

Technical Appendix 2.2: TLI Technical Note 1

TECHNICAL NOTE 1

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| Project: Barnesmore Windfarm Repowering – 110kV Grid Connection | Ref: Rev2 |
| Section: 110kV Grid Connection Works Review | Job No: 05-728 |
| | Date: 13.12.19 |
| Made By: SK | Checked By: RG |
| | Sheet No: 1 of 6 |

Instruction

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| Technical Lead: | Shane Kiely - TLI Group |
| Date of Writing: | 13.12.19 |
| Scope of Note: | Review of the 110kV Grid Connection and associated works for the Barnesmore Windfarm Repowering |
| Documents & Data Issued for Review: | TLI-05728-GC-DR-F-001-00 Cable Interface Tower Details TLI-05728-SS-DR-F-001-03 Proposed Golagh SS Layout Plan PE687-D318-005-004-000 Cathaleen's Fall – Golagh Tee 110kV Line Route |

Overview

TLI Group (the Consultant) were engaged by Jennings O'Donovan (the Client) who are working on behalf of ScottishPower Renewables (the Developer) on the repowering of Barnesmore Windfarm in Co. Donegal. This project involves replacing the existing turbines with a smaller number of larger turbines in order to increase the MEC of the windfarm. Barnesmore Windfarm is currently supplied by the Cathaleen's Fall-Golagh Tee 110kV OHL. It is proposed to reconfigure this OHL to connect directly to Clogher 110kV Substation instead of the hard tee-connection from the Cathaleen's Fall-Letterkenny 110kV OHL, this configuration will provide more capacity for the increased MEC of the windfarm.

The Consultant was to complete a review of the proposed new 110kV grid connection configuration and the associated works required. This exercise was to include a review of the current windfarm substation layout and what upgrades may be required to meet the new EirGrid 110kV Tail Fed Substation requirements.

Proposed New 110kV Grid Connection Configuration

The current 110kV Grid Connection to Barnesmore Windfarm does not have sufficient capacity to facilitate the proposed increase in the windfarm MEC from 15MW to approx. 65MW. The Consultant is therefore proposing to reconfigure the grid connection to Barnesmore Windfarm. The existing 110kV OHL connection to the windfarm is supplied via a "hard tee-connection" from the Cathaleen's Fall-Letterkenny 110kV OHL which has limited capacity. It is proposed to disconnect the windfarm OHL connection from the Cathaleen's Fall-Letterkenny 110kV OHL and connect it directly to Clogher Substation.

Grid Connection Supply Reconfiguration Works

- Construction of a new Cable Interface Tower between Structure 130T and Structure 310
 - New cable interface tower to be built on the east side of the Cathaleen's Fall-Letterkenny 110kV OHL, under the existing Golagh Tee 110kV OHL
- Underground Cable connection from new interface tower to Clogher 110kV GIS Substation (Spare Bay)

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- Removal of hard tee-connection between Cathaleen's Fall-Letterkenny 110kV OHL and Cathaleen's Fall-Golagh Tee 110kV OHL.
- Retirement of existing structure 130T
- Termination of existing conductor to new proposed cable interface tower

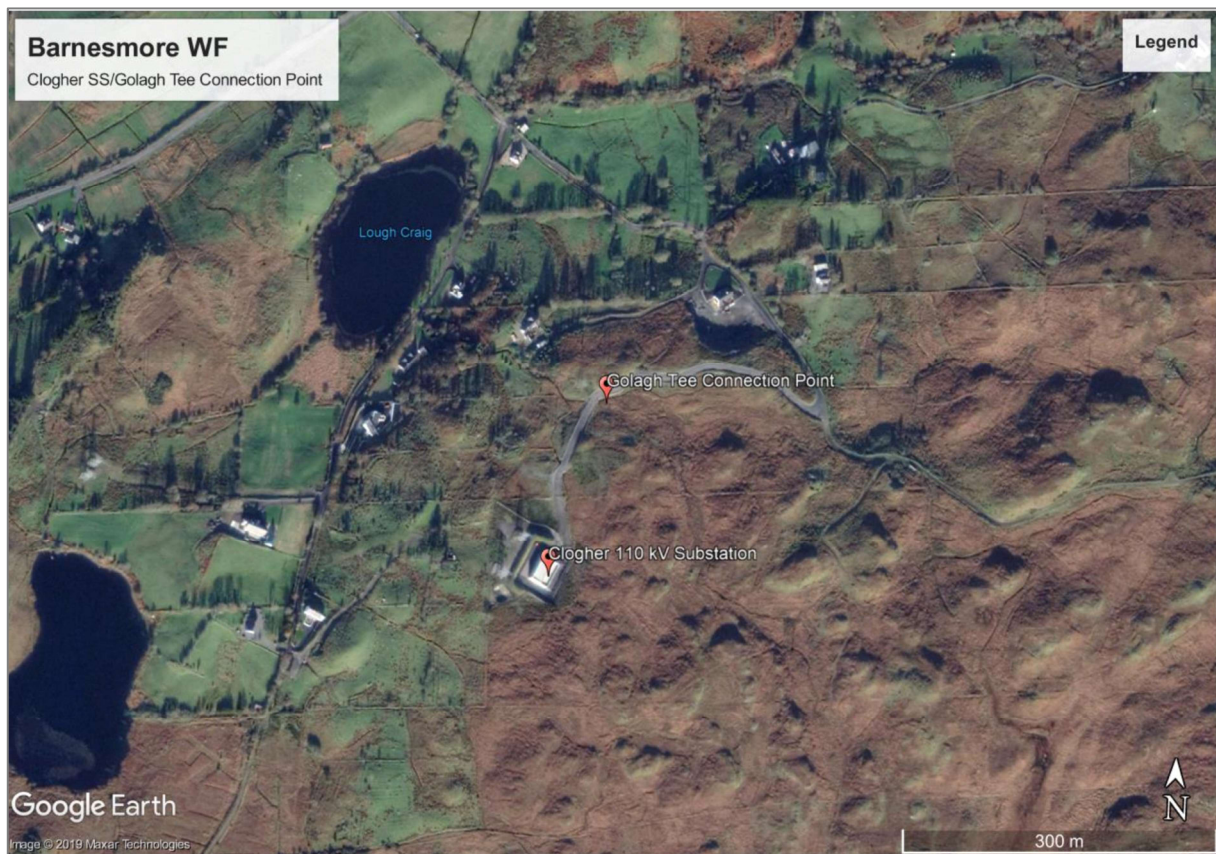


Figure 1 - Clogher SS/Golagh Tee Connection Point

The repowering of Barnesmore Windfarm will implement a new turbine layout within the windfarm to facilitate the larger turbines. The existing Golagh Tee 110kV OHL utilises overhead to connect to Golagh Substation. The proposed new windfarm layout is proposing to install a new turbine in closer proximity to the final section of the OHL into Golagh Substation. Due to the close proximity of the new turbine the Consultant is proposing that the existing OHL be undergrounded from Structure 322 to Golagh Substation. These works would require a new cable interface tower to be constructed adjacent to Structure 322 and a new 110kV UGC to be installed within the access track on the approach to Golagh Substation.

It should be noted that the Client has indicated that the new turbine location closest to the new cable interface tower will be less than 3.5 times the rotor diameter as requested in the EirGrid Overhead Line Functional Specification (LDS-EFS-00-001-R0). The largest rotor diameter of the new proposed candidate turbines is 158m which equates to a clearance distance of 553m (3.5xRD). The Consultant estimates that the new cable interface tower will be approx. 290m from the turbine location. The Client will need to request a derogation from EirGrid for this reduced clearance.

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Golagh Tee 110kV OHL Undergrounding Works

- Construction of a new Cable Interface Tower adjacent to Structure 322
- Installation of new 110kV UGC from new cable interface tower to Golagh SS
 - New UGC is to be installed in the windfarm access road (EirGrid requirement)
- Retirement of existing structure 322
- Termination of existing conductor to new proposed cable interface tower
- Retirement of OHL from new cable interface tower location to Golagh Substation
- Cable termination from new cable interface tower to Golagh Substation
 - Golagh Substation expansion works required as detailed below

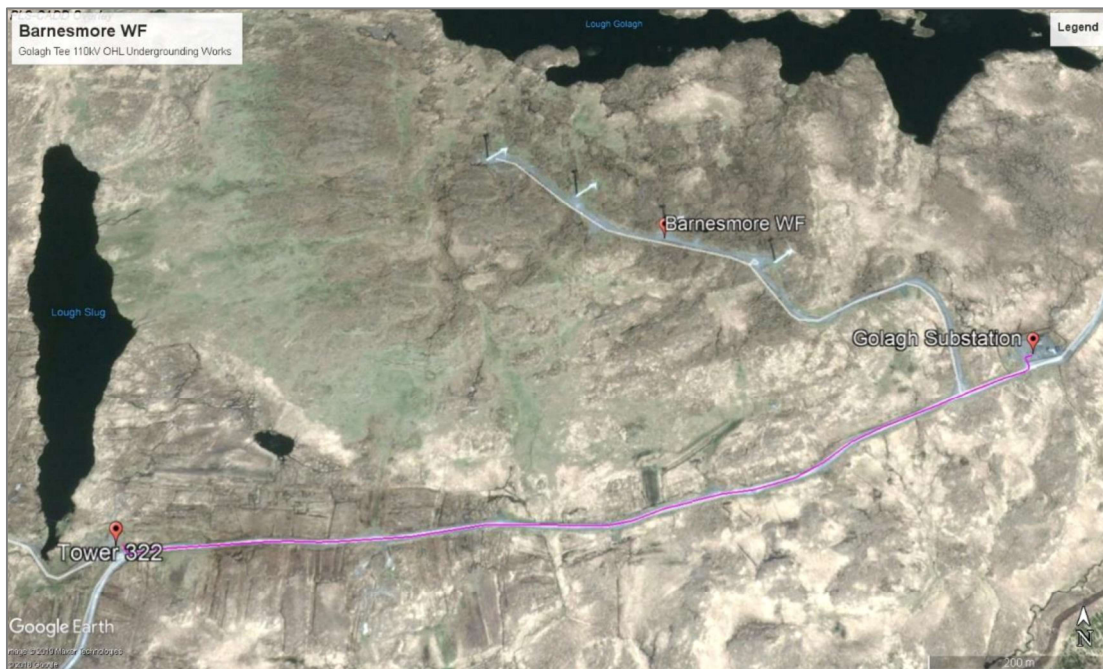


Figure 2 - Golagh Tee 110kV OHL Undergrounding Works

The existing Golagh Substation was designed to meet previous EirGrid Specifications. The new EirGrid 110kV Tail Fed AIS Specification has a number of new requirements not previously required in the older specification. These new requirements will increase to overall substation footprint with considerations to minimise exceeding development boundaries due to the sensitivity of the area. The lands around Barnesmore Windfarm are designated as part of Barnesmore Bog Natural Heritage Area (NHA).

A review of the existing substation design and a comparison to the new EirGrid Specification to identify how the existing substation could be upgraded and expanded to meet the new EirGrid requirements rather than constructing a new substation. The main difference between the existing substation layout and the new EirGrid specification is the requirement for a larger EirGrid control building. The Consultant is proposing that the existing substation compound is extended to the west to facilitate the construction of a new EirGrid control building.

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The Consultant is also proposing that the substation compound be extended slightly to the east to facilitate the installation of the larger transformer required for the windfarm. The compound will also need to be extended slightly to the north to facilitate the larger IPP building and Aux Transformer. The Consultant is proposing to maintain the current layout of the 110kV switchgear where possible, however this will need to be confirmed with EirGrid as the current layout varies in some areas to the new specification. It should be noted that some of the 110kV switchgear may need to be upgraded to a higher rating as part of the project works. The proposed 110kV grid connection reconfiguration works and substation expansion works are subject to detailed design.

Golagh Substation Expansion Works

- Extension of the existing substation compound to the west, north and east
- Installation of a new substation access point on the west side of the substation
- Installation of a second substation access point on the east side of the substation
- Installation of a new substation boundary and perimeter fence
- Construction of a new EirGrid control building as per new specification
- Extension of the existing control building to be used as the IPP control building
- Installation of a larger transformer (incl. transformer bund and plinth)
- Installation of a new Auxiliary Transformer
- Installation of reactive compensation equipment (if required)
- Retirement of the exiting OHL connection
- Installation of a 110kV Cable Chair
- Connection of a new 110kV UGC to the new cable chair
- *Surge arresters at line side are currently located on line disconnect. TBC with EirGrid.*
- *Maintaining use of gantry for over the fence connection. TBC with EirGrid.*
- *Location of transformer disconnect and surge arresters to remain in IPP side of substation. TBC with EirGrid.*

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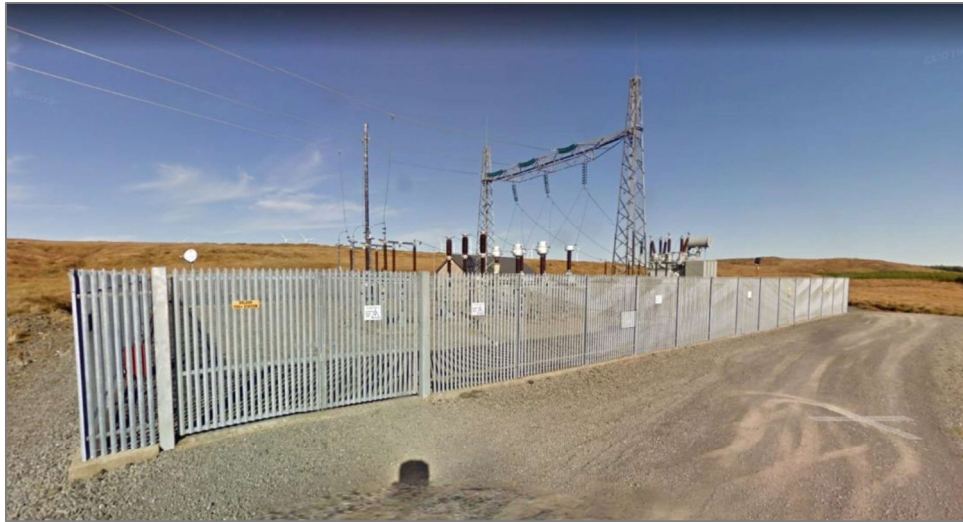


Figure 3 - Golagh 110kV Substation

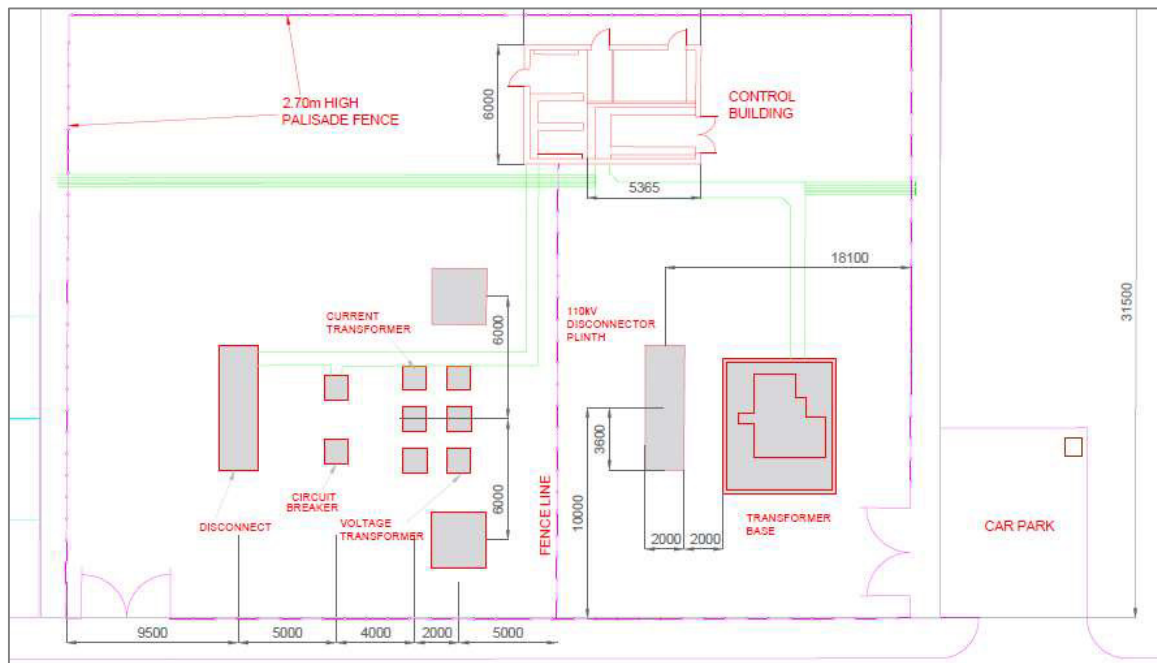


Figure 4 - Golagh 110kV Substation – Existing Layout

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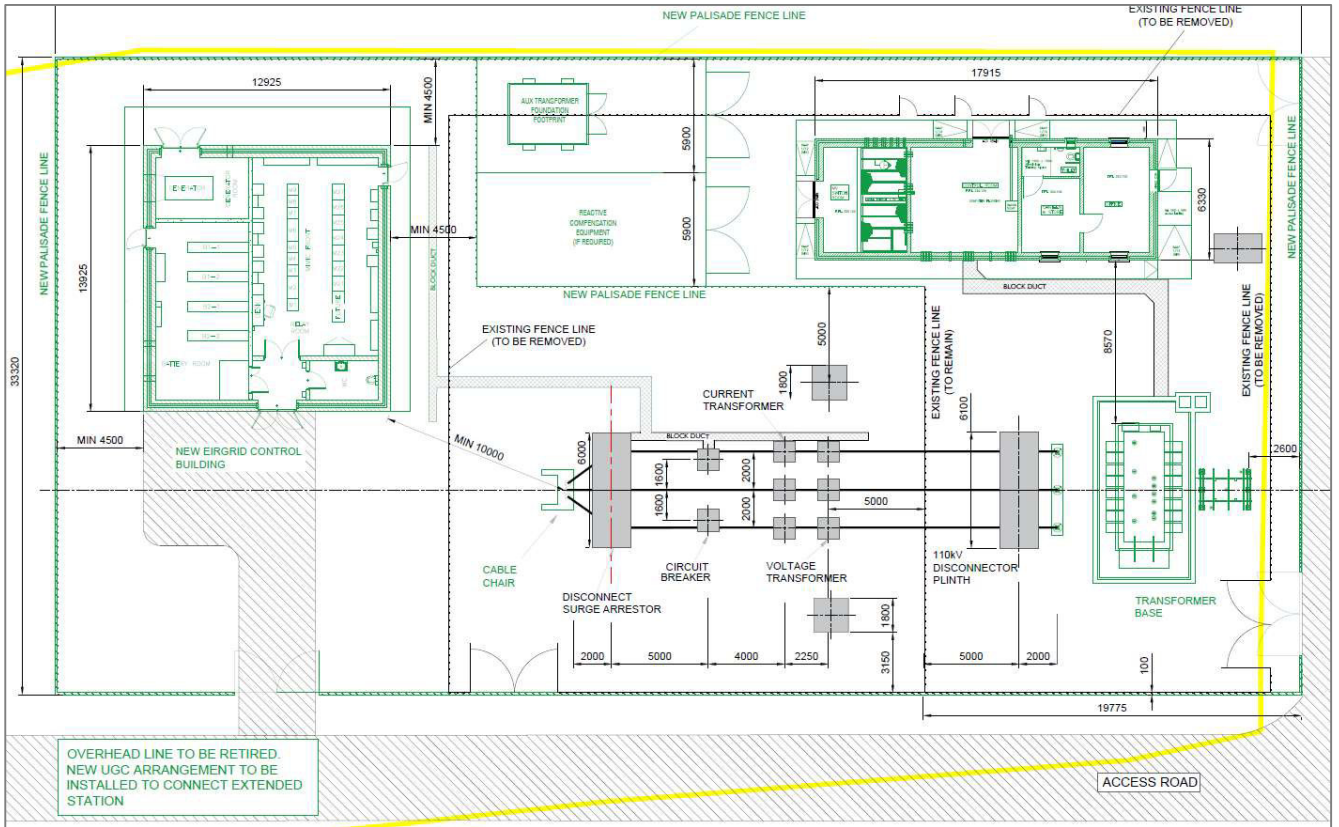
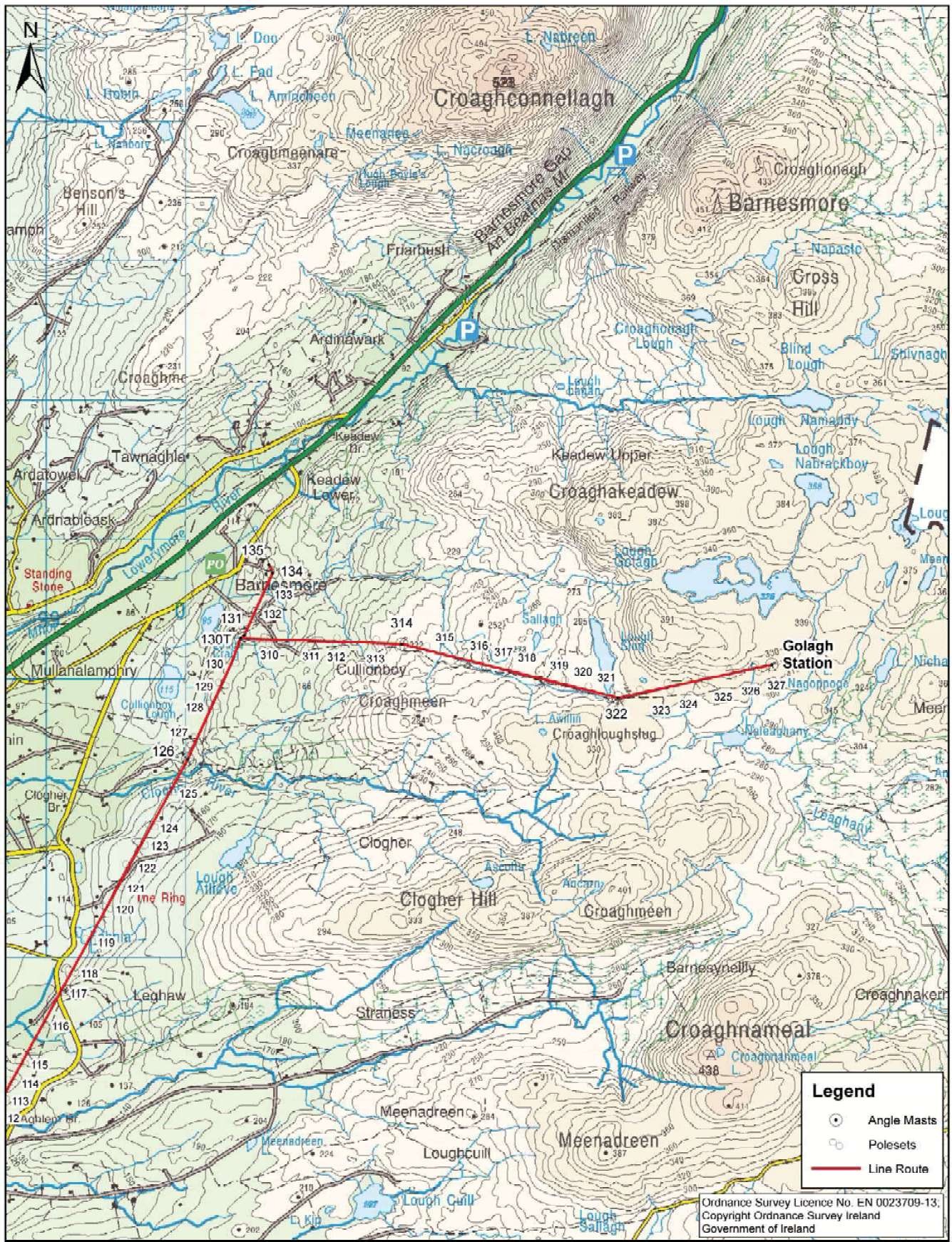


Figure 5 - Golagh 110kV Substation – Proposed New Layout



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Client
Cathaleen's Fall - Golagh Tee 110 kV Line Route

Drawing title
Cathaleen's Fall - Golagh Tee 110 kV HTLS Uprate

Production unit
HV Overhead Lines

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