North Connacht 110 kV Project

Step 4A Report

9 September 2020

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Contents

1 Introduction

1.1 Introduction

Mott MacDonald Ireland has been appointed by EirGrid plc as lead consultant for the North Connacht 110 kV Project (hereafter referred to as *the Project*).

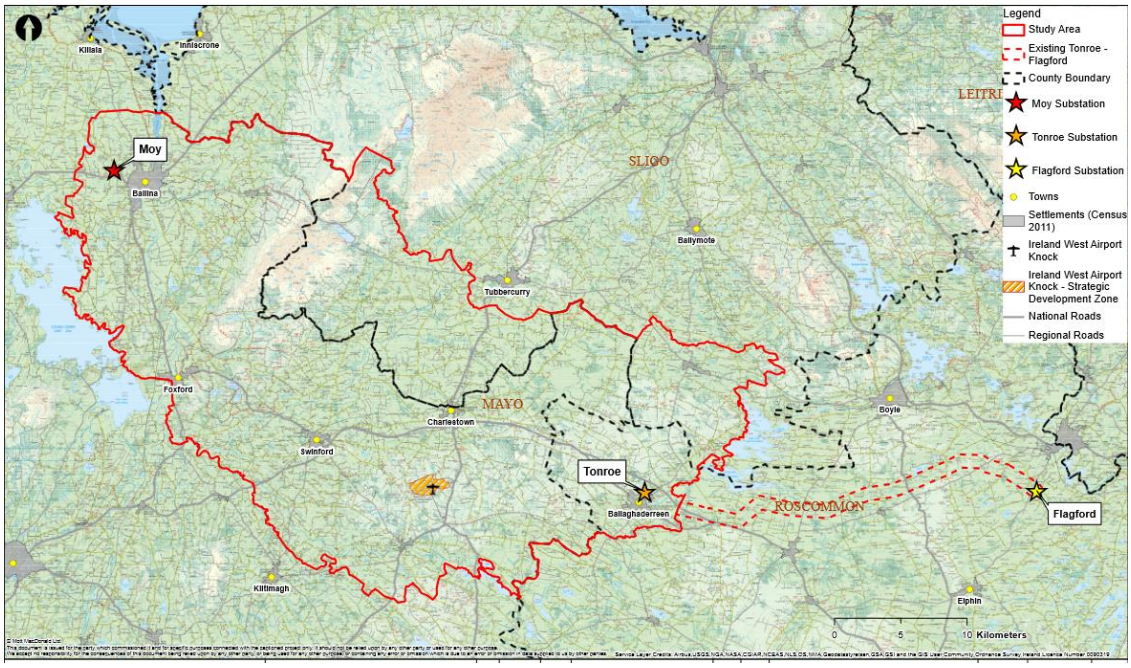
The Project comprises;

- A proposed new transmission circuit – comprising either overhead line (OHL) or underground cable (UGC) between two existing substations; Moy substation in County Mayo and Tonroe substation in County Roscommon; and
- An upgrade of approximately 32 kilometres of the existing overhead line between Tonroe and Flagford in County Roscommon.

The Project is being developed in accordance with EirGrid's Framework for Grid Development. The Project is currently in Step 4 of EirGrid's six-step Grid Development Framework. Details of the Framework are provided in Chapter *2 Framework for Grid Development.*

The Step 4A Project study Area is presented in *Figure 1.1 North Connacht 110 kV Project Study Area (Step 4A) – Existing Tonroe – Flagford.*

Figure 1.1 North Connacht 110 kV Project Study Area (Step 4A)



Source: Mott MacDonald

The Project is required to facilitate the connection of renewable energy which is being generated in the North Connacht region onto the national electricity grid (see Chapter 3 *The Project Technology Options* for a more detailed outline of the Project).

This Step 4A Report identifies and maps the constraints and potential areas of opportunity (referred to in this document as route corridor options) for OHL and UGC options. This report does not evaluate the merits of any of the options, as the main purpose of this report is to solicit the views of members of the public and stakeholders as to the preferred technology option (OHL or UGC), and to obtain relevant information and local knowledge in respect of those route corridors which should be taken into consideration in our subsequent evaluation of those options.

Feedback from the public consultation process is therefore an integral element informing the process of evaluating the corridor options presented in this report and identifying the best performing technology and corridor option against a number of different criteria. Chapter 8 of this report outlines the *Next Steps* in the *Framework for Grid Development* including the opportunities for the public to shape the evolution of the project.

1.2 About EirGrid

EirGrid plc (EirGrid) is the state-owned independent Transmission System Operator (TSO) and developer of Ireland's national high voltage electricity grid (also called the "Transmission System"). The European Communities Regulations 2000 (SI 445 of 2000) sets out the role and responsibilities of the TSO; in particular, Article 8(1) (a) gives EirGrid, as TSO, the exclusive function:

"*To operate and ensure the maintenance of and, if necessary, develop a safe, secure, reliable, economical, and efficient electricity transmission system, and to explore and develop opportunities for interconnection of its system with other systems, in all cases with a view to ensuring that all reasonable demands for electricity are met having due regard for the environment*."

In addition, Article 8(1) (i) requires EirGrid:

"*to offer terms and enter into agreements, where appropriate, for connection to and use of the transmission system with all those using and seeking to use the transmission system*".

1.3 Project Background

There is a large amount of electricity generated by wind farms in the North Connacht region with more planned over the coming years. The level of planned renewable electricity generation in the North Connaught region is significantly greater than the capacity of the existing local electricity network. This means that EirGrid has to look at ways of improving the electricity infrastructure in the region, particularly in the context of Ireland's commitments to decarbonisation and global measures to address global warming and climate change.

EirGrid is legally obliged to connect those who generate electricity. Consequently, EirGrid must develop the national electricity transmission grid in response to plans for new electricity generation, such as the aforementioned wind farms.

EirGrid's original proposal in the region was the Grid West 400 kV project in 2012, a large-scale (400 kV) development to facilitate the significant level of renewable generation planned at that time. However, by June 2017 the amount of planned renewable generation capacity in the region had dropped by half and a project the scale of Grid West was no longer required. It is now the case that the smaller (though still significant) amount of renewable generation that requires to be accommodated on the grid can be met through a proportionally smaller scale of development, which is known as the North Connacht 110 kV project.

The primary element of the North Connaught 110 kV project will be a new 110 kV circuit. Studies previously carried out by EirGrid have determined that the best performing beginning and end points (substations) for this circuit are Moy substation near Ballina, County Mayo, and Tonroe substation near Ballaghadereen, County Roscommon, Refer to Figure 1.1 *North Connacht 110 kV Project Study Area (Step 4A).*

During this phase (Step 4) of project development, the best performing technology and corridor options for this new circuit will be identified and evaluated. No decision has yet been made on whether the technology to be used for the new 110 kV circuit will be OHL or UGC. If OHL is used, the circuit will primarily be carried on twin wooden polesets, with steel angle masts where the circuit changes direction. If a UGC option is chosen, the cable will be buried mainly in the public road network. These technology options are illustrated in greater detail in Chapter 3.

The North Connaught 110 kV project will also include the upgrade of the existing OHL between existing substations at Tonroe and Flagford (Carrick-on-Shannon), a distance of approximately 32 kilometres. As this OHL has been in existence for a long period of time, and its alignment will not change as part of its planned upgrading, this element of the overall project [*refer to Figure 1.1 North Connacht 110 kV Project Study Area (Step 4A).– Existing Tonroe – Flagford*] is excluded from the study area within which corridor options in respect of the new circuit are being identified.

1.4 Step 4 Report Structure

This report firstly introduces the project and outlines why the project is needed and EirGrid's role in this process.

Chapter *2* outlines the six step *Framework for Grid Development* which EirGrid uses to maximise stakeholder engagement in the development of the project, with a key focus on the social impact assessment of the project along with technical, cost, environmental and deliverability considerations associated with the project.

The Project Technology Options – overhead/underground - are explained in Chapter 3. The process which identified the study area is outlined in Chapter 4 *Study Area Identification*. Thereafter, Chapter 5 provides a *Strategic Planning Overview. Chapter 6* is concerned with the *Identification of Constraints* within the study area. The I*dentification of Corridors* for the overhead and underground options are described and mapped in Chapter *7*.

Finally, Chapter 8 outlines the *Next Steps* in the *Framework for Grid Development* including the opportunities for the public and EirGrid to engage to shape the evolution of the project.

2 Framework for Grid Development

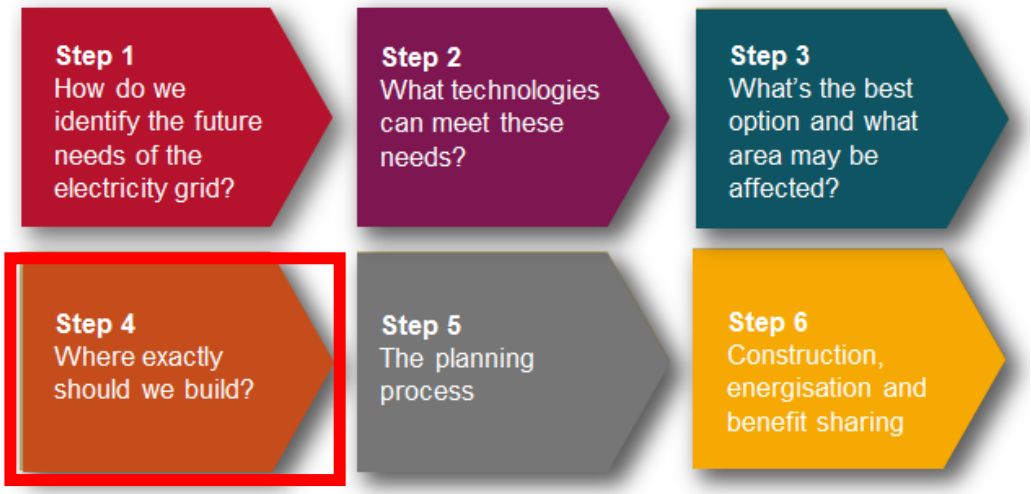
2.1 Framework for Grid Development – Consultation Process

EirGrid follows a six-step approach when developing and implementing the best performing solution option to any identified transmission network need. This six-step approach is described in the document 'Have Your Say'. The six steps are shown at a high-level in Figure 1 below. Each step has a distinct purpose with defined deliverables.

When managing transmission system development designed to connect Demand Customers to the transmission network, Steps 1, 2 and 3 are managed under the EirGrid Connections Process. This process identifies the optimum connection method between the Demand Customer and the transmission network.

The North Connacht 110 kV project is now in Step 4 of the Framework.

Figure 2.1: EirGrid Six-Step Framework for Grid Development



Source: EirGrid

2.2 Project Development to Date (Steps 1-3)

Step 1 of the Framework for Grid Development relates to confirming the need for a project and its scale. As confirmed in Step 1, the transmission network need for the North Connacht 110 kV Project arises as a result of the connection of renewable electricity generation capacity in the North Connacht area, and the movement of much of that generation from the area via the transmission system to demand centres – for example in the south and east of the country. This is because the amount of renewable electricity planned to be generated in the region will exceed the anticipated demand for that electricity in the region.

The key outcome from Step 1 of the Framework for Grid Development, and as outlined in Chapter 1, is that a smaller-scale solution than that previously required (the 400 kV Grid West project) will suffice to meet the additional grid development need in the area. This smaller-scale

project is named the North Connacht 110 kV Project, reflecting the size (in kilovolts) of the planned new and upgraded circuits, and the general project region.

Step 2 of the Framework for Grid Development relates to examining what technologies are available to meet the identified need. The Step 2 Options Report did not identify a preferred technology solution but instead drew up a shortlist of technology options to bring forward for further investigation in Step 3.

The key outcome of Step 2 therefore was the identification of four technology options as follows:

- Moy – Tonroe new 110 kV OHL plus 32km uprates;
- Moy – Srananagh new 110 kV OHL plus 58km uprates;
- Moy – Tonroe new 110 kV UGC plus 32km uprates; and
- Moy – Srananagh new 110 kV UGC plus 0km uprates.

Step 3 of the Framework for Grid Development sought to determine the best performing technology option, and the geographical area in which it is likely to be situated. These shortlisted options were therefore subject to more detailed analysis, on a spatial and geographical basis.

The key outcome of Step 3 was that, following the assessment of each of the four options identified in Step 2 against five criteria - technical, economic, environmental, socio-economic and deliverability, the two best performing options were identified as:

- Moy (Ballina) – Tonroe (Ballaghadereen) 110 kV – OHL plus 32km upgrade from Tonroe to Flagford (Carrick-on-Shannon); and
- Moy – Tonroe 110 kV – UGC plus 32km upgrade from Tonroe to Flagford.

These two technology options are the subject of this current Step 4 process whereby potential areas of opportunity/route corridors are identified in this report for both OHL and UGC options having regard to environmental and other constraints identified and mapped in the study area.

3 The Project Technology Options

3.1 Introduction

In essence, the project will seek to reinforce the grid in the North Connacht area primarily by means of an additional 110 kV electricity transmission circuit between Moy substation in County Mayo and Tonroe substation in County Roscommon. The project will also include the upgrade of the existing OHL between Tonroe and Flagford, a distance of approximately 32km.

3.2 Technical Options

The technical options which EirGrid seeks to consult on in respect of the planned new transmission circuit are an OHL development or a UGC option, both at 110 kV.

The following sections provide further detail on these technology options.

3.2.1 110 kV Overhead Line

Overhead line (OHL) is the conventional technical option for high voltage power transmission. It is a well-established method of transmitting electrical energy over long distances and operates at a number of different voltage levels in Ireland and internationally. Single circuit systems consisting of three current carrying wires (conductors) and two additional shield wires for lightening protection are proposed for the North Connacht 110 kV Project.

At 110 kV, the single circuit OHL option would be built using double wooden polesets such as that shown in Figure 3.1, for straight sections of the circuit.

Steel angle towers would be required where an OHL needs to change direction or at a line termination point. Steel angle towers are galvanised lattice steel structures such as the one shown in Figure 3.2.

Fibre optic communication wires are required to ensure the substations at either end of the line can “talk” to each other. These are either installed within the conductors or wrapped along the conductors.

Figure 3.1: Typical *110 kV Single Circuit Poleset with Shield Wire*

Source: EirGrid

Figure 3.2: Typical *110 kV Single Circuit OHL Steel Angle Tower with Shield Wire*

Source: EirGrid

3.2.2 Underground Cable

At 110 kV, it may be possible to construct the circuit using Underground Cable (UGC). A 110 kV UGC single circuit consists of three individual current carrying cables. For 110 kV circuits the cables are typically installed in plastic ducts within a trench measuring approximately 600 mm wide x 1250 mm deep. Where possible the ducts are usually installed in roadways or along road margins as shown in Figures 3.3 and 3.4.

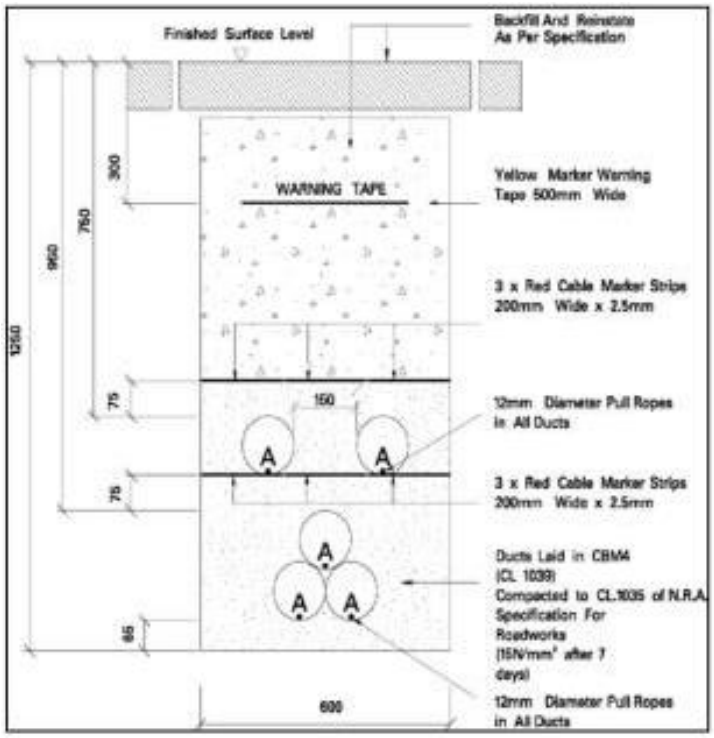
Generally, the ducts are installed in the road with ropes installed in them and the cable is pulled through later using the ropes when the road is backfilled and reinstated. The cables are delivered to site on large drums. A joint bay is installed periodically underground to allow for the joining of the cables from one drum to another.

Two additional ducts would generally also be installed to facilitate the installation of fibre optic communication wires.

Figure 3.3: Typical 110 kV Cable Installation

Source: EirGrid

Figure 3.4: Typical 110 kV Cable Arrangement



Source: EirGrid

3.2.3 Overhead Line/Underground Cable Interfaces

In general, a partial underground, partial overhead solution is avoided for connecting two substations. This split technology solution is only considered to overcome or mitigate unavoidable local constraints.

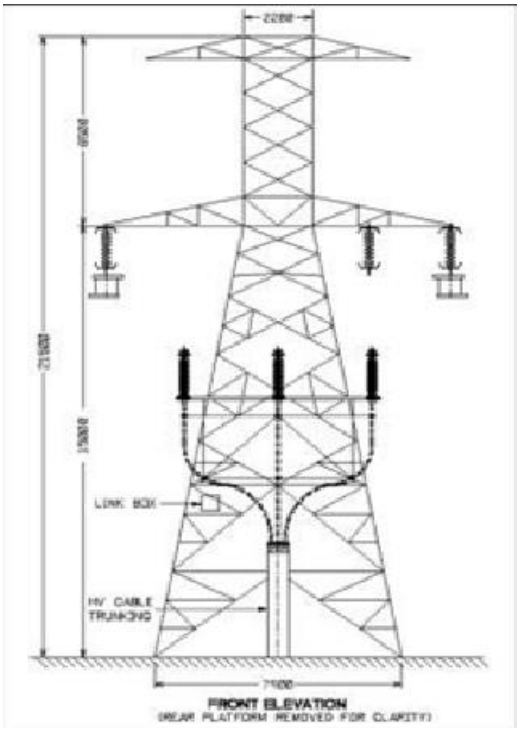
In these situations, an OHL/UGC interface tower is necessary and a typical interface tower is shown in Figures 3.5 and 3.6.

In Ireland, it is common practice to allow for an interface only at one end of a section of cable with a substation at the other. In other words, multiple changes from OHL to UGC along a circuit are avoided if possible, in order to ensure a secure and reliable transmission of electricity..

Figure 3.5: Typical 110 kV OHL/UGC Interface tower

Source: EirGrid

Figure 3.6: Typical 110 kV OHL/UGC Interface tower drawing



Source: EirGrid

4 Study Area Identification

4.1 Introduction

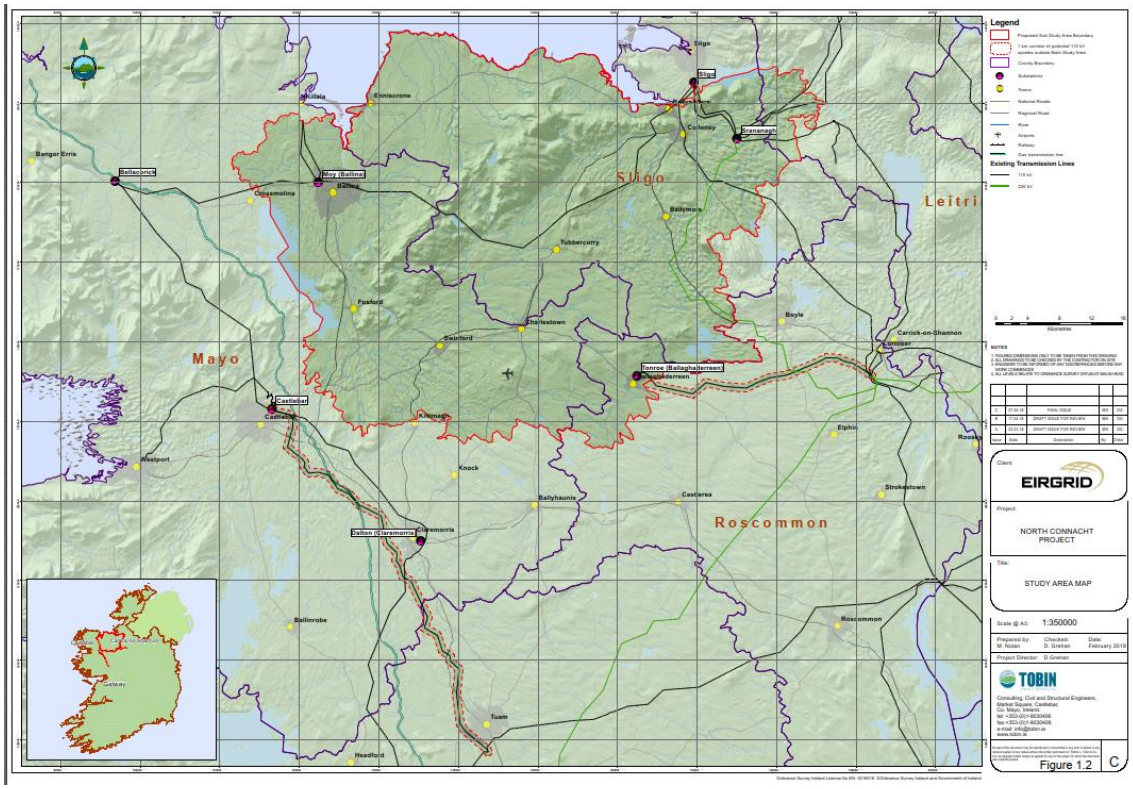
As addressed previously, the North Connacht 110 kV Project is currently in Step 4 of the Framework for Grid Development having previously completed Steps 1, 2 and 3.

EirGrid undertook an evaluation of the Shortlist of Technology Options in Step 3. The evaluation of the options used a multi-criteria comparison against five main criteria: Technical, Economic, Environmental, Socio-economic and Deliverability. Each of these five criteria was divided again into sub-criteria. These sub-criteria were used in Step 3 to evaluate the Shortlist of Technology Options in more detail and to select the one best performing option.

4.2 Step 3 Study Area

The Step 3 study area was defined by EirGrid with TOBIN Consultants as per Figure 4.1 below:

Figure 4.1: Initial Step 3 Study Area



Source: North Connacht 110 kV Project - Step 3 - Best Performing Options Report

According to the North-Connacht Step-3 Best-Performing-Options-Report the Step 3 Options Report identified the following two best performing technology options and their associated uprates.

Table 4.1: Best Performing Technology Options

Option	Technology	Distances (approx.)	Detail
Moy – Tonroe 110 kV	Overhead Line (OHL)	• New Build: 58km • Line Upgrade: 32km	• Redevelopment of the existing Tonroe 110 kV substation to AIS enhanced "C-Type" Outdoor Station (Strung Busbar) including two-line, one transformer and one spare bay. • Installation of new 110 kV AIS line bay in Moy 110 kV substation as part of the new circuit • Uprate of 110 kV OHL circuit from Tonroe to Flagford (430mm^2 ACSR or equivalent rating) with a length of 32km • Uprate of 110 kV AIS line bay in Flagford 110 kV substation as part of the associated uprate
Moy – Tonroe 110 kV	Underground Cable (UGC)	• New Build: 58km • Line Upgrade: 32km	• Redevelopment of the existing Tonroe 110 kV substation to AIS enhanced "C-Type" Outdoor Station (Strung Busbar) including two line, one transformer and one spare bay. • Installation of new 110 kV AIS line bay in Moy 110 kV substation as part of the new circuit • Uprate of 110 kV OHL circuit from Tonroe to Flagford (430mm2 ACSR or equivalent rating) with a length of 32km • Uprate of 110 kV AIS line bay in Flagford 110 kV substation as part of the associated uprate

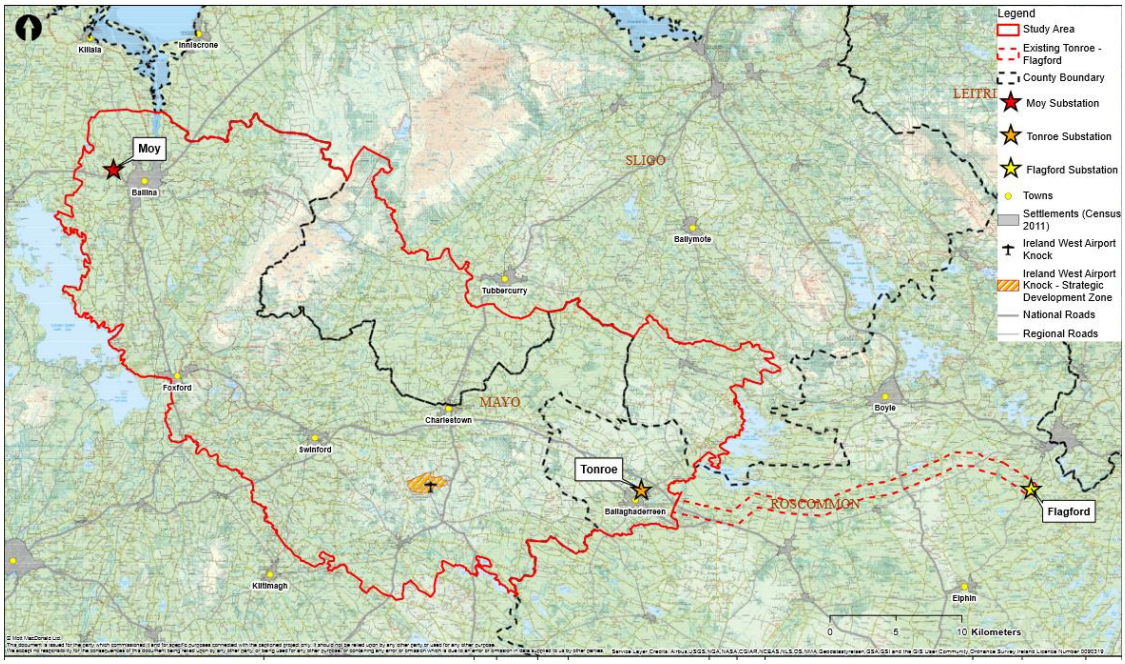
The study area was subsequently refined having regard to the general geographical area between the two identified substation nodes, and the mapping of that area against established Electoral Division areas identified and utilised by the Central Statistics Office (CSO). In this way, official statistics for example relating to population numbers and densities, households, employment and land uses activities could be used in understanding the baseline context of the study area.

4.3 Updated Step 4A Study Area

At the commencement of Step 4, the study area was extended to include more Electoral Districts to the north, refer to the Project Information Brochure (Autumn 2019). This was done to include the possibility of an OHL route to the north of the identified study area between Ballina and Sligo.

This resulted in the study area shown in Figure 4.2 being carried forward for the Step 4 process now being undertaken by EirGrid. Step 4 mapping is also presented in Appendix E of this report.

Figure 4.2: Step 4 Study Area



Source: Mott MacDonald

The map above identifies the Step 4 project study area in red. This project study area map includes the corridor alignment of the existing Flagford – Tonroe 110 kV OHL – as noted above, the overall project scope includes the upgrading of this existing 110 kV OHL circuit.

For the purposes of corridor identification for the new 110 kV connection between Moy and Tonroe 110 kV substations, the constraints identification mapping focuses on the study area defined with the solid red line in the map above only, as the existing alignment of the Flagford - Tonroe 110 kV OHL will not alter with its upgrading.

The study area lies within the counties of Mayo, Sligo and Roscommon in the province of Connacht. The area is predominantly rural agricultural in nature and includes the following main settlements (population is according to the 2016 population census: Ballina (pop.10171), Swinford (pop.1394), Foxford (pop. 1315) and Charlestown (pop. 1003). Ireland West Airport Knock is located within the study area.

The landscape in the area is dominated by the River Moy, one of Ireland's premier salmon rivers, and the south western part of the Ox Mountain range, with its characteristic peat bogs. The landscape is predominantly pastureland, dominated by agriculture with areas of natural vegetation. There are patches of peat bogs, coniferous and mixed woodland. The landscape is the study area is typically low-lying; the Ox Mountains are the dominant topographical feature.

5 Strategic Planning Overview

5.1 Introduction

This Chapter concentrates on national, regional and local policies and objectives and the European and National policy context are set out in detail in Appendix A *Planning Policy Context* and summarised in this Chapter of the Step 4A Report.

5.2 EirGrid Strategy

EirGrid develops, manages and operates the transmission grid and electricity market on an all-island basis. EirGrid's strategy document, *Strategy 2020-2025 Transform the Power Systems for Future Generations,* is shaped by two factors: climate change and the impending transformation of the electricity sector. This document sets out the vision of EirGrid over the next five years to plan for a transition to a low carbon future. The Strategy recognises that electricity from renewable sources will play a vital role in the global response to the climate crisis. The North Connacht 110 kV Project forms part of this wider Strategy.

EirGrid's long-term strategy document, *Ireland's Grid Development Strategy*, describes the three main factors that have informed the strategy: feedback from consultation processes on major projects; advances in technology; and changes in external economic environment. The strategy defines the need for continuing development of the infrastructure. This report describes the Grid West project, as originally envisaged and states that *depending on the final volume of generation, the solution may be a more local reinforcement of the grid*.

5.3 National Policy

The most recent National policy context in which the project must be seen relates to tackling climate change through the increased use of renewable energy sources. The Government of Ireland has produced the Climate Action Plan (2019) to promote, among other climate action plans, the decarbonisation of the energy industry. Chapter 7 of the Climate Action Plan deals with Electricity and sets down a challenge to achieve 70% renewable electricity by 2030 which will involve phasing out coal- and peat-fired electricity generation plants, increasing our renewable electricity, reinforcing our grid (including greater interconnection to allow electricity to flow between Ireland and other countries), and putting systems in place to manage intermittent sources of power, especially from wind.

Action 17 requires "that ESB Networks and EirGrid plan network and deliver on connecting renewable energy sources to meet the 2030 70% RES-E target".

Other policy context at National level is located in Appendix A *Planning Policy Context* of this report.

5.4 Regional Policy

5.4.1 Northern & Western Regional Spatial & Economic Strategy

The principal statutory purpose of the Regional Spatial and Economic Strategy (RSES) is to support the implementation of the emerging National Planning Framework (NPF) - Ireland 2040 Our Plan, and the economic policies and objectives of the Government by providing a long-term strategic planning and economic framework for the development of the regions. The NPF replaces the former National Spatial Strategy (NSS) and its related documents, such as the

Regional Planning Guidelines (RPGs) 2010. In Chapter 4.5.2 of the Northern and Western RSES it is noted that:

Ireland's 2020 renewable energy target is to increase the share of final energy consumption made up of renewable energy sources (RES) to 16%. This target is broken into three key sectors with individual targets for each sector: 40% of electricity supply (RES-E), 12% of heating (RES-H), and 10% of transport (RES-T). Ireland also has a target of a 20% improvement in energy efficiency by 2020.

Chapter 8 of the RSES deals with the infrastructure of the region and Chapter 8.2 states that *"ensuring the necessary investment in the transmission and distribution networks to meet the needs of a growing economy and the transition from fossil fuels to renewables is imperative but also to incentivise local innovation and micro-generation."* Chapter 8.3 further notes that *"developing the grid will enable the transmission system to safely accommodate more diverse power flows from surplus regional generation and also to facilitate future growth in electricity demand. These developments will strengthen the network for all electricity users, and in doing so will improve the security and quality of supply. This is particularly important if the region is to attract high technology industries that depend on a reliable, high quality, electricity supply."*

Regional Policy Objectives of relevance to provide policy context for this project are as follows:

- *RPO 8.1 - The Assembly support the development of a safe, secure and reliable electricity network, and the transition towards a low carbon economy centred on energy efficiency and the growth projects outlined and described in this strategy.*
- *RPO 8.2 – Support the reinforcement and strengthening of the electricity transmission network with particular reference to the regionally important projects contained within Table 1 [includes North Connacht Project].*
- *RPO 8.3 – The Assembly supports the necessary integration of the transmission network requirements to allow linkages with renewable energy proposals at all levels to the electricity transmission grid in a sustainable and timely manner.*
- *RPO 8.4 - That reinforcements and new electricity transmission infrastructure are put in place and their provision is supported, to ensure the energy needs of future population and economic expansion within designated growth areas and across the Region can be delivered in a sustainable and timely manner and that capacity is available at local and regional scale to meet future needs. Ensure that development minimises impacts on designated areas.*

5.5 Local Policy

5.5.1 Mayo County Development Plan 2014-2020

In terms of local policy, we have reviewed the current statutory local development plan, which is the Mayo County Development Plan 2014-2020 (the plan). It is noted that the preparation of the future statutory development plan, the Mayo County Development Plan (2020-2026) has begun and initial pre-draft consultation has been completed, however this is not considered material given the early stage of preparation.

Chapter 3 of the Mayo County Development Plan 2014-2020 (the Plan) relates to Infrastructure Strategy and the following policies are relevant to the project.

PY02 It is the policy of the Council, in conjunction with all relevant statutory agencies and infrastructure providers to provide, or facilitate the provision of, high quality sustainable infrastructure to serve the economic and social needs of the County through the implementation of the objectives below.

Energy

EY01 It is an objective of the Council to support and facilitate the provision of a reliable energy supply in the County, with emphasis on increasing energy supplies derived from renewable resources whilst seeking to protect and maintain biodiversity, wildlife habitats, the landscape, nature conservation, and residential amenity.

EY02 It is an objective of the Council to implement the Renewable Energy Strategy for Co. Mayo 2011 ‐2020.

EY03 It is an objective of the Council to promote energy conservation through reduced consumption and incorporating renewable energy technology into building design standards.

EY04 It is an objective of the Council to seek the extension of the Gas Network to other towns in the County and to Ireland West Airport Knock.

EY05 It is an objective of the Council to support and facilitate the provision of a high quality electricity infrastructure in the County, whilst seeking to protect and maintain bio ‐ diversity, wildlife habitats, scenic amenities, including protected views and nature conservation.

5.5.2 Renewable Energy Strategy for County Mayo 2011 ‐ 2020

The Renewable Energy Strategy for County Mayo 2011-2020 (the Strategy) sets out a path to allow County Mayo to contribute to meeting the national legally-binding targets and sets out opportunities for individuals, communities and businesses to harness renewable energy in a sustainable manner and to assist in combating climate change. In the context of the preparation of the new Mayo County Development Plan (2020-2026), the Council has not indicated, when they would also be updated the current renewable energy strategy, therefore the current strategy is discussed below.

The Strategy also clarifies the approach Mayo County Council takes to renewable energy and should assist direction and reduce uncertainty for the most regarding issues associated with renewable energy developments in Mayo.

The following parts of Chapter 4 relating to The National Grid are of relevance in providing policy context to this project.

4.5 Future Development of the National Grid in Co. Mayo

Mayo forms part of the North West Region in Grid 25 – an area which has been identified as having the largest (35%) expected regional distribution of the renewable generation capacity, as the area is particularly rich in wind and ocean renewable energy resources

The upgrading of the national grid is imperative for the future development of renewable energy production in Mayo. According to EirGrid, the consequences of non-action means that "by the second half of the next decade there will be no capacity in the network to cater for new customers and the reliability of supply to existing customers will fall below international standards and there will not be enough capacity in the network to connect further renewable generation; as the north west is a renewable-rich region this will have severe consequences on the ability of Ireland to meet its renewable energy targets and its long term sustainable energy supplies".

However, it will not be possible to utilise Mayo's natural resources for renewable energy (or efficiently produce energy from conventional sources) without essential upgrades to the national grid. Having conservatively estimated the amount of renewable energy that can be generated in

the County (outlined above) it is reasonable to state that a 400 kV line will be required to harness the County's natural resources and to achieve the policies and objectives of this Strategy. The corridor for a 400 kV transmission line is to be assessed in accordance with best international practice following a detailed analysis of routing options incorporating technical and environmental considerations. Building one 400 kV circuit avoids the need for building a multiplicity of 220 kV lines and so has less long-term impact on the environment and local communities.29 Securing the provision of a 400 kV line and associated infrastructure in the County will be a priority for Mayo County Council.

Other upgrades to existing voltage lines or new voltage lines/underground cables may be required throughout the County to facilitate the movement of power generated from renewable energy. The Council will require that routes and wayleaves of existing voltage lines/underground cables should be the first option considered for any new voltage line/cable proposals. Any upgrades to existing voltage lines or new voltage lines/underground cables will be considered on a case by case basis having regard to the principles of proper planning and sustainable development.

It should be noted that EirGrid's original proposal was the Grid West project in 2012, a large-scale 400 kV development to facilitate the level of renewable generation planned at that time. By June 2017 the amount of planned renewable generation capacity in the region had dropped by half and Grid West was no longer required. The reduced amount of renewable energy can be accommodated on the grid by way of a smaller scale of development, the North Connacht 110 kV project and this is likely to be reflected in the Mayo County Development Plan 2021-2027.

5.5.3 Roscommon County Development Plan 2014-2020

In the context of local policy, the Roscommon County Development Plan 2014-2020 (RCDP) sets out the framework for the sustainable development of the County. There has not been any formal publication from the Council in terms of preparing a new County Development Plan, with work expected to begin in Q2 of 2020. The RCDP, and the associated Landscape Character Assessment, supports the development of renewable energy at appropriate locations throughout the County.

Chapter 6 of the RCDP provides a broad discussion on renewable energy and energy policies and objectives are provided within the Plan.

This Renewable Energy Strategy (Chapter 6) provides the specific framework for the development of renewable energy throughout the County and is incorporated as part of the County Development Plan. This Renewable Energy Strategy is consistent with the policies and objectives of the County Development Plan in relation to the promotion and facilitation of renewable energy in County Roscommon.

Within the Renewable Energy Strategy, Chapter 3 deals with Energy Infrastructure including the National Grid. Chapter 3.2 refers to Grid 25 (now superseded by Strategy 2020-2025) but the aspirations are largely the same. The Renewable Energy Strategy notes that:

The potential benefits of implementing the transmission projects within Roscommon and the *wider region include inter alia:*

- *This region of the country can become a net exporter of power to the rest of the island, reducing its reliance on generation from outside the region.*
- *The development of new and upgraded transmission networks will facilitate the growth of renewable energy connections in the County.*
- *An increase in power supply will accommodate and help attract future industry to the County.*

5.5.4 Sligo County Development Plan 2017–2023

Sligo County Development Plan 2017–2023 is the over-arching strategic framework document for sustainable development in spatial, economic, social and environmental terms.

Chapter 11 of the County Development Plan relates to 'Energy and Telecommunications' which supports the transition to clean renewable energy and the associated infrastructure to support same. Specifically, section 11.1.7 of the Plan relates to 'Electricity Transmission' and it is recognised that *"the transmission network forms the backbone of power supply. Its development is critical to ensuring that County Sligo has the necessary infrastructure and capacity to attract business and accommodate the future development of the local economy".* The Plan recognises that "*developing the grid will enable the transmission system to safely accommodate power flows from surplus regional generation and also to facilitate future growth in electricity demand".*

The Plan sets down Strategic Energy Policies and the relevant policy in this instance is as follows:

SP-EN-1: *Support the sustainable development, upgrading and maintenance of energy generation, transmission, storage and distribution infrastructure, to ensure the security of energy supply and provide for future needs, as well as protection of the landscape, natural, archaeological and built heritage, and residential amenity and subject to compliance with the Habitats Directive.*

6 Identification and Mapping of Constraints

6.1 Introduction

This Chapter seeks to describe the following:

- Identification of constraints. These fall into the following categories:
  - Technical Constraints
  - Deliverability Constraints
  - Economic Constraints
  - Environmental Constraints
  - Socio-economic Constraints
- Sources and methods of data collection
- Constraints Mapping

6.2 Constraints Identification

A constraint can be identified as “any physical, technical, legal, environmental, topographical or other consideration that may potentially affect, limit, restrict or confine the proposed development within the study area”. These considerations are outlined below.

6.2.1 Technical Constraints

In relation to compliance with safety standards, the project must comply with relevant safety standards such as those from the European Committee for Electrotechnical Standardisation (CENELEC). Materials should comply with IEC or CENELEC standards. The project must also comply with the specified ratings as provided by EirGrid.

- System Reliability: The average failure rates for the OHL or UGC can be calculated using, for example, estimated availability figures (unplanned outages/100km/year), Mean Time to Repair (MTTR) and the length of the line or cable.

6.2.2 Deliverability Constraints

Deliverability Constraints are:

- Implementation Timelines: Relative length of time until energisation (assess significant differences) and outage requirements.
- Project Plan Flexibility: Does the project plan allow for some flexibility if issues arise during design and construction?
- Permits & Wayleaves: Various permissions and wayleaves required to proceed to construction (e.g. number or level).
- Construction related impacts:
  - Water Impact during construction. Ease/ difficulty of mitigation measures that may be required to prevent impacts on river crossings, lakes, and groundwater
  - Air Quality Impact during construction. Ease/difficulty of mitigation measures that may be required to reduce impacts from construction-related dust and traffic.
  - Traffic & Noise Impact during construction: Noise and traffic disturbance and impacts that may occur during the construction phase and mitigation measures to reduce impacts.

6.2.3 Economic Constraints

Project Implementation Costs: Costs associated with the procurement, installation and commissioning of the grid development and therefore include all the transmission equipment that forms part of the project's scope.

6.2.4 Environmental Constraints

The following environmental constraints within the study area were considered:

- Land Use Planning – Land Use – Land Use Zoning
- Soils, and Geology – Ground Conditions.
- Landscape and Visual – Landscape designations, scenic routes, protected views.
- Biodiversity (Flora and Fauna).
- Waterbodies, Drainage and Flood Risk – watercourses and water crossings – flood risk.
- Cultural Heritage – Protected and unrecorded cultural heritage.

6.2.5 Socio-economic Constraints

Socio-economic constraints considered within the study area are detailed below

- Population and Economic Profile;
- Material Assets – e.g. Ireland West Airport, towns and other settlements, transmission network, roads network;
- Traffic and Transport; and
- Tourism and Recreation.

An understanding of these spatial and land use constraints within the study area will allow feasible route options and site locations for the substation and high voltage transmission infrastructure to be fully considered.

6.3 Data Sources and Information Gathering

The constraints identified are, in general, based on a review of publicly available statutory and environmental sources as follows:

- Department of Culture, Heritage and the Gaeltacht;
- Department of Housing, Planning and Local Government;
- National Parks and Wildlife Service;
- National Monuments Service;
- The Office of Public Works;
- Transport Infrastructure Ireland;
- Ordnance Survey of Ireland;
- All Ireland Research Observatory;
- Mayo County Council;
- Roscommon County Council;
- Sligo County Council;
- Environmental Protection Agency;
- The Geological Survey Ireland;

- Inland Fisheries Ireland;
- GeoDirectory Ireland;
- Birdwatch Ireland; and
- Utilities providers (Bord Gáis, EirGrid/ESB).

6.4 Constraints Data Mapping

Geographic information system (GIS) mapping was used to display the key datasets that inform this report.

Constraints mapping was prepared using ArcGIS v 10.6.1 GIS software. Subject specific constraints maps were prepared to allow multiple data layers to be displayed concurrently. The maps were prepared by experienced GIS technical specialists to ensure that all relevant data is displayed clearly and concisely with legends indicating all the data contained on each constraint map.

The constraints mapping was prepared in order to inform the identification of viable route corridors within the study area.

Each map was prepared on standard A3 landscape map layout sheets. Each constraints map contains standard background mapping layers to allow viewers to identify locations of constraints. The maps are provided in Appendix E *Mapping* of this report.

The constraints mapped were Environmental and Socio-economic only. The Technical, Deliverability and Economic constraints were not mapped at this stage of the project as they are considered equal across the study area.

7 Identification of Corridor Options

7.1 Introduction

This section of the report describes how the environmental and socio-economic constraints mapped within the project study area, as described in Chapter 6 were used to develop general corridors within which OHL routes can potentially be developed. Similarly, these constraints were used to inform the development of broad route options for UGC. UGC route options will mainly be confined to the public road network and hence have a limited range of potential impact on adjacent constraints. OHL corridor options however are mainly located in the open countryside, sometimes adjacent to the public road network where possible, for ease of access during construction and maintenance.

7.2 Heat Mapping

Heat mapping is a tool that is used to determine the sensitivity and significance of the identified constraints, both in isolation and cumulatively (i.e. in areas where constraints overlap), taking cognisance of appropriate buffers. It provides a graphical representation of this using colours. This process involves two steps with the outputs providing a high-level overview of potential OHL corridor and UGC route options within the study area.

1. Initial data preparation of criteria specific fields by converting an excel file for each layer and assigning a buffer distance.
2. The outputs are then run through a weighted overlay tool designed by Mott MacDonald which calculates statistics relative to weightings and the overlap of constraints. A colour is then assigned as shown below.

Colour Key Level of Risk/Significance/Sensitivity

Colour Key	Level of Risk/Significance/Sensitivity
Yellow	Low
Green	Low-Moderate
Dark Green	Mid-Level / Moderate
Blue	Moderate-High
Dark Blue	High

The collated datasets were stored within project specific ArcGIS File Geodatabases. All data was thoroughly checked and converted to the appropriate co-ordinate system prior to use.

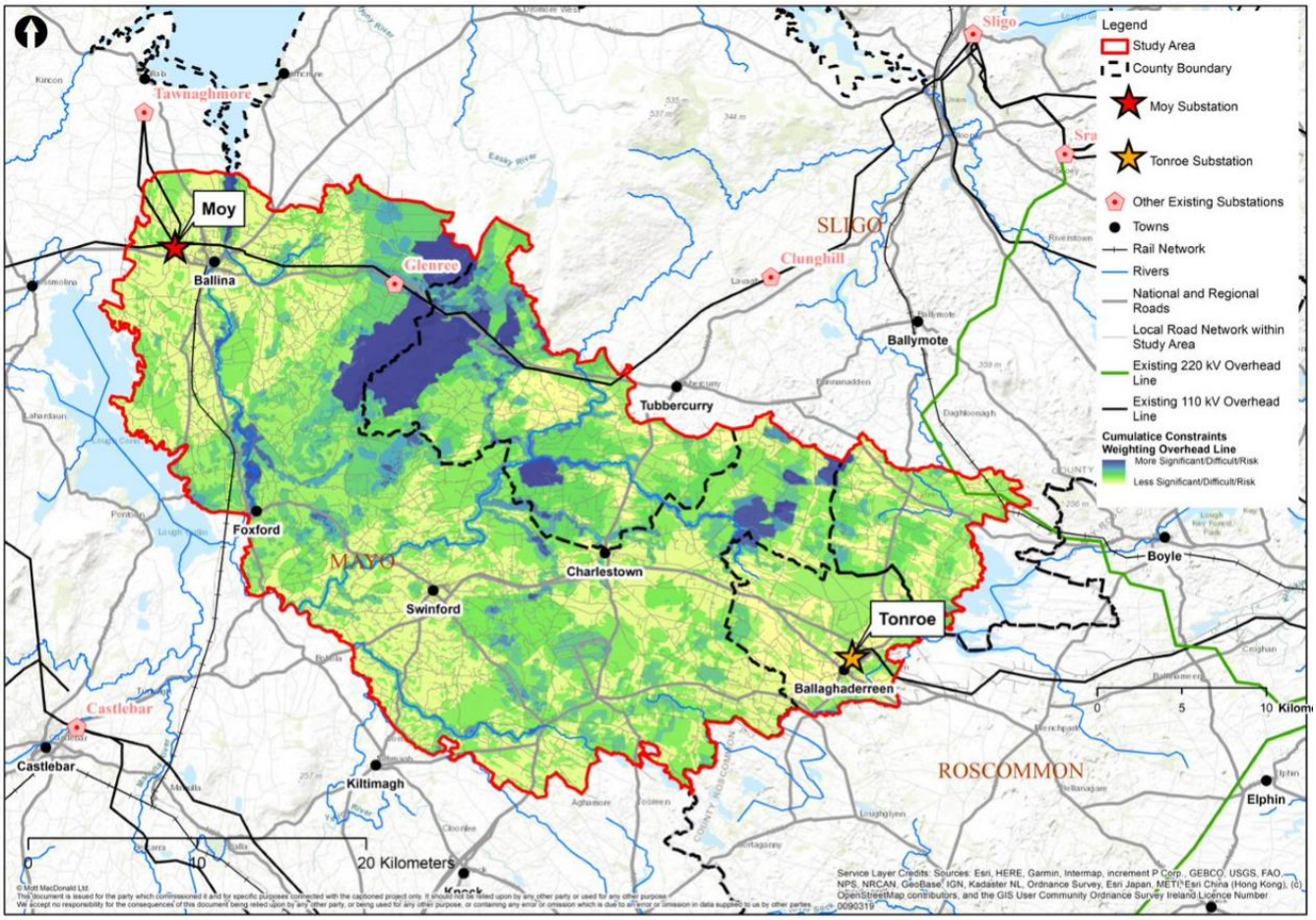
The significance/weighting of constraints and their associated buffers differs between the OHL and UGC options as the potential impacts are different for the two technologies. For example; visual and landscape sensitivities (scenic views and sensitive landscapes) are more relevant to the OHL option and are therefore assigned a higher impedance.

Where the level of significance or sensitivity is low (i.e. an area where there are no sensitive constraints), this is interpreted as an area of opportunity.

The tables listing the heat mapping constraints applied to the OHL and UGC options together with their assigned weightings are listed in Appendix C and D respectively.

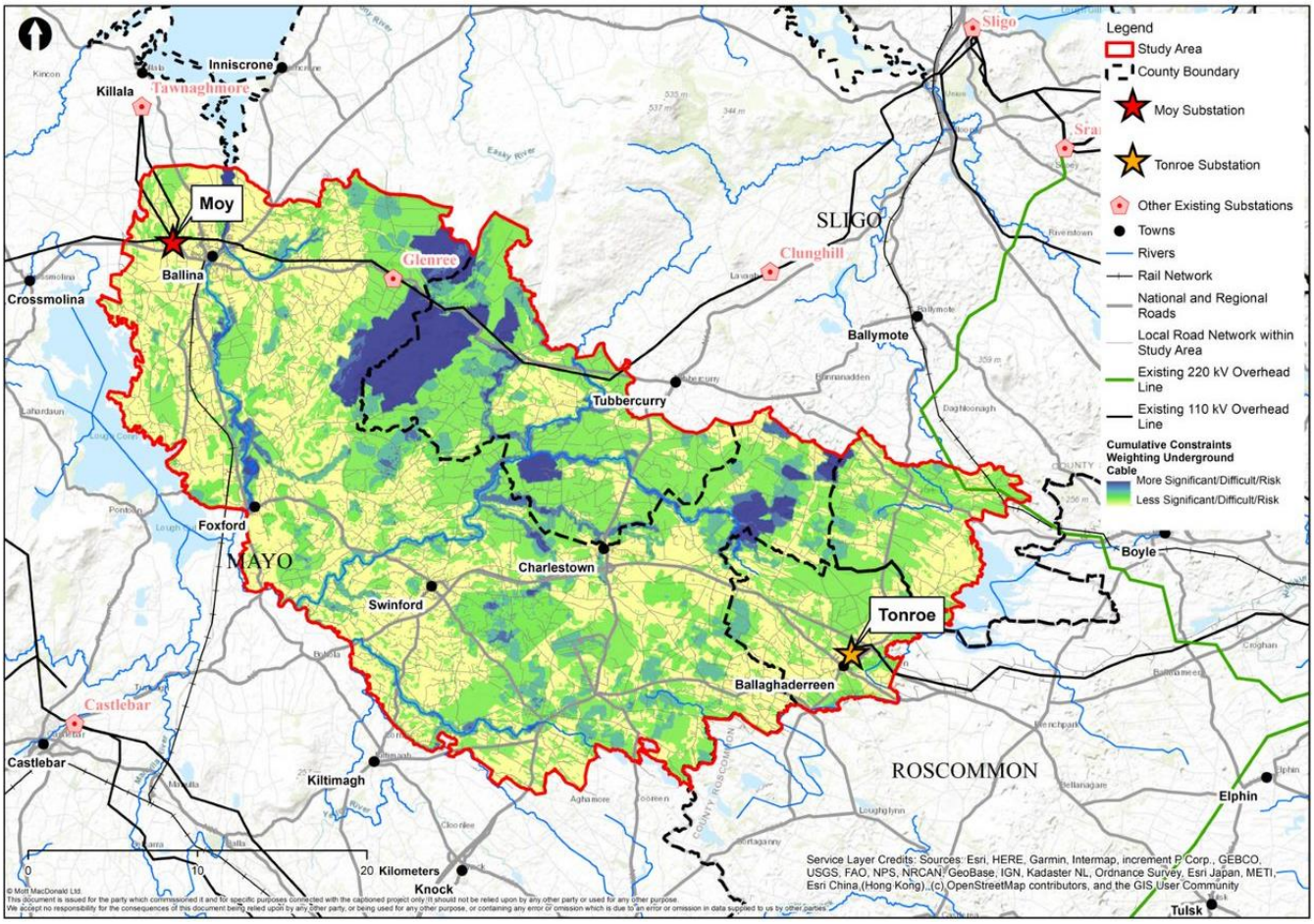
The resultant heat map for the study area for OHL and UGC are shown in Figure 7.1 and Figure 7.2 respectively. The resultant heat mapping is also available in Appendix E *Mapping* of this report.

Figure 7.1: Heat Map (Overhead Line)



Source: Mott MacDonald

Figure 7.2: Heat Map (Underground Cable)



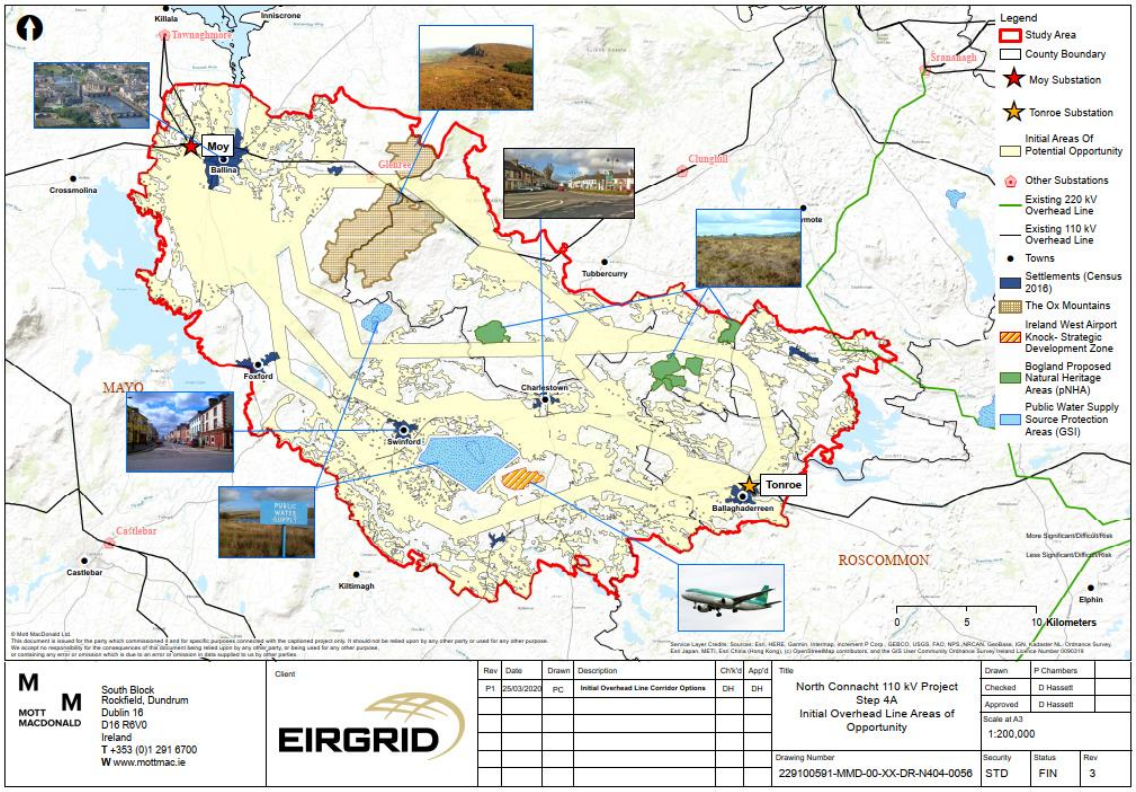
Source: Mott MacDonald

7.3 Areas of Opportunity

The environmental and socio-economic constraints mapped within the project study area, as described in Chapter 6, and the heat mapping described in Section 7.2 above were used to assist in identifying possible potential areas of opportunity within which viable OHL and UGC route corridors could be developed. These areas of opportunity are shown in Figure 7.3 (and also in Appendix E).

The areas of opportunity were formed by principally avoiding areas of potentially high impact and following areas where, based on the results of the heat mapping, the risk/sensitivity/significance is low (yellow on the heat map). Areas of potentially high impact are the settlements, Ox Mountains, ecologically protected areas, peat, areas of public water supply, and Knock Airport. Single dwellings were included as an input in the constraints mapping (refer to mapping in Appendix E, but given the significant number and scattered pattern of single dwellings throughout the study area, they were not used as an input in the heat mapping. Avoidance of dwellings will be of primary importance at the subsequent route identification stage, and the areas of opportunity and subsequent potential corridors are wide enough to facilitate avoidance.

Figure 7.3: Initial Areas of Opportunity



Source: Mott MacDonald

7.4 Corridor Identification

The heat map (Figure 7.1) for the study area was used as a high-level tool in order to visually identify areas where an OHL would have the least significant environmental and socio-economic impact. Thus, the corridors primarily follow areas of Low to Low-Moderate Risk/Significance/Sensitivity. There are, however, areas of Moderate-High Risk/Significance/Sensitivity that are unavoidable (for example: crossing of the River Moy SAC).

The corridors identified for the OHL options are typically 1km in width; however, this width is not rigid, and are intended as indicative general areas for analysis. Further detail is provided in Section 7.4 *Overhead Line Corridor Identification.* It should be noted that the corridors identified below are initial corridors based on the constraints known at the time of writing through desktop study. The final corridors and subsequent routes may differ from these initial corridors as further information is gathered, county policy changes are implemented, and field studies are carried out. The selection of the OHL corridors was carried out by a number of specialists on the project team in a workshop format, informed by the constraints mapping and the heat mapping.

GIS least distance tools, which use Dijkstra's shortest path algorithm, were used to assist in identifying UGC routes, further detail is provided in Section 7.6 *Underground Cable Route Identification*.

Maps showing the constraints within the corridor options are included in Appendix E.

7.5 Overhead Line Corridor Identification

The route corridor development process identified the following potential corridor options (see Appendix E):

- Corridor A (purple on map).
- Corridor B (yellow on map).
- Corridor C (pink on map).
- Corridor D (blue on map).
- River Moy Area (black on map).

The lands are pre-dominantly rural-agricultural with on-off housing, refer to Corine Landcover mapping in Appendix E. Each of these Corridor Options is described separately below starting with the River Moy Area.

7.5.1 OHL The River Moy Area (black on map)

The River Moy Area lies to the south of Moy substation and Ballina and has been identified as a broad area in which a viable route could be developed with the least significant impact on the town of Ballina and the section of the River Moy Special Area of Conservation (SAC) which runs between Ballina and Foxford, notwithstanding the fact that the area includes linear patterns of dwelling development on approach roads to Ballina.

The River Moy Area includes an unavoidable crossing of the River Moy SAC. In addition, it encompasses a number of Sites and Monuments Records (SMRs) sites and National Inventory of Archaeological Heritage (NIAH) sites, however the area allows for significant flexibility to avoid these cultural heritage sites.

The River Moy Area lies within Policy Area 4A and 4 (Mayo County Council Development Plan) to the east and west respectively of the N26.

Policy Area 4A is defined as "*Lakeland Sub-policy Area - a distinctive area of the County which comprises landscapes of policy areas 3 and 4, which bound Lough Mask. It bounds often steep slopes and prominent ridge lines to the west and undulating areas of pasture, woodland and forest with underlying glacial drumlins to the east.*"

Policy Area 4 is "…*undulating areas of pasture, woodland and forest which make up the remainder of the County and are considered to have a generally similar ability to absorb development.*"

Several National Roads and rail network infrastructure were identified within the River Moy Area, but these are not normally viewed as constraints in routing OHL infrastructure. The town of Ballina and its environs was identified as a constraint as built up areas are not optimal for OHL infrastructure construction and such areas are to be avoided where possible. There are two primary schools within this area, however there is sufficient room for avoidance with an acceptable buffer zone. The width of the River Moy Area allows for an adequate buffer between the town and environs.

7.5.2 OHL Corridor Option A (purple on map)

The overall length of Corridor Option A is approximately 50km. Corridor Option A which is approximately 1km in width after leaving the River Moy Area, runs in a north-east and then an easterly direction towards Lough Talt initially running south of the R294. In the area of Glenree Corridor Option A crosses to the north of the R294 and the existing Clunghill – Glenree 110 kV overhead line. Thereafter, Corridor Option A follows the approximate route of the existing 110

kV overhead line until that line heads north-east approximately 4km west of Tubbercurry and Corridor Option A continues in a south-east direction until Corridor Option A turns south to Ballaghaderreen and Tonroe substation.

Corridor Option A passes between Lough Hoe Bog SAC to the south and Ox Mountain Bogs SAC to the north as it passes Lough Talt. Both SACs are also proposed Natural Heritage Areas. The corridor crosses the River Moy SAC at a single location, south west of Tubbercurry. A section of Corridor Option A occurs within a Margaritifera Sensitive Area, namely the Moy Catchment. The population of pearl mussel within the catchment is not associated with any SAC but is included within the category; Catchments of other extant populations. The species is critically endangered in Ireland and is highly sensitive to changes in water quality. Owing to its threatened status and dramatic decline, the freshwater pearl mussel is listed on Annex II and Annex V of the Habitats Directive. Further east lies Cloonakillina Lough SAC and Flughany Bog SAC to the north of the corridor.

Corridor Option A passes through landscapes within Policy Areas 3 and 4 (Mayo County Council Development Plan).

Policy Area 3 is described as comprising "*"distinctive and vast areas of the County which form a single policy unit due to the similar visual characteristics of smooth topography, limited shelter vegetation, often steep slopes and prominent ridge lines, rendering this policy unit similar suitability to absorb development."*

Policy Area 4 comprises "…*undulating areas of pasture, woodland and forest which make up the remainder of the County and are considered to have a generally similar ability to absorb development."*

The corridor also passes through areas described as Sligo Sensitive Rural Landscape Areas. As the corridor turns south towards Tonroe it enters an area defined as of Moderate Character value in Roscommon.

This corridor passes through an area with a high density of SMRs south of Ballina as the route proceeds north in order to avoid the Lough Hoe Bog SAC. There is a Geological Heritage Site , Zion Hill, within the corridor north east of Lough Talt. The site is of national Importance.

Corridor Option A passes through a significant area of peat as it passes between Lough Hoe Bog SAC to the south and Ox Mountain Bogs SAC to the north. Here there are also areas of coniferous forest. Peat is encountered again as it heads south east to Tonroe.

Corridor Option A crosses turlough (1429NEK00) which is located to the north of the River Moy SAC and to the south of Cloonakillina Lough SAC.

7.5.3 OHL Corridor Option B (orange on map)

The overall length of Corridor Option B is approximately 44km. Corridor Option B, after leaving The River Moy Area, runs in a south-east direction keeping east of Foxford, approximately 7km, and approximately 5km north of Swinford and approximately 2.5km north and east of Charlestown. Corridor Option B thereafter runs north of the N26 and N5. Corridor Option B after Charlestown turns in a south-east direction and heads toward Ballaghaderreen where it crosses over the N5 and merges with Corridor Option C for the last 10km before reaching Tonroe substation.

Constraints along Corridor Option B mainly comprise the River Moy SAC which the corridor crosses on two occasions. The corridor passes to the south of the Cloongoonagh Bog proposed Natural Heritage Area (pNHA).

Corridor Option B passes through landscapes described as Policy Area 3 and 4(Mayo County Council Development Plan). These Policy Areas are described in Section 7.5.2 above. To the north of Charlestown, the corridor passes through areas described as Sligo Sensitive Rural Landscape Areas. There are a number of SMR sites both in the area where corridor option B joins Corridor Option A south east of Ballina, and in an area north west of Swindon. The corridor passes through an area of peat south of the Lough Hoe Bog SAC and there are patches of broad-leaved and coniferous forest.

7.5.4 OHL Corridor Option C (pink on map)

The overall length of Corridor Option C is approximately 50km. Option C departs from The River Moy Area on the west side of the River Moy and then crosses the river at Tonybaun/Shanclough having first crossed the rail line lying to the west of the River Moy. Corridor Option C then runs in a south-east direction keeping east of Foxford, approximately 4km, and approximately 1km north of Swinford. It passes approximately 1km south of Charlestown. Thereafter, Corridor Option C runs south of the N5 and turns to merge with Corridor Option B for a distance of approximately 10km before entering Ballaghaderreen.

The most significant constraint is the River Moy SAC which this corridor option crosses five times. There is a proposed Natural Heritage Area (pNHA) to the south of where it joins The River Moy Area (brown). It also crosses Mayo County Council Local Biodiversity Areas south and south west of Charlestown.

This corridor crosses landscapes identified as Policy Area 4A, 4 and 3 (Mayo County Council Development Plan). These policy areas are defined in sub-sections 7.5.2 and 7.5.3 above. As the corridor approaches Tonroe it enters an area defined as being of Moderate Character Value by Roscommon County Council.

This corridor passes through an area where there is a high density of SMRs south of the River Moy crossing east of Foxford. There are also several NIAH sites within the corridor but given the corridor width, these are avoidable.

7.5.5 OHL Corridor Option D (blue on map)

The overall length of Corridor Option D is approximately 55km. Corridor Option D is comprised initially of a common corridor with Corridor Option C until Corridor Option C crosses to the east bank of the River Moy where Corridor Option D diverges and turns due south, a distance of approximately 10km. Corridor Option D crosses the N26 approximately 1km east of Foxford and then travels in a south-east direction and runs approximately 3km south of Swinford, crossing the N5 as it does so. Corridor Option D then moves in an easterly direction and approaches Ballaghaderreen from the south-west partially merging with Corridor Options B and C on entering the urban area.

Corridor Option D crosses the River Moy SAC four times (including the possible links). It also encompasses a Mayo County Council Local Biodiversity Area south of Swinford.

This corridor option crosses landscapes 4A, 4 and 3 as identified in the Mayo County Council Development Plan. These are defined in Section 7.3.4, above. As with Corridor C, it enters an area defined as being of Moderate character value by Roscommon County Council.

This corridor passes through two areas where many SMRs are encountered: the one north east of Foxford, and the other extended area as the corridor heads south east as it passes south of Swinford. There are a number of NIAH sites within the corridor but given the corridor width, these are avoidable.

7.5.6 Corridor Links (brown on map)

7.5.6.1 Corridor Link B – C

This link lies to the north of Swinford and runs from Corridor Option B in a southerly direction for 3km to link up with Corridor Option C. It crosses the River Moy SAC, but could potentially offer a lower impact option than the crossing of the River Moy SAC further east along Corridor Option B as the SAC crossing is much narrower at this location and it is likely that works within the designated sites could be avoided.

7.5.6.2 Corridor Link C – D

This link leaves Corridor Option C just west of Charlestown and runs in a south-easterly direction to link up with Corridor Option D approximately 9km west of Ballaghaderreen. It crosses the River Moy SAC and there is a Mayo County Council Local Biodiversity Area at its junction with Corridor C.

7.6 Underground Cable Route Identification

The initial route sections for UGC were identified through desktop analysis to determine feasible routes along public roads between the two substations. This desktop assessment considered the roads available between the substations based on the shortest distance between the substations, as well as their type and width. For example, regional and national roads were generally identified and considered over narrower local roads as they are wider and allow for more favourable traffic management options during construction. In some cases, however, only local roads were available, and, in this instance, the most direct and widest roads were considered.

The initial UGC routes have been derived by using a GIS least distance tool which uses Dijkstra's shortest path algorithm which is an iterative process to find the shortest route between two locations. This algorithm minimises each of the following parameters individually:

- Route length;
- Total number of crossings (infrastructure, watercourses);
- Roads less than 5m in width; and
- Roads with congested underground services.

Dijkstra's algorithm is a well-known method for finding shortest paths between two points and has been used by mapping companies for that purpose. This assessment has used this algorithm to find paths which have the lowest number of features according to the list above. Each of these paths is called a "minimising route".

In this case using a filtered subset of the OSI prime 2 roads data to derive the shortest route on feasible roads based on average road width for road sections. The two shortest routes were determined by this method. The third route was determined by mapping the closest feasible alternative to long national road sections to ensure viable routes remain should the national roads be unavailable to the project in the future. The three routes have been mapped in Figure 7.3 (also contained in Appendix E). Feedback from public consultation along with further analysis of the available data and initial field surveys will inform the next refinement of these initial route options. or UGC.

For the UGC routes, the width of the corridors is largely confined to the width of the actual road and the adjacent verges. However, where pinch points occur, for example where bridges cross watercourses, the route may need divert off the roads to minimise impacts, diversions such as

these, if required, will be accounted for at later stages of the project, when location-based requirements are known and fully understood.

The route selection process identified the three potential UGC routes as follows:

- UGC Route Option 1 (yellow on map).
- UGC Route Option 2 (blue on map).
- UGC Route Option 3 (purple on map).

It should be noted that where the UGC cable route passes through an urban area the route is indicative only at this early stage of the route selection process and a more defined route will be assed later in the Step 4 process following public consultation and more detailed assessment of route options.

7.6.1 UGC Route Option 1 (yellow on map)

This route originates at Moy substation to the west of Ballina, Co. Mayo and proceeds south along the public road (L1109) continuing in a southward direction along the N59. As the N59 approaches Ballina in an east-west direction, the Route Option 1 turns south on the third-class road network before turning east just south of Ballina to join up with the N26. Route Option 1 crosses the Irish Rail train track immediately before joining the N26.

Once on the N26 this Route Option 1 runs south along the N26 to Foxford. The River Moy SAC lies to the east of Route Option 1 and is indicated as blue/dark-blue reflecting the environmental sensitivity of the SAC. There are no significant environmental or other constraints to the west of Route Option 1 as reflected in the yellow/green heat mapping – low/moderate potential impacts. As stated above, the Route Option 1 is marked as indicative while running through built up areas such as Foxford as further detailed assessment would be required at a later stage of Step 4 to determine the feasibility of a route through this and other urban areas.

After Foxford, Route Option 1 heads east on the N26 and re-joins the third-class road network via Noorey Park and runs eastward through Coolagagh, Coolegraine and Bokeen. There are no significant constraints along this section of Route Option 1. Running south-east along this road network, Route Option 1 does not encounter any significant constraints until the River Moy (an SAC) is reached where a crossing is proposed at Drumalooaun. Route Option 1 thereafter runs in a south-west direction to Swinford. Within Swinford Route Option 1 is marked as indicative only for reasons previously explained.

After Swinford Route Option 1 heads east on the third class road network to the south of the N5 (along which Route Option 2 runs) and crosses the N17 south of Charlestown. There are no significant constraints along this section of Route Option 1. After crossing the N17, Route Option 1 travels east then south-east along the third class road network to the south of the N5 until it comes to Ballaghaderreen, Co. Roscommon where Tonroe substation is located. Route Option 1 becomes an indicative route once it enters the built up area.

7.6.2 UGC Route Option 2 (blue on map)

Route Option 2 has a common commencement as Route Option 1 from Moy substation but stays on the N59 and does not veer south before Ballina like Route Option 1. Route Option 2 is marked as indicative through the urban area of Ballina and then continues in a south-east direction along Church Road. The River Moy running north-south through Ballina is an SAC as reflected in the blue/dark blue of the heat mapping. Route Option 2 then runs south along the third-class road network with the River Moy to the west of Route Option 2 and links up with the N26 to the east of Foxford. Apart from a slight deviation to the north of the N26 after

Doonamona, Route Option 2 follows the N26 to Swinford and thereafter the N5 to Ballaghaderreen departing from the N5 onto the L1244 to link up with Tonroe substation.

Aside from the River Moy (SAC) which Route Option 2 crosses in two places, no significant constraints have been identified to date along this route.

7.6.3 UGC Route Option 3 (purple on map)

Route Option 3 has the same starting route at Moy substation as Route Options 1 and 2 and like Route Option 2 it runs east through Ballina and over the River Moy. After Ballina Route Option 3 travels due east along the R294 towards Lough Talt. Then Route Option 3 departs from the R294 at Mullany's Cross and runs south-east to Toorlestraun and Treankeel and crosses the River Moy, an SAC. Route Option 3 continues to run in a south-east direction and crosses over the N17 north of Charlestown and continues using the third-class road network until Route Option 3 crosses over the N5 north-west of Ballaghaderreen and thence to Tonroe substation.

Aside from the River Moy which Route Option 2 crosses in two places, no significant constraints have been identified to date along this route.

8 Next Steps

8.1 Introduction

The following sections outline the proposed 'next steps' following publication of the Step 4A Report, as presented in Figure 8.1.

8.2 Step 4A - Consultation on Areas of Opportunity

EirGrid will consult on the Areas of Opportunity for both OHL/UGC options (i.e. "route corridors" for the new circuit) presented in this Step 4A Report. This consultation will run for a number of weeks and include Public Consultation Events and an online presence. In advance of the events, presentations will be made to Mayo, Sligo and Roscommon County Councils. Elected representatives will be notified in advance of the Public Consultation Events, which will also be advertised in newspapers. A mobile unit will also be available in advance of the consultation events.

8.3 Step 4B – Identify Best Performing Route Corridor

The next step in the Framework for Grid Development following on from consultation with the public and relevant stakeholders on the Step 4A Report will be Step 4B.

Feedback from 4A consultation and engagement will be considered and analysed and presented in the Step 4B Report. An evaluation of the route corridor options will be carried out to identify the Emerging Best Performing Option (EBPO), i.e. the chosen technology option (OHL or UGC) and associated route corridor.

Stakeholder, community, public and landowner engagement will continue throughout Step 4B and will include for further Public Consultation events, as outlined above.

8.4 Step 4C – Identify Emerging Best Performing Technology and Route

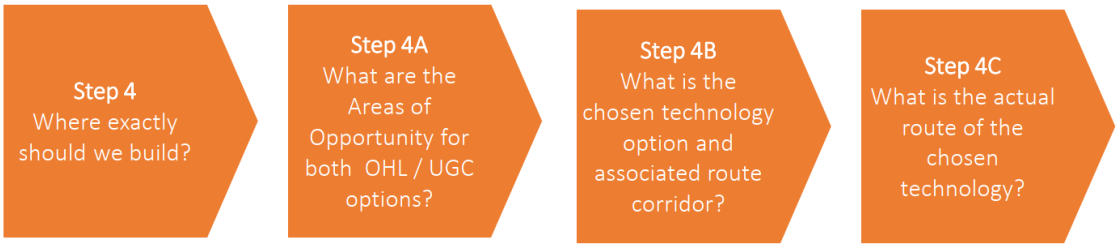
Subsequent to Step 4B engagement a Step 4C Report will be prepared, the purpose of which is to identify the actual route of the chosen technology option within the EBPO corridor by means of more detailed evaluations.

Landowner engagement will be carried out within the identified EBPO corridor to identify potential route(s).

Feedback from 4B consultation and engagement; will be considered and analysed. An evaluation of the EBPO corridor will be carried out to identify the actual route of the chosen technology option.

Step 4 will conclude with a Step 4C report, confirming the Best Performing Technology and associated route for the North Connaught Project to be taken into Step 5 (Planning).

Figure 8.1: EirGrid's North Connacht Step 4 Framework for Grid Development



Source: Mott MacDonald

A. Planning Policy Context

A.1.1 National Planning Policy Context Project Ireland 2040 - National Planning Framework (2018)

Ireland 2040 - National Planning Framework, hereafter referred to as the NPF, published by the Government in February 2018, is a 20-year planning framework designed to guide public and private investment, to create and promote opportunities for Irish citizens, and to protect and enhance Ireland's built and natural environment.

The NPF notes that the population of Ireland is projected to increase by approximately 1 million people by 2040 which will result in a population of roughly 5.7m. This growth will place further demand on both the built and natural environment as well as the social and economic fabric of the country. In the context of the Northern and Western Regional Assembly, including Counties Mayo, Roscommon and Sligo, proximity to Dublin city has resulted in significant development in the region with a population growth rate more than twice the national average. A more 'balanced and sustainable' pattern of development is therefore required in these counties with a greater focus on addressing local utility infrastructure needs in the context of on-going growth.

The National Strategic Outcome 8 (Transition to Sustainable Energy), notes that in creating Ireland's future energy landscape, new energy systems and transmission grids will be necessary to enable a more distributed energy generation system which connects established and emerging energy sources to the major sources of demand. To facilitate this, NPF acknowledges the need to:

'Reinforce the distribution and transmission network to facilitate planned growth and distribution of a more renewables focused source of energy across the major demand centres.'

The implementation of the Project will strengthen energy provision within the Northern and Western Regional Assembly, which includes Counties Mayo, Roscommon and Sligo, especially in the context of ensuring grid capacity to meet growing demand for the export of renewables. This will assist in delivering a secure and sustainable electricity system which will in turn improve the performance of local and regional enterprises in terms of 'innovation, export potential and productivity, supporting technology-led start-ups and by attracting further investment to the regions' as described in National Strategic Outcome 5 (A Strong Economy Supported by Enterprise, Innovation and Skills). As such, the available support provided by the proposed development will comply with the strategic outcomes envisioned by the NPF's National Energy Policy and National Strategic Outcomes.

A.1.2 National Development Plan 2018-2027 (2018)

The National Development Plan 2018-2027, hereafter referred to as the NDP, sets out the investment priorities at national, regional and local planning levels which will facilitate the implementation of the NPF. In the context of the energy sector, the ultimate objective of the NDP is to assist in ensuring a 'long-term, sustainable and competitive energy future for Ireland'. The NDP notes that State Owned Enterprises (SOEs), such as EirGrid, are predicted to invest over €13 billion in energy related investments within the lifetime of this Plan; specifically, works will focus on regulated energy network infrastructure to provide smart reliable electricity networks to support security of electricity supply, SMART metering and enable increased renewable generation. Targeted investment within network infrastructure ensures that Ireland's power grid is:

- Maintained to the highest international safety standards;
- Fit for purpose in the medium to longer-term to meet projected demand levels and
- Meets the challenge of integrating world-leading levels of renewable energy.

Similar to the precedent set out in the NPF, the NDP states that investments within grid infrastructure, including improvements to transmission networks, are an important enabler of economic growth and as such, the energy sector will play a critical role in meeting priority infrastructural needs at both national and local levels. The implementation of the proposed Project by EirGrid represents the type and nature of investment described within the NPD required to achieve the NPF's strategic outcomes.

B. Constraints Mapping Data Sources

Name of dataset	Theme	Source	Drawing Number
Ancient and Long Established Woodland	Environment	The National Parks and Wildlife Service	229100591-MMD-00-XX-DR-N404-0019
Margaritifera Sensitive Areas	Environment	The National Parks and Wildlife Service	229100591-MMD-00-XX-DR-N404-0019
Mayo County Council Landscape Policy Areas	Environment	Mayo County Council	229100591-MMD-00-XX-DR-N404-0020
Mayo County Council Local Biodiversity Areas	Environment	Mayo County Council	229100591-MMD-00-XX-DR-N404-0019
Mayo County Council Scenic Routes	Environment	Mayo County Council	229100591-MMD-00-XX-DR-N404-0020
Mayo County Council Scenic Views	Environment	Mayo County Council	229100591-MMD-00-XX-DR-N404-0020
Mayo County Council Vulnerable Areas	Environment	Mayo County Council	229100591-MMD-00-XX-DR-N404-0020
Mayo County Council Walking Routes	Environment	Mayo County Council	229100591-MMD-00-XX-DR-N404-0020
Natural Heritage Areas (NHA)	Environment	The National Parks and Wildlife Service	229100591-MMD-00-XX-DR-N404-0019
Proposed Natural Heritage Areas (pNHA)	Environment	The National Parks and Wildlife Service	229100591-MMD-00-XX-DR-N404-0019
Roscommon County Council Landscape Character Areas	Environment	Roscommon County Council	229100591-MMD-00-XX-DR-N404-0020
Roscommon County Council Scenic Routes	Environment	Roscommon County Council	229100591-MMD-00-XX-DR-N404-0020
Roscommon County Council Scenic Views	Environment	Roscommon County Council	229100591-MMD-00-XX-DR-N404-0020
Semi-Natural Grasslands	Environment	The National Parks and Wildlife Service	229100591-MMD-00-XX-DR-N404-0019
Sligo County Council Scenic Routes	Environment	Sligo County Council	229100591-MMD-00-XX-DR-N404-0020
Sligo County Council Sensitive Rural Landscape	Environment	Sligo County Council	229100591-MMD-00-XX-DR-N404-0020
Sligo County Council Visually Vulnerable Areas	Environment	Sligo County Council	229100591-MMD-00-XX-DR-N404-0020
Special Areas of Conservation (SAC)	Environment	The National Parks and Wildlife Service	229100591-MMD-00-XX-DR-N404-0019
Special Protection Areas (SPA)	Environment	The National Parks and Wildlife Service	229100591-MMD-00-XX-DR-N404-0019
Irish Wetland Locations	Environment	Wetland Surveys Ireland	229100591-MMD-00-XX-DR-N404-0019
Petrifying Springs	Environment	The National Parks and Wildlife Service	229100591-MMD-00-XX-DR-N404-009-19
Bedrock Aquifer	Geology	The Geological Survey of Ireland	229100591-MMD-00-XX-DR-N404-0025
Bedrock Aquifer Faults	Geology	The Geological Survey of Ireland	229100591-MMD-00-XX-DR-N404-0022

Name of dataset	Theme	Source	Drawing Number
Bedrock Outcrop	Geology	The Geological Survey of Ireland	229100591-MMD-00-XX-DR-N404-0022
GeoDirectory Buildings	Social	GeoDirectory	229100591-MMD-00-XX-DR-N404-0057
Geological Heritage Sites Audited	Geology	The Geological Survey of Ireland	229100591-MMD-00-XX-DR-N404-0021
Geological Heritage Sites Unaudited	Geology	The Geological Survey of Ireland	229100591-MMD-00-XX-DR-N404-0021
Geological Linework 1:100,000 series	Geology	The Geological Survey of Ireland	229100591-MMD-00-XX-DR-N404-0022
Ground Water Karst points	Geology	The Geological Survey of Ireland	229100591-MMD-00-XX-DR-N404-0022
Groundwater Vulnerability	Geology	The Geological Survey of Ireland	229100591-MMD-00-XX-DR-N404-0024
Landslide Events	Geology	The Geological Survey of Ireland	229100591-MMD-00-XX-DR-N404-0022
Landslide Susceptibility	Geology	The Geological Survey of Ireland	229100591-MMD-00-XX-DR-N404-0023
Mayo County Council Quarries	Geology	Mayo County Council	229100591-MMD-00-XX-DR-N404-0022
Mineral Localities	Geology	The Geological Survey of Ireland	229100591-MMD-00-XX-DR-N404-0022
Public Water Supply Source Protection Zone	Geology	The Geological Survey of Ireland	229100591-MMD-00-XX-DR-N404-0022
Structural Symbols 1:100,000 series	Geology	The Geological Survey of Ireland	229100591-MMD-00-XX-DR-N404-0022
Subsoil Permeability	Geology	The Geological Survey of Ireland	229100591-MMD-00-XX-DR-N404-0026
Mayo County Council Record of Protected Structures	Heritage	Mayo County Council	229100591-MMD-00-XX-DR-N404-0021
Mayo County Council Heritage Bridges	Heritage	Mayo County Council	229100591-MMD-00-XX-DR-N404-0021
National Inventory of Architectural Heritage (NIAH)	Heritage	Department of Culture, Heritage and the Gaeltacht	229100591-MMD-00-XX-DR-N404-0021
Roscommon County Council Architectural Conservation Areas	Heritage	Roscommon County Council	229100591-MMD-00-XX-DR-N404-0021
Roscommon County Council Record of Protected Structures	Heritage	Roscommon County Council	229100591-MMD-00-XX-DR-N404-0021
Sites and Monuments Records (SMR)	Heritage	Department of Culture, Heritage and the Gaeltacht	229100591-MMD-00-XX-DR-N404-0021
Sligo County Council Record of Protected Structures	Heritage	Sligo County Council	229100591-MMD-00-XX-DR-N404-0021
Lakes	Hydrology	Environmental Protection Agency	229100591-MMD-00-XX-DR-N404-0028
Mayo County Council Flood Points	Hydrology	Mayo County Council	229100591-MMD-00-XX-DR-N404-0028
Mayo County Council Highly Scenic Viewpoints	Hydrology	Mayo County Council	229100591-MMD-00-XX-DR-N404-0020
Past Flood Events	Hydrology	The Office of Public Works	229100591-MMD-00-XX-DR-N404-0028

Name of dataset	Theme	Source	Drawing Number
Present Day Flood Zones	Hydrology	The Office of Public Works	229100591-MMD-00-XX-DR-N404-0028
River Network	Hydrology	Environmental Protection Agency	229100591-MMD-00-XX-DR-N404-0028
National Roads	Infrastructure	Transport Infrastructure Ireland	Various
OSI Roads 1:250,000 SERIES	Infrastructure	Ordnance Survey of Ireland	Various
High Voltage Overhead Lines	Infrastructure	EirGrid / ESB Networks	Various
Rail Network	Infrastructure	Ordnance Survey of Ireland	Various
Corine Land Cover	Land Cover	Environmental Protection Agency	229100591-MMD-00-XX-DR-N404-0027
Knock Airport Strategic Development Zone	Planning	Mayo County Council	229100591-MMD-00-XX-DR-N404-0029
Mayo County Council Local Area Plans	Planning	Mayo County Council	229100591-MMD-00-XX-DR-N404-0029
Mayo County Council Proposed Roads	Planning	Mayo County Council	229100591-MMD-00-XX-DR-N404-0029
Mayo County Council Road Study Areas	Planning	Mayo County Council	229100591-MMD-00-XX-DR-N404-0029
Roscommon County Council Local Area Plans	Planning	Roscommon County Council	229100591-MMD-00-XX-DR-N404-0029
Sligo County Council Mini Plans	Planning	Sligo County Council	229100591-MMD-00-XX-DR-N404-0029
Fáilte Ireland Approved Accommodation	Social	Fáilte Ireland	229100591-MMD-00-XX-DR-N404-0030
Fáilte Ireland Tourist Activities	Social	Fáilte Ireland	229100591-MMD-00-XX-DR-N404-0030
Fáilte Ireland Tourist Attractions	Social	Fáilte Ireland	229100591-MMD-00-XX-DR-N404-0030
Health Centres	Social	The Health Service Executive	229100591-MMD-00-XX-DR-N404-0030
Mayo County Council Burial Grounds	Social	Mayo County Council	229100591-MMD-00-XX-DR-N404-0030
Mayo County Council Churches	Social	Mayo County Council	229100591-MMD-00-XX-DR-N404-0030
Mayo County Council Community Facilities	Social	Mayo County Council	229100591-MMD-00-XX-DR-N404-0030
Mayo County Council Libraries	Social	Mayo County Council	229100591-MMD-00-XX-DR-N404-0030
Mayo County Council Playgrounds	Social	Mayo County Council	229100591-MMD-00-XX-DR-N404-0030
Mayo County Council Sports Facilities	Social	Mayo County Council	229100591-MMD-00-XX-DR-N404-0030
Post Primary Schools (2013 / 2014)	Social	All Island Research Observatory	229100591-MMD-00-XX-DR-N404-0030
Primary Schools (2013/2014)	Social	All Island Research Observatory	229100591-MMD-00-XX-DR-N404-0030

Name of dataset	Theme	Source	Drawing Number
Roscommon County Council Community Facilities	Social	Roscommon County Council	229100591-MMD-00-XX-DR-N404-0030
Roscommon County Council Community Parks	Social	Roscommon County Council	229100591-MMD-00-XX-DR-N404-0030
Roscommon County Council Graveyards	Social	Roscommon County Council	229100591-MMD-00-XX-DR-N404-0030
Roscommon County Council Libraries	Social	Roscommon County Council	229100591-MMD-00-XX-DR-N404-0030
Roscommon County Council Playgrounds	Social	Roscommon County Council	229100591-MMD-00-XX-DR-N404-0030
Roscommon County Council Sports Facilities	Social	Roscommon County Council	229100591-MMD-00-XX-DR-N404-0030
Sligo County Council Burial Grounds	Social	Sligo County Council	229100591-MMD-00-XX-DR-N404-0030
Sligo County Council Sports Facilities	Social	Sligo County Council	229100591-MMD-00-XX-DR-N404-0030

C. Heat Mapping Overhead Line Inputs

ID	Dataset Name	Buffer (m)	Colour Weighting
1	Special Protection Areas (SPA)	150	Dark Blue
2	Special Areas of Conservation (SAC)	50	Dark Blue
3	Killala Bay/Moy Estuary SAC	50	**Blue**
4	Callow Bog SAC	50	**Blue**
5	Lough Hoe Bog SAC	50	**Blue**
6	Lough Nabrickkeagh Bog SAC	50	**Blue**
7	Ox Mountains Bogs SAC	50	**Blue**
8	River Moy SAC	100	**Blue**
9	Cloonakillina Lough SAC	100	**Blue**
10	Doocastle Turlough SAC	100	**Blue**
11	Flughany Bog SAC	50	**Blue**
12	National Heritage Areas (NHA)	50	**Blue**
13	Proposed National Heritage Areas (pNHA)	50	**Blue**
14	Ancient and Long Established Woodland	70	**Dark Blue**
15	Corine Land Cover Forestry (Coniferous / Broadleaved / Mixed)	70	**Dark Blue**
16	Corine Land Cover Peat Soils	1	**Blue**
17	Landslide Susceptibility - High	100	**Dark Blue**
18	Geological Heritage Sites Unaudited	50	**Blue**
19	Geological Heritage Sites Audited	50	**Blue**
20	110 kV Overhead Line	35	**Blue**
21	220 kV Overhead Line	40	**Blue**
22	National Inventory of Architectural Heritage (NIAH)	50	**Blue**
23	Sites and Monuments Records (SMR)	50	**Blue**
24	Record of Protected Structures	50	**Blue**
25	Architectural Conservation Areas	50	**Dark Blue**
26	Roscommon County Council Scenic Routes	500	**Blue**
27	Roscommon County Council Scenic Views	500	**Blue**
28	Mayo County Council Landscape Policy Area 3	1	**Blue**
29	Mayo County Council Landscape Policy Area 3A	1	**Blue**
30	Mayo County Council Landscape Policy Area 4	1	**Yellow**
31	Mayo County Council Landscape Policy Area 4A	1	**Yellow**
32	Mayo County Council Scenic Routes	500	**Blue**
33	Mayo County Council Scenic Views	500	**Blue**
34	Mayo County Council Highly Scenic Viewpoints	500	**Blue**
35	Mayo County Council Walking Routes	1	**Dark Green**
36	Regional Roads	1	**Yellow**
37	National Roads	1	**Yellow**

38	Knock Airport Strategic Development Zone	500	**Dark Blue**
39	Lakes (EPA)	1	**Dark Blue**
40	Rail Network	1	**Dark Blue**
41	Public Water Supply Source Protection Zone	200	**Dark Blue**

D. Heat Mapping Underground Cable Inputs

ID	Dataset Name	Buffer (m)	Colour Weighting
1	Special Protection Areas (SPA)	50	Dark Blue
2	Special Areas of Conservation (SAC)	50	Dark Blue
3	Killala Bay/Moy Estuary SAC	50	Dark Blue
4	Callow Bog SAC	100	Blue
5	Lough Hoe Bog SAC	100	Blue
6	Lough Nabrickkeagh Bog SAC	100	Blue
7	Ox Mountains Bogs SAC	100	Blue
8	River Moy SAC	100	Blue
9	Cloonakillina Lough SAC	100	Blue
10	Doocastle Turlough SAC	100	Blue
11	Flughany Bog SAC	100	Blue
12	National Heritage Areas (NHA)	50	Blue
13	Proposed National Heritage Areas (pNHA)	50	Blue
14	Ancient and Long Established Woodland	100	Dark Blue
15	Corine Land Cover Forestry (Coniferous / Broadleaved / Mixed)	100	Dark Blue
16	Corine Land Cover Peat Soils	1	Dark Green
17	Landslide Susceptibility - High	1	Blue
18	Geological Heritage Sites Unaudited	50	Blue
19	Geological Heritage Sites Audited	50	Blue
20	110 kV Overhead Line	35	Dark Green
21	220 kV Overhead Line	40	Dark Green
22	National Inventory of Architectural Heritage (NIAH)	50	Blue
23	Sites and Monuments Records (SMR)	50	Blue
24	Record of Protected Structures	50	Blue
25	Architectural Conservation Areas	50	Dark Blue
26	Regional Roads	1	Yellow
27	National Roads	1	Yellow
28	Knock Airport Strategic Development Zone	1	Dark Blue
29	Lakes (EPA)	1	Dark Blue
30	Rail Network	1	Dark Blue
31	Public Water Supply Source Protection Zone	200	Dark Blue

E. Mapping

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