



Capital Project 1021

Substation Feasibility Assessment - Woodland 400 kV Connection

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EirGrid

CP1021



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Executive Summary

Jacobs was requested to prepare a set of substation feasibility reports for EirGrid CP1021 project analysing three sites – Woodland, Finglas and Belcamp. A new 400 kV circuit will originate in Woodland and terminate at either Finglas or Belcamp. This report describes the 400 kV connection requirements at Woodland.

To connect the proposed 400 kV circuit from Woodland to either Finglas or Belcamp requires combining design and construction works for this project with others taking place at Woodland, namely:

- CP0966 – Kildare Meath. New 400 kV connection from Woodland to Dunstown.
- CP1194 – Extension and reinforcement of 400 kV busbar at Woodland. Will result in expansion of the site boundary.
- CP0466 North-South Interconnector – 400 kV connection from Woodland to site in Northern Ireland.
- Future 400/220 kV transformer – within Woodland Substation.

To allow the necessary offline construction and to minimise high risk busbar outages, a combined design incorporating the 400 kV busbar extensions for all of these projects will allow the most efficient use of space and least intrusive outages on the system. This is addressed by project CP1194.

The CP1021 circuit is proposed to enter Woodland from the east side, this is primarily to maintain sufficient clearance from the new CP0966 400 kV bay. The circuit connection can be made to the extension of the A1/B1 400 kV busbar constructed under CP1194. The need circuit feeder bay will use standard outdoor AIS equipment as is used in the rest of the site.

The potential environmental and social impacts of the proposed connection to Woodland Substation have been considered. Overall there is a low risk of environmental impact and a low to moderate risk of social impacts; specifically this relates to potential amenity impacts which may be experienced by the local community as a result of the combined impacts of several projects proposed for this Substation. Both environmental and social impacts will be considered further and in more detail as the proposed project progresses into the next Steps in EirGrid’s grid Development Framework.

Summary Of MCA

400 kV Connection Options	Technical Feasibility	Environmental Feasibility	Social Feasibility	Deliverability	Economic Feasibility	Combined Performance
Overhead Line	Green	Yellow	Green	Green	Green	Green
Underground Cable	Green	Yellow	Green	Green	Dark Green	Dark Green

1. Introduction

Capital Project 1021 (CP1021) is a Proposed Project to reinforce the electricity network between East Meath and North Dublin. Further details are provided in the Proposed Project Overview Report [321084AJ-REP-001], along with more information to explain EirGrid's approach to Grid Development.

The technology options being considered by EirGrid, both including a connection to Woodland substation, are:

- 400 kV Overhead Line (OHL); and
- 400 kV Underground cable (UGC).

There are two final connection options:

- Woodland substation to Finglas substation
- Woodland substation to Belcamp substation.

This report considers the multi-criteria feasibility of the configuration of connections at Woodland substation; these are the same technology configuration options whether the terminus connection for OHL or UGC routes is Finglas or Belcamp substation.

1.1 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).

1.2 Relationship to other technical documents

Parallel to this report, Technical Feasibility, Environmental and a Social Impact studies have been prepared to investigate the impact of the technical solution options (i.e. Underground cable or overhead line) on the study area. These reports have considered the feasibility and constraints of connections to Finglas substation and Belcamp substation from Woodland substation. The findings of these assessments are not directly relevant to this report, however they form part of the wider feasibility assessment for CP1021 and so should be considered in that context.

Please read in conjunction with the following reports:

- 321084AJ-REP-001 CP1021 Proposed Project Overview
- 321084AJ-REP-002 CP1021 Cable Feasibility Report
- 321084AJ-REP-003 CP1021 OHL Feasibility Report
- 321084AJ-REP-004 CP1021 Environmental Constraints Report
- 321084AJ-REP-005 CP1021 Strategic Social Impact Assessment Scoping Report
- 321084AJ-REP-006 CP1021 Substation Feasibility Report Finglas

- 321084AJ-REP-007 CP1021 Substation Feasibility Report Woodland – this report
- 321084AJ-REP-008 CP1021 Substation Feasibility Report Belcamp

2. The Project

2.1 Site Description

Woodland 400/220 kV 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 2-1 and Figure 2-2 respectively. Further to this, Figure 2-3 shows the extent of land ownership held by the Transmission Assets Owner (TAO).

Adjacent to Woodland Substation is the East West Interconnector (EWIC) converter station. This converts electricity from AC to DC and connects to the EWIC cable for onward transmission to or from the UK mainland. This site is owned by a third party.

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



Figure 2-1: Map View of Woodland Substation (From Google Earth)

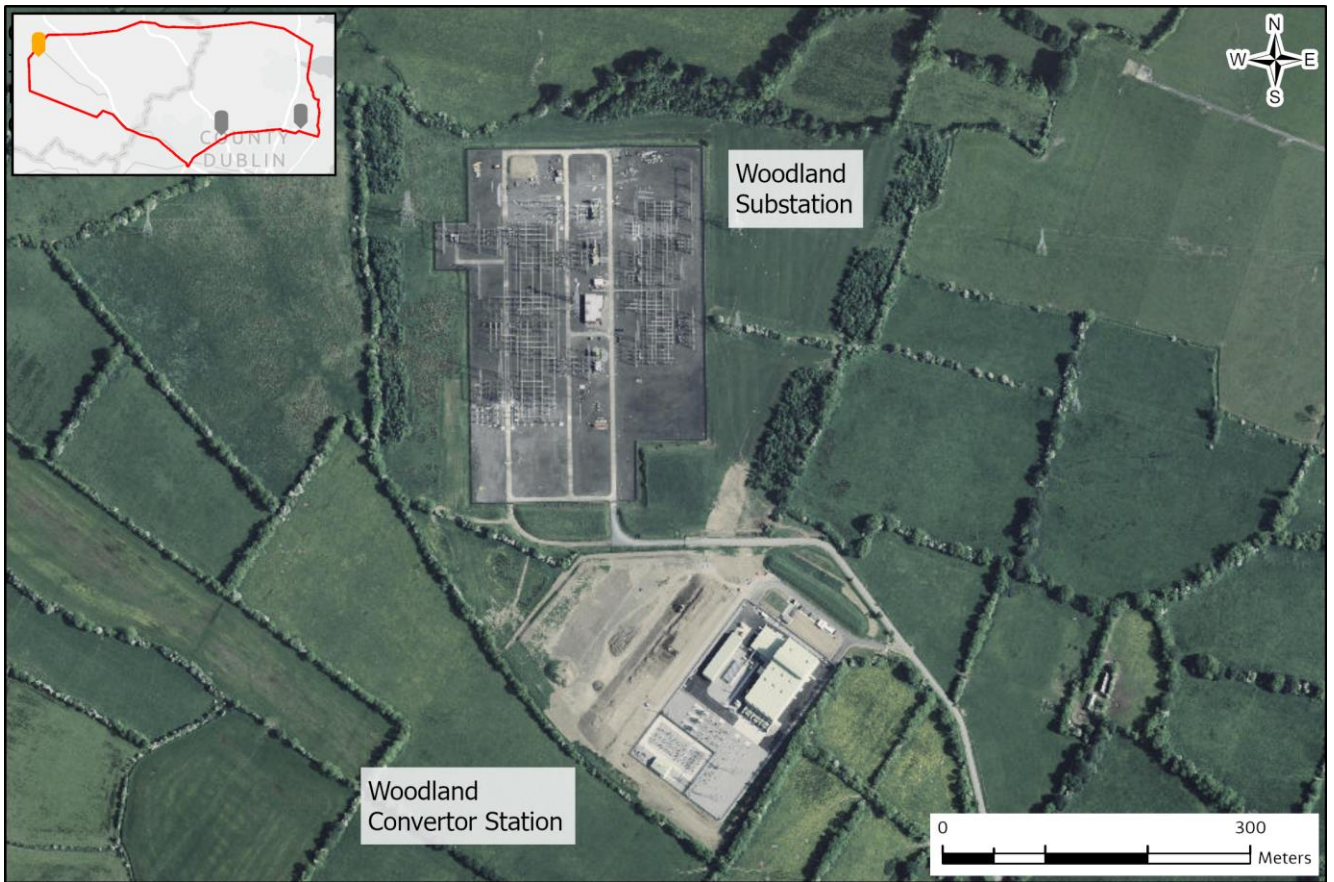


Figure 2-2 Woodland Substation and EWIC Converter Station

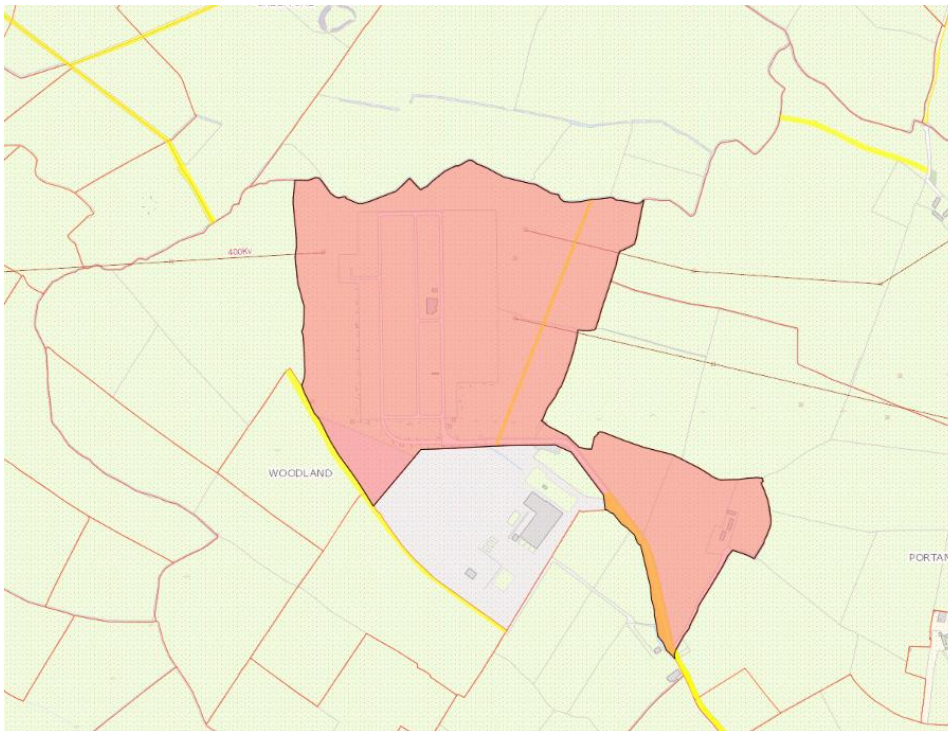


Figure 2-3 : Extent of ESB Land Ownership Boundary; EirGrid EWIC land ownership boundary in grey

2.2 Objective

This feasibility report considers the requirement to connect a new 400 kV circuit from Woodland into either Finglas or Belcamp as part of CP1021. It describes the site issues with installing new 400 kV cable or overhead line connection along with all new primary plant and equipment as described in the EirGrid Request for Proposal document SCF17112L1. These requirements have been confirmed in project meetings between Jacobs and EirGrid.

2.3 Relationship to Other EirGrid Projects

There are a number of high voltage circuits proposed to connect into Woodland substation in addition to CP1021, including the North South Interconnector and the Kildare Meath Upgrade Project. The planning and design of the connection of these projects have been brought together in a single project, CP1194. This project will take forwards the design of the substation and be submitted as an application for Planning Consent ahead of Kildare Meath and CP1021. Whilst full details of the design of the connection for CP1021 will not be known at the time of submission to planning, allowance will be made within the red line boundary for the connection.

2.4 Assumptions

- As per project meetings between Jacobs and EirGrid, it has been decided that the CP1021 400 kV circuit will use a newly constructed AIS bay on a busbar extension, rather than making use of any existing spare bay.
- The above busbar extension will be created under project CP1194. This project will create busbar bays for several 400 kV connections and will expand the current site boundary. It is assumed that all works associated with CP1194 will be complete before CP1021 works begin.
- The auxiliary control room will require extension to accommodate the control and protection equipment associated with the new 400 kV bays and this is able to be done within the existing site without disturbing any primary plant. Project CP1194 will carry out this extension.
- Reactive compensation will be required on the 400 kV circuit. The assumed capacity is 100 MVar.

3. Technical Feasibility

3.1 Project Requirements

A new 400 kV circuit connection is to be made from Woodland 400 kV substation. The receiving site for this shall be either Finglas or Belcamp Substation. The circuit will consist of either overhead line (OHL) or underground cable (UGC). If UGC is used, it shall consist of one conductor per phase only. The equipment to be installed at Woodland substation is, (Ref SCF17112L1 section 1.2.4.1):

The new 400 kV circuit planned in CP1021 shall preferably connect into a new E12 bay on the A2/B2 busbar in Woodland 400 kV station. The feasibility study shall assess the feasibility of this connection and identify any required work which needs to be carried out including any outages required. An existing spare bay at E2 can be evaluated as an alternative paying particular attention to outage requirements.

Space may be required at this substation for reactive compensation and harmonic filters for the new cable circuit. The size of any required reactive compensation or filters will be determined in the course of Step 3.

Due to the strategic importance of Woodland 400 kV station, the feasibility shall as an option investigate how this station can be developed into a ring configuration on the 400 kV voltage level.

The feasibility study takes into account plans and methods to connect the new CP0966 Kildare Meath Grid Upgrade, and CP0466 North South Second Interconnector 400 kV circuits which are also proposed for this substation, as well as CP1194, which will create the necessary busbar extension for these connections.

Reactive compensation is considered as it has significant space requirements as well as a high likelihood of being required. Harmonic filters require more space, albeit a lower likelihood of being required. However, the presence of harmonic filters cannot be discounted at this stage.

Reviews with EirGrid during the course of Step 3 have refined the available options to an agreed one whereby the A1/B1 busbar will be extended to accommodate the CP0966 new connection as well as CP1021 and the proposed installation of wing couplers to create the ring configuration of the 400 kV busbar. These works will be assessed and carried out under project CP1194.

3.2 Other Requirements

As per above, projects CP0466 and CP0966 are installing new 400 kV feeder bays.

Project CP1194 is replacing end of life 400 kV circuit breakers and disconnectors, as well as extending the 400 kV busbar adding wing couplers to both ends.

The Portan 400 kV circuit between Woodland and the East West Interconnector (EWIC) Station is currently on the south end of the 400 kV busbar. It has been indicated that this is a critical circuit and outages on it must be avoided wherever possible. There must not be excavation works that place this cable at risk of accidental damage or that require an outage to carry out.

3.3 Design Options

Development of options looked at different connection point options on the 400 kV busbar for the CP1021 circuit.

3.3.1 Discounted options

- Use existing spare bay for new 400 kV circuit. There is a spare bay available adjacent to the Portan circuit. This bay is however, now assigned for use in CP1194 as a new sectionaliser bay. It is therefore not available for use on this project.

- Extension of busbar section A2/B2 to create CP1021 bay as per original scope. The new North South Interconnector bay is planned to be constructed at this end of the bar. To extend it further and still fit in the wing coupler required under CP1194 would require extending the busbar beyond the existing ownership boundary. There is a preferred solution where this is not required.

3.3.2 Preferred Solution

The recommended solution is as per drawing XDN-SKE-CPXXXX-E-WOO-001 developed for project CP1194 by EirGrid. See Figure 3-1 for excerpt from this drawing. The red dashed line indicates the boundary of existing land ownership. This bay location for CP1021 allows feasible connection for either an OHL or UGC for the CP1021 circuit, including reactive compensation.

The 400 kV bay for the Finglas or Belcamp circuit will be constructed under CP1021 to connect to the 400 kV busbar extension constructed under CP1194. Equipment to be installed under CP 1021 will consist of:

- 400 kV switchgear – pantographs busbar disconnectors; line disconnectors; earth switches; circuit breaker
- 400 kV busbars
- 400 kV shunt reactor (assumed requirement; estimated rating 100 MVAR)
- Gantries and support structures with concrete foundations for all equipment
- Current transformers and voltage transformers
- Protection and control equipment for the new feeder circuit
- Cable termination structure OR overhead line termination gantry, depending on which circuit option is selected

3.3.3 Reactive Compensation

It is assumed that reactive compensation will be required at Woodland to offset the reactive characteristics of the circuit to Finglas or Belcamp. For purpose of this report it is assumed to be required for both UGC and OHL options. The assumed compensation device is a shunt reactor rated 100 MVAR. This is to be connected as close as possible to the termination point of the circuit. EirGrid system planning have indicated that the reactive compensation should not be independently switchable off the feeder circuit.

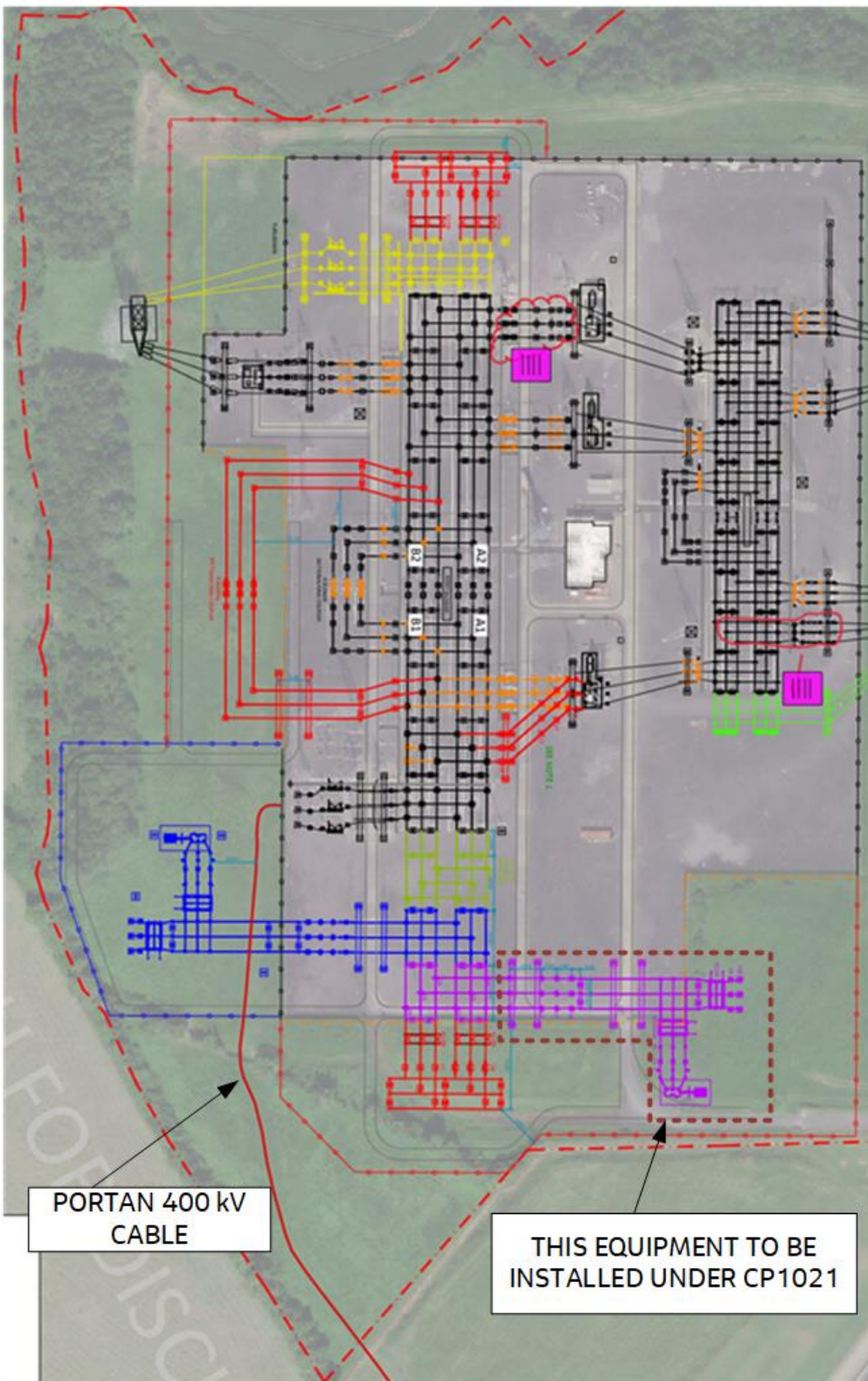


Figure 3-1 Woodland Proposed Layout. Coloured sections constructed under project CP1194 except where noted

The above layout is aligned north – south. The CP1021 circuit bay is shown in purple in the south east corner. CP0966 circuit is shown in blue to the south west. These two circuit bays may not be constructed on the same side of the substation as their proximity to each other in service would unduly restrict operation and maintenance without requiring outages. Consideration was given as to which circuit would exit the site east and which west. The

orientation shown above is considered to be the best one to avoid the CP0966 and CP1021 circuits needing to cross each other and cross other 220 kV and 400 kV circuits, either overhead line or underground cable. This would be the case whether CP1021 was cable or overhead line.

Construction of the new CP1021 bay will require outages on the new 400 kV busbar. Refer to Section 5.2 Outage Requirements for more detail.

The proposed North South interconnector circuit is indicted in yellow on the above figure. It will connect to the A2/B2 section of the 400kV busbar and will not impact directly on CP1021.

3.4 Site Modifications

The site boundary will be expanded under project CP1194. The expansion affects the road access to the site and the main entry gate where provision for the CP1021 circuit equipment affects the existing site entrance. Coordination is needed between these two projects to ensure that all requirements are catered for.

It is therefore assumed that substation works for CP1021 will not require any modifications to the site boundary or access arrangements.

3.5 Feasibility Assessment

As per Section 1.1, the following scale is used to assess the technical feasibility of this option.



The principle of how the site will be extended to enable CP1021 works and the additional projects has been agreed following design workshops. The CP1021 bay may be constructed within the Woodland Substation site. The bay constructed will have sufficient clearance from other live equipment to allow safe operation and maintenance. Options for overhead line or underground cable are equally feasible.

400 kV Connection Options	Technical Feasibility
Overhead line	
Underground Cable	

4. Environmental and Social Constraints

4.1 Overview

The preferred solution identified in Section 3.3.2 can be accommodated wholly within the existing site boundary.

Project CP1194, as outlined in Section 2.3 of this report, is subject to a separate planning process with accompanying assessments. It will require an extension to the substation boundary, to accommodate the Kildare Meath Connection. As no extension is required for CP1021 that extension does not form part of the feasibility assessment and MCA in this report. As each project progresses, however, the combined impacts of each on environmental and social receptors will be considered by EirGrid at later stages in each.

4.2 Biodiversity, Flora & Fauna

There are no designated sites in the vicinity of Woodland substation.

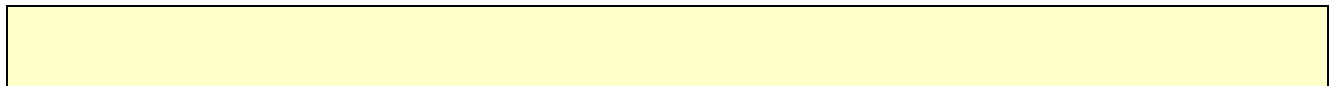
Potential impacts during construction include:

- 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; and
- Temporary loss of foraging habitat for mammals such as badger and bat.

There will be no permanent impacts on habitat as the works will take place within the existing substation boundary.

4.2.1 Colour coding for MCA – Biodiversity

There will be limited impacts on biodiversity as a result of the extension. The risk of impacts is rated as low.



4.3 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 Landform 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 in the Tolka_SC_010 sub-catchment. There are six river water bodies in this sub-catchment, which includes the headwaters of the Tolka River and its associated tributaries. The preliminary risk assigned to five of the water bodies within this sub-catchment is 'At Risk'. The sixth has no monitoring information and is Unassigned. The Tolka_020 flows in a west to easterly direction immediately north of the lands surrounding Woodland substation. It is identified as being 'At Risk'. It suffers from Poor biological, ecological Status and chemistry status, with phosphorous levels being of particular concern (www.eden.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 the high level of nutrients.

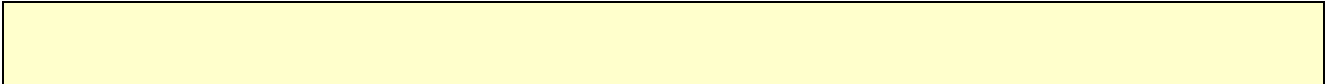
There is no history of flooding on the site; there is some evidence of pluvial flooding (PFRA) approximately 400m to the west of the existing substation (10% Annual Exceedance Probability (AEP)); no potential for fluvial flooding (10%AEP) along the banks of the Tolka_020 as it borders the substation is identified.

As the Tolka_020 is on the far side of the existing substation and there are no other water bodies, it is not anticipated there would be any effects on surface water as a result of the Proposed Project.

The works will be within the existing substation boundary and so there will be no increase in impermeable areas as a result of the Proposed Project. There would be no change to existing flood risk to and from the Substation.

4.3.1 Colour coding for MCA – Soil and Water

There is unlikely to be any impact on soils or water as a result of the extension. The risk is rated as low.



4.4 Material Assets – Planning Policy and Land Use

Details of policies in the Meath County Development Plan (CDP) of relevance to the potential extension of the substation are included in the environmental Constraints Report (Document ref 321084AJ-REP_004). The land in this area is not zoned in the CDP for any particular use; it is currently in agricultural use, however that use is set within the context of being in the curtilage of land owned by ESB as part of Woodland substation.

There is one approved planning application in the vicinity of the substation: the East West Interconnector (EWIC) application, which is now constructed and operational. The North South Interconnector project is proposed to connect into Woodland substation from the west, using existing 400 kV overhead lines as it approaches the substation. It is now under construction. In addition, as has been stated, the Kildare Meath Grid Upgrade 400 kV underground cable connection project will terminate at Woodland and will require an extension to the south west; it is in Step 4 of EirGrid’s Framework for Development and is therefore in a pre-planning stage. The preferred design solution for Woodland substation includes the connections required for the North South Interconnector and the Kildare Meath connection project.

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 is no requirement for land outside of ESB ownership to facilitate the Proposed Project.

4.4.1 Colour coding for MCA – Material Assets

There is potential for concerns to be raised by planning authorities regarding the extent of projects proposed and consented for at Woodland, particularly in relation to any impacts this may have on the amenity of local communities (see Section 4.10).

The risk of an impact associated with planning and land use is considered to be low to moderate.



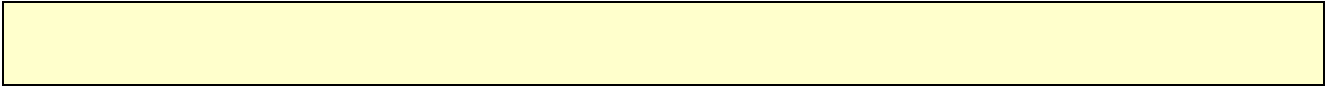
4.5 Landscape & Visual

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 Proposed Project would be continuous development with the existing substation.

There is potential for effects on views however as the Proposed Project would be to the south east of the existing substation, this would not be immediately visible to local residents, screened as it would be by hedgerows, the existing substation and the EWIC Converter Station.

4.5.1 Colour coding for MCA – Landscape and Visual

It is anticipated that risks to landscape and visual receptors would be low.



4.6 Noise and Vibration

Set in a rural location, the surrounding baseline environment at Woodland is a naturally quiet one. The nearest regional road is approximately 1100m from the substation (as the crow flies). There are, however, noise sources within the existing substation from 400 kV transformers. The EWIC Converter Station is also a potential source of noise, however since it is enclosed, this would be limited.

The closest residential property is approximately 850m from the southernmost point of the proposed extension.

The proposed additional equipment required at the substation would include one, or possibly two 400 kV shunt reactors and possibly harmonic filters; these can be significant sources of noise. However it is not considered likely that, with the distance to the nearest sensitive receptor being 850m, the additional noise compared to the existing baseline will be significant. The EWIC Converter Station will also provide some noise screening to reduce impacts on local residents, as will mature trees and hedgerows which surround the substation lands.

4.6.1 Colour Coding for the MCA – Noise & Vibration

There is some potential for impacts from the proposed new equipment at Woodland substation; it is considered to be a low to moderate risk of impacts.



4.7 Climate Change

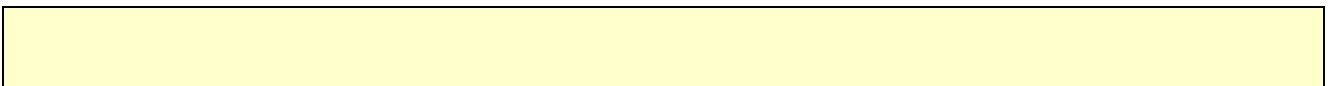
In terms of the potential impacts of the proposed project at Woodland, consideration is given to:

- Climate resilience: new energy infrastructure is a long-term investment and will need to remain operational over many decades, in the face of a changing climate; and
- Material use/embodyed carbon

As set out in Section 4.3, there is no significant risk of flooding to Woodland substation. It is not anticipated that the proposed project would increase flood risk elsewhere. There is potential for increased storminess to impact the substation, for example, through increased lightning strikes. This would be taken into account in the design of the proposed new connection, through detailed lightning studies, as is standard practice for substation design. It is considered the substation will be resilient to a changing climate.

4.7.1 Colour Coding for the MCA – Climate Change

There is a low likelihood of impacts on climate change from the proposed new equipment at Woodland substation.



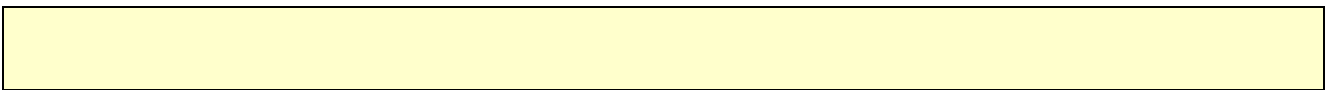
4.8 Cultural Heritage

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.

4.8.1 Colour coding for MCA – cultural heritage

It is anticipated that risks to cultural heritage receptors would be low.



4.9 Summary Assessment of Woodland Connection - Environment

More significant/difficult/risk

Less significant/difficult/risk



Biodiversity
Soil & Water
Material Assets
Landscape & Visual
Cultural Heritage
Noise & Vibration
Climate Change
ENVIRONMENTAL SUMMARY

4.10 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 4.5 Landscape and Visual, it is not considered that there would be significant visual impacts as a result of the proposed extension; in terms of traffic impacts, it is likely that there would be a localised impact on highways

and access during the construction phase. 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, given the existing screening. There is some potential for noise impacts as a result of the new transformers and harmonic filters proposed.

There is also potential for cumulative effects on the amenity of the area near Woodland Substation, as a result of the other proposed electricity transmission projects in the vicinity. There are no timeframes for the construction of these projects currently, however it is anticipated that construction could begin with the next two years for the North South Interconnector, should it receive consent, and Kildare Meath could be a short time after that. CP1021 is approximately one year behind Kildare Meath in terms of pre-planning. The construction of these projects sequentially means that amenity impacts on the local community could persist for several years. Once operational, it is not anticipated that there would be permanent impacts on local amenity.

4.10.1 Colour coding for MCA – Amenity and Health

It is considered that there is a moderate risk of impacts to amenity and health, during construction only.



4.11 Economy

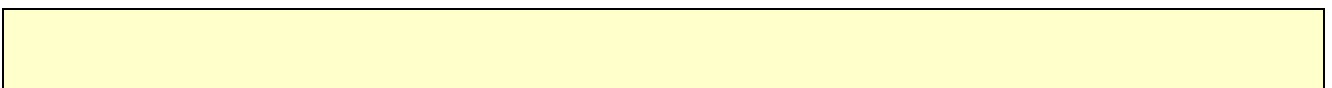
In local communities close to Woodland Substation, there is a very low level of unemployment, with numbers ranging from 2 to 4%. Most of the working population in this area are in skilled or professional jobs, with a significant minority in the farming industry. In terms of impacts to local businesses 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 4.4; the land surrounding the substation is agricultural and arable. No additional land is required to facilitate the Proposed Project.

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.

4.11.1 Colour coding for MCA - Economy

There is therefore a low likelihood of impacts on the economy from the proposed extensions and new equipment at Woodland substation.

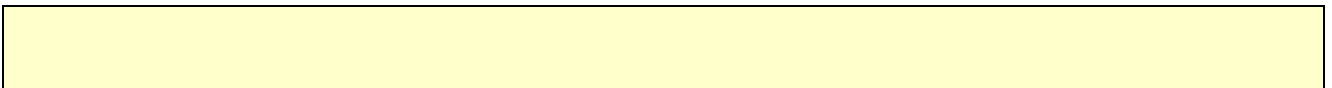


4.12 Utilities

Above ground utilities in the area include telephone network cables and OHLs. Near to Woodland substation, there is the existing Moneypoint to Woodland 400 kV OHL travelling east to west; the Woodland to Maynooth 220 kV 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 connection, 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. Also as this land is already owned by ESB it is likely any underground utilities would be known. During operation, there are unlikely to be effects on third part utilities; any effects on the existing arrangements at the substation will be factored into the design of the proposed works.

4.12.1 Colour Coding for the MCA – Utilities

There is a low likelihood of impacts on utilities from the proposed new extension and equipment at Woodland substation.



4.13 Summary Assessment of Woodland Connection - Social Impacts

More significant/difficult/risk

Less significant/difficult/risk



Amenity and Health
Economy
Utilities
SOCIAL

5. Deliverability

5.1 Construction

New earthworks, foundations and cable troughs will be required for the new 400 kV bay. The substation earthing grid will need to be extended to connect the new equipment. Part of the works to construct the new CP1021 400 kV bay will take place in proximity to the new access road to the substation site. Therefore, part of the initial phase construction planning will be to ensure that safe site access is maintained throughout the construction process.

Delivery routes for plant, particularly the shunt reactor, must be planned and incorporated into the overall site layout. It is possible that further analysis may force a change in the layout of the CP1021 bay, i.e. reactor moved to a different position, to allow delivery and access for future maintenance.

Works to construct the CP1021 bay will be carried out inside the operational compound. A suitable works area will need to be demarcated and controlled by a suitably authorised person(s). This area must be sufficiently far from the live 400 kV busbar that a Designated Work Area (DWA) may be created to allow the main construction works to take place without the need for any busbar outages. The final design should seek to maximise offline works.

5.2 Outage Requirements

Outage requirements for the CP1194 works to extend the 400 kV busbar and replace in-service 400 kV circuit breakers and disconnectors are not considered in this report.

400 kV outages, particularly on the busbars, are undesirable at Woodland and availability is limited. Works will need to be planned so that outages are minimised or avoided until commissioning commences. This initial feasibility review indicates that this is likely to be possible.

It is assumed that CP1194 will not install the pantograph busbar disconnectors required for the CP1021 circuit. Busbar outages will be required for installation and commissioning of these. It is expected that these works can be done with a half-bar outage, which is acceptable on the extended busbar at Woodland, with the additional security of supply provided by the CP1194 works.

The Portan 400 kV cable circuit from Woodland to the EWIC station is the UK-Ireland interconnector and thus is a strategically important circuit. Construction works will be undertaken in proximity to the Portan bay and 400 kV cable. It must be ensured that works do not necessitate proximity outages on the Portan circuit. Allowable clearances from the above ground equipment will be as per the DWA. The allowable proximity of excavation works from the cable will need to be agreed with ESB. Drawing VIL-X-8.3.4-201, refer to Appendix A, shows the route of this cable along the edge of the landownership boundary.

5.3 Deliverability Feasibility

As per Section 1.1, the following scale is used to assess the deliverability feasibility of this option. There is no significant difference in substation works between OHL and UGC options, although the need for a shunt reactor is more likely for the UGC option, requiring additional works. The construction strategy for CP1021 is an offline build as far as possible. As all works will be within a live substation, there are additional site safety and permit requirements on all works contractors. These should be considered a typical requirement though for contractors qualified to undertake these types of works.

More significant/difficult/risk

Less significant/difficult/risk



400 kV Connection Options	Deliverability Feasibility
Overhead line	Light Green
Underground Cable	Light Green

6. Economic

The standard cost of a 400 kV AIS bay is as below:

Item No.	TAO Cost Ref.	Item Description	TAO Rate Gross €	Quantity	Gross Cost Estimate Amount €
1	S400-9	New 400 kV AIS Line Bay in existing 400 kV AIS Double Busbar Outdoor Station (Strung / Tubular Busbar)	€ 1,710,000	1	€ 1,710,000

The CP1021 bay required to accommodate the shunt reactors will be non-standard due to the presence of the shunt reactor, so the cost is likely to be somewhat higher than this.

The underground cable option will definitely require reactive compensation. For an overhead line option this is still possible, but less likely. Therefore the UGC is assessed as having a higher economic impact.

6.1 Economic Feasibility

As per Section 1.1, the following scale is used to assess the economic feasibility of this option.

More significant/difficult/risk

Less significant/difficult/risk



400 kV Connection Options	Economic
Overhead line	Light Green
Underground Cable	Green

7. Conclusion

The 400 kV connection proposed incorporating a new bay for project CP1021 at Woodland substation is technically feasible. The connection will be enabled by the project CP1194, which will create an extended 400 kV busbar with bays on the south end for projects CP0966 and CP1021, as well as a wing coupler providing extra security of supply. Works for project CP1021 will be to construct a bay for the new feeder circuit, connecting to the extended 400 kV busbar.

A cable connection will require a cable termination structure as part of the new bay. For the overhead line a high level gantry will be required. Either of these may be constructed within the existing site.

Reactive compensation in the form of a shunt reactor is assumed to be a requirement. The reactor will be connected directly onto the new feeder bay near the point of termination.

No land acquisition is required to facilitate CP1021.

The potential environmental and social impacts of the proposed connection to Woodland Substation have been considered. Overall there is a low risk of environmental impact and a low to moderate risk of social impacts; specifically this relates to potential amenity impacts which may be experienced by the local community as a result of the combined impacts of several projects proposed for this Substation. Both environmental and social impacts will be considered further and in more detail as the proposed project progresses into the next Steps in EirGrid's grid Development Framework.

The proposed works will require 400 kV busbar outages to connect the CP1021 feeder bay to the in-service bars and for commissioning. The logistics of these outages must be agreed far in advance. Although the CP1194 works will increase the site resilience to outages, these still represent the most likely threat to the timely delivery of the project.

This overall assessment has been presented in the table below.

400 kV Connection Options	Technical Feasibility	Environmental Feasibility	Social Feasibility	Deliverability	Economic Feasibility	Combined Performance
Overhead Line	Light Green	Yellow	Light Green	Light Green	Light Green	Light Green
Underground cable	Light Green	Yellow	Light Green	Light Green	Dark Green	Dark Green

Appendix A. Drawings

VIL-X-8.3.4-201 Portan AC Cable Route

XDN-SKE-CPXXXX-E-WOO-001-R00 (DRAFT19) WOODLAND 400kV AIS STATION SITE
ARRANGEMENT PROPOSAL LAYOUT DRAWING