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Cavan-Tyrone and Meath-Cavan

400kV Power Lines

Locating 400kV Cables in or Adjacent to Rail Beds

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LIST OF ACRONYMS AND ABBREVIATIONS

Cigre: International Council on Large Electric Systems

Cllr: Councillor

EIS: Environmental Impact Statement

EMF: Electromagnetic Fields

ESB: Energy Supply Board

m: metres

OHL: Overhead Lines

PB Power: Parsons Brickerhoff

RMP: Record of Monuments and Places

TSO: Transmission System Operator

UGC: Underground Cable

CIE: Comhras Iompair Éireann

1 EXECUTIVE SUMMARY

To increase the security and reliability of electricity supplies, strengthen existing power supplies in the North East, facilitate the all-Ireland market in electricity, and increase the use of renewable energy, EirGrid, the Transmission System Operator (TSO), proposes the following:

- The development of a 400kV transmission project between Woodlands Substation in Co. Meath and a new substation in the vicinity of Kingscourt in Co. Cavan; and

- A 400kV transmission interconnector project between Kingscourt in Co. Cavan and Turleenan in Co. Tyrone.

Use of overhead transmission lines (OHL) is the proposed technology.

As part of the consultation process for these projects stakeholders suggested that disused railway lines in Meath, Cavan, Monaghan, Armagh, and Tyrone could be used to provide a route for an underground cable option (UGC). An underground option of this type was viewed as preferable to OHL as it leveraged existing infrastructure and was believed to be more cost effective, for the following reasons:

- Rail beds readily available and of uniform grade;

- Existing bridges can be reused, thereby reducing costs; and

- Opportunity to co-locate with the railways means installation works could be done at the same time as the railway renewal or afterwards.

As the TSO, EirGrid takes its obligation to develop and operate a safe, secure, reliable, and economical system very seriously. With this in mind, it commissioned this report, *Considerations in Relation to Locating 400kV Cables in or Adjacent to Rail Beds*, to examine the viability of the UGC option for both the Woodlands to Kingscourt and the Kingscourt to Turleenan sections of the line along the suggested rail routes as compared to other UGC cable routes and in particular the route corridor proposed by PB Power in their report commissioned by EirGrid in 2009 entitled '*Comparison of High Voltage Transmission Options: Alternating Current Overhead and Underground, and Direct Current Underground'* (Appendix A).

While EirGrid is of the firm belief that undergrounding does not represent an appropriate technology for the proposed 400kV projects or for the general development of the transmission system, in this report, the considerations that would arise in relation to the use of the rail beds involved are examined.

EirGrid finds that co-location of transmission cables and rail to be unfavourable in this instance, in terms of ongoing security of the system and the arrangements necessary in the event of major accidents or faults. Secondly, the selection of a rail bed selection would only serve to direct a cable route at a series of obstacles, such as bridge abutments and narrow, steep sided embankments and cuts which would have to be severely modified. Legacy structures of the old railway would also have to be modified, removed or avoided. Such a routing would not have the advantages of a route corridor selected to minimise community and environmental impacts, such as was done in the report produced by PB Power.

In the course of EirGrid preparing this report the identified issues were discussed with Iarnród Eireann and comments made by Iarnród Eireann have been incorporated in the report.

The report concludes that the route corridor independently identified by PB Power is superior to the option presented by attempting to make use of existing rail beds. Furthermore the PB Power report found that the OHL option is superior to the UGC option based on a balanced assessment on economic, technical, reliability, security, and environmental grounds.

1.1 ECONOMIC CONSIDERATIONS

The railway beds from Navan to Armagh have many stretches of rail bed on embankments and in cuts that have inadequate width to accommodate the cables installation and future repair. Selecting such routes would direct the cable along a series of obstacles, including bridge abutments, remnant rail works at stations and level crossings, hedgerow, culverts, and bridges, all of which would have to be removed or by-passed at significant added cost in construction and maintenance, when compared to the route corridor selected by PB Power.

The section of rail from Dunboyne to Navan is to be re-opened. Joint rail and cable works would require additional land take and the nature of the works would severely impact each others' development and operation, imposing additional costs, risks, and unacceptable constraints on the parties, even as compared to the route corridor selected by PB Power.

The question of whether or not the Navan to Kingscourt line will be reopened is not resolved and while there are no immediate plans to do so; there is considerable local support for re-opening. The question of acquiring the land from CIE and the likely costs involved are unknown, but such costs are likely to be considerable, even as compared to the route corridor selected by PB Power.

1.2 TECHNICAL AND RELIABILITY CONSIDERATIONS

Joint rail and cable works would severely impact each others' development and greatly augment the risk of damage to the cables either during installation or thereafter.

There are a numerous stretches where embankments and cuts would have to be widened and even by so doing the top of a narrow embankment would quickly dry out and not provide the thermal characteristics necessary for the operation of cables. The location of junction boxes in such location would require even greater extension to the cross sections and would require considerable additional works to achieve.

The extent of construction necessary would be increased with major environmental impacts over those required if cables were independently located in the landscape to meet environmental and technical requirements.

Ongoing maintenance to embankments and cuts and extensive vegetation management associated with a rail bed route, would arise with all such operations posing added risks to cables, when compared to the route corridor selected by PB Power.

1.3 SECURITY CONSIDERATIONS

Placing the dual cable circuits adjacent to an operating railway would give rise to major difficulties during and after construction in the event that cable repairs or modifications to the railway facilities are required. There is also the consideration of major impacts to the other utility if major accidents occur.

There would also be non-compatibility of the operating regimes for maintenance and repair. Further, ongoing stability of embankments and their maintenance represent an increased risk that would not arise for an independently selected cable corridor.

Rail line fencing at encroachments and fly tipping also pose security risks.

Accessibility to embankments and cuts in adverse weather conditions represents an added impact on the TSO's capacity to render fast repair in the event of cable faults arising.

The UGC route corridor has been identified by Parsons Brickerhoff (PB Power), which minimises community and environmental impact, is shorter than the rail bed cable route and optimises the technical requirement necessary for the installation, operation, and repair of the cables. However, as the OHL solution for the above projects meets the requirements of the TSO and is superior on technical, security, reliability and economical grounds to the UGC's option, there is currently no basis for EirGrid to alter their current plan to use the railway beds or any other UGC option.

2 INTRODUCTION

EirGrid, acting as the TSO, proposes the development of a 400kV transmission project between Woodlands Substation in Co. Meath, known as the Meath Cavan 400kV project, a new substation in the vicinity of Kingscourt in Co. Cavan, and a 400kV transmission interconnector project between Kingscourt in Co. Meath and Turleenan in Co. Tyrone, known as the Cavan-Tyrone 400kV project. Both of these projects together are known as the North East 400kV projects. Overhead transmission lines are the proposed technology.

As part of the consultation process for these projects, stakeholders suggested that disused railway lines in Meath, Cavan, Monaghan, Armagh, and Tyrone (map can be found in Appendix B) could be used to provide a route that would have many advantages if an UGC option were used instead of an OHL.

Some of the advantages cited were its ready availability, uniform grade, use of existing bridges, low cost, co-location with the railways, and completion time of installation works during or after the railway renewal.

Maps showing rail beds forming the basis of discussion in this report are presented at Appendix B

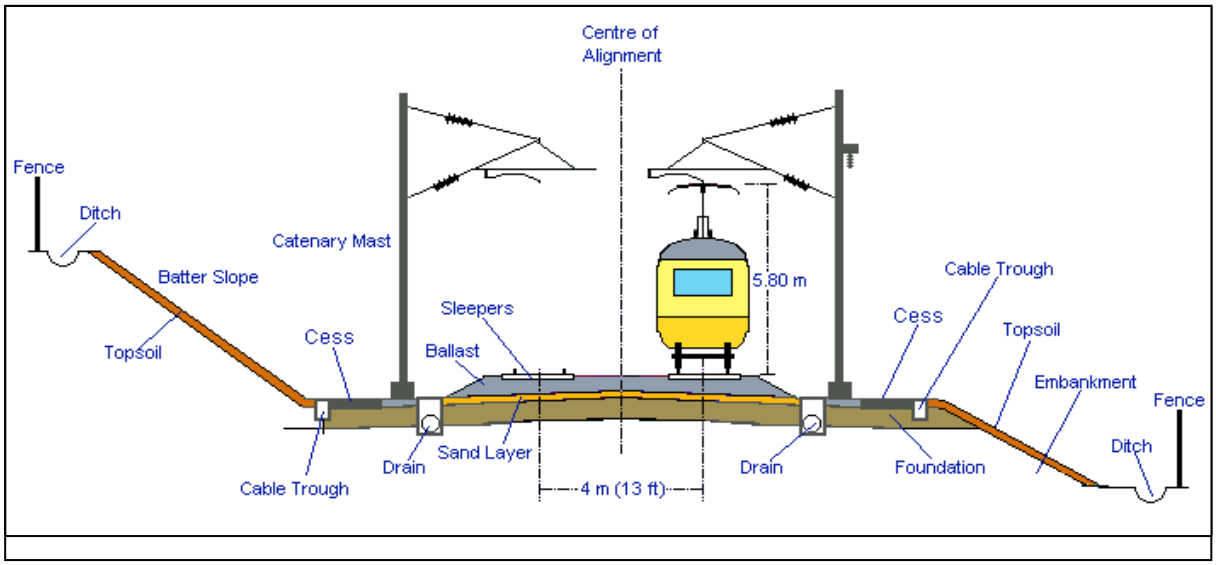
2.1 PURPOSE OF THIS DOCUMENT

The purpose of this document is to examine the considerations that would arise if the disused rail beds in the vicinity of the proposed transmission developments were used as cable routes and whether or not such a routing would be superior to other UGC routes, which are not constrained by the requirement to run along rail beds.

2.2 BACKGROUND

The rail bed has been suggested as an alternative route by stakeholders due to the potential for the joint development of infrastructure, such as rail, telecoms, and electricity. Reference to this option is made in the report received by EirGrid from the NEPP titled *'Study on the Comparative Merits of Overhead Lines and Underground Cables as 400kV Transmission Lines for the North-South Interconnector Project'*. Also on 1st April 2009 a proposal as to how this might be done was made in a presentation to EirGrid by the North East Pylon Pressure (NEPP) and is reproduced in part in Figure 2.1.

Figure 2.1: Sample of Joint Infrastructure Development



Note: Image taken from NEPP's presentation to EirGrid.

Also in this same presentation, the NEPP have referenced a communication from the European Union titled *Trans-European networks: Towards an integrated approach*" (Appendix A). Reading the full text of the document, it is clear that the quotation is taken from a section that deals with exploring potential synergies between trans-European networks. The main conclusion relates to telecommunications networks and not to the undergrounding of electricity transmission lines, which is mentioned as an idea, but not apparently given priority. Indeed the sentence immediately following the quotation reads:

"These suggestions do not replace the immediate need to interconnect the national high-voltage networks, but are a proposal for finer meshing of the national electricity systems over a longer time span matching the time it takes to complete the major infrastructure projects."

Earlier in the same document it is said:

"Development of the trans-European networks is vital for the creation of the internal market and to strengthen economic and social cohesion. To this end, Community action should aim at promoting the interconnection and interoperability of national networks as well as access to these networks."

Further highlighting European Union interest in this type of joint development a report commissioned by the European Commission titled *Synergies between Trans-European Networks Evaluations of potential areas for synergetic impacts* (Appendix A). This report states that laying certain linear infrastructure types in the same corridor may, in theory, offer synergies as follows:

- ***Procedural synergies**,* arising from the integrated planning of various infrastructure networks;

- ***Physical synergies***, which lower costs and impacts due to the combined construction of sections of infrastructure networks and structural works (e.g. bridges, tunnels, underpasses); and

- ***Financial synergies**,* including the additional value or revenues that can be created and captured when sections of infrastructure networks are combined.

While such synergies may apply in some instances, they are not applicable for the North East projects, particularly because of the essential services involved, and because of the specific characteristics associated with the rail beds in question. The benefits from the application of such synergies do not arise where

- The installation or operational requirements for one service imposes an unacceptable constraint on the other service or where incidents arising in one service could knock out the other essential service; and

- Results in an unacceptable compromise to the community and to the environment.

Whilst therefore these documents urge that new ideas are explored there is a much clearer message as to the development of these networks being vital to strengthening economic and social cohesion. The idea of undergrounding, and indeed combining networks has been explored (as evidenced by the studies carried out by EirGrid and by government) however EirGrid believes that building the network in a tried and sustainable manner is the first priority and one that is consistent with both European and national objectives.

The High Voltage Transmission System, as the core and primary conveyor of electric power, is society's cornerstone technology, the technology on which virtually all other infrastructure and services depend. This background is reinforced by the legislative provisions that require EirGrid, as TSO, to operate and develop a safe, secure, reliable and economical transmission system.

In considering the use of OHL versus UGC, EirGrid is informed by its own experience, the experience of its international consultants, ongoing dialogue with other electrical utilities and learned bodies, such as International Council on Large Electric Systems (CIGRE). In addition, for these specific projects, EirGrid is informed by the Ecofys Report under the title '*Study on the Comparative Merits of Overhead Electricity Transmission Lines Versus Underground Cables'* (Appendix A) that was commissioned by the Department of Communications, Energy and Natural Resources and the PB Power Report entitled '*Comparison of High Voltage Transmission Options: Alternating Current Overhead and Underground, and Direct Current Underground'* (Appendix A) commissioned by EirGrid. Both of these reports conclude that currently OHL is the most appropriate technology option for projects such as the Cavan-Tyrone and Meath-Cavan 400kV power line.

It is EirGrid's view, supported by the findings of both the Ecofys and PB Power Reports, that an OHL will provide a more reliable, flexible and cost effective solution than an UGC solution for these projects. EirGrid, however, considers suggestions arising in consultation very seriously and examines their merits carefully in order to determine their applicability.

With respect to co-location of underground transmission circuits and railways a key consideration for the TSO is system security. System security relies heavily on the availability of circuits and the opportunity to render fast repairs in the event of faults. This is a primary driver constraining EirGrid. This gives rise to two key requirements for the operating environment in which transmission infrastructure is placed.

2.3 KEY REQUIREMENTS FOR TRANSMISSION CIRCUITS

The first key requirement concerns the TSO's requirement for ongoing reliable operation of its circuits. This requires that circuits are located in secure environments.

The critical nature of the transmission circuits requires immediate and unhindered access to locate and make repairs, which is the second key requirement.

Both the above have far-reaching consequences for the location of UGC's. The issues involved are dealt with in further detail later in this document.

3 THE CANDIDATE RAIL BEDS

An examination of the straight line route between Woodlands and Kingscourt and Kingscourt and Turleenan indicates that the nearest rail beds to be:

1. the old Clonsilla to Navan railway line
2. the old Navan to Kingscourt line, and
3. the Carrickmacross to Castleblayney to Keady to Armagh line.

3.1 WOODLANDS TO NAVAN, NEAREST RAILWAY STATIONS AND HALTS

No rail bed exists between the Woodlands 400kV substation and the Dunboyne to Fairy House Bridge section (of the old Clonsilla to Navan railway line). The rail bed then continues between the following: Dunboyne, Fairy House Bridge, Batterstown, Drumree, Kilmessan, Bective, and Navan.

3.2 NAVAN TO KINGSCOURT, NEAREST RAILWAY STATIONS AND HALTS

The rail bed exists between the following Navan, Gibbstown, Wilkinstown, Castletown Halt, Nobber, Kilmainham Wood, and Kingscourt.

3.3 KINGSCOURT TO TURLEENAN, NEAREST RAILWAY STATIONS AND HALTS

There is no rail bed between Kingscourt and Carrickmacross; however it continues between Carrickmacross, Essexford, Inniskeen, Culloville, Castleblayney, Keady, and Armagh, but it does not join up with Turleenan.

4 METHODOLOGY

Each section of rail bed is considered as a cable route, taking into account the advantages cited in consultations with stakeholders and using a structured approach to assess the likelihood of being able to realise these advantages.

The approach adopted was:

- Examining the potential redevelopment of the disused railways;
- Visiting sections of the route of the railway to establish its general condition and current use; and
- Reviewing the considerations that would arise in the context of technical feasibility, economic viability to achieve the least disturbance during construction and operation to the environment, to people who live in the area, and to people who recreate in and visit the area.

Based on the considerations arising from the assessment outlined above, conclusions were then drawn on whether or not EirGrid's plans need to be adjusted.

5 RAIL BEDS INVOLVED

This report will deal with the rail bed sections as follows:

- Section One: Dunboyne to Navan
- Section Two: Navan to Kingscourt
- Section Three: Carrickmacross to Armagh

5.1 SECTION ONE: DUNBOYNE TO NAVAN RAIL BED

5.1.1 Interest in Redeveloping this Section of the Railway

It is government policy (Transport 21, Appendix A) to re-establish a rail link from Dublin to Navan and this will most likely follow the route of the disused railway line from Clonsilla to Navan. This track had previously been a single-track line, but a double track would be required for the new service. The initial service would operate using light diesel powered trains (Arrow-type), but provision would be made for future electrification (DART-type). An extensive redevelopment of the existing railway reserve, consisting of its widening and construction of new bridges and underpasses would be required. Iarnród Éireann are working on the re-opening of the Clonsilla to Navan first phase of the rail development to Dunboyne (Pace Railway Station) for 2010 and the second phase development is under route investigation with an expectation to complete the rail link to Navan by 2015.

The County Meath Development Plan states an objective of maintaining:

“the reservation of the former Dublin-Navan rail line free from development” (Appendix A).

5.1.2 Installation of Cables Prior to Railway Construction

5.1.2.1 Cables Located in Rail Bed with Respect to Security and Reliability

As previously outlined, TSOs have a critical requirement for ongoing reliable operation of circuits. This requires that circuits are located in secure environments and where, in the event of a fault, they are quickly returned to service, in order to meet statutory requirements of security and reliability. Because of the critical nature of transmission circuits this implies immediate and unhindered access to locate and make repairs.

As a consequence, any rail bed that is due to be re-opened does not provide a viable option as a host to an UGC, as the installation environment does not meet basic technical requirements. Railway re-opening work would disturb the cables and ongoing ready access requirements cannot be met. Further issues involve:

- The installation environment and the thermal characteristics of the ground must allow the cable to operate effectively. 400kV cables are typically installed at a depth of about 1.05m to achieve thermal efficiency. At this depth the nature of the grading, drainage, ballast, foundation and service works for a rail bed would not deliver a secure environment or the necessary technical characteristics for the two underground circuits required;

- Locating the two sets of 400kV UGCs required for this project would inhibit the extensive works required to bring the railway back into service and such works would adversely impact the cables; and

- Access to the cables for repair could disrupt the rail operation for prolonged periods extending from many weeks to months.

Hence, locating the cables in the rail bed does not provide a technically viable solution.

5.1.2.2 Security and Reliability of Cables Located in the Zone Adjacent to the Rail Bed

- If the 400kV cables were placed in an additional land take adjacent to the rail line in trenches 1.3m deep they would considerably constrain the access for the extensive development and facilitation works for the railway reconstruction. They would also give rise to significant issues where the new rail line deviates from the old line or additional works for access to car parking, car park areas, footbridges, ramps, passing areas, electrification, or similar facilities could not be foreseen and avoided. Avoidance would require acquiring lands outside the rail operating zone;

- Placing a cable route in an area that would in effect, be a major construction site, even with measures designed to avoid damage, would introduce major risk and costs on the cable installation and subsequent maintenance. It would also impose an additional risk on the rail contractor, increasing cost on that contract. Not withstanding such provision It would remain exceptionally difficult to ensure adequate protection; and

- The considerations set out in Section 5.1.2.1 would also apply.

5.1.3 Post-Construction Installation Cables In/Adjacent to Railway

- If 400kV UGCs were installed within the railway reserve after the rail line was brought back into service then it would have to be done in such a way that its operation would not interfere with the safe operation of the rail service and vice versa. The main points to note are as follows:

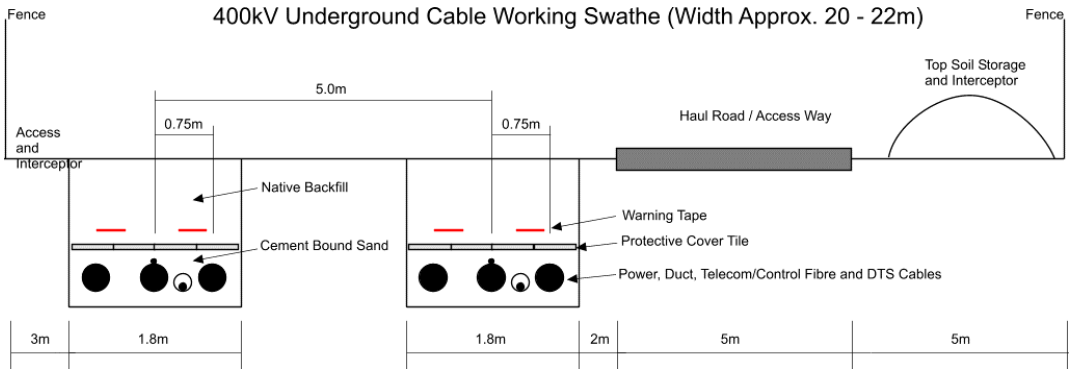
- To meet the TSO's first key requirement the cables would have to be located so their operation would not be compromised;

- To meet the TSO's second key requirement unhindered access would have to be immediately available to enable repair of the cable circuits. This implies that all of the heavy equipment required for such operations could immediately and readily access all locations along the cables;

- Permanent vehicular access would be required along the entire length of the UGC. The railway could not be used for this, as it would disrupt the service. Therefore, a road would have to be constructed alongside the railway for its entire length. This would also require that both sets of cables be placed on the same side of the rail tracks so that the road would provide access to both sets of cables and avoid the need to have vehicles crossing the rail tracks. Iarnród Éireann does not require this access road and would therefore not be expecting to make space provision for one;

- The UGC would also have to be set back far enough from the rail line to enable mechanical excavators, concrete trucks, and cable laying equipment to operate safely without interfering with the train service or impinging on railway regulations. Space provision must also be made available for grade adjustment and excavated spoil as the adjacent slopes are levelled to create a suitable location to work and install cables. This would typically require 22m to the side of the railway-operating zone (see Figure 5.1) and would give rise to considerable additional land acquisition. Indeed, such a routing would have the added effect of directing the new cable route into many of the legacy obstacles, structures (some possibly protected),, embankments, cuts, and bridge abutments of the old railway or that are contemplated for the new one;

Figure 5.1: 400kV Underground Cable Working Swathe

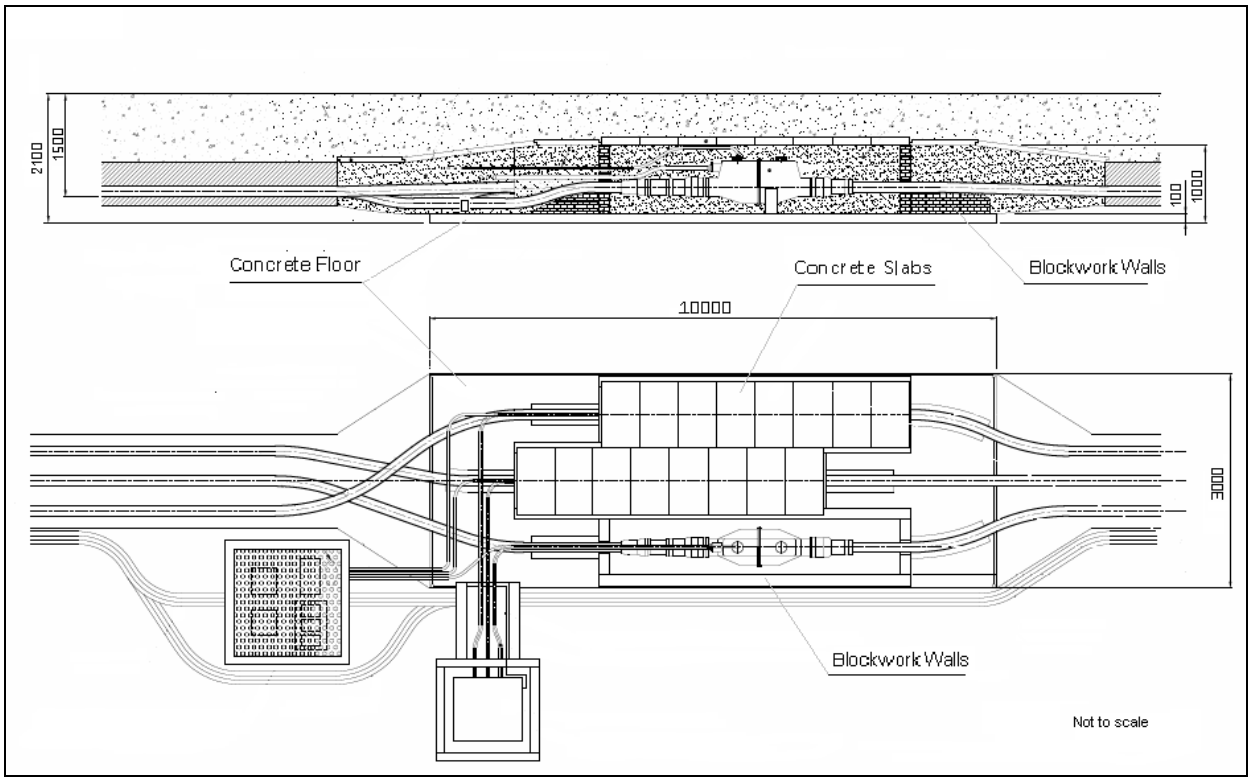


- The initial UGC design must make provision for the construction of a pair of joint bays (Figures 5.2 and 5.3), that is, one per set of three cables, every 600 – 800m. A typical 'joint bay' for 400kV cable is shown in Figure 3 and has the dimensions 10m long by 3m wide by 2.1m deep;

- Should a fault occur on a cable after it has been put into service it would be necessary to construct a new joint bay in the vicinity of the fault and replace the faulty section of cable between the new joint bay and the nearest existing joint bay. This would clearly require extensive civil works alongside the railway and therefore the haul road would be essential;

- The cable trenches would have to be routed clear of access ramps, bridges, railway stations, ancillary structures, signalling equipment, crossing bridges, underpasses, culverts, drains, and access ways. This would also give rise to additional land take;

Figure 5.2: Drawing of 400kV Joint Bay



Note: Dimensions 10m (L) X 3m (W) X 2.1m (D), Courtesy of EuropaCable

Figure 5.3: Image of 400kV Joint Bay

Note: Dimensions 10m (L) X 3m (W) X 2.1m (D), Courtesy of EuropaCable

- There are also technical difficulties that must be considered, such as the shielding of the railway signalling system from interference arising from the nearby cables; Iarnrod Eireann

notes that their system has not been designed to take account of 400kV cables close by and the implications of such would have to be considered in detail.

- In the event of major accidents the risk of the power system impacting the rail system or visa versa would be considerable;

- The question of the land acquisition costs and ownership would be an issue as the TSO normally does not normally acquire the lands over or under which it places its transmission infrastructure;

- The operational requirements of the rail operator would have to be set aside to facilitate all aspects of the cable repair processes; and

- Rail operators would be restrained from works or operations that could damage or undermine 400kV cable circuits' adjacent to their railways. Future major works by Iarnród Éireann on the rail route, such as the works required for the proposed electrification for the construction of any new railway facilities, site investigation, digging or construction in the vicinity of the 400kV UGCs would be highly constrained or prevented. It is recognised that rail operators have to add new signalling, control equipment, signage, crossing bridges, underpasses, park and ride car parks, passing lines, twin lines, service buildings, storage areas, alterations to fencing, alterations to retaining walls and embankments, and such works would be severely constrained.

5.1.4 Other Considerations

Using the disused railway line between Dunboyne and Navan would not shorten the length of 400kV cable circuit, as its use would require a detour from Woodlands Station to the rail line**.** To avoid entering Navan, a deviation away from the rail route around the town of Navan would also be required. An optimised cable route from Woodland to Kingscourt Substation would be shorter and avoid such deviations.

The railway route with its attendant steep embankments and drains would require considerable maintenance; such maintenance would, in itself, increase the potential to damage the cables.

It would be necessary to carry out routine maintenance on link boxes (Figure 5.4) and other monitoring equipment located at intervals (a pair of link boxes at approx 600-800m intervals) along the length of the cables. Access to such boxes along a railway would again give rise to restrictions on operational access on health and safety grounds.

EirGrid past experience of transmission and railway interfaces in instances where one service crossed another took many months to resolve and provide a clear indication of the difficult issues that may arise.

Figure 5.4: Typical Pillar-Type Link Box

5.1.5 Conclusions in Relation to the Woodland to Navan Section

The rail line corridor introduces many additional works, environmental impacts, and risks; it has no particular benefit over a cable route corridor.

Placing critically important 400kV cables in or in close proximity to the re-opened rail line would not be a superior option and would not meet the criteria identified in the methodology or the key requirements of the TSO.

5.2 SECTION TWO: NAVAN TO KINGSCOURT RAIL BED

5.2.1 Interest in Reopening this Rail Bed

There is significant interest in Cavan in having this section of rail reopened (See Appendix C).

5.2.2 Current Condition of the Rail Corridor

The section from Navan to Kingscourt closed in 1963. It is largely intact with some minor incursions where landowners have fenced along parts of the railway (within two metres of the old tracks) and where houses exist at old stations and level crossings. It appears, however, that its condition would not prevent it from being opened in the future. This rail bed runs in close proximity to the R162 for

much of its route. It is bounded for most of its length by extensive hedgerows and adjoining agricultural land, as can be seen in Figure 5.5.

Figure 5.5: Extensive Hedgerows

The rail bed seeks to follow a uniform grade, thus giving rise to embanked and cut sections. For the southern part of the route, from Navan to the vicinity of Castletown, these are minor in nature; however, from Castletown to Kingscourt many very significant cuts and embankments are encountered that would give rise to very extensive works if cables were to be installed. Figures 5.6, 5.7, 5.8, and 5.9 show images of the cuts and embankments that could be encountered.

Figure 5.6: Cut Section of Old Railway

Figure 5.7: Significant Banked Section of Old Railway

Figure 5.8: Old Railway in Significant Cut Section

Note: South of Nobber near Bridge 352.

Figure 5.9: Old Railway Running Along Significant Embankment

5.2.3 Considerations Arising in a Context of Reopening a Railway

It is clear that in the event of this line being reopened it would require considerable investment, as the original single-track line was built to a low standard with 12 level crossings that would most likely need to be replaced with bridges. The development of the line as a railway would require considerable work involving the following:

- Service diversions;
- Fencing and boundary treatments;
- Accommodation roads;
- Drainage works;
- Earthworks;
- Bridge works;
- Station construction including car parks; and
- Track and signalling installations.

As the extent of such works can not be determined at this time, in the absence of route selection and an Environmental Impact Statement (EIS), there is no way of practically locating a 400kV cable route in the rail bed in such a way as to avoid compromising future redevelopment of the rail line.

In addition, even if the cable circuits could be physically located in or along the rail bed, the issues, as outlined in Section 5.1.2.1 would still prevail. In the Navan to Kingscourt section the extent of the works required would be much greater, particularly in the section from Castletown to Kingscourt, making this a less feasible and desirable potential solution.

5.2.4 Considerations Arising if a Rail Bed is Abandoned as a Railway

The following adjustments to the railway bed cross-section and removal of unsuitable materials would be required:

5.2.4.1 Width of Swathe

The width of swathe required to install and maintain the two cable circuits is 20 to 22m (See Figure 5.1). The cable trenches would occupy a width of 6.8m, allowing for a centre-to-centre separation of cable trenches of 5m. In addition, it would be necessary to allow a further 2m each side of the trenches for safe working and any battering of the trench excavations that might arise in poor ground conditions. The remaining width is for access, material storage and working room. As much of the route is made up of embankment and cut sections it means that there is inadequate width to install the cables with the separation and working spaces required. The additional width required if provided would require major civil engineering works to increase the embankment and cut widths. Such works would be additional to those required for an optimised cable routing and would give rise to greater environment impact and disruption to local community as the greater volumes of material are drawn, removed or relocated along the route.

5.2.4.2 Removal of Hedgerows

In order to accommodate such a working area it would be necessary to remove the extensive boundary hedgerows that have grown up both sides of the disused railway (See Figure 5.10). It would also be necessary to remove all hedgerows currently established in embankments. As these hedgerows have undermined the embankments their removal would tear away many sections of bank.

It would not be permissible to reinstate such hedgerows because of the adverse impact the hedgerows' roots would have on the cables. Additionally, it would be necessary to ensure no new hedgerows establish on the widened embankments. Removing the hedgerows and ensuring that they do not re-establish themselves represents a significant environmental impact and greatly increased cost in initial works and ongoing maintenance.

Figure 5.10: Portion of Existing Rail Bed

Adjustments to the cross sections of the rail bed would be required as follows:

- To remove the original track foundation and ballast materials and replace it with materials of suitable construction and thermal performance to meet the technical requirements for 400kV cables buried at a depth of 1.05m in trenches 1.3m deep. It would be difficult to achieve the thermal performance required for cable trenches perched on top of embankments due to the heating from the cables and the drying out of the embankments, unless the embankments were widened considerably beyond the cable trench positions. Such widening would greatly increase the costs either through embankment cut down and removal or extension.

- To widen the original track bed to provide a stable cross-section into which the cable trenches could be created.

- To provide an independent access and working area to transport cable drums and materials along the side of the cable trenches. To create this access it would be necessary to make considerable adjustments to the rail bed and its immediate boundaries of banks, drains and fences. Removing, disposing, and ultimately replacing such material would add considerably to the cost of the project and have a significant impact on the local road infrastructure. The extent of the works involved would be significantly greater than would be the case where a route was selected so that its natural characteristics minimised such works.

5.2.4.3 Removal of Contaminated Soils

The removal of contaminated soil from excavations and materials from buildings where encountered would be required. Inspection of the route indicates the presence of some fly dumping.

The possibility that contaminated soils may be present is flagged by Iarnród Éireann's EIS for the Clonsilla to Dunboyne section. See the note in relation to the Clonsilla to Pace line, which contains the following note in the summary of the EIS:

> "The soil investigation revealed the presence of some small localised areas of contaminated soil which, if they require to be excavated, will need specialist handling and disposal. Further studies are proposed to be conducted to determine the extent of contamination."

While the above statement relates to the Clonsilla to Pace line it is significant in so far as the sources of contamination involved (i.e. fly dumping post rail closure) are also present on the Navan to Kingscourt railway.

5.2.4.4 Removal and Adjustment to Existing Structures and Remnants of Former Structures

The old rail route had 12 level crossings and a combination of six stations/halts in addition to a number of bridges over the R52 (See Figure 5.11) and under the R162. These brown sites have varying combinations of buildings, platforms, signals, gates, access points, and other disused rail facilities (Figures 5.12, 5.13, and 5.14) in close proximity to the rail line. Given the cable layout dimensions required, it would be necessary to divert around such obstacles or to demolish those in the way, including their foundations. It is important to note that some of these structures may also be protected.

Figure 5.11: Railway Bridge Over R52

Figure 5.12: House Adjacent to Railway One

Figure 5.13: Remnant Structure

Figure 5.14: House Adjacent to Railway Two

A complicating factor is the presence of culverts and bridges where the old rail bed crosses over streams. The structures involved and their foundation would lie in the pathway of the cable trenches and have to be removed or avoided using directional drilling. It would also be necessary to remove or divert existing drains and place them outside the cable route in order to accommodate the works.

The use of the old rail bed route would have the consequence of directing the route to such obstacles instead of avoiding them.

5.2.5 Acquisition of the Disused Rail Line

The current disused rail line is in CIE ownership. Given that the installation of 400kV cables along the line would not be compatible with railway operations it is clear that it would be necessary to acquire ownership. The value to be placed on such ownership is complicated. Iarnród Eireann has concerns over the high cost of acquiring or reacquiring the lands associated with the Clonsilla to Navan line and quote figures of the order of 30% of the value of this new rail development cost.

As it is not generally EirGrid/ESB policy to acquire the lands for transmission lines or cables, but rather to compensate affected parties for losses incurred, the large cost to acquire the disused rail bed would be a significant issue with much potential to introduce delay. Further, by placing the constraint of locating the cable along the rail bed, opportunities for avoiding other constraints (for example, houses or stations) are lost.

A further significant requirement would be to gain access to the disused rail line from adjacent roadways and farmers' lands for cable and material supply in a situation where the flexibility to choose the location is preset by the rail route. Many of the level crossings are over minor roads of the order of 3m wide and such roads would be inadequate for the loads to be transported.

Again it should be noted that the rail bed reservation area does not provide a sufficiently wide UGC working swathe and additional land take would be required to achieve the required working swathe.

5.2.6 Cultural Heritage and Archaeology

The important issues of cultural heritage and archaeology that may be encountered in the preparation and access works is a consideration. Such encounters could give rise to serious delays and much additional cost. There is known to be significant archaeology in the Meath and Cavan areas. It is worth viewing the provisions made by Iarnród Eireann to deal with Cultural Heritage – Archaeological in the EIS summary for the Clonsilla to Pace railway line (See Appendix D).

It is evident that the mere fact of a railway being constructed in the area in the past is not adequate to assume that archaeologically significant sites would not be encountered during new construction; it does not deal with the cultural heritage or the archaeological issues that may still arise. Being constrained to the rail route would eliminate the flexibility to optimise route location in relation to cultural heritage and confine the project to dealing with the archaeology encountered, instead of avoiding it, which is the preferred course of action in selecting an independent route.

5.2.7 Line Length

The disused railway deviates considerably from a straight line and does not represent the shortest technically feasible route that could be identified. Use of the rail route would make it necessary to divert the cables so as to:

- Link into the nearest rail beds;
- Avoid going through Navan;
- Avoid going through Kingscourt; and
- Avoid other obstacles that cannot be penetrated.

A route independently selected to minimise environmental, constructional, installation and operational issues is likely to represent a shorter and better solution and would provide more opportunities to resolve issues than a route confined to the disused rail line.

Such a route corridor has been identified by PB power in their report Final report on “Comparison of High Voltage Transmission options dated February 2009” (Appendix A).

5.2.8 Summary of the Navan to Kingscourt Disused Rail Line as a Cable Route

- Sterilises potential linear developments;
- Local interest in reopening the rail line;
- Iarnród Eireann have no plans position to abandon or dispose of this line;
- The many complications and uncertainties introduced by the disused corridor;
- Removal of hedgerows, embankments and drains;
- Removal of the rail bed and foundation and replacement with materials with the correct construction and thermal characteristics;
- Requirement to change the cross section to provide access along the route for the heavy equipment required involving major earthworks where embankments and cut are inadequate;
- Difficulty achieving the thermal performance from cables perched in raised embankments;
- Possible encounters with archaeology that could be avoided in independent route selection. It may be necessary to revise the route in light of arising archaeology, meaning that the rail bed could no longer be followed;
- Removal of boundary structures and artefacts at stations, bridges, and rail crossings and replacement with suitable materials that an alternative route would avoid;
- Possibility of encountering contaminated materials in the ground, in old railways buildings, or dumped in the area;
- The provision of access for construction and maintenance to the disused rail line at intervals along its length where many of the crossing roads are inadequate;

- The removal and/or diversion of drains, culverts and bridges and their replacement elsewhere, possibly on lands outside the rail right of way entailing further land acquisition;
- The lack of flexibility to adjust the line;
- The likely cost of acquiring the line and the negotiating timelines that may be involved; and
- It is not the shortest route.

5.2.9 Conclusions in Relation to the Navan to Kingscourt Section

Placing the critically important 400kV cables in the old rail corridor would not be a superior option to a route selected so that the environmental routing for the cables was optimised and the technical and construction requirements for the cables satisfied. The selection of the rail route would direct the cable route into steep embankments and cuts, structures, difficult working areas, existing culverts and drains and give rise to much added civil works, greatly increasing the environmental impact and costs.

5.3 SECTION THREE: CARRICKMACROSS TO ARMAGH RAIL BED

5.3.1 Interest in Reopening the Line

No official record of any recent interest in reopening this route, as a rail link has been found.

5.3.2 Current Condition of the Rail Corridor

There was never a railway between Kingscourt and Carrickmacross. The nearest northern rail link started at Carrickmacross and was linked to Armagh via the stations mentioned in Section 3.3. The section of rail from Castleblayney to Keady closed in 1923 after only seeing 12.5 years of use and the sections from Keady to Armagh closed in 1957. These sections have largely been absorbed back into the landscape. In all, there were seven stations along this route. The station at Carrickmacross has been demolished with only an engine shed, water tower base, and the remains of the stationmaster's house present; the station at Inniskeen is now a private house. The track bed at Culloville station is now a roadway to a private house. At Castleblayney the station building is now a private house; only the platform retaining wall on the railway side is intact; all other buildings, such as the adjacent goods shed, have been demolished or are in alternative use. Only remnants of Keady station platform remain. The station at Armagh is not relevant, as the cable route would detour before reaching Armagh.

There has been much encroachment along this section of line. The line of the old railway traverses difficult terrain and is located in many steep cuts and embankments; in Keady it crosses the Tassagh Viaduct. In many cases there are houses near to the locations of the old stations. In general the rail bed, where it can be identified, is overgrown and bounded with extensive hedgerows.

A significant detour and an increased route length would be involved to route the cables from Kingscourt substation to join the disused railway at Carrickmacross and then to follow the old section of rail bed from Carrickmacross to Castleblayney. This cross-country plus railway routing can be discounted on the basis that a shorter direct route is feasible.

The section of rail bed from Castleblayney to Armagh has much encroachment and much of it is located on embankments and in cuts (See Figure 5.15). As mentioned, private developments exist in a number of places. To lace a cable corridor along such a route would direct it at a series of obstacles and would require extensive civil works to create a working platform that could accommodate cable installation and working access. Such works would have significant environmental impact and give rise to greatly increased costs.

Figure 5.15: Rail Bridge and Embankments at Iniskeen

5.3.3 Conclusions in Relation to the Kingscourt to Armagh Section

An independently determined cable route corridor chosen to mitigate the environmental constraints, taking into account the technical requirements for a 400kV cable, would be shorter and more secure, could more easily mitigate its environmental impacts, and be more cost effective.

6 CONSIDERATIONS COMMON TO ALL THREE ROUTE CORRIDORS: EMF EMISSIONS

One of the arguments being made in favour of the use of 400kV UGC for this project, by stakeholders, is that residents living close to an OHL circuit would be exposed to a much higher level of EMF emissions than residents living close to an equivalent UGC circuit. This, however, is not the case; for example, a dwelling at 5m distance from a UGC would be exposed to a magnetic field five to ten times stronger than a dwelling 50 metres from an equivalent OHL. It can be clearly seen from the previous photographs that there are dwellings within five metres of the rail bed (Figures 5.12 and 5.14).

It should be noted that regardless of whether UGC or OHL is used for this 400kV project the level of exposure would be, in all cases, well below the specified EU and national guidelines.

7 OBSERVATIONS IN RELATION TO THE RAIL BED AS A ROUTE IN COMPARISON TO THE ROUTE SEARCH CORRIDOR PROPOSED BY PB POWER

In early 2008 PB Power were asked to identify a route search corridor within which an UGC could be located and be environmentally feasible.

Such a corridor was identified and reported on in their report titled “Comparison of High Voltage Transmission Options: Alternating Current Overhead and Underground, and Direct Current Underground” (Appendix A). Briefly, the following observations can be made:

- The PB Power route search corridor complies more satisfactorily with environmental requirements;
- The PB Power route search corridor has fewer risks or constraints arising from the attempted use of the rail corridor route;
- The PB Power route search corridor route search corridor is shorter;
- The PB Power route search corridor provides the flexibility necessary to adequately locate such an undertaking.

8 OVERALL CONCLUSIONS

The rail bed routes discussed in this report represent a suboptimal routing option for possible 400kV cable circuits, particularly, for example, as compared to the route corridor option proposed by PB Power in their report prepared for EirGrid. The issues associated with rail bed routing outlined in this here report would introduce significant additional environmental impacts and costs; where rail redevelopment would occur, it would introduce additional constraints and risks for the cables. The use of rail beds is not consistent with the development of a safe, secure, reliable and economical transmission system.

As the OHL solution for these projects meets the requirements of the TSO and is superior on technical, security, reliability and economical grounds to the underground option, regardless of rail bed routing or otherwise. There is no basis arising from the consideration of the railway routing for EirGrid to alter their preference of the OHL option for the new North East projects.

APPENDIX A

References

1) The European Union, Synergies between Trans-European Networks Evaluations of potential areas for synergetic impacts, March 2007, http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=CELEX:52007DC0135:EN:NOT

2) PB Power, Comparison of High Voltage Transmission Options, February 2009, http://www.eirgrid.com/EirgridPortal/DesktopDefault.aspx?tabid=CT%20Comparison%20of%20High%20Voltage%20Transmission%20Options

3) Department of Transportation, Transport 21, http://www.transport21.ie/.

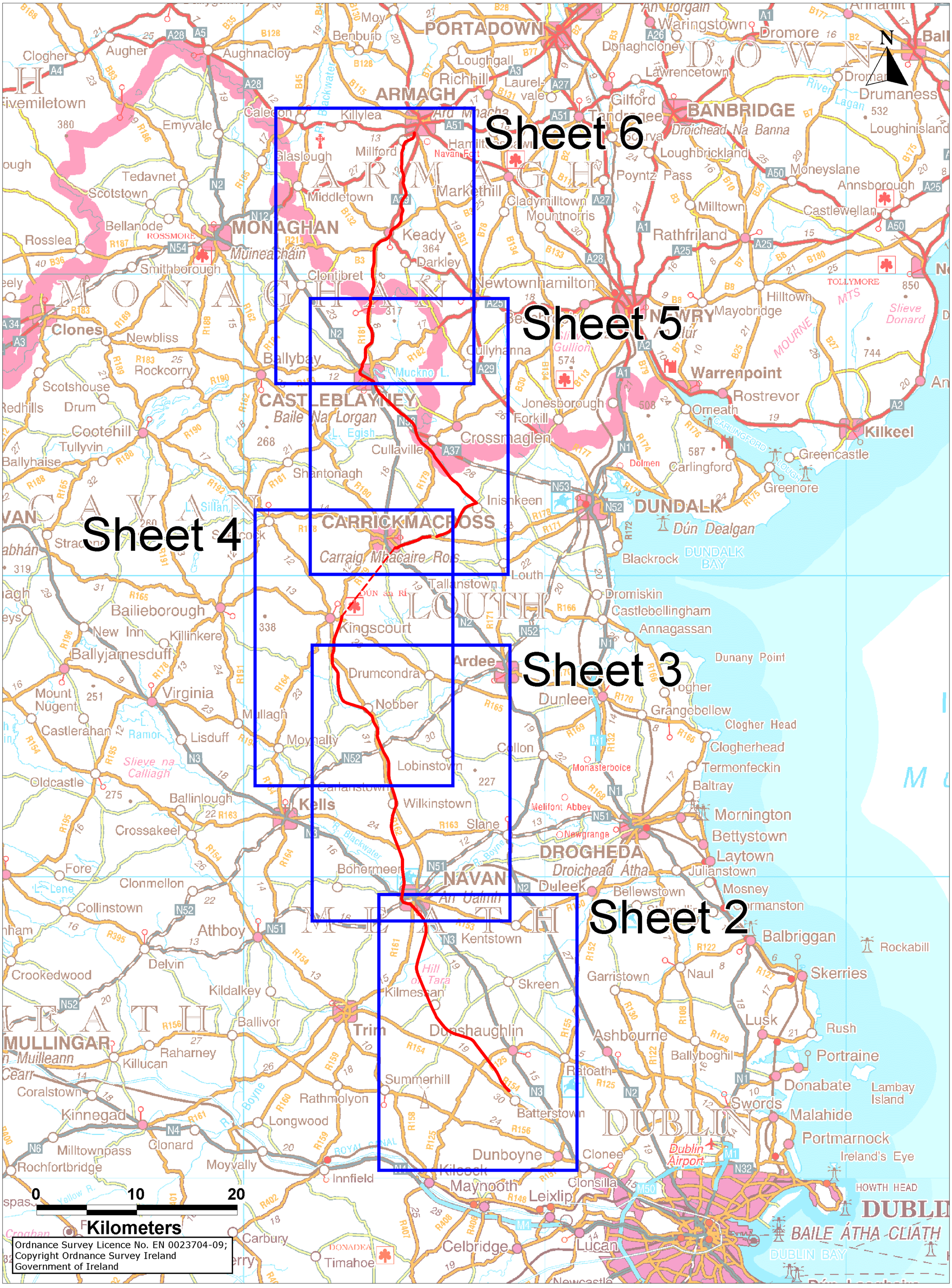
4) Ecofys, Study on the Comparative Merits of Overhead Electricity Lines versus Underground Cables, http://www.dcenr.gov.ie, May 2008.

5) *Trans-European networks: Towards an integrated approach*" COMMUNICATION FROM THE COMMISSION {SEC (2007) 374} COM (2007) 135 final

6) County Meath Development Plan, 2007-2013, adopted 2 March 2007, http://www.meath.ie/LocalAuthorities/Publications/PlanningandDevelopmentPublications/CountyMeathPlanningPublications/CountyMeathDevelopmentPlan2007-2013/

APPENDIX B

Map of Disused Railway Corridor



ESB International
ESBI Engineering & Facility Management Ltd.
Stephen Court, 18/21 St Stephen's Green,
Dublin 2, Ireland.
Telephone: +353-1-7038000
Fax: +353-1-661-5359/662-3269
Website: www.esbi.ie

CLIENT: **EirGrid**

PROJECT: **Cavan-Tyrone 400kV**

DRAWING TITLE: **Locating 400kV Cables in or Adjacent to Rail**

Index Sheet

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CLIENT REF	No. of Shts	SIZE	SCALE
	1/6	A2	1:250000

DRAWING NUMBER
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PE687-D141-042-001-000

Section 1 -34Km

Woodland 400kV Station

Dunboyne

Legend

- Disused Rail Corridor
- No existing Corridor
- Cut embankment
- Fill embankment
- IE Navan Line Route A
- IE Navan Line Route B

0 2 4 Kilometers

ESB International

ESBI Engineering & Facility Management Ltd.
Stephen Court, 18/21 St Stephen's Green,
Dublin 2, Ireland.
Telephone: +353-1-7038000
Fax: +353-1-661-5359/662-3269
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Sheet 2

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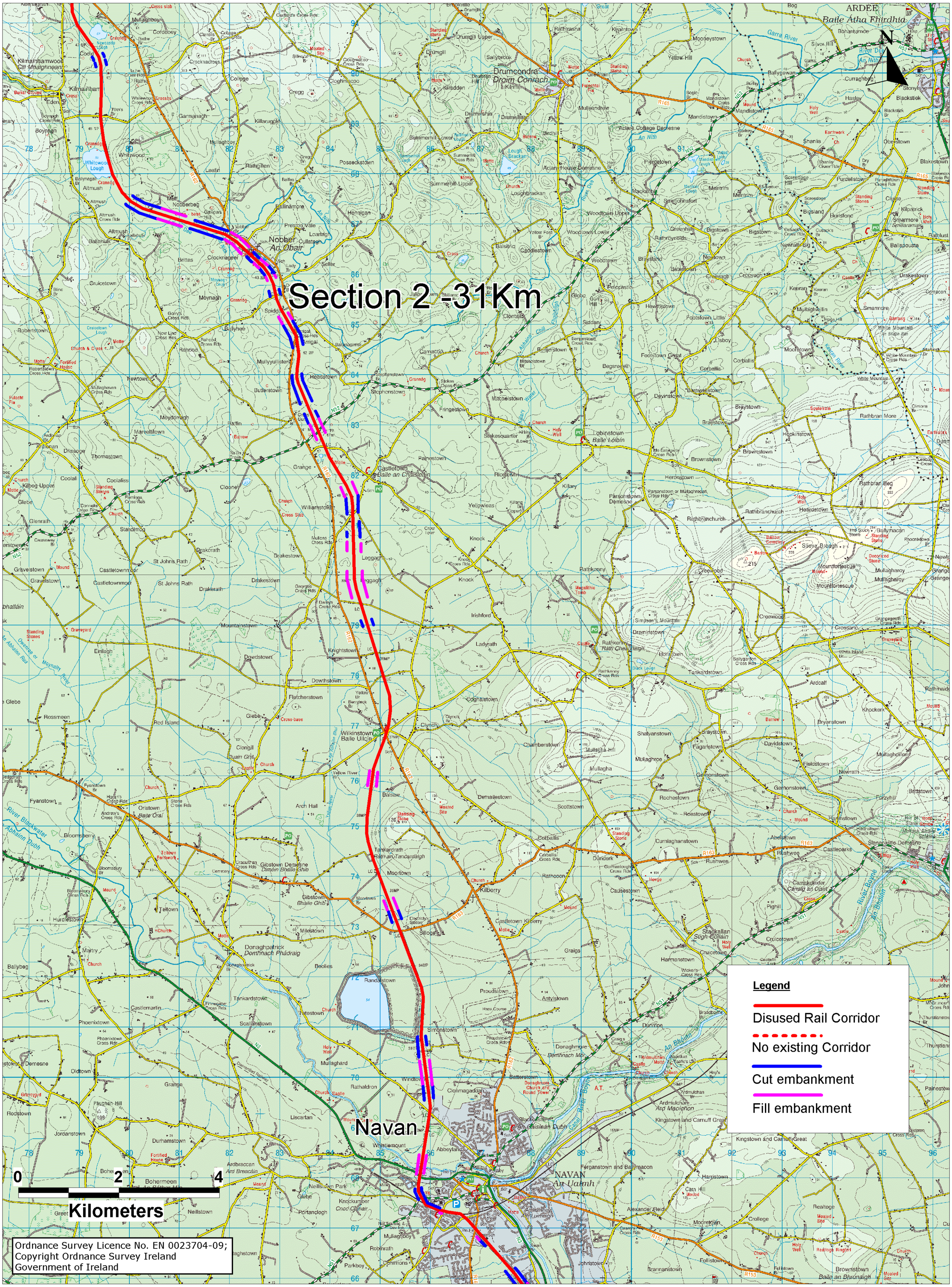

ESB International
ESBI Engineering & Facility Management Ltd.
Stephen Court, 18/21 St Stephen's Green, Dublin 2, Ireland.
Telephone: +353-1-7038000
Fax: +353-1-661-5359/662-3269
Website: www.esbi.ie

CLIENT: **EirGrid**

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Sheet 3

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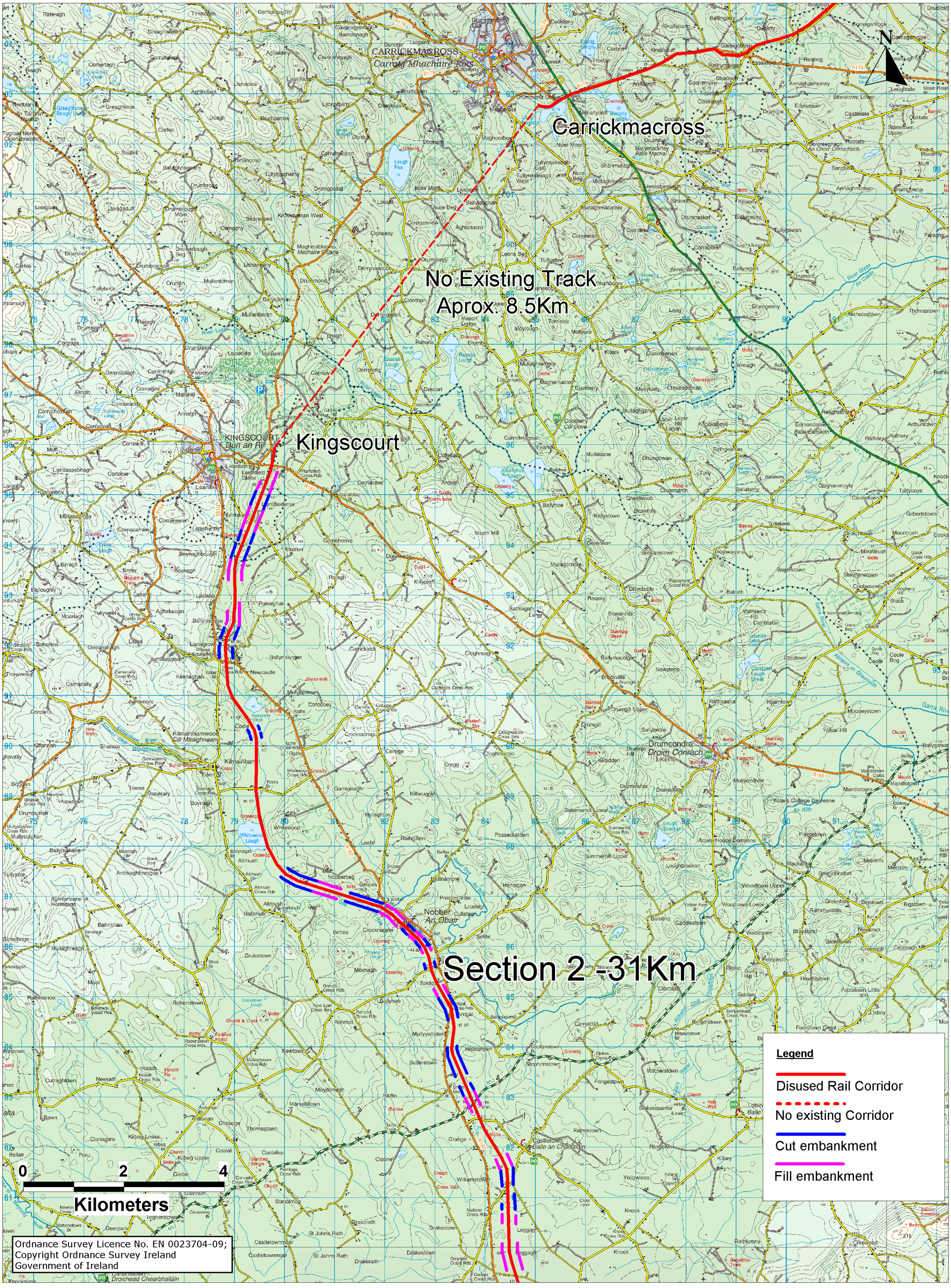

ESB International
ESBI Engineering & Facility Management Ltd.
Stephen Court, 18/21 St Stephen's Green,
Dublin 2, Ireland.
Telephone: +353-1-7038000
Fax: +353-1-661-5359/662-3269
Website: www.esbi.ie

CLIENT: **EirGrid**

PROJECT: **Cavan-Tyrone 400kV**

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Sheet 4

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CLIENT REF	No. of Shts	SIZE	SCALE
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DRAWING NUMBER
SHEET REV
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Section 3 - 54Km

Castleblayney

Carrickmacross

Inishkeen
Inis Caoin

0 2 4
Kilometers

Legend

Disused Rail Corridor

No existing Corridor

Cut embankment

Fill embankment

ESB International

ESBI Engineering & Facility Management Ltd.
Stephen Court, 18/21 St Stephen's Green,
Dublin 2, Ireland.
Telephone: +353-1-7038000
Fax: +353-1-661-5359/662-3269
Website: www.esbi.ie

CLIENT: **EirGrid**

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Sheet 5

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ESB International
ESBI Engineering & Facility Management Ltd.
Stephen Court, 18/21 St Stephen's Green, Dublin 2, Ireland.
Telephone: +353-1-7038000
Fax: +353-1-661-5359/662-3269
Website: www.esbi.ie

CLIENT: **EirGrid**

PROJECT: **Cavan-Tyrone 400kV**

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Sheet 6

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APPENDIX C

Reopening of the Navan to Kingscourt Rail Line

A Motion to Cavan County Council by Councillor (Cllr.) Sean McKiernan:

The motion read:

"That this Council welcomes the proposed Navan/Dublin rail link and suggests that:

1) The proposed 2015 projected date for completion be advanced;

2) The Kingscourt/Navan rail link be opened again to passengers on foot of the completion of the Navan/Dublin line; and

3) That Irish Rail keeps the existing Kingscourt/Navan line in good order."

Cllr. McKiernan further resolved that Iarnród Éireann be invited to the Chamber at a future meeting to make a presentation on the matter. It was reported that Cllr. McKiernan was successful in attaining cross party agreement for his motion at Cavan County Council regarding the extension of the proposed Navan/Dublin rail link to Kingscourt and the wider border region.

Reference*:* www.seanmckiernan.ie/?p=120

Councillor Clifford Kelly

There are positive indications of the proposed Navan/Dublin rail link being extended in to County Cavan according to Cllr. Clifford Kelly. Speaking at Monday's meeting of Cavan County Council, Cllr. Kelly referred to a meeting held in Navan, which was attended by Ministers Dempsey and Cullen along with senior representatives of Irish Rail including Dr. John Lynch. He told fellow Councillors that Dr. Lynch seemed to be favourably disposed towards the extension of the Navan line to Kingscourt.

Mr. Kelly complimented the Meath County Manager for an excellent presentation and it was heartening to hear of the plans to extend the railway from Dunboyne to Navan. Continuing, Councillor Kelly said he raised the issue of the link for Cavan in general and Kingscourt in particular. He was delighted with the reply from Dr. Lynch that Irish Rail was looking at the possibility of opening the line between Navan and Kingscourt.

Questions were raised regarding the link from Navan to Drogheda and Dublin and it was pointed out that this was feasible. The discussion also covered the possibility of extending the link to Kells. Councillor Kelly said that if this were to happen then Cavan County Council should have its proposals prepared to bring the line through from Kells to Cavan town. He called for the Kingscourt line to be re-opened and he said the Council should be joining with Meath to accelerate the establishment of these rail links.

Reference: Cavan County Development Board, A Strategy for the Economic, Social and Cultural Development of County Cavan, 2002-2012.

http://www.cavancoco.ie/cccws/publish/general/documents/d551805101404.pdf

Dáil Questions

Mr. Eamon Ryan asked the Minister for Transport the procedures which have been put in place to secure the preservation of the existing Navan to Kingscourt railway line pending the reopening of the line in conjunction with the opening of rail services from Navan to Dublin. [12773/04]

Mr. Brennan: I am informed by Irish Rail that the Navan to Kingscourt line is presently disused, and that the infrastructure is life expired and no longer suitable for rail traffic. The strategic rail review examined the future potential of the line for both passenger and freight and concluded that there was no economic case for restoration of services on this line. The line is in Iarnród Eireann ownership and the company has no plans to abandon or dispose of any part of this line.

Reference: Dail Eireann, Questions for Oral Answer, 5 May 2004.

http://193.178.1.235/documents/op/May04/Questions/pq050504.pdf

APPENDIX D

Cultural Heritage – Archaeological

An archaeological assessment was commissioned in advance of the proposed restoration of the Clonsilla to Dunboyne Railway Line. Its purpose was to assess the impact of the proposed works in respect of the archaeological heritage in the area and minimise potential impacts.

A number of sources were consulted in order to evaluate the archaeological potential of the area that will be impacted upon during the upgrading of the railway line. Field walking was carried out to assess the proximity and therefore likely impact of the development on the archaeological monuments and to record any other potential monuments that are not marked on the RMP (Record of Monuments and Places) maps.

The existing railway line is within an area rich in archaeological remains and these are indicative of past population groups. While there is no direct impact on the recorded archaeological monuments within the environs of the old railway line, as yet unknown archaeological monuments may be impacted upon during the construction phase.

A number of mitigation measures are recommended in order to prevent accidental loss or damage to archaeological finds or features that lie below the present surface and have no visible surface traces.

Reference: Irish Rail, Environmental Impact Statement, Volume 1. Railway (Dunboyne M3 Commuter Rail) Order 2007.

http://www.irishrail.ie/projects/pdf/dunboyne/Environmental%20Impact%20Statement%20Vol%201-4/Vol%201%20.pdf