Capital Project 966

Substation Feasibility Assessment - Woodland 220kV C-Type Extension

321084AE-REP-004 | B

27 April 2020

EirGrid

CP966

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Contents

Figures

Executive Summary

Jacobs was requested to prepare a set of substation feasibility reports for the EirGrid CP966 project, which is a proposed development that will help transfer electricity to the east of the country and distribute it within the network in Meath, Kildare and Dublin. The project will help meet the growing demand for electricity in the east. This growth is due to increased economic activity and the planned connection of new data centres in the region. The project will therefore require substation modifications at Dunstown and Woodland to accommodate these system upgrades.

The report content and format are suitable to support EirGrid's network development process, in step 3. The substation modification options to be investigated by Jacobs are as follows:

- Woodland 220kV AIS C-Type Extension
- Woodland 220kV Connection
- Woodland 400kV Connection
- Woodland 400kV Ring configuration
- Dunstown 220kV AIS C-Type Extension
- Dunstown 220kV Connection
- Dunstown 400kV Connection

Specialists were sent, during the month of November 2019, to visit each of the substation sites to investigate the current infrastructure and what would be needed for the proposed substation connections and modifications. Further to this, sets of drawings have been produced for the reports to give an indicative view of how each of the above substation modifications will look and have been referenced throughout all the reports.

This technical report examines the option for Woodland 220kV C-type extension and highlights these findings by describing technical, environmental, deliverability, and economic factors. Throughout each of the reports, the design methodology and construction approach, and their costs have been detailed.

The 220kV C-type extension at Woodland substation is technically feasible and provides minimal technical challenges, as a standard EirGrid C-type extension can be implemented.

However, to achieve the C-type extension planning works will be required for land acquisition as the substation extension works required extend beyond the current Transmission Assets Owners' (TAO) land ownership boundary. This extension beyond the land ownership boundary is on the north side of the substation and in addition would extend across the existing water course on this boundary requiring diversion or culverting of the water course and further hindering the environmental feasibility of this option. Earthworks and civil works will also be required for the extension. Project timeline and EirGrid cost implications should be considered for these works as both will increase due to substation boundary extension requirements.

1. Introduction

1.1 What is Capital Project 966?

Capital Project 966 is a proposed development that will help transfer electricity to the east of the country and distribute it within the network in Meath, Kildare and Dublin.

The project will help meet the growing demand for electricity in the east. This growth is due to increased economic activity and the planned connection of new data centres in the region.

A significant number of Ireland's electricity generators are located in the south and south west. This is where many wind farms and some modern, conventional generators are located. This power needs to be transported to where it is needed.

The power is mainly transported cross-country on the two existing 400 kV lines from the Moneypoint station in Clare to the Dunstown substation in Kildare and Woodland substation in Meath. Transporting large amounts of electricity on these 400 kV lines could cause problems that would affect the security of electricity supply throughout Ireland, particularly if one of the lines is lost unexpectedly.

To solve this emerging issue, we need to strengthen the electricity network between Dunstown and Woodland to avoid capacity and voltage problems.

Capital Project 966 aims to strengthen the transmission network between Dunstown and Woodland substations. and suggests a number of technical solutions to do so.

1.2 Framework for grid development explained

EirGrid follow a six step approach when they develop and implement the best performing solution option to any identified transmission network problem. This six step approach is described in the document 'Have Your Say' published on EirGrid's website1. The six steps are shown on a high-level in Figure 1. Each step has a distinct purpose with defined deliverables and represents a lifecycle of a development from conception through to implementation and energisation.

[1] http://www.eirgridgroup.com/the-grid/have-your-say/

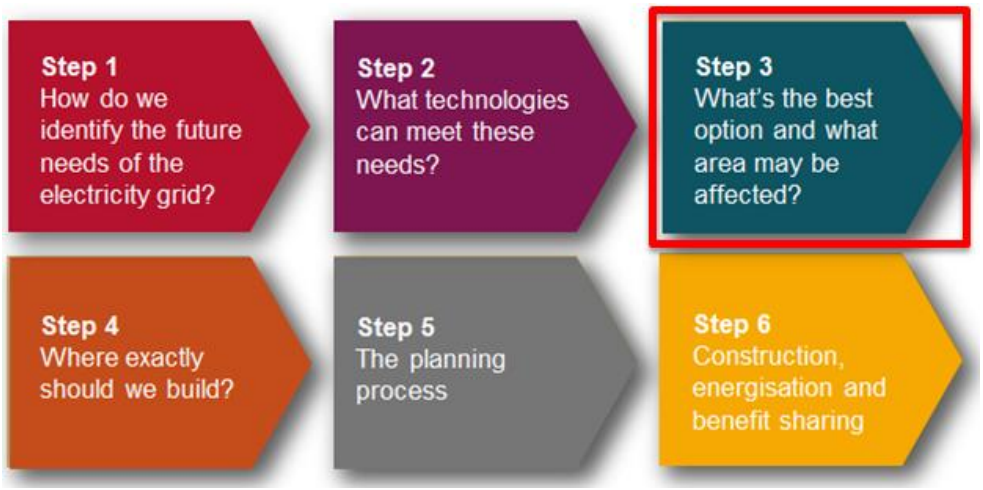

Figure 1 : EirGrid's Six-Step Framework for Grid Development

Capital Project 966 is in Step 3 of the above process. The aim of Step 3 is to identify a best performing solution option to the need identified. There are four remaining technical viable options to be investigated in Step 3. All options create a connection between Woodland and Dunstown substations and have common reinforcements associated in relation to voltage support devices and 110 kV uprates. The main four options are:

- Up-voltage existing 220 kV circuits to 400 kV to create new Dunstown – Woodland 400 kV overhead line (OHL);
- A new 400 kV overhead line;
- A new 220 kV underground cable,
- A new 400 kV underground cable.

Common reinforcements to all four options (outcome of Step 2, may change in Step 3):

- Uprating of the Bracklone – Portlaoise 110 kV overhead line
- Dynamic reactive support device in greater Dublin area rated at approximately ±250 Mvar

These options will be evaluated against five criteria: technical, economic, environmental, deliverability and socio-economic and each criteria incorporates a number of sub-criteria. It shall be noted that the overall assessment is carried out by EirGrid, but certain aspects are investigated and assessed by various consultants and their assessment will feed into the overall assessment.

1.3 Aim and context of this report

EirGrid (the Client) has engaged Jacobs to assess the required substation modifications at Woodland and Dunstown to accommodate these network changes specified by EirGrid. This report is aimed at presenting the findings of this investigation in regard to a 220kV AIS C-Type extension at Woodland Substation. The finding will feed into EirGrid's overall evaluation of the four remaining options.

1.4 Description of criteria used to assess the options

This report uses the following criteria to assess each substation option:

- Technical

As part of technical feasibility assessment, substation layouts were developed in accordance with relevant EirGrid design standards to indicate a proposed solution. Constructability and health and safety implications for operation and maintenance activities through the achievement of appropriate electrical clearances have been considered.

- Environmental

As part of environmental feasibility, only the impact arising from any extension to the existing substation boundary has been identified and examined. For a broader environmental assessment, please refer to report 321084AE-REP-002 – CP966 Environmental Feasibility Report.

- Deliverability

As part of deliverability assessment, existing access roadways and operational/maintenance assessments were made to ensure that the solution can be safely constructed, maintained and operated.

- Economic

An approximate bill of quantities and cost estimate has been produced for each option.

- Socio-economic

As part of the social feasibility, a socio-economic assessment has been included as part of this report for the substation works only. For a broader social impact assessment, please refer to the report 321084AE-REP-003 – CP966 Social Impact Assessment Report.

1.5 Scale used to assess each criteria

The effect on each criteria parameter is presented along a range from “more significant”/”more difficult”/“more risk” to “less significant”/”less difficult”/“less risk”. The following scale is used to illustrate each criteria parameter:

In the text this scale is quantified by text for example mid-level/moderate (Dark Green), low-moderate (Green), low (Cream), high-moderate (Blue) or high (Dark Blue).

1.6 Relationship to other technical documents

Parallel to this report, Cable Feasibility, Environmental and Social Impact studies are being prepared to investigate the impact of proposed solutions on the study area.

Please read in conjunction with the following reports;

- 321084AE-REP-001 – CP966 Cable Route Feasibility Report
- 321084AE-REP-002 – CP966 Environmental Feasibility Report
- 321084AE-REP-003 – CP966 Social Impact Report

2. The Project

2.1 Site Description

Woodland 400/220kV AIS substation is an existing substation located in County Meath and is surrounded by farmland in a rural area. Aerial views of the area and substation are shown in Figure 2 and Figure 3 respectively. Further to this, Figure 4 shows the extent of land ownership held by the TAO.

The substation presently contains both 400kV and 220kV equipment in a double busbar arrangement with 3 x 400/220kV transformer bays, 2 x 400kV line bays and 4 x 220kV line bays.

Figure 2 : Map View of Woodland Substation (From Google Earth)

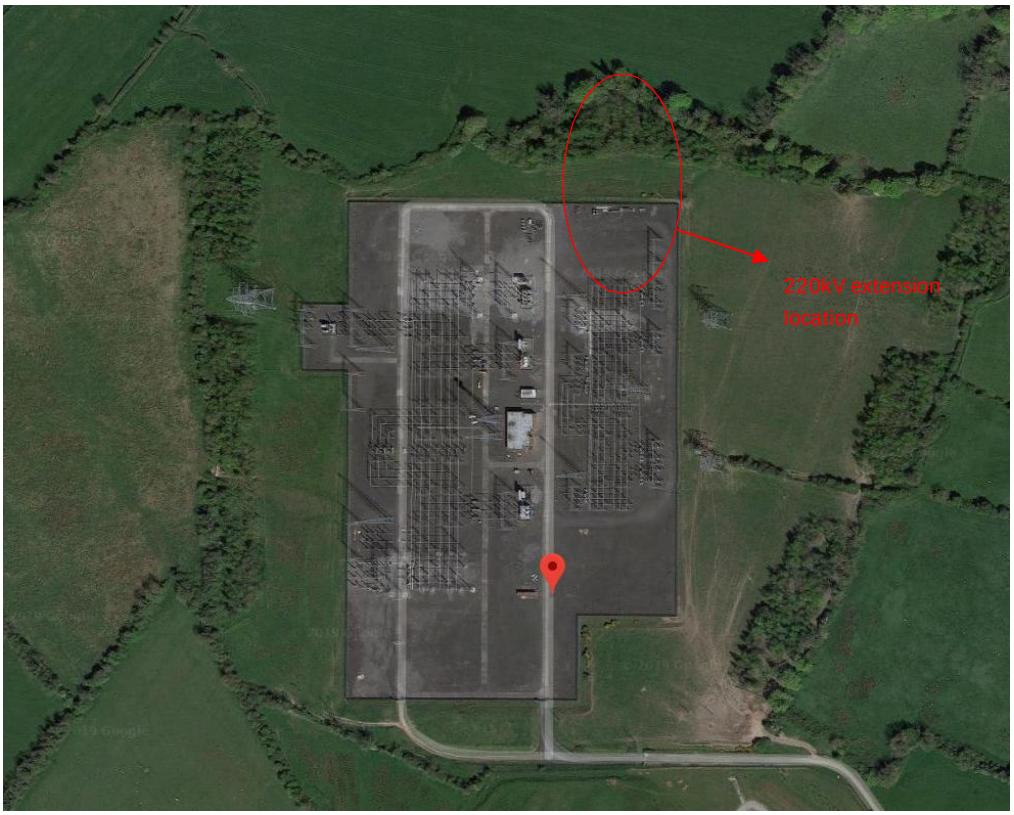

Figure 3: Location of 220kV extension (From Google Earth)

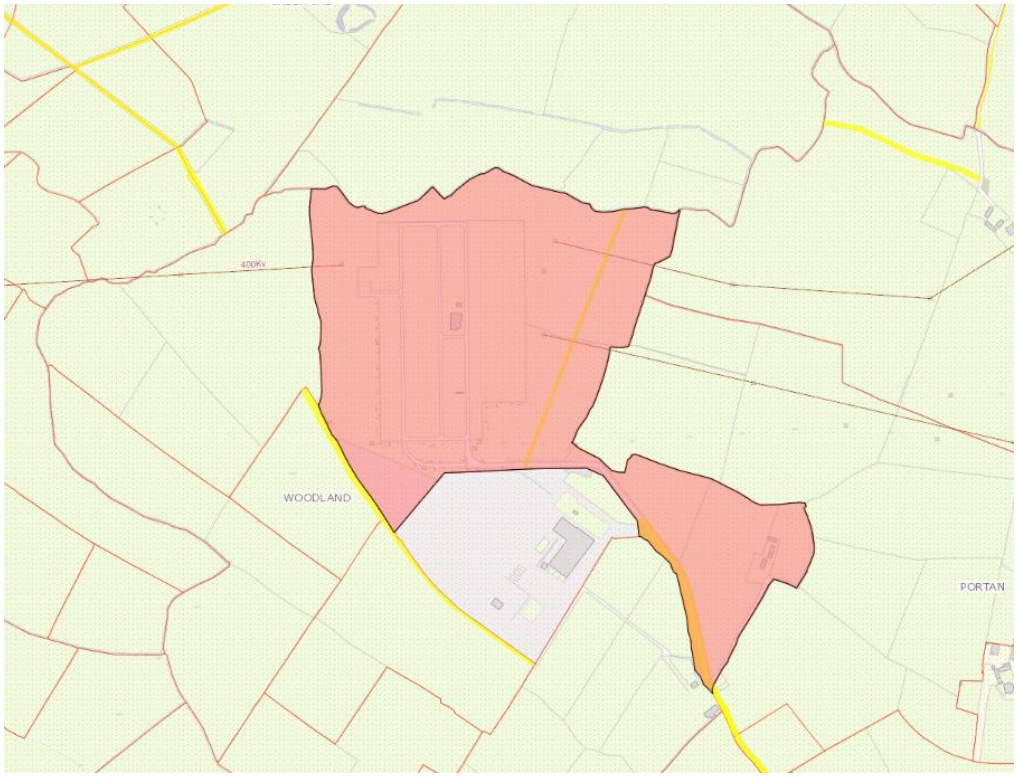

Figure 4: Extent of Land ownership boundary

2.2 Objective

This report will provide a feasibility assessment of the works required to extend the 220kV side of the substation with a C-type arrangement.

2.3 Technical

2.3.1 Project Requirements

The 220kV C-type extension utilises standard substation design parameters in determining the scope and extent of the substation extension works. These standard parameters ensure a safe and effective design. The extension is based on the EirGrid drawing PG406-D020-123-00, which includes 1 bus section, space for 4 future feeder-bays and 1 bus coupler.

Refer to Figure 5 for a single line diagram schematic representation of the proposed extension works to the existing substation. Existing substation is indicated in black, new works are indicated in red with future feeder bays in blue. See drawing 321084AE-LAY-007 in Appendix A for the substation layout arrangement of the proposed works.

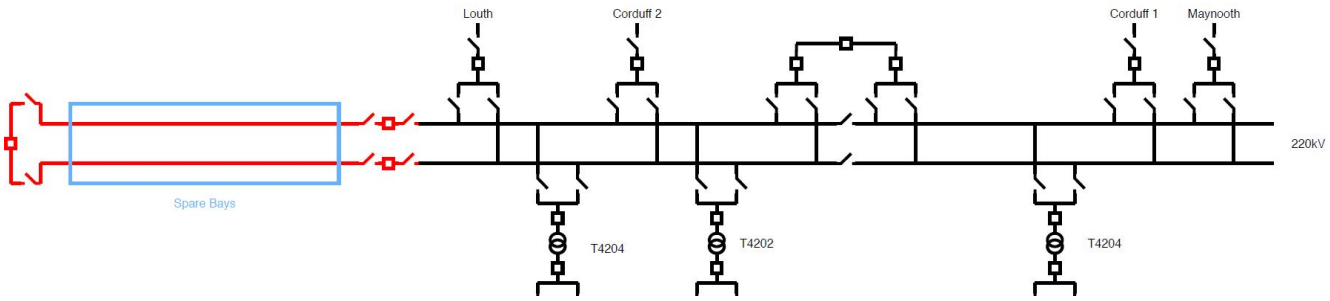

Figure 5: Woodland 220kV C-Type Extension

The new extension will be equipped with a complete bus section, bus coupler and space allocated for 4 future feeder bays.

2.3.2 Other Requirements

Although associated work with the new 220kV C-type extension includes investigating and allocating space for new protection panels in the existing control building and an assessment of the existing LVAC and DC systems to confirm adequate capacity, these elements have not been considered at this stage as they would have no material impact on the physical extent of the construction works required.

2.3.3 Technical Feasibility

As per Section 1.5, the following scale is used to assess the technical feasibility of the new 220kV C-type extension. There are no technical challenges for this extension work and build will be done to EirGrid standards therefore, a low risk rating (Cream) has been assigned.

More significant/difficult/risk Less significant/difficult/risk

2.4 Site Modifications

The following site modifications will be required to accommodate the new extension as per drawing 321084AE-LAY-007 in Appendix A.

- Extend the substation perimeter fence on the north side by approximately 76.7 meters.
- Existing palisade fence will need to be removed and new palisade fencing to be installed to accommodate the larger substation boundary, along with associated civil earthworks to provide a flat and level platform for the extended substation.

Figure 3 shows the location of proposed site extension work and Figure 4 shows the extent of the land ownership boundary of the substation.

The new 220kV C-type extension extends beyond the land ownership boundary of the substation on the north side and encroaches on an existing water course requiring the diversion or culverting of this water course. This is considered a significant issue.

An alternative option may be to locate the 220kV C-type section on the south side of the site, where existing access roads already exist. This may allow the C-type extension to be located within the existing TAO land ownership boundary and would obviate the environmental issues associated with the water course on the northern boundary. This would present fewer planning and environmental concerns, however this would need to be reviewed by EirGrid to determine if the revised layout arrangements meet the overall system design requirements for the project.

2.5 Environmental Constraints

2.5.1 Biodiversity, Flora & Fauna

There are no designated sites in the vicinity of Woodland substation, however an extension to the substation footprint to facilitate works would have potential temporary and definite permanent impacts on biodiversity.

Potential impacts during construction include:

- Temporary loss of terrestrial habitat within the footprint of the Project to facilitate access roads and construction compounds;
- Disturbance, and temporary displacement of birds, mammals, amphibians, fish and other aquatic species in habitats within or in close proximity to the Project footprint;
- Temporary loss of foraging habitat for mammals such as badger and bat; and

§ Pollution of the Tolka_020 from silty water runoff or other deleterious materials, leading to secondary effects on aquatic species.

During operation, there would be a permanent loss of biodiversity-rich hedgerows and an area of woodland to the immediate south of the Tolka_020 water body.

Proposals are for the Tolka_020 to be either diverted or culverted to facilitate the extension. The worst-case scenario would be for culverting; this would lead to a permanent loss of habitat. Effects on the Tolka_020 downstream of the works could be long term depending on the nature and magnitude of any disturbance of the banks and beds and deleterious inputs during construction (in the absence of mitigation). Further details on this are provided in the water section.

There would therefore be high risk to biodiversity in this location from this proposal. The risks are greatest during operation.

2.5.2 Soils and Water Impacts

The subsoils around Woodland substation are shale and sandstone till (Namurian) with an area of Alluvium to the north of the substation. There is a significant Karst Landforms to the north west of Woodland Substation, however it is not within or in close proximity to the footprint of the proposed extension and so it is not likely that there would be any effects.

In terms of surface water, Woodland substation is within the Tolka WFD sub basin. The Tolka_020 water body, as has been outlined in Biodiversity, runs west to east immediately to the north of the substation. It is of Poor status and considered to be At Risk (www.epa.ie). Pressures on the water body, upstream and in the vicinity of the substation, are from diffuse agricultural sources, such as silage runoff and have resulted in nutrients being high which is the main reason for its Poor WFD status.

During construction, without mitigation, there is the potential for significant impacts to the Tolka_020 as a result of in-stream works, silty water runoff, and the potential for other deleterious substances to enter the water body from the construction site.

It is proposed to extend the substation beyond the river, necessitating the Tolka_020 to be diverted or culverted. It is assumed that the worst-case scenario is that the river is culverted, leading to morphological effects on the banks and bed of the river. This has direct effects on the length of river being culverted but also downstream effects on banks and beds as these changes have secondary effects. All of these morphological changes have impacts on the aquatic ecosystem and biodiversity, as described. There is also the potential for culverting to cause issues with flow, potentially creating further morphological changes further downstream and with the potential for flood risk related issues.

The greatest impacts would be during operation, although those during construction would also be significant, in the absence of mitigation. The risk is assessed as being high to this river as a result.

2.5.3 Impact on Land Use (forestry, farmland, bogs/peats, horticulture, roads)

The lands immediately surrounding Woodland are arable agricultural lands. There is no forestry or peat/bogs present. The Trim Road is about 750m from the site. There would be some requirement for land outside of TAO ownership, although this is not expected to be a significant amount of land or that it would have a significant impact on land use in this area, although it would be a permanent change of use. The risk to land use is considered to be of low risk.

2.5.4 Landscape & Visual

The substation is within the Tara Skryne Hills LCA which is a high sensitivity landscape. However, there are no protected views or prospects within 2km of the Woodland substation and the extension would be continuous development with the existing substation.

There is potential for effects on views but as the proposed extension is to the north of the substation, this would not be immediately visible to local residents, screened as it would be by the existing substation and the Converter Station.

As a result, it is anticipated that risks to landscape and visual receptors would be of low to moderate risk.

2.5.5 Cultural Heritage

There are two National Monuments (RMP and SMR sites) within 1km of the Woodland substation. Neither is within 300m of the boundaries of the proposed extension and so it is not anticipated there would be any impacts on these sites.

There may also be a risk of unrecorded or undiscovered heritage assets, including unknown archaeology within this area.

As a result, it is anticipated that risks to cultural heritage would be low to moderate.

2.5.6 Assessment of Substation Extensions and New Connections into Woodland

More significant/difficult/risk — Less significant/difficult/risk

Table 2.1 Constraints Risk Assessment for Substation Extensions and New Connections into Woodland Substation

Constraint	Risk
Biodiversity	
Soil & Water	
Land Use	
Landscape & Visual	
Cultural Heritage	
Environmental Summary	

As two topics are of high risk, one of low risk and two of low to moderate risk, it could be argued that the overall risk to the environment is moderate. However, it is considered that the risks to biodiversity and the Tolka_020 are high enough to raise the risks to the environment to moderate-high overall.

2.6 Social Constraints

2.6.1 Amenity and Health

There are several residential properties close to Woodland substation. The properties are quite dispersed but in places cluster to form small communities alongside local roads. Small Area statistics for this area show that all households are in houses or bungalows, none in apartments or mobile homes; this is typical of low-density populations. Given its rural nature, background noise levels in the area would be expected to be low; air quality would be good, and traffic would be at a low level: the local roads are narrow and largely serving the local community only.

In terms of amenity effects, these occur when there are two or more significant 'nuisance' effects on communities. These nuisance effects are generally taken to be visual impacts, traffic, noise and air quality. They are most likely to combine to create an amenity effect during the construction phase of any project. As has been stated under Section 2.5.4 Landscape and Visual, it is not considered that there would be significant visual impacts as a result of the proposed extension; traffic impacts are discussed further in 2.6.3 and it is likely that there would be a localised impact on highways and access during the construction phase only. In addition, noise and dust from the construction phase may also impact local properties. As a result, there is likely to be a combination of nuisance effects creating an effect on local amenity during construction.

During operation, there would be no traffic or air quality issues associated with the new equipment. Visual impacts are unlikely to be significant. There may be noise issues from the equipment but as it will be located to the rear of the existing substation and away from residential properties, it is unlikely to present a significant impact.

There is also potential for cumulative effects on the amenity of the area near Woodland Substation, as a result of other proposed electricity transmission projects in the vicinity. It is difficult to determine the likely extent of this at this stage. There are no timeframes for the construction of these projects, indeed some are still within the pre-planning phase. Two of the three projects are reinforcement or refurbishment; the North south interconnector is proposed to use the spare suspension arm of the double circuit towers of the existing 400kV OHL for its conductors. Notwithstanding this, if all projects were constructed at the same time or sequentially the magnitude on the amenity of the local community would be high as a result of large amounts of construction traffic and potential noise at once, or over a long period of time. This assessment Is not, however, included in the amenity impact assessment set out below.

It is considered that the effects on amenity would be low to moderate as much of the noise and dust impacts would be mitigated by distances from local populations, leaving only traffic as a potential impact.

2.6.2 Economy

In local communities close to Woodland Substation, there is a very low level of unemployment, with numbers ranging from 2 to 4%. Most of the working population in this area are in skilled or professional jobs, with a significant minority in the farming industry. In terms of impacts to local businesses or the economy, during construction there may be some disruption and access difficulties as a result of construction traffic to the substation, however this is unlikely to be a significant issue and would likely occur over a short period of time. It is not likely there would be a significant benefit from construction work or local expenditure as a result of this project. During operation there would be no significant effects on land use or existing commercial premises; no significant effects on local industry and commerce are expected.

Land use is discussed in Section 2.5.3; the land surrounding the substation is agricultural and arable. The land required to facilitate the extension is not considered to be enough to have an economic impact on the landowner or local farming community. Additional land required for construction compounds is also unlikely to cause a significant impact.

There are no tourist sites nearby and the local roads are not likely to be used by tourists en route to attractions as there are none near the substation.

As a result, effects on the economy from the proposed extension are likely to be neutral.

2.6.3 Traffic and Transport

75% of people in this area have journey to work, school or college times of under 45 minutes, indicating local schools and employment locations. Most of the journeys are by car. Local roads in the area are narrow, sometimes only 4m wide, especially near Woodland substation. During construction, the narrow local roads pose a significant constraint to the use of the public highway to deliver materials to the substation to carry out any works required there and the introduction of heavy vehicles on the local roads could have an impact on local communities and their ability to travel to work, school or college. During operation there would be no significant effects on traffic and transport.

As a result, effects on traffic and transport are likely to be moderate.

2.6.4 Utilities

Above ground utilities in the area include telephone network cables and OHLs. Near to Woodland substation, there is the existing Moneypoint to Woodland 400kV OHL travelling east to west; the Woodland to Maynooth 220kV OHL travelling north to south; and a 110kV OHL crossing to the south of Woodland substation in a north west to south east direction. During construction, there is some potential for underground utilities in the area of the proposed extension, which would need to be assessed and managed prior to construction commencing. However, given the nature of the land in this location it is not anticipated that this would be a significant issue. During operation, there are unlikely to be effects on third part utilities; any effects on the existing arrangements at the substation would be factored into the design of the proposed works.

As a result, the effects on third party utilities are likely to be neutral.

2.6.5 Assessment of Social Impacts

More significant/difficult/risk Less significant/difficult/risk

Table 2.2 Constraints Risk Assessment for Substation Extensions and New Connections into Woodland Substation

Constraint	Risk
Amenity & Health	
Economy	
Traffic & Transport	
Utilities	
Social Summary	

The proposed extension has a generally low to moderate risk of social impacts; the location of the extension to the rear of the existing substation mitigates or removes many risks that would otherwise have been present. Traffic issues are likely to be the main concern. These can be mitigated through the use of a Construction Traffic Management Plan; timings of deliveries, for example, to avoid hours when local people are travelling to work or school would reduce much of the impact discussed here.

2.7 Deliverability

2.7.1 Construction

No significant issues are identified for the deliverability of the new 220kV C-type section as the works are in accordance with standard substation construction parameters. New earthworks would be required for extending beyond the existing substation perimeter fence and for the diversion or culverting of the water course on the northern boundary, and whilst care would need to be taken to mitigate potential contamination of the water course during the construction works these are relatively standard civil construction activities. New foundations and cable troughs will also be required for the new 220kV C-type section. The substation earthing grid will need to be extended as per the new substation boundary.

2.7.2 Outage Requirements

The majority of the construction and earthworks for the new 220kV C-type extension can be done as an offline build without the need for outages. Single busbar outages will be required during final busbar connections and commissioning works.

It is noted that an outage on the Louth circuit would likely be required to facilitate the removal of the redundant 220kV line landing gantry which presently shares a support leg with the Louth gantry.

2.7.3 Deliverability

As per Section 1.5, the following scale is used to assess the deliverability of the new 220kV C-type extension. Apart from the need for measures to mitigate potential contamination of the water course during the construction works, there are no deliverability challenges for this extension work and no complex/extended outages required and the build will be done to EirGrid standards therefore, the extension has been given a moderate-low risk rating (Green).

More significant/difficult/risk Less significant/difficult/risk

2.8 Economic

2.8.1 Cost Estimate

The following assumptions have been made for the cost feasibility assessment:

- The cost has been developed based on standard equipment configuration using information from the Transmission Asset Owner (TAO) and includes the electrical plant items/works and associated civil works.
- The works associated with planning and extension of the substation perimeter fence and substation grounds have not been included.

- This assessment has been made using the information currently available and is therefore indicative at this stage. A complete feasibility assessment using EirGrids scale has not been carried out.
- There are outstanding stages to this extension and therefore costs outstanding meaning this should not be taken as end results for this extension.

Item No.	TSDC Ref.	Item Description	TAO Rate Gross €	Quantity	Gross Cost Estimate Amount €
1	S220-29	New 220 AIS Coupler/Wing Coupler in existing 220kV AIS Double Busbar Station / "C-Type" Station	€ 1,700,000	1	€ 1,700,000
2	S220-22	New 220kV AIS Double/Twin Sectionaliser Bay excluding Disconnects in existing 220kV Enhanced "C-type/Ring" Type Outdoor Station inc CB (Strung/Tubular Busbar)	€ 1,970,000	1	€ 1,970,000
3	NSS-10	Incremental Bay 220kV AIS	€ 90,000	4	€ 360,000
TOTAL					€ 4,030,000

3. Conclusion

The 220kV C-type extension at Woodland substation is technically feasible and provides minimal technical challenges, as a standard EirGrid C-type extension can be implemented.

However, to achieve the C-type extension planning works will be required for land acquisition as the substation extension works required extend beyond the current Transmission Assets Owners' (TAO) land ownership boundary. This extension beyond the land ownership boundary is on the north side of the substation and in addition would extend across the existing water course on this boundary requiring diversion or culverting of the water course and further hindering the environmental feasibility of this option. Earthworks and civil works will also be required for the extension. Project timeline and EirGrid cost implications should be considered for these works as both will increase due to substation boundary extension requirements.

Assessment Criteria	Scale
Technical Feasibility	
Environmental Feasibility	
Social Feasibility	
Deliverability	
Combined Feasibility	

Appendix A. Drawings

321084AE-LAY-007 - Woodland 220kV C-Type Extension RevB