate that even the maximum field levels produced by the proposed 400 kV line, which would be produced only rarely if ever in practice, are below the EU (1999) exposure limits (basic restrictions).
19. In Ireland, consideration of low-cost precautionary measures to minimise exposure to EMFs in siting or line design has been recommended (DCMNR, 2007; WHO, 2007b) and followed in the case of this proposed interconnector (i.e. avoiding residences to the greatest extent possible and minimising EMFs by optimal phasing

of the transmission line where it is supported on double-circuit structures). In Northern Ireland, the specific precautionary measures to be followed are specified in policy and have been followed.

20. In summary, even the maximum EMF levels from the proposed 400 kV line are still below EMF guidelines of both Ireland and Northern Ireland and the EU. Authoritative reviews of scientific research on topics relating EMFs to health of humans and other species do not show that EMFs at these levels would have adverse effects on these populations.

## 18.6 Traffic

21. The operational stage of the proposed interconnector will generate minimal volumes of traffic. The construction stage of the proposed interconnector will generate more traffic, albeit temporary, because the primary means of transporting materials and labour to / from site will be via the existing public road network.
22. Due to the nature of the proposed interconnector, the construction phase will consist of multiple discrete construction sites. Access to the individual sites will generally be achieved via existing field accesses and existing internal tracks where available. A total of 362 temporary accesses are required from the public road network to construct the proposed interconnector.
23. Despite the scale of the proposed interconnector, the volumes of vehicles required to attend each individual construction location along the length of the linear development will be relatively low and this traffic will be spread out over several weeks, the duration it will take to construct individual structures. Due to the length of the proposed line, traffic will be dispersed over a large area during the construction phase, notwithstanding the fact that construction will occur in any one location for a relatively short duration.
24. The construction of the proposed substation in Turleenan, County Tyrone, the extension of the existing substation in Woodland, County Meath and the operations at the proposed construction material storage yards, located at Carn Industrial Estate, Craigavon and also to the south east of Carrickmacross, County Monaghan will result in higher volumes of traffic over longer periods however these traffic flows will not result in congestion on the road network.
25. Heavy vehicles will be used to construct the transmission line. Local and minor roads are particularly sensitive to the increase in heavy vehicles as these roads are typically not designed to accommodate large numbers of these types of vehicles. With the proposed mitigation measures, the residual impacts in terms of disturbance



caused to the local community in relation to noise, vibration, dust and air quality impacts will be minimised or eliminated and will not be significant.

26. A Construction Traffic Management Plan shall be prepared prior to the commencement of construction operations. The objective of this plan will be to minimise the impact caused by the construction stage of the proposed interconnector.

## 18.7 Noise

27. Extensive noise surveys have been conducted around the proposed overhead line route and substation site to establish the existing noise levels. The receiving environment is predominantly rural and the background and ambient noise levels reflect this.
28. Potential noise levels from the construction and operation of the proposed interconnector have been evaluated.
29. It is predicted that the highest noise emissions levels from the proposed interconnector will be that of construction noise of the Turleenan substation, extension of Woodland substation and construction of the overhead line. However, this impact will be short term and of a limited nature. Mitigation measures have been provided to reduce the potential 'worst case' impact from construction noise and the contractor will be required to liaise with the Local Authority and residents throughout the contract. Construction and operation of a temporary construction material storage yard near Carrickmacross has been assessed and mitigation measures have been provided to reduce the potential 'worst case' noise and vibration impacts. The residual impact is not predicted to be significant.
30. The residual impact of construction noise and vibration as a whole, following the implementation of mitigation measures is not predicted to be significant.
31. The overhead line will be subject to an annual survey by helicopter patrol. By way of mitigation, helicopter inspections will be announced in advance in local newspapers and through landowner consultations. The steady rise in noise level as the helicopter is approaching any given point (while following the line route) should minimise any surprise element to the onset of the helicopter noise. This is not expected to cause any significant noise impact, due to the short term and transient nature of the annual survey and the advance notice to landowners.
32. Once complete the operational noise impact of the proposed overhead line route, towers, and substation will be limited to intermittent corona noise and continuous

transformer/plant noise at the substation. There will be no operational phase vibration impacts to sensitive receptors for the proposed interconnector.

33. The line and substation noise emissions have been predicted and assessed and no mitigation is proposed for noise emissions arising from the operational stage of these elements. The predicted levels are below the recommended levels and targets set by the WHO and are thus within acceptable limits with regard to residual impacts for noise and vibration.
34. It has therefore been assessed that the proposed interconnector will not result in any significant noise and vibration effects.

## **18.8 Ecology (Flora and Fauna)**

35. An assessment of the proposed interconnector has been undertaken in accordance with the requirements of the EIA Directive and the respective legislation applicable in Northern Ireland and Ireland.
36. The proposed interconnector will not adversely impact upon populations of European and/or Nationally protected habitats/ species in both jurisdictions; however it does have potential to impact upon local populations of protected fauna.
37. Mitigation measures will be implemented at the construction and operation phase to eliminate or minimise identified impacts. Where impacts are minimised this residual impact is outlined.
38. The level of residual impacts were assessed from an entire project perspective with the highest impact being minor negative to hedgerows / treelines, Wintering birds (Whooper Swans) and Breeding birds (Lapwing). All other impacts are considered negligible.

## **18.9 Soils, Geology and Hydrogeology**

39. An assessment of the proposed interconnector in respect of the ground, geological and hydrogeological conditions has been undertaken in accordance with the requirements of the EIA Directive and the respective legislation applicable in Northern Ireland and Ireland.
40. The nature of the transmission line development dictates that the greatest potential impact for geological impact (including soil, subsoil and bedrock) associated with the development will be in the construction phase. Mitigation measures will be implemented at the construction phase to minimise and/or eliminate impacts.

41. The subsoil underlying the proposed interconnector is primarily composed of unsorted till deposits while minor quantities of soft sediments including peat and alluvial deposits are also located along the proposed interconnector. The construction phase of the proposed interconnector will impact on the ground and geological conditions through the use of temporary access routes and excavations required for the tower bases and the excavations required for the Turleenan substation.
42. The tower locations have been selected to avoid known areas of lacustrine deposits, intact peat and cutover peat where possible. Intact peat was not identified at any tower location along the line route including Cashel Bog. Accordingly, it is considered that the excavations required for the construction of the proposed interconnector would have no adverse impacts on the more sensitive peat ecosystem.
43. It is considered no significant impacts will occur on the geology and groundwater conditions in Ireland or Northern Ireland; accordingly, it is concluded that the proposed interconnector would have no significant transboundary impacts on soils, geology and hydrogeology. With regard to the operational phase of the development, no significant impacts on the local hydrogeological environment are predicted. Any predicted impact on the soils and geology is considered to be Imperceptible.

## **18.10 Water**

44. An assessment of the proposed interconnector has been undertaken in accordance with the requirements of the EIA Directive and the respective legislation applicable in Northern Ireland and Ireland.
45. The construction phase of the proposed interconnector will impact on the water conditions through the use of temporary access tracks and excavations required for the tower bases.
46. The nature of the transmission line development dictates that the greatest potential impact associated with the development will be in the construction phase. During construction the potential impacts to the underlying water environment from the proposed works could, without mitigation, derive from accidental spillages of fuels. Mitigation measures will be implemented at the construction phase to minimise and/or eliminate impacts to previously recorded features and to resolve any unknown features discovered during construction.
47. The tower locations have been selected to avoid known areas of flood plains and river banks where possible. No significant adverse effects are predicted on the

water environment as a result of the construction phase of the proposed overhead line.

48. With regard to the operational phase of the development, no significant impacts on the local water environment are predicted with the implementation of proposed mitigation measures. The predicted impact on the water environment is considered to be long term and Imperceptible.

### **18.11 Air and Climatic Factors**

49. The proposed interconnector has the potential to have positive long term residual impacts on greenhouse gas emissions as it will facilitate further development and connection of renewable energy sources thereby reducing the dependence on fossil fuels with consequent reduction in greenhouse emissions.
50. In terms of dust no significant impacts are predicted following the implementation of good construction practice and implementing appropriate mitigation measures.
51. Traffic emissions themselves will not give rise to significant air quality effects from vehicular emissions.
52. With the implementation of mitigation measures no significant local air quality effects are predicted.

### **18.12 Cultural Heritage**

53. An assessment of the proposed interconnector has been undertaken in accordance with the requirements of the EIA Directive and the respective legislation applicable in Northern Ireland and Ireland.
54. Mitigation measures will be implemented at the construction phase to minimise and/or eliminate impacts to previously recorded features and to resolve any unknown features discovered during construction.
55. While the proposed interconnector will not have a direct physical impact on the upstanding remains of any known archaeological sites or architectural features, it will have such an effect on a number of demesne landscapes. The impact on one of the demesnes landscapes, Brittas, was found to be significant. A further 3 demesne sites will be experience a moderate negative impact in terms of setting.
56. There will be likely significant effects to the setting of a number of features. In summary there will be 24 moderate negative, 7 moderate to significant negative and 6 significant negative impacts to archaeological sites. In addition there will be 3

moderate negative and 1 moderate to significant negative impacts to architectural sites.

57. All other sites in the receiving environment will not be affected by the proposed interconnector or have a slight negative impact.

### **18.13 Landscape**

58. An overhead line of the length and nature of the proposed interconnector will inevitably have landscape and visual impacts. However, considerable efforts have been made in the routeing and design processes to avoid or minimise these impacts as much as possible. Based on the detailed consideration of alternative routes, the respective applicants have developed a route for the proposed interconnector which will result in the least impacts to the landscape and visual resource of the assessed area, given the nature of an infrastructure project of this nature.
59. The route and location of the proposed interconnector was selected based on the results of a number of alternatives studies which examined the environmental, technical and economic constraints present between various route corridors, line route options, and design details. Landscape and visual impacts were two major environmental constraints that influenced the selection of the preferred route corridor, the line route, and the components of (what became) the proposed interconnector.
60. The alternatives studies were therefore the principal means by which the permanent and operational effects of the overhead line and substation have been mitigated.
61. Detailed routeing of the line has sought to achieve the best fit with the landscape using landform and vegetation whilst recognising the technical constraints of the construction and operation of an overhead line.
62. The proposed interconnector will be located within an area that is primarily agricultural, consisting of low rolling hills, shallow valleys and structured fields, which often have overgrown hedgerows and many mature trees.
63. After construction, the towers and overhead lines would remain as significant visual elements in the landscape.
64. Over time, any vegetation cut back affected by construction works will generally re-grow and any new replacement planting will become established. Clearance of vegetation that could fall on the overhead line, general inspections and any repairs will periodically be undertaken, however, the level of activity in the landscape would be greatly reduced to a required minimum.

65. Mitigation measures will reduce visual impacts of the proposed Turleenan substation and will see the embankments, earth bunds and entrance road heavily planted with predominantly native woodland. Over time, as the mitigation landscape matures, views of the substation will be filtered and assimilated back into the local landscape setting.
66. The landscape appraisal indicates that there will be significant adverse impacts upon the landscape of some parts of the assessed area. There will also be significant adverse effects on the visual amenity afforded from many locations from within the immediate area following the line route. However, notwithstanding these conclusions, it is considered that the landscape and visual resource of the wider assessed area along the proposed interconnector will not deteriorate to a significant degree and the overall impact upon landscape and visual amenity in general is therefore restricted to those receptors/areas within close proximity to the towers and overhead line.

## **18.14 Cumulative Impacts and Interactions**

67. An assessment of the likely significant cumulative effects of the proposed interconnector with other developments has been undertaken. Also included in the assessment is a summary of interacting effects of the proposed interconnector between assessment topics.
68. The assessment chapters in this JER (Chapters 4 – 17) contain assessments of the likely significant interacting effects arising from the proposed interconnector. During the assessment process, coordination took place between assessment specialists to ensure that interacting impacts arising from the proposed interconnector were identified, assessed and, where appropriate, mitigated.
69. The assessment of cumulative impacts between the proposed interconnector and other developments has included identification of the other planned developments which have not yet been constructed. This has led to the identification of other overhead line projects. Other developments also include proposed chicken sheds and wind turbines.
70. The cumulative effects are generally predicted to be Not Significant. However there will be separate significant landscape and visual cumulative impacts with the proposed interconnector and the proposed wind turbines at Teevurcher, Raragh, Old Mill Wind Farm (Lisduff), Emlagh Wind Farm, and the future Kingscourt substation.

## Appendix A: Comparison of JER Structure to Consolidated ES and EIS

The purpose of this Joint Environmental Report is to provide a report that covers the whole project and assesses its overall effects, in-line with the EC Transboundary Guidance document (2013). Further information on the proposed interconnector can be read in the published Consolidated ES and EIS for the proposed interconnector. The table below has been provided for reference purposes.

Joint Environment Report Chapter	Overview	Consolidated ES (2013) Chapters	EIS (2014) Chapters
Non-Technical Summary	A summary of the Joint Environmental Report	N/A	N/A
1 – Introduction	General overview of report.	N/A	N/A
2 – Project Description and Purpose	A summary of Project Need and the Project Description.	3 – Need 5 – Project Description	2- Strategic Need For The Project (Vol 3B) 6 - Description of proposed interconnector (Vol 3B) 7 – Construction (Vol 3B)
3 – Alternatives	A summary of the assessed Location and Technological Alternatives for the proposed interconnector.	4 - Alternatives	4 - Consideration of Alternatives – Technology(Vol 3B) 5 - Consideration of Alternatives – Routeing (Vol 3B)
4 - Population - Socio-economics	A summary of the findings for each specialist assessment topic for the overall project.	15 – Socio-economics	2 - Humans Beings (Socio-economics) (Vol 3C and 3D)
5 - Population - Tourism		15 – Socio-economics	4 - Humans Beings (Tourism and Amenity) (Vol 3C and 3D)
6 - Population - Land Use		14 – Community Amenity and Land Use	2 – Human Beings (Population and Economic) (Vol 3C and 3D) 3 - Humans Beings (Land Use) (Vol 3C and 3D)
7 - Material Assets		5 – Project Description 16 – Telecommunications and Aviation Assets	13 - Material Assets (General) (Vol 3C and 3D)
8 – EMF		7 – EMF	8 – EMF General (Volume 3B) 5 - Humans Beings (EMF) (Vol 3C and 3D)

Joint Environment Report Chapter	Overview	Consolidated ES (2013) Chapters	EIS (2014) Chapters
9 – Traffic	A summary of the findings of the ES and EIS for each specialist assessment topic for the overall project.	18 – Transport	14 – Material Assets (Traffic) (Vol 3C and 3D)
10 - Noise		11 – Noise	9 – Air (Noise) (Vol 3C and 3D)
11 – Ecology (Fauna and Flora)		10 – Ecology	6 – Flora and Fauna (Vol 3C and 3D)
12 – Soils, Geology and Hydrogeology		9 - Soils, Geology (and Groundwater)	7 – Soils and Geology (Vol 3C and 3D)
13 – Water		8 - Water Environment 9 – (Soils, Geology and) Groundwater 17 – Flood Risk Assessment	8 – Water (Vol 3C and 3D)
14 – Air and Climatic Factors		6 - Scoping and Consultation	10 and 11 – Air (Quality and Climate) (Vol 3C and 3D)
15 – Cultural Heritage		12 – Cultural Heritage	15 – Material Assets (Cultural Heritage) (Vol 3C and 3D)
16 – Landscape		13 – Landscape and Visual	12 – Landscape (Vol 3C and 3D)
17 – Cumulative Impacts and Interrelationships		19 – Cumulative and Interactions of Impacts	9 – Transboundary (Vol 3B) 10 - Interaction of Impacts and Cumulative Impacts (Vol 3B) 16 – Interrelationships Between Environmental Factors (Vol 3C and 3D)
18 – Conclusions		Summary of findings	N/A



## Appendix B: Confirmed Planning Applications Included in Cumulative Assessment

Based on the scoping selection process, the following confirmed planning applications have been considered within the cumulative assessment (please see Consolidated ES (Figure 19.1) and EIS for location):

### Consolidated ES:

- M/2011/0652/F Erection of 1 no. 50 kW wind turbine with a hub height of 36.5 m to supply farm business;
- M/2008/0797/F Erection of 1 no. wind turbine;
- M/2010/0412/F Proposed installation of a GAIA (11kW) wind turbine on a 18 m high lattice tower type mast;
- M/2010/0589/F 24.8 m height 11kW white wind turbine with galvanised steel lattice tower for domestic use;
- M/2011/0465/F Erection of wind turbine (32.3 m hub height 30 m blades);
- M/2010/0913/F Erection of a Wind Turbine (50 kW Max) With a Tower height of 30 m;
- M/2009/0940/F Proposed wind turbine 1 Gaia Wind 11 kW turbine (18.3 m lattice tower construction);
- M/2008/0464/F Proposed 24 m High (10kW) domestic wind turbine;
- O/2011/0364/F Proposed erection of wind turbine with 30 m hub height and 30 m rotor diameter with a maximum output not exceeding 250 kW;
- O/2006/1142/F Erection of 33 m high wind turbine;
- O/2010/0406/F Installation of 50 kW wind turbine on 36.6 m high free standing steel mast;
- O/2010/0646/F Proposed new 20kW wind turbine on 18 m mast;
- O/2011/0195/F Erection of a single 250 kW wind turbine of 40 m tower height (55 m to tip) and control room;
- O/2007/0796/F Erection of 1 No. wind turbine 33 m high with associated site works;
- O/2010/0212/F 600 mm diameter radio transmission dish mounted on steel pole fixed to existing facade of building;
- O/2007/0374/F 15 m high 6 kW proven wind turbine for domestic use at 90 Clay Road, Keady;
- O/2007/0449/F Erection of a 15 m High 6 kW wind turbine for domestic and agricultural use at 44 Tievenamara Road;
- O/2011/0401/F Proposed 2 No. free range poultry sheds with 4 No. feed bins;
- O/2011/0539/F Replacement poultry shed with 2 No. feed bins to contain 35,000 egg laying hens in enriched cages;
- O/2011/0412/F Proposed free range poultry shed generator store and feed bin (amended scheme to include 6 passing bays);

- M/2012/0340/F Proposed 2 No. select farm poultry sheds 4 No. feed bins and an ancillary building with biomass boiler, standby generator, office and changing facilities (each poultry shed will contain 25,850 chickens);
- O/2012/0234/F Erection of 1 no. chicken house (22,600 birds - high welfare broilers);
- O/2003/0276/A4 Proposed new chicken house;
- O/2010/0490/F Proposed free range poultry shed generator store and feed bin;
- M/2010/0717/F Proposed 2 No. poultry houses (each containing 23,000 chickens) 4 No. feed bins and an office, changing & generator building;
- M/2008/0143/F Proposed chicken house (planning permission expired May 2013);
- O/2009/0807/F Erection of 1 No. free range organic chicken house;
- O/2009/0805/F Erection of 1 No. free range organic chicken house;
- O/2009/0804/F Erection of hen house;
- M/2010/0487/F Proposed additional free range poultry shed and feed bin (to contain 6,000 free range egg laying hens);
- 10416 (Monaghan County Council Planning Reference) Four wind turbines of hub height 85 m and associated development (This planning application redesigns the permitted wind farm granted on site under Reg. Ref 04/1207/ABP ref PL18.218484);
- 10480 (Monaghan County Council Planning Reference) 1) demolish existing farm buildings; (2) erect a poultry unit, manure store and egg store; (3) insert a holding tank and two number meal bins; and,
- 11358 (Monaghan County Council Planning Reference) To erect a second poultry rearing house.

**EIS:**

PLANNING APPLICATION REFERENCE	PLANNING AUTHORITY	NAME OF APPLICANT	DEVELOPMENT	ADDRESS OF THE PROPOSAL	DECISION / STATUS	DATE OF FINAL GRANT
09447	Cavan County Council	ESB Networks	To build a 38 kV overhead line from existing Shercock 38 kV Station	Shinan, Shercock and across the townlands Lecks, Croley, Lisdrumskea, and to a point at Lisdrumfad, Shercock	Grant with conditions	22/07/2010
09561	Monaghan County Council	ESB Networks	To build a 38 kV overhead line from existing Shercock 38 kV Station	Shinan, Shercock and across the townlands Lecks, Croley, Lisdrumskea, and to a point at Lisdrumfad, Shercock	Grant with conditions	23/06/2010
PL17.PA0013	Meath County Council	College Proteins	Biomass Combined Heat And Power (CHP) Plant	College Road, Nobber, County Meath	Grant with conditions	28/02/2013
PL25.VA0013	Westmeath County Council & Meath County Council	EirGrid	Proposed 110 kV Circuit From Mullingar 110 kV Station, Co. Westmeath To Kinnegad 110 kV Station At Killaskillen Townland, Co. Meath	County Westmeath and County Meath	Grant with conditions	10/01/2013
PL17.PA0026	Meath County Council	Indaver Ireland Limited	Amendments to existing Permissions for Waste Energy Plant	Carranstown, Duleek, County Meath	Grant with conditions	04/02/2013
10485, 12306, 13125, 13206 and 13207	Monaghan County Council	Gaeltech Energy Developments Ltd	Reg. Ref. 10485: Construction of 8 no. wind turbines of hub height 70m (also referred to as the Old Mill Wind Farm in this report).	Townlands of Carrickatee, Tossy, Lisduff, Loughmourne, Corderrybane, Greagh, Drumlane, Drumguillew Upper, Shane,	All granted with conditions	Reg. Ref. 10485: 20/11/2011 Reg. Ref. 12306:

PLANNING APPLICATION REFERENCE	PLANNING AUTHORITY	NAME OF APPLICANT	DEVELOPMENT	ADDRESS OF THE PROPOSAL	DECISION / STATUS	DATE OF FINAL GRANT
			<p>Reg. Ref. 12306: Amendments to Reg. Ref. 10485.</p> <p>Reg. Ref. 13125: Single wind turbine with a hub height of 80m.</p> <p>Reg. Ref. 13206: 38 kV overhead line from a substation in Lisduff to a substation in Killycard, County Monaghan.</p> <p>Reg. Ref. 13207: new 38 /20 kV wind farm substation and associated works at Lisduff, County Monaghan.</p>	Tullycarragh, Derryisland, Monagar, Muldrumman, Tullyskerry and Killycard.		<p>27/11/2012</p> <p>Reg. Ref. 13125:17/07/2013</p> <p>Reg. Ref. 13206: 13/01/2014</p> <p>Reg. Ref. 13207: 30/09/2013</p>
O9/270 /PL02 .236608	Cavan County Council	PWWP Developments Limited	Wind farm of up to seven turbines, anemometry mast, electrical substation, access tracks, underground cabling and ancillary works.	Raragh and Corrinshigo, Kingscourt, County Cavan.	Grant with conditions	15/11/2010
Ka / 120679	Meath County Council	SSE Renewables Ireland Ltd.	Five wind turbines of up to 80m hub height and up to 82.5m rotor diameter with a total tip height not exceeding 121.25m, a transformer and crane handstand area at each turbine, underground electrical	Teevurcher and Agheragh, Tierworker, Kells.	Granted	06/06/2013

PLANNING APPLICATION REFERENCE	PLANNING AUTHORITY	NAME OF APPLICANT	DEVELOPMENT	ADDRESS OF THE PROPOSAL	DECISION / STATUS	DATE OF FINAL GRANT
			and communication cables linking the turbines, internal site tracks, a permanent meteorological mast 80m high, drainage works, a substation and associated equipment and control building with a wastewater treatment system and associated works.			
PA0038	An Bord Pleanála	North Meath Windfarm Limited	<p>Construction of 3 windfarm clusters comprising <i>inter alia</i>: a combined total of 46 no. wind turbines with a maximum tip height of up to 169 metres and associated turbine foundations, hardstanding areas and drainage; 1 meteorological mast (80 metres in height); a 110 kV substation; 6 no. borrow pits, new entrances and site tracks; cabling between turbines and on-site substation and the existing Gorman substation; and all associated site development works.</p> <p>Details of the proposed development including an EIS are available at <a href="http://www.emlaghwindfarm.ie">www.emlaghwindfarm.ie</a>.</p>	<p>County Meath</p> <p>It is located in the vicinity of the North South 400 kV Interconnector between Towers 282 and 2950. Refer to EIS.</p>	An application for planning approval was lodged with An Bord Pleanála on 6 <sup>th</sup> October 2014.	N/A

PLANNING APPLICATION REFERENCE	PLANNING AUTHORITY	NAME OF APPLICANT	DEVELOPMENT	ADDRESS OF THE PROPOSAL	DECISION / STATUS	DATE OF FINAL GRANT
N/A	N/A	National Transport Authority	Phase II of the Dublin to Navan rail link. The Railway Order was substantially complete but was deferred by the Infrastructure and Capital Investment 2012-2016 Medium Term Exchequer Framework (November 2011)	Dublin to Navan rail link.	On hold	N/A
N/A	N/A	NRA	Leinster Orbital Route (LOR) - in the vicinity of Trim	Feasibility / On hold		N/A
N/A	Cavan and Meath County Council	NRA	The improvement / replacement of a section of the N3	From a location south of the Cavan / Meath County boundary (in the townland of Derver, County Meath), to an appropriate location on the existing network between the townlands of Thomas Court or Drumroosk and Kilnaleck, Butlersbridge County Cavan, a potential distance of 46km	Suspended	N/A
6. N/A	Louth and Meath County Council	NRA	The N52 Ardee bypass consists of 4.48km of reduced single carriageway roadway and commences to the west of Ardee running east to the N2 road North of Ardee. The scheme includes two river	North of Ardee, County Louth	Planning Stage	N/A

PLANNING APPLICATION REFERENCE	PLANNING AUTHORITY	NAME OF APPLICANT	DEVELOPMENT	ADDRESS OF THE PROPOSAL	DECISION / STATUS	DATE OF FINAL GRANT
			crossings of the River Dee and River Garra, a staggered junction at Silver Hill road and a T-junction with the Mullinstown Road.			
N/A	Monaghan County Council	NRA	Upgrade approximately 28km of the N2 in north County Monaghan between the village of Clontibret and the border of County Tyrone.	Clontibret to the border of County Tyrone.	Suspended	N/A

## **Appendix C: Tyrone - Cavan Interconnector Consolidated ES (2013)**

NB In response to the submitted Draft Application File (December 2014), which included a Draft JER, An Bord Pleanála (by letter dated 16th December 2014) has requested that the: “consolidated Environmental Statement lodged in conjunction with planning applications for that section of the proposed development in Northern Ireland be provided and accompany the JER as an Appendix”.

EirGrid and SONI have therefore included the Consolidated ES as Appendix C of this JER. The JER is being submitted to the planning authorities in both Ireland and Northern Ireland. In circumstances in which the Consolidated ES has already been submitted to Planning NI, the Consolidated ES has not been appended to the version of the JER submitted to Planning NI as to do so would be unnecessary duplication of a report previously submitted and consulted upon in Northern Ireland.

DRAFT