5 ROUTE ALTERNATIVES

5.1 INTRODUCTION

1 This section of the Environmental Impact Statement (EIS) outlines the main alternatives considered in the process of identification of the route alignment of the proposed development, and an indication of the main reasons for the final route alignment chosen by EirGrid, taking into account the effects on the environment. It describes the process of detailed route selection for the proposed development, in both Ireland and Northern Ireland, and options evaluated as part of a process to determine the final route for the proposed development.

2 The consideration of route alternatives has occurred over a considerable period of time. This has occurred contemporaneously with the consideration of transmission and technology alternatives, as set out in **Chapter 4** of this volume of the EIS, whilst continuously having regard to the strategic need for, and objectives of, the proposed development. The overall process has included ongoing review in order to ensure that the conclusions drawn by the respective applicants have resulted in the optimum route for the interconnection project.

3 This consideration of alternatives in respect of the route for the proposed development focuses primarily on a 400 kV High Voltage Alternating Current (HVAC) overhead line (OHL), as set out in **Chapter 4** of this volume of the EIS.

4 This chapter considers the main alternatives regarding the location of the proposed development. The strategic approach adopted by EirGrid in the route selection process is best understood as occurring in a number of phases. Each of these phases, including the re-evaluation of that phase, are described separately in this chapter.

5 The phased approach to route selection is summarised as follows:

Phase 1:

- **To identify Broad Study Area(s)** on the island of Ireland within which the proposed interconnector could best be developed in order to meet the overall objectives of the development while having regard to strategic technical and environmental constraints. This also entailed identification of 'Project Study Areas' i.e. the portions of the proposed interconnector occurring within Ireland and Northern Ireland (see **Section 5.2**);

Phase 2:

- **To identify Feasible Corridors** and a preferred corridor (including identification of an indicative potentially feasible route within each corridor), within the identified project

study area, following a strategic analysis of technical and environmental constraints (see **Section 5.3**);

- **To identify a Preferred Route Corridor** (of an indicative width, for comparative purposes, of approximately 1km wide) following a qualitative evaluation of the identified feasible route corridors, against a comprehensive set of technical, environmental, community and other criteria (see **Section 5.3**); and

Phase 3:

- **To identify a Preferred Line Design** – an 'Indicative Line Route' within the identified 'Preferred Route Corridor'. This indicative route formed the basis for the final site-specific line design (including the positioning of tower structures), which would be subject of the application for planning approval (i.e. the proposed development as described in **Chapter 6** of this volume of the EIS) (see **Section 5.4**).

6 The overall route selection process, was conducted by a multi-disciplinary technical, environmental, stakeholder, and strategic planning project team, and is considered to have concluded with the identification and selection of a route that provides the best balance between often competing community, technical, environmental and other criteria.

7 This chapter of the EIS has had detailed regard to the considerable body of work undertaken for the previous application for planning approval to An Bord Pleanála in 2009. It also has had regard to the extensive work carried out as part of the comprehensive re-evaluation of the portion of the proposed interconnector located within Ireland following the withdrawal of that previous application. The re-evaluation process is documented in detail in the *Final Re-evaluation Report* (April 2013). The re-evaluation process included *inter alia* a review of the route alternatives, and other main alternatives, considered for the previously proposed development.

8 This work is detailed in the following publications and summarised in the following sections where relevant:

- *North-South 400 kV Interconnection Development Preliminary Re-evaluation Report* (May, 2011);
- *North-South 400 kV Interconnection Development Final Re-evaluation Report* (April, 2013); and
- *North-South 400 kV Interconnection Development Preferred Project Solution* Report (July, 2013).

9 These reports are provided in **Volume 3B Appendices.** Other background / historic reports and reference material, particularly those published by or on behalf of EirGrid, referred to in this Chapter, are provided in **Volume 3B Reference Material**. The Bibliography at the end of this volume of the EIS identifies those reports and material included in **Volume 3B Reference Material.**

5.2 PHASE 1: IDENTIFICATION OF BROAD STUDY AREA(S) FOR THE PROPOSED DEVELOPMENT

10 It is important to note that the proposed development originated as two separate projects, a need to establish second interconnector and the need to reinforce for the reliability and supply of electricity of the transmission system in the north-east area of Ireland. The two projects are evaluated separately for Phase 1 in **Section 5.2.1** and **Section 5.2.2** for clarity and for legacy reasons.

5.2.1 Background to the Identification of the Broad Study Area for a Second Interconnector

5.2.1.1 Broad Study Area Alternatives for a Second Interconnector

11 Phase 1 included the identification of a 'Broad Study Area' within which to route the planned second interconnector. This 'Broad Study Area' derived from initial technical studies undertaken jointly by the respective applicants over the period from 2001-2004. The primary purpose of these studies was to jointly determine best options for the selection of transmission system connection points, the geographic positioning of all infrastructure needed for an additional further interconnection, and to quantify the potential improvements in transmission capacity and system security that would be provided by various interconnection solution options. The conclusions of the technical studies on the identified potential strategic interconnection options were set out in a joint report *Additional Interconnection between Northern Ireland and Republic of Ireland – Selection of Preferred Option* (Oct 2005).

12 A joint Steering Committee, comprised of members from the respective applicants, reviewed the proposed interconnection options. The joint Steering Committee identified four potentially feasible strategic interconnection options (see **Figure 5.1**), which were subject to technical investigation, with a high-level feasibility assessment of associated issues, including environmental and economic constraint analysis.

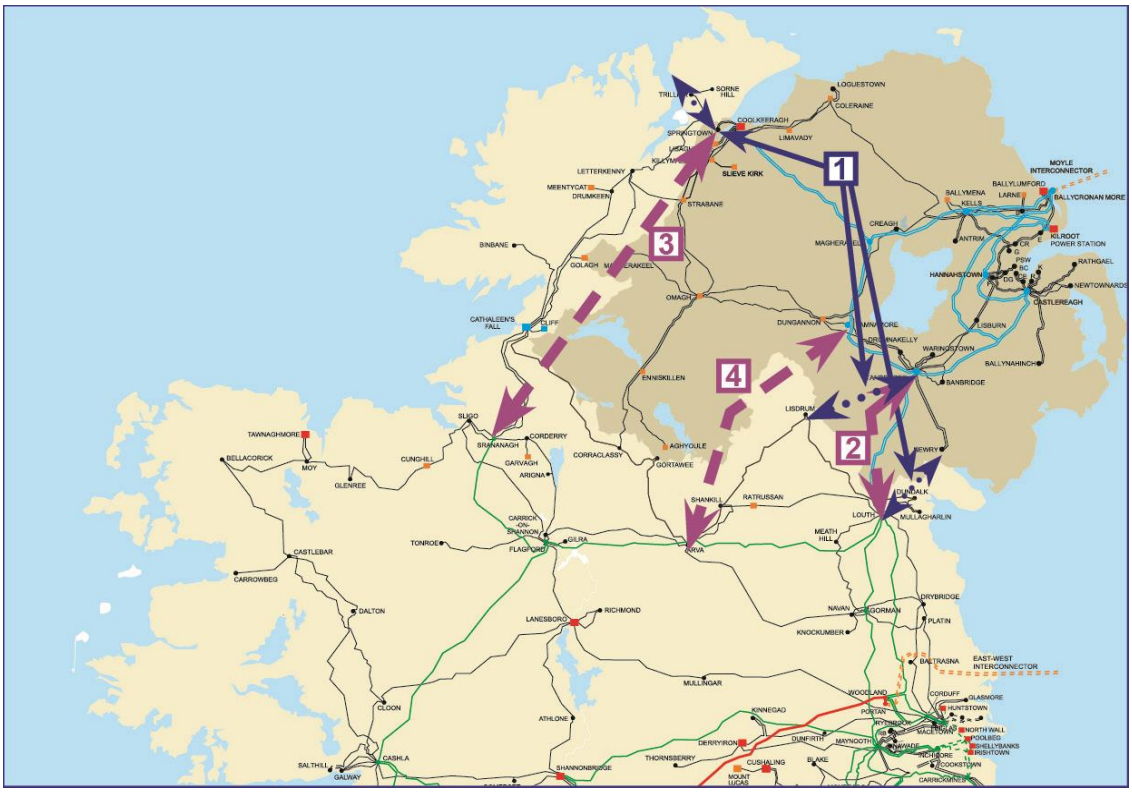

Figure 5.1: Potential Strategic Interconnection Options

(NB: arrows are indicative of the Strategic Options, but not of any particular routing solution)

13 The four potential connection options identified by the respective applicants are summarised below:

- **Option 1: Multiple 110 kV Development**
  This option consisted of development of 110 kV transmission lines between the following existing substations:
  - Coolkeeragh Substation, County Derry – Trillick Substation, County Donegal;
  - Louth Substation, County Louth – Newry Substation, County Down; and
  - Tandragee Substation, County Armagh – Lisdrum Substation, County Monaghan.
- **Option 2: Eastern Study Area**
  This option was primarily based on reinforcing the existing double circuit interconnection between substations at Tandragee, County Armagh, and Louth, County Louth, by constructing a third circuit, operated at either 275 kV or 400 kV, along or to the east of the alignment of the existing north-south interconnector.

- **Option 3: Western Study Area**
  This option was based on a new 275 kV transmission line between substations at Coolkeeragh, County Derry and the planned 220 kV station at Srananagh, County Sligo.

- **Option 4: Mid-Country Study Area**
  This option was based on a new 275 kV or 400 kV circuit between a new substation in the vicinity of Drumkee, County Tyrone and potential connection point at an existing substation at Arva, County Cavan.

14 The next stage in the process was to evaluate these identified broad study area options, in order to identify a preferred study area (or project study area) within which subsequent route corridor options might best be identified.

15 The conclusions for the technical studies were set out in a joint report *Additional Interconnection between Northern Ireland and Republic of Ireland – Selection of Preferred Option* (Oct 2005). In this regard, Option 1 and 3 would not increase the transfer capability in any direction and were not brought forward for further investigation. Option 2 and Option 4 did increase the transfer capability and were proposed for further investigations including a high-level feasibility assessment of associated issues, including environmental and economic constraint analysis.

5.2.1.2 Preferred Broad Study Area Alternatives for a Second Interconnector

16 The two identified preferred 'Strategic Interconnection Options' (Option 2 and Option 4) were both contained within a geographical area where the northern boundary was defined by the existing 275 kV double circuit OHL between Tandragee and Dungannon, and where the southern boundary was defined by the existing 220 kV OHL between Louth and Flagford.

17 NIE and ESB National Grid jointly agreed a scope of works for undertaking environmental, technical and economic feasibility studies of the identified preferred broad study area alternatives. The outcome of the investigations were set out in the following documents:

Option 2: Eastern Study Area

- ESBNG, *Louth-Tandragee 275 kV Feasibility Study (South of the Border)* (2005); and
- NIE, *Tandragee–Louth 275 kV Feasibility Study* (2005).

Option 4: Mid-Country Study Area

- ESBNG / NIE, *Arva–Drumkee 275 kV Feasibility Study* (2004);
- ESBNG / NIE, *Drumkee–Kingscourt 275 kV Feasibility Study (South of the Border)* (2005); and
- NIE, *Drumkee-Kingscourt 275 kV Feasibility Study* (2005).

Option 2: Eastern Project Study Area

18 Two potential options within the Eastern Study Area were identified which minimised identified potential environmental impact. These are described below and illustrated in **Figure 5.2.**

19 **Option 2(a):** Reinforce the existing Louth-Tandragee Interconnector. This option would entail the construction of a third circuit along or adjacent to the general alignment of the existing double-circuit (meaning two circuits on a single set of towers) north-south interconnector. This option would increase transfer capacity in both directions. However, given that this option would most likely be located adjacent to, or otherwise closely follow, the alignment of the existing interconnector, there remained a consequent significant risk of a single event causing a simultaneous outage of all three interconnector circuits. This was a key technical constraint of this option.

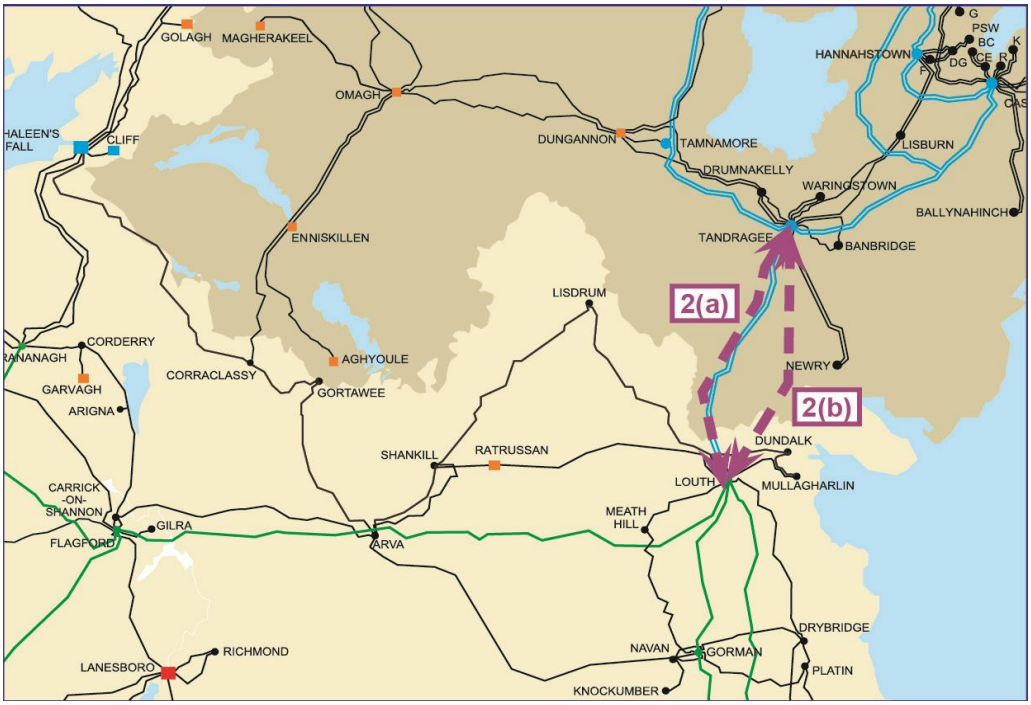

Figure 5.2: Options 2(a) and 2(b)

(NB: arrows are indicative of the Strategic Options, but not of any particular routing solution)

20 **Option 2(b):** A new Louth-Tandragee Circuit. This option would entail construction of a new circuit to the east of the existing north-south interconnector alignment, passing between Drumilly Mountain and Sturgan Mountain to avoid the populated area around Newry. This option passed through the Ring of Gullion Area of Outstanding Natural Beauty (AONB), with resulting significant constraints regarding landscape and visual impact.

Option 4: Mid-Country Study Area

21 Two potential options were identified for these areas that minimise potential environmental impact. These are described below and illustrated in **Figure 5.3.**

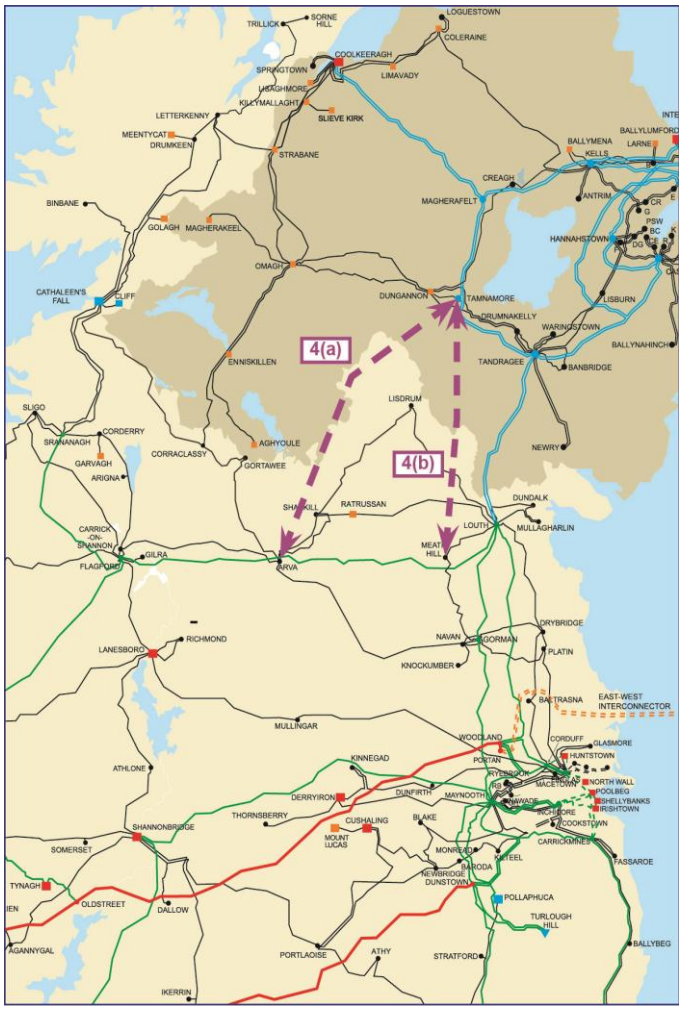

Figure 5.3: Options 4(a) and 4(b)

(NB: arrows are indicative of the Strategic Options, but not of any particular routing solution)

22 **Option 4(a):** New circuit between Drumkee and Arva. This option was capable of linkage to the existing strategic east-west Flagford-Louth 220 kV line; however, the option did not compare favourably with the option between Drumkee and Kingscourt (see below) in terms of route length and transmission synergy.

23 **Option 4(b):** New circuit between Drumkee and Kingscourt. This option originated in Drumkee, and extended southwards avoiding the Armagh Green Belt. It was determined that this option would be capable of accommodating the nature and extent of planned development, albeit with careful attention to detail, such as siting of towers, particularly in the vicinity of Tassagh, Aghavilla, the County Water River and the Armagh Green Belt. This option did not cross any designated landscapes or any land above 150m, it was also shorter in distance than Option 4(a), and ensured synergy with the planned reinforcement of the north-east area (refer to **Section 5.2.3**).

24 The technical and environmental studies carried out jointly by ESBNG and NIE identified Option 4(b) as the preferred broad study area within which to route the proposed second interconnector. This is set out in the ESBNG and NIE joint report *Additional Interconnection between Northern Ireland and Republic of Ireland – Selection of Preferred Option* (October 2005).

5.2.2 The Identification of Broad Study Area Alternatives for a New Circuit to Reinforce the North-East Area of Ireland

25 As noted in **Section 5.2**, separate (though concurrent) to the process of identification of the alignment of the proposed interconnector, ESBNG was undertaking a project with the objective of ensuring greater security and reliability of electricity transmission in the north-east area of Ireland (extending between Dublin and Louth). Network analysis for this area indicated that the network was approaching its capacity with the potential for future thermal overloads and widespread low voltages.

26 Two strategic alternatives were identified by ESB National Grid, as identified in **Figure 5.4** and summarised below.

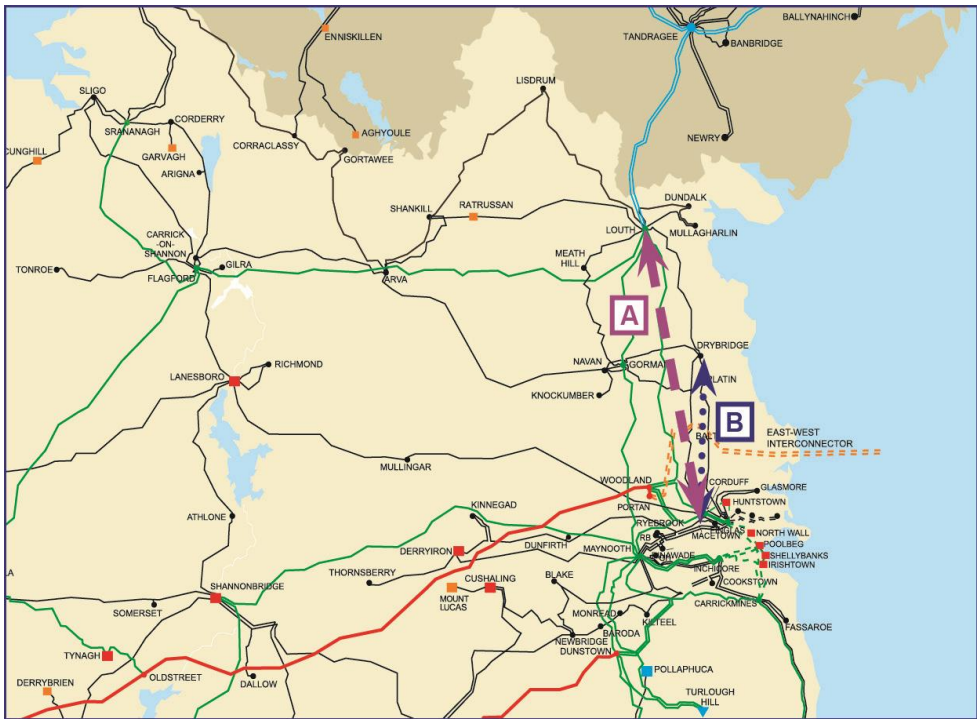

Figure 5.4: Strategic Alternatives for Transmission Reinforcement in the North-East

(NB: arrows are indicative of the Strategic Options, but not of any particular routing solution)

5.2.2.1 Broad Study Area Alternatives for Transmission Reinforcement in the North-East

27 The broad study area alternatives for transmission reinforcement in the north-east of Ireland are summarised below:

- **Option A: New 220 kV Transmission Circuit**
  Several variations of reinforcement of the north-east area by means of a new 220 kV transmission circuit were considered, with all existing substations within the region identified as potential connection points. In particular, in the Greater Dublin Area, the existing substations of Corduff, Finglas and Woodland were considered as southern nodes, while the existing substations of Louth and Gorman, as well as a potential new 220 kV substation located in the vicinity of demand, were considered as alternative northern termination points.

- **Option B: Uprating of Existing 110 kV Circuits and Reactive Support**
  This option consisted of uprating the following existing 110 kV transmission circuits, which extend between the Dublin area, and the north-east area:

  - Corduff – Platin 110 kV line; and
  - Corduff – Drybridge 110 kV line.

28 In conjunction with these 110 kV upratings, a substantial amount of reactive support, such as substation capacitors or SVC (Static Var Compensation), would require to be installed in the north-east area to deliver a technically acceptable solution.

5.2.2.2 Preferred Broad Study Area Alternatives for Transmission Reinforcement in the North-East

29 Following the identification of potential technical reinforcement options within the north-east area of Ireland, a process of environmental evaluation of the broad study area options was undertaken in 2002. The outcome of this assessment is detailed in the feasibility study *North East 220 kV Reinforcement Project – Initial Feasibility Study– Final* (2002) prepared by ESB International (ESBI).

30 This feasibility study considered potential routes in the area between existing 220 kV lines in the north-east area and the coast line, as this would provide a more direct route to the demand centres in the area, and subsequently reduced new circuit length. As noted above, it also assessed the merit of uprating existing 110 kV circuits in the area. A summary of the findings in respect of the identified options is set out below.

Option A: New 220 kV Transmission Circuit

31 This option was divided into two sub options: **Option A1,** comprising an easterly route between the identified node points; and **Option A2** comprising a westerly route (see **Figure 5.5**).

32 **Option A1 – Easterly Option**: All variations of this option were technically acceptable. However, the environmental findings in the feasibility study identified that all eastern routes between Dublin and Drogheda were problematic, in that they were located close to the most densely populated areas along this part of the east coast, and traversed, or were immediately proximate to, designated Natural Heritage Areas (NHAs), Special Protection Areas (SPAs) and Highly Scenic Areas. The study concluded that the construction of a new 220 kV double circuit line in this area is not feasible, having regard to its potential visual impact on sensitive landscapes. While it was considered that a single circuit 220 kV line could be visually absorbed into the landscape, it would not on its own, achieve the level of reinforcement required to meet the demand as identified at that point in time in the north-east area. In addition, any new route served by the existing north Dublin substations of Corduff and Finglas would require a crossing within the environmental and heritage landscape of the River Boyne at Drogheda, together with visual and other environmental impacts.

33 **Option A2 – Westerly Option:** All the variations of this option were technically acceptable. Refer to **Section 5.2.3**.

Option B: Uprating of Existing 110 kV Circuits and Reactive Support

34 The technical studies identified this option as a solution which would remedy the limitations of infrastructure in the north-east area in the medium term only. It would, however, not be a long term solution for the north-east area, as it would not provide the desired transfer capacity or the required additional circuit into the area to secure electricity supply. It should be noted that this option has subsequently been implemented in the transmission system to remedy the identified limitations in the north-east area in the short term, prior to a longer term reinforcement solution being implemented (see **Figure 5.5**).

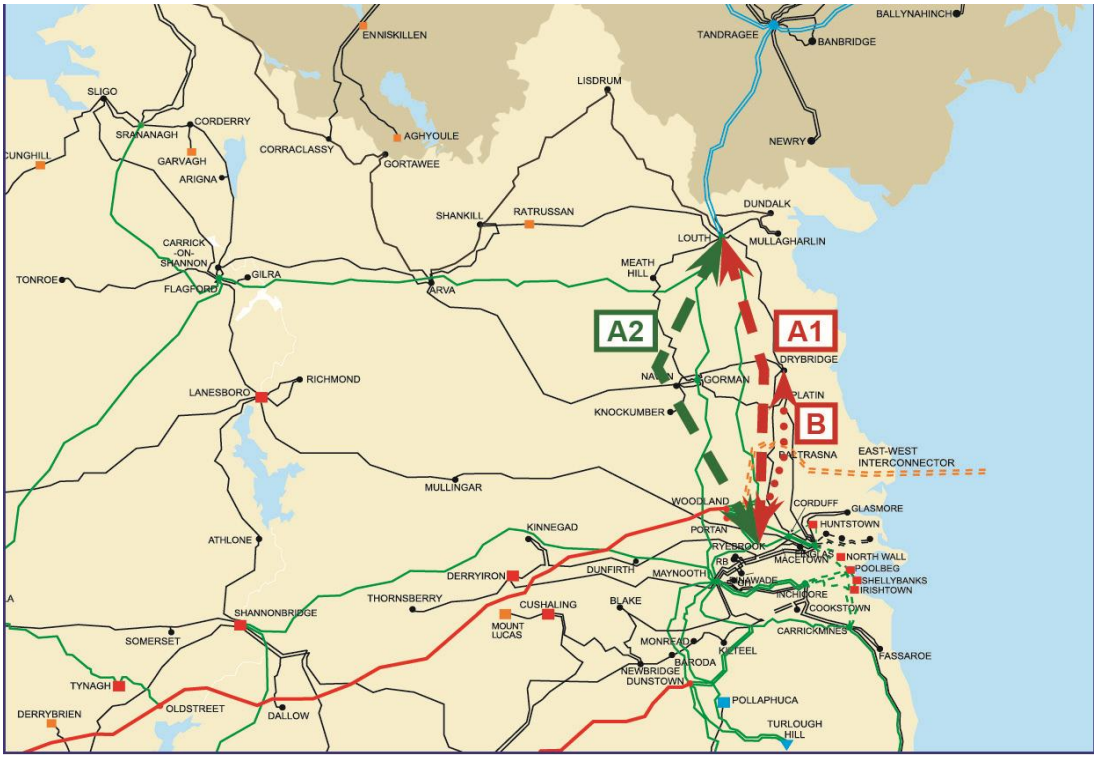

Figure 5.5: Potential Options (A1, A2 and B)

(NB: arrows are indicative of the Strategic Options, but not of any particular routing solution)

35 The evaluation studies, as summarised, confirmed that Option A2 (Western new 220 kV transmission circuit) was the preferred broad study area within which to reinforce security and reliability of electricity transmission in the north–east area of Ireland; this was primarily on the basis of avoiding highly sensitive environmental and settlement areas.

5.2.2.3 Further Consideration of an East of Navan Project Study Area Alternative

36 Some years subsequent to these investigations, EirGrid was advised by An Bord Pleanála, during formal pre-application consultation in respect of the previous application for the Meath-Tyrone 400 kV Interconnection Development, to present a full consideration and robust

examination of a wider project study area, incorporating that area east of Navan to the eastern coastline, taking into account social and environmental constraints (see **Figure 5.10**). This analysis was presented in the Socoin / Tobin Response to An Bord Pleanála – *Kingscourt to Woodland Route Comparison Report* (December 2008). This study confirmed the previously identified Western Route Option A2 project study area (i.e. to the west of Navan) as the preferred project study area for the southern portion of what, by this stage, had become a single project (see **Sectio**n **5.2.3**).

37 The constraints to the east included *inter alia:* high population density particularly concentrated in the settlements along the coastline, including at Drogheda; widespread ribbon development extending from those coastal settlements east of the M1 Motorway; potential to affect the visual amenity and setting of the Brú na Bóinne Complex (an Annex 1 World Heritage Site); the existence of a number of SPA / NHAs; and likely additional environmental impact and cost implications deriving from additional route length.

5.2.3 Opportunity to Link Strategic Transmission Projects

38 As highlighted in **Figure 5.6**, although separate projects, with – at that time – separate rationales, study teams etc., it was becoming clear that the preferred broad study area alternatives for the second interconnector project, and those for the reinforcement of transmission infrastructure in the north-east area, had a certain extent of potential overlap – at the southern end of the former, and the northern end of the latter. This provided a sound basis to investigate the synergies between the two projects, and in particular, the potential merits and benefits of linking the two projects. It emerged through further analysis that a single alignment transmission infrastructure project between the transmission systems of Ireland and Northern Ireland offered an appropriate solution for both additional interconnection, and for ensuring a secure and reliable supply of electricity in the north-east of the country. Consequently, additional studies were undertaken to identify a potentially suitable common connection point between the two projects

39 Given that the existing Flagford–Louth 220 kV circuit is a major part of the existing electricity infrastructure serving the north-east area, various potential nodal points (a new substation) along this existing circuit were examined, with a view to identifying an optimum interface area between the two projects. In addition to this, ongoing technical analysis included *inter alia* examining the potential for the planned second interconnector to link the most robust parts of the Ireland and Northern Ireland transmission networks. In Ireland, the strongest node on the transmission network in this area is Woodland Substation. In Northern Ireland, NIE separately identified that a node in the vicinity of Drumkee, County Tyrone, would constitute the most robust part of that network. As a result, it emerged that the preferred overall project study area for any such combined project was between Drumkee (Turleenan), Kingscourt and Woodland.

40 Concurrent with this, other studies examined the potential performance increase of the total development being constructed at 400 kV.

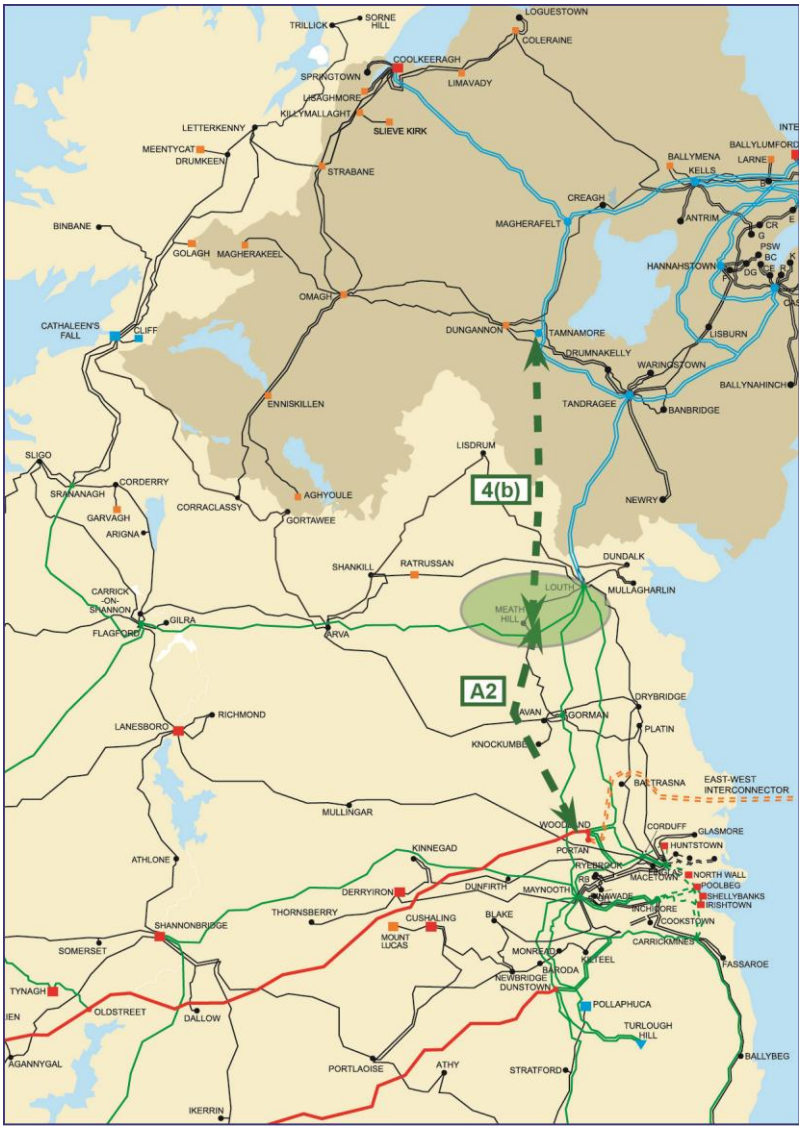

Figure 5.6: Opportunity for Strategic Linkage Between the Second Interconnector Project Option 4(b) and Transmission Reinforcement in the North-East Project Option A2 – at a Location along the Existing Flagford-Louth 220 kV Circuit

(NB: arrows are indicative of the Strategic Options, but not of any particular routing solution)

5.2.4 Re-evaluation of the Preferred Broad Study Area Alternatives

41 The re-evaluation process subsequent to the withdrawal of the previous application for statutory approval of the Meath-Tyrone 400 kV Interconnection Development included confirming the applicability, or otherwise, of the previously identified preferred broad study area alternatives within Ireland for the overall project.

42 As part of its re-evaluation, EirGrid considered updated need and technical considerations, environmental constraints and other information gathered since the original identification of the project's broad study area. The findings of the re-evaluation process are detailed in the *Final Re-evaluation Report* (April, 2013) contained as **Appendix 1.2**, **Volume 3B Appendices**, of the EIS.

5.2.4.1 Re-evaluation of the Points of Connection

43 During the re-evaluation process, EirGrid reviewed the effectiveness of the previously identified preferred broad study area alternatives in respect of the proposed interconnector in meeting the requirements of the project. Based on this re-evaluation, EirGrid reached the following key conclusions regarding the most appropriate points of connection of a new north-south interconnector to the existing transmission networks in Ireland and Northern Ireland:

- In Northern Ireland, the northern terminus of the proposed interconnector will be at a planned new substation at Turleenan in County Tyrone; and
- The existing 400 kV Woodland Substation in County Meath should be the southern terminus for the proposed interconnector.

44 The previous proposal included an intermediate substation on the proposed Turleenan-Woodland 400 kV OHL at a nodal location in the vicinity of the existing Flagford-Louth 220 kV OHL. As this intermediate substation is not now expected to be required within the next ten years (refer to **Chapter 2** of this volume of the EIS) it was decided, in accordance with proper planning and sustainable development, that such a substation would not be included in the new application for approval of the proposed development. However, it is still anticipated that this substation will be required at some future point in time, and its location remains most appropriately in the vicinity of the intersection of the proposed development and the existing Flagford-Louth 220 kV OHL. This is considered further in **Chapter 10** of this volume of the EIS. The conclusions regarding the project connection points formed the basis for the confirmation of the project study areas within which to route the proposed development (see **Section 5.2.5**).

5.2.4.2 Re-evaluation of Technical and Environmental Considerations in respect of the Broad Study Area

45 The re-evaluation of the broad study area alternatives for the project occurred in the context of the connection point parameters outlined at **Section 5.2.4.1**, while also having regard to normal practice in routing linear transmission infrastructure which is to seek the shortest environmentally and technically acceptable route between identified connection points.

46 In summary, having reviewed the broad study areas previously considered in relation to the proposed development, including the additional study area east of Navan, the additional submissions and other information available to EirGrid since June 2010, no new significant environmental or other relevant constraints, arose during the re-evaluation process which merited consideration of alternative or additional broad study areas within which to route the proposed development. The only significant technical issue which did arise was the decision not to proceed at this juncture with the intermediate substation in the vicinity of the point of intersection of the new circuit with the existing Flagford-Louth 220 kV OHL.

47 Following the re-evaluation process EirGrid concluded that the proposed interconnector between the existing Woodland Substation, County Meath, and the planned Turleenan Substation, County Tyrone, should best occur within a broad Mid-Country Study Area comprising in Ireland the counties of Monaghan, Cavan and Meath, and in particular, located to the west of Navan, County Meath.

5.2.5 Identification of Project Study Area for the Proposed Development

48 Based on the identification of a broad study area for the overall project, the specific project study area for the proposed development is presented in **Figure 5.7**. This project study area is essentially the amalgam, in spatial terms, of the two broad study areas, originally identified in respect of the previously separate projects – the second interconnector, and the reinforcement of transmission infrastructure in the north-east area.

49 Whilst comprising a single transmission infrastructure project, within an overall project study area, given the significant geographical extent of this study area, for clarity and convenience the overall study area is identified in two sections: the **Cavan Monaghan Study Area (CMSA)** refers to that portion of the overall study area north of the existing Flagford-Louth 220 kV OHL, and south of the border with Northern Ireland, having regard to the counties located within this area (this was termed Cross Border Study Area (CBSA) in the previous application for planning approval of the Meath-Tyrone 400 kV Interconnection Development); the **Meath Study Area (MSA)** refers to that portion of the overall study area, south of the existing Flagford-Louth 220 kV OHL, and extending to, and encompassing Woodland Substation, and which is almost exclusively contained within County Meath (this was termed the North East Study Area (NESA) in the previous application).

50 The nominal interface between the two sections of the overall project study area is therefore located in the vicinity of the existing Flagford–Louth 220 kV OHL line. The presentation of the overall project study area by means of two sections (CMSA and MSA) is intended to facilitate review by the public concerned and other parties of that section of the proposed development which is of most importance to them, rather than having to seek this information as part of a

much larger study area. It has also facilitated ongoing coordinated but focused technical and environmental analysis by the two teams of project consultants.

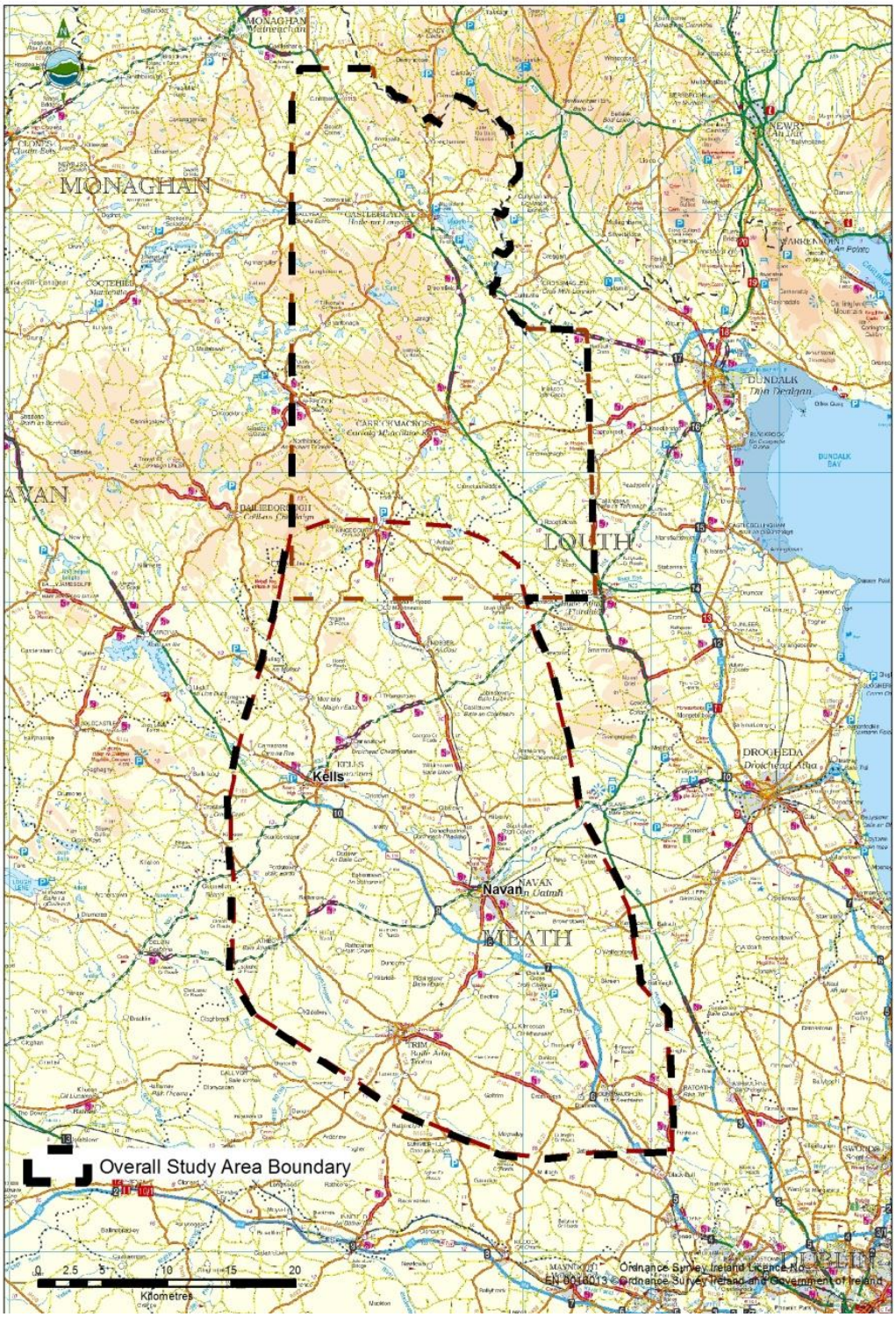

Figure 5.7: The Project Study Area for the Proposed Development

5.2.5.1 The Cavan-Monaghan Study Area (CMSA)

51 This area is primarily situated between the areas of the crossings of the jurisdictional border with Northern Ireland (in the townland of Lemgare, County Monaghan, east of Clontibret) to the north, and as noted above, the area of the existing Flagford-Louth 220 kV OHL (west of Kingscourt) to the south. The CMSA is approximately 30km in width and 40km in length. The primary settlements within the CMSA include Kingscourt, Carrickmacross, Castleblayney and Bailieborough.

52 The topography of the CMSA comprises a varied landscape of hedge-enclosed fields draped over drumlins and scattered lakes throughout. The land use within the CMSA, outside of the settlements, is predominantly agricultural.

53 The CMSA is illustrated in **Figure 5.8**.

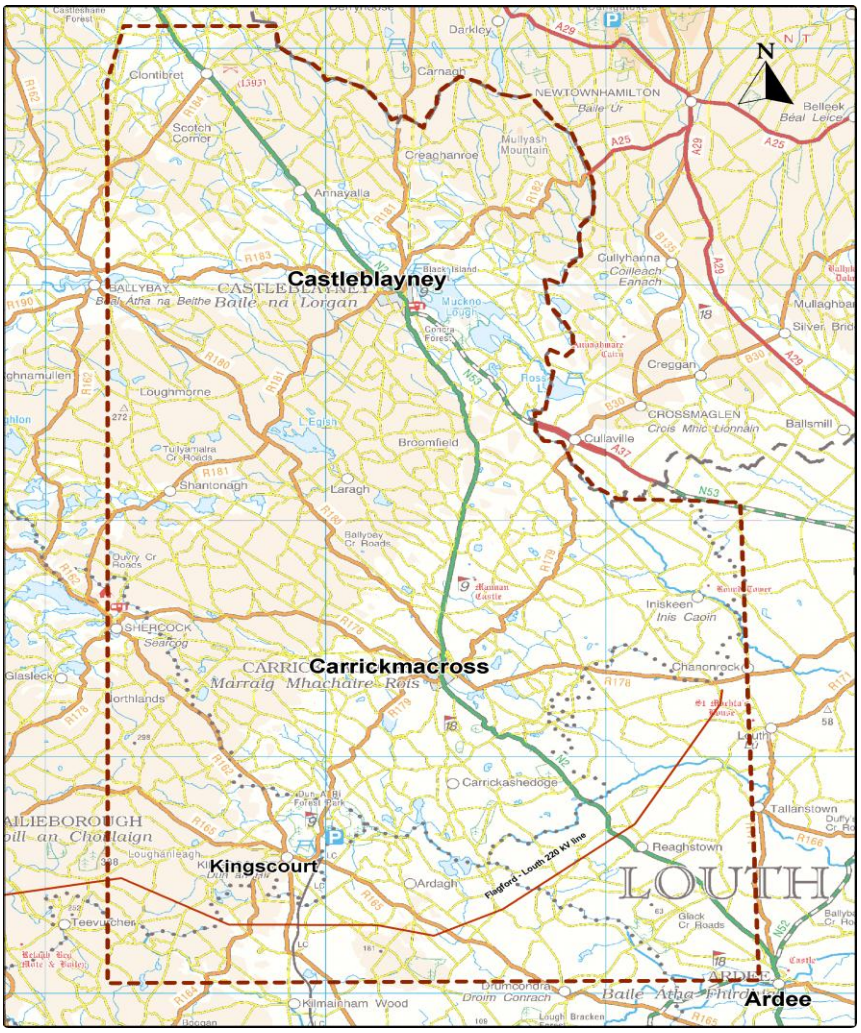

Figure 5.8: The Cavan-Monaghan Study Area (CMSA)

5.2.5.2 The Meath Study Area (MSA)

54 The MSA is situated between the existing 400 kV Woodland Substation in County Meath in the south, and the area of the Flagford-Louth 220 kV OHL (west of Kingscourt) in the north. The area is bounded to the east by the Hill of Tara and to the west by the towns of Trim and Athboy. Other settlements within the MSA include Dunshaughlin, Kells, Navan, Nobber and Moynalty.

55 The study area contains two major rivers, the River Boyne and the River Blackwater. The land use within the study area, outside of the settlements, is predominantly agricultural.

56 The MSA is illustrated in **Figure 5.9.**

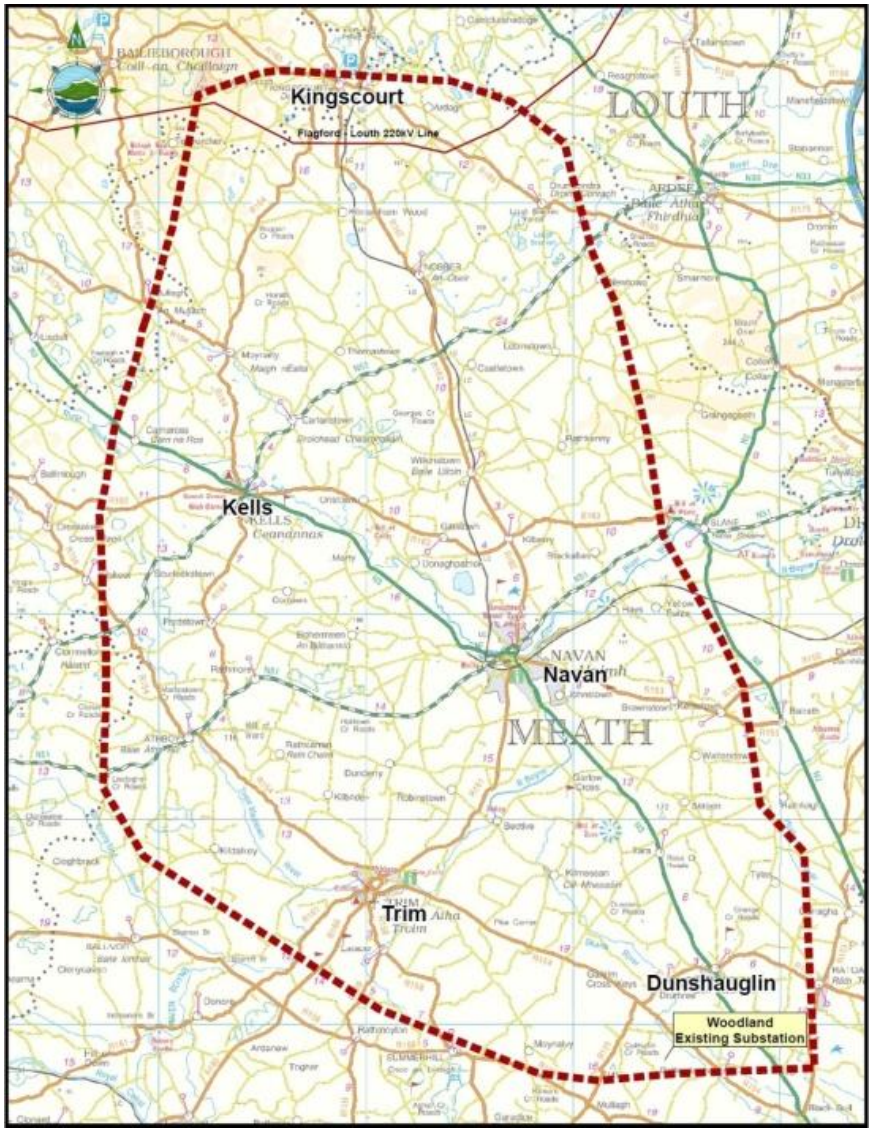

Figure 5.9: The Meath Study Area (MSA)

57 As noted at **Section 5.2.2.3** EirGrid was subsequently advised to present a full consideration and robust examination of a wider project study area, incorporating that area east of Navan to the eastern coastline. This area is illustrated in **Figure 5.10**. This analysis was presented in the Socoin / Tobin *Response to An Bord Pleanála – Kingscourt to Woodland Route Comparison Report* (December 2008). This study confirmed the area to the west of Navan as the preferred project study area for the southern portion of what, by this stage, had become a single project.

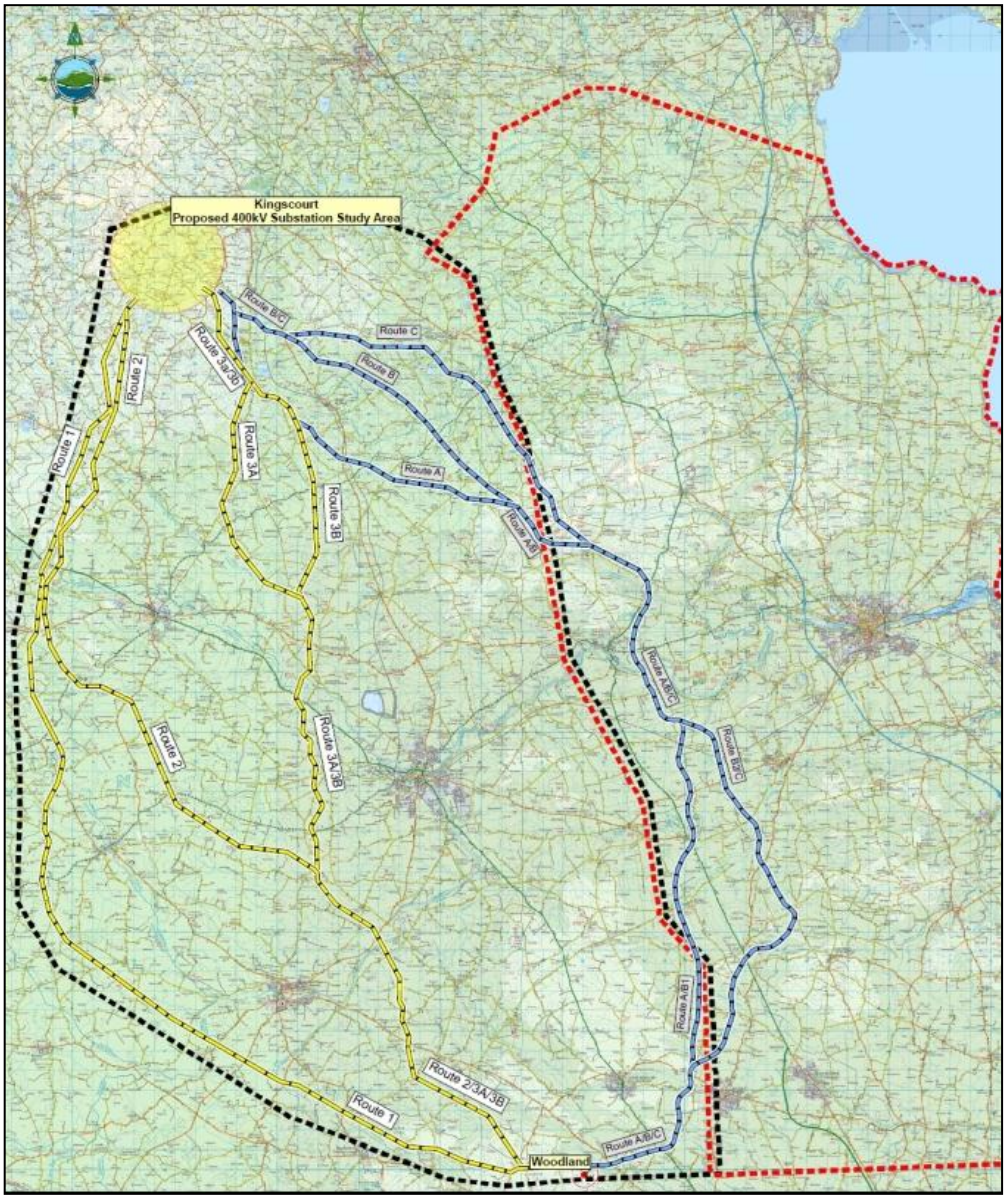

Figure 5.10: Subsequent Extended Study Area East of Navan to the Eastern Coastline

(Extended Study Area is outlined in red)

5.3 PHASE 2: IDENTIFICATION OF ALTERNATIVE ROUTE CORRIDOR OPTIONS AND A PREFERRED ROUTE CORRIDOR FOR THE PROPOSED DEVELOPMENT

58 As set out in **Section 5.1**, the next phase (phase 2) in the route selection process was twofold: firstly to identify alternative feasible route corridors within the identified project study area, and secondly to identify a preferred route corridor following a strategic analysis of technical and environmental constraints. This process included a high level evaluation of the likely impacts of each of the route corridor options on the key constraints, with some indication as to which, if any, of these are likely to be significant.

59 The identified route corridor alternatives are of a nominal indicative width of 1km. Such width has no technical or, scientific basis; rather the 1km wide corridor is intended to ensure that an adequate area is identified in which a potential line route, including all associated structures, can best be sited, while making provision for as great a buffer distance as possible to identified sensitive receptors (i.e. any element of the environment which has the potential to be significantly impacted). In addition, corridor options need to be of comparable width, to facilitate a robust comparative evaluation.

5.3.1 Background to the Identification of Alternative Route Corridor Options

60 As noted in **Section 5.2**, the proposed development originated as two separate projects. EirGrid therefore originally employed separate consultants to undertake studies, including route corridor feasibility studies, within the respective broad study areas within Ireland. ESBI and AOS Planning Ltd were appointed to identify and evaluate options relating to the planned second interconnector, and in particular within the preferred Option 4(b) Mid-Country Study Area; Tobin Consulting Engineers with Socoin (formerly Soluziona and now GasNaturalFenosa) were appointed to identify and evaluate options for reinforcement of the transmission system within the north-east area of Ireland, and in particular within the preferred Option A2 Western Study Area.

61 As set out in **Section 5.2.3**, these two originally separate projects merged into the single project. ESBI / AOS Planning Ltd continued their work on the northern portion of the overall project study area– previously termed CBSA and now termed the CMSA, while Tobin / Socoin continued their work on the southern portion of the study area – previously termed NESA and now termed the MSA. This work included carrying out baseline studies of all key environmental criteria, and the identification of indicative 1km wide route corridors. The scope and methodology of this work, as well as the subsequent identified route corridor options, are detailed in the following publications:

- ESBI and AOS Planning Ltd, *Route Constraints Report* (September 2007); and
- Socoin and TOBIN Consulting Engineers*, Kingscourt to Woodland Constraints Report Volume 1* (July 2007).

62 Subsequently, ESBI / AOS Planning Ltd and Tobin / Socoin prepared Addendum Reports, which complemented the earlier *Route Constraints Reports* by assessing the relative merits of each identified 1km wide corridor on the basis of further analysis undertaken, and having regard to a number of issues raised during public stakeholder and other consultation processes. This work is detailed in the following publications:

- ESBI and AOS Planning Ltd, *Route Constraints Report September 2007 ADDENDUM* (May 2008); and
- Socoin and TOBIN Consulting Engineers, *Kingscourt to Woodland Powerline Addendum Report 1* (May 2008).

63 The identified potential route corridors within the previously identified CBSA (now CMSA), and NESA (now MSA) project study areas are summarised below.

The CBSA (now CMSA) Project Study Area

64 Three 'Potential Route Corridor' options were identified for the CBSA (now CMSA), avoiding where possible the most significant identified constraints (see **Figure 5.11**). These were:

- **Route Corridor Option A** runs from the area of the Flagford-Louth 220 kV line within the western part of the study area, west of the N2, Castleblayney and Carrickmacross. Extending generally northwards, it turns in a north-easterly direction approximately 1km north of Annayalla to cross the N2 and then turns in north-westerly direction at Lemgare to the border crossing locations;
- **Route Corridor Option B** runs within the central part of the study area, west of the N2, Castleblayney and Carrickmacross but closer to Castleblayney and Lough Muckno than the western route. It is straighter and slightly shorter than Route A; and
- **Route Corridor Option C** follows Route Option B to a point approximately 4km north-west of Carrickmacross before turning east to run to the east of the N2 and east of Lough Muckno. It is the longest of the routes.

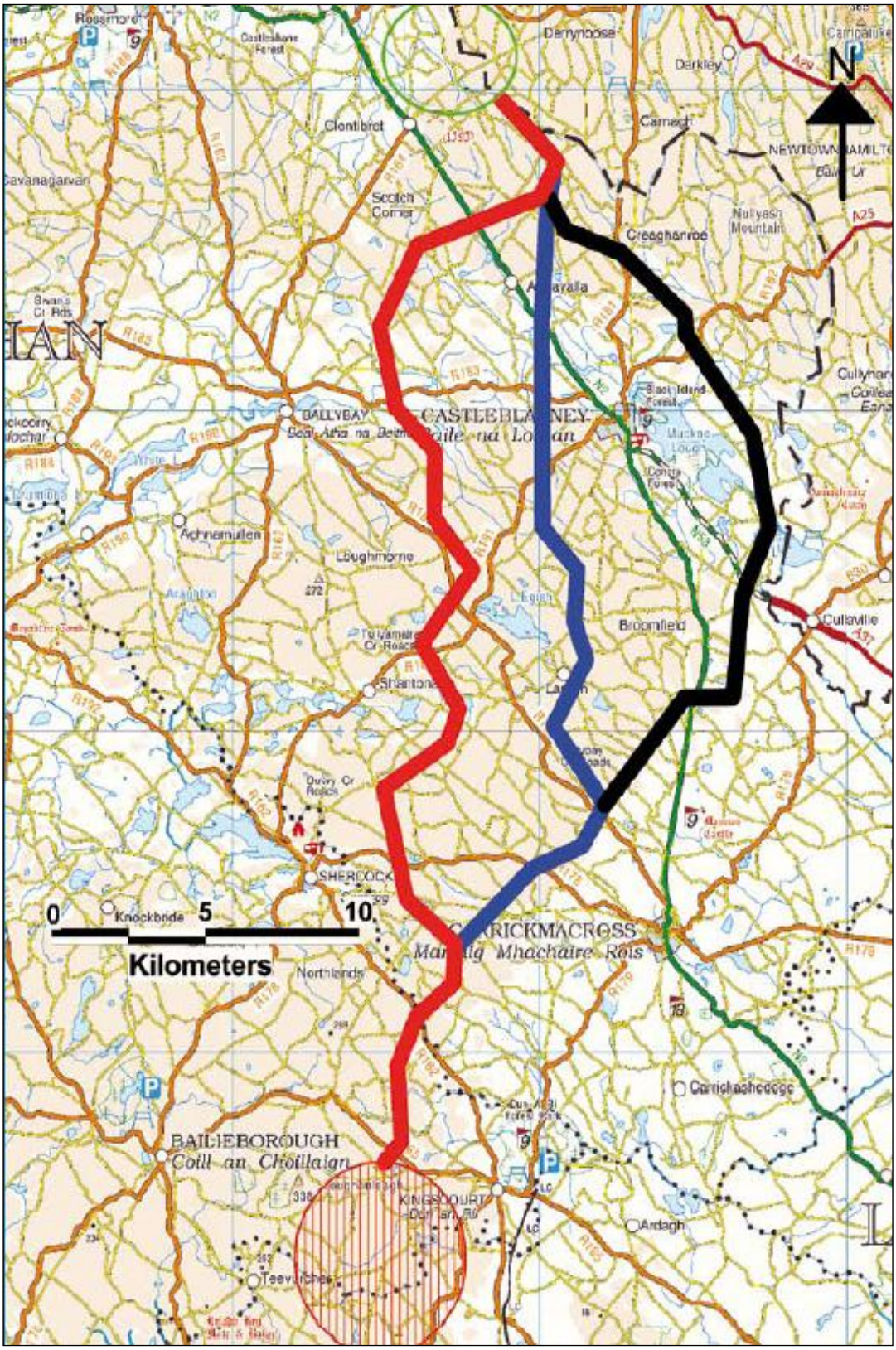

Figure 5.11: Potential Route Corridor Options A, B and C in the CBSA (now CMSA)

Option A
Option B
Option C

The NESA (now MSA) Project Study Area

65 Three potential route corridor options (with a sub-option of one of the options) were identified for the NESA (now MSA), taking cognisance of identified constraints (see **Figure 5.12**). These were:

- **Route Corridor Option 1** extends from Woodland Substation within the western part of the study area, to the west of Trim, Athboy and Kells and approximately 4km north of Ballivor and east of Mullagh.

- **Route Corridor Option 2** extends from Woodland Substation between the central and western section of the study area, staying to the east of Trim and Athboy, west of Kells and then runs parallel to Route Option 1, running approximately 1.5km to the east of Mullagh.

- **Route Corridor Option 3A** follows route corridor Option 2 initially before extending in a due north direction, running to the west of Navan and to the east of the town of Kells. Approximately 5km north of the M3, this route corridor option splits into two sub-options 3A and 3B. 3A runs to the west of Castletown and Nobber before joining together west of Whitewood Lough.

- **Route Corridor Option 3B** follows route corridor Option 2 initially before extending in a due north direction, keeping to the west of Navan and to the east of the town of Kells similar to route corridor Option 3A. This route corridor option splits into two options 3A (see above) and 3B. 3B runs to the west of Carlanstown before joining together west of Whitewood Lough.

66 All route corridor options extend out from Woodland Substation in a westerly direction along the alignment of the existing Oldstreet-Woodland 400 kV transmission line. The northern side of the double circuit structures along this OHL are currently unused and available for use. From an environmental perspective, it was considered that using the unused side of these double circuit towers has a much lower potential impact compared to using new route corridors into / out of Woodland Substation.

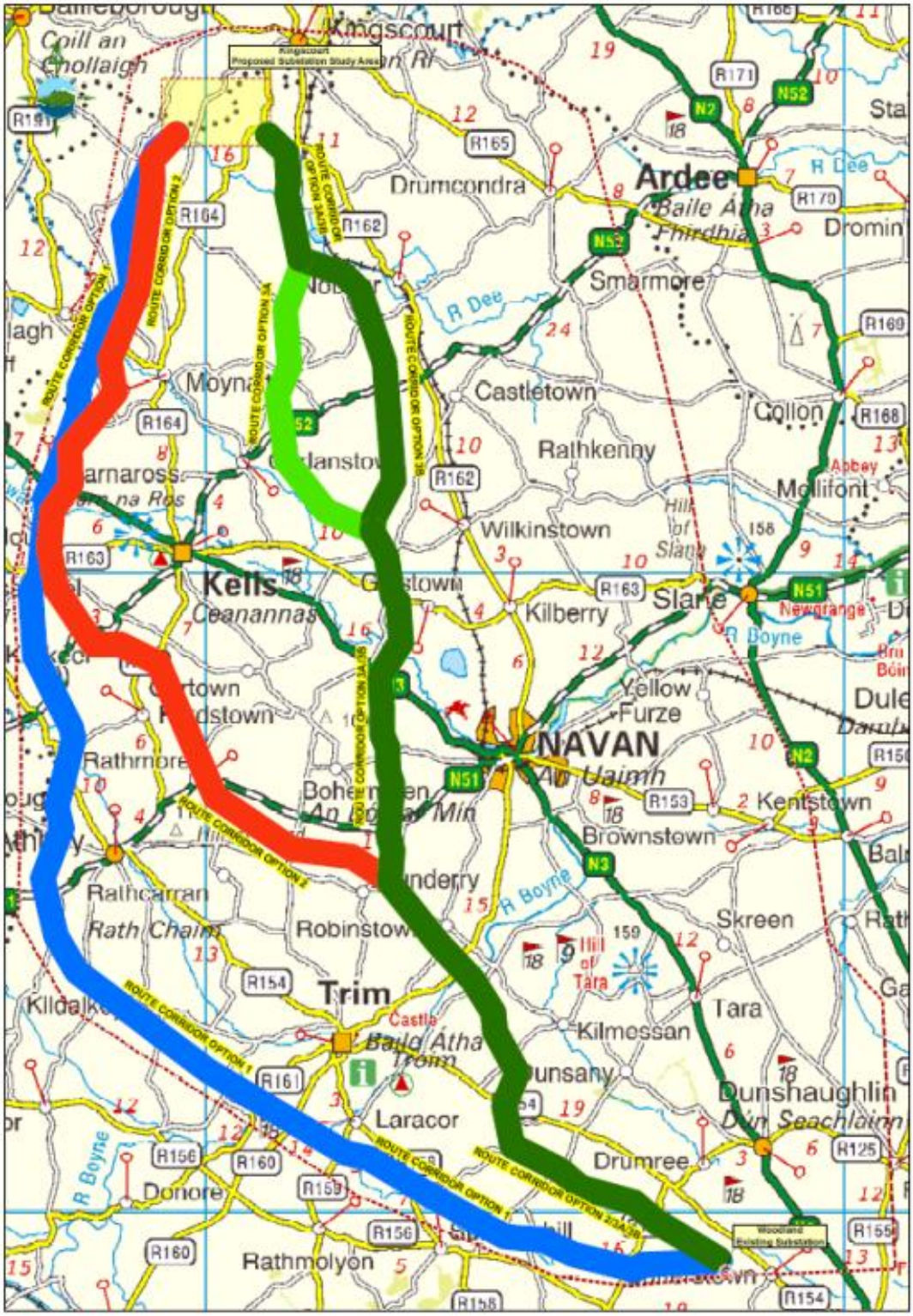

Figure 5.12: Potential Route Corridor Options 1, 2, 3A and 3B in the NESA (now MSA)

5.3.1.1 Other Potential Route Corridor Alternatives

The M3 Corridor

67 During the initial stages of the project EirGrid consulted with the National Roads Authority (NRA) regarding the possibility of locating the planned transmission infrastructure along the M3 Motorway corridor, either as OHL or UGC.

68 Locating OHL alongside the motorway was ruled out because it was considered that to do so, would not be environmentally sustainable within a highly sensitive receiving environment. This opinion was based on, among other things, the stated intention of the planning authority to protect "*landscapes of exceptional value and sensitivity and in particular to protect the rural character, setting, amenity and archaeological heritage of Brú na Bóinne and the Hill of Tara, and of the surrounding areas including the area in the vicinity of the proposed M3 motorway and its related interchanges*". The motorway passes through this sensitive landscape.

69 Locating a 400 kV UGC within the reserve of the M3 was ruled out primarily because in EirGrid's opinion it would not be appropriate to use 400 kV UGC in place of 400 kV OHL for this project, as addressed in **Chapter 4** of this volume of the EIS.

70 In addition to this, the NRA advised that a 400 kV UGC would only be permitted within the motorway reserve if indemnities regarding damage, disruption, costs, etc. acceptable to both NRA and the PPP (Public-Private Partnership) company that constructed and operates the motorway, were received. This requirement introduces considerable complexity, uncertainty and risk to such an option, even if it was deemed to be technically appropriate, making it a less favourable UGC route than a direct cross country route, such as that identified in the PB Power Report *Cavan-Tyrone and Meath-Cavan 400 kV Transmission Circuits Comparison of High Voltage Transmission Options: Alternating Current Overhead and Underground, and Direct Current Underground (2009)* (refer to **Chapter 4** of this volume of the EIS).

Disused Railway Line

71 During public consultation, but after commencement of the site specific part of the PB Power Report (referred to above), it was noted that there are disused railway lines in all five counties to be traversed by the planned transmission line, and it was suggested that these would provide a technically feasible optimum and least cost route for UGC. To consider this EirGrid carried out its own comprehensive study of the disused rail beds in the five counties, Meath, Cavan, Monaghan, Armagh and Tyrone to evaluate their suitability for accommodating the size and quantity of the UGC that would be required for the development. The findings of this study were published in the following EirGrid Report *Cavan-Tyrone and Meath-Cavan 400kV Power Lines – Considerations in Relation to Locating 400kV Cables in or adjacent to Rail Beds* (2009).

72 In summary, the EirGrid Report concluded that the rail bed routes represented a sub-optimal routing option for potential 400 kV UGC circuits, introducing significant additional environmental impact and cost, as well as safety risks to cables. Issues include: a railbed route is often not the shortest route; it would require directing a cable along a series of obstacles including embankments, bridge abutments, level crossings, culverts, bridges and stations; there are also safety and security implications during construction and for maintenance. It was concluded that the use of rail beds was not consistent with the development of a safe, secure, reliable and economical transmission system. Selecting a UGC route which follows the disused rail lines, insofar as they still exist, and which in any case are not sufficiently wide enough in many places to accommodate the required UGC works, would not have the advantages of a route corridor selected to minimise community and environmental impacts, such as is identified in the PB Power Report.

73 The EirGrid Report concluded that the theoretical potential cross-country UGC route identified by PB Power (see **Figure 4.1**) in its report was superior to the option to make use of existing rail beds. In addition, it reiterated the consideration of EirGrid that any OHL solution for the proposed interconnector meets the requirements of the Transmission System Operator (TSO) and is superior to an UGC option on technical, security, reliability and economical grounds.

East of Navan

74 As set out in **Section 5.2.2.3**, EirGrid was advised by An Bord Pleanála during formal pre-application consultation in respect of the previous application for the then Meath-Tyrone 400 kV Interconnection Development, to carry out further analysis on possible routes within a study area east of Navan to the eastern coastline. This analysis comprised an evaluation update of the route corridor assessment process undertaken in respect of the NESA (now MSA). This was presented in the Socoin / Tobin *Response to An Bord Pleanála – Kingscourt to Woodland Route Comparison Report (*December 2008). A total of eight corridor options were analysed for the NESA option - the original four options to the west of Navan, and four new corridor options to the east of Navan:

- Woodland-Kingscourt Western Route Options, (1, 2, 3A and 3B – as previously described). The area is bounded to the east by the Hill of Tara and Navan and to the west by Trim and Athboy (see **Figure 5.12**).

- Woodland to Kingscourt, Eastern route corridor Options, (A, B1, B2 and C). The area is enclosed on the west by the Hill of Tara and Navan and to the east by the Irish Sea coastline (see **Figure 5.13**).

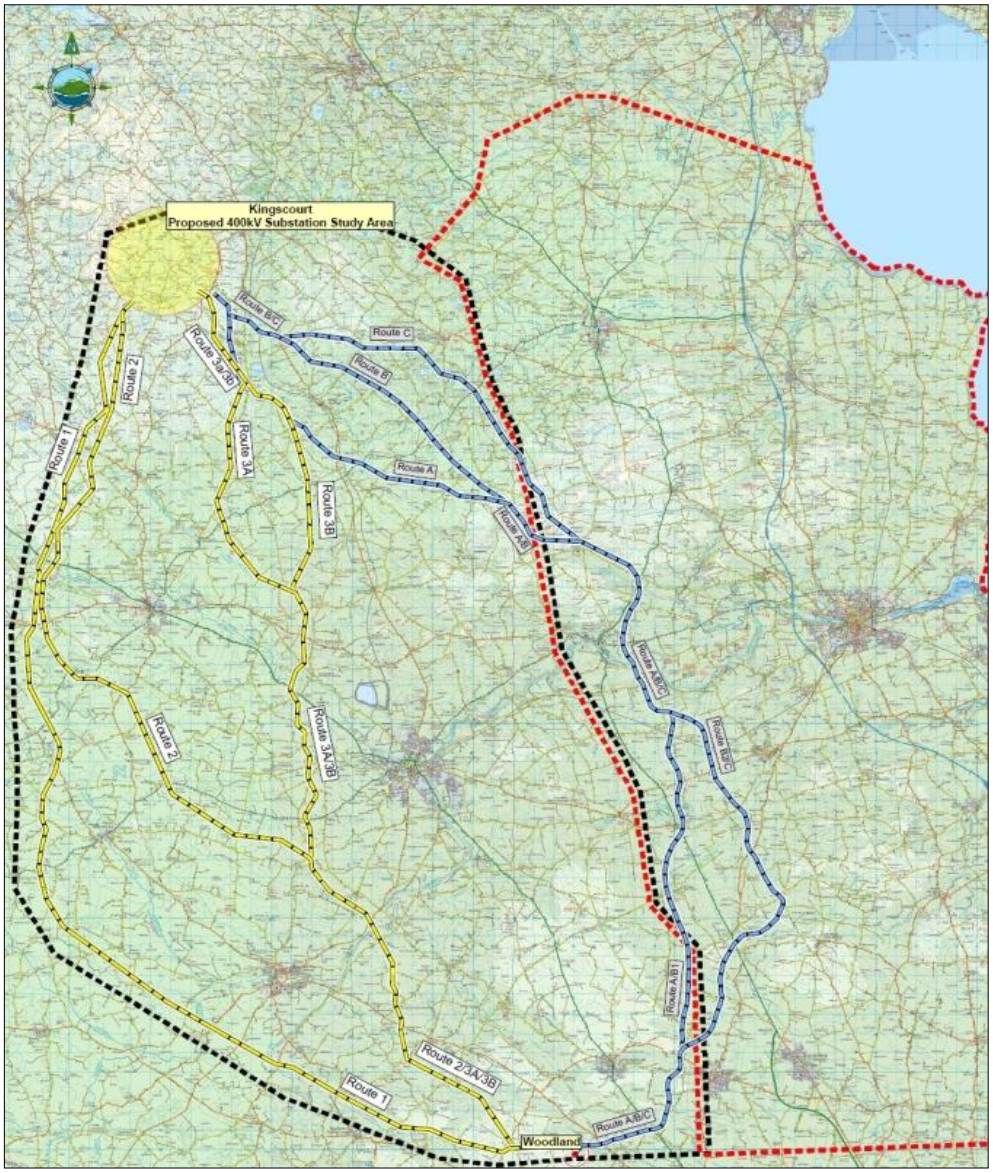

Figure 5.13: Potential Eastern Route Corridor Options A, B1, B2 and C in the NESA (now MSA)

(Potential Eastern Route Corridor Options indicated in blue)

75 The easterly corridor options (A, B1, B2 and C) were rejected *inter alia* because they pass in close proximity to Brú na Bóinne (an Annex 1 World Heritage Site) and the Hill of Slane. These constraints are discussed in detail in the Tobin / Socoin report (submitted to An Bord Pleanála). As noted in **Section 5.2.2.2**, the Western Route Option A2 broad study area (i.e. to the west of Navan – see **Figure 5.13**) was therefore confirmed; this evolved into the NESA (MSA) project study area, with the identified Indicative route corridor Options 1, 2, 3A and 3B (see **Figure 5.12**) comprising the focus for further studies as the project progressed towards identification of a preferred corridor and indicative line routes.

Direct Route Option

76 In its Scoping Opinion dated 11th December 2013, An Bord Pleanála requested consideration of alternative corridor options *"including the most direct route option"* (see **Figure 5.14**). The most direct route or shortest route is generally considered 'best practice' for routing OHL; however, it is also necessary to avoid constraints. The direct option between Woodland, County Meath and Turleenan, County Tyrone would bring the route close to main population settlements including Armagh, Ardee, Slane and Dunshaughlin. Furthermore it would pass directly through or very close to a number of villages including Moy, Charlemont, Milford, Cullaville, Corcreeghagh, Newtown, Hays, Tara, Drumree. Additionally it would pass over a number of one-off houses, archaeological monuments and significant archaeological landscapes, and sensitive ecological receptors. A number of lakes would also have to be traversed with a straight line option. Accordingly, the direct route is not appropriate for the North-South 400 kV Interconnection Development.

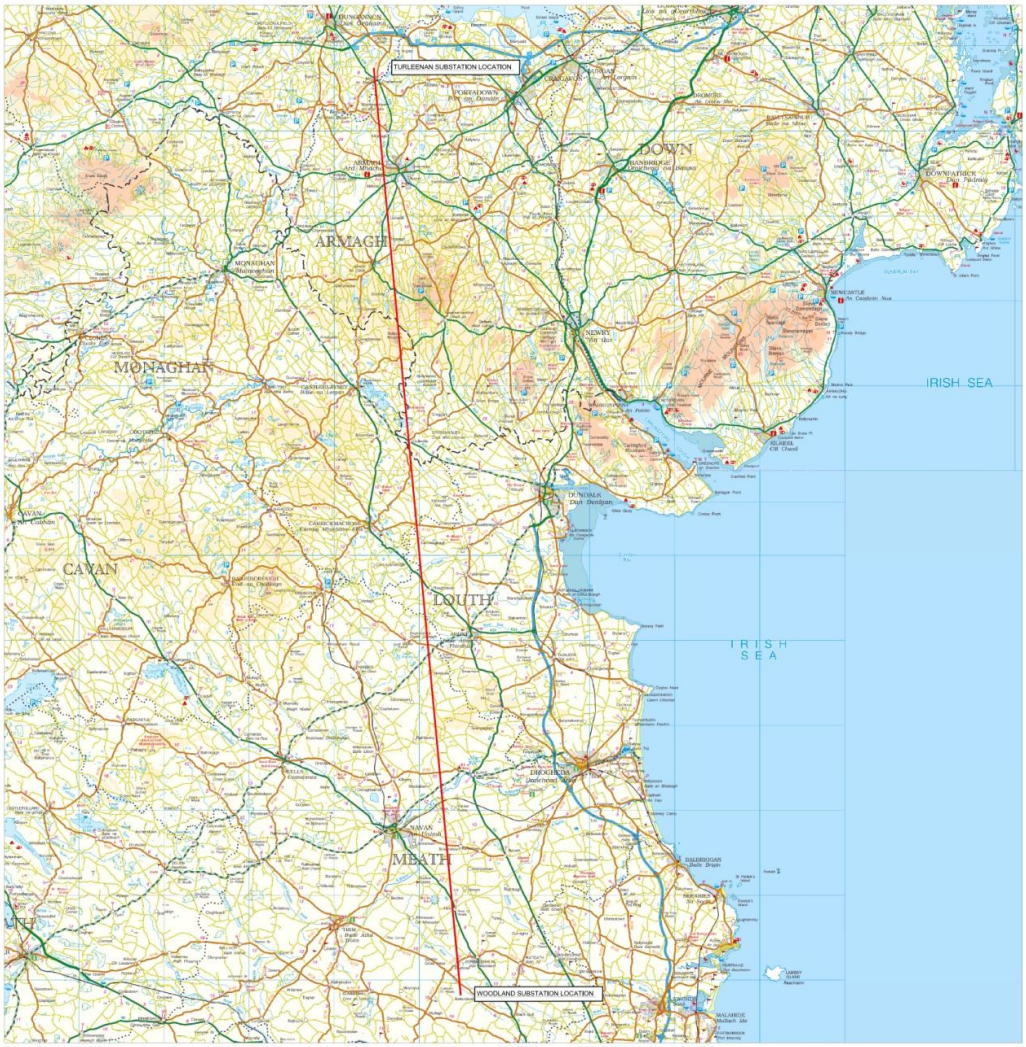

Figure 5.14: Direct Route Option

5.3.2 Background to the Identification of a Preferred Route Corridor

77 The selection of a preferred route corridor for the previous Meath-Tyrone 400 kV Interconnection Development involved a comparative evaluation of the identified route corridor options taking account of a wide range of technical, environmental and other criteria. The original decision making process and diverse range of evaluation criteria was outlined in the Report *Tyrone-Cavan Interconnector & Meath Cavan Transmission Circuit – Corridor Evaluation Document* (2008) prepared by RPS Planning and Environment on behalf of EirGrid. The criteria are identified in **Table 5.1**.

Table 5.1: Original Evaluation Criteria (2009)

Technical Criteria	
1. Safety • Operational Safety Risk • Construction Safety Risk • Risk of Disturbance by Third Parties	**2. Construction / Operation** • Road Infrastructure • Availability of Construction Materials • Maintenance During Operation • Ground Condition / Stability • Extent of Civil Works • Road Closures
3. Design • Need for Temporary and Permanent Compounds • Watercourse Crossings • Road Crossings • Length of Route	**4. Other Technical Considerations** • Security of Supply • Reliability • Potential for Future Linkage • Assurance of Adequate MVA Capacity
Environmental Criteria	
5. Human Beings • Health Impacts • Noise • Potential for Negative Economic Impact	**6. Electrical & Magnetic Fields** • Impact of Electrical Fields • Impacts of Magnetic Fields
7. Flora & Fauna • Potential Impact on Livestock • Potential Impact on Bloodstock • Potential Impact on Other Fauna / Flora Including Specific Species / Birds • Potential Impact on Protected and Designated Habitats	**8. Visual Amenity & Landscape** • Potential Impact on Protected Views and Prospects • Potential Impact on Areas of High Scenic Value • Potential Impact on Non-Designated but Scenic Landscapes

9. Archaeology, Culture & Local Heritage • Potential Impact on Protected Structures and Their Settings • Potential Impact on Recorded Monuments (RMPs) & Places and Their Settings • Potential for Cultural Heritage Constraints	**10. Water** • Disruption to Groundwater • Risk of Pollution of Ground and / or Surface Water
11. Air Quality • Disturbance and or creation of Particle Matters (PM10s)	
Community Criteria	
12. Planning and Land Use • Impact on Rural Development and Land Use • Impact on Urban Development and Land Use	**13. Community Severance**
14. Number of Dwellings within the 1 km wide Corridor	**15. Number of Dwellings and Other Occupied Buildings within 100 metres of Indicative Routes**
16. Landowner Consent	**17. Potential Impact on Public Amenities** • Distance to Nearest School (within approximately 500m) • Playing Pitches (within approximately 200m) • Recreational Areas • Other Public Buildings / Institutions • Tourism Facilities • Airfield
Other Criteria	
18. Compliance with Current Planning & Development Policy & Guidelines **19. Project Programme and Deliverability** **20. Economic Feasibility** **21. Compliance with Best International Practice** **22. Adaptability for Future Development**	

78 No quantitative weighting system was applied to the various technical, environmental and community criteria in order to evaluate the corridors. Rather, the approach allowed the construction of a strategic profile of each of the corridors, and how they met the identified criteria. This qualitative comparative approach determined whether in respect of a particular criterion, a corridor was 'More Preferred' or 'Less Preferred', or indeed whether it had a considered neutral implication.

79 The multi-criteria comparative evaluation process confirmed the following as the preferred 1km wide corridor:

- **CBSA – Border – vicinity of Kingscourt (Option A):** Corridor A was approximately 48km in length. It extended from the border crossing point north-east of Clontibret, County Monaghan, south to a proposed substation in the vicinity of Kingscourt, County Cavan.

- **NESA – Vicinity of Kingscourt – Woodland (Option 3(b)):** Corridor 3(b) was approximately 57km in length. It extended from the proposed substation in the vicinity of Kingscourt, County Cavan to Woodland Substation, near Batterstown, Dunshaughlin, County Meath.

80 CBSA - Option A and NESA – Option 3(b) as illustrated in **Figure 5.15** were therefore brought forward for confirmation of line design, EIA and ultimately formed the basis for the proposed development which was the subject of the 2009 application for approval (subsequently withdrawn).

81 The omission of the previously proposed intermediate substation in the vicinity of Kingscourt from this current proposal has resulted in a southerly extension, and associated amendments, of the previously identified route corridor Option A so that it meets the MSA corridor, and a northerly extension, and associated amendments, of the previously identified route corridor Option 3B so that it meets the CMSA corridor. However, it is more appropriate to consider that there is a single route corridor for the proposed development, within a single overall project study area.

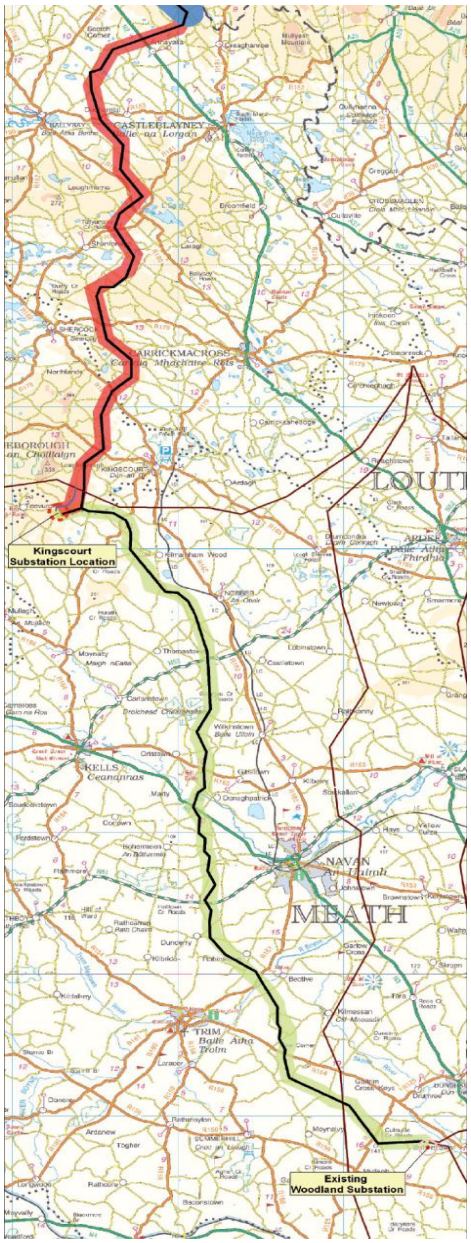

Figure 5.15: CBSA (now CMSA) - Option A and NESA (now MSA) – Option 3(b) – 2009

5.3.3 Re-evaluation of Alternative Route Corridor Options and a Preferred Route Corridor

82 The purpose of the re-evaluation process was to confirm the applicability, or otherwise, of the identified corridors outlined in the previous withdrawn application, in the context of updated constraints and other information gathered since the original identification of these potential route corridors in 2007. The re-evaluation process also provided an opportunity to review and update the evaluation criteria used in 2008 to identify a preferred route corridor.

83 The findings of the re-evaluation process are detailed in the *Final Re-evaluation Report* (April 2013), comprising **Appendix 1.2**, **Volume 3B Appendices**, of the EIS.

5.3.3.1 Re-evaluation of Alternative Route Corridor Options

84 The re-evaluation process, including the evaluation of potential route corridors to the east of Kingscourt**,** determined that no new significant environmental or other constraints have arisen since the previous application in 2009, which would result in any substantial change to the previously identified route corridor options (although it is noted that some minor localised changes did occur). In particular route corridor Option A/3B remains the preferred route corridor within which to route the proposed transmission circuit.

5.3.3.2 Re-evaluation of the Preferred Route Corridor

85 The re-evaluation process provided an opportunity to review and update the evaluation criteria used in 2008. For example, the criteria that previously yielded results that were generally 'Neutral' were reviewed, and where appropriate omitted, in order to focus on those other criteria which differentiate the route corridor options, and specifically on whether a particular route corridor option is 'More Preferred' or 'Less Preferred' in respect of that particular criterion. This is set out in the *Final Re-evaluation Report* (April 2013).

86 As with the previous comparative evaluation process, no quantitative or weighting system was applied to the criteria in order to re-evaluate corridors. Rather, a strategic qualitative evaluation system, based on professional experience and expertise, was applied to each corridor against the identified criteria.

87 A summary of the findings of the re-evaluation process, with reference to the updated evaluation criteria is set out in **Tables 5.2** and **5.3**. The tables initially categorise the significance of impacts (minor, moderate or major) with reference to each environmental criterion for the project in an overall context. The tables then indicate the degree to which potential impacts can be mitigated (no practicable mitigation possible, reduce scale of impact or avoid impact). Finally, the tables indicate the preference for one route corridor over another with reference to being more preferred or less preferred.

Table 5.2: Route Corridor Re-evaluation CMSA

Less Preferred ← → More Preferred

CAVAN - MONAGHAN STUDY AREA

	Significance of Impact	Ease of Mitigation		Corridor Option A	Corridor Option B	Corridor Option C
Ecology	--	--	Potential Impact on Wintering Bird Sites			
	--	--	Potential Impact on Designated Sites Potential Impact on Fisheries Potential Impact on Mature Deciduous Woodlands Potential Impact on Wetlands Potential Impact on Hedgerows			
Landscape	---	-	Potential Impact on Protected Views and Prospects Potential Impact on Areas of High Scenic Value Potential for impacts on non designated but scenic landscapes Potential Impact on Landscape Character including landscape values and sensitivity.			
Cultural Heritage	--	--	Potential Impact on Archaeological Sites Potential Impact on Architectural Sites			
Techincal	N/A	N/A	Length of Line Route			
Water	-	---	Potential Impact on River Crossings Potential Impact on River Catchments Impact on Lakes			
Geology	-	---	Potential Impact on Proposed Geological National Heritage Areas (NHA's) Potential Impact on County Geological Sites (CGS's)			
Settlements	--	--	Potential Impact on Urban & Rural Settlements			
Infrastructure / Utilities	-	---	Potential Impact on Road Crossings Potential Impact on Railways Potential Impact on Existing Electricity Lines Potential Impact on Airfields			

Table 5.3: Route Corridor Re-evaluation MSA

Less Preferred ← → More Preferred

MEATH STUDY AREA

	Significance of Impact	Ease of Mitigation		Corridor Option 1	Corridor Option 2	Corridor Option 3A	Corridor Option 3B
Ecology	--	--	Potential Impact on Wintering Bird Sites				
	--	--	Potential Impact on Designated Sites Potential Impact on Fisheries Potential Impact on Mature Deciduous Woodlands Potential Impact on Wetlands Potential Impact on Hedgerows				
Landscape	---	-	Potential Impact on Protected Views and Prospects Potential Impact on Areas of High Scenic Value Potential for impacts on non designated but scenic landscapes Potential Impact on Landscape Character including landscape values and sensitivity.				
Cultural Heritage	--	--	Potential Impact on Archaeological Sites Potential Impact on Architectural Sites				
Techincal	N/A	N/A	Length of Line Route				
Water	-	---	Potential Impact on River Crossings Potential Impact on River Catchments Impact on Lakes				
Geology	-	---	Potential Impact on Proposed Geological National Heritage Areas (NHA's) Potential Impact on County Geological Sites (CGS's)				
Settlements	--	--	Potential Impact on Urban & Rural Settlements				
Infrastructure / Utilities	-	---	Potential Impact on Road Crossings Potential Impact on Railways Potential Impact on Existing Electricity Lines Potential Impact on Airfields				

88 Following the comparative evaluation process, which incorporated consideration of public and stakeholder feedback arising both in respect of the previous proposed application, and in respect of the subsequent re-evaluation process, as well as updated studies carried out by or on behalf of EirGrid, route corridor Option A and Option 3B emerged as the preferred route corridor for the proposed development.

89 In the CMSA, route corridor Option A was the 'most preferred' option, by virtue of the fact that it has the lowest potential for creating long term adverse significant residual impacts which cannot be mitigated. These potential impacts arise primarily in terms of landscape and visual impacts. All other potential significant environmental impacts, including potential impact on Whooper swans, are localised, and can be mitigated.

90 Similarly, in the MSA, route corridor Option 3B was the 'most preferred' option, as it was considered to create the lowest potential visual impact on the landscape, with all other potential significant environmental impacts being localised, and capable of being mitigated.

91 The preferred route corridor is therefore termed '**Route Corridor A/3B**'.

5.3.3.3 Re-evaluation of Alternative Route Corridor Options East of Kingscourt

92 Notwithstanding the decision not to proceed with a new substation as part of the proposed development at this stage, EirGrid gave consideration to the location of the substation, in anticipation that it will be required at some future point in time. As previously noted, from a transmission planning perspective, a suitable substation location is in the vicinity of the point of intersection of the proposed interconnector (Turleenan-Woodland) 400 kV OHL, and the existing east-west oriented Flagford-Louth 220 kV OHL, as this will minimise the additional lengths of 400 kV and / or 220 kV circuits that have to be constructed in the future in order to connect in the new substation.

93 Given, the fact that, while the substation may be in the vicinity of Kingscourt, it may not necessarily be located at Moyhill (the site of the previously proposed substation), EirGrid reviewed the wider area between Nobber (east of Kingscourt) and north of Kingscourt, to determine if it presented any route corridor alternatives that were preferable (in terms of being least constrained) to the previously identified Option A/3B route corridor.

94 The review process consisted of an environmental evaluation of additional identified potentially feasible route corridors. The process had regard to a number of environmental considerations (specifically ecology, archaeology, landscape / visual and the impact on settlements). Four route corridor options to the east of Kingscourt were compared against the preferred route

corridor option to the west of Kingscourt to determine if any were of equal or greater merit to those already considered. The options are illustrated in **Figure 5.16**.

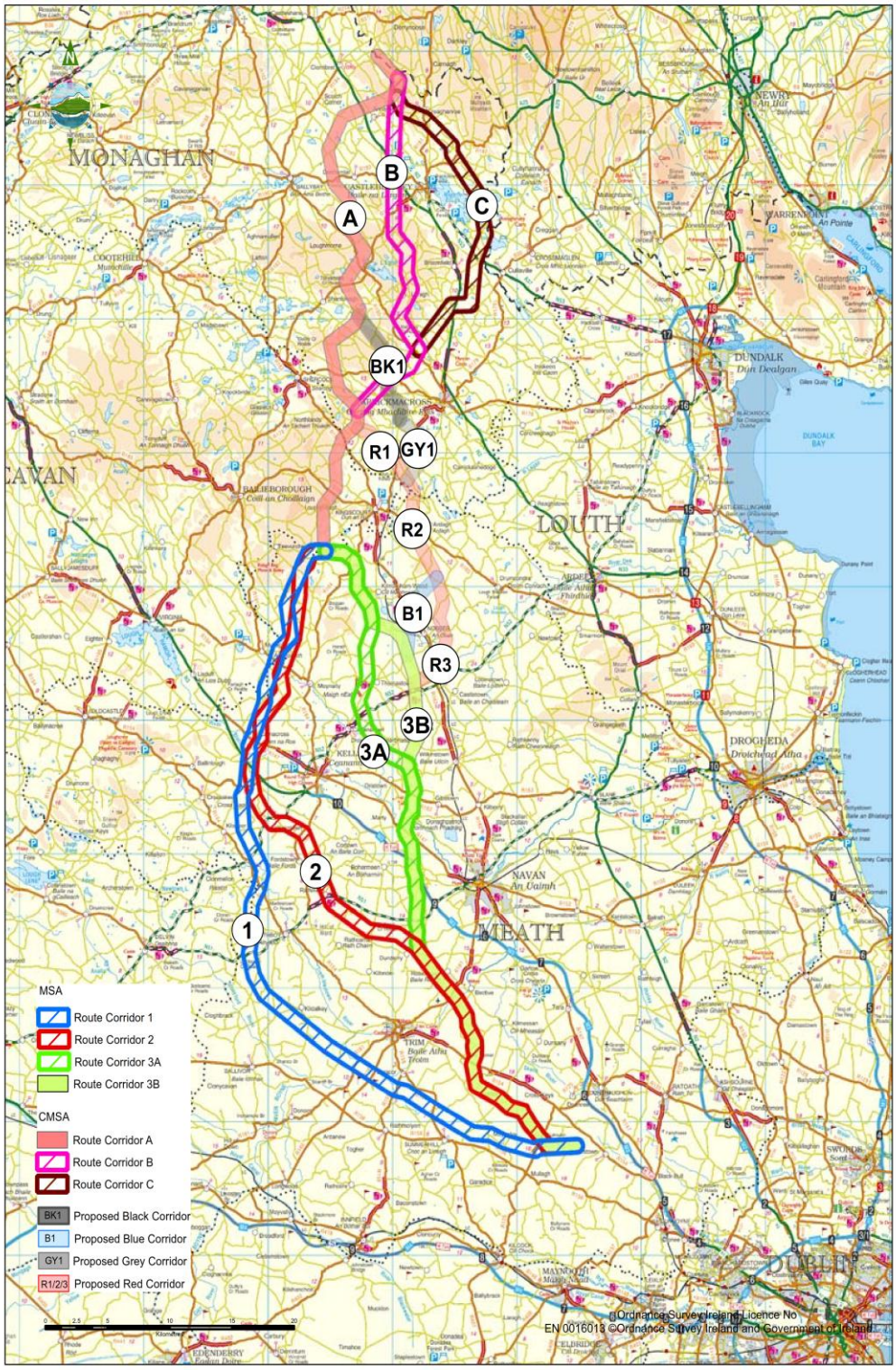

Figure 5.16: Identified Potential Route Corridor Options East of Kingscourt, and the Preferred Route Corridor A/3B West of Kingscourt

95 The analysis confirmed the preferred route corridor A/3B (see **Figure 5.16** to the west of Kingscourt) as remaining the least constrained (and thereby preferred) route corridor option, primarily on the basis of having the lowest number of dwellings within 100m of the indicative line route, and being at a greater distance from all of the key settlement in the area (i.e. Kingscourt, Nobber and Carrickmacross) with particular implications from a visual amenity perspective.

5.3.4 Confirmation of Preferred Route Corridor (and Indicative Line therein)

96 Following a comprehensive re-evaluation process of all corridor options, including the evaluation of potential route corridors to the east of Kingscourt, it was concluded that no new significant environmental or other constraints have arisen since the previous application in 2009, which would result in any substantial change to the previously identified route corridor options (although it is noted that some localised modifications did occur).

97 Route corridor option A/3B remains the preferred route corridor within which to route the proposed transmission circuit. **Figure 5.17** shows the preferred route corridor Option A/3B from Woodland to the jurisdictional border with Northern Ireland.

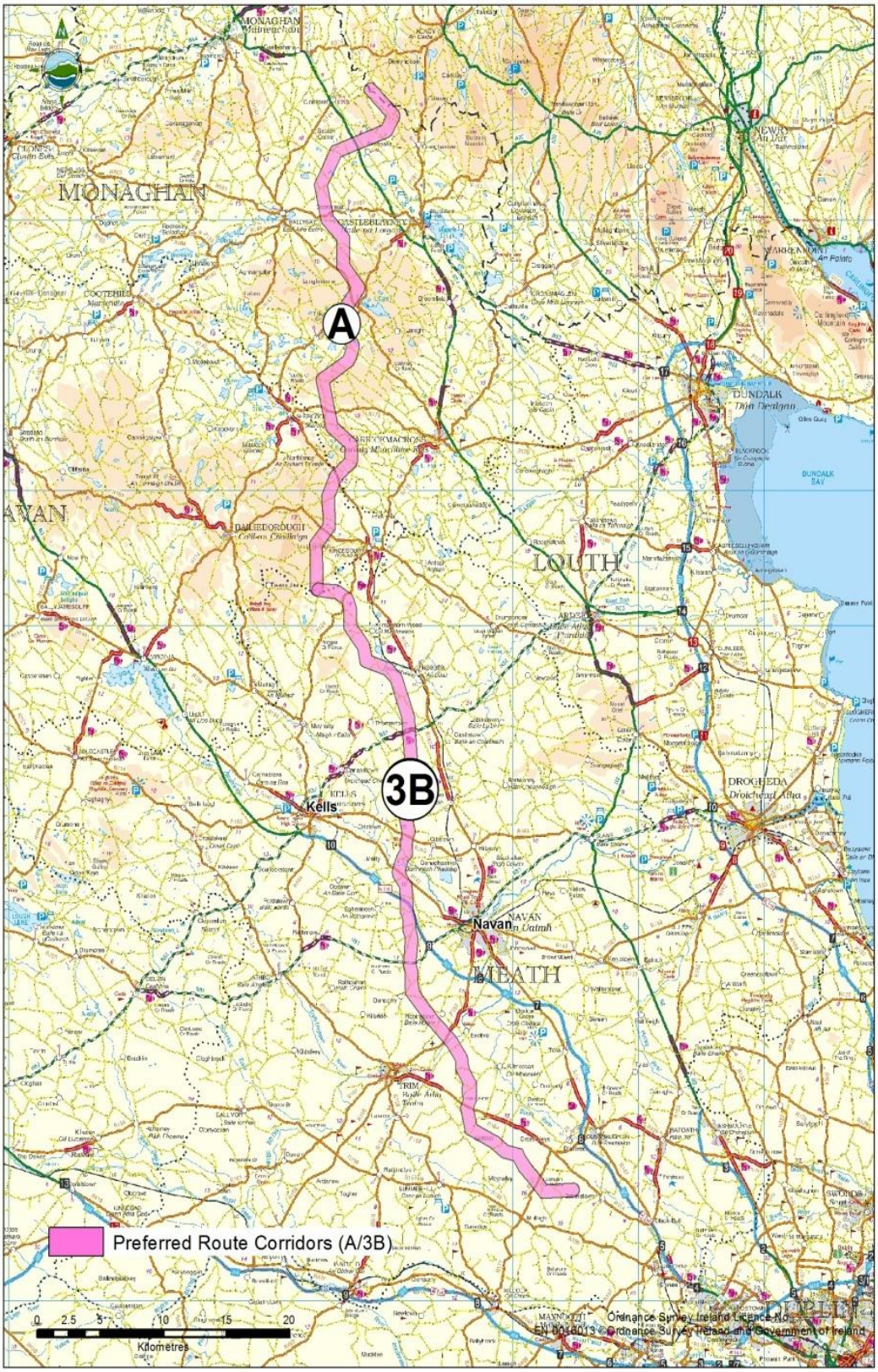

Figure 5.17: Preferred Route Corridor A/3B for the Proposed Development – 2013

5.4 IDENTIFICATION OF A PREFERRED LINE DESIGN

98 As set out in **Section 5.1**, Phase 3 of the route selection process was to identify an indicative route alignment within the preferred route corridor, following more focussed technical and environmental analysis within the identified preferred route corridor A/3B.

5.4.1 Background to the Indicative Route Alignment and Line Design for the Proposed Development

5.4.1.1 2009 Planning Application

99 The line design approach for the previous application, was consistent with the general principles of environmental assessment which emphasise the following:

- Avoidance - Impacts should be avoided through selecting the route which avoids creating the highest level of significant impacts.
- Reduction – Where impacts are unavoidable they should be reduced by applying mitigation measures to the particular environmental impact.
- Remedy – Where impacts cannot be reduced to an acceptable level they should be remedied through environmental compensation (i.e. sensitive habitats may have to be recreated at an alternative location).

100 Technical routing limitations and considerations were also particularly important as they influence tower locations and heights. The technical considerations for the line design for the previous application for approval would have been informed by *inter alia*:

- Euronorm EN 50341, *Overhead Electrical Lines exceeding 1 kV and the associated National Normative Aspects (NNA) for Ireland* as defined by the Electro Technical Council of Ireland.
- CIGRÉ Document, *High Voltage Overhead Lines Environmental Concerns, Procedures, Impacts and Mitigations* (1999).
- UK National Grid Document, *Our Approach to the Decision and Routeing of New Electricity Transmission Lines* – which incorporates 'The Holford Rules' and supplementary notes.
- EU Council Recommendation 1999/519/EC on the limitation of exposure of the general public to electromagnetic fields (0 Hz to 300 GHz).
- Health & Safety Legislation.

101 A line design was developed by firstly assessing a potential tower location using a specialised computer design programme (PLS CADD) and ordnance survey mapping in order to determine its feasibility and to confirm it meets all technical requirements. Initially, a desk-based assessment was completed, which includes a review of aerial photography, LiDAR[72] data and other environmental datasets. Following this, vantage point surveys and, where land access was granted, site specific surveys were also carried out.

102 The result of the design process was the identified line route which formed the basis of the 2009 application for approval.

5.4.1.2 The Re-evaluation of the Indicative Line Route

103 The principal recommendation arising from the re-evaluation process is that the general alignment of the previously identified indicative line route within route corridor Options A and 3B remains the 'best-fit' alignment for the proposed new transmission circuit within the preferred route corridor.

104 The *Final Re-evaluation Report* (April 2013) also concluded that, on the basis of the re-evaluation of updated environmental constraints and other information, a viable and environmentally acceptable indicative line route for a 400 kV OHL exists within the identified preferred route corridors A and 3B.

5.4.1.3 Description of the Indicative Line Route

105 The indicative line route identified in the *Final Re-evaluation Report* (April 2013) was broadly similar to the previously proposed line route (i.e. the subject of the 2009 application) but incorporates localised modifications as follows:

- Modifications to the line route in order to take account of the construction and granting of permission for new houses occurring since the preparation and submission of the previous Meath-Tyrone 400 kV Interconnection Development application in December 2009.
- Modification arising as a result of the decision not to proceed with the intermediate substation (in the area to the west of Kingscourt) development.

[72] LiDAR is a remote sensing technology that uses laser scanning to collect height and elevation data.

- Modifications arising from technical and environmental considerations during the re-evaluation process.

106 The preferred route corridor Option A/3B with the indicative line route therein is illustrated in **Figure 5.18**.

107 The *Final Re-evaluation Report* (April, 2013) also concluded on the basis of updated environmental constraints and other information, that at the strategic level of the re-evaluation process, no areas would warrant the use of UGC along any part of the indicative line route, other than on an identified section at the approach to Woodland Substation (albeit that this no longer forms part of the final design which is the subject of this application for statutory approval – refer to **Chapter 2** of this Volume of the EIS). However, it was noted that EirGrid would continue to investigate partial undergrounding as part of the detailed line design process and preparation of the EIS.

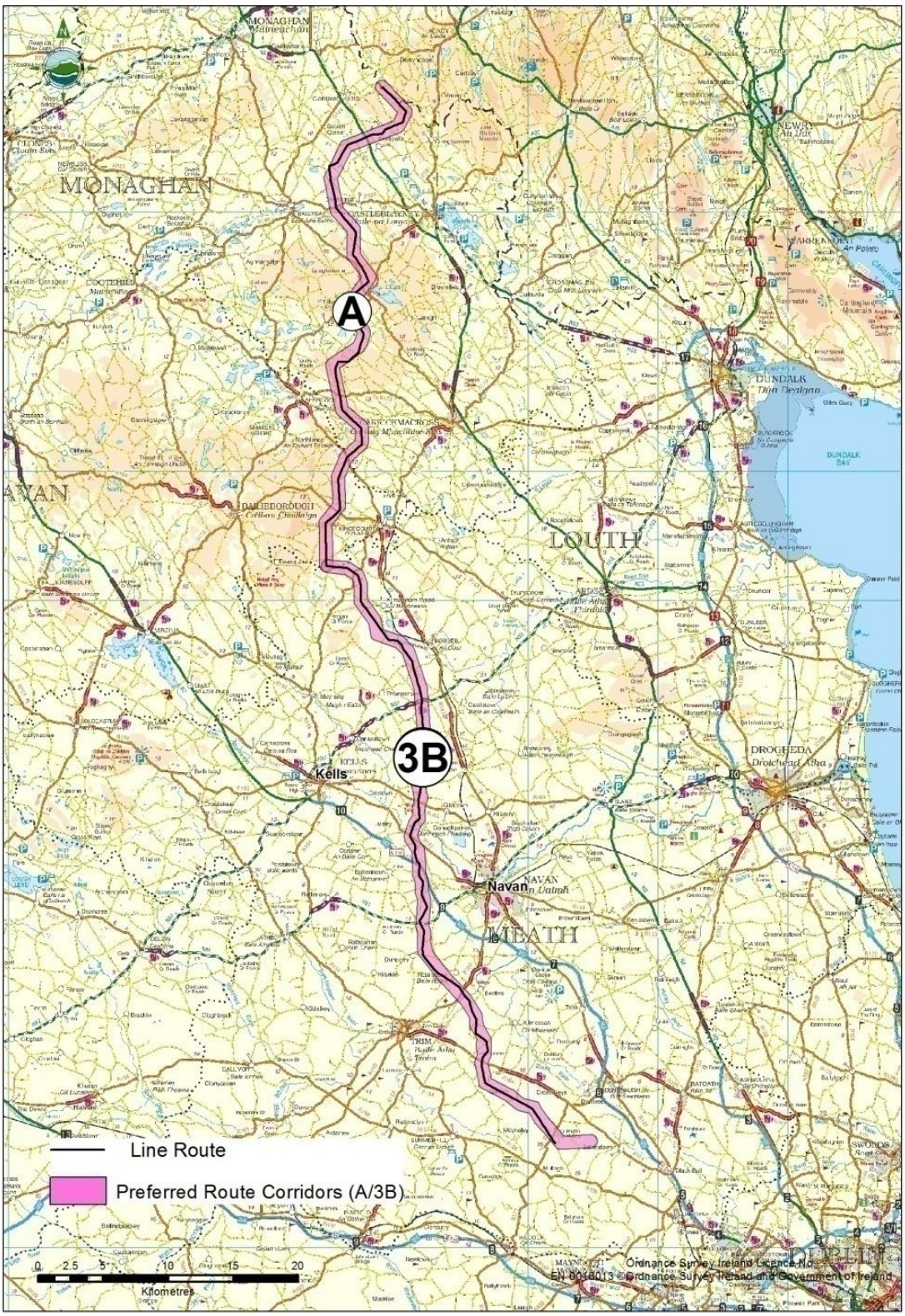

Figure 5.18: Preferred Route Corridor with Indicative Route Alignment

5.4.2 Confirmation of the Final Line Design for the Proposed Development

108 Following on from the *Final Re-evaluation Report* the *Preferred Project Solution Report* (July, 2013) provided detail as to the specific Preferred Line Design for the proposed development. This Preferred Line Design included identification of feasible alternative locations for, and design of the infrastructure, such as tower positions, tower types and associated construction related details (e.g. temporary access tracks). The evolution of the Final Line Design also had significant regard to previous feedback (including during the course of the previous Meath-Tyrone 400 kV Interconnection Development application and consultation), as well as to public and landowner feedback received during the re-evaluation process.

109 The *Preferred Project Solution Report* and other relevant matters which influenced the final line design are addressed below.

5.4.2.1 Line Design Guidelines

110 In the *Preferred Project Solution Report*, EirGrid identified the main routing principles (focusing on technical, environmental and landowner considerations) which guided the line design process for the proposed development. These equally informed the line design approach for the 2009 application. The principles are:

Technical Routing Considerations

- The minimum clearance for a 400 kV OHL shall be 9m over ground and 10m over major roads / railways. Clearance over canals / navigable waterways shall be 14.7m minimum.
- EirGrid's line design standard requirements and technical limits of existing tower designs include *inter alia* a requirement to achieve the appropriate span length for the kV (i.e. the maximum span length at 400 kV is 500m; however the average is 350m).
- Avoid sharp changes in direction in the line (or Angle of Deviation (AOD)) and minimise the number of angle towers required, where possible.
- Minimise the number of crossings of other power lines, railway lines, roads and other infrastructure.
- Tower foundations should be located in stable flood free environments with minimal erosion to avoid excessive costs related to highly reinforced or piled foundations and for long term maintenance access.

Environmental Considerations

- On the grounds of general amenity, where possible EirGrid will avoid routing overhead transmission lines close to residential areas.

- With respect to individual houses, EirGrid will seek to maximise distances between OHL and existing dwellings and specifically, where possible, to achieve a lateral clearance of at least 50 metres from the centreline of the proposed development to the nearest point of dwellings.

- Avoid known ecologically sensitive areas (e.g. cSAC / SAC / pNHA / NHA /SPAs) where possible.

- Sites of potential ecological importance (e.g. hedgerows and wetlands) shall be assessed via on-site survey. Where such surveys are not possible overhead towers should be sited away from the potentially sensitive areas and into adjoining managed agricultural fields where the ecological sensitivity is low.

- Cause least disturbance and minimise impacts to identified natural heritage interests (including watercourses).

- Avoid major areas of highest amenity value and deviate around areas of lesser amenity value, where possible.

- Integrate the line within the landscape, where possible including *inter alia*: utilising natural background and foreground features to visually absorb towers (e.g. hills, forests, vegetation etc.); avoiding axial views, breaking the skyline and a concentration of 'wirescape' (arising from proximity to lower voltage or telephone lines); maintain uniformity of tower heights where possible, etc.

- When crossing a flat landscape characterised by a large visual field, poor complexity and a clear organisation of land pattern, it is preferable to use higher towers with longer span lengths (to match the simplicity of the landscape).

- Cause least disturbance to and minimise impacts to cultural heritage interests.

Landowner Considerations

- Minimise disturbance to current land use and farm / land management practices.

- Consult with landowners throughout the various stages of the design.

- Gather inputs from landowners on their farm practices and suggested locations for towers.

111 These guidelines informed and provided a starting point for identifying a potentially suitable line design which appropriately balances competing considerations.

112 Having regard to the above routing principles, a line design can then be developed by firstly assessing a tower location using a specialised computer aided design programme (PLS-CADD) and ordnance survey mapping in order to determine its feasibility and to confirm it meets all technical requirements. The tower locations are then passed on for further iterative assessment by relevant specialists including ecologists, archaeologists, hydrologists, geologists, agronomists and landscape consultants. Initially, a desk-based assessment is completed, which includes a review of aerial photography, LiDAR data and other environmental datasets. Following this, vantage point surveys and, where access is granted, site specific surveys are also carried out.

5.4.2.2 Transposition

113 As identified in the *Final Re-evaluation Report*, the consequence of the deferment of the intermediate substation near Kingscourt was the establishment of a continuous 400 kV OHL circuit from Woodland to Turleenan; such a circuit would be more than 130km in length. It was noted that the operating performance of such a long high voltage OHL can be sometimes improved by the insertion of one or more points of 'transposition' along its length.

114 Transposition is the practice of transposing or rearranging the spatial arrangement of the three electricity wires or conductors that make up the three-phase circuit. The transposition takes place over four structures (the transposition alignment) as shown schematically in the **Figure 5.19**.

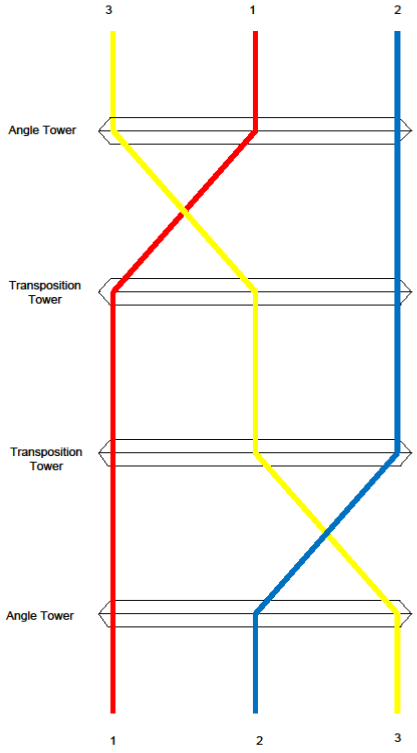

Figure 5.19: Schematic of Transposition Alignment

115 The three wires enter the transposition alignment orientated, left to right, 1 - 2 - 3 and exit the transposition alignment orientated, left to right, 3 - 1 - 2.

116 The *Final Re-evaluation Report* concluded that a *"transposition alignment will likely be required for this development*".

117 Following the conclusion of the *Final Re-evaluation Report* that a transposition alignment was likely to be required for this development, analysis by EirGrid showed that the OHL would benefit from a single transposition and that the optimum location for the transposition alignment was a general location 40 to 50km south of the proposed substation at Turleenan.

118 The exact location for such transposition required identification of a suitable straight section of the alignment capable of accommodating four structures installed in the following sequence, angle tower – transposition tower – transposition tower – angle tower.

119 A straight consisting of four structures was the optimum choice for a transposition alignment as it would avoid the requirement to insert an additional tower into the straight. Avoiding an additional structure has both environmental and cost advantages.

5.4.2.3 Feedback on the Preferred Line Design

120 The preferred line design as published in the *Preferred Project Solution Report* provided focus for ongoing landowner engagement, particularly in respect of the specific siting of structures on lands, as well as further environmental survey, design and assessment, primarily in engagement with directly affected landowners, as well as in consultation with prescribed bodies, other stakeholders and members of the public.

5.4.2.4 Partial Undergrounding

121 In the *Preferred Project Solution Report* (July 2013), EirGrid continued to consider the potential for partial undergrounding of the proposed development. This evaluation included having regard to submissions which specifically requested consideration to be given to undergrounding in particular areas and / or for certain sections of the proposed indicative line route, including a request by Cavan County Council to consider undergrounding in the area of Lough an Leagh. This latter submission was examined by the project team and its conclusion was set out in the *Preferred Project Solution Report* as follows:

> *"The scenic view point referred to in the submission, Lough an Leagh is approximately 2km west of the line route. It is an elevated area with extensive panoramic views. The visual assessment indicates that visibility of the line from this location would be confined to long distance views of the upper portions of some towers, and these would be difficult to discern against the background landscape. There is therefore no strong justification for undergrounding in the vicinity of Lough an Leagh."*

122 More generally on the potential for partial undergrounding, the *Preferred Project Solution Report* concluded:

> *"As part of the line design process, EirGrid and its consultants have reviewed the potential for partial undergrounding. At the conclusion of this review, EirGrid is of the opinion that a viable and environmentally acceptable OHL line route exists within which to design the proposed North-South 400 kV Interconnection Development. However, partial undergrounding as a measure to mitigate potential significant environmental impacts will be further considered as part of the preparation of the EIS and within the broader EIA process".*

123 With the identification of a preferred OHL line design, EirGrid and its consultants were in a position to identify potential significant environmental impacts and to consider likely mitigation measures, which included, *inter alia*, the potential for partial undergrounding. Reference is also made to the Scoping Opinion issued by the Board on 11th December 2013, which stated that

"*the potential for alternative routing or partial undergrounding in sensitive landscape areas should be addressed*".

124 Both OHL and UGC technologies result in environmental impacts. These impacts are however different for the different technologies and in most cases, if not all, mitigation measures are available.

125 As referenced in **Section 4.8**, the circuit design and operating voltage are both important variables which determine the eventual size, scale, and ultimately appearance of the necessary support structures for an OHL. In general, the higher the voltage, the larger the support structure that is required with a consequential impact on landscape and visual resources. Therefore, careful route selection during the planning stages is critical in mitigating landscape and visual resources, particularly for high voltage OHLs. It is at this route selection stage where there is maximum potential to achieve avoidance and minimal adverse landscape or visual effects.

126 The potential for undergrounding as a mitigation measure required consideration of the potential environmental impacts associated with partial undergrounding. In this regard, reference is made to **Section 4.7.3.3** of this volume of the EIS which examines some of the environmental implications of partial undergrounding and Chapter 6 of the Government commissioned Ecofys *Study on the comparative merits of overhead electricity transmission lines versus underground cables* (2008) which examines a number of key environmental issues and compares OHL and UGC in terms of 'Environmental Impact' and 'Ease of Potential Mitigation'.

127 The Ecofys Report concludes, in Section 6.12, by stating: "*the purpose of this study is to provide decision-makers with an unbiased, comparative assessment of the general environmental implications of either scenario in environments typical of Ireland to enable them to make informed decisions in this regard."* It then presents its findings in tabular form, see **Figure 5.20** Table 6-1: *High Voltage Transmission Systems – Overhead Lines versus Underground Cables: Environmental Impact & Ease of Potential Mitigation*.

	Underground Cables		Overhead Lines	
Potential for Effect	**Signif[1]**	**Ease of Mitigation**	**Signif.**	**Ease of Mitigation**
LAND USE				
Time and Flexibility of Construction	***	●●	**	●●
Length of Construction	***	●●	**	●●
Disrupt. To Agric. Operations	***	●●●	**	●●●
Land Take	**	●●	*	●●●
Effect on Field Boundaries	***	●●	**	●●●●
Effects on Farm Buildings	**	●	**	●●●
Effects on Drainage Patterns	***	●●	*	●●●●
Catastrophic Event Implications	***	●●	**	●●●
Repair & Maintenance	***	●●	*	●●●●
GEOLOGY and SOILS				
Soil Cover	***	●●●	**	●●●●
Excavated Material	***	●●	**	●●●●
Quarrying and Mining	**	●●●	**	●●●
EFFECTS ON WATER				
Disruption to Groundwater incl. Wetland	***	●●	*	●●●●
Effect on Surface Waters	***	●●●	*	●●●●
GROUND RESTORATION	***	●●●	**	●●●
ECOLOGY and NATURE CONSERVATION				
Bird Strike	N/A	N/A	***	●●●
Risk to Flora (construction)	***	●●	**	●●●
Risk to Flora (operations)	**	●●	*	●●●
Risk to Mammals	**	●●	*	●●●
Risk to Insects	**	●●	*	●●
Loss of Habitat (construction)	***	●●●	**	●●●

	Underground Cables		Overhead Lines	
Potential for Effect	**Signif[1]**	**Ease of Mitigation**	**Signif.**	**Ease of Mitigation**
Loss of Habitat (operations)	**	●	**	●
Risk to Aquatic Ecosystems	***	●●●	*	●●●●
Restoration	***	●●●	*	●●●
LANDSCAPE and VISUAL				
Landscape Character	*	●●●	***	●●
Landscape Features	**	●●	*	●●●
Visual Impact (construction)	***	●●	**	●●
Visual Impact (operations)	*	●●●	***	●●
Access Tracks/Haul Roads	***	●●●	**	●●●●
Communities	**	●●●	***	●●
CULTURAL HERITAGE				
Archaeological Resources	***	●●	*	●●●
Cultural/Historic Resources	**	●●	**	●●●
Language and Culture	*	●●●	***	●●
TRAFFIC AND NOISE				
Traffic	***	●●	**	●●
Noise (construction)	***	●●	**	**
Noise (operations)	*	●●●●	**	●●
AIR QUALITY				
Construction	***	●●	**	●●
Operations	N/A	N/A	**	●
COMMUNITIES				
Quality and Cohesiveness	*	●●●●	***	●●
Business, Economy and Employment	*	●●●●	**	●●
Tourism Industry	*	●●●●	**	●●
Fishing	*	●●●●	**	●●●

	Underground Cables		Overhead Lines	
Potential for Effect	**Signif[1]**	**Ease of Mitigation**	**Signif.**	**Ease of Mitigation**
Animal Breeding	*	●●●●	**	●●●
Health & Safety and Electromagnetic Fields	*	●●●●	**	●●●●
Property Prices	**	●●	***	●
Severance	*	●●●●	***	●●
Educational Enrolment	*	●●●●	***	●●
Future Development	**	●●●	***	●●
RECREATION and TOURISM	*	●●●	***	●●

(Source: Ecofys *Study on the comparative merits of overhead electricity transmission lines versus underground cables* (2008))

Note: 1 = Significance of Impact

Significance:

*** Major: a fundamental change to a sensitive environment

** Moderate: a material but non-fundamental change to the environment

* Minor: a detectable but non-material change to the environment

N/A Not applicable

Mitigation:

● No practicable mitigation possible

●● Remedial measures only

●●● Mitigation likely to reduce adverse scale of impact

●●●● Mitigation likely to avoid adverse discernible impact

N/A Not applicable

Figure 5.20 Table 6-1: High Voltage Transmission Systems – Overhead Lines versus Underground Cables

(Source: Ecofys *Study on the comparative merits of overhead electricity transmission lines versus underground cables* (2008))

128 Of particular note, the table identifies that, for the majority of environmental topics an OHL has an equal or lesser environmental impact to a UGC, with obvious exceptions (including bird strike, landscape character, visual impact and certain community issues). This is generally consistent with EirGrid's findings.

129 In relation to landscape and visual impact, in particular, Ecofys reported a significance of impact of 'major – a fundamental change to a sensitive environment' in terms of landscape character, visual impact (operations) and communities. Mitigation is identified as 'likely to reduce adverse scale of impact'. Identified mitigation measures include *inter alia* avoiding conspicuous sky lines and horizons, particularly in visually sensitive areas and avoiding, to the extent feasible, areas of high visual amenity and areas with highly sensitive visual receptors. It is important to note that these measures have fed into the line design process for the proposed development (refer to **Section 5.4.2.1).**

130 **Table 5.4** below summarises EirGrid's consideration of partial undergrounding to mitigate potential significant environmental impacts arising from the preferred OHL line design, based on an understanding of the environmental issues associated with the Monaghan, Cavan and Meath study area. In this regard, the majority of environmental topics identified OHL as having an equal or lesser environmental impact to partial undergrounding. These findings are generally consistent with the comparative environmental implications described in Table 6-1 of the Ecofys Report (as replicated in **Figure 5.20**).

Table 5.4: Consideration of Partial Undergrounding as a Mitigation Measure for the Proposed Development

Environmental Topic	Consideration of Partial Undergrounding as a Mitigation Measure for the Proposed Development
Human Beings – Population and Economic	Partial UGC could be considered as an effective mitigation measure in order to reduce the most significant impacts (localised visual impacts) on population, assuming that an appropriate location and screening plan can be identified for minimising the visual effect of the requisite sealing-end compounds. This has been considered by the landscape specialist and it is concluded that, having regard to the above, and the strategy of avoiding those parts of the landscape in the study area most sensitive to the landscape effects of OHL (as well as the generally robust character of the study area landscape), there is no particular location along the proposed route which has been identified as presenting a critical need for partial undergrounding within the technical parameters of this project.

Environmental Topic	Consideration of Partial Undergrounding as a Mitigation Measure for the Proposed Development
Human Beings - Land Use	UGC would cause a greater level of disturbance to livestock, farming operations and has a higher potential to damage soil and land drainage during construction compared to OHL. During the operational phase both UGC and OHL may restrict development in the area immediately above the cable or under the towers, however, the permanently restricted area for both is low. Furthermore, while UGC will only be an obstacle to deep cultivation (e.g. land drainage and sub-soiling); the presence of towers has a higher potential to inconvenience other farming practices (all field operations). In summary both OHL and UGC are likely to have similar residual impacts however they are imperceptible. Therefore there are no impacts of such significance envisaged that would introduce the need for consideration of partial undergrounding for the proposed development from a land use and agronomy perspective.
Human Beings - EMF	A comparative assessment of OHL and UGC from an EMF emissions perspective for this proposed development can be found in the PB Power Report, 2009. The Report confirms that both the proposed 400 kV OHL and a comparable AC UGC (including partial UGC) would comply with the ICNIRP (1998) Guidelines and EC Recommendation (1999/591/EC). Partial undergrounding cannot therefore be considered as a way of mitigating EMF from the proposed overhead line as there is no difference between the two technologies from a compliance perspective. Partial undergrounding is not therefore proposed.
Human Beings – Tourism and Amenity	Partial UGC is an effective mitigation measure in order to reduce localised visual impact and resultant potential impacts on tourism assets, assuming that an appropriate location and screening plan can be identified for minimising the visual effect of the requisite sealing-end compounds. Partial UGC would result in higher temporary physical landscape effects at construction stage, but these effects can be mitigated with reinstatement of planting (excluding tree planting). However, having regard to the above, and the strategy of avoiding those parts of the landscape in the study area most sensitive to the landscape effects of OHL as well as the generally robust character of the study area landscape - no location along the proposed route has been identified where there is a critical need for partial undergrounding within the technical parameters of this project.
Flora & Fauna	Potential impacts on flora and fauna associated with OHL and partial UGC vary. UGC would eliminate the collision risk to Whooper swans and other such collision prone birds; however during the construction phase there is the potential for adverse impacts on sensitive habitats such as wetlands (including rivers and associated riparian habitats), woodlands, hedgerows and treelines. The construction of the cable would result in significant habitat disturbance

Environmental Topic	Consideration of Partial Undergrounding as a Mitigation Measure for the Proposed Development
	arising from extensive ground excavations along the length of the cable section. In addition there would be some loss of habitat as a section of every hedgerow intersected by the cable route would be removed and grubbed out during construction and would not be reinstated in its original form. In addition the construction of the cable would result in greater potential for risk of disturbance to protected mammals and birds; for example permanent removal of breeding sites and greater risks of pollutant / soil water runoff to aquatic receptors. During the operational phase, habitat fragmentation could arise with reduced connectivity (e.g. gaps through hedgerows), due to the requirement for a non-wooded corridor along the cable length. In addition UGC would have a greater potential to impact aquatic habitats (rivers and streams – including the River Boyne and Blackwater cSAC / SPA in the case of the proposed development) during both construction and operational phases (i.e. maintenance). Trenchless directional drilling methods could be used to install the UGC under rivers and streams, however this introduces the risk of 'frac-out' (fracturing of the bore hole) with the accompanying risk of the escape of bore hole grout into the water which has the potential for severe, albeit short term, impact on water quality (aquatic receptors). UGC would present a greater risk to water quality (aquatic receptors), protected fauna and habitats. The only reason for considering partial UGC from an ecology standpoint regarding the proposed development is to remove the risk of Whooper Swans colliding with an OHL at relevant sections identified in the EIS. In conclusion, there are no impacts of such significance envisaged that would introduce the need for consideration of partial undergrounding for the proposed development from a flora and fauna perspective.
Soils, Geology and Hydrogeology	The potential impacts from UGC are greater than OHL and would require additional mitigation measures particularly in sensitive areas (i.e. the River Boyne / River Blackwater cSAC). Potential impacts may occur on wetlands and peatlands identified along the line route. Potential impacts include groundwater impact adjacent to wetlands in the CMSA and the Boyne and Blackwater cSAC. Additional soil excavation and disposal will be required in the event of undergrounding. The use of bridge crossings where feasible and directional drilling for the crossing of major water courses would be required. Additional impacts are also likely to occur on the wetlands (i.e. Cashel Bog, Tassan Grassland and Clarderry Bog) and geological heritage sites along the proposed development including the Altmush Stream and Galtrim Moraine CGS. Additional potential impacts may include settlement / disturbance of overlying areas. Additional mitigation measures would be required to deal with the extra groundwater encountered

Environmental Topic	Consideration of Partial Undergrounding as a Mitigation Measure for the Proposed Development
	during excavation work and directional drilling. In conclusion, notwithstanding mitigation measures, UGC would present a greater potential risk to soils, water and hydrogeology than OHL. Accordingly, partial undergrounding of the proposed development is not required.
Water	The potential impacts from UGC are greater than OHL and would require additional mitigation and detailed design particularly at the River Boyne / River Blackwater cSAC. Potential impacts include the diversion of numerous land drains and small streams connected to salmonid streams. Potential impacts may also occur on wetlands and peatlands identified along the line route. The use of bridge crossings where feasible and directional drilling for the crossing of major water courses would be required. Diversion of water courses should be avoided where possible to minimise disruption to aquatic ecosystems. Additional mitigation measures would be required to deal with the additional construction periods and excavation areas involved. In conclusion, notwithstanding mitigation measures, UGC would present a greater potential risk to water than OHL. Accordingly, partial undergrounding of the proposed development is not required.
Noise	The construction of UGC would result in greater noise impact than OHL (arising from more extensive, longer lasting and more machinery intensive works; higher traffic volumes; and construction of additional transition stations). In the operational phase the UGC would reduce the effect of corona noise in the UGC sections. However, additional noise and vibration impacts would arise for both the construction and operational phases of UGC due to the introduction of transition stations. When the construction phase and operational phase noise and vibration impacts are viewed as a whole, it is considered that there is no significant noise and vibration benefit to be gained by introducing partial undergrounding as part of the proposed development. Noise and vibration impacts of the proposed OHL are predicted to meet all relevant guidelines limit values.
Air - Climate	Undergrounding the proposed line would involve a greater level of groundworks, increased traffic emissions and increased use of natural resources such as concrete and aggregate materials. This would increase the level of impacts associated with the construction phase.
Landscape	The primary mitigation measure in landscape terms is avoidance at route selection stage. The determination of the best route for an OHL resulted in the avoidance of those parts of the landscape in the study area which are most sensitive to the landscape and visual effects of an OHL; including where possible, higher ground and ridgelines, waterbodies, landscape designations and important scenic views. Best practice routing principles (refer to **Section**

Environmental Topic	Consideration of Partial Undergrounding as a Mitigation Measure for the Proposed Development
	5.4.2.1) also informed the line design process including measures to integrate the line within the landscape where possible. The *Preferred Project Solution Report* states that the use of short lengths of UGC will only be considered in the event that an appropriate and acceptable OHL solution could not be found. This is considered to occur if *Profound* impacts, as defined in the EPA Guidelines, were predicted. A profound impact is defined in the Guidelines as one which "*obliterates sensitive characteristics".* This would be the case if, for example, there are major landscape and visual impacts on highly sensitive landscape features of National or International value. The proposed OHL does not result in effects of this magnitude within the study area and therefore there is no critical need for partial UGC along the route. However, the scoping opinion from the Board has also requested that the *potential for partial undergrounding be assessed in sensitive landscape areas*. The approach to landscape and visual impact evaluation for this EIS accepts that it is not possible to eliminate all the landscape and visual effects of OHL and significant visual impacts will potentially occur over the course of the entire length of the line route. The most sensitive landscape areas along the line route have been identified in the EIS (refer to Chapter 11 of **Volume 3C** and **Volume 3D)**. In terms of visual impact, it is acknowledged that removing towers from views would reduce the extent of visibility of the proposed development in short lengths of sensitive landscape locations such as the crossings of the Boyne and Blackwater. The precise locations where partial undergrounding may be appropriate have not been identified i.e. with the capacity to screen the UGC associated infrastructure such as sealing-end compounds and absorb the residual landscape effects of partial UCG. Areas where partial UGC might be considered are also the locations that would be most sensitive to the landscape and visual effects of the required sealing-end compounds and permanent haul roads. Partial UGC in these locations would result in new landscape and other environmental impacts. These have been described in detail in **Section 4.7.3.3** this volume of the EIS. For example from a landscape perspective, potential impacts at construction will arise from excavation, haul roads and vegetation removal; and UGC will also introduce additional new permanent features into the receiving environment such as haul roads, sealing-end compounds and manholes. While vegetation needs to be removed during construction stage, reinstatement / screen planting and appropriate siting can reduce the long term impact of, for example, sealing end compounds.
Material Assets – General	In comparison to OHL, the construction of underground sections of the proposed development would result in increased volumes of excavated soil

Environmental Topic	Consideration of Partial Undergrounding as a Mitigation Measure for the Proposed Development
	(and potentially rock) material which may not be suitable as backfill material and may need to be sent to waste facilities. Furthermore, during the construction phase for both UGC and OHL there is the potential to disrupt other underground and overhead services. During the operational phase, UGC would have no impact on aircraft operating at Trim Airfield or ballooning activities. OHL would also have no impact on these operations as they would be factored into flight planning considerations, along with all similar existing infrastructure in the area. Accordingly it is not considered that there is an overriding need for partial undergrounding along the proposed route.
Material Assets – Traffic	The construction of partially underground sections of the proposed development would have a somewhat different traffic impact to that of the construction of an OHL. The key difference would be the volumes of excavation required to lay the cable and the potential that some or all of that material would have to leave the site via the road network, thus increasing the volumes of traffic generated by the proposed development. The volumes of soil excavated when constructing the underground sections would be greater than those expected for the construction of a similar length of the overhead transmission line. The construction of UGC sections would therefore result in greater volumes of soil leaving the site and being disposed of as waste, thereby increasing the number of vehicles accessing the site compared to an equivalent section of the OHL. Dependent on the design and construction methods used for underground sections, the volumes of construction materials would also likely have implications for the volumes of traffic generated. In conclusion, the construction of underground sections of the proposed transmission line will increase the volumes of construction traffic using the public road network when compared to overhead line construction. Therefore, from a traffic impact perspective, there is no reason to consider the undergrounding of sections of the proposed development.
Cultural Heritage	The methods of construction for OHL and UGC have very different impacts upon cultural heritage. OHLs have a very small physical footprint and avoidance of all direct impacts upon known archaeological and architectural sites is usually achievable however, their potential to impact upon the setting of cultural heritage sites is much greater. UGC and associated works are unlikely to impact upon the setting of cultural heritage sites but are more likely to impact physically upon known and previously unrecorded archaeological and architectural sites. In relation to the proposed development, from an archaeological, architectural and cultural heritage perspective, there is no overriding need for partial undergrounding.

131 Partial undergrounding to mitigate potential significant impacts on landscapes arising from the preferred OHL is considered further in **Appendix 5.1, Volume 3B Appendices,** of the EIS**.**

132 In conclusion, EirGrid's environmental consultants have given extensive and detailed consideration to the potential for partial undergrounding (and its likely environmental impacts) as a potential mitigation measure in the context the environmental issues associated with the Monaghan, Cavan and Meath study area and the preferred line design. However, no particular area(s) have been identified where there is an overriding need for partial undergrounding in order to mitigate significant potential impacts.

133 Also during this process, EirGrid and its consultants gave due consideration to specific requests to partially underground on particular landholdings on the grounds of general amenity; however, having regard to the environmental, technical and cost considerations set out in **Section 4.7.3** of this volume of the EIS, and the findings of specialists, as set out in **Table 5.4**, EirGrid and its consultants are of the view that, on the basis of the evidence presented to date, there are no areas along the proposed development that would warrant partial undergrounding.

5.5 FINAL LINE DESIGN (AND CERTAIN ASSOCIATED DEVELOPMENT) FOR THE PROPOSED DEVELOPMENT

5.5.1 Proposed Interconnector Overview

134 As noted previously, the proposed interconnector consists of two separate but related and complementary developments, one in Northern Ireland and the other in Ireland. The final design can be broken up as follows:

135 The SONI element of the proposed interconnector (i.e. Towers 1–102) comprising:

- The construction and operation of a new 275 kV / 400 kV (source) substation at Turleenan townland, north-east of Moy, County Tyrone;
- The construction and operation of two 275 kV terminal towers to enable connection of the Turleenan substation to NIE's existing 275 kV OHL and the removal of one existing 275 kV tower; and
- The construction and operation of a single circuit 400 kV overhead transmission line supported by 102 towers for a distance of 34.1km from the source substation (at Turleenan) to the border where it will tie into the future ESB network. The OHL will continue on in the Republic of Ireland with all further towers being promoted by EirGrid for placement within that jurisdiction. Because of the meandering nature of the border,

the OHL will oversail a portion of land within the Northern Ireland townland of Crossbane for a short distance of 0.2km.

136 The EirGrid element of the proposed interconnector comprising:

- **CMSA – New 400 kV Line:** The proposed development in the CMSA comprises a single circuit 400 kV overhead transmission circuit supported by 134 towers (Tower 103 to Tower 236) extending generally southwards from the jurisdictional border with Northern Ireland (between the townland of Doohat or Crossreagh, County Armagh, and the townland of Lemgare, County Monaghan) to the townland of Clonturkan, County Cavan for a distance of approximately 46km. It includes lands traversed by the conductor from the jurisdictional border to Tower 103 and from Tower 103 to Tower 236 inclusive and lands traversed by the conductor strung from Tower 236 to Tower 237 (the first tower on the MSA section of the proposed development).[73] It also includes modifications to existing 110 kV transmission overhead lines, and all associated and ancillary development works including permanent and temporary construction and excavation works.

- **MSA – New and Existing 400 kV Line:** The proposed development in the MSA comprises a new single circuit 400 kV overhead transmission circuit supported by 165 new towers (Tower 237 to Tower 401) extending for a distance of approximately 54.5km from Tower 237 in the townland of Clonturkan, County Cavan to Tower 402 (an existing double circuit tower on the Oldstreet to Woodland 400 kV transmission line) in the townland of Bogganstown (ED Culmullin), County Meath. It also includes modifications to an existing 110 kV transmission overhead line, and all associated and ancillary development works including permanent and temporary construction and excavation works.

  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 (ED Culmullin), County Meath to Tower 410 and the Woodland Substation in the townland of Woodland, County Meath. From an environmental perspective, it was considered that using the unused side of these

[73] Between Tower 106 and Tower 107 the proposed transmission line crosses the jurisdictional border with Northern Ireland at two points - from the townland of Lemgare, County Monaghan into the townland of Crossbane, County Armagh and back into the townland of Lemgare, County Monaghan. This results in a section of the span between Tower 106 and Tower 107 oversailing Northern Ireland. The oversail section forms part of the SONI proposal.

double circuit towers has a much lower potential impact compared to a new line route into / out of Woodland Substation.

- Woodland Substation**:** The MSA preferred line design also includes an associated extension to the existing Woodland Substation. The proposed extension will take place entirely within the existing ESB property boundary and will involve work to an area of approximately 5,440sq.m. (0.544ha) including the area to accommodate the proposed electrical equipment and the extension to the existing 2.6m high palisade fence. The overall area of the substation within the proposed fence line will however only be extended by approximately 2,307sq.m. (0.231ha) as the majority of the works are accommodated with the existing fence line. In this regard, in the previous application for planning approval a short section of underground cable was proposed at the approach to Woodland Substation and to connect into Bay E3. However, following ongoing review of the preferred line design as published in the *Preferred Project Solution Report* (July 2013) it is now proposed to connect into Bay E10 thus avoiding the need for an underground cable section within the substation. The specific works are detailed in **Chapter 6** of this volume of the EIS.

- **Temporary Construction Material Storage Yard:** Furthermore, in identifying a suitable site for a temporary construction material storage yard the criteria included location relative to the proposed line route, accessibility to the road network, size, suitability (including good topography and ground condition, minimum environmental impact and residential amenity considerations), security and availability. A number of potential sites were identified. However, the site at Monaltyduff and Monaltybane, Carrickmacross, County Monaghan being a former construction yard facility associated with the construction of the N2 National Primary Road and being centrally located along the line route and immediately adjacent to the southern side of the N2 National Primary Road, with access thereto and therefrom via a local road (L4700) met all suitability criteria without having an adverse environmental impact on the receiving environment. It was therefore identified as the preferred construction material storage yard location.

5.6 CONCLUSIONS ON ROUTE ALTERNATIVES

137 The route alignment of the proposed development has been subject to an extensive and careful examination of alternatives as part of an iterative project development process, from the broadest study area for the project down to localised alternatives for line routing. As this chapter has demonstrated, the mitigation of environmental impacts by design has been a fundamental aspect of EirGrid's line design process, and the proposed line design is considered

to represent the best overall option amongst the main alternatives considered through the route development process.