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Pentir i Drawsfynydd

The Great Grid Upgrade
Pentir to Trawsfynydd



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Prosiect i Atgyfnerthu'r cysylltiad rhwng Pentir a Thrawsfynydd

Pentir to Trawsfynydd Reinforcement Project

Environmental Statement Volume 4: Glaslyn Cables Works

November 2025

nationalgrid

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Executive Summary

Background

Introduction

i. This document (Volume 4 – Glaslyn Cables) forms part of the Environmental Statement which accompanies applications by National Grid Electricity Transmission plc to construct and operate developments which comprise parts of the Pentir to Trawsfynydd Reinforcement Project (the 'Project'). Volume 4 focuses on the works at the Glaslyn Cables. It provides an assessment of likely significant effects that could arise from the replacement of the Glaslyn Cables, including decommissioning of existing infrastructure and the construction and operation (including maintenance) works for the Glaslyn works.

Glaslyn Cables Location

ii. The proposed works would run between the existing Wern Cable Sealing End Compound (CSEC) and the existing Garth CSEC, Porthmadog (the 'Glaslyn works site'). The Glaslyn works site would run through undulating land and is characterised by predominantly rural land uses with scattered woodland. A large proportion of the Glaslyn works site is on agricultural land, which the Agricultural Land Classification data identifies as Grade 5 (very poor quality) with small patches of Grade 3a (good to moderate). The Glaslyn works site crosses through the Glaslyn Site of Special Scientific Interest, Coedydd Derw, a Safleoedd Ystlumod Meirion/Meirionnydd Oakwoods, and Bat Sites Special Area of Conservation and a small area of Ysbyty Bron y Garth Site of Special Scientific Interest.

Glaslyn Cables Works Site and the Proposed Works

iii. The existing 400 kilovolt (kV) cables are near the end of their operational life and as installed could not operate at the capacity now required. These cables need replacing. The existing 132 kV cables cannot be upgraded to operate at 400 kV nor meet the capacity now required by the circuit. These cables will be replaced with new 400 kV cables.

iv. The Glaslyn works site covers an area approximately 106.4 hectares. The land within the Glaslyn works site comprises access roads, turning areas, construction compounds and laydown areas required for the construction and operation of the works.

v. Works would include the extension to the existing Wern CSEC; the replacement of the 400 kV cables and associated infrastructure i.e. joint bays, link pillars, link boxes; purged, decommissioning and removal of the redundant 132 and 400 kV cables and associated infrastructure, with some sections of cable being left *in situ* due to social and ecological sensitivities; removal of the existing Garth CSEC and installation of the proposed Minffordd CSEC. The proposed works include the Minffordd Tunnel Head House (THH), similar to that already consented under the Eryri Visual Improvement Provision (EVIP) project, to bring the ground level in line with the Minffordd CSEC.

vi. New infrastructure at the CSEC consists of high voltage electrical equipment (a surge arrestor, earth switches, cable sealing ends) as well as foundations and support steelwork, , security fencing and access roads.

vii. The replacement cables would be installed in ducts via either open cut or trenchless technology. The proposed open cut technique would be trenching and backfill, which would

be employed for approximately half of the cable route. The proposed trenchless technology would be Horizontal Directional Drill (HDD) used for the other half of the cable route. Small sections of cable in the joint bays at Wern and Minffordd CSECs would be installed through direct burial of the cable. Generally, the construction works would be completed from Monday to Friday between 7 am – 7 pm and 8 am – 6 pm on Saturdays. 24-hour working will be required for critical activities such as the HDD, cable pulling, jointing and terminating. The construction works would take place over a three year period between Quarter 2, 2026 and Quarter 3, 2030.

Alternatives

viii. In accordance with the Town and Country Planning (Environmental Impact Assessment) (Wales) Regulations 2017, design alternatives considered for the proposed works have been described. Design alternatives were considered for the Glaslyn cable route, A487 crossing, Minffordd CSEC and Bodawen playground.

ix. An Options Appraisal Report divided the Glaslyn cable route into five sections. After considering multiple options for each section, the preferred route was determined based on fewer complexities, reduced environmental impacts and cost efficiency.

x. The Glaslyn cable route intersects the A487 Porthmadog Bypass in three locations: Porthmadog Roundabout; west of the Welsh Highland Heritage Railways (WHHR) and Ffestiniog & Welsh Highland Railway (FfWHR); and north-west of the Afon Glaslyn. At each location multiple options were appraised. For Porthmadog Roundabout an open cut trench approach was only option that can be constructed without significant protective measures to the high-pressure gas main, minimises risk to the structural integrity of nearby infrastructure, and does not impact the ancient woodland. The preferred A487 crossing west of the WHHR and FfWHR follows the A487 to the south turns north to cross the A487 and then east to cross, WHHR and FfWHR, it was chosen for being the best location to minimise the impact on the highway by routeing the HDD so that it can pass under the other constraints, offering more space for HDD to avoid highway structures, crossing the WHHR and FfWHR at a location to avoid the train station and was less impactful on trees and hedgerows. Nine options were considered for the Afon Glaslyn, some of which were discounted due to technical constraints. The chosen option was technically preferred as it had the potential to be completed with a single cable drum with joint bays on either side of the crossing, avoids direct impact on the A487, projected low costs and from a health and safety perspective due to the need for less temporary works.

xi. Three options were considered for the connection with EVIP at Minffordd. The preferred option comprised an air insulated switchgear (AIS) CSEC. The chosen option was an AIS CSEC at Minffordd as it gave good cost efficiency whilst enabling a cable connection to be achieved, was consistent with high voltage equipment at the Pentir and Trawsfynydd Substations and allowed a connection to the EVIP project.

xii. Bodawen playground is immediately west of Porthmadog Roundabout. A number of options were considered to mitigate the effects of the temporary two-year closure. Temporary relocation was not taken forward due to overlooking, security, accessibility issues and the proximity of alternative playgrounds. To minimise impacts, the playground would be closed for a maximum of two years and the playground would be refitted with new equipment on completion.

xiii. Five options were considered for the Minffordd THH. West THH (Alternative 4) was preferred due to its relationship of new built form with the existing settlement pattern, and it could accommodate landscape works. West THH and West THH (Alternative 1) were both rejected based on the proximity of the high-pressure gas pipeline and buried high voltage cables.

Although West THH (Alternative 2) was similar to Alternative 4, it was in a less favourable location, was less able to provide screening and would create a build form closer to existing settlement. West THH (Alternative 3) was rejected as there was more potential for impacts on visual amenity.

Key Findings of the Environmental Impact Assessment

Landscape and Visual Amenity

xiv. The Study Area for Landscape and Visual Amenity encompasses land within a 3 km radius of the Glaslyn works site. The Glaslyn works site is not covered by any statutory landscape designations; however, part of the Study Area is in h Eryri National Park which is 300 m east of the Glaslyn works site at its closest point. There are recognised sites that cover parts the Glaslyn works site and Study Area, including two Special Landscape Area including three Historic Landscapes, three Registered Historic Parks and Gardens and part of the Slate Landscape of Northwest Wales - Ffestiniog: its Slate mines and Quarries, 'city of slates' and Railway to Porthmadog is a World Heritage Site. The landform of the Glaslyn works site is largely flat and low-lying with the two CSECs lying at either end and the route corridor passing through the broad, flat valley floor of the Glaslyn Estuary. Settlement within the Study Area comprises the town of Porthmadog and villages generally in lower lying areas and villages and caravan sites along the coast. On higher land, settlements are limited to scattered farms and individual properties. There are numerous public rights of way (PRoW) in the Study Area linking settlements and providing recreational routes. The Study Area includes some common land and open access land in Eryri National Park, but none is in the Glaslyn works site.

xv. The proposed works would introduce some new elements into the landscape, creating the potential for landscape and visual effects. The effects from the following activities could occur simultaneously or in isolation: vegetation clearance, utility diversions, temporary compounds, construction activities, temporary access tracks, temporary diversion of PRoWs, erection of temporary scaffolding infrastructure, construction lighting and new permanent infrastructure. During operation, the proposed works have potential to create landscape or visual effects due to the introduction of new infrastructure. During operation the proposed works would add new elements into the landscape, creating the potential for landscape and visual effects. These effects may arise at either the Wern CSEC and the Minffordd THH and CSEC from the following activities: new infrastructure and new planting.

xvi. Embedded mitigation measures include minimising the extent of the proposed works, incorporation of new and additional planting such as hedgerows and trees, reinstating land used temporarily, confining lighting to locations where safety is a priority, minimising the use of tall equipment, designing permanent structures to minimise their visual impact and minimising construction duration.

xvii. During construction, significant residual impacts as a result of the Glaslyn Cables have been identified on Landscape Character Area 09 Porthmadog, Seascape Character Area 20 Porthmadog and Glaslyn Estuary, Viewpoint 9: Wales Coast Path – The Cob (eastern end), Porthmadog and Viewpoint 10: Ffordd Tan-y-Glannau, Minffordd. No significant residual operational impacts are anticipated.

Ecology and Nature Conservation

xviii. The Study Area or Zone of Influence for the proposed works was defined to assess potential ecological risks from direct and indirect impacts. The Zone of Influence considers the nature of the proposed works, nearby land use, habitats, watercourses, species behaviours, and duration of effects. It incorporates designated sites, sensitive habitats, and protected and

notable species at varying distances from the Glaslyn works site, considering professional good practice and guidance.

xix. A desk study was carried out to identify sites designated for nature conservation and records of protected or notable habitats and species (important ecology features) and Invasive Non-Native Species (INNS) that are relevant to the Glaslyn works site. The desk study also identified the status of water bodies covered by the Water Framework Directive (WFD) to identify those likely to be impacted from an ecological perspective. Cofnod, the local biological records centre, was contacted in June 2023 to gain information on pre-existing ecological data (i.e. locations of locally designated sites, habitats of principal importance (HoPI), ancient woodland and existing records of protected and notable species, and INNS within 2 km of the Glaslyn works site). A series of field surveys has been undertaken including an extended Phase 1 habitat survey, targeted habitat survey, aquatic scoping surveys, hedgerow, aquatic macrophyte, aquatic macroinvertebrate, fish, breeding birds, non-breeding birds, bats (ground level tree, potential roost features, roost, foraging/commuting), badger, riparian mammals, great crested newt and INNS surveys.

xx. The Glaslyn works site comprises various types of woodland, scrub, grassland, hedgerows, marginal and inundation vegetation, buildings, standing water and running water. There are six international statutory sites for nature conservation (Special Areas of Conservation (SAC), Special Protection Areas and Ramsar sites) within 10 km of the Glaslyn works site and a further two SACs designated for bats within 30 km of the Glaslyn works site. Twenty-two other statutory designated sites (Site of Special Scientific Interest, National Nature Reserve and Local Nature Reserves) are present within 5 km of the Glaslyn works site.

xxi. There are 41 non-statutory sites designated for nature conservation within 2 km of the Glaslyn works site, two of which are partially in the Glaslyn works site. There are two North Wales Wildlife Trust sites in the Study Area, one of which is wholly in the Glaslyn works site. There are 80 areas of ancient semi-natural woodland, 38 site of restored ancient woodland, seven plantations on ancient woodland sites and one site of ancient woodland of unknown category in the Study Area.

xxii. Habitats of Principal Importance identified within 1 km of the Glaslyn works site include coastal and floodplain grazing marsh, lowland fen and reedbed, saltmarsh, lowland dry acid grassland, purple moor grass and rush pastures, traditional orchards, lowland heathland, lowland meadow, maritime cliff and slope, blanket bog, hedgerows, rivers, standing water or ponds and deciduous woodland.

xxiii. The following protected and notable species were identified within 2 km of the Glaslyn works site: terrestrial invertebrates, aquatic macroinvertebrates, fish, breeding and non-breeding birds, bats, badger, otter, water vole, pine marten, reptiles, hedgehog, brown hare, polecat, flora, lichen, fungi and invasive non-native species (INNS).

xxiv. The proposed works have the potential to affect ecology and nature conservation through habitat loss (temporary and permanent), disturbance (light, noise, vibration and human activity), habitat degradation, species mortality and spread of INNS during construction. During operation, no effects are anticipated. However, should maintenance works be intrusive and require refurbishment or replacement the sources of potential effects include species mortality, disturbance (light, noise, vibration and human activity) and spread of INNS.

xxv. Embedded mitigation measures have been integrated into the proposed works to minimise potential ecological impacts on construction and operation . The design of the proposed works has evolved to avoid statutory designated sites and ancient woodland as far as practicable. Minimum buffers from key habitat features will be applied to reduce the

likelihood of significant environmental effects, this will apply to woodlands, hedgerows, individual trees, watercourses and the Afon Glaslyn bankside (in the Glaslyn SSSI).

xxvi. The Construction Environmental Management Plan (CEMP) will outline measures to address construction dust, pollution, water quality, light, noise and vibration. Vegetation clearance would be carried out in advance of the construction works commencing and would avoid the besting bird period, precautionary working methods will be adhered to in areas of habitat suitable for reptiles, common amphibians and common mammals. Statutory and non-statutory sides would be protected from incursion through security and protection fencing. Watercourses crossed by the proposed works will be reinstated hedgerow removal will be kept to a minimum, where removal is required, new sections will be planted. Lighting during construction will be minimal and comply with best practice guidelines to prevent disturbance to wildlife. Where grassland vegetation removal is required, underlying topsoil and subsoil will be stripped and stored appropriately, omitting the use of glyphosate. Once the works are completed, the topsoil and subsoil will be backfilled promptly, retaining the original soil profile and seed bank. Temporary noise attenuation fencing will be installed within the Glaslyn works site, including around HDD working areas, to minimise potential disturbance to sensitive receptors. Pre-construction surveys will ensure the latest data on protected species and INNS are used to inform mitigation measures, including wildlife protection and reasonable avoidance measures for badgers, otters and bats.

xxvii. Additional mitigation will apply for hedgerows, ancient and veteran trees, protected and notable flora, aquatic macroinvertebrates, aquatic macrophytes, fish, badger, bats and otters to minimise any potential adverse effects. Enhancements in the form of new bat boxes will be provided (with landowner consent) on retained trees within the Glaslyn works site.

xxviii. With the implementation of suitable embedded mitigation and additional mitigation the assessment has concluded that the construction and operation of the proposed works are unlikely to result in significant adverse effects to identified species, habitats and designated sites.

Historic Environment

xxix. Two Study Areas were used for the Historic Environment assessment: a Study Area of 3 km from the Glaslyn works site for designated historic assets and a 500 m Study Area for non-designated heritage assets. The settings of designated assets of the highest value (i.e. World Heritage Sites, scheduled monuments, Grade I and II* listed buildings, registered parks and gardens, conservation areas containing a number of assets of the highest value and registered historic landscapes) have been considered, up to 3 km from the Glaslyn works site, guided by the proposed works ZTV prepared as part of **Chapter 4: Landscape and Visual Amenity.**

xxx. Most historic assets were scoped out of further assessment in the baseline study (**Volume 8, Appendix 4.6.A: Historic Environment Desk-based Assessment**) however, the proposed works could result in physical impacts or impacts on the setting of one World Heritage Site, one scheduled monument, two Grade II* listed buildings, 17 Grade II listed buildings, two registered park and gardens, one registered historic landscape and 27 non-designated historic assets.

xxxi. The potential construction impacts associated with the proposed works include temporary short-term impacts or permanent impacts to assets as a result of change to their setting and permanent physical impacts to below ground archaeological remains.

xxxii. Potential impacts to these historic landscape features that cannot be avoided by design can be mitigated through a proportionate programme of archaeological investigation, recording and reporting, such as archaeological excavation in advance of construction, which would

form additional mitigation measures. This would not result in a reduction in the physical impacts to archaeological remains but would mitigate the impact by providing a greater understanding and appreciation of the evidential value of archaeological remains.

xxxiii. Apart from Wern Manor Grade II* listed building (Cadw 4626) (Grade II*) and Wern Manor Grade II* registered historic park and garden (PGW(Gd)19(GWY)) where moderate adverse significant effects have been identified, no other significant effect has been identified during the construction or operation of the proposed works. Considerations of size, materials, distribution, lighting and screening in the final designs of the alterations to the existing Wern CSEC, the construction of the new Minffordd CSEC, the Minffordd EVIP tunnel head house (at a greater height than presently consented) and the removal of the Garth CSEC will ensure that impact on the setting of designated historic assets will be kept to a minimum.

Geology, Hydrogeology, Land Use and Agriculture (Soils)

xxxiv. The Study Area comprises the Glaslyn works site plus a 250 m buffer extending to 1 km for water abstractions.

xxxv. The Study Area is underlain with Alluvium and Till Superficial deposits, and Mawddach Group, Tremadoc Series and Ogwen Group Bedrock. There are two faults which cross the proposed works east of Porthmadog harbour. They are both unnamed and trend in a north-south direction with downthrows to the west. There are 80 historic borehole logs within the Study Area, 16 of which are within the Glaslyn works site. Ground stability across the Glaslyn works site varies, with potential issues including collapsible ground in several localised areas, probably compressibility and uneven settlement hazards, possible slope instability especially at the western extent of the Glaslyn works site and the presence of running sand. Three soil types were identified within the Study Area: Saline 1 soils of variable texture flooded by high tides; well drained fine loamy or fine silty Manod soils; and deep stoneless silty and fine sandy Rockcliffe soils. There are two geological SSSIs close to the west of the Glaslyn works site, The Ty'n Llan SSSI lies approximately 50 m north-west and Wern Road Section SSSI is approximately 120 m south. Sandstone, slate and igneous rocks have been identified across the Glaslyn works site. One Category 1 Aggregate Safeguarding Area for high specification aggregate (sandstone and igneous rock), one Category 2 Aggregate Safeguarding Area for slate and one Category 2 Aggregate Safeguarding area for igneous rock have been identified within 250 m of the Glaslyn works site. One historical mineral planning area was identified within 250m of the Glaslyn works site. There are five locations within the Study Area which are noted as known to have underground mining or considered likely within or very close to the Glaslyn works site. There are several areas of surface ground workings in and adjacent to the Glaslyn works site. In the Study Area there are eight private water supplies. There is one historical landfill site for household waste and one historical waste site (recycling facility) within 250 m of the Glaslyn works site. There are 20 Licensed Discharge Consents to Controlled Waters within the Study Area, 13 are current and effective, five are expired, and two have been revoked. There are no source protection zones, groundwater abstractions, active or recent landfill sites, sources of ground gas within the Study Area.

xxxvi. Construction activities have the potential to result in groundwater and ground pollution due to chemical spillages and leaks including from oil-filled cables, disturbance of potentially contaminated soils, sediments and waters posing a risk to construction workers, groundwater, and geology, importation of contaminated aggregates posing a potential risk to human health and underlying geology and groundwater quality, requirement to remove/reinstate spoil from construction of the buried cables posing a potential risk to human health and the environment, partial loss or damage to geological receptors during construction and temporary disturbance and permanent loss of soil resources. During maintenance works there is the potential for the foundations of structures and cables to

provide a preferential pathway for contaminants to migrate to non-contaminated soils, geology and groundwater and for aggressive ground contaminants posing a risk to foundations or cable infrastructure.

xxxvii. Mitigation measures include a CEMP, targeted ground investigations, a method statement, discovery strategy and materials management plan, waste management plan. Following the implementation of mitigation measures, no significant impacts on Geology, Hydrogeology, Land Use and Agriculture are anticipated.

Water Quality, Resources and Flood Risk

xxxviii. The Study Area for this assessment has been defined through setting a Zone of Influence (ZoI). In this instance the ZOI has been set to include the fluvial and tidal flood zone associated with the Afon Glaslyn and Y Cyt water bodies as this is well defined by local topography. No water environment impacts are expected to occur further upstream or downstream than this, and the topography restricts the flood zone from changing extent significantly as a result of proposed works.

xxxix. The topography varies between 0 m AOD and 345 m AOD across the Glaslyn works site. There are two Main Rivers in the Glaslyn works site: the Afon Glaslyn and Y Cyt/Nabt Yr Afon Oer, both in Porthmadog. There are different soil types across the ZoI, including loamy and clayey soils of coastal flats with naturally high groundwater, freely draining acid loamy souls over rock and naturally wet saltmarsh soils. There is once licensed surface water abstraction (abstracting from two points) in the ZoI, on the left bank of the Afon Glaslyn, 210 m upstream of the Glaslyn works site. The abstraction is associated with mining related activities at Minffordd Quarry. There are no groundwater abstractions in the ZoI. There are five conservation sites with potential water designations including Coedydd Beddgelert a Cheunant Aberglaslyn SSSI, Coedydd Nanmor SSSI, Glaslyn SSSI, Meirionnydd Oakwoods and Bat Sites SAC and Hafod Garregog NNR. There are seven Water Framework Directive (WFD) river water bodies within the ZoI.

xl. The potential Water Quality, Resources and Flood Risk effects during construction include: deterioration in the water quality of surface water bodies from sediment laden run-off; effects on hydromorphology and flow regime of surface water bodies as a result of increased run-off, dewatering of excavations and sediment inputs from working areas or direct watercourse disturbance; deterioration in the water quality of surface and groundwater bodies affected by disturbance of contaminated land or accidental spillage of pollutants; deterioration in water quality due to permitted discharges from construction; impacts on groundwater levels from dewatering activities and the effects of underground infrastructure; changes to fluvial or tidal flood risk associated with raised structures in the floodplain; and changes to surface water flood risk due to changes in run-off rates and flow pathways resulting from ground disturbance and creation of new impermeable surfaces. The potential effects during operation include: potential for accidental contamination entering watercourses associated with spillage or leakages; ground disturbance and mobilisation of sediments or contaminants leading to silt laden or otherwise contaminated run-off entering watercourses; physical disruption to existing infrastructure from isolated repairs of joint bay link pillars or cable circuits; changes in channel morphology and fluvial geomorphological processes, should cables become exposed at watercourse crossings; changes to fluvial or tidal flood risk associated with loss of floodplain storage and change in floodplain flow conveyance, where permanent above ground infrastructure is in tidal or fluvial flood zones; changes to surface water flood risk due to changes in flow pathways and runoff rates resulting from changed ground levels and creation of new impermeable surfaces for permanent above ground infrastructure; and changes to groundwater flood risk due to presence of underground infrastructure.

xli. Mitigation measures including an Environmental Management Plan, Flood Evacuation Plan, Pollution Prevention Plan and a Pollution Incident Response Plan will be applied. Construction works will take place during periods of normal to low flow conditions and floodplain compensation will be implemented to account for the volumetric displacement of flood water from the proposed works.

xlii. The WFD Assessment concludes that the Glaslyn Cable Works would not impact on the WFD status or objectives of any associated surface water or groundwater bodies near the Glaslyn Cable Works. The assessment also concludes no adverse impacts on Protected Areas in hydrological connection with the scheme. The Glaslyn Cable Works would not prevent the achievement of the wider WFD objectives in the Western Wales River Basin District (RBD) and is not predicted to have an impact on any other water body within the Western Wales RBD or mitigation measures developed to achieve good status.

xliii. The assessment has demonstrated that the construction and operation of the proposed works, in combination with the identified mitigation measures, is mostly not anticipated to have significant impacts on the aquatic environment or water resources in the ZOI.

xliv. There is however potential for significant effects on flood risk during the construction and operation of the proposed works. The flood risk impact on residential receptors is currently assessed as being potentially significant. However, additional mitigations are being prepared to address this and will be submitted as supplementary environmental information. When this information is submitted, it is anticipated that it will be possible to conclude that there will be no significant impacts on flood risk during the construction and operation of the proposed works.

Traffic and Transport

xlv. Several roads on the local and strategic highway network could be used by traffic associated with the proposed works and could be subject to increases in traffic. The roads identified cover likely routes to the Glaslyn works site from the Strategic Road Network (SRN) and from local and regional population centres between a 30–45-minute drive time of the Glaslyn works site. This is the likely catchment area for construction traffic. The roads in the Study Area included the A487 west of A498, A498 south of A487, A498 north of A487, A497 south of A498, Penamser Road, Brittania Terrace/A497, A487 west of Minffordd Roundabout, Church Street, A498 east of Church Street Junction, Porthmadog High Street, A487 west of Porthmadog High Street Junction, A487 east of Porthmadog High Street Junction and an unnamed Road (north of Porthmadog Roundabout). Automatic Traffic Counts (ATCs) have been carried out at specific locations on the roads above which, collectively, form the Study Area.

xlvi. The roads in the Study Area form part of the SRN, local highway network and unclassified roads. There are four footpaths, two bridleways and one NCR that intersect the Glaslyn works site. The Study Area is served by several bus routes and two passenger rail stations: Porthmadog Railway Station and Minffordd Railway Station. There is a station in Porthmadog for the FfWHR. Between 2016 – 2022, there were 41 collisions in the Study Area, 15 serious and 26 slight. The ATCs were carried out at 13 locations between 26 September – 02 October 2024 (due to a sensor failure during this period, the survey along Penamser Road was completed between 09 October – 15 October 2024) concluded the 24-hour annual average daily traffic was 76,407, 2,004 of which were heavy duty vehicles.

xlvii. The potential construction impacts associated with the proposed works include severance of communities, driver delay, non-motorised user amenity, fear and intimidation, road safety and accidents, total traffic increase, heavy goods vehicles (HGVs) increase. No operational effects are anticipated as operational traffic levels are expected to be no different from the baseline.

xlviii. Embedded mitigation measures include establishing appropriate access points to facilitate vehicle movements, designing bell mouth junctions to accord with relevant standards and carrying out swept path analysis for abnormal indivisible loads (AILs) and HGVs. AILs and HGVs would follow designated routes, internal routes would be unitised where practicable to avoid using the existing road network, traffic management would be employed where construction vehicles need to interact with the public road network, a Delivery Management System would apply to control deliveries, construction staff would be directed to take the most direct route to the proposed works and would be encouraged to car share.

xlix. No significant adverse effects are anticipated at any of the assessed links. Despite HGV traffic levels at some links being expected to increase by more than 30%, none of the links will experience increases substantial enough to result in significant impacts.

Air Quality and Emissions

l. An area within 10 km of the Glaslyn works site has been considered with respect to published baseline information on existing air quality, however specific Study Areas were used to assess dust emissions generated during construction activities: dust emissions from construction activities include amenity or human health receptors in 250 m of the construction site and 50 m of the construction route; and ecological receptors in 50 m of the site or construction route, up to 250 m from the Glaslyn works site entrances.

li. There are 2,575 receptors which are sensitive to dust spoiling i.e. residential properties, car show rooms, long stay car parks, playing fields and farmland, within the Study Area. 2,575 receptors have been identified within the Study Area which will have sensitivity to human health impacts of increased PM_{10} caused by the construction dust. Receptors include residential properties, schools, parks, shops and bus shelters. In addition, there are four nationally designated sites within the Study Area which are potentially sensitive to the impacts of dust settling either directly or indirectly through increased stresses on plant life. These are the Coedydd Derw a Safleoedd Ystlumod Meirion/Meirionnydd Oakwoods and Bat Sites Special Area of Conservation, Glaslyn Site of Special Scientific Interest, Ysbyty Bron y Garth Site of Special Scientific Interest and Tyn-Llan Site of Special Scientific Interest.

lii. The source of potential Air Quality and Emissions during construction includes construction dust emissions and site plant emissions. Dust emissions are assessed using Institute of Air Quality Management guidelines and considers demolition earthworks, construction activities and trackout, all of which were classed as having a large magnitude. The area surrounding the Glaslyn works site is deemed to have medium to high sensitivity to dust soiling, human health impacts, and nature conservation impacts. The large dust emissions magnitude and the medium to high sensitivity of the area equates to a medium to high impact of dust soiling, human health and nature conservation receptors. The impact of operational emissions has been scoped out of this assessment.

liii. A series of mitigation measures recommended by the Institute of Air Quality Management would be adopted during construction and regular site visits would be conducted to monitor compliance with the CEMP. By applying dust mitigation throughout the Glaslyn works the residual effects from the proposed works are anticipated to be low or negligible and not significant.

Noise and Vibration

liv. The Study Area has been defined as 300 m from the Glaslyn works for construction noise site and 100 m for construction vibration. Baseline monitoring surveys were undertaken at five locations to establish the ambient noise levels. There are 943 sensitive receptors within the Study Area which were all are defined as of medium sensitivity to noise.

lv. During construction there are seven Noise Generating Activities (NGA) that may result in potential adverse noise and vibration effects: NGA1 – preliminary works; NGA2 – CSEC enabling works; NGA3 – Glaslyn cables installation and decommissioning (open cut cable laying); NGA4 – Glaslyn cables installation and decommissioning (HDD crossings); NGA5 – Garth CSEC removal; NGA6 – land reinstatement and NGA7 – demobilisation. It is predicted that the daytime construction noise levels would be highest during the NGA1, NGA2 and NGA6. During NGA1, major adverse effects have been identified at two receptors and moderate adverse effects at four receptors; during NGA2, moderate adverse effects have been identified at seven receptors; during NGA4, major adverse effects have been identified at three receptors; during NGA6, moderate adverse effects have been identified at 10 receptors; and during NGA7, moderate adverse effects have been identified at two receptors. The remaining receptors at each NGA would, at worst, experience minor adverse effects. Vibratory rollers may generate significant levels of vibration at receptors within 25 m and two receptors are identified within 25 m of a haul road where vibratory rollers may be used. Both receptors may experience a moderate adverse effect. Significant vibration effects are not anticipated at any other receptor.

lvi. Mitigation measures include Section 61 prior consent, measures to control noise as defined in Annex B of BS 5228-1 and measures to control vibration as defined in Section 8 of BS 5228-2 adopted where reasonably practicable. A Communication Strategy would be produced, and temporary barriers used to screen receptors experiencing significant effects.

lvii. Given the application of mitigation measures to be secured in the CEMP, proposed works would not result in any significant noise and vibration effects.

Socio-Economics

lviii. Various Study Areas were used for the Socio-Economics assessment: a 60-minute drive area (Principal Economic Impact Area) which applies to employment generation, skills and training and gross value added; a 30-minute and 60-minute drive area for temporary accommodation services; up to 500 m radius from the Glaslyn works site for PRoW and agricultural land holdings, residential properties, business premises, visitor attractions and development land; and a 1 km radius from the Glaslyn works site for community facilities.

lix. The baseline outlines the population, economy and local resources in the various Study Areas. The Principal Economic Impact Area had a population of 297,517 in 2021, with 25.3% of the population aged over 65. Employment rates in the Principal Economic Impact Area show a smaller proportion of economically active individuals. Employment by industry is similar to Gwynedd and Wales, the largest industries include human health and social activities; wholesale and retail trade; and repair of motor vehicles and motorcycles. Gwynedd is relatively less deprived on average compared to Wales. Accommodation capacity in a 30-minute and 60-minute drive of the Glaslyn works site is sufficient, although it varies seasonally. There are six PRoW within the Glaslyn works site, four footpaths and two bridleways. NCR 8 partially falls in the Glaslyn works site and the Gwynedd long distance trail costal path and an informal recreational route fall within 500 m of the Glaslyn works site. There are a further 32 PRoW within 500 m. There are 38 community facility within 1 km; 18 dedicated open spaces, two visitor attractions, 169 business premises and several residential properties within 500 m of the Bryncir works site. There are 14 agricultural land holdings within the Glaslyn works site. There is no development land in 500 m of the Glaslyn works site.

lx. During construction, the proposed works will support, on average, seven total net jobs per day. Of those, two jobs will be expected to be taken up by residents within the Study Area. Murphy, an engineering and construction company, who will be supplying 100% of the construction workforce aims to have a minimum of 10% of employees being emerging talent

(apprenticeships, graduates and university placement students). There will be a beneficial impact on the local workforce relating to training and skills uplift. The proposed works will generate approximately £560,000 to the national economy, of which approximately £140,000 would likely be in the Study Area. During peak workforce employment and typical seasonal occupancy levels, 100% of the construction workforce could be accommodated within a 30 and 60-minute drive time of the Glaslyn works site. Where the PRoWs cross the Glaslyn works site, it will be fenced to create a designated crossing point. To install ducts, there may be a temporary requirement to create a diversion for a short duration. There will be nine receptors which would experience temporary land take to facilitate construction works. There is potential for permanent impacts on agricultural land holdings for the installation of raised link boxes and construction of the Wern CSEC extension and proposed Minffordd CSEC.

lxi. No additional mitigation or enhancement measures are required, due to no significant adverse effects associated with Socio-Economics being identified. No likely significant residual effects of the proposed works on Socio-Economics receptors are found.

Climate Change

lxii. The Study Area for the greenhouse gas (GHG) assessment includes direct greenhouse gas emissions (arising through works on the Glaslyn works site) and indirect greenhouse gas emissions (occurring outside the Glaslyn works site). The Climate Change Risk Assessment Study Area encompasses the temporary and completed works that make up the proposed works. The In-combination Climate Change Impact Assessment is determined by the other topic assessments.

lxiii. The GHG assessment uses the current condition of the Glaslyn works site, which consists of the carbon stock and sources of greenhouse gas emissions as the baseline. Greenhouse gas emissions are reported in line with the life cycle stages (pre-construction, product, construction process and operation). It is estimated the 90% of all emissions from the proposed work will arise from the pre-product, product and construction process stages. Based on a qualitative assessment, the impact of greenhouse gas emissions associated with the proposed works is minor adverse and not significant. No additional mitigation is required.

lxiv. The GHG assessment is consistent with the ruling of the UK Supreme Court in the case of Finch v Surrey County Council. That ruling requires that planning authorities take account of the indirect as well as the direct environmental effects of a proposed development. The qualitative GHG assessment for the proposed works includes all relevant direct and indirect environmental impacts.

lxv. The Climate Change Risk Assessment considers how resilient the proposed works and surrounding environment are to current and projected climate hazards. The climate risks were assessed as moderate, unlikely, or rare. While the event is possible, its occurrence is infrequent, with some evidence suggesting a potential shift from business as usual. The likelihood of the event is estimated to be between 0% and 50%. Fourteen of the 27 initial risk ratings risks were deemed to have a ‘significant’ impact on the proposed works: 12 occurring in the 2070 – 2099 period, and the remaining two in the 2010 – 2039 and 2040 – 2069 periods.

lxvi. Mitigation measures include weather monitoring, flood contingency planning, flood defence measures, vegetation and land management and underground cable protection. Following the implementation of these mitigation measures, the CCRA identified nine significant residual effects across the operational phase of the proposed works.

lxvii. Overall, the GHG impact of the proposed works will be minor adverse and not significant. The CCRA identified 11 significant climate risks during the operational phase of the

proposed works. The control measures and embedded adaptations have resulted in seven significant residual climate risks being identified.

Materials and Waste

lxviii. Two Study Areas were used for the Materials and Waste assessment: a Glaslyn works site Study Area in which waste associated with the proposed works is generated, and an expansive Study Area within which landfills and other waste facilities that manage waste generated by the proposed works are likely to be located.

lxix. The non-hazardous and inert landfill void capacity for Wales (8.3 million cubic metres (m^3) and 1.8 million m^3 respectively). Waste will be generated from the following construction activities: decommissioning of the existing cables (redundant cables, waste oil, vegetation clearance, concrete, steel, thermocoupler bays, cable markers and cable bridges), decommissioning of the Garth CSEC (redundant underground services, foundations, earthing and platform granular material) and Minffordd and Wern CSEC construction and cables installation (vegetation clearance, excess construction materials, surplus excavated material, waste drilling fluid and cuttings from HDD work, material packaging, construction worker waste, waste oils from construction plants, aggregates, geotextile, geomembrane, fencing, paints and coatings).

lxx. The proposed works have been designed as far as possible to avoid and minimise the impacts and effects on Materials and Waste. The following embedded mitigation measures have been implemented: design for reuse and recovery (using materials that already exist on-site), design for materials optimisation (simplifying layout and form to minimise material use) and design for off-site construction (maximising the use of prefabricated structure and components).

lxxi. There are no significant residual effects associated with construction of the proposed works and an assessment of the operation and decommissioning is scoped out of the assessment on the basis the effects would be of a similar or lower magnitude to those identified for construction.

In-combination Effects

lxxii. In-combination effects occur where a single receptor is affected by more than one type of effect arising from different aspects of the proposed works. In-combination effects are not assessed in this Volume; an assessment of the potential in-combination effects is carried out at a Project level and is discussed in **Volume 7: The Project and Cumulative Effects**.

Cumulative Effects

lxxiii. Cumulative effects occur when two or more planned developments impact the same receptor leading to an increase in the effect, and possibly an effect of greater significance. A 2 km buffer from the Glaslyn works site has been implemented to assess the cumulative effects.

lxxiv. One proposed development was identified for potential cumulative effects. This comprised the erection of eight new flexible business/industrial units (Use class B1, B2, B8) with associated parking and landscaping.

lxxv. The cumulative effects have been assessed in **Volume 7: The Project and Cumulative Effects**.

1. Introduction

1.1 Introduction

1.1.1 Volume 4 (this document) forms part of the Environmental Statement (ES) that accompanies applications by National Grid Electricity Transmission plc (NGET) to construct and operate developments that comprise parts of the Pentir to Trawsfynydd Reinforcement Project (the 'Project').

1.1.2 This volume focuses on the Glaslyn Cables. It provides an assessment of likely effects that could arise from the construction and operation (including maintenance) of this aspect of the Project. A description of the Glaslyn Cables works is provided in **Chapter 2: Glaslyn Cables Works**.

1.2 Structure of the Volume

1.2.1 This volume is structured as follows:

- **Chapter 1: Introduction.**
- **Chapter 2: Glaslyn Cables Works.**
- **Chapter 3: Assessment of Alternatives.**
- **Chapter 4: Landscape and Visual Amenity.**
- **Chapter 5: Ecology and Nature Conservation.**
- **Chapter 6: Historic Environment.**
- **Chapter 7: Geology, Hydrogeology, Land Use and Agriculture (Soils).**
- **Chapter 8: Water Quality, Resources and Flood Risk.**
- **Chapter 9: Traffic and Transport.**
- **Chapter 10: Air Quality and Emissions.**
- **Chapter 11: Noise and Vibration.**
- **Chapter 12: Socio-Economics.**
- **Chapter 13: Climate Change.**
- **Chapter 14: Materials and Waste.**
- **Chapter 15: In-combination Effects.**
- **Chapter 16: Cumulative Effects.**

1.3 Figures and Appendices

1.3.1 All figures noted in this volume are in an appendix attached to this volume, all other supporting documents will be compiled in **Volume 8: Appendices**.

1.3.2 The figure numbering system is as follows: Volume number, chapter number then 1, 2, 3 etc. For example, **Figure 4.1.1**.

1.3.3 The appendix numbering system is as follows: Volume number, chapter number, then A, B, C etc. For example, **Appendix 4.1.A**. All figures associated with a given appendix will follow the same system, followed by the figure number, for example, a figure to Appendix 1.1.A would be Figure 1.1.A.1, 2, 3 etc.

2. Glaslyn Cables Works

2.1 Introduction

2.1.1 This chapter provides a description of the works required to replace the existing 400 kilovolt (kV) and 132 kV cables in the Glaslyn Cables section of the Project (the 'proposed works'). The proposed works include new proposed infrastructure, construction, removing some redundant infrastructure, measures to retain other redundant infrastructure and operation details. The proposed works would take place between the existing Wern cable sealing end compound (CSEC) (SH 543401) and the existing Garth CSEC (SH 595387) (**Figure 4.2.1**), Porthmadog (the 'Glaslyn works site').

2.2 Background

2.2.1 When the Central Electricity Generating Board applied to the Ministry of Power, Electricity Division for permission to build and operate the overhead line between Pentir and Trawsfynydd in a series of applications during 1963 and 1964, permission was not granted for the then proposed section of overhead line between the current Wern and Garth CSECs. This section of the electricity line route was installed as underground cables as two circuits; an 'inland' 400 kV circuit (circuit A) and a 'coastal' 132 kV circuit (circuit B). The CSECs at Wern and at Garth connect the underground cables and the overhead lines.

Existing Cables and CSECs

400 kV Cables

2.2.2 The 'inland' A circuit of the 4ZC operates at 400 kV between Pentir and Trawsfynydd. The existing cables between Wern and Garth CSECs are installed and operate at 400 kV. There is one cable per phase, meaning that there are three underground cables comprising this circuit. The route of these existing cables, approximately 6 kilometres (km), is shown in **Figure 4.2.2**. The existing 400 kV cables exit the Wern CSEC to the north and immediately turn south-east, running in parallel to the south of the Nant yr Afon-oer. The cables cross beneath the A498 and continue east, intersecting Y Cyt. As the cables approach the A487 Porthmadog Bypass, the cables turn south-east, passing south of the Porthmadog Roundabout, north of Ysgol Eifionydd, and beneath the Welsh Highland Heritage Railway (WHHR) and Ffestiniog & Welsh Highland Railway (FfWHR) and a caravan park off Snowdon Street. Approximately 20 metres (m) east of the caravan park, the cables turn south, intersecting the Cambrian Coast Railway Line before continuing in an east to south-east direction. The cables broadly follow the Cambrian Coast Railway Line, crossing the Afon Glaslyn before reaching the Garth CSEC.

2.2.3 The existing 400 kV cables are nearing the end of their operational life and as installed could not operate at the capacity now required for the Pentir-Trawsfynydd circuits. The existing 400 kV cables need replacing with two new cables per phase.

132 kV Cables

2.2.4 The 'coastal' B circuit of the 4ZC operates at 132 kV between Trawsfynydd and Tower 4ZC070 south of Bryncir. At Tower 4ZC070, a feed is taken to provide a supply to the 132 kV SP Energy Networks (SPEN) DB route overhead line which feeds electricity into the Llŷn Peninsula.

2.2.5 The route of the existing 132 kV underground cables, approximately 5.6 km, is shown on **Figure 4.2.2**. The existing 132 kV cables exit the Wern CSEC to the east and immediately head south-east, running in parallel to the south of the existing 400 kV cables and Nant yr Afon-oer. The cables cross beneath the A498 and continue south-east to Pensyflog, the cables follow Pensyflog and intersects the A4971 High Street. The cables then head east, over Y Cyt, to the north of Cambrian Coast Railway Line. Approximately 215 m east of High Street, the cables turn south, intersecting the Cambrian Coast Railway Line before continuing in an east direction. The existing 132 kV cables broadly follow the Cambrian Coast Railway Line, crossing the route of the existing 400 kV cables 340 m east of Snowdon Street. The 132 kV cables cross the Afon Glaslyn before terminating at the Garth CSEC.

2.2.6 The existing 132 kV cables between Wern and Garth CSECs on this circuit cannot be upgraded to operate at 400 kV, nor to meet the capacity now required on the circuit. The existing 132 kV cables (two cables each with three phases), need replacing by 400 kV cables with two cables per phase.

Wern CSEC

2.2.7 Wern CSEC is between Pentrefelin and Porthmadog (SH 543401), north of Wern Manor, and is accessed via a single lane road from the A497 or via a track from the north. The existing CSEC is approximately 50 m by 23 m and accommodates six 132 kV cable sealing ends, three 132 kV post insulators, three 400 kV cable sealing ends, three post insulators, a gantry with 400 kV and 132 kV conductors that supports the overhead line downleads from Tower 4ZC044, busbars, pressure tanks, a Lucy Pillar for high voltage cables and earthing infrastructure within security fencing.

2.2.8 The compound will be extended to accommodate the new 400 kV double circuit cable connection (two cables per phase).

Garth CSEC

2.2.9 The existing cables connect to the 4ZC overhead line at Garth CSEC and the existing overhead line heads east, entering Eryri National Park. Garth CSEC is in Minffordd (SH 595387) and is accessed from Syenite Terrace. The existing CSEC is approximately 50 m by 23 m and accommodates six 132 kV cable sealing ends, three 132 kV post insulators, three 400 kV cable sealing ends, three post insulators, a gantry with 400 kV and 132 kV conductors that supports the overhead line downleads from Tower 4ZC037, busbars, pressure tanks, a Lucy Pillar for high voltage cables, earthing infrastructure and a compound concrete slab within security fencing.

2.2.10 The Garth CSEC will become redundant when the Eryri Visual Impact Provision (EVIP) project cables connect to the replacement cables at Minffordd CSEC (described later in this chapter). In the absence of this Project, the EVIP project would include the removal of tower 4ZC037 and the downleads to the gantry at Garth CSEC but the CSEC would be retained and require an extension.

2.3 Proposed Glaslyn Works

2.3.1 The Glaslyn works include the installation of replacement 400 kV cables, the Minffordd CSEC, the Tunnel Head House (THH) similar to that consented under the EVIP project, and the extension of the Wern CSEC, as well as the decommissioning of the existing 132 kV and 400 kV cable circuits including the Garth CSEC. The Glaslyn works site, shown on **Figure 4.2.3,** covers an area approximately 106.4 hectares (ha). The land within the Glaslyn works site comprises access roads, turning areas, construction compounds and laydown areas required for the construction and operation of the works.

Proposed Glaslyn Works Site

2.3.2 Between the existing Wern and proposed Minffordd CSECs, the Glaslyn works site would comprise approximately 6 km of works of variable widths.

2.3.3 The Glaslyn works site comprises undulating land. The Wern CSEC lies at approximately 10 m Above Ordnance Datum (AOD) and moving east the land reaches a low point of 3 m AOD before rising to 5 m at the A498. Continuing east, the land fluctuates between 1 m and 5 m AOD as the replacement cables pass across the Porthmadog Roundabout, beneath the A487 Porthmadog Bypass, across the WHHR, FfWHR, north of the Clwb Chwaraeon Madog before turning south and beneath the A487 Porthmadog Bypass again. As the replacement cables pass through the Glaslyn Site of Special Scientific Interest (SSSI), the land rises from 0 m AOD to a peak of 7.5 m AOD immediately west of the Afon Glaslyn. To the east of the Afon Glaslyn, the land gradually increases from 0 m AOD to 3 m AOD at the proposed Minffordd CSEC.

2.3.4 The Glaslyn works site is characterised by predominantly rural land uses with scattered woodland. A large proportion of the Glaslyn works site is on agricultural land, which the Agricultural Land Classification (ALC) data identifies as Grade 5 (very poor quality) with small patches of Grade 3a (good to moderate) west of Porthmadog Roundabout and surrounding the proposed Minffordd CSEC (Ref 2.1).

2.3.5 The eastern extent of the Glaslyn works site would cross the Glaslyn SSSI, which is designated for its biological interest including floodplain grassland, riverine habitat, vascular plant and breeding bird assemblage and broadleaved woodland, particularly alluvial wet woodland. The Glaslyn works site also intersects part of the Coedydd Derw, a Safleoedd Ystlumod Meirion/Meirionnydd Oakwoods, and Bat Sites Special Area of Conservation (SAC) which is designated for a variety of habitats including woodland, heath and rivers, and the lesser horseshoe bat. A very small area of Ysbyty Bron y Garth SSSI is crossed by the existing 400 kV and 132 kV cables and Glaslyn works site, the existing cables would be left in-situ.

2.3.6 The Glaslyn works site crosses several Public Rights of Way (PRoW) including the Dolbenmaen No 107, Porthmadog No 6, 8 and 11 footpaths and Porthmadog No 10 and 37 bridleways (Ref 2.2). There are numerous other PRoWs in the wider area. Generally, access will be maintained, with temporary local diversions for short durations during duct installation. However, footpath Porthmadog No 11 may require a temporary closure.

2.3.7 The Glaslyn works site intersects National Cycle Route (NCR) Route 8, which runs through the centre of Porthmadog (Ref 2.3). A temporary surfaced track to the west of the current location will be provided during the works.

2.3.8 The proposed works are described in the following sections sequentially from Wern CSEC to Garth CSEC.

Wern CSEC

2.3.9 The existing CSEC would be modified to accommodate 12 replacement cables comprising two cable circuits each containing three phases, with two cables per phase. Works include new foundations and support steelwork, high voltage electrical equipment (a surge arrestor, earth switches and cable sealing ends). This work would require an extension to the existing Wern CSEC, including an extension to the earth mat (a mesh of metallic conductors shallowly buried). Drainage, access and hard standings would also form part of the works. The compound would be extended to the east, increasing the size from approximately 50 m by 23 m to 52 m by 49 m. The existing fence would be removed and 2.4 m high fencing would be reinstalled around the larger footprint (see **Figure 4.2.4**). Some trees would need to be removed to the east of the current CSEC to accommodate the extension.

2.3.10 A new permanent access road would be built from the west of the A498, approximately 1.26 km long and 5 m wide. The current access is restricted and would not be able to support the delivery of equipment and plant needed for the works. The access road would cross three ditches via permanent short span beam bridges. The new road would provide access to the CSEC along the eastern boundary via a 6 m wide, manually operated gate. The access road would also pass around the northern boundary of the CSEC, to the west of the CSEC where it splits into two short sections creating a 'hammerhead', allowing for vehicle turning. Four gates would be erected along the access road, one near the entrance from the A498, one after the first ditch crossing and two further gates after the second ditch crossing. The new access road would connect with two existing accesses, 180 m and 280 m east of the extended CSEC, that provide access to the fields north of the Nant yr Afon-oer. A filter trench would run in parallel to the access road from the CSEC to the A498 and would comprise headwalls at ditch crossings and periodic 450 millimetres (mm) inspection chambers.

2.3.11 To provide a low voltage electricity supply, a short section of 11 kV conductor would run from the existing 11 kV line to terminate on a new 11 kV single wood pole with a transformer and metering unit on it. An 11 kV underground cable would run from the pole south along the existing west fence line and into the CSEC.

Glaslyn Cables

2.3.12 The redundant 132 kV cables and 400 kV cables would be removed in part with some sections being left *in situ* due to amenity and ecological sensitivities detailed below and shown on **Figure 4.2.2**.

2.3.13 The existing cables use oil-impregnated paper as thermal and electrical insulation and the oil is kept under pressure from tanks installed along the route. Removing redundant cables requires full excavation of the cables in the ground and so is avoided in areas where this could cause damage to sensitive habitats, such as in designated sites, or would cause disturbance to protected species where this can be reasonably avoided. Where existing cables are to be left *in situ*, they will be cut at predetermined locations (low points and joint bays), drained of oil and purged by flushing with nitrogen to extract as much oil as possible before being capped. These cut and capped cables are then housed in monitoring pits. Monitoring pits will be installed at low points and joint bays

with sumps to collect any oil that escapes. Periodic visits will be made to remove oil that has collected, initially quarterly, reducing to every six months, then yearly.

2.3.14 Where the existing cables are being removed there is a risk of oil leaking from the cables. This risk needs to be managed by the same process of draining and capping the cables, prior to removal from the ground, to minimise the likelihood of leaks during cables removal.

2.3.15 The replacement 400 kV cables will be cross-linked polyethylene (XLPE) cables which do not contain oil-impregnated paper or oil. They do not require oil tanks and there is no risk of oil escape during installation, operation or when they are redundant.

2.3.16 The lengths of replacement cables that can be installed beneath land depend on the extent of cable that can fit on a drum which can be transported to the installation sites. Each section of cable needs to be 'jointed' to the next. Cable jointing is a carefully controlled work activity which requires very clean conditions to avoid contaminating the cable and risking failure and compromising operation. Cable jointing is carried out in joint bays in which the joints are sealed on completion and then buried. The design has taken cable length, accesses and transportation restrictions into consideration in the placing of joint bays along the route.

2.3.17 The cables may have induced currents on their metallic sheaths which can give rise to losses and difficulties during operation. This risk is greatly reduced by making a cross bonding of the cable sheaths, the cables are cross bonded using copper bonding leads joining the differing phases of the cable joints at the joint bay location.

2.3.18 The temperature of cables is monitored by thermocouples installed at joint bays. The information is relayed by the fibre optic cable installed with the electricity cables and which connects to the fibre optic carried along the earthwire of the 4ZC overhead line.

2.3.19 Link pillars would be installed above ground at each joint bay to allow monitoring of the replacement cables. Due to the flood risk in the area some link pillars would be installed above the existing ground level, by creating a 'mound' approximately 2.9 m AOD, using existing material which has been excavated from the joint bay. The link pillars will be light grey (RAL 7032). On the existing cables these are kiosks which are visible at intervals.

2.3.20 The position of the cables at road crossings and at other locations along the route is indicated by occasional cable markers which typically are concrete and approximately 16 centimetres (cm) wide x 7.5 cm deep and 77 cm high with two thirds above ground. **Plate 2-1** shows a cable marker.

2.3.21 Each of the existing cables is marked below ground with warning tape and with cable protection tiles below the tape and above the cable. Any excavation above a cable would first disturb the warning tape and then, below the tape, the solid warning tiles.

2.3.22 The replacement cables would be installed in unplasticised polyvinyl chloride (uPVC) ducts which would be pre-installed prior to sections of cables being pulled through between joint bays. To place the uPVC ducts, the ground is first excavated to the required dimensions and then cement bound sand (CBS) is installed as duct bedding. The PVC ducts are then installed onto the bedding and connected together in 6 m lengths via push-fit connections. Above the ducts a layer of CBS is installed as

'surround' material. The warning tape and cable protection tiles are then placed above the CBS, as the backfill process is completed.



Plate 2-1 – An example concrete marker post

Cable Decommissioning Works

2.3.23 The following two sections describe the specific decommissioning works associated with the existing 400 kV and 132 kV cables. Sub-sections have been used which split the cable route according to sections of cable that would be removed and left *in situ* from west to east. Each sub-section describes the proposed works that would be undertaken.

2.3.24 All redundant sections of the Glaslyn Cables will be made safe before being left *in situ*. The oil would be drained from the cables and monitoring pits installed. Monitoring would initially be quarterly, reducing every six months, then yearly. The results of the monitoring will serve to establish the monitoring regime for a period of approximately 10 years.

400 kV Cables

Wern CSEC – Porthmadog Roundabout

2.3.25 A 2.6 km section of the existing 400 kV cables between the Wern CSEC and a point 140 m south-east of the Porthmadog Roundabout would be removed (**Figure 4.2.2, pages 1 – 3**). A monitoring pit would be installed at the end of this section. The following works would be required:

- Eighteen cable markers[1] would be removed.
- Fourteen joint bays[2] would be decommissioned and removed.
- Four cable bridges[3] that cross four ditches would be decommissioned and removed. Another cable bridge that comprises nine precast beams spanning approximately 14.1 m across the Y Cyt would also be decommissioned and removed The bridge

[1] Cable markers provide a clear, visual indication of the presence of live underground cables.

[2] A joint bay is an excavated area to allow for joining different sections of cables.

[3] A cable bridge is a bridge used to carry electric cables over watercourses.

foundations will be cut 1 m below the surface and left in place to ensure ground stability.

- The existing cables crossing the A498 are inside 12-inch uPVC pipes filled with bentonite and encased in concrete below the tarmac. The cables would be cut, oil extracted, and the pipe capped on one side, then pulled out from the other side. The ducts crossing the road and the concrete mix encasement would be left *in situ* unless there is a benefit from removing them at the time the new corridor section closes the road for construction works.
- Four thermocoupler pits[4] would be decommissioned and removed.
- Vegetation clearance would be required in multiple areas within this section.

Porthmadog Roundabout – 355 m east of the Afon Glaslyn

2.3.26 A 2.6 km section of the existing 400 kV cables between the point 140 m south-east of the Porthmadog Roundabout and point 355 m east of the Afon Glaslyn will be left *in situ* due to amenity and ecological sensitivities (**Figure 4.2.2, pages 3 – 5**). A monitoring pit would be installed at the end of this section. The following work in this section would be required:

- A 20 m section of existing 400 kV cables which crosses a north-south running watercourse, east of Ysgol Eifionydd would be decommissioned and removed. The cables would be cut and plumbed into the monitoring pits that would be installed on both sides of the watercourse. The cable bridge would be decommissioned and removed.
- Of the 14 joint bays in this section:
  - One would be left *in situ*, the buried link box frame would be removed.
  - One would be decommissioned and replaced with a monitoring pit. There is also a buried oil tank at this location which will be decommissioned and removed.
  - Five would be left *in situ* and the link box would be removed, two would require additional preparation to reduce pollution risk.
  - Five would be left *in situ* and the link box and cable joining fittings would be removed, all would require the installation of a new monitoring pit and additional planning to reduce pollution risk.
  - Two joint bays would be left *in situ* and the cable joining fittings would be removed, both would require additional planning to minimise risk to the Coedydd Derw, a Safleoedd Ystlumod Meirion/Meirionnydd Oakwoods, and Bat Sites SAC.
- Two thermocoupler pits would be decommissioned and removed, a third would be decommissioned and left *in situ* due to its location within the Glaslyn SSSI.
- Of the 18 cable markers in this section:
  - Seventeen would be replaced for a decommissioned high voltage cable marker (i.e. a marker showing that there is a decommissioned high voltage cable); seven

[4] A thermo coupler pit comprises a sensor used for measuring the temperature of the underground cables.

of the existing cable markers would be left *in situ* if easy access cannot be gained.

- One would be left *in situ*.

355 m east of the Afon Glaslyn – 105 m west of the Garth CSEC

2.3.27 A 255 m section of existing 400 kV cables beneath agricultural fields 105 m west of the Garth CSEC would be removed (**Figure 4.2.2, page 5**). Within this section one cable marker, two joint bays and two thermocoupler pits would be decommissioned and removed. The decommissioned cables would be cut and plumbed into the monitoring pit at the end of the section.

105 m west of the Garth CSEC – Garth CSEC

2.3.28 A 75 m section of the existing 400 kV cables beneath an agricultural field, a block of woodland which forms part of the Ysbyty Bron y Garth SSSI and the Garth CSEC access road, 30 m west of Garth CSEC, would be left *in situ* (**Figure 4.2.2, page 5**). In this section three cable markers would be replaced for decommissioned high voltage cable markers if access could be easily gained; if not the cable markers would be left *in situ*. The decommissioned cables would be cut and plumbed into the monitoring pit at the end of the section.6

2.3.29 A 60 m section of the existing 400 kV cables between the Garth CSEC access road and the Garth CSEC will be removed (**Figure 4.2.2, page 5**). The following works would be required in this section:

- Two cable markers would be removed and one would be replaced for a decommissioned high voltage cable marker if access could be easily gained; if not the cable marker would be left *in situ*.
- One thermocoupler pit would be decommissioned and removed if access could be easily gained; if not it would be left *in situ*.

132 kV Cables

Wern CSEC – A498

2.3.30 A 1.2 km section of existing 132 kV cables between the Wern CSEC and 20 m east of the A498, would be decommissioned and removed (**Figure 4.2.2, pages 1 – 2**). A monitoring pit[5] would be installed at the end of the section. The following works would be required:

- Six cable markers would be removed.
- One joint bay marker would be removed.
- Three joint bays would be decommissioned and removed.
- Four thermocoupler pits, containing moisture sensitive elements, would be decommissioned and removed.

[5] A monitoring pit is an underground concrete pit, approximately 1.2 m wide, with a bitumen coating for waterproofing. The monitoring pits would ensure that any remaining oil can be captured in the future without impact to the surrounding environment.

- Where the existing cables cross three ditches, the ducts and cables would be cut, the cables capped on both ends, cables drained and the cables pulled out of the ducts. The ducts will be grouted and remain *in situ.*
- The existing 132 kV cables crossing the A498 are encased in ducts. The ducts and cables would be cut, the cables capped at both ends, cables drained and pulled out of the ducts. The ducts will then be grouted. These ducts may remain as redundant infrastructure, providing minimal decommissioning works within the road sections. Considerations for additional enabling works shall be in place in case the ducts sections do not reach the fence or wall sections at each side of the road. In which case, temporary removal and reinstatement works will be required.
- Vegetation clearance would be required to the north, and east of the Wern CSEC for its extension.

A498 – 210 m north-west of the proposed Minffordd CSEC

2.3.31 A 3.9 km section of the existing 132 kV cables between a point 20 m east of the A498, through Porthmadog, to a point 210 m north-west of the proposed Minffordd CSEC would be left *in situ* (**Figure 4.2.2, pages 2 – 5**). At the end of this section the decommissioned cables would be cut and capped and a monitoring pit would be installed. The following works would be required:

- The stop joints, north of the Rhandiroedd Cae Rawb Allotments, would be cut out and removed.
- Five joint bays would be left *in situ*. A further two joint bays in the Glaslyn SSSI, one of which also fall within in the Coedydd Derw a Safleoedd Ystlumod Meirion/Meirionnydd Oakwoods and Bat Sites SAC, would be decommissioned and removed. The existing cables would be cut and capped and a monitoring pit would be installed at the joint bay locations within the Glaslyn SSSI and Coedydd Derw a Safleoedd Ystlumod Meirion/Meirionnydd Oakwoods and Bat Sites SAC.
- There are four thermocoupler pits containing moisture sensitive elements in this section. The one north of the Cambrian Coast Railway Line would be decommissioned and left *in situ;* the other three would be decommissioned and removed if access can be gained or left *in situ*.
- At the two ditch crossings, the cables would be cut, drained and capped at each end. Cables will be pulled out of the ducts at one end. The ducts would then be grouted and left *in situ*.
- A 20 m section of existing cables beneath Y Cyt would be left *in situ* due the presence of Japanese knotweed.
- The crossing beneath the A4971 High Street and the ditch crossing to the east of Ysgol Eifionydd would be left *in situ*.
- Additional monitoring pits would be installed at the following locations where the cable would be cut and capped:
  - Immediately south of Y Cyt, between Maes Gerddi and Pensyflog.
  - 70 m east of the Afon Glaslyn.
- Of the 26 cable markers in this section:

- Four would be removed.
- Five would be removed and replaced with an abandoned cable marker.
- Five would be left *in situ*.
- Thirteen would be removed if easy access can be gained i.e. due to dense vegetation or proximity to the Cambrian Coast Railway Line; if not the markers would be left *in situ*.

210 m north-west of the proposed Minffordd CSEC – 105 m west of the Garth CSEC

2.3.32 A 255 m section of the existing 132 kV cables beneath agricultural fields 105 m west of the Garth CSEC would be removed (**Figure 4.2.2, page 5**). At the end of this section the decommissioned cables would be cut and capped and a monitoring pit would be installed. The following works would be required:

- Three cable markers would be removed.
- One joint bay would be decommissioned and removed.
- One thermocoupler pit containing moisture sensitive elements, would be decommissioned and removed.
- Vegetation clearance would be required in the centre of the section.

105 m west of the Garth CSEC – Garth CSEC access road

2.3.33 An 80 m section of the existing 132 kV cables beneath an agricultural field, a block of woodland which forms part of the Ysbyty Bron y Garth SSSI and the Garth CSEC access road, 30 m west of Garth CSEC, would be left *in situ* (**Figure 4.2.2, page 5**). Three cable markers would be removed if easy access can be gained i.e. due to dense vegetation; if not the markers would be left *in situ*. At the end of this section the decommissioned cables would be cut and capped and monitoring pits would be installed at either end.

Garth CSEC access road – Garth CSEC

2.3.34 A 115 m section of the existing 132 kV cables between the Garth CSEC access road and the Garth CSEC itself would be removed (**Figure 4.2.2, page 5**). A thermocoupler pit would also be decommissioned and removed.

Cable Installation Works

New 400 kV Cables

2.3.35 The replacement cables route is illustrated on **Figure 4.2.3;** it is approximately 6 km long and is as direct as possible taking into account environmental and technical constraints. For the most part the cable route is in agricultural fields although it crosses roads, railway and watercourses.

2.3.36 The replacement cables would be installed in ducts via either open cut or trenchless technology. The proposed open cut technique would be trenching and backfill, which would be employed for approximately half of the cable route. The proposed trenchless technology would be Horizontal Directional Drill (HDD), this would be used in for the other half of the cable route where it crosses roads, railway lines and rivers (**Figure**

4.2.4). Small sections of cable within the joint bays and at Wern and Minffordd CSEC's would be installed through direct burial of the cable.

2.3.37 The route exits Wern CSEC in a south-easterly direction and runs parallel to the existing cable alignment and Nant yr Afon-oer to the north and the A497 to the south, approximately 1.2 km from the Wern CSEC, until it reaches the A498, crossing the Afon Bontfaen along the route. The route briefly turns north-east, crossing the A498, near Pont Pen-amser.

2.3.38 Following the A498 crossing the route continues in a north-easterly direction towards the A487. The route crosses the Y Cyt and then Porthmadog No 6 footpath and NCR 8 between Tremadog and Porthmadog. The route then turns in a south-easterly direction and runs in parallel to the existing cables to the south for approximately 320 m. It the turns north-east to cross a gas main, foul water sewer and the existing cable route before continuing south-east towards the Porthmadog Roundabout, which connects the A487 Porthmadog Bypass and High Street.

2.3.39 After the Porthmadog Roundabout the route continues south-east towards Ysgol Eifionydd and its associated playing field. At this location the replacement cables split into two sections, one set of cables turns north-east immediately north of Ysgol Eifionydd, going under the existing cable route and A487 Porthmadog Bypass via HDD. The second set of cables also goes under the existing cable route and A486 Porthmadog Bypass via HDD but from a location 110 m east of Ysgol Eifionydd. The two sets of replacement cables cross the route of the gas main and then reconverge at a location immediately south of the Porthmadog No 37 bridleway.

2.3.40 The route continues east crossing the WHHR and FfWHR north of the Pen-y-Mount Junction Station, Porthmadog No 11 footpath, Porthmadog No 37 bridleway for a second time and Porthmadog No 10 footpath. The route passes along the northern boundary of Clwb Chwaraeon Madog Sports Club and fields before turning in a south-easterly direction towards the A487 Porthmadog Bypass.

2.3.41 The route then turns in a southerly direction going under via HDD the A487 Porthmadog Bypass, Cambrian Coast Railway Line, the Afon Glaslyn, part of the Glaslyn SSSI and Coedydd Derw a Safleoedd Ystlumod Meirion/Meirionnydd Oakwoods and Bat Sites SAC on a curve over a distance of approximately 1 km.. At the end of the curved section , the route would intersect the Glaslyn SSSI and would continue in a north-east direction before terminating at the new Minffordd CSEC, north-west of Minffordd.

Crossings

2.3.42 **Table 2-1** details some of the features that would be crossed by the cables, their location, the method used to cross the feature, the length of time it would take to cross the feature and any additional information regarding the crossing. **Table 2-1** does not provide an exhaustive list of all crossings. Temporary road crossing works associated with cable installation have been assessed in this area and may require traffic management measures, including potential short-term road closures. Specifically, the Porthmadog Roundabout will be constructed using an open-cut method in two halves, ensuring that all exits remain open throughout the works. During each phase, 3-way traffic lights will be in operation to manage vehicle movements safely. Each half of the roundabout is expected to take approximately two months to complete, resulting in a total construction duration of around four months. Detailed arrangements for these measures will be developed and secured through the Construction Traffic Management

Plan (CTMP), which will set out how impacts on the local highway network will be managed and mitigated. The CTMP will be agreed with the relevant highway authority prior to construction.

Table 2-1 – Crossing details

Feature	Location	Method	Approximate duration	Other
24 drainage ditches/watercourses	Various locations.	Open cut and HDD.	12 months	Works will be completed in phases during this time.
Road	A498	Open cut.	3 weeks	Full road closure is required
PRoW	Porthmadog No 6 footpath and NCR 8.	Open cut.	3 months	A temporary surfaced track to the west of its current location will be provided
Bodawen Playground	Immediately west of the Porthmadog Roundabout.	Open cut.	2 years.	The playground would be closed and reinstated post construction.
Road	Porthmadog Roundabout, junction between A487 Porthmadog Bypass and High Street.	Open cut.	4 months (2 months each side)	The roundabout will be open cut in two halves. All exits will remain open with 3-way traffic lights in operation.
School playing field	Ysgol Eifionydd Secondary School, south-east of the Porthmadog Roundabout.	HDD.	2 years	The school playing field would be closed and fenced off from the school grounds; however, the playing field would be reinstated post construction.
Railway	WHHR and FfWHR.	Open cut.	4 months	None
PRoW	Porthmadog No 11 footpath.	Open cut.	2 months	Access would remain along the footpath, with temporary local closures during the duct installation across the path
PRoW	Porthmadog No 37 and No 10 bridleways.	Open cut.	2 months	Access would remain along the footpath, with temporary local closures during the duct installation across the path

Feature	Location	Method	Approximate duration	Other
Road	A487 Porthmadog Bypass.	HDD.	6-months	These crossings will be completed together.
Rail	Cambrian Coast Railway	HDD.	6-months	
River	Afon Glaslyn.	HDD.	6-months	

Cable Characteristics

2.3.43 **Table 2-2** provides a summary of the physical characteristics of the underground cables.

Table 2-2 – Replacement cable characteristics

Parameter	Description
Cable type	XLPE
Nominal voltage	400 kV
Number of cables	12
Approximate cable diameter	145 mm
Approximate weight of cable	37 kilograms per m
Cable trench width	1.55 m (generally)
Cable burial depth	Up to 3.3 m for trenching Up to 18.2 m for HDD depth
Ducts (trenching)	237/250 mm internal diameter/outer diameter, uPVC ducts
Ducts (HDD)	229/280 mm internal diameter/outer diameter, high density polyethylene (HDPE) ducts

Cable Configuration

Open Cut

2.3.44 In the open cut areas three replacement cable phases would be laid in a single cable trench separated by approximately 500 mm (centre to centre), with varying separation between the trenches containing each cable group along the length of the route due to varying constraints and the cable system design requirements. Where space allows, the total width would be up to 23 m, **Plate 2-2** shows a typical cross section of the trenches, cable groups and phases. The proposed separation distances are required due to the cable system design and are also intended to ensure easier access during maintenance activities, and to provide additional space near joint bays to allow link pillars to be installed.

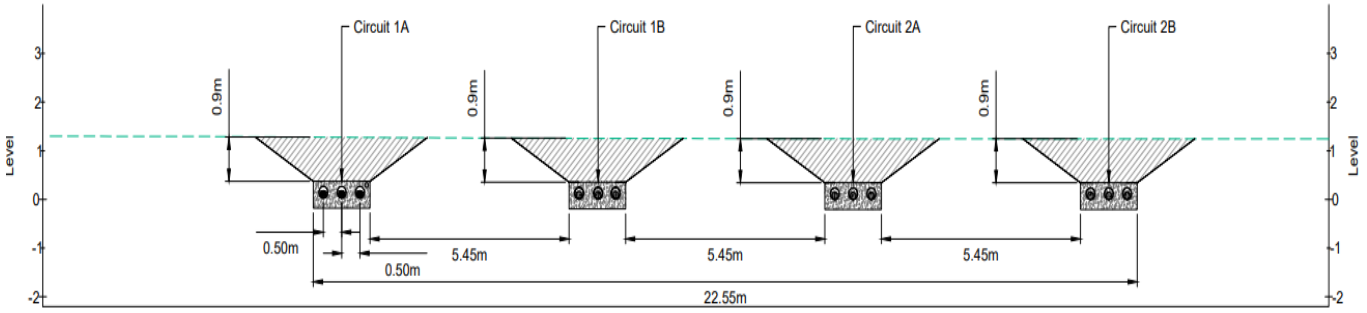


Plate 2-2 – A typical cross section of the cable configuration through trenching

2.3.45 The trench would be backfilled with a combination of cement-bound sand and excavated soils and the ground surface reinstated as appropriate. All backfill materials must be carefully compacted around the cables to ensure no air pockets exist.

HDD

2.3.46 Where the replacement cables are drilled using HDD the cables would be separated and installed in separate ducts. A greater separation is required at increased depth to minimise the effects of heating between the cable phases. Through the HDD sections of the route the spacing would vary from 4 – 10 m, however the spacing would be equal between each duct. A typical cross section of an HDD configuration is shown in **Plate 2-3.**

Joint Bays

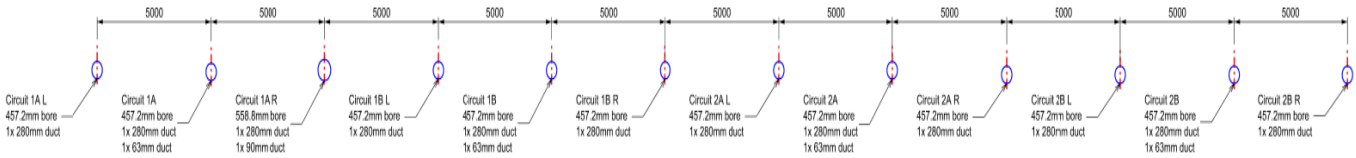


Plate 2-3 – A typical cross section of the cable configuration through HDD

2.3.47 Six joint bays would be required along each phase. Joint bays would be positioned underground in the following locations:

- 250 m west of the A498.
- 620 m west of Porthmadog Roundabout, bound by the A487 Porthmadog Bypass to the north and Y Cyt to the south.
- 100 m south-east of Porthmadog Roundabout.
- 100 m east of the WHHR and FfWHR.
- 350 m south-east of the Clwb Chwaraeon Madog grounds, immediately north of the A487 Porthmadog Bypass.
- 290 m south-west of Minffordd CSEC.

Link Pillars

2.3.48 Each joint bay would require a link pillar, which would be 1 m wide, 0.6 m deep and 1.2 m high. The link pillars would be used to monitor and occasionally test the replacement cables. The link pillars need to be accessed for maintenance using an off-road vehicle and do not require an access track.

2.3.49 At Wern CSEC, one way gantry mounted link boxes would be installed on each phase to provide solid bonding at one end of the cross-bonded section for each cable group. The cable sheath will be solidly grounded via the link box at the cable sealing end.

2.3.50 At Minffordd CSEC, one way gantry mounted link boxes with sheath voltage limiters would be installed on each phase at the single-point bonded cable section.

Minffordd THH and CSEC

Minffordd THH

2.3.51 The Minffordd THH, which forms part of the EVIP project, will be in north Minffordd (SH 593387) and accessed from an unnamed road to the west of the Quarry Lane and Osmond Terrace junction. The Minffordd THH would be 15.18 m x 12.17 m x 6.09 m high and will contain the tunnel shaft. When the EVIP project was commenced, the EVIP cables were proposed to connect to the existing Glaslyn Cables at Garth CSEC described earlier. Planning permission was granted by Gwynedd Council for the Minffordd THH and its access road in December 2020 (Permission Reference C20/0244/08/LL (Ref 2.4)).

2.3.52 The Project presents an opportunity to rationalise and reduce the amount of electricity infrastructure in the locale of Minffordd and Garth. The EVIP project envisaged underground cables connecting its Minffordd THH to the existing Garth CSEC where the existing Glaslyn Cables terminate. However, replacing the Glaslyn Cables allows the new cables to connect to the EVIP underground cables close to the Minffordd THH. When compared to a proposal to replicate the existing Glaslyn Cables' connection at Garth CSEC, the following benefits can be secured:

- The replacement Glaslyn Cables can terminate close to Minffordd THH meaning that a shorter overall length of underground cables is required between Wern and the connection with the EVIP underground cables.
- The EVIP cables can connect to the replacement Glaslyn Cables close to Minffordd THH meaning that a shorter overall length of EVIP underground cables is required from the THH and Garth CSEC becomes redundant and can be removed.

2.3.53 The selection of the cables type to be used on each project is made considering factors including operational suitability, availability and cost-effectiveness. The underground cables that are being used for the EVIP project are a different proprietary type to those to be used for the Glaslyn Cables. The two types of cables are fully compatible in electrical performance and characteristics but cannot be connected (jointed) underground in the way described for sections of the replacement Glaslyn Cables. The replacement Glaslyn Cables would connect to the EVIP underground cables via a new CSEC close to the Minffordd THH. This will be part of a single National Grid installation comprising the CSEC and the Minffordd THH.

2.3.54 The proposed Minffordd CSEC will be constructed on land which was previously identified for landscape works to the north of the consented EVIP Minffordd THH. This means that the landscaping as part of the existing planning permission for the Minffordd THH cannot be implemented as approved. A revised landscape proposal has been included with the Planning Application for the Glaslyn Cables works. Adjustments to the previously consented fencing and drainage have also been made to accommodate the Minffordd CSEC adjacent the EVIP Minffordd THH.

2.3.55 There are two main design differences between the now proposed Minffordd THH and that previously consented. The first is that the now proposed ground level is 1 m higher, which corresponds with the ground level for the proposed Minffordd CSEC to account for changes in flood levels following more recent flood modelling.

2.3.56 The second design change is that the tunnel shaft design shown on the approved drawing PDD-33494-ARC-206 in the Minffordd THH planning application (Ref 2.4) was

circular, but now is proposed to be rectangular The tunnel and shaft comprise permitted development but the tunnel shaft cover and an access to the shaft is shown on the Minffordd THH planning drawings.

2.3.57 The initial EVIP design was to build a circular shaft at Garth up to 35 m deep from which the tunnel boring machine (TBM) would be launched. In detailed design, after the planning permission for the Minffordd THH, a shallower rectangular launch pit (approximately 13 m deep) was shown to offer advantages. These include improved safety during construction, improved access during operation, a reduction in programme and cost, an improved carbon footprint and the ability for an easier launch for the TBM.

2.3.58 This change means that the top of the shaft will be rectangular with a smaller above ground surface cover slab. The previously proposed cover slab was a semi-circle of approximately 15 m diameter. The cover slab now proposed will be 16 m x 3 m with a surface area of approximately 48 metres squared (m^2). There will be an access hatch of approximately 2.25 m x 1.0 m.

2.3.59 The changes outlined from the proposals when the EVIP project commenced mean that the Glaslyn Cables planning application includes a revised Minffordd EVIP THH. A description of the Minffordd THH and CSE proposals is set out below.

2.3.60 The ground level and shape of the top of tunnel shaft, as well as a minor correction to the building height to address previous drawing inconsistencies and a change to the direction of the roof drainage have been made. The rest of the design of the Minffordd THH remains as the previously approved proposal. The design emerged from an appraisal of architectural options including input from stakeholders and from two consultation events in 2018. The design uses the typology of the local village vernacular: scaling down the building mass by using two pitched roofs and enclosing the building in local stone walls.

2.3.61 The dimensions of the THH are 15.18 m x 12.17 m x 6.09 m high. The size of the THH is determined by the requirement for mechanical and electrical equipment to ventilate and access the tunnel and tunnel shaft. The layout plan for the Minffordd THH is shown on drawing GLAS-ARUP-71-XX-DR-X-9240. The THH will provide maintenance access to the shafts and tunnel and contain ventilation equipment to regulate the temperature in the tunnel. The Minffordd THH will accommodate:

- Ventilation plant for the tunnel, shaft and dedicated access staircase.
- Accommodation for operational services such as a control room.
- Shaft access.
- Uninterrupted Power Supplies (UPS).
- Limited Welfare facilities.

2.3.62 Small ventilation fans will be installed in the Minffordd THH to provide air to the sealed staircase. These will be used only when the tunnel is accessed for maintenance.

2.3.63 The external appearance of the Minffordd THH will be in pre-cast stone with a dressed slate grey finish. At the front and back of the Minffordd THH (southern and northern elevations) there will be silver adonised aluminium louvre cladding with painted steel goalpost frame. A slate ashlar wall will surround the Minffordd THH structure. A timber or steel framed roof will be installed with a zinc standing seam roof finish. External

doors are to be louvre clad (in accordance with National Grid's security specification) and will match the external finish of the THH. The surface around the THH will be reinforced grass.

Minford CSEC

2.3.64 The Minffordd CSEC works will include new foundations, cable sealing end structures, high voltage plant and steelworks and earth mat. Elevations of the CSEC are shown on drawing GLAS-ARUP-71-XX-DR-X-9241.

General Layout

2.3.65 The general layout is shown at **Figure 4.2.5.**

2.3.66 All equipment and structures, including the Minffordd THH, would be contained within a raised compound (for flood protection) with ground level at 4.2 m AOD.

2.3.67 The Minffordd site will be accessed via a new permanent access road, from the unnamed road west of the Quarry Lane and Osmond Terrace junction. The access will be approximately 30 m long and oriented in a general north-west direction. Farm style gates will be installed 6 m back from the access entrance. The access road to the Minffordd site will be ramped from a low point at its junction with the unnamed road to the established site levels at the gates.

2.3.68 The operational area will be fenced by a 2.4 m high steel black/brown colour, palisade fence with an electric fence inside it extending a further 1.0 m above the palisade fence. The access into the operational area will be via gates with access controls for use by authorised National Grid persons. There will be three parking bays close to the access gate into the operational area.

2.3.69 Cables troughs will run from the THH to the eastern side of the CSEC to allow installation of the EVIP cables. Cables will be directly buried from inside the western boundary fence to the western side of the CSEC to allow installation of the Glaslyn Cables.

Drainage and Site Surfacing

2.3.70 The Minffordd site drainage will use a Sustainable Drainage System (SuDS) to ensure that the rate of discharge into the existing ditch to the south remains at 'greenfield' rates. This will be achieved by using an attenuation pond to the north of the ditch into which the CSEC area, the Minffordd THH and its surrounds will drain.

2.3.71 The existing ditch will be temporarily culverted during the Minffordd THH and CSEC construction works. As part of Minffordd site completion, the culvert will be opened, pipework removed and the ditch profile reinstated. The access road will bridge the ditch via a culvert.

2.3.72 The access road, the road in the Minffordd site and the parking bays will be reinforced grass. The majority of the Minffordd site surface finish will be loose, free-draining aggregate above drainage collection pipes. A level verge for pedestrian access is required around the perimeter fence. The levels will be formed to fall at slopes of 1 in 3 to existing grade. The slopes will be sown with a low maintenance grass seed.

2.3.73 An exception to this sloped finish will be a short length of the eastern boundary where a retaining wall will be installed to allow retention for an existing cathodic protection cabinet serving the nearby Wales and West Utilities gas pipeline.

Landscape

2.3.74 The landscape proposals round the Minffordd THH and CSEC installation have sought to integrate the infrastructure into the landscape, similar to the way that nearby buildings are nestled in pockets of tree cover associated with the well-treed Minffordd peninsula.

2.3.75 The Minffordd THH and CSEC would be screened using woodland planting, broadleaved scattered trees, scrub planting and neutral grassland. Native tree and shrub planting will comprise an approximate mix of species to complement and enhance the local landscape.

Garth CSEC

2.3.76 All the infrastructure in the Garth CSEC compound would be removed to a depth of 1 m, including underground services, foundations, earthing and platform granular material, and the area would be reinstated. Landscaping works would include woodland, woodland edge, scrub and grassland planting.

2.4 Construction

General Construction Information

2.4.1 The mobilisation works would comprise site vegetation clearance, bell mouth construction, compound set up, erection of fencing, ecological mitigation, pre-construction drainage, topsoil stripping, haul road construction and temporary crossing construction, including culvert and bridge installation.

2.4.2 During installation, the Contractor would operate under a detailed site-specific Construction Environmental Management Plan (CEMP) (**Volume 8, Appendix 4.2.A: Outline Construction Environmental Management Plan**). It would, as a minimum, implement the mitigation measures identified within this ES. The CEMP would set out a variety of control measures for managing the potential environmental effects of installation works including control and management of noise, dust, surface water runoff, waste and pollution control.

Lighting

2.4.3 Works outside of daylight hours are generally not expected. Emergency provision for 24-hour working will be required for critical activities such as HDD, Cable Pulling, Jointing and Terminating. This will require lighting; care will be taken to minimise light spill from task lighting in the SSSI. No other designated sites or ancient woodlands will be impacted by night working.

2.4.4 Where lighting is required in low-light conditions, it would be temporary task lighting with security and safety lighting required at construction compounds and along worker access routes to work sites.

Construction Waste and Soil

2.4.5 Subject to geotechnical testing, excavated materials would be re-used on site wherever possible. Where waste materials are to be disposed of off-site this would be at licensed waste disposal facilities in accordance with a Site Waste Management Plan (SWMP).

Elevated Working Areas

2.4.6 The joint bay compounds and the HDD compounds between Wern CSEC and Tremadog would have surface levels approximately 20 cm above existing ground level. The HDD compounds between Ysgol Eifionydd and Minffordd CSEC would be raised by a minimum of 3.2 m AOD for flood protection. Material will be sourced from local quarries and when working areas are reinstated will either be returned to the quarry or provided for other projects in the area.

Installation Activities

2.4.7 Ducts would be installed through a combination of open cut and trenchless technology described below. The areas where each technique would be used are illustrated on **Figure 4.2.2**.

Open Cut Techniques

Trenching

2.4.8 Underground cable construction activities begin with the establishment and preparation of the working area along the replacement cable route and any temporary access tracks required to connect with the local road network. This construction corridor would be approximately 65 m wide to accommodate the cable trenches, haul road, storage areas for stripped topsoil and subsoil from the cable trench excavation, post and wire fencing and inclusion of any temporary and permanent land drainage requirements. The width of the construction corridor would be narrower through constrained areas. A temporary haul road would continue along the length of the underground cables as far as possible so that construction traffic can run on dedicated routes and avoid public highways. The topsoil would be stored along the working area and would be reinstated once the installation of the ducts is complete.

2.4.9 The replacement cables would be delivered to the working areas using articulated lorries of approximately 70 tonnes; the cables being wound round drums and transported on the trailer. The cables would be pulled off the drums onto rollers within the joint bays and then pulled through the uPVC ducts.

2.4.10 The trenches would be excavated up to approximately 1.5 m deep and 1.5 m wide in standard formation. Where the ground conditions dictate, trench support will be installed in the trenches to maintain stability. Up to three cables would be laid in each of the trenches. The ducts into which the cables are installed will be at a depth of approximately 1 m on a bed of CBS and then surrounded by an additional layer of CBS. The CBS would be delivered to the work areas in tipper lorries or by tractor and trailers. A cable would be installed into the centre duct to monitor the temperature of the cables. Fibre optic cable would be placed in the trenches with the cables for communication with the substations. An earth connectivity conductor cable will be installed in its own small duct. Above the CBS, cable protection tiles would be laid to protect the cables from any future excavation works and as an additional warning, warning tape would be placed into each trench to indicate that cables lay beneath.

2.4.11 The cable joints would be connected on-site in controlled and clean conditions. To achieve this, a mobile jointing shelter will be used. The finished joints are protected by a glass fibre box filled with resin or bitumen before the jointing bay is backfilled.

Direct Burial

2.4.12 Direct burial would follow the same technique as trenching, however the replacement cables would not be within ducts allowing easier manipulation of the cables at specific locations such as joint bays and terminations (in the CSECs).

Horizontal Directional Drill (HDD)

2.4.13 HDD is a steerable trenchless method of installing underground pipes, ducts and cables. HDD can be used to install cables under major crossings such as rivers and roads. A drill rig drills a hole in an arc along a prescribed path.

2.4.14 Each section of HDD would require a hardstanding area compound at each end. One compound would be the drilling site and would comprise a launch pit, and the other would be an exit site and would comprise a receiver pit. Drilling, using a drilling rig, would commence from the launch pit and would follow a pre-planned path creating a pilot hole, once the drill reaches the reception pit a reamer (a tool used to enlarge the pilot hole) is attached and pulled back through the hole to create the required size for the duct. Spoil would be placed in temporary storage areas within the compounds. The HDPE duct is then attached to a pulling device in the drilling site and pulled through to the exit site. The replacement cables would be installed in the ducts.

2.4.15 Drill fluid would be required throughout the HDD process. The fluid would be mixed on the surface and delivered to an enclosed storage tank at the drilling compound. The fluid would be pumped into the borehole at high pressure to aid the forming and opening of the hole and to reduce friction when pulling the ducts into place.

2.4.16 The major component of the drill fluid would return to the surface at the exit point and would be captured and stored in the mud lagoon for re-use or off-site treatment. A mud processing plant, which is a multi-screened cleaning system to separate the cuttings from the fluid, enables the fluid to be re-used. Solids removed from the mud returns would be collected in the holding pit and would be disposed of to an approved disposal site.

2.4.17 Following the installation the HDD equipment would be removed from the Glaslyn works site and the working areas reinstated.

Minffordd THH and CSEC Site

2.4.18 Access to the Minffordd THH and CSEC site will be via the established EVIP site works access. The EVIP tunnel works are currently being carried out as permitted development and construction access will be from this site. The permitted development comprises the tunnel and cables installation. The THH construction will take place within the existing construction compound, where works are currently being undertaken.

CSECs

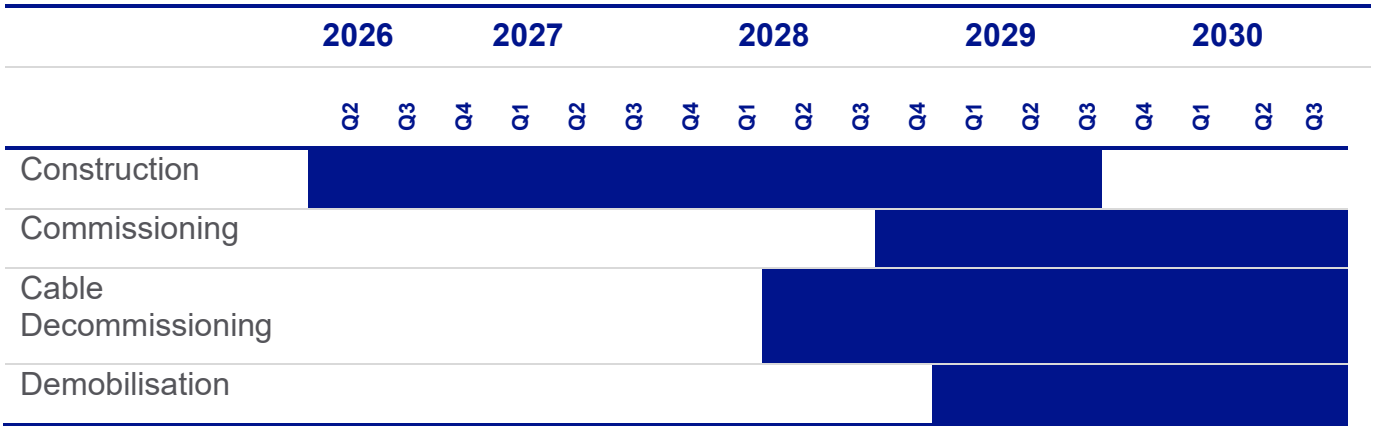
2.4.19 The replacement cables would be channelled via ducts to a location adjacent to the cable sealing ends. The cable sealing end terminations and other electrical equipment, such as earth switches, would be lowered onto their foundations and support structures by a mobile crane equipment. The cable sealing ends require controlled and clean

conditions whilst the terminations to the cables are being installed. To achieve this, a scaffold structure is erected over the installation area and covered with weather-proof material.

Construction Programme

2.4.20 The construction works are planned to be carried out over a period of approximately three years from Q2 2026 – Q3 2030 to coordinate with the wider Project. Construction will occur in phases. The shaft and tunnelling works for EVIP, which are permitted development, are under construction already.

Table 2-3 – Construction Programme



2.4.21 In the phases outlined above a number of activities will be carried out including:

- Construction – compounds (main and construction), temporary and permanent accesses, haul roads, HDD compounds, crossings, duct and cable installation, Wern and Minffordd CSECs and THH.
- Commissioning of the replacement cables.
- Cable decommissioning – removal of the existing 132 kV and 400 kV cables.
- Demobilisation - removal of all temporary structures, construction compounds, fencing and equipment, reinstatement of topsoil and landscape.

Construction Access

Haul Roads

2.4.22 The Glaslyn works site, temporary access roads, access points, access bell mouths and turning areas are shown on **Figure 4.2.3**.

2.4.23 During construction a range of vehicles would be accessing the Glaslyn works site including excavators, large tippers, long and low loader vehicles, abnormal indivisible loads (AILs) for the delivery of large cable drums, cranes (for material handling along with the installation of the crossing points and the removal of the existing cable bridges), concrete lorries, drill rigs, slurry tankers, and pipe welding equipment.

2.4.24 On completion of the construction works, the temporary access roads would be removed, any stone walls, wildlife fencing and kerbing would be reinstated, and any construction road markings or traffic signs would be removed.

Construction Site Layout

Compounds

2.4.25 The main construction compound would be to the west of the A498. It would be approximately 1.9 ha and would be split into two sections. The western section would comprise a laydown area and stockpiles; the eastern section would contain office buildings, health and welfare facilities, and vehicle parking. The compound would be secured through open mesh fencing with timber posts and three gate houses, one at each end of the compound and one in the centre. The western section of the compound would be accessed via two 10 m double mesh fence gates, one at the western extent and one in the centre of the compound. Two 7 m double mesh gates would be installed for the eastern section. A one-way system would be implemented where staff would enter via the eastern gate and exit via the central gate.

2.4.26 The two gates into the laydown area would be used by Heavy Goods Vehicle (HGVs) for the delivery of materials and equipment. A one-way system would be implemented with exit and entry being via a temporary road from/to the A498.

2.4.27 The compound hardstanding would be created by stripping and storing topsoil in various bunds around the extremities of the compound area, before importing and compacting aggregates. The aggregates will be laid on a geotextile membrane and geogrid later for structural support. **Plate 2-4** provides an example of the construction compound set up.



Plate 2-4 – Example construction compound set up

2.4.28 Each section of HDD would require a hardstanding area compound at each end. One compound would be the drilling site and would comprise a launch pit, and the other would be an exit site and would comprise a receiver pit. Drilling would commence from the launch pit and would follow a pre-planned path creating a pilot hole, once the drill reaches the reception pit a reamer (a tool used to enlarge the pilot hole) is attached and pulled back through the hole to create the required size for the duct. The duct is then attached to a pulling device in the drilling site and pulled through to the exit site. The works need 11 HDD compounds. An odd number of compounds is required as the cables split into two groups at Ysgol Eifionydd with two separate reception sites but a shared launch site north of the A487 Porthmadog Bypass (see **Figure 4.2.3**).

2.4.29 The drilling site would accommodate a drilling rig, generator, site office, welfare facilities, plant and equipment storage and a temporary mud storage lagoon. The exit

compound would comprise a generator, excavator, pipe rack and a temporary mud lagoon. An example HDD pad layout is show on **Plate 2-5.**



Plate 2-5 – Example HDD pad layout

2.4.30 The THH construction will take place within the existing construction compound, where works are currently being undertaken.

Joint Bay Work Areas

2.4.31 Six joint bay working area are required for the proposed works (see **Figure 4.2.3):**

- Immediately north of the main construction compound between the compound access roads.
- South of the A487 Porthmadog Bypass and north of Y Cyt.
- South-east of the Porthmadog Roundabout.
- Between the WHHR and FfWHR and Clwb Chwaraeon Madog.
- North of the A487 Porthmadog Bypass and east of the Clwb Chwaraeon Madog.
- South-east of Minffordd CSEC.



Plate 2-6 – A typical joint cable set up

2.4.32 The joint bay would be excavated to the required depth and would have battered sides. Excavated material would be stored near the joint bay, to avoid impeding the jointing works or plant or overloading the battered sides of the pit. Heras fencing would be

installed around the excavation. A typical joint bay set up during construction is shown on **Plate 2-6.**

Staffing and Employment

2.4.33 The number of staff on the Glaslyn works site will vary according to the construction phase and activities being carried out. The average number of staff on the Glaslyn works site will be seven Full Time Equivalent (FTE) positions, with 28 FTE positions at its peak. Please note this does not include the EVIP tunnelling works.

Hours of Working

2.4.34 Generally, construction activities would be carried out from Monday to Friday 7am-7pm (inclusive of an hour set up and hour shut down) and 8am-6pm on Saturdays. Prior agreement will be required from the Local Planning Authority for any works on a Sunday. During the summer months maximum advantage of day light hours will be used, however during the winter months working hours may be reduced to suit available daylight.

2.4.35 Emergency provision for 24-hour working will be required for critical activities such as HDD, cable pulling, jointing and terminating.

2.5 Operation

2.5.1 The CSECs would be unmanned but monitored remotely. Visual checks would be carried out on a monthly inspection visit to the site. Maintenance inspections of the CSECs would take place following any issues identified during inspection, involving electrical isolation of equipment before it is worked on. If the CSEC required refurbishment or replacement works, vehicles would be used to carry workers in and out of the site and suitable vehicles would be used to bring new materials and equipment to site and remove old equipment.

2.5.2 For the cables left in situ, periodic monitoring will be undertaken. The frequency of these visits will initially be every four months, reducing to six months and then yearly. The results of the monitoring will serve to establish the monitoring regime for a period of approximately 10 years.

2.5.3 Access to the Wern CSEC would be gained from the east via a new, permanent access road from the A498.

2.5.4 Access to the Minffordd THH and CSEC will be via an unnamed road west of the Quary Lane and Osmond Terrace junction.

2.5.5 Maintenance checks will be carried out at weekly intervals of the THH and would cover elements including the fans, lighting, pumps and gas detection. The THH will not require day to day access and will not be open to the public.

Electric and Magnetic Fields

2.5.6 All equipment that generates, distributes or uses electricity produces electric and magnetic fields (EMFs). An EMF report has been produced which sets out the technical specifications of the proposed works and how the works would comply with EMF

exposure guidelines. This report is in **Volume 8, Appendix 7.1.A**: **Electric and Magnetic Field Assessment.**

3. Assessment of Alternatives

3.1 Introduction

3.1.1 This chapter outlines the alternatives to the proposed works that have been considered by NGET.

3.2 Requirement for the Consideration of Alternatives

3.2.1 There is both a policy and legal need to report the main alternatives considered during the development of a project.

3.2.2 Part 5, 17 (3)(d) of the Town and Country Planning (Environmental Impact Assessment) (Wales) Regulations 2017 (the '2017 TCP EIA Regulations') (Ref 3.1) and paragraph 4 of The Electricity Works (Environmental Impact Assessment) (England and Wales) Regulations 2017 (Ref 3.2) states that an ES should include:

"a description of the reasonable alternatives studied by the applicant or appellant, which are relevant to the proposed development and its specific characteristics, and an indication of the main reasons for the option chosen, taking into account the significant effects of the development on the environment."

3.3 Design Alternatives

Glaslyn Cable Route

3.3.1 In December 2023 an Options Appraisal Report was produced by Arup (see **Volume 8, Appendix 4.3.A: Options Appraisal Report**) which analysed options for the route of the Glaslyn cables within the area. The route was split into five sections:

- Section A – Wern CSEC to A498.
- Section B – A498 to Trunk Road Island.
- Section C – Trunk Road Island to Heritage Railways.
- Section D – Heritage Railway to East of Afon Glaslyn.
- Section E – East of Aon Glaslyn to Minffordd.

3.3.2 Within each section, multiple options were considered as shown on **Plate 3-1** and **Plate 3-2**.

Section A – Wern CSEC to A498

3.3.3 Option A1 follows the existing cable alignment south of Nant-yr Afon-oer. Option A2 stays north of the watercourse and runs under the overhead line. Option A3, deviates farther north. Option A1 was preferred as the shortest and least complex route, with fewer crossings and less tree removal. It was also the least expensive and safest option, offering better construction flexibility. Option A2 ranked lower due to its proximity

to the overhead line, impacting several criteria negatively, while Option A3 was less favourable due to its longer cable length and Socio-Economic concerns.



Plate 3-1 – The route options within Section A and B



Plate 3-2 – The route options within Section C, D and E

Section B – A498 to Trunk Road Island

3.3.4 Three options were considered in Section B: Option B1, which aligns with the end of Options A2 and A3; and Options B2 and B3, which align with Option A1. Option B1 runs along the northern plots, while B2 and B3 take different routes along the southern plots, joining halfway into Section B. At the eastern end, the cables were confined to a corridor between the highway and high-pressure gas main to the north and the existing 400 kV cables to the south. The Porthmadog roundabout was seen as the only viable crossing point between Section B and Section C due to the town of Porthmadog to the south. Option B3 was the preferred route, being the shortest, least disruptive, and least expensive, crossing closer to the existing 400 kV cables. It required fewer tree removals and provided greater flexibility. Option B1 ranked lower due to its separation from the existing cables and the need to cross the 400 kV line twice. Option B2 was similar to B3 but ranked lower due to its impact on the former driving range, despite offering greater flexibility at the A498 highway crossing.

Section C – Trunk Road Island to Heritage Railways

3.3.5 Four options were considered in Section C: Option C1, which routed south of the existing 400 kV cables before heading north to cross the WHHR and the FfWHR; Option C2, which followed the A487 and crossed the WHHR and FfWHR further south than Option C1; Option C3, which closely followed the 400 kV route to the south of the highway. It crosses the WHHR and FfWHR before then turning north and crossing the highway; and Option C4, which was similar to Option C2 but crossed the A487 farther east. Option C4 was the preferred route due to its shorter length, better space for equipment, and favourable angle for crossing the high-pressure gas main. It also intersected fewer hedgerows and land parcels and was more cost-effective with minimal disruption. However, upon review of the typical construction swathe and space constraints between the highway and 400 kV cables, it is decided to use the western portion of Option C1 (where the alignment meanders south) to achieve an improved alignment of cables in the approach to the trenchless crossing under the highway. Option C3 was not preferred due to its heritage rail crossings location and constraints associated with the existing 400 kV cables. Option C1 and C2 ranked lower due to the less advantageous crossing location of the highway.

Section D – Heritage Railways to East of Afon Glaslyn

3.3.6 Nine options were considered for Section D, with routes starting north of Clwb Chwaraeon Madog and continuing toward the A487 and Glaslyn SSSI. Option D1 was the preferred route due to its shorter length, requiring only one HDD and minimal disruption to the Glaslyn SSSI, traffic corridors, and construction. It was also the most cost-effective and safest option and a simpler construction process. Options D2, D3, D4, and D9 ranked lower due to the need for two HDDs and open cut construction within the SSSI, and Option D4 and D9 also faced challenges due to pinch points at the Section C connection. Options D5, D6, D7, and D8 were not taken forward due to technical constraints.

Section E – East of Afon Glaslyn to Minffordd

3.3.7 Four options were considered in Section E. After crossing the woodlands in the Coedydd Derw, a Safleoedd Ystlumod Meirion/Meirionnydd Oakwoods SAC and Glaslyn SSSI region, Option E1 aligns with the end of Options D1, D2, D3, D4 and D9 at the south most of Section E. Similarly, Option E3 aligns with the end of Option D7 and Option E4 aligns with the end of Option D6. In contrast, Option E2 starts from the Afon Glaslyn and aligns with the end of Option D5 and D8, running from west to east

between the A487 and Garth Quarry. It meanders south after reaching the Garth Quarry entrance and crosses perpendicular to the A487 and Cambrian Coast Railway Line until it arrives the Minffordd CSEC.

3.3.8 As Options D5 and D8 were not taken forward, the only available option was Option E1.

Summary

3.3.9 A preferred route comprising Options A1, B3, C4, D1 and E1 was taken forward. Details are in **Volume 8, Appendix 4.3.A: Options Appraisal Report**.

A487 Crossing

3.3.10 In May 2024 a technical note was produced by Arup (**Volume 8, Appendix 4.3.B: A487 Highway Crossing Options Appraisal**) which summarised how the A487 crossing options were selected. The Glaslyn cable route intersects the A487 in three locations:

- At the Porthmadog Roundabout.
- West of the WWHR and FfWHR.
- North-west of the Afon Glaslyn.

A487 Porthmadog Roundabout

3.3.11 Four options were considered for crossing the Porthmadog Roundabout: Option 1A uses an open cut trench to approach from the west, turning south-east at the Porthmadog Roundabout; Option 1B used HDD to cross the Porthmadog Roundabout; Option 2 avoids the Porthmadog Roundabout, crossing the A487 to the west of the roundabout via HDD; and Option 3 crosses beneath the town of Porthmadog using HDD, south of the Porthmadog Roundabout. Option 1A was preferred as it is the only option that can be constructed without significant protective measures to the high-pressure gas main, minimises risk to the structural integrity of nearby infrastructure, and does not impact the ancient woodland. It also offered flexibility to preserve the stone circle and was expected to be the least expensive option.

A487 West of the Welsh Highland Heritage Railway

3.3.12 Four options were considered for crossing the A487 highway west of the WHHR and FfWHR: Option C1 heads south of the existing 400 kV cables, before heading north crossing the A487 north of the school building, crosses the WHHR and FfWHR further to the north than the other options and avoids the Clwb Chwaraeon Madog grounds; Option C2 follows the A487, crossing it early and crosses the WHHR and FfWHR south of the station building before intersecting the Clwb Chwaraeon Madog; Option C3 closely follows the existing 400 kV route, crossing the WHHR and FfWHR before turning north to cross the A487; and Option C4, similar to C2, crosses the A487 farther east. Option C4 was preferred for being best location to minimise the impact on the highway by routeing the HDD so that it can pass under the other constraints, offering more space for HDD to avoid highway structures, is the second shortest route, crossing the WHHR and FfWHR at a location to avoid the train station and being less impactful on trees and hedgerows.

A487 North-west of the Afon Glaslyn

3.3.13 All route options use HDD to cross the A487, with open-cut construction used for other sections of route. Option D1 starts north of Clwb Chwaraeon Madog, passing the sports ground, then turns south to cross the A487, Cambrian Coast Railway Line, the Glaslyn

SSSI and the Afon Glaslyn in one drive. Option D2 also starts north of Clwb Chwaraeon Madog but deviates south, crossing the A487 and Cambrian Coast Railway Line at a perpendicular angle, taking a longer route through the Glaslyn SSSI. Option D3 is similar to D1 crossing the A487 at approximately the same location but in a perpendicular manner, requiring two HDD drives. Option D4 starts south of Clwb Chwaraeon Madog until it combines with Option D2 and requires an additional HDD drive; Option D5 stays north of Clwb Chwaraeon Madog and the A487 and is not considered for the highway crossing. Option D6 crosses the A487 and Cambrian Coast Railway Line at an acute angle but was not considered due to Network Rail's rejection. Option D7 is technically complex, requiring two HDD crossings near existing infrastructure, so it was not taken forward. Option D8 runs south of Clwb Chwaraeon Madog and along the A487 but was dismissed due to technical complexity and issues associated with traffic management and potential congestion. Option D9 starts south of Clwb Chwaraeon Madog, crossing the A487 and Cambrian Coast Railway Line further to the west, and continues through the Glaslyn SSSI. Option D1 was selected as it was technically preferred, had the potential to be completed with a single cable drum with joint bays on either side of the crossing, avoids direct impact on the A487, expected to have the lowest cost and is preferred in terms and health and safety due to the need for less temporary works.

Minffordd CSEC

3.3.14 Three options were considered for the connection with EVIP at Minffordd CSEC. Option 1 was an air insulated switchgear (AIS) CSEC which would be consistent with the rest of the network from an operational standpoint as the existing Wern and Garth CSECs are also AIS. Option 2 used a cable-to-cable solution which would enable a seamless connection between the Glaslyn cables and the EVIP cables. Option 3 comprised a gas insulated switchgear or gas insulated busbar (GIB) solution. Option 2 (cable to cable) solution however, it is not cost effective therefore Option 1 was chosen as it gave good cost-efficiency for the development whilst enabling a cable connection to be achieved; it was consistent with high voltage equipment at the Pentir and Trawsfynydd Substations; allowed for a connection to the EVIP tunnel cables immediately adjacent to the head house removing the need to install new cables to the existing Garth CSEC and allowed for earth switches to be installed .

3.3.15 Details are in **Volume 8, Appendix 4.3.C: Minffordd CSEC Options Appraisal**.

Bodawen Playground

3.3.16 The Bodawen playground, owned and managed by Porthmadog Town Council, is immediately west of the Porthmadog Roundabout. The existing 400 kV cables run in a south-east/north-west direction to the south of the Bodawen Playground and would need to be removed to facilitate the proposed works.

3.3.17 National Grid has liaised with the Town Council on the required playground closure and mitigation. It investigated alternative sites for temporary relocation of the playground to mitigate effects of its temporary closure (anticipated to be for two years). It was agreed that National Grid would reinstate the playground, including seating in addition to play equipment, and appropriate safety surfacing when it reinstates the land.

Alternative Sites

3.3.18 Several alternative options were considered for the playground. The two main alternatives for a temporary relocation were:

- On a parcel of land south-west of the playground, behind residential houses on Maes Gerddi. This land has poor 'overlooking' and a temporary playground would not be in general sight of persons passing, giving security concerns, and would be close to the rear of properties where nuisance could occur from misuse. This potential temporary relocation was not taken forward.
- On a parcel of land south-west of the playground, south of Pensyflog. Concerns that this would not be accessible for works to install, manage and remove the temporary playground meant it was not taken forward.

Minimising Required Playground Closure

3.3.19 National Grid investigated ways of working to minimise the playground closure and to avoid future disturbance including possible temporary closures. By occupying the playground land for a maximum period of two years, it can install replacement cables and remove the existing cables entirely from the playground land, avoiding the need for monitoring and possible removal of oil from cables monitoring pits. This time period allows for reinstatement of the playground with new replacement equipment.

Minffordd THH

3.3.20 Five options were considered for siting of the Minffordd THH independently, prior to the original planning application being submitted (**Plate 3-3**):

- West THH – close to existing infrastructure, required a short stretch of buried cable into the Garth CSEC, existing trees provided screening and the permanent access could utilise the existing access track. However, this option was adjacent to the Glaslyn SSSI, potential for tree loss and conflicted with a high-pressure gas pipeline.
- West THH (Alternative 1) – this option was the furthest away from the local community, had more scope for screening the THH and its compound through additional woodland planting which could tie into the adjacent woodland and the existing access track could potentially be used. However the option conflicted with a high-pressure gas pipeline.
- West THH (Alternative 2) – this option would be built closer for existing settlement than Alternative 1. However, there is less scope to screen this option compared to Alternative 4.
- West THH (Alternative 3) – this option is the closest to the road network and NCR 8, therefore there is greater potential to affect views from people using this route. There is more likelihood that this location would affect views to the east from the local community and users of NCR 8 travelling south.
- West THH (Alternative 4) – this option would keep the built form closer to existing settlement. It is considered that there is more scope to screen this option and tie in mitigation proposals with the existing pattern of land cover and built form.



Plate 3-3 – Minffordd THH options

3.3.21 West THH (Alternative 4) was considered a favourable location due to its potential ability to screen and its relationship of new build form with the existing settlement pattern. West THH and West THH (Alternative 1) were both rejected based on the proximity of the high-pressure gas pipeline and buried high voltage cables. Although West THH (Alternative 2) was similar to Alternative 4, it was in a less favourable location, was less able to provide screening and would create a build form closer to existing settlement. West THH (Alternative 3) was rejected as there was more potential for impacts on visual amenity.

3.3.22 The EVIP project received planning permission for its THH at the West THH Alternative 4 location and this was taken forward for the EVIP THH in the current proposals.