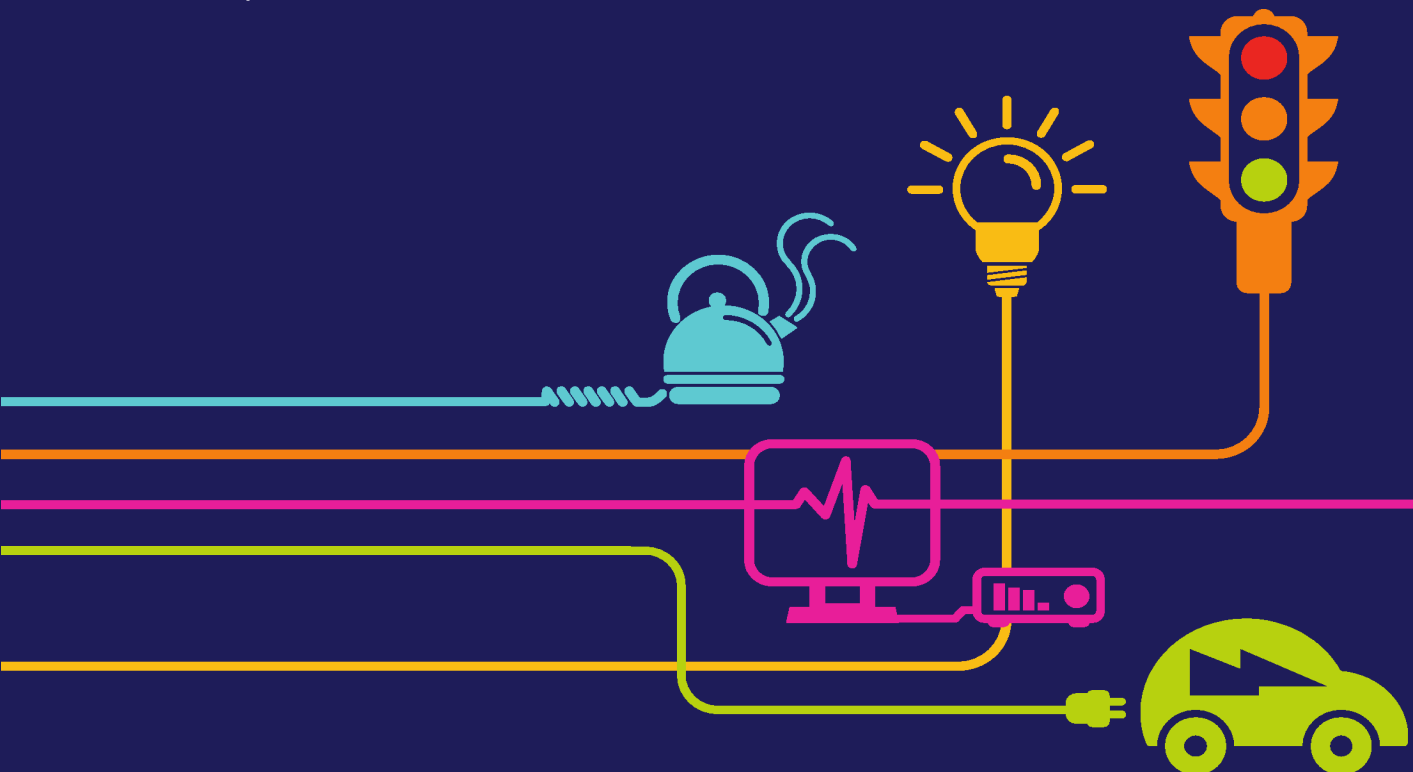


# Wylfa to Pentir Preferred Route Corridor Selection Report (2015)

National Grid (North Wales Connection Project)

*Regulation 5(2)(a) of the Infrastructure Planning  
(Applications: Prescribed Forms and Procedure) Regulations 2009*

*First published October 2015*



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## EXECUTIVE SUMMARY

A new electricity connection to the mainland transmission system is needed to allow the export of power from a new nuclear power station proposed to be built at Wylfa, on the Isle of Anglesey. National Grid has contractually agreed to connect the new Wylfa Newydd Power Station to the transmission system in North Wales by 2024/25.

In 2012, National Grid discussed with statutory stakeholders a number of strategic options for exporting the power generated by the proposed nuclear station to the wider transmission system. National Grid also undertook a high-level appraisal of the environmental, socio-economic, technical and cost considerations associated with each strategic option. The responses from this initial consultation and the findings of the appraisal were taken into account and used to inform the selection of a preliminary preferred strategic option before presenting the appraisal findings for wider public consultation. The preferred option involved the development of a second transmission connection overland across Anglesey between Wylfa and an existing National Grid substation at Pentir, on the mainland in Gwynedd.

In parallel with the strategic options appraisal, National Grid undertook an assessment of the constraints that could influence the routeing of an overhead line between Wylfa and Pentir. The constraints assessment identified four route corridors for the overhead line. It also determined five locations for crossing the Anglesey Area of Outstanding Natural Beauty (AONB) and the Menai Strait, neither of which could be avoided. Each route corridor could be connected to each crossing point through an area common to the four route corridors (the Southern Common Area). Feedback on these route corridors (the Purple, Yellow, Blue and Orange Route Corridors) and Crossing Options A to E was sought during public consultation in late 2012.

In 2013 and 2014 National Grid undertook further detailed appraisals of the likely technical, environmental, socio-economic and cost impacts of an electricity transmission line development within each of the four route corridors and five crossing options. Following these appraisals, the Orange Route Corridor was selected as the preferred route corridor.

This 'Preferred Route Corridor Selection Report' summarises the main findings of each route corridor appraisal and describes the main reasons why the Orange Route Corridor was the preferred route corridor for a new transmission connection between Wylfa and Pentir.

The selection of the preferred route corridor was determined through a qualitative review of the appraisal findings. Further investigation is needed to ascertain the best technology and location to cross the Menai Strait and link to Pentir Substation. Therefore, the preferred route corridor was selected based on those route corridor differentiators between Wylfa and the Southern Common Area. The main differentiators between the four route corridors included potential effects on: Anglesey AONB; panoramic views from Snowdonia; visual amenity; and nationally designated ecological sites.

The reasons for selecting the Orange Route Corridor as the preferred option, based on the appraisal and the differentiators, were that the Orange Route Corridor:

- would be less visible from Anglesey AONB than the Yellow and Purple Route Corridors;
- covers an area already affected by an existing overhead transmission line;
- has the greatest natural screening from the surrounding terrain;
- offers the best compliance with the Holford Rules;
- would affect the fewest new visual amenity receptors;
- is the least likely route corridor to affect undeveloped landscapes and panoramic views to Snowdonia;

- is the only route corridor that could avoid crossing any designated nature conservation sites between Wylfa and the Menai (all the route corridors would need to cross the Menai Special Area of Conservation);
- is the only option that could avoid any need to manage risks of infringement of a safeguarding zone where development of tall structure is controlled to protect low flying aircraft;
- is preferred by the majority of the feedback from public consultation as it is the shortest, most direct route and follows the existing line; and
- is the shortest route so would require the fewest towers and be the lowest cost option.

Going forward, National Grid will develop a set of viable route options for consultation with stakeholders and the public. The feedback from this consultation will inform the selection of the preferred route option for detailed design and environmental assessment prior to submission of an application for consent to build.

# 1 INTRODUCTION

## 1.1 Background

- 1.1.1 National Grid Electricity Transmission Ltd (National Grid) owns and operates the high-voltage electricity transmission system in England and Wales. National Grid has a statutory duty to promote competition in the supply of electricity and is obliged to offer to connect to the system anyone who applies for such a connection. Horizon Nuclear Power applied to National Grid to connect a proposed new nuclear power station to the system. The proposed power station would be within a site already identified for this type of development in the UK government's National Policy Statement (NPS) EN-6 'Nuclear Power Generation'. Throughout various changes to both the date and scale of the power station development, National Grid has remained contracted to connect this proposed power station. Therefore National Grid is developing proposals that would facilitate this connection by the contracted date of 2024/25.
- 1.1.2 National Grid already owns and operates an electricity substation at Wylfa, which the proposed nuclear power station would connect to. This substation is connected to the main interconnected power transmission system in North Wales by a single 400 kilovolts (kV) overhead electricity line (see Figure 1.1). To provide reliable electricity supplies across Great Britain National Grid cannot allow more than 1,800 mega-watts (MW) of power generation to be connected by any single overhead line. As the Horizon Nuclear Power proposal is for a total output of 2,800 MW, a second connection is required between Wylfa and the main interconnected transmission system. More details concerning the need for this second connection are set out in National Grid's published 'Need Case' document, which was revised in January 2015<sup>1</sup>.
- 1.1.3 National Grid has considered various means by which this second connection could be established. The strategic options identified represented a number of ways in which the power generated by the proposed nuclear station could be exported to a number of different points on the wider transmission system. National Grid consulted on these strategic options with stakeholders in 2012 and undertook a high-level appraisal of the environmental, socio-economic, technical and cost considerations associated with each. The responses from this initial consultation and the findings of the appraisal were taken into account and used to inform the selection of a preliminary preferred strategic option before presenting the appraisal findings for wider public consultation. National Grid's preliminary preferred strategic option involved the development of a second transmission connection between Wylfa and an existing National Grid substation at Pentir, on the mainland in Gwynedd. Taking into account the work undertaken at that time, it was considered that this connection could be wholly or largely achieved using an overhead transmission line.
- 1.1.4 Due to the number of other generation proposals in North Wales at the time of the appraisal, the preferred strategic option also involved the upgrading of existing National Grid transmission routes between Pentir and Deeside and between Pentir and Trawsfynydd, to remove 'bottlenecks' in the wider system. It was considered that this option was most likely to achieve an appropriate balance between National Grid's technical, economic, environmental and amenity obligations. The findings of this initial

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<sup>1</sup> **National Grid (2015)** *North Wales Connections, Need Case* [on-line] Available at: <http://northwalesconnection.com/route-corridor-announcement.aspx>

strategic options appraisal are set out in National Grid's published 'Strategic Options Report'<sup>2</sup> dated October 2012.

- 1.1.5 In response to subsequent changes in the scale and location of generation projects proposing to connect in North Wales since October 2012, and taking into account stakeholder responses to National Grid's initial round of consultation, a review of the strategic options appraisal has been undertaken. This review is recorded in the updated 'Strategic Options Report'<sup>3</sup> published in January 2015.
- 1.1.6 In parallel with the strategic options appraisal National Grid undertook an assessment of the constraints likely to influence the routeing of a new overhead transmission line between Wylfa and Pentir. This resulted in the identification of four possible route corridors across Anglesey which avoided the most sensitive parts of the island and within which a new overhead line might be developed. As almost the whole of the coastline of Anglesey facing the mainland is designated an Area of Outstanding Natural Beauty (AONB) it would not be possible to route an overhead line to Pentir that would avoid this nationally valued landscape. Five possible locations were identified for crossing the AONB and Menai Strait. Each of the route corridors identified across Anglesey could be connected to each of these crossing points through an area common to the four route corridors (known as the Southern Common Area). The work undertaken to identify the potential route corridors and crossing points is set out in National Grid's published 'Route Corridor Identification Report'<sup>4</sup>, dated October 2012.
- 1.1.7 National Grid presented these options as part of its public consultation undertaken in late 2012 and sought feedback on the relative merits and effects of developing an overhead line within these route corridors and crossing points. This consultation feedback has been considered and is summarised in National Grid's 'Stage 1 Consultation Feedback Report'<sup>5</sup> published in June 2014.

## 1.2 Purpose of this Report

- 1.2.1 Further to the work to identify a preferred strategic option, National Grid has been undertaking more detailed appraisals of the likely effects that the development of an overhead line within each of the four route corridors and five crossing options might have. These appraisals took into account the feedback received during public consultation in 2012 and subsequent discussions with a number of statutory consultees. This work informed the selection of a preferred route corridor and a decision to adopt a technical solution that would avoid the need for an overhead line crossing of the Anglesey AONB and Menai Strait. National Grid's decision to take forward the Orange Route Corridor across Anglesey, which broadly follows the route of the existing overhead line across the island, and to use underground cables to cross the AONB and Menai Strait was announced in January 2015 and was based upon the appraisal work recorded in this Report.

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<sup>2</sup> **National Grid (2012)** *North Wales Connections, Strategic Options Report* [on-line] Available at: <http://northwalesconnection.com/stage-one-consultation.aspx>

<sup>3</sup> **National Grid (2015)** *North Wales Connections, Strategic Options Report* [on-line] Available at: <http://northwalesconnection.com/route-corridor-announcement.aspx>

<sup>4</sup> **National Grid (2012)** *North Wales Connections, Wylfa-Pentir Initial Route Corridor Report* [on-line] Available at: <http://northwalesconnection.com/stage-one-consultation.aspx>

<sup>5</sup> **National Grid (2014)** *North Wales Connections, Stage One Consultation Feedback Report* [on-line] Available at: [http://nationalgrid.opendebate.co.uk/files/North\\_Wales\\_Connection\\_-\\_Feedback\\_Report.pdf](http://nationalgrid.opendebate.co.uk/files/North_Wales_Connection_-_Feedback_Report.pdf)



- 1.2.2 The appraisal of the route corridors and crossing points was undertaken in line with the approach set out in National Grid's 'Our Approach to Options Appraisal' document. It considered those environmental, socio-economic, technical and cost topics that might help inform the identification of a preferred route corridor and connection design.
- 1.2.3 This 'Preferred Route Corridor Selection Report' summarises that further appraisal work, and explains in more detail the main reasons why the Orange Route Corridor was considered to achieve the best balance of environmental, socio-economic, technical and cost impacts. It also explains why National Grid believes that an overhead line crossing of the AONB and Menai Strait would be inappropriate and likely to be in conflict with relevant planning policies. As such it is an important document that should inform feedback to the next stage of (non-statutory) consultation. This report records the alternatives considered and the main reasons for the decision taken at this stage, which will be reported in the Environmental Statement required by the Infrastructure Planning (Environmental Impact Assessment) Regulations 2009.
- 1.2.4 The findings of this latest stage of appraisal considered and confirmed the assumptions made in earlier documents. The findings have also been used to inform the back-check and updating of the strategic options appraisal as set out in the revised strategic options report published in January 2015.
- 1.2.5 This Preferred Route Corridor Selection Report only considers the appraisal of options for a new transmission connection between Wylfa and Pentir. Information concerning the appraisal and conclusion relating to wider strategic alternatives can be found in National Grid's Strategic Options Report.
- 1.2.6 This report does not address any wider works that National Grid needs to carry out to the existing transmission system on the mainland. These works are described in the Strategic Options Report. National Grid is contracted to have these works in place by 2020 in order to allow generation projects in the Republic of Ireland to connect to the National Grid system at Pentir by that date, substantially in advance of the Wylfa to Pentir connection works, which are needed by 2024/5. Therefore, works on the mainland will be the subject of separate appraisals, consultations and applications for consent. National Grid will continue to keep this position under review as the project progresses, in consultation with stakeholders.



## 1.3 Report Layout

1.3.1 This report describes how the preferred route corridor for the new Wylfa to Pentir transmission connection was selected. The report is structured as follows:

- **Chapter 2:** National Grid Duties and Policies – An overview of the statutory duties and policies that National Grid is obliged to adhere to when developing and operating new transmission lines.
- **Chapter 3:** Project Context – An overview of the factors justifying the need for a new electricity transmission line between Wylfa and Pentir. Also presents the route corridor options identified during the previous stages.
- **Chapter 4:** Policy Context – An overview of national and local planning policies considered by the Planning Inspectorate when determining whether to consent a new transmission line under the Planning Act 2008.
- **Chapter 5:** Electricity Transmission Developments – A generic guide to transmission line infrastructure components and construction / operational requirements to provide an understanding of the type of development being considered.
- **Chapter 6:** Appraisal Process – Outlines how the route corridor options were assessed, in particular the selection of technical topics and the additional investigations undertaken to inform the appraisals and decision-making process.
- **Chapter 7:** Consultation – Outlines the consultation activities undertaken and the feedback received that was used to inform the route corridor option appraisals and decision-making process.
- **Chapter 8:** Route Corridor Design Refinement – In response to potential significant environmental and socio-economic risks / effects from the original fully overhead only route corridor proposals, this chapter presents how high level mitigation was identified, assessed and, if appropriate, incorporated in a route corridor design to improve its acceptability at this stage of the process. This chapter concludes with the refined route corridors used for the appraisal that informed the selection of the preferred route corridor.
- **Chapter 9:** Appraisal of Route Corridors – Highlights the main findings from the environmental, socio-economic, technical and cost appraisals of the route corridors.
- **Chapter 10:** Selection of Preferred Route Corridor – Presents the preferred route corridor following a review of the main differentiators, arising from the appraisal in Chapter 9, between route corridors to influence the selection of the preferred route corridor. Concludes with a summary of the preferred route corridor justification.
- **Chapter 11:** Way Forward – Brief outline of what will happen next and the Development Consent Order application process.

## 2 NATIONAL GRID DUTIES AND POLICIES

### 2.1 Introduction

- 2.1.1 National Grid is the owner of the high-voltage electricity transmission system in England and Wales and operates the transmission system across the whole of Great Britain. The transmission system carries electricity from power generators (e.g. nuclear power stations and wind farms) to regional substations.
- 2.1.2 The transmission system in England and Wales consists of approximately 7,200 kilometres (km) of overhead lines and a further 700km of underground cabling, operating mainly at 400kV and 275kV. The overhead lines and cables connect around 340 substations to form a highly interconnected network. The substations provide points of connection to the local distribution networks that operate at lower voltages, from 132kV down to 240V, for distribution to domestic consumers. These local distribution networks are owned by Distribution Network Operators, such as SP Manweb (Scottish Power Energy Networks) in north Wales.
- 2.1.3 National Grid has duties placed upon it by the Electricity Act 1989, and operates under the terms of its transmission licence. Those duties and terms relevant to the proposed Wylfa to Pentir connection are set out below.

### 2.2 Duty to Provide a Connection

- 2.2.1 Under Section 9(2) of the Electricity Act 1989, National Grid has a duty to “*facilitate competition in the supply and generation of electricity*”. Therefore, National Grid must do what it can to provide the connection of new power generation to the transmission system.
- 2.2.2 When a power generation developer applies for a connection to the national transmission system, National Grid has a statutory obligation under the terms of its transmission licence to offer a new connection, or to modify an existing connection.
- 2.2.3 Condition C8 (requirement to offer terms) of National Grid’s operating licence also requires the connection agreement to set a date by when any works required to permit access to the transmission system (including any works to reinforce or extend the transmission system) shall be completed.
- 2.2.4 As a result of an application by Horizon Nuclear Power for the connection of their proposed Wylfa Newydd Power Station, National Grid’s subsequent offer and the completed ‘Connection Agreement’ contract, National Grid has a contractual obligation to endeavour to provide a transmission connection to the proposed new power station by 2024/25.

### 2.3 Economic Duties

- 2.3.1 Section 9(2) of the Electricity Act 1989 also requires National Grid to “*develop and maintain an efficient, co-ordinated and economical system of electricity transmission*”. National Grid is also regulated by the Office of Gas and Electricity Markets (OfGEM), which sets the level of charges that National Grid is allowed to make for the use of the transmission system. These charges are indirectly passed on to consumer bills, so OfGEM also seeks to prevent unnecessarily high levels of cost when developing the transmission system. These statutory and licence obligations to develop the transmission system economically and efficiently are necessarily important considerations for National Grid.

## 2.4 Duty to Protect the Environment

2.4.1 As the holder of the electricity transmission licence for England and Wales, National Grid has a statutory duty to consider the amenity impacts of its work. When formulating a proposal to develop an overhead electricity line, or carry out other works to the transmission system, Schedule 9(1) in Section 38 of the Electricity Act 1989 specifically requires National Grid to:

*“have regard to the desirability of preserving natural beauty, of conserving flora, fauna and geological or physiographical features of special interest and or protecting sites, buildings and objects of architectural, historic or archaeological interest; and shall do what it reasonably can to mitigate any effect which the proposals would have on the natural beauty of the countryside on such flora, fauna, features, sites, buildings or objects.”*

2.4.2 When determining any application for consent to undertake works to the transmission system, the Secretary of State for Energy and Climate Change must also consider the extent to which National Grid has complied with these duties.

2.4.3 As a statutory undertaker, National Grid also has other duties relating to amenity and environmental considerations. In relation to designated landscapes, the National Parks and Access to the Countryside Act 1949 and the Countryside and Rights of Way Act 2000 require all statutory undertakers to have regard to the purposes of National Parks and AONBs, respectively, when carrying out their statutory duties. Government guidance acknowledges that *“the duties do not override particular obligations or considerations which have to be taken into account by relevant authorities in carrying out any function”*, but goes on to explain that the purposes of designating nationally protected landscapes need to be *“recognised as an essential consideration in reaching decisions or undertaking activities that impact on those areas”*.

## 2.5 Stakeholder, Community and Amenity Policy

2.5.1 National Grid's Stakeholder, Community and Amenity Policy<sup>6</sup> sets out how the company will work with stakeholders and communities to meet the environmental duties placed on it by Schedule 9 of the Electricity Act and includes ten commitments. Of particular relevance to this stage of project development are the following:

- Establishing need.
- Involving stakeholders and communities.
- Routeing of networks and site selection – seeking to avoid areas which are nationally or internationally designated for their landscape, wildlife or cultural significance.
- Minimising the effects of works and new infrastructure on communities, by having particular regard to safety, noise and construction traffic, and on areas which are nationally or internationally designated for their landscape, wildlife or cultural significance and other sites valued for their amenity such as listed buildings, conservation areas, areas of archaeological interest, local wildlife sites, historic parks and gardens and historic battlefields (taking into account the significance of these and other areas through consultation with local authorities and other stakeholders with particular interests in such sites).

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<sup>6</sup> **National Grid (2010)** *National Grid's commitments when undertaking works in the UK: Our stakeholder, community and amenity policy* [on-line] Available at: <http://northwalesconnection.com/supporting-information-and-factsheets.aspx>

- Mitigating adverse effects of works – through the application of environmental assessment techniques.

## 2.6 Transmission Line Route Options Appraisal Process

- 2.6.1 In 2012 National Grid published a document entitled '*Our Approach to the design and routeing of new electricity transmission lines*<sup>7</sup>', which sets out how the most appropriate route and technology for any new transmission line should be identified in order to best satisfy society's needs. It also sets out how National Grid will collect data, undertake research and analysis, consult stakeholders and communities and listen to feedback to inform National Grid's judgements.
- 2.6.2 Further guidance on how the appraisal of competing design options should be undertaken is explained in a second National Grid document: '*Our Approach to Options Appraisal*<sup>8</sup>'. A summary of the stages that have been undertaken to date and the stages to be undertaken are illustrated in Figure 2.1.
- 2.6.3 The Strategic Options and route corridor options appraisal studies represent the first stages in the consenting process for the Wylfa to Pentir transmission connection project. Once a preferred route corridor and alignment is selected, National Grid will proceed through the Environmental Impact Assessment (EIA) stages of the process before submitting a Development Consent Order (DCO) application. Many activities will need to be planned and delivered, but these will be undertaken in consultation with statutory consultees, non-statutory stakeholders and local communities before an application for development consent is made to the Secretary of State alongside any other applications for required consents.

## 2.7 Other Legislation

- 2.7.1 In addition to the Electricity Act 1989, during development of the Wylfa to Pentir transmission connection, National Grid will have to comply with other national legislation and regulations relating to consenting works and protecting the environment; for example (but not limited to):
- The Planning Act 2008.
  - The Infrastructure Planning (Environmental Impact Assessment) Regulations 2009.
  - The Conservation of Habitats and Species Regulations 2010 (as amended).
  - The Countryside and Rights of Way Act 2000.
  - The Wildlife and Countryside Act 1981 (as amended).
  - The Heritage Bill – planned to be implemented in Wales in 2015.
- 2.7.2 Chapter 4 considers in further detail those planning policies relevant to this project.

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<sup>7</sup> **National Grid (2010)** *Our approach to the design and routeing of new electricity transmission lines* [on-line] Available at: <http://northwalesconnection.com/supporting-information-and-factsheets.aspx>

<sup>8</sup> **National Grid (2012)** *Our approach to options appraisal* [on-line] Available at: <http://northwalesconnection.com/supporting-information-and-factsheets.aspx>

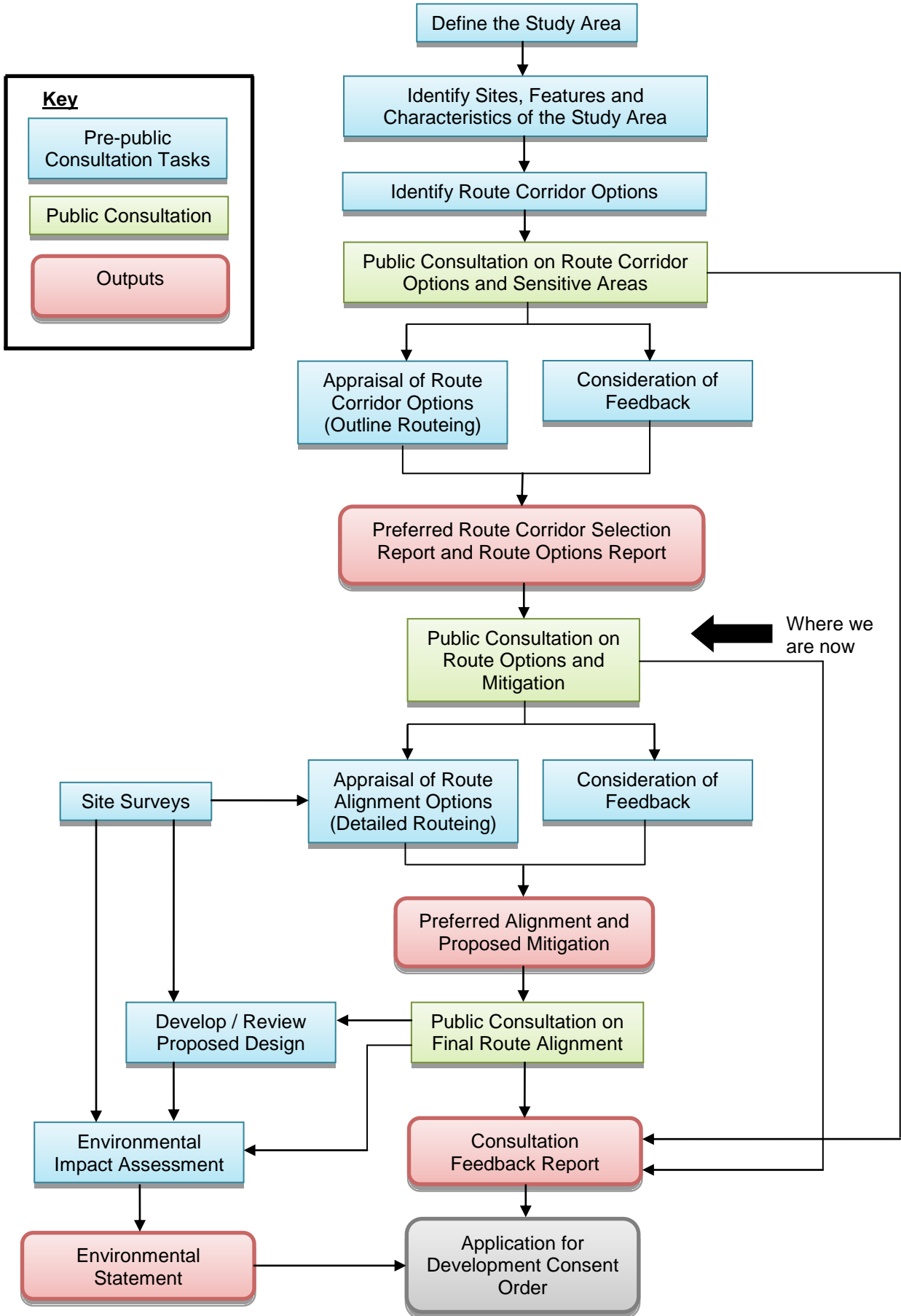


Figure 2.1 Route Selection Methodology

### **3 PROJECT CONTEXT**

#### **3.1 The UK Energy Challenge**

- 3.1.1 The UK is facing a major challenge to meet projected energy needs over the coming decades, while at the same time tackling climate change. A significant challenge for National Grid and the UK energy industry is to deliver low carbon energy in an affordable, secure and sustainable way. This is a challenge that will require an estimated £110 billion of investment in electricity generation and transmission up to 2020 to transform the UK's energy infrastructure.
- 3.1.2 The majority of electricity is currently generated by burning gas or coal and by nuclear power stations. However, there is potential for around 20 per cent of generating capacity to be removed from the electricity transmission network by 2020, as a proportion of existing power stations close because they have reached the end of their operating lives or are unable to meet the requirements of climate change legislation. This means that a major investment in new electricity generation is needed to replace power stations due for closure to meet future electricity demand.
- 3.1.3 At the same time, North Sea oil and gas are in decline, so Britain's gas-fired power stations are becoming increasingly dependent on imports. Even if existing coal-fired power stations could meet EU emissions legislation, the domestic coal industry is no longer the major force it once was. Therefore, Britain is no longer self-sufficient in energy and is increasingly reliant on imports. The movements in global energy markets have underlined concerns about the price and security of future electricity supplies
- 3.1.4 Tackling climate change will also have a significant influence on the electricity industry. Burning fossil fuels, such as gas and coal, to generate electricity creates large quantities of carbon dioxide (CO<sub>2</sub>), which is a major greenhouse gas. The UK government is committed to reducing emissions by 34% from 1990 levels by 2020 and this will mean a move from 4% of energy being produced from renewable sources (in 2012) to 15% from renewable sources by 2020.
- 3.1.5 The UK energy market needs electricity from renewable sources such as wind power, and also from nuclear power, to help tackle climate change and enable the country to meet its national and international obligations. The introduction of new wind and nuclear power generation over the next few years will require a reinforcement and extension of the existing electricity transmission system.

#### **3.2 North Wales Transmission System**

- 3.2.1 Electricity generation in North Wales is currently conveyed to the main interconnected transmission system in England and Wales via three 400kV transmission lines:
- Wylfa to Pentir (across Anglesey and Menai Strait);
  - Pentir to Connaught Quay (running parallel to the North Wales coast); and
  - Pentir to Trawsfynydd and Trawsfynydd to Connaught Quay / Legacy (Wrexham).
- 3.2.2 All of the overhead lines carry two transmission circuits, with the exception of the route between Pentir and Trawsfynydd which carries a single transmission circuit, limiting the transmission capacity of the whole North Wales area. This capacity is further limited by the three underground transmission cables that cross the Glaslyn Estuary at Porthmadog.
- 3.2.3 A new, additional electricity transmission connection to the mainland transmission system is needed to facilitate the connection of the proposed Wylfa Newydd Power Station. The NPS for Energy, entitled the Overarching Energy Network Policy Statement



(EN-1<sup>9</sup>), acknowledges the need for new lines to be built to connect new nuclear power stations.

- 3.2.4 Further information on the North Wales transmission system and the project need case is provided in the *North Wales Connection Project: Project Need Case* (National Grid 2015)<sup>10</sup>.

### 3.3 Strategic Options Appraisal

- 3.3.1 In 2012, National Grid identified a range of options for the locations where the power from the proposed Wylfa Newydd Power Station could be connected to the main interconnected transmission system, and how that power might be transmitted there. Five 'strategic options' were identified as a result; four involving sub-sea cabling to either Pentir, Deeside (Connahs Quay) or Pembroke. The option involving an onshore connection to Pentir, and crossing the Menai Strait, considered employing a range of possible transmission technologies, including both overhead line and buried cables for the whole of the distance. These five strategic options were appraised against a range of environmental, socio-economic, technical and cost topics, in discussion with officers from statutory consultees. National Grid's appraisal concluded that the 'preliminary preferred option was an overhead line between Wylfa and Pentir with appropriate mitigation, potentially including the use of underground technologies'.

- 3.3.2 The strategic option appraisal and conclusions were reported in National Grid's Strategic Options Report published in October 2012. The report also advised that certain assumptions had been made including:

*“...that adequate mitigation of landscape and visual and other impacts will be possible between Wylfa and Pentir. As indicated such mitigation potentially includes the use of underground technologies for parts of the route. ... In this context early feedback from key statutory consultees has already raised concerns about the sensitivity of the Anglesey AONB to overhead line development which would be considered in more detail at the next stage of options appraisal.”*

- 3.3.3 National Grid took forward the overland Wylfa to Pentir connection element of the preliminary preferred Strategic Option to the next stage of appraisal. This sought to identify a potential suitable route for the connection and locations where the use of underground technologies might be appropriate.

- 3.3.4 In parallel with this work, National Grid has: reviewed and taken into account consultation feedback from the consultation stage undertaken in 2012; considered the implications of subsequent changes to the volume and location of new power generation projects seeking to connect to the transmission system in North Wales; and considered the findings of the more detailed appraisal of route corridors summarised in this Preferred Route Corridor Selection Report. As a consequence, National Grid has back-checked and re-evaluated whether the preliminary preferred strategic option remains valid. This included the appraisal of a sixth 'strategic option', identified as a result of consultation, involving a significant length of onshore connection on Anglesey as well as a significant length of sub-sea cable running to a new substation in Gwynedd that would be connected to the existing Pentir to Trawsfynydd overhead line, somewhere south of Caernarfon. The findings of this back-check exercise were captured in the revised Strategic Options Report published in January 2015, which concluded that the preliminary preferred strategic option identified in 2012 remained preferred and that an

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<sup>9</sup> Department for Energy and Climate Change (2011) *Overarching Energy Network Policy Statement*

<sup>10</sup> Available at: <http://northwalesconnection.com/route-corridor-announcement.aspx>

underground cable crossing of the Anglesey AONB and Menai Strait was appropriate and would be taken forward.

- 3.3.5 Both Strategic Options Reports also considered wider reinforcement works that would be required to the existing transmission system on the mainland in North Wales. National Grid is currently contracted to have these works in place by 2020 in order to allow generation projects located in the Republic of Ireland to connect to the transmission system at Pentir. As such, the works on the mainland will already be in place by the time that the Wylfa to Pentir connection is required. As a result, National Grid announced in July 2014 that it would be taking forward the development of these works separately from the Wylfa to Pentir connection, which is solely required to allow the connection of Horizon Nuclear Power's Wylfa Newydd project. National Grid is continuing its appraisal work in respect of those works, and will report separately on the outcomes of that work in due course. Appropriate applications for consent will follow, either separately or as part of the application for development consent.

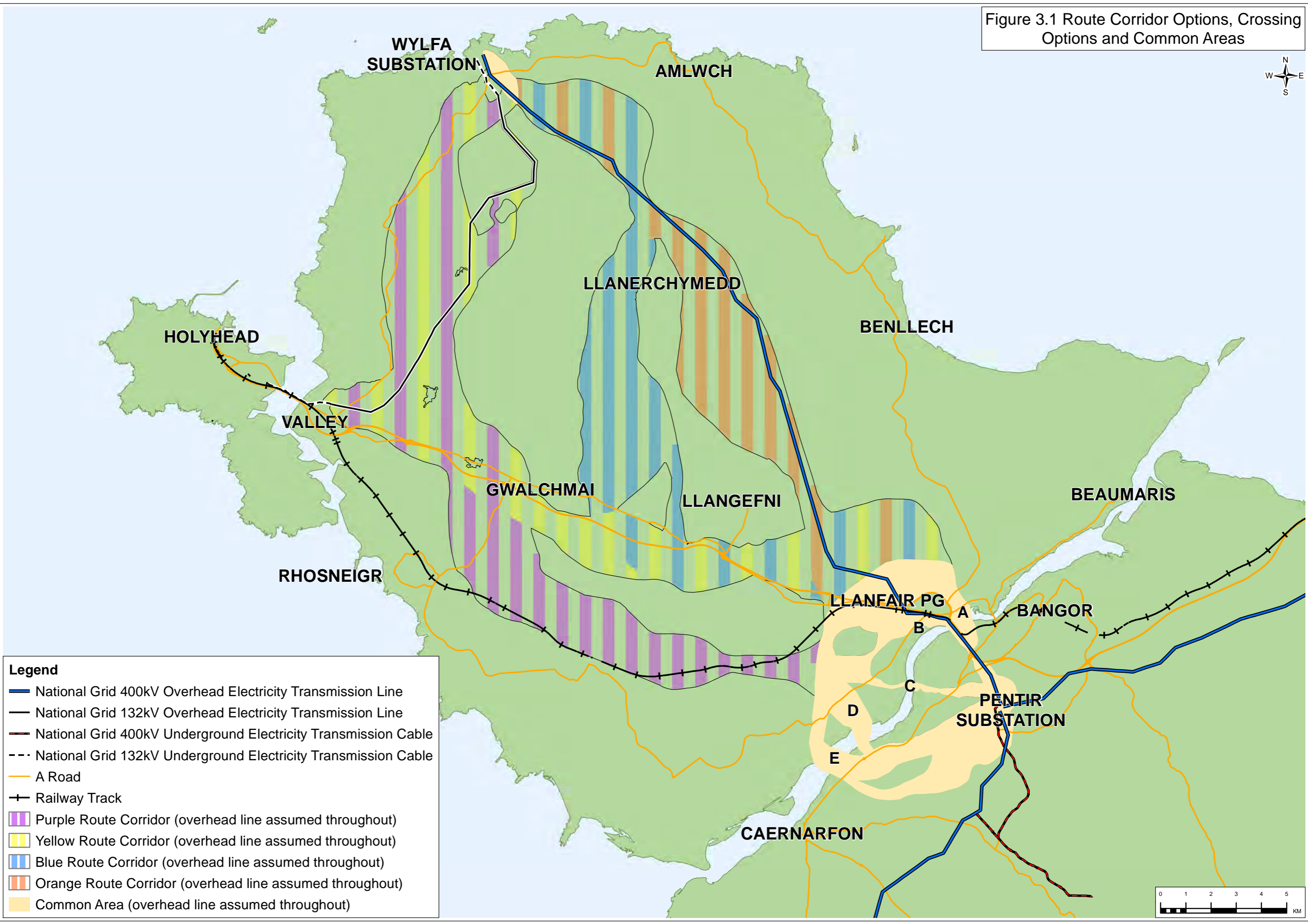
### 3.4 Wylfa to Pentir Route Corridor Options

- 3.4.1 National Grid identified initial route corridor options for a new 400kV overhead line between Wylfa and Pentir using a desk-based study, supplemented by specialist surveys of 'baseline' technical, environmental and socio-economic data within the study area (the whole of Anglesey and the north-west coastline of Gwynedd along the Menai Strait). These baseline data were reviewed to identify features or sensitive sites that have the potential to pose significant constraints to the development of a new overhead line (e.g. location of large residential areas, conservation sites or other development such as wind farms). From this review, four potential route corridors that avoided or minimised the potential effects associated with these constraints were identified. Taking account of the data and assessments available at that stage, it was assumed a transmission connection could be achieved with a fully overhead line connection between Wylfa and Pentir.

- 3.4.2 Figure 3.1 illustrates the route corridors and crossing options identified and presented for public consultation in October to December 2012. In summary, the route corridor options comprised:

- **Northern Common Area** – all the route corridors shared a 'common area' around Wylfa and Treglele connecting into the 400kV substation at Wylfa.
- **Orange Route Corridor** – broadly based on the route of the existing 400kV overhead electricity transmission line as it runs from Wylfa Power Station to Llanfair PG, where it joins the Southern Common Area.
- **Blue Route Corridor** – presented an option running generally north-south through open countryside in the centre of the island before turning east to follow the A55 towards the Southern Common Area.
- **Yellow Route Corridor** – presented an option to route a transmission line to the west of the island. It left Wylfa in a south or south-westerly direction, with an option to largely follow the direction of the existing 132kV overhead electricity transmission line and A5025 that runs along the west of the island down to the area near Valley and the A55. The route corridor then followed the A55 to join the Blue Route Corridor near Royal Air Force (RAF) Mona.
- **Purple Route Corridor** – shared the same route as the Yellow Route Corridor until the A55, from where it took a more southern route away from, but parallel to, the A55 through the centre of Malltraeth Marsh, to the Southern Common Area.

Figure 3.1 Route Corridor Options, Crossing Options and Common Areas



**Legend**

- National Grid 400kV Overhead Electricity Transmission Line
- National Grid 132kV Overhead Electricity Transmission Line
- - - National Grid 400kV Underground Electricity Transmission Cable
- - - National Grid 132kV Underground Electricity Transmission Cable
- A Road
- + + Railway Track
- Purple Route Corridor (overhead line assumed throughout)
- Yellow Route Corridor (overhead line assumed throughout)
- Blue Route Corridor (overhead line assumed throughout)
- Orange Route Corridor (overhead line assumed throughout)
- Common Area (overhead line assumed throughout)



- **Crossing Options and Southern Common Area** – A number of alternative overhead line crossing options were identified through the AONB and across the Menai Strait, defined largely by environmental considerations; in particular the potential opportunity to reduce adverse landscape and visual amenity effects by routeing close to Britannia Bridge and a wish to avoid the established woodland blocks within Plas Newydd and Vaynol Registered Parks and Gardens. A single search area was established between the four route corridors on Anglesey and Pentir Substation in Gwynedd, which included the crossing points and onward corridors to Pentir, allowing any one of the route corridors to be linked to Pentir via any one of the crossing options. The crossing options were:
  - Crossing Option A – to Pentir from between Llanfair PG and Menai Bridge via a corridor parallel to the A55 over Britannia Bridge and between Parc Menai and western edge of Bangor.
  - Crossing Option B – to Pentir from south-west of Llanfair PG via a corridor parallel to the A55 over Britannia Bridge and between Parc Menai and western edge of Bangor.
  - Crossing Option C – from between Llanedwen and Plas Newydd crossing through southern, less wooded areas of Plas Newydd and Vaynol estates to Pentir, crossing the A487 east of Y-Felinheli.
  - Crossing Option D – from between Brynsiencyn and Llanedwen towards Llanfair Hall on the south bank, then towards Pentir north of Bethel and via Seion.
  - Crossing Option E – from Brynsiencyn to the west side of Plas Menai on the south bank, then towards Pentir, north or south of Bethel, via Seion.

3.4.3 High level baseline considerations within each route corridor between Wylfa and Pentir can be found on the plans in Appendix A and in the 'Wylfa-Pentir Initial Route Corridor Report'<sup>11</sup>. Some of the more significant sites and features within or near the route corridors are outlined below.

- There are national and international designated nature conservation sites, with the main ones comprising: Corsydd Môn / Anglesey Fens Special Area of Conservation (SAC) and Corsydd Môn a Llyn / Anglesey and Llyn Fens Ramsar site plus associated Cors Erddreiniog Site of Special Scientific Interest (SSSI) and National Nature Reserve (NNR), and Caeau Talwrn SSSI within the Orange Route Corridor; Malltraeth Marsh SSSI within the Yellow, Purple and Blue Route Corridors; and Y Fenai a Bae Conwy / Menai Strait and Conwy Bay SAC traversed by all the crossing options.
- The Anglesey AONB covers much of the Anglesey coastline. The route corridors all need to cross the Menai Strait, so would cross the AONB at some point.
- Under the Unitary Development Plans (UDPs) the whole of Anglesey was classified as a Special Landscape Area (SLA), which are defined by National Resources Wales (NRW) as 'areas of high landscape importance for their intrinsic physical, environmental, visual, cultural and historical value in the contemporary landscape'. A review of local landscape designations (SLAs) in Anglesey and Gwynedd, commissioned by the Anglesey and Gwynedd Joint Planning Policy Unit (JPPU), proposed six smaller and more targeted SLAs across Anglesey and ten across

<sup>11</sup> **National Grid (2012)** *Wylfa-Pentir Initial Route Corridor Report* [on-line] Available at: <http://northwalesconnection.com/stage-one-consultation.aspx>

Gwynedd; six of these lie within the Wylfa to Pentir route corridors and common areas, as shown on Figure A.1 in Appendix A.

- There are many scheduled monuments, Grade I, II\* and II listed buildings and Cadw Guardianship sites within the route corridors.
- The Grade I Listed Plas Newydd and the Vaynol Estate Registered Historic Parks and Gardens are located on the shore of the Menai Strait.
- Dinorwig Landscape of Outstanding Historical Interest is located on the mainland within the Southern Common Area. Pentir Substation is within this historic landscape.
- Residential properties are scattered across Anglesey, with a number of larger settlements within or immediately adjacent to the route corridors and common areas on Anglesey; these include Tregele, Rhosgoch and Rhosybol, Capel Coch, Bodedern, Llanfechell and Llanfair PG.
- There are recreational and tourism facilities, such as Bangor University sports and playing fields, caravan parks, the National Trust property and Conway Centres (Outdoor Education) at Plas Newydd, Plas Menai Outdoor Pursuit Centre, Nuffield Trust Centre at HMS Indefatigable and Tre-Ysgawen 4-star Hotel and Spa.
- There are a number of large wind farms on Anglesey, including the Llyn Alaw wind farm south of Mynydd Mechell, which the existing National Grid 132kV overhead line passes through.
- Whilst not within the route corridors and crossing points it should also be noted that the Caernarfon and Beaumaris Castles form part of the Castle and Town Walls of King Edward in Gwynedd World Heritage Site. Caernarfon Castle lies on the mainland coastline to the south-west of the Menai Strait crossing options.

## 4 POLICY CONTEXT

### 4.1 National Policy Statements

#### Introduction

4.1.1 The construction of an above ground transmission connection of 132kV or above and over 2km in length is a 'Nationally Significant Infrastructure Project' (NSIP). The delivery of energy related NSIPs is covered by NPSs. The Secretary of State determines consent applications for NSIPs in accordance with NPSs.

4.1.2 Six NPSs for energy infrastructure were designated by the Secretary of State for Energy and Climate Change in 2011. The most relevant NPSs for the Wylfa to Pentir transmission connection are the Overarching NPS for Energy (EN-1)<sup>12</sup> and the NPS for Electricity Networks Infrastructure (EN-5)<sup>13</sup>, which should be read in conjunction with EN-1.

#### Overarching NPS for Energy (EN-1)

4.1.3 EN-1 describes the estimates for future electricity demand (59 gigawatt of new capacity required by 2025) and the requirement for diversification of the UK's energy sources, plus greater use of renewable and other low carbon forms of generation. With regard to the new nuclear development at Wylfa and associated need for a new National Grid electricity transmission line, the following paragraphs from EN-1 are particularly relevant:

*"Lack of sufficiently robust electricity networks can cause or contribute to large scale interruptions. Existing transmission and distribution networks will have to evolve and adapt in various ways to handle increases in demand, but construction of new lines of 132kV and above will also be needed to meet the significant national need for expansion and reinforcement of the UK's transmission and distribution networks." (paragraph 3.7.20).*

*"New lines will have to be built, and the location of renewable energy sources and designated sites for new nuclear power stations makes it inevitable that a significant proportion of those new lines will have to cross areas where there is little or no transmission infrastructure at present, or which it may be claimed should be protected from such intrusions." (EN-1, paragraph 3.7.7).*

4.1.4 EN-1 also emphasises that: *"the urgency of need for new generating capacity means that the need for new transmission infrastructure that is required to connect that capacity will be similar"* (paragraph 3.7.7).

4.1.5 In addition EN-1 sets out a number of 'Assessment Principles' (Part 4). It states that in considering any proposed development, and in particular when weighing up the beneficial and adverse effects, the Planning Inspectorate should take into account:

- The potential benefits, including contributions to energy infrastructure, job creation and any long term or wider benefits.
- The potential adverse effects, including any long term and cumulative adverse effects, as well as any mitigation measures incorporated to reduce these adverse effects.

<sup>12</sup> Department for Energy and Climate Change (2011) *Overarching National Policy Statement for Energy*

<sup>13</sup> Department for Energy and Climate Change (2011) *National Policy Statement for Electricity Networks Infrastructure (EN-5)*

### NPS for Electricity Networks Infrastructure (EN-5)

- 4.1.6 NPS EN-5 also highlights that transitioning electricity generation infrastructure in the UK to a low carbon economy, whilst maintaining security of supply, will be dependent on the availability of a reliable electricity network.
- 4.1.7 NPS EN-5 does not direct National Grid to particular sites or routes for new energy network infrastructure. Instead EN-5 states that the route should be chosen based on the location of a generating station in relation to the existing network, or the need for more strategic reinforcement of the network (paragraph 2.2.2). However, EN-5 does acknowledge that the transmission connections may not be via the most direct route as many factors, including engineering and environmental aspects, will need to be taken into account.
- 4.1.8 EN-5 also explains how new proposals will be assessed, and the supporting evidence needed, before being allowed to proceed. Any assessment will also need to cover issues raised in EN-1.
- 4.1.9 The implications of climate change need to be considered and NPS EN-5 requires any proposal to be able to cope with:
- Flooding, particularly for substations that are vital for the electricity transmission and distribution network.
  - Effect of wind and storms on overhead lines.
  - Higher average temperatures leading to increased transmission losses.
  - Earth movement or subsidence caused by flooding and drought affecting underground cables and above ground electricity infrastructure.
- 4.1.10 EN-5 (paragraph 2.8.8) states that the Government expects it would often be appropriate to fulfil the need for new electricity lines of 132kV and above through the development of overhead lines, though there will be cases where this is not so. Paragraph 2.8.7 supports the use of the 'Holford Rules' when deciding routes for overhead lines, and in relation to designing a connection NPS EN-5 states that:
- "... wherever the nature or proposed route of an overhead line proposal makes it likely that its visual impact will be particularly significant, the applicant should have given appropriate consideration to the potential costs and benefits of other feasible means of connection or reinforcement, including underground and sub-sea cables where appropriate." (paragraph 2.8.4).*
- 4.1.11 EN-5 goes on to state:
- "... Government has not laid down any general rule about when an overhead line should be considered unacceptable. The IPC<sup>14</sup> should, however only refuse consent for overhead line proposals in favour of an underground or subsea line if it is satisfied that the benefits from the non-overhead alternative will clearly outweigh any extra economic, social and environmental impacts and the technical difficulties are surmountable." (paragraph 2.8.9).*
- 4.1.12 With respect to public concerns relating to electric and magnetic fields (EMFs), EN-5 notes that the International Commission on Non-Ionising Radiation Protection (ICNIRP)

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<sup>14</sup> IPC = Infrastructure Planning Commission, introduced in 2009 under the Planning Act 2008 to examine and decide on NSIP applications. In 2012 the IPC was abolished and the relevant Secretary of State became the decision maker on NSIPs. The Planning Inspectorate took over the functions of the IPC and is responsible for the examination of NSIP proposals.

has developed health protection guidelines<sup>15</sup> for both public and occupational exposure (paragraph 2.10.3), and that the:

*“Government has developed with the electricity industry a Code of Practice, “Power Lines: Demonstrating compliance with EMF public exposure guidelines – a voluntary Code of Practice”, published in February 2011 that specifies the evidence acceptable to show compliance with ICNIRP (1998) in terms of the EU Recommendation.” (paragraph 2.10.9).*

4.1.13 It goes on to advise that:

*“Before granting consent to an overhead line application, the IPC should satisfy itself that the proposal is in accordance with the guidelines, considering the evidence provided by the applicant and any other relevant evidence.” (paragraph 2.10.9).*

## 4.2 Welsh Planning Policy

### Introduction

4.2.1 In Wales, planning policy comprises both national (Welsh) and local policy documents. This section outlines the main national and local planning policy documents and policies relevant to a new transmission line connection development between Wylfa and Pentir.

### Wales Spatial Plan

4.2.2 The Welsh Assembly Government (2008) *People, Places, Futures: The Wales Spatial Plan Update* sets out the Welsh Ministers’ policies in relation to the development and use of land in Wales over a 20 year period. It notes that ‘a significant challenge’ is the ability to play a local and national role in adapting to the effects of climate change.

### Planning Policy Wales

4.2.3 The Welsh Government (2014) Planning Policy Wales (Edition 7) sets out the land use planning policies of the Welsh Government and is supplemented by a series of Technical Advice Notes (TANs). Planning Policy Wales and the TANs, together with circulars and policy clarification letters, form the national planning policy in Wales. Paragraph 4.4.3 of Planning Policy Wales states that planning policies and proposals should:

*“...support the need to tackle the causes of climate change by moving towards a low carbon economy. This includes facilitating development that reduces emissions of greenhouse gases in a sustainable manner, provides for renewable and low carbon energy sources at all scales and facilitates low and zero carbon developments.”*

4.2.4 The Welsh Government’s objectives are to promote the generation and use of energy from renewable and low carbon energy sources for all developments in order to meet national targets. The proposed Wylfa Newydd Power Station supports these objectives as a low carbon energy source.

### Local Planning Policy (Anglesey and Gwynedd)

#### *Introduction*

4.2.5 The planning policy functions of Isle of Anglesey County Council and Gwynedd Council are combined and co-ordinated through the JPPU. Some of the current development

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<sup>15</sup> **International Commission on Non-Ionising Radiation Protection (1998) Guidelines for limiting exposure to time-varying electric, magnetic and electromagnetic fields.**



plan documents which contribute to the local policy framework pre-date the establishment of the JPPU in 2010 while others, specifically the Joint Local Development Plan (JLDP), are in development.

#### *Development Plan Documents*

4.2.6 The current adopted development plan for the Gwynedd local planning authority area is the Gwynedd UDP 2001 - 2016, which the Council formally adopted in 2009.

4.2.7 The current adopted development plans for the Anglesey local planning authority area comprise:

- Gwynedd Structure Plan (1993),
- Ynys Môn Local Plan (1996), and
- Stopped Ynys Môn UDP 2005 [*unadopted*].

4.2.8 Anglesey's Stopped UDP is considered by the Council to be a material planning consideration, whilst the current adopted development plans are supported by a series of Supplementary Planning Guidance (SPG).

4.2.9 During the route corridor options appraisal, work was underway on the Anglesey and Gwynedd JLDP, with the Anglesey and Gwynedd JLDP Consultation Draft Preferred Strategy Document<sup>16</sup> having been issued for public consultation in 2013. The JLDP will implement the Welsh Government policies at a local level and present planning policy up to 2026 to:

- Guide the development of housing, retail, employment and other uses.
- Aid the Local Planning Authority's decision with regard to planning applications.
- Protect areas to ensure the maintenance and enrichment of the natural and built environment.

#### *Local Development Plan Policies - New Electricity Transmission Line*

4.2.10 The Gwynedd Structure Plan has no policies relating specifically to nuclear energy generation or power transmission.

4.2.11 The main planning issues relevant to the proposed Wylfa to Pentir transmission line are identified in Chapter 2 of the Ynys Môn Local Plan:

*"Wylfa Nuclear Power Station: The future life of this important employer could be decided during the plan period. Any major change requires this Plan to be reviewed. Among issues that will need consideration are the decommissioning of the power station, alternative employment schemes and the provision of new infrastructure to support economic development".*

4.2.12 However, the Ynys Môn Local Plan does not mention the potential for new electricity transmission infrastructure associated with any future replacement of the existing Wylfa Power Station.

4.2.13 The Stopped Ynys Môn UDP identifies that responding to the changes of energy generation is an important issue. It states that *"there is a need to plan appropriately for energy generation in the light of issues around new power stations; the closure process*

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<sup>16</sup> **Anglesey and Gwynedd JPPU (2013) Anglesey and Gwynedd JLDP Consultation Draft Preferred Strategy Document** [on-line] Available at: <https://www.gwynedd.gov.uk/en/Council/Documents---Council/Strategies-and-policies/Environment-and-planning/Planning-policy/Preferred-Strategy/Preferred-Strategy.pdf>

*that will eventually affect Wylfa nuclear power station and the emergence of new wave energy and renewable technologies” (paragraph 4.11).*

- 4.2.14 Objective 12 of the Stopped Ynys Môn UDP is *“to promote and encourage the development and use of renewable and non-renewable sources of energy (where appropriate) and promote energy efficient development and design”*.
- 4.2.15 The Stopped Ynys Môn UDP makes no reference to electricity transmission.
- 4.2.16 Policy C27 in the Gwynedd UDP requires any overhead connection line associated with a renewable or sustainable energy scheme to not cause significant harm to the visual quality of the landscape.
- 4.2.17 Strategic Objective 18 of the draft JLDP is to *“promote renewable and low carbon energy production within the area”*.
- 4.2.18 Strategic Policy PS6 of the emerging JLDP is an overarching policy relating to all Major Infrastructure Projects whether determined by the Secretary of State, the Isle of Anglesey County Council, Gwynedd Council or any other agency. Strategic Policy PS7 applies to the proposed new nuclear power station, including development associated with it. Both of these strategic policies list detailed compliance requirements, including requirements to assess the environmental, social and economic effects of proposals.
- 4.2.19 The New Nuclear Build at Wylfa SPG was adopted by the Council in July 2014 and sets out the County Council’s vision and objectives for Wylfa Newydd. It is an important material consideration in assessing other planning applications linked to the project. It provides supplementary advice on significant local direct or indirect matters, and sets out the Council’s response to national and local policy and strategies in the context of the Wylfa Newydd project. While the SPG would not be supplemental to the JLDP, it seeks to be consistent with policy in the emerging JLDP.
- 4.2.20 A series of Topic Papers drafted by Isle of Anglesey County Council in support of the Wylfa SPG presented the evidence base and proposed main drivers which were to shape the SPG. Topic Paper 1: Natural Environment and Topic Paper 8: Infrastructure emphasise, respectively, the need to consider (among other things): i) *“how the natural environment can be managed in an integrated and sustainable way, along with social and economic issues, addressing the intrinsic value of the natural environment alongside the contribution made by it in terms of community well-being, a sense of place, tourism, agriculture and recreation progress”*; and ii) *“the power distribution network required to support nuclear new build development”*.
- 4.2.21 The Môn a Menai Regeneration Area programme was implemented to encourage economic development across Anglesey and north Gwynedd, based on an economic hub centred on the Menai Strait. It was announced in 2006 as a response by the Welsh Government and its stakeholders to the decommissioning of Wylfa Power Station, and the potential closure of the Anglesey Aluminium plant at Penrhos.
- 4.2.22 An action plan was published in 2008 which developed into the strategy framework for a regeneration programme which ran from 2011-14. The action plan’s programme focused on main themes including: low carbon energy; innovation, knowledge and skills; infrastructure, mobility and transport; and natural environment, heritage and coastal assets.
- 4.2.23 The Môn - Menai Coast Action Plan centred on optimising the assets provided by Anglesey’s coastline to promote economic development. The Action Plan focused mainly on the tourism, leisure and recreation sectors, and, therefore, did not relate specifically to the energy sector or electricity connection projects.

### Local Development Plan Policies – Landscape Designations and Visual Amenity

- 4.2.24 The local policy framework is strongly supportive of preserving the natural landscape and heritage within the AONB, and in particular areas along the Menai Strait adjacent to the Menai Bridge, Plas Newydd and the Vaynol Estate.
- 4.2.25 Under the adopted Ynys Môn Local Plan the whole of Anglesey was classified as a SLA, defined by NRW as ‘areas of high landscape importance for their intrinsic physical, environmental, visual, cultural and historical value in the contemporary landscape’. In 2012, the JPPU commissioned independent consultants to undertake a thorough review of local landscape designations (SLAs) in Anglesey and Gwynedd<sup>17</sup>. The review proposed six smaller and more targeted SLAs across Anglesey and ten across Gwynedd based on a detailed appraisal of landscape quality and value; six of these lie within the Wylfa to Pentir study area (see Figure A-1 in Appendix A).

### **4.3 Planning Consents**

- 4.3.1 The proposed new Wylfa to Pentir electricity transmission line is classified as a NSIP under the Planning Act 2008, so requires an application to be submitted to the Secretary of State for a DCO. An EIA would be undertaken in accordance with the Infrastructure Planning (Environmental Impact Assessment) Regulations 2009 (as amended).
- 4.3.2 Consent for works which are not integral to or do not form part of the NSIP, such as advance works to improve the connecting substations and wider system improvements, may be sought via a Town and Country Planning Act application to the local planning authority (Gwynedd Council or Isle of Anglesey County Council). The consenting regime for every element of the project will need to be carefully considered, in discussion with the relevant authorities, as the project moves forward.
- 4.3.3 For the purposes of this document and assessing and comparing options, given the interdependence of the component parts, the proposed Wylfa to Pentir connection has been considered as a single scheme so potential effects are considered in their entirety.

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<sup>17</sup> **LUC (2012)** *Review of Special Landscape Areas in Gwynedd and Anglesey: Executive Summary* [on-line] Available at: <https://www.gwynedd.gov.uk/en/Council/Documents---Council/Strategies-and-policies/Environment-and-planning/Planning-policy/Supporting-documents/Review-of-Anglesey-and-Gwynedd-Special-Landscape-Areas-Executive-Summary.pdf>

## 5 ELECTRICITY TRANSMISSION DEVELOPMENTS

### 5.1 Introduction

5.1.1 In order to appraise the potential effects of any new connection, it is important to have an understanding of the potential forms that transmission infrastructure may take and how this would influence the nature of the associated environmental and socio-economic effects. This chapter seeks to provide an overview of these issues, but a detailed understanding of these forms of development has underpinned the whole of the appraisal process and the selection of a preferred route corridor.

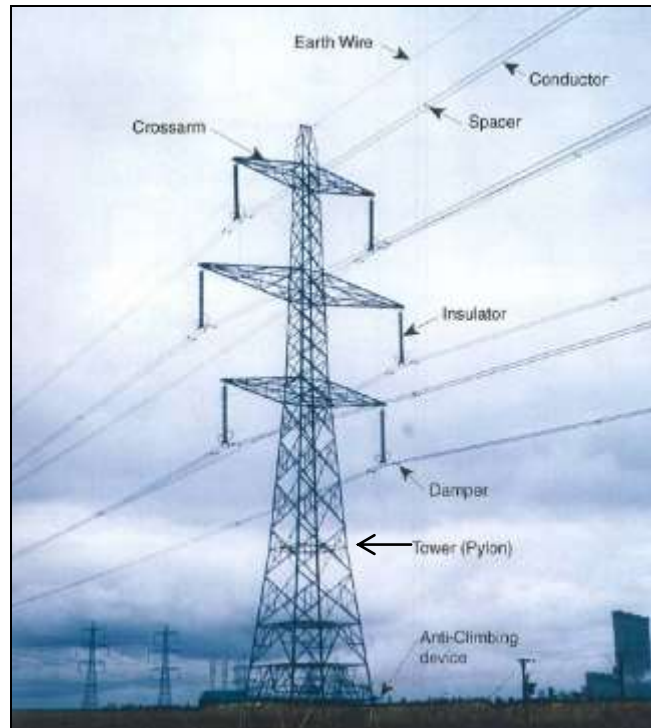
5.1.2 The transmission of electricity at high voltages of 275kV and 400kV allows bulk supplies of electrical power to be efficiently transported over long distances (i.e. with least energy loss) from large power generators to large centres of electrical demand. Electricity transmission systems comprise a series of electricity substations that transform the operating voltage or switch circuits in or out of operation to control the flow of electricity. These substations are connected together by a network of transmission circuits across the country, which are either carried on overhead lines or comprise lengths of underground cable. Due to the amounts of power being transmitted and the operating voltages employed, electricity transmission equipment tends to be large in scale and complex in nature. This chapter provides a generic overview of standard overhead and underground transmission infrastructure and its construction and operation.

### 5.2 Overhead Lines

#### Overhead Line Components

5.2.1 Overhead lines comprise two main components: towers (commonly known as pylons) and the suspended conductors (commonly referred to as the 'wires'). The conductors carry the electrical power flows, whilst the towers are used to ensure that safe clearances are maintained between the live conductors, the ground and the supporting tower itself.

5.2.2 Figure 5.1 shows a Suspension Tower, which is the structure primarily used to support the conductors along a straight section of route. This image also details the various components of an overhead tower.



**Figure 5.1 Suspension Tower - Overhead Line and Tower Components**

5.2.3 The overhead line and tower components are listed below.

- *Earth Wire:* The highest wire supported between the peaks of the towers and connected to the ground in order to protect the conductors during lightning strikes.
- *Conductor:* A continuous wire (normally made from aluminium) suspended from the towers that carries the electrical current. Several conductors may be grouped together to form a bundle. Each circuit comprises three bundles of conductors (one for each electrical phase), each supported by a separate cross arm.
- *Tower:* Typically a lattice steel structure (pylon) that comprises a tower body and six cross arms, normally carrying two discrete electrical circuits.
- *Cross arms:* Arms of the tower that carry the conductors and maintain safe electrical clearances between the live conductors, the ground and the main tower body.
- *Insulator:* Used to maintain a safe clearance between the live conductor and the tower cross arms that support them.
- *Spacers:* Keep a bundle of conductors separated from each other.
- *Damper:* Reduces vibration in the conductors caused by cross-winds, helping to reduce wear and tear to the conductors and insulators.
- *Anti-Climbing Device:* A barrier fitted to each of the four tower legs to deter individuals from climbing the tower.

5.2.4 Typically, towers are around 50 metres (m) in height, have standard base dimensions of between 7m and 10m wide and are spaced approximately 360m apart. Where an overhead line changes direction, terminates or needs to negotiate more complex terrain, stronger towers are required that have heavier steelwork and larger footprints than the standard towers.

### Tower Types

- 5.2.5 Alternative tower types to the standard lattice towers, used along the existing Wylfa to Pentir line, may be considered for the connection if they offer substantive benefits (e.g. reduction in visual effects). As illustrated in Figure 5.2, a range of tower types could fulfil the technical requirements of the project, including those outlined below.
- *Steel lattice towers* – The current ‘high capacity’ 400kV lattice tower is the L13 design (typically 50m in height). These are similar in design to those used along the existing Wylfa – Pentir overhead line (the L6 design).
  - *T-pylon* – Following a design competition in 2011, a new type of transmission tower was developed that would provide the same transmission capability as the ‘traditional’ steel lattice pylon, but be more compact in height terms. The resultant ‘T-Pylon’ is approximately 33m in height, similar in height to a ‘low height’ lattice steel design. National Grid has recently constructed a five-pylon test section of overhead line near Eakring in Nottinghamshire using the new T-pylon, from which National Grid is evaluating its construction and operation.
  - *Low height towers* – Low height lattice towers (the L12 design) are typically 36m in height, but are wider than ‘traditional’ lattice towers. These towers have generally been used on short sections through height restriction areas (e.g. low flying zones), but have the potential to offer landscape and visual advantages in some settings.
- 5.2.6 Figure 5.3 provides a visual comparison of an L13, L6 and L12 low height lattice towers and a T-pylon. These are photomontages of each tower type in a generic rural setting, not dissimilar to that found on Anglesey, to provide a visual comparison of the tower differences with all else being equal.

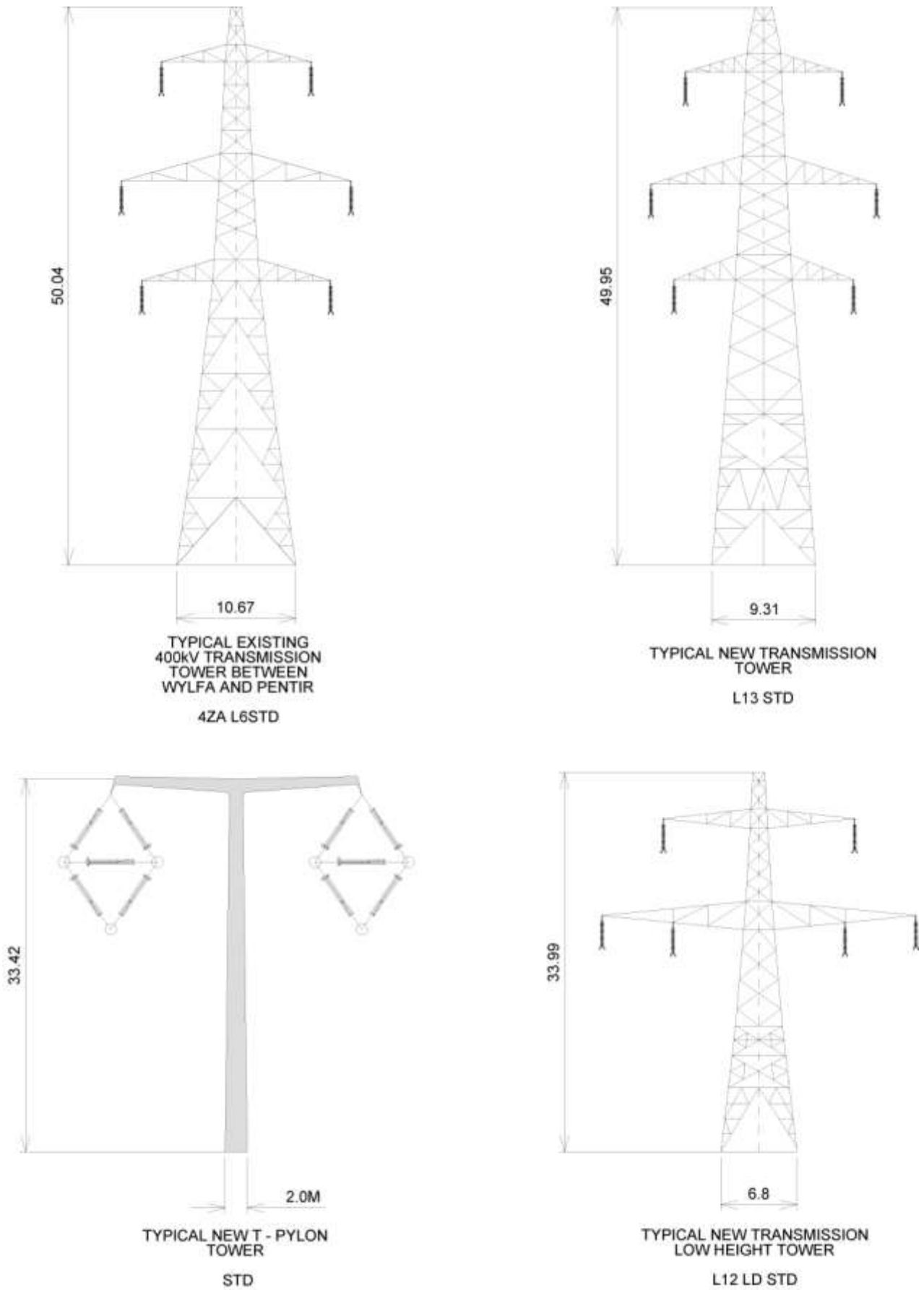


Figure 5.2 400kV Electricity Transmission Tower Types



*Existing L6 Tower*



*L13 Standard Tower*



*L12 Low Height Tower*



*T-Pylon*

**Figure 5.3 Visual Comparisons of Electricity Transmission Tower Types**



- 5.2.7 For all tower types, more robust, stronger angle (or tension) towers are required where the transmission line changes direction. Figure 5.4 shows a lattice suspension tower (on the left) and a tension tower (on the right).



**Figure 5.4 Suspension Tower (left) and Tension Tower (right)**

- 5.2.8 During ongoing consultation on the connection design, National Grid will review pylon design options for the project and consider if alternative pylon designs would provide advantages when compared with the standard lattice tower design. Representations made during consultation regarding pylon design would be considered as the detailed design progresses.

#### Overhead Line Construction

- 5.2.9 Construction of lattice pylons requires the following activities:
- Construction of temporary access tracks and construction areas to every pylon site (metal or stone) where existing roads are not present (e.g. in a farmers field); see Figure 5.5.
  - Localised vegetation clearance and soil excavation, if required, in the area the pylon is to be located.
  - Implementation of drainage works, if required.
  - Creation of site compounds to store materials, equipment and provide welfare facilities for workers during the construction period.
  - Installation of temporary fencing around working areas around the tower bases, the size of which is dependent on tower type (typically 30m x 30m around the base of the suspension towers or 50m x 50m around tension towers).
  - Creation of the foundations for each pylon, which are normally made of concrete, although piles may be needed in certain ground conditions.
  - Construction of the tower (see Figure 5.6) using a range of machinery, such as excavators, cranes, winches and delivery vehicles. The cranes used tend to be large to allow the full height of the tower to be reached with the crane arm.
- 5.2.10 Once the towers are erected, the conductors are brought to site on drums and winched and secured into position. Winches would not be needed at the majority of tower sites, but where needed would be located some distance from the tower itself. Where the overhead line crosses roads, other electricity lines or telephone wires, these are protected; for example, scaffolding and nets are erected over roads, and lower voltage lines are made dead, relocated or protected with scaffolding.



**Figure 5.5 Temporary Stone Access Track with Pylon Construction Area**

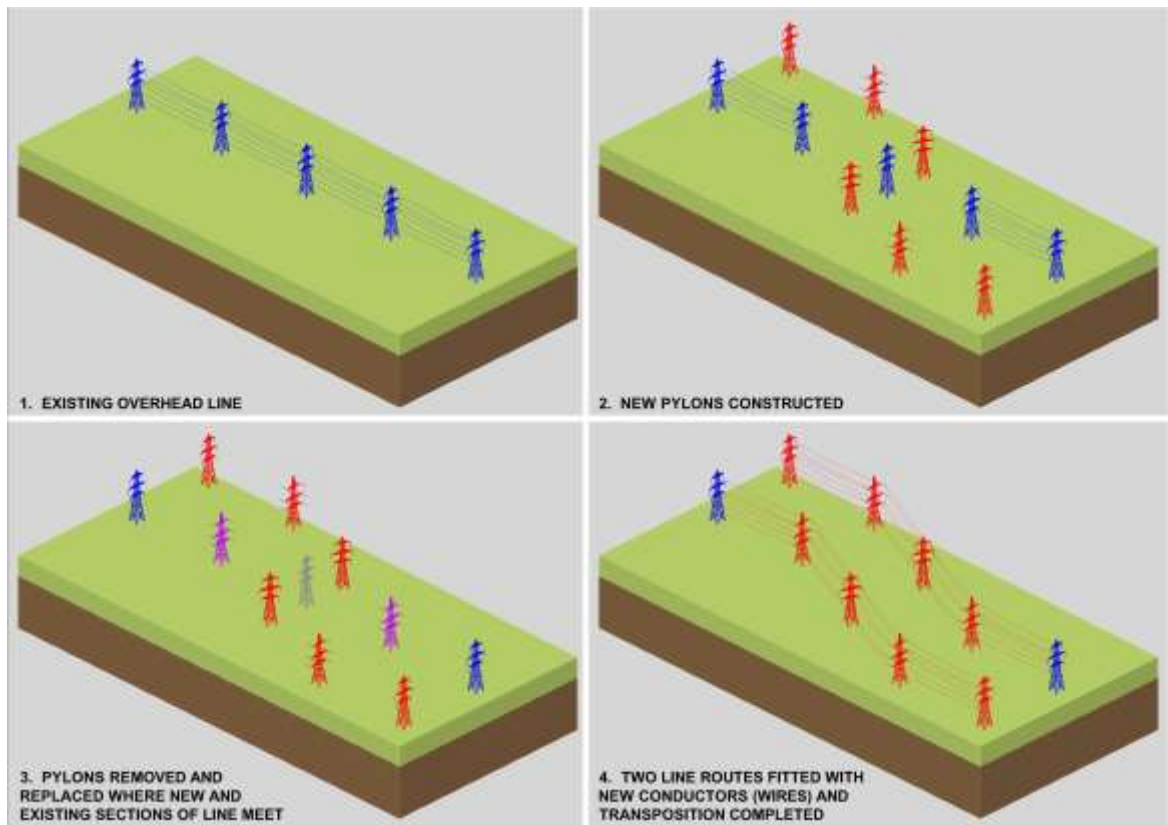


**Figure 5.6 Crane Assembling a Tower**

- 5.2.11 Following construction of the towers, all temporary site compounds, access tracks and machinery are removed and the land is returned to its original condition. However, where it is necessary to route across areas of trees or tall shrubs, National Grid may need to clear or trim this back on a regular basis to maintain safety clearances to the conductors above.
- 5.2.12 The construction of the T-pylon follows a similar sequence of activities, but whereas the lattice steel tower is delivered as individual steel members, to be assembled on site, the larger components of the T-pylon tend to be delivered on a long articulated vehicle. This can result in shorter construction periods for each individual tower when compared with the four week sequence typically associated with the erection of a lattice tower.

#### Potential Design Interactions between New and Existing Electricity Lines

- 5.2.13 Where two overhead transmission lines are in close proximity, there may be a need for them to cross, and in those circumstances a number of specific design considerations arise.
- 5.2.14 It may be possible for the two lines to cross each other, with the line operating at the higher voltage tending to be uppermost. Such a crossing requires the upper line to be constructed significantly higher than would otherwise be the case. This would be required to achieve safe electrical clearances to the conductors of the line below, which in turn would need to maintain safe electrical clearance to the ground beneath. Further clearance height might also be needed to give clearance to any scaffolding and nets that might be erected between the two lines as a safety measure during construction and maintenance activities. The resultant towers either side of the crossing can be noticeably taller.
- 5.2.15 A number of alternative design solutions are available that would avoid or reduce these concerns. Where the line being over-sailed is of a relatively low voltage, then it may be cost effective, and desirable in environmental terms, to permanently replace a section of the line with buried cables. When this might not be technically feasible or prove prohibitively expensive, the lower voltage line might be replaced with two sections of lower height towers, each carrying a single circuit. This allows the existing line to pass below ('duck under') the over-sailing line, which could then be somewhat lower whilst still maintaining safe electrical clearances.
- 5.2.16 Alternatively where the voltages of the two lines are the same and the direction of power flows across the electricity system allow it, a 'transposition' or 'swap-over' can be achieved. This is done through the removal of a section of the existing line, allowing the two newly formed 'ends' of existing line to be connected to two sections of new route located on different sides of the existing line. The two resultant routes would then both comprise sections of newly built and original overhead line. This is illustrated schematically in Figure 5.7.
- 5.2.17 The transposition of a new line route from one side of an existing line to the other can be achieved on adjacent towers, resulting in up to four bulkier angle towers being located in close proximity. Alternatively it may be possible to utilise existing angle towers on the current line to partly form the transposition, or to extend the distance over which a transposition is achieved to make the change of route direction more gradual, with greater separation between the angle towers.



**Figure 5.7 Transposition Process**

### Overhead Line Maintenance

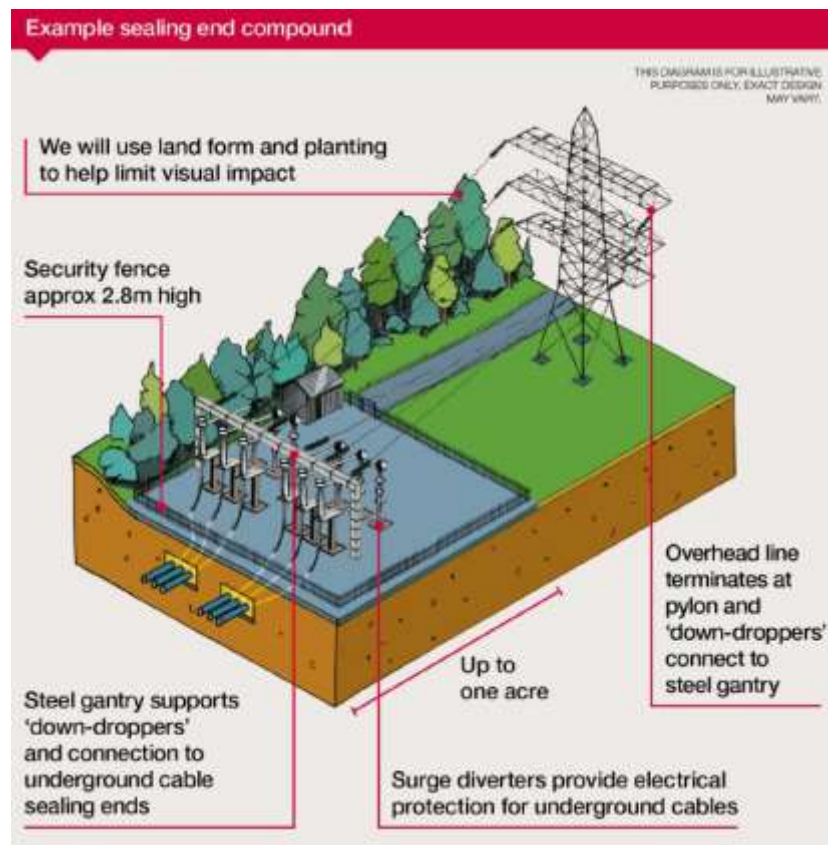
- 5.2.18 During the operation of a line, the pylons are inspected regularly via both walk-through and helicopter inspections. Conductors are replaced after a period of 20 to 60 years, depending upon the local climate, altitude, exposure, and the electrical loads to which they are subjected. The lifespan of a pylon is around 80 years.
- 5.2.19 During this time very little routine maintenance is required other than tower body and cross arm painting approximately every 20 years. Painting of the cross arms and some section of the tower bodies requires the circuits to be switched off. Fittings can be upgraded during routine inspections if required.

### **5.3 Underground Cables**

- 5.3.1 Where required, connections can be made using underground cables, with a sealing end compound at the interface between an overhead line and underground cable. Each transmission circuit would normally comprise either three or six buried cables, dependent upon the required capacity of the route.
- 5.3.2 In the case of overhead conductors, the air insulates the live conductor from its surroundings and aids the dissipation of heat generated by the electrical current. When operating buried cables at transmission voltages robust insulating materials are needed to surround the conductor, which also needs to be larger to compensate for the reduced heat dissipation when buried. Identifying and accessing faults within cables is also more problematic. Therefore, the use of buried cables at transmission voltages is technically more complex and significantly more expensive than an equivalent overhead line.

### Cable Sealing End Compound

- 5.3.3 Sealing end compounds (SECs) are secure sites surrounded by a palisade fence where the overhead conductors are connected to the ends of buried cables which are brought vertically upwards out of the ground. The cable ends are supported within insulated columns. The site may also accommodate equipment for the protection of the cables that would prevent electrical power surges or allow the cables to be isolated from the transmission system. Small kiosks containing monitoring equipment for the cables may also be located within the compound. A permanent access track is required to the compound, but the surface treatment can vary as maintenance traffic is generally infrequent and light.
- 5.3.4 SECs are generally constructed on relatively flat sites. Their size varies according to the number of cable ends that they accommodate and the nature of the additional equipment that they contain. Generally a SEC occupies a footprint of approximately 60m x 60m (approximately 0.4 hectares), but this can increase to 120m x 60m (approximately 0.7 hectares) for the largest sites. Additional land will also be needed for access development, the creation of a level development platform (dependent upon site topography) and the creation of peripheral landscape screening.
- 5.3.5 The overhead line needs to terminate within or adjacent to the compound fence line with the conductors from the last tower connecting to a gantry structure, normally constructed from lattice steelwork. The gantry can be designed to take the full tension from the overhead line, allowing the last tower to be 150-300m from the SEC. Alternatively a heavier tower can be located immediately adjacent to the SEC, allowing the conductors to drop nearly vertically onto a slightly lighter gantry structure located within the SEC.



**Figure 5.8** Illustration of a SEC for a Directly Buried Cable

- 5.3.6 Figure 5.8 illustrates an example SEC with a termination tower, steel gantries, supports for cable terminations and earth switches to allow the transition from overhead line conductor to cables. Variations on the compound design can reduce the overall visual effect (e.g. use of gantries instead of a termination tower).

#### Direct Buried Cable Installations

- 5.3.7 Cable installation can be done using a variety of techniques. The most common method is by open cut trenching. Each trench would be approximately 1.5m wide by 1.2m deep (see Figure 5.9). Typically two or four trenches are required, each accommodating three separate cables (one for each of the three electrical phases). A central construction haul route is established, and peripheral drainage installed along the construction corridor. The soils excavated from the access track and working areas are also stored within the corridor. These requirements result in a typical working width of between 40m and 50m (see Figure 5.9), although this can be reduced significantly in localised areas to avoid sensitive sites or features.
- 5.3.8 In designing a 400kV cable system, if the electrical performance of the cables is not to be compromised, it is important that the physical environment of the cables enables:
- heat dissipation to prevent overheating and subsequent reduction in cable rating (capacity for carrying current);
  - physical protection so that the cable does not become damaged or become a potential danger to third parties; and
  - proper access to ensure efficient inspection repairs or replacement.



**Figure 5.9 Construction Working Area during Underground Cable Laying**

- 5.3.9 Where underground cables are used, each circuit typically comprises one or two sets of three separate cables, dependent upon the power flows and ground conditions. For each set of three cables, underground joint bays (concrete lined) are necessary at intervals of 500m to 1000m, to allow joining of individual section lengths of cable. To facilitate cable testing, either surface accessible link box chambers or small above

ground cabinets would be provided at a number of locations directly adjacent to the joint bays.

- 5.3.10 The main disadvantage with underground cabling buried in trenches is the technical constraints, environmental effects during construction and costs associated with their operation, maintenance and replacement; for example, any faults would necessitate excavation in order to access the cables. Once in place, the construction of buildings, planting of trees and use of deep cultivating equipment are prohibited over the cables. During operation, a corridor of approximately 35m wide encompassing the buried cable would still be required for maintenance access; referred to as an easement.

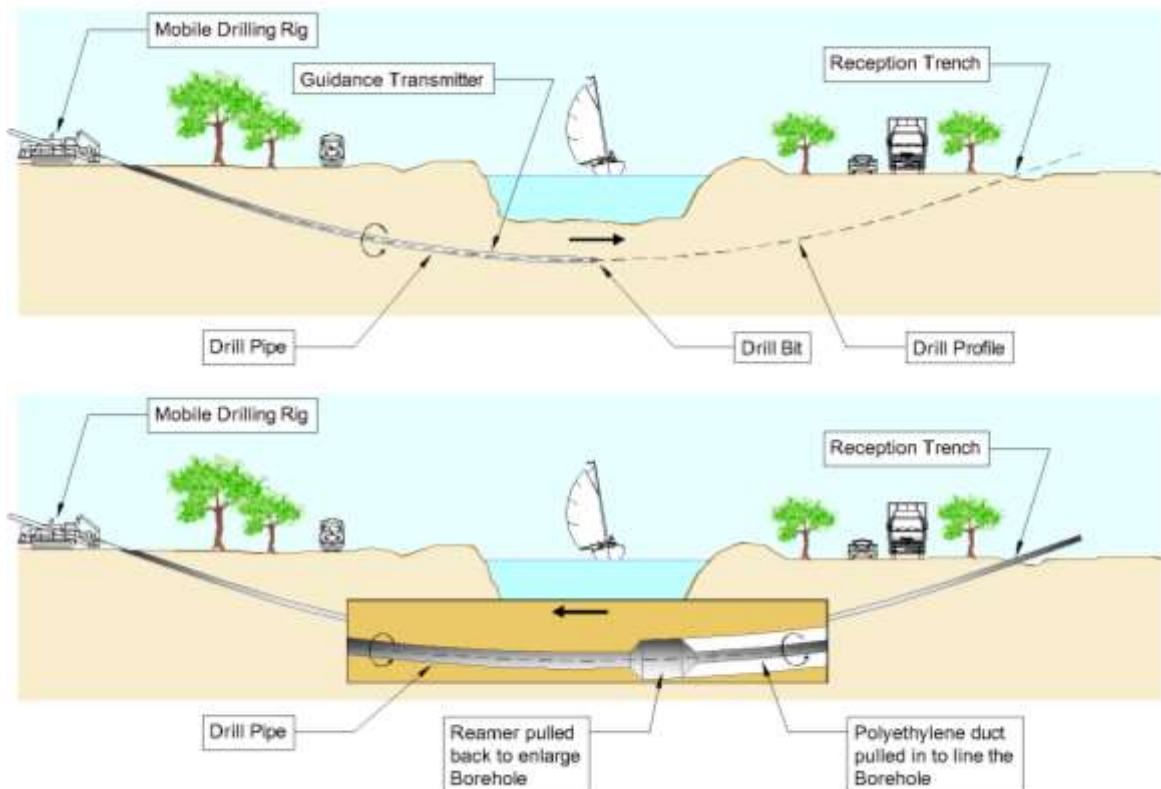
#### Marine Burial

- 5.3.11 In a marine environment it is possible to install direct buried cables in the seabed. A variety of different techniques could be used to achieve this dependent upon the nature of the seabed substrate, water depth, navigational and environmental constraints.
- 5.3.12 Marine cables are generally installed using a specialised cable laying vessel. In suitable conditions these employ a seabed plough that cuts a furrow and buries the cable in a single operation. Where the seabed is less dense, such as in sandy sediments, a high pressure water jet may be used to fluidise the sediments and allow the cable to settle into the jetted trench. Sediments then refill the trench over time. In harder substrates, such as rock, or where space is constrained, a remotely operated trenching vehicle may be employed. This is a submersible, tracked machine with a toothed cutting wheel guided from a surface vessel. The excavated material may either be recovered to the vessel, or deposited adjacent to the cut trench. The cables are then lowered into the trench.
- 5.3.13 With jetting or cutting it is possible to install ducts, before then installing the cables within them, providing the distances are comparatively short (less than 1 kilometre).
- 5.3.14 In suitable locations it may also be possible to lay the cables directly onto the surface of the seabed, either within or without enclosing ducts. However, such installations are at significantly greater risk of damage, either through erosion or deposition of the sea bed, tidal movement or physical damage from human activities such as anchoring or fishing. This risk can be partially mitigated by the installation of protective concrete mattresses or rock filled baskets above the cables.

#### Trenchless Techniques for Laying Cables

- 5.3.15 At major crossing points, generally major rivers, main roads and railways, the use of open cut trenches may not be technically, environmentally or economically viable, and trenchless techniques would need to be employed. At these points the cable installation would be at greater depths and the cables would need to be spaced more widely to avoid the risk of overheating when in use.
- 5.3.16 The type and extent of the trenchless technique would be determined by a number of factors which include ground conditions, topography, available working space and stability of existing slopes.
- 5.3.17 There are three main options:
- 5.3.18 **Horizontal Directional Drilling (HDD)** requires a construction compound at each end of the drilled section with a reception pit at one end and a drive pit at the other between which drills are guided back and forth to enable polyethylene ducts to be pulled through from one side (see Figure 5.10). Cables are then pulled through the installed ducts, which are then filled with a clay-based material (bentonite) to aid heat dissipation. Using this technique there is minimal disturbance to the environment between the site compounds. As sections of cables cannot be joined within a duct, the maximum length

of 400kV underground cable that could be pulled through a buried duct is limited by the delivery weight of a single cable drum and the stress placed on the cable when pulling it through the duct. These considerations typically limit maximum lengths to approximately 1km.



**Figure 5.10 Horizontal Directional Drilling (HDD) Cable Laying**

- 5.3.19 **Tunnelling** requires the construction of two shafts which are then used to ‘launch’ and ‘recover’ a tunnel boring machine. The shafts and tunnel are typically lined with concrete sections and the cables clamped to the shafts and hung on the walls within the tunnel. A permanent above ground head house would be required above one or more of the tunnel shafts to allow for maintenance access, winching equipment and cable cooling ventilation. The head houses would be in addition to the SEC. The SECs may be located some distance from the tunnel shaft with direct buried cables installed between the two.
- 5.3.20 **Bridge Installation** For shorter distances, to cross a linear feature such as a river or railway, it may be possible to install cables on, in or beneath the deck of existing bridges where this would not conflict with its primary purpose. Alternatively a new purpose-built bridge can be constructed specifically to carry cables across a linear feature. The scale of the bridge would be determined by the form of support chosen, the weight (size and number) of the cables to be carried, and the width of the feature to be crossed.

#### Cabling Construction Working Areas

- 5.3.21 For all cabling works, vegetation would be cleared and topsoil stripped from the areas of ground to be disturbed in the working area. Where required, drainage improvement works would be implemented to maintain existing land drainage arrangements. Once the cables have been laid and, where necessary, any excavations backfilled, the temporary haul road and access tracks would be removed and soil replaced. Temporary



stored topsoil and subsoil would be re-used for surface reinstatement. Where possible, hedgerows would be planted or replaced; however, trees cannot be planted on top of the cables.

- 5.3.22 Where the route climbs a steep slope, there may be the need for civil engineering works to reduce the mechanical strain on the cables. In such circumstances, it is normal to lay the cables in a snake formation (not straight up the slope), in order to distribute the cable weight. Due to this snaking, these sections can require a greater installation width and a larger amount of excavation.
- 5.3.23 For underground cables, in significant areas of rock different excavation techniques would be required. For areas of large, continuous rock formations, rock-cutting techniques would be required.

#### Cabling Operation and Life Expectancy

- 5.3.24 Cables have a life expectancy of approximately 40 years. After this time, the cables would need to be fully replaced, further adding to significant lifetime cost differences in comparison with an equivalent overhead line. If there is space, a new cable route could be constructed alongside the existing to avoid prolonged non-availability of the circuit. The redundant cables would then normally be removed once the new cables become operational.
- 5.3.25 Monitoring would be carried out via fibre-optic cables installed within the cables.

### **5.4 Substations**

- 5.4.1 National Grid substations are required where power stations connect to the transmission system. They are also required where National Grid can control the direction and quality of power across the transmission system, and where the transmission voltages of 400kV and 275kV need to be transformed to the lower voltages at which the distribution networks or large electricity consumers (such as Network Rail) operate. Equipment within substations generally ranges up to 12m in height. Each circuit that connects to a substation (whether connecting to another National Grid substation or a power station) requires a dedicated section of electrical equipment. The connection of additional circuits to an existing substation requires the extension of the equipment footprint at the site, which may require the extension of the site boundary to enclose the equipment. National Grid substations vary in size depending on the number of associated connections, but all are surrounded by a metal security fence.

## 6 APPRAISAL PROCESS

### 6.1 Introduction

6.1.1 The environmental, socio-economic and technical considerations used to evaluate and appraise the route corridors have been influenced, amongst others, by:

- National Grid's statutory duties and policies;
- other legislative requirements including the Planning Act 2008 and associated Regulations, including the duties with regard to consultation; and
- planning policy.

6.1.2 Chapter 4 outlines the relevant planning policies, and in this Chapter additional information specific to the scoping of appraisal topics is presented. This Chapter then outlines the environmental, socio-economic, technical and cost considerations used to evaluate and appraise the route corridors.

### 6.2 Statutory Duties

6.2.1 As outlined earlier in this report, Section 9 of the Electricity Act places an obligation on National Grid to develop and maintain an efficient, co-ordinated and economical system of electricity transmission. In addition, Schedule 9(1) in Section 38 of the Act requires National Grid to consider the effects of its works on amenity by having regard to:

*"the desirability of preserving natural beauty, of conserving flora, fauna, and geological or physiographical features of special interest and of protecting sites, buildings and objects of architectural, historic or archaeological interest".*

### 6.3 Planning Act 2008

6.3.1 The installation of an above ground transmission connection over 132kV and 2km is defined as a NSIP. As such, should any part of a new connection involve overhead lines that exceed these thresholds, an application for a DCO would be required under the Planning Act 2008. The Secretary of State is the determining authority for such applications.

6.3.2 In England, a DCO application would usually also include all additional development associated with the overhead line. In Wales, applications for any associated development, which does not form part of the NSIP, would be determined by the relevant local planning authority. However, development which forms part of the overhead line would be included within the DCO.

6.3.3 In determining an application for development consent by virtue of Sections 104 and 105<sup>18</sup>, there are a number of issues to which the Planning Inspectorate and the Secretary of State must have regard. In summary, these are:

- any relevant NPS;
- any local impact report produced by relevant Local Authorities;
- any matters prescribed by regulations; and
- any other matters which the decision maker considers to be both important and relevant to the decision.

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<sup>18</sup> The Planning Act, 2008; Chapter 29

### National Policy Statements EN1 and EN-5

- 6.3.4 NPS EN-1 provides overarching policy for the consideration of any form of energy-related NSIP. It requires the decision maker to take account of adverse effects (environmental, social and economic) and weigh these against the benefits of the proposal. It identifies the generic issues that should be taken into account in assessing applications for development consent, recognising that these are the issues which are likely to arise most frequently, but that they are not equally applicable to all projects. NPS EN-5 identifies a number of issues specific to proposals for electricity networks infrastructure.
- 6.3.5 The generic issues raised by EN-1 and EN-5 include:
- air quality and emissions;
  - biodiversity and geological conservation, noting particularly the effects on designated sites (EN-5 seeks information on the effects on birds and their flight paths);
  - civil and military aviation and defence interests;
  - coastal change;
  - dust, odour, artificial light, smoke, steam and insect infestation;
  - flood risk and climate change resilience;
  - historic environment, noting particularly the effects on designated sites (and also the statutory preference to preserve such sites in response to any risk of harm);
  - landscape and visual effects, noting particularly the effects on nationally designated landscapes (EN-5 promotes the use of the Holford Rules and outlines the approach to the consideration of undergrounding);
  - land use, including open space, green infrastructure and Green Belt;
  - noise and vibration (EN-5 notes that noise from overhead lines is unlikely to lead the determining authority to refuse an application);
  - socio-economic effects;
  - traffic and transport effects;
  - waste management; and
  - water quality and resources.
- 6.3.6 In addition, EN-5 notes that, with regard to EMFs, the determining authority would need to satisfy itself that ICNIRP<sup>19</sup> guidelines are met.

### Holford Rules

- 6.3.7 The Holford Rules, cited in NPS EN-5, are a set of broad principles developed by Lord Holford in 1959 to assist with choosing overhead line routes. These 'rules' are now used as standard by the industry, and have been tested at public inquiries and at hearings under the Electricity Act 1989. The Holford Rules need to be considered at all stages of the development of an overhead line, with the following particularly applicable to the route corridor selection stage for the Wylfa to Pentir transmission connection:

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<sup>19</sup> **International Commission on Non-Ionising Radiation Protection (1998) Guidelines for limiting exposure to time varying electric, magnetic and electromagnetic fields**

- **Rule 1** – Avoid altogether, if possible, the most valued landscapes by planning the route of the line in the first place, even if the route ends up being longer. This applies to nationally important landscapes such as National Parks and AONBs.
- **Rule 3** – Other things being equal, choose the most direct line, with no sharp changes of direction and thus fewer angle pylons.
- **Rule 6** – In countryside which is flat with few trees, keep the high voltage lines as far as possible away from smaller power lines, joining routes, distribution poles and other masts, wires and cables so as to avoid visual clutter.
- **Rule 7** – Approach towns and cities through industrial areas where they exist (noting that where a line needs to pass through a built up area, it should be routed to lessen harmful views and routes should be chosen after considering the effects on the amenity of existing development and on proposals for new development).
- **Supplementary Note A** – Avoid routeing close to housing as far as possible.
- **Supplementary Note B** – Where possible, choose routes which minimise the effect on SLAs, Areas of Great Landscape Value and other similar designations of County, district or local value.

#### Horlock Rules

6.3.8 The Horlock Rules<sup>20</sup> provide National Grid guidance to identify locations for and the design of new substations and other operational sites, which may be required as part of a new transmission connection. This guidance assists National Grid in fulfilling its amenity obligations set out in Schedule 9 of the Electricity Act 1989. Those guidelines most relevant to this stage in the Wylfa to Pentir transmission connection project are:

- **Guideline 2** – The siting of new substations, SECs and line entries should, as far as possible, try to avoid internationally and nationally designated areas of the highest amenity, cultural or scientific value by the overall planning of the connections.
- **Guideline 3** – Areas of local amenity value, important existing habitats and landscape features, including ancient woodland, historic hedgerows, surface and ground water sources and nature conservation areas should be protected as far as practicable.

## 6.4 Route Corridor Appraisal Process

6.4.1 National Grid has developed an approach to options appraisal ('Our Approach to Options Appraisal'<sup>21</sup>), which has been designed to reflect the requirements of the Planning Act 2008 for DCO applications. National Grid carries out options appraisals for new electricity transmission lines as it provides a framework to identify and balance environmental, socio-economic, technical and cost considerations in selecting project options. It also documents, in a transparent manner, the information on which National Grid has based its judgements.

6.4.2 At this stage in the project's development, the options appraisal was used to compare route corridors and to inform the selection of a preferred route corridor.

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<sup>20</sup> **National Grid:** *The National Grid Company plc, NGC Substations and the Environment: Guidelines on Siting and Design (Horlock Rules)*

<sup>21</sup> **National Grid (2012)** *Our Approach to Options Appraisal* [on-line] Available at: <http://northwalesconnection.com/supporting-information-and-factsheets.aspx>

### Appraisal Topics

6.4.3 Taking into account the factors identified in the NPSs, EN-1 and EN-5, and feedback from stakeholders, the following topics were considered during the appraisal of each route corridor as those likely to provide a significant differentiator for a high level comparison of route corridor options:

- **Environmental**

- **Landscape and Visual:** the potential effects on designated landscapes, landscape character, landscape sensitivity, open access areas and landscape and visual receptors were particular concerns raised in the NPSs and consultation feedback as needing attention during the routeing of the overhead line.
- **Historic Environment:** Holford Rules seek to avoid internationally, nationally and locally designated sites; effects on heritage assets' settings were also considered and may include links to landscape value.
- **Ecology** Holford Rules encourage avoidance of internationally, nationally and locally designated sites and features. Where influential in regard to the decision-making, other undesignated sites and features, such as woodlands, were also considered.

- **Socio-economic**

- **Local Economy:** considered potential effects upon settlements and residential areas, tourism features, recreational facilities, commercial forestry and planning development allocations. Tourism is a major employment industry for the area, with concerns about effects on this sector raised in consultation feedback.
- **Aviation and Defence:** considered the proximity of route options to aviation and defence assets and any associated low fly zones.
- **Technical:** considered the technical complexity, construction/project delivery issues, suitability of technology, network capacity and network efficiencies/benefits (including energy efficiency).
- **Cost** – considered capital cost to construct the proposed development within each route corridor.

6.4.4 Information relating to these topics was identified through research, site visits, analysis of data and ongoing consultation with stakeholders. Using publicly available information and site visits, maps were produced to show the 'baseline' environmental and socio-economic data within the study area.

6.4.5 Should consultation responses identify other topics, receptors or concerns that have not been included as part of this appraisal then these will be considered and, if necessary, a back-check will be carried out to confirm whether their inclusion would have influenced the route identification and selection process.

### Factors Not Considered in Evaluating Options

6.4.6 With respect to environment and socio-economic considerations the evaluation carried out has focused on those factors which are likely to provide a differentiator between the options at this stage.

6.4.7 A number of factors that appear in the generic list of issues included in the NPS EN-1, and others put forward by stakeholders during consultation, were taken into account within the route corridor options evaluation but could not assist significantly in comparing the merits of different route corridors; either because:

- a) there are no receptors of that type likely to be significantly affected by any of the options; or
- b) because the magnitude and significance of the effects are likely to be broadly similar for all options.

6.4.8 Should consultation responses or other reasons require additional consideration, we would carry out a back-check and review of these matters. Factors not considered to be a material differentiator during this pre-application stage of the project would be re-considered for assessment in detail during later the EIA of the detailed design stage.

6.4.9 The factors not considered to be differentiators, and therefore given limited weight, were as follows:

- **Air Quality and Emissions to Air:** Potential effects on air quality would be temporary, and related to construction traffic. There is no evidence to suggest that there would be a significant difference between routes / technologies / site locations in terms of effects on air quality and emissions arising from the construction works.
- **Coastal Change:** Although this generic effect is included in NPS EN-1, it has not been considered at this stage as the potential for the proposed development to affect, or be affected by, coastal processes is dependent upon by the detailed design of the connection, such as the Menai Strait crossing technology and location of working areas / infrastructure, which was not currently defined at this stage.
- **Dust, Odour, Artificial Light, Smoke, Steam and Insect Infestation:** It is considered that the scheme would only have the potential to temporarily give rise to dust and artificial light effects during the construction phase. These effects could be avoided or significantly reduced through detailed design and the implementation of a standard construction phase environmental management plan. There is no evidence to suggest that there would be a significant difference between route corridors with regard to these effects.
- **Electric and Magnetic Fields (EMFs):** Though the potential effect of EMFs on a range of health issues is often raised as a concern with electricity transmission infrastructure, including within EN-5, it was not considered at this stage. National Grid designs all of its system to be compliant with ICNIRP guidelines on exposure to EMFs, and the connection design would take these guidelines fully into account, whichever route corridor option is selected. An assessment of the potential effect of EMFs would be included in the DCO submission for the preferred scheme. EN-5 notes only that the determining authority would need to be satisfied that ICNIRP guidelines are met.
- **Land Ownership:** In general, land ownership would not affect alternative route corridors. At this stage, land ownership issues would not influence National Grid in the selection of a preferred route corridor.
- **Noise and Vibration:** The effects of operational noise can only be assessed once a more detailed route, technology, site locations and outline design are identified; therefore, they were not considered at this stage. EN-5 notes that noise from overhead lines is unlikely to lead the determining authority to refuse an application as a variety of mitigation measures could be introduced, such as the positioning of lines and the design and maintenance of conductors. National Grid follows the guidelines on noise set out in EN-5 and would consider these as part of the siting and design of any sections of overhead lines. Noise assessments would also be undertaken as part of the detailed design process for any new substation and SECs should they be required. Where required, measures may be incorporated to mitigate the effect of any noise at local properties. The assessment methodology would take account of existing background noise levels and the proximity of residential

properties, and would also consider other noise sensitive land uses, for example schools, where necessary. Underground cables do not give rise to operational noise effects.

- **Soils and Geology** – Though Anglesey is an internationally recognised Geopark, the designation applies to all the route corridors and the geotechnical constraints of the geology have been considered as part of the technical appraisal. The associated effects on soils and geology are likely to be localised, and could be mitigated through design and the adoption of appropriate good practice mitigation measures for all of the route corridors.
- **Traffic and Transport Effects:** As the potential effects are likely to be only temporary and related to construction traffic and other construction activities, National Grid do not believe that the overall traffic and transport effects of developing one route corridor would be any worse than those associated with another route corridor. However, access has been considered as one of the technical considerations for alternative route corridors.
- **Water Resources and Flood Risk:** As the potential effects on water resources (e.g. rivers and other water bodies) and flood risks are likely to be localised and dependent on the detailed design, these topics would not influence the determination of a preferred route corridor. It is recognised that there is a technical preference to avoid placing pylons in marshes or areas that are frequently water-logged.
- **Waste Management:** Although this generic effect is included in EN-1, waste would primarily arise from construction operations and would not be distinctly different for alternative routes, technology or site locations.

#### Route Corridors Presented in 2012

- 6.4.10 The route corridors presented in 2012 were identified by National Grid based on a number of routeing criteria. National Grid considered that there was the potential for making a fully overhead line connection within all of these route corridors. At that time no specific measures to reduce or eliminate potential effects were identified. Constraints mapping only considered data that would influence routeing and strategic decision-making (e.g. designated sites mapping, rather than local, non-statutory data records).

#### Refinement of Route Corridor Design for Appraisal

- 6.4.11 Prior to appraising the 2012 route corridors, further work was undertaken to identify high level mitigation measures that could potentially reduce the effect of the proposed project upon sensitive sites, features or areas.
- 6.4.12 Using publicly available information and site visits, maps were produced to show the 'baseline' environmental and socio-economic data within the study area. These data were reviewed to identify potential issues or sensitive locations or designations for each of the appraisal topics (see Section 8). The review also confirmed there was no need to modify the route corridors presented for public consultation in 2012.
- 6.4.13 For each of the Appraisal Topics and sub-topics, an 'Appraisal Zone' was identified to allow the appraisal of potential significant effects. This not only allowed each route corridor to be assessed, it also allowed assessment of sites and features outside of the route corridor that have the potential to be directly or indirectly affected by the scheme.
- 6.4.14 Sites, features and areas that would benefit from potential high level mitigation to reduce effects were identified based on the following:
- A review of topic effects within the appraisal zones, based on desk based information.

- Whether it could influence route corridor or crossing option selection.
- Specific concerns raised by stakeholders and/or the public.

6.4.15 For each site, feature or location identified, a high level mitigation measure was proposed and reviewed to confirm that the risk of the effect had been reduced. The potential for new effects from the mitigation option itself was also considered such that the beneficial and adverse effects of the mitigation measure relative to the original route corridor design were identified.

6.4.16 If a proposed mitigation measure presented a potential new significant adverse effect, then a secondary mitigation measure was considered to ascertain whether there was any alternative to an overhead line that could resolve, as far as practicable, any significant adverse residual effects. For example where a buried section of cable was considered, mitigation measures were also considered that might reduce the visual effects of the associated above ground SECs.

#### Identification of Preferred Route Corridor

6.4.17 The selection of the preferred route corridor was based upon a qualitative review of the appraisal findings. The selection of the preferred route corridor aimed to balance environmental, socio-economic, technical and cost considerations.

6.4.18 Feedback from stakeholders and the public (see Section 7) was also considered as part of the process.

6.4.19 Once the preferred route corridor is selected, detailed design will progress, including consideration of alternative tower designs use and precise alignment of the connection.

### **6.5 Additional Supporting Activities**

6.5.1 Once the route corridors had been announced in 2012, and prior to the selection of the preferred route corridor, a number of additional investigations were undertaken to supplement the baseline data presented in the Wylfa-Pentir Initial Route Corridor Report<sup>22</sup>, and thereby inform the appraisal of the route corridors. Additional information has also been identified through the ongoing consultations with stakeholders.

6.5.2 Additional investigations included:

#### For All Route Corridors

- Review of socio-economic activity, strategies and guidance, including:
  - Tourism Strategy North Wales (2010 – 2015);
  - Isle of Anglesey Destination Management Plan (2012 – 2016);
  - Review into the socio-economic effects of gas and electricity transmission projects; and
  - A study into the effects of National Grid major infrastructure projects on socio-economic factors<sup>23</sup>.
- Bird strike risk review of vulnerable/sensitive bird species, sites on Anglesey designated for these vulnerable species and known movements of sensitive species

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<sup>22</sup> **National Grid (2012)** *Wylfa-Pentir Initial Route Corridor Report* [on-line] Available at: <http://northwalesconnection.com/stage-one-consultation.aspx>

<sup>23</sup> **ERM (2014)** *A study into the effects of National Grid Major Infrastructure Projects on Socio-economic Factors* [on-line] Available at: [www2.nationalgrid.com/WorkArea/DownloadAsset.aspx?id=38741](http://www2.nationalgrid.com/WorkArea/DownloadAsset.aspx?id=38741)



on Anglesey to identify locations where construction / operation of overhead line may increase the risk of bird strikes with overhead lines. Birds considered included: Red-throated Diver (*Gavia stellata*), Whooper Swan (*Cygnus cygnus*), Mute Swan (*C. olor*), Pink-footed Goose (*Anser brachyrhynchus*), Greylag Goose (*A. anser*) and European White Fronted Goose (*A. albifrons*).

- Development of indicative Zone of Theoretical Visibility (ZTV) models to illustrate how many towers within each corridor might be visible from the lower arms upwards (i.e. from a point on the tower 17m above ground level)<sup>24</sup>.
- Review of Local Development Plan policies and proposed development sites relevant to the Wylfa-Pentir route corridors to identify potential for future constraints or opportunities.
- Review of potential visual effects on views from the Anglesey AONB and A55 corridor, especially on panoramic views of Snowdonia, through site visits by landscape and visual amenity specialists.
- Review of possible cable crossing locations and technology options, informed by:
  - Bangor University's Menai Strait bathymetry data to understand the depth of the Menai Strait.
  - Site visit to the north and south sides of the Menai Strait to identify landscape considerations and inform the identification of SEC search areas and review viability for underground cabling technology options. The visit considered potential visual effects from sensitive/designated sites, topography, existing woodland and scope for replanting, open ground for cabling, sensitive local landscape and visual receptors.

#### For Orange and Blue Route Corridors

- Unique to the Orange Route Corridor and northern-most section of the Blue Route Corridor was the presence of the existing transmission line. This was regarded as providing a potential opportunity to route new transmission infrastructure in an area where it is already a feature, whilst also increasing the risk of cumulative effects being so great as to preclude the adoption of the corridor. In order to understand the feasibility of achieving two 400kV overhead lines (i.e. the current and proposed infrastructure) within the Orange and Blue Route Corridors, or whether the effects could exclude it from further consideration the following was undertaken:
  - High level review, based on field observations, of visual and residential amenity effects on residential properties within 100m of an indicative close parallel route alignment option within the Orange Route Corridor. This assisted in understanding the potential visual amenity effects of a parallel alignment. The review was informed by a visit to an existing parallel line near Stockton-On-Tees to appreciate the effects of parallel 400kV overhead lines, in particular where there are transpositions that allow the second line to cross to the other side of the existing line.
  - Production of indicative photomontages to aid visualisation of cumulative effects from close parallel alignments, deviations away from close parallel, close proximity to other infrastructure (e.g. wind farms, 132kV line), skylining and natural screening.

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<sup>24</sup> At 17m the ZTV avoided being distorted by towers where only the top few metres may be visible. In addition, it would also shows visibility of low height towers, thus was representative of any overhead alignment

- Review of habitats within the Cors Erddreiniog SSSI and NNR, which is part of the Corsydd Môn (Anglesey Fens) SAC and Corsydd Môn a Llyn (Anglesey and Llyn Fens) Ramsar site, to identify those sensitive to the development of an overhead line, and to identify whether towers for a new overhead line could be positioned within the SAC close to the existing overhead line without directly affecting designated features.

For Yellow and Purple Route Corridors

- Review and site visit to the area around Bodedern and Valley to identify whether there could be viable areas for a new substation that would be required to allow the replacement of part of the 132kV line between Wylfa and Holyhead in the Yellow and Purple Route Corridors.

## 7 CONSULTATION

### 7.1 Introduction

7.1.1 National Grid acknowledges the importance of informing, and seeking the views of statutory consultees and stakeholders, including the general public, and of taking their views into account during the design of connection proposals. Therefore, National Grid has engaged with a number of statutory consultees and stakeholders to inform the identification and refinement of route corridors and the route corridor appraisal.

7.1.2 To date, this consultation process has been 'informal' and feedback from statutory stakeholders was based on the local knowledge, experience and judgements of professional officers of the organisations. It was understood that feedback from individual statutory authority officers did not necessarily represent the views of the stakeholder organisations and general public themselves. In due course National Grid will carry out its 'formal' statutory consultation process under the Planning Act 2008.

### 7.2 Route Corridor Consultation

7.2.1 Between October and December 2012 National Grid consulted publicly on the strategic options appraisals and the proposal for a new overhead line connection between Wylfa and Pentir. The consultation included potential route corridors and options for crossing the Menai Strait (see Section 3.4), together with work needed at Bryncir and the Glaslyn Estuary in Gwynedd.

7.2.2 Full details of the consultation exercise and responses are available in the Stage One Consultation Feedback Report<sup>25</sup>. In summary:

- National Grid held 35 events, attended by 736 people.
- National Grid received 38 stakeholder responses from community councils and other stakeholders.
- 1,549 pieces of feedback were received from members of the public; of these, 1,057 used a campaign group postcard to submit a response.
- 153 members of the public provided detailed feedback on the route corridors, using the Wylfa-Pentir consultation feedback form.

### 7.3 Route Corridor Appraisal Consultation

7.3.1 In 2013 and 2014 National Grid consulted officers from a number of statutory consultees (Isle of Anglesey County Council, Gwynedd Council, NRW and Cadw) on the route corridors and the appraisal process to further inform the selection of the preferred route corridor.

7.3.2 In order to facilitate feedback, National Grid met with representatives of such authorities during the project's development. These were informal meetings with officers to obtain guidance and draw on their local knowledge. It was acknowledged that the feedback provided did not necessarily represent the official views of their respective organisations and Council Members.

7.3.3 National Grid has also met with other stakeholders with an interest in the project (including several Community Councils, Welsh Government, National Trust, RSPB,

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<sup>25</sup> **National Grid (2014)** *North Wales Connection Project: Stage One Consultation Feedback Report* [on-line] Available at: [http://nationalgrid.opendebate.co.uk/files/North\\_Wales\\_Connection\\_-\\_Feedback\\_Report.pdf](http://nationalgrid.opendebate.co.uk/files/North_Wales_Connection_-_Feedback_Report.pdf)

University of Bangor, etc.) to improve the understanding of the local environment and the main stakeholder concerns.

## **7.4 Summary of Stakeholder Feedback**

7.4.1 The following presents a summary of the consultation responses that have been taken into account in the selection of the preferred route corridor:

- The majority of responses to the October to December 2012 consultation were in favour of a subsea connection between Wylfa and the mainland.
- Where stakeholders expressed a view, they generally preferred the Orange Route Corridor over the other route corridors for a new overhead line as it was the shortest most direct route and followed the existing line (i.e. 'something already there') and avoided introducing new infrastructure in the south-west of the island.
- Of the 153 members of the public who expressed a route corridor preference, 121 expressed a preference for the Orange Route Corridor.
- The Menai Strait area was indicated by stakeholders as a particularly sensitive area to overhead line development due to potential effects on the AONB and many other sites and features located along the coast.
- Malltraeth Marsh was seen as sensitive regardless of the technology (i.e. overhead or underground): overhead lines may pose a risk to wildfowl crossing the site north to south; whilst trenching would cause a larger footprint of habitat damage than overhead lines.
- In discussions, the value of removing the existing 132kV overhead line between Wylfa and Valley was acknowledged by stakeholders.
- There were concerns from stakeholders about the perceived effects of an overhead line on views of Snowdonia from the A55; in particular for those arriving through the Port of Holyhead or Anglesey Airport to visit Wales.
- The Blue Route Corridor was viewed by stakeholders as the least favoured option.
- When asked for a preferred crossing option, 92 stakeholders preferred Crossing Option B (out of 131 expressing a crossing option preference) for an overhead line crossing of the Menai Strait.

## 8 ROUTE CORRIDOR DESIGN REFINEMENT

### 8.1 Introduction

8.1.1 The route corridor options presented for public consultation in 2012 (see Figure 3.1) assumed the new transmission connection would be a fully overhead line connection.

8.1.2 However, it was appreciated that there may be 'pinch points' or more highly sensitive areas / sites within the route corridors where the construction of a new overhead line could create significant adverse environmental or socio-economic effects. It was recognised that these effects may influence the selection of the preferred route corridor and crossing option.

8.1.3 At these locations, mitigation measures, such as underground cables as an alternative to a new overhead line, were considered as they offer the potential to reduce or remove the significant adverse environmental or socio-economic effects.

8.1.4 This chapter outlines how the route corridors were reviewed and, where justified, locations identified where an alternative to an overhead line connection should be considered at this stage of the process. These were then included in the appraisal and selection of the preferred route corridor.

### 8.2 Main Issues for an Overhead Line Connection

8.2.1 As mentioned above, a number of locations have been identified as 'pinch points' or sensitive areas where the construction / operation of a new overhead line could create significant adverse effects. These locations were identified as a result of both preliminary appraisals of a fully overhead connection informed by site visits undertaken by environmental professionals and by feedback from the first round of public consultation.

8.2.2 Appendix B summarises the analysis of potentially sensitive sites, features and areas that National Grid identified, taking into account stakeholder (including general public) consultation feedback. The analysis considered what the potential effects could be for each site, categorised them based on the nature of the effect and then provided a recommendation on whether this effect could be reduced or avoided during the detailed design stages.

8.2.3 The main 'pinch points' and sensitive areas considered for more detailed appraisal are outlined below:

- **All Menai Strait crossing locations** were identified as sensitive areas following extensive feedback from the general public and technical stakeholders. The need to route through Anglesey AONB and other sensitive landscape designations may also lead to significant adverse effects to this nationally important landscape.
- Between **the Menai Strait and Capel-y-Graig** (Crossing Option A) - the technical complexities of routing an overhead line through this area mean there could be a requirement for temporary closures of sections of the local rail and road networks during the installation and dismantling of extensive protective netting on scaffolding systems, and also during operation due to safety requirements for maintenance works.
- In the **Southern Common Area between the route corridors and the Menai Strait crossings** - there is a risk of an overhead line skylining across high points, especially around the settings of the Bryn Celli Ddu chambered tomb, which is a scheduled monument and Cadw Guardianship Site.

- Around **Rhosgoch, Rhosybol, Talwrn and Capel Coch** - there are possible cumulative wirescape effects, where there could be two overhead transmission lines in close proximity, creating a risk of significant cumulative landscape and visual effects. The significance of these effects would be highly dependent upon the final alignment and tower design if the Orange or Blue Route Corridors were taken forward.
- Around **Tregele** - there are possible cumulative wirescape effects from a new overhead line passing north of Tregele within the Purple and Yellow Route Corridors.
- **Cors Erddreiniog** – the existing overhead line passes through this SSSI and NNR, which is also part of the Corsydd Môn / Anglesey Fens SAC and Corsydd Môn a Llyn / Anglesey and Llyn Fens Ramsar site. The fenland habitat and water sources upon which it relies could be especially sensitive to large scale construction activities if seeking a new line close to the existing overhead line.
- **Malltraeth Marsh SSSI** – an overhead line within the Purple Route Corridor would have to cross this site. The Yellow and Blue Route Corridors have an opportunity to potentially avoid the designated site boundary, but would still cross the wider marsh. However, RAF Mona low fly restrictions and the A55 may require the overhead line to cross the designated site.
- **Tre-Ysgawen Hall** (4-star Country House Hotel and Spa) - located within the Orange Route Corridor; a new overhead line could affect its setting and views if routed west of Capel Coch and near the Hotel to avoid the designated habitats at Cors Erddreiniog.
- **Llynonn Mill** (a regional tourist attraction promoted as ‘the home of rural life in Wales’) - located within the Purple and Yellow Route Corridors, a new overhead line could affect the landscape and heritage value of its setting.
- **RAF Mona** - a sizeable area of the Blue Route Corridor is unable to avoid the safeguarding zone adjacent to RAF Mona. The height of overhead line structures may have to be reduced to avoid interfering with aviation and defence activities.
- The **western section of the AONB** - views eastwards, from high ground within the AONB, across the Purple and Yellow Route Corridors, do not currently have the 400kV overhead line in the foreground. There is a risk of significant negative effects on high value expansive views across Anglesey to Snowdonia.

### 8.3 High Level Mitigation Consideration for an Overhead Line within Route Corridors

8.3.1 National Grid reviewed the route corridors and took into account consultation feedback and considered, at a high level, measures which could potentially mitigate (avoid or reduce) the effects at the pinch points or sensitive areas / sites. Appendix B presents a table summarising the conclusions of this review. It is important to note that the high level mitigation measures considered are those that could significantly influence the selection of a preferred route corridor or crossing option. Avoidance and/or mitigation of effects upon all sensitive areas / sites would be re-considered at the next stage of assessment, whichever route corridor was selected, and the findings used to back-check the assumptions made at this stage.

8.3.2 The principle of avoidance has already been applied during the identification of the route corridor options, and future opportunities for avoidance or mitigation of effects through detailed alignment at the next stage of project development were considered. Therefore, the following high-level mitigation measures were considered at this stage:

- underground cabling;

- replacement of an existing 132kV overhead line with a 400kV line;
- use of lower height towers to avoid technical constraints; and
- attaching cables to alternative structures for the Menai Crossing (e.g. Britannia Bridge).

8.3.3 There may be opportunities for other mitigation measures within all the route corridors that would be lesser in scale or duration, but which are unlikely to affect the choice of route corridor. Such measures would be considered in the future detailed design development and impact assessment studies.

8.3.4 Opportunities for wildlife habitat creation or enhancement for works affecting a designated nature conservation site, or tree and hedge screening for visual receptors, were reserved as 'secondary' measures if significant effects remained following the adoption of the high level mitigation measure.

#### Assumptions and Considerations

8.3.5 The type of overhead line towers employed will influence the likely magnitude and significance of effects that would arise. In this respect the following assumptions (illustrated in Figure 5.2) have been made:

- The standard height of a tower for a 132kV overhead line was assumed to be 27m, compared to the standard height for a 400kV overhead tower at 50m. It was important to understand this difference in scale in order to assess the increased effects of replacing one line with the other.
- Any double circuit low height 400kV towers that could be employed were assumed to be 37m in height.
- Where even lower height towers might be needed for technical reasons, such as to prevent infringement of safety clearances in the vicinity of the RAF airfields, it was assumed that two lines of single circuit towers could be used with a tower height of approximately 28m.

8.3.6 In the case of underground cables, it was assumed at this stage that six cables would be required for the Wylfa to Pentir connection. However, the geology and further engineering design may result in the need for twelve cables to meet the heat dispersion requirements. Whilst the number of cables would result in only a modest change in the potential construction and operational effects, it could have a more significant effect upon the capital costs of the project.

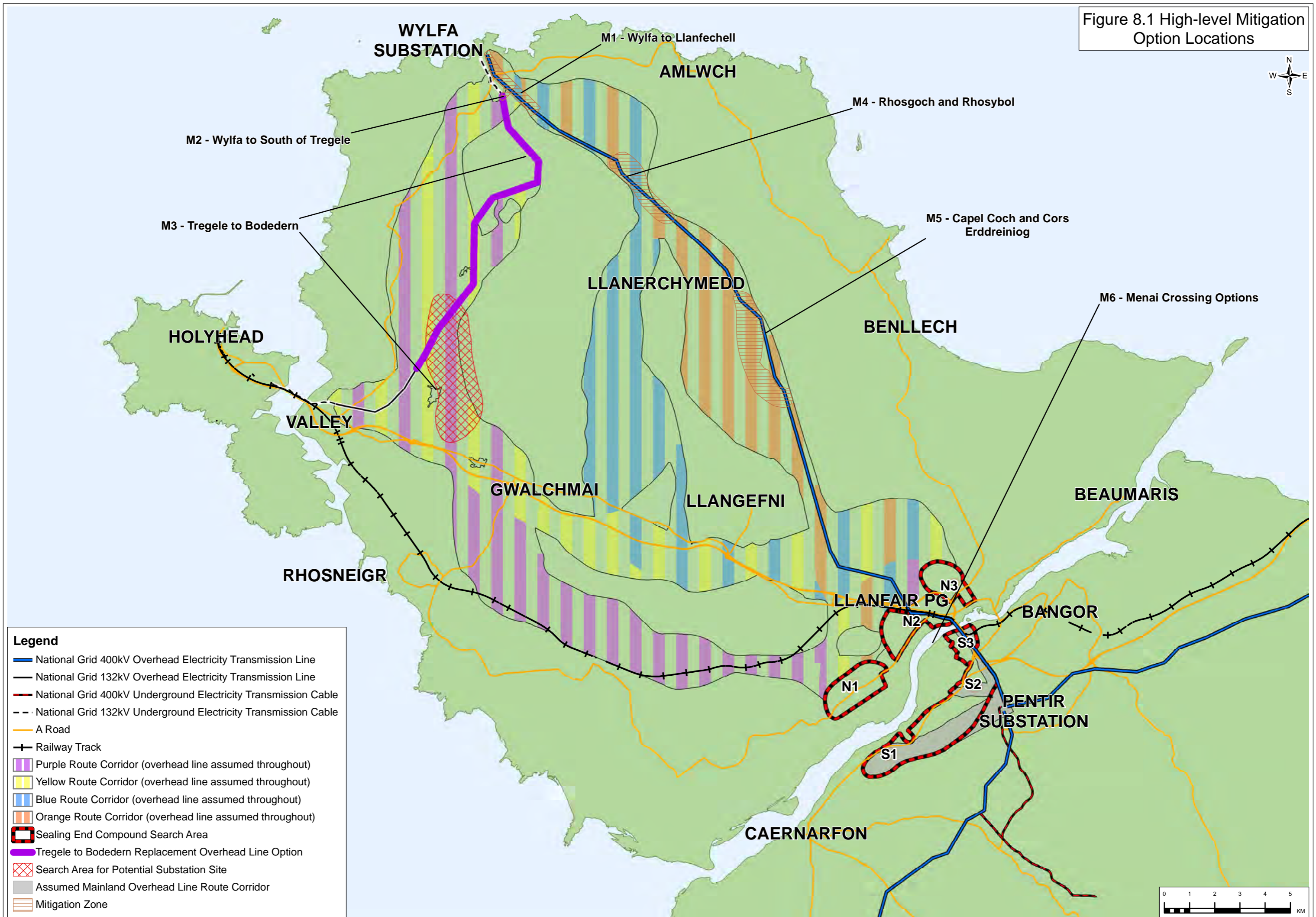
8.3.7 For the purpose of the appraisal it was assumed that underground cables would be laid within an approximately 55m wide working corridor. During operation a worst case 35m wide easement corridor free of buildings and large scale vegetation would be required. At the start and end of an underground section, a SEC would be required to change from an underground cable to overhead line. A maximum area approximately 120m x 60m in size could be required for construction of a double circuit 400kV SEC.

8.3.8 For cables in a tunnel a 'head house' would be required as well as a SEC. It was assumed that these could be located together in an area of approximately 120m x 75m.

8.3.9 Additional working areas would be required throughout any construction period for all the route corridors; no assumptions around these requirements were made at this stage.

8.3.10 It was also assumed that best practice construction environmental management plans would be employed and that detailed proposals for mitigation would be brought forward. Such measures might include, for example, on and off-site screen planting, archaeological investigation and cultural heritage interpretation. It was assumed that

Figure 8.1 High-level Mitigation Option Locations





8.3.11 opportunities would be taken wherever possible to reduce or avoid significant adverse effects through detailed route alignment at the next stage of project development.

#### 8.4 Overhead Line Mitigation Options Considered

8.4.1 Figure 8.1 illustrates the locations where, at a high level, measures were considered to mitigate (avoid or reduce) potentially significant environmental or socio-economic effects to sensitive areas or features.

8.4.2 This section describes:

- the mitigation measures considered at each location;
- the review of their viability to mitigate the environmental or socio-economic effect of concern; and
- the justification as to whether to retain or reject the proposed mitigation as part of the refinement of the route corridor definition prior to the appraisal and selection of the preferred route corridor.

##### M1: Wylfa to Llanfechell (Orange and Blue Route Corridors)

8.4.3 **Reason for Consideration:** The existing 400kV and 132kV overhead lines pass between the town of Cemaes and the village of Tregale (see Figure 8.2). The addition of a new 400kV overhead line along this section of the Orange or Blue Route Corridor may significantly affect the views from properties on the edge of Cemaes, and between Cemaes and Tregale, creating close range, skylined views of multiple overlapping overhead lines. There could also be adverse effects on views from the AONB along the coast to the north-east and from neighbouring elevated locations, including Mynydd Mechell (located in the proposed JLDP SLA).



**Figure 8.2 Looking West Towards Tregale with Existing Overhead Line in the Foreground**

- 8.4.4 Consideration was given to the need to avoid affecting views from residential properties and the risk of increasing the industrialised look of the area, which might be caused by additional overhead lines and the planned Wylfa Newydd Power Station development.
- 8.4.5 **High Level Mitigation Measures Considered:** Underground cables between Wylfa Substation and Llanfechell running past Tregede to the east of Llanfechell, where an SEC would be required to change from underground cable to overhead line.
- 8.4.6 **Conclusion of Review:** The sites and features in this section of the route corridors were considered, feedback from consultation was reviewed, and taken into account, and a site visit carried out to better understand the distribution of residential properties and the sensitivity of the main receptors. Consideration was also given to the opportunities that might be available to reduce or avoid effects through route alignment at the next stage of the project's development. This led to a conclusion that, at this stage, an assumption should be made that an overhead line route could be identified in this area that would comply with all relevant legislation and planning policies. Whilst no environmental, socio-economic or technical considerations appeared to preclude the use of buried cables in this area, it was considered that the significant additional cost associated with this mitigation would not be justifiable in the context of National Grid's statutory duties.
- 8.4.7 Therefore for the purposes of the route corridor appraisal it was assumed that this section of the Orange and Blue Route Corridors would not include an underground cable connection and that a 400kV overhead line in this section would be retained as the basis for the appraisal.
- 8.4.8 If either the Orange or Blue Route Corridor were taken forward, these assumptions would be back-checked following more detailed design and assessment plus feedback from a second stage of public consultation, taking into account the full range of mitigation measures that would be available to reduce the adverse effects of an overhead line.

#### M2: Wylfa to South of Tregede (Yellow and Purple Route Corridors)

- 8.4.9 **Reason for Consideration:** The existing 400kV and 132kV overhead lines pass between the town of Cemaes and the village of Tregede (see Figure 8.2). The addition of a new 400kV overhead line along this section of the Yellow or Purple Route Corridors may significantly affect views from properties on the edge of Cemaes, and between Cemaes and Tregede, creating close range, sky-lined views of multiple overlapping overhead lines. There could also be adverse effects on views from the AONB along the coast to the north-east and from neighbouring elevated locations, including Mynydd Mechell (located in the proposed JLDP SLA). A Standing Stones Scheduled Monument lies south-east of Tregede, between the existing 400kV and 132kV overhead lines, and its setting could be affected by the addition of a new 400kV overhead line.
- 8.4.10 **High Level Mitigation Measures Considered:** Underground cables, running east and south of Tregede between Wylfa Substation and the northern end of the existing National Grid 132kV overhead line. A SEC would be required at the Tregede end of the underground section.
- 8.4.11 **Conclusion of Review:** The sites and features in this section of the route corridors were considered, feedback from consultation was reviewed, and taken into account, and a site visit carried out to better understand the distribution of residential properties and the sensitivity of the main receptors. Consideration was also given to the opportunities that might be available to reduce or avoid effects through route alignment at the next stage of the project's development. This led to a conclusion that, at this stage, an assumption should be made that an overhead line route could be identified in this area that would comply with all relevant legislation and planning policies. In particular the effect upon residential views and the natural beauty of the AONB would not be so great as to

preclude the use of an overhead line. Whilst no environmental, socio-economic or technical considerations appeared to preclude the use of buried cables in this area, it was considered that the significant additional cost associated with this mitigation would not be justifiable in the context of National Grid's statutory duties.

- 8.4.12 Therefore, for the purposes of the route corridor appraisal, it was assumed that this section of the Yellow and Purple Route Corridors would not include an underground cable connection and that a 400kV overhead line would be retained as the basis for the appraisal.
- 8.4.13 If either of these route corridors were taken forward these assumptions would be back-checked following more detailed design and assessment plus feedback from a second stage of public consultation, taking into account the full range of mitigation measures that would be available to reduce the adverse effects of an overhead line.

### M3: Treglele to Bodedern (Yellow and Purple Route Corridors)

- 8.4.14 **Reason for Consideration:** In the north-west of Anglesey there are several notable receptors that may be adversely affected by a new 400kV overhead line along the Yellow or Purple Route Corridors. The potential risks are:
- adverse effects on the regional tourist attraction of Llynonn Mill, west of Llanddeusant;
  - adverse ecological effects on the Fferam Uchaf and Salbri SSSIs, east of Mynydd Mechell; and
  - adverse visual effects on the AONB along the western coast, especially on views from the high ground on the eastern edge looking inland and towards Snowdonia.
- 8.4.15 **High Level Mitigation Measures Considered:** Replace the existing National Grid 132kV overhead line with a 400kV overhead line on the same route. Secondary mitigation options could be considered where circumstances would prevent replacement of a 27m high 132kV tower with a 50m high 400kV tower at the same location; for example, use of low height 400kV towers in specific locations or deviations away from the original 132kV alignment.
- 8.4.16 A new substation would be required to step down the voltage of any new 400kV line to 132kV in order to provide an alternative means of supplying the existing 132kV substation at Penrhos. Locations near Bodedern or Valley were considered for this substation, resulting in the option M3 assuming the development of a new substation north or east of Bodedern. This mitigation option only considers the effects of replacing the existing 132kV overhead line with a 400kV overhead line between Treglele and a new substation north of Bodedern. The connections to the substation, both 132kV and 400kV, were not considered as these would be determined by the final substation location.
- 8.4.17 **Conclusion of Review:** The sites and features in the vicinity of this section of the Purple and Yellow Route Corridors between Bodedern and Treglele were considered, feedback from consultation was reviewed, and taken into account, and a site visit carried out to better understand the distribution of residential properties and the sensitivity of the main receptors.
- 8.4.18 The review considered that replacing the existing 132kV overhead line with a 400kV overhead line between Treglele and Bodedern would lead to fewer effects than paralleling the existing 132kV overhead line with a new 400kV overhead line.

- 8.4.19 It was also concluded that a suitable site for a new substation might be found in the area to the north or east of Bodedern. Whilst a new substation would be difficult to screen in the short to medium term, planting would help in the long term (e.g. after 15 years).
- 8.4.20 The environmental benefit of these works (the removal of the 132kV and the substation development) was considered to provide sufficient benefit in offsetting or mitigating the landscape and visual effects of a new 400kV overhead line over a wide area within the Purple and Yellow Route Corridors as to justify the additional cost assumed for the construction of the substation and dismantling of the line. This led to a conclusion that, at this stage, an assumption should be made that the 132kV overhead line would be removed if either the Purple or Yellow Route Corridors was taken forward.
- 8.4.21 If either of these route corridors were taken forward, these assumptions would be back-checked following more detailed design and assessment plus feedback from a second stage of public consultation, taking into account the full range of mitigation measures that would be available to reduce the adverse effects of an overhead line and the potential new substation.

#### M4: Rhosgoch and Rhosybol (Orange and Blue Route Corridors)

- 8.4.22 **Reason for Consideration:** At Rhosgoch and Rhosybol, the Orange and Blue Route Corridors pass through a 'pinch point'; this is a location at which a number of constraints pose a significant level of influence to narrow a route corridor. This would result in the introduction of a new 400kV overhead line close to the villages, creating views of multiple overhead lines due to the close proximity and presence of the existing 400kV overhead line.
- 8.4.23 **High Level Mitigation Measures Considered:** Underground cables along a section of the Orange and Blue Route Corridors between north-west of Rhosgoch and south of Rhosybol. SECs would be constructed at each end of the underground cable.
- 8.4.24 **Conclusion of Review:** The sites and features in this section of the corridor were considered, feedback from consultation was reviewed, and taken into account, and a site visit carried out to better understand the distribution of residential properties and the sensitivity of the main receptors. Consideration was also given to the opportunities that might be available to reduce or avoid effects through route alignment at the next stage of the project's development. This led to a conclusion that, at this stage, an assumption should be made that an overhead line route could be identified in this area that would comply with all relevant legislation and planning policies. In particular, the effect upon residential views would not be so great as to preclude the use of an overhead line. Whilst no environmental, socio-economic or technical considerations appeared to preclude the use of buried cables in this area, it was considered that the significant additional cost associated with this mitigation could not be justified at this stage in the context of National Grid's statutory duties.
- 8.4.25 Therefore, for the purposes of the route corridor appraisal it was assumed that this section of the Orange and Blue Route Corridors would not include an underground cable connection and that a 400kV overhead line would be retained as the basis for the appraisal.
- 8.4.26 If either of these corridors were taken forward these assumptions would be back-checked following more detailed design and assessment plus feedback from a second stage of public consultation, taking into account the full range of mitigation measures that would be available to reduce the adverse effects of an overhead line.

### M5: Capel Coch and Cors Erddreiniog (Orange Route Corridor)

- 8.4.27 **Reason for Consideration:** A new 400kV overhead line past Capel Coch could have potentially significant effects, depending on its final route:
- Paralleling the existing 400kV overhead line may affect nationally and internationally protected habitats and species within Cors Erddreiniog SSSI and NNR (part of the Corsydd Môn / Anglesey Fens SAC and Corsydd Môn a Llyn / Anglesey and Llyn Fens Ramsar site);
  - Effects on views looking east from Capel Coch, which are already exposed to views of the existing 400kV overhead line, if the new 400kV overhead line was aligned between Cors Erddreiniog and Capel Coch;
  - An alignment to the west of Capel Coch would enclose the village between the proposed and existing 400kV lines, harming views to the north and longer distance views from the west and south-west to a new overhead line; and
  - An alignment to the west could potentially affect views from Tre-Ysgawen Hall (a 4-star Country House Hotel), which could then result in socio economic effects.
- 8.4.28 **High Level Mitigation Measures Considered:** Underground cables within a section of the Orange Route Corridor between north of Capel Coch and north of Talwrn.
- 8.4.29 **Conclusion of Review:** The sites and features in this section of the route corridor were considered, feedback from consultation was reviewed, and taken into account, and a site visit carried out to better understand the distribution of residential properties and the sensitivity of views from Capel Coch and Tre-Ysgawen Hall Country Hotel. Consideration was also given to the opportunities that might be available to reduce or avoid effects through route alignment at the next stage of the project's development. This led to a conclusion that, at this stage, an assumption should be made that an overhead line route could be identified in this area that would comply with all relevant legislation and planning policies. In particular, it was likely that an alignment could be found that would avoid direct effects upon the European designated features at Corsydd Môn / Anglesey Fens SAC, whilst not resulting in such adverse landscape and visual effects as to pose a significant risk of a DCO not being granted when judged against the policy tests contained in NPS EN-5.
- 8.4.30 Whilst no environmental, socio-economic or technical considerations appeared to preclude the use of buried cables in this area, it was considered that the significant additional cost associated with this mitigation would not be justifiable in the context of National Grid's statutory duties.
- 8.4.31 Therefore, for the purposes of the route corridor appraisal, it was assumed that this section of the Orange Route Corridor would not include an underground cable connection and that a 400kV overhead line would be retained as the basis for the appraisal.
- 8.4.32 If this route corridor were taken forward, these assumptions would be back-checked following more detailed design and assessment plus feedback from a second stage of public consultation, taking into account the full range of mitigation measures that would be available to reduce the adverse effects of an overhead line.

### M6: Anglesey AONB and Menai Strait (All Crossing Options)

- 8.4.33 **Reason for Consideration:** Feedback was received from both local communities and stakeholder organisations concerning the unacceptability of crossing the AONB and Menai Strait with an additional overhead transmission line. Of particular note were the views of the two local authorities and NRW, the Government's statutory adviser on landscape matters, all of whom felt that such a crossing would be contradictory to national and local planning policies and insupportable. The Anglesey AONB and Menai Strait are unavoidable for the preferred strategic option (comprising an onshore connection between Wylfa and Pentir). A new overhead line would lead to significant adverse landscape and visual effects to this nationally important landscape at all possible crossing options, in potential conflict with Holford Rule 1 and correspondingly NPS EN-5, that seeks to avoid areas of highest landscape value. Intervisibility between the shorelines of the Menai Strait and the intimate seascape, back-dropped by the Snowdonia mountain range when viewed from Anglesey, make this landscape particularly sensitive. The community of Y Felinheli also has extensive views over the Strait from Gwynedd. The area also contains many other sensitive landscape and historic designations (e.g. Plas Newydd & Vaynol Estate Grade I Registered Historic Parks and Gardens, the iconic Grade 1 Listed Menai Suspension Bridge and the associated public viewpoint on the A5, long distance views from Caernarfon Castle and Town Walls World Heritage Site). The area is also an important contributor to the local economy through tourism and water sports. Of particular note in this regard are attractions such as the National Trust property at Plas Newydd, Greenwood Forest Park, Plas Menai National Watersports Centre and tourist accommodation at Plas Coch.
- 8.4.34 **High Level Mitigation Measures Considered:** Consideration was initially given to whether an underground cable in a trench across the Menai Strait could be achieved between a SEC on Anglesey and a SEC on the mainland. To better inform this consideration, SEC search areas were identified on either side of the Menai Strait. Figure 8.1 illustrates the location of the SEC search areas identified for this appraisal stage. Three potential areas were identified on Anglesey: one to the north of Llanfair PG (labelled SEC zone N3) and SEC zones N1 and N2 located between Brynsiencyn and Llanfair PG. On the mainland a single more linear SEC search area was identified, with SEC zone S1, west of Y Felinheli; SEC zone S2, east of Plas Vaynol; and SEC zone S3, between Parc Menai and the Menai Strait.
- 8.4.35 These zones were identified by a desk-based review of technical, environmental and socio-economic constraints supplemented by site visits. These sought to assess the likelihood of finding suitable SEC sites, based upon the existence of features that might afford opportunities to sensitively site a SEC, such as topography and existing woodland that might help to screen the SEC, and open areas of ground where buried cables might more easily be installed. The site visits also considered the visual and landscape sensitivity of sites and features in the vicinity and how this may influence the SEC search areas. As a result, no SEC search areas were identified within Anglesey AONB or the Vaynol Estate Registered Park and Garden due to their designated status and setting links to the AONB and Plas Newydd Registered Park and Garden. Whilst this would preclude the development of an overhead line proposal within both Plas Newydd and Plas Vaynol, the possible need to install buried cables through these sites could not be ruled out at this stage.
- 8.4.36 Where there was the potential for significant environmental or socio-economic effects associated with using a trench technique (e.g. adverse effects on the European designated habitats in the Menai Strait), opportunities for alternative mitigation measures were also considered:
- Cables routed directly across the Britannia Bridge, suspended from the structure (e.g. piers and bridge deck); or

- Use of fully trenchless techniques, such as installation within ducts installed by HDD or the placement of underground cables in a tunnel (requiring associated tunnel shaft and head house, as well as SECs on both the sides of the Menai Strait).

8.4.37 **Conclusion of Review:** The large number and concentration of sensitive sites on both shores of the Menai Strait was acknowledged. Given the nature of the landscape and the importance of these sites an overhead line crossing of Anglesey AONB and the Menai Strait would result in significant adverse landscape and visual effects.

8.4.38 Whilst the use of buried cables to cross the AONB and Menai Strait presents considerable technical challenges, initial studies suggested that viable installation techniques could be found that would avoid long-term landscape and visual effects and would not result in significant adverse effects upon the marine habitats of the Y Fenai a Bae Conwy / Menai Strait and Conwy Bay SAC.

8.4.39 National Grid concluded that an overhead line route compliant with all relevant planning policies and duties could not be found in this area, and credible alternatives appeared likely.

8.4.40 In particular, an overhead line across Anglesey AONB and the Menai Strait within any of the crossing option locations would likely perform less well against the requirements of EN-5 sections 2.8.8 and 2.8.9 (assuming that viable alternatives exist). Particular concerns included the effect upon iconic views from within the AONB (including from Plas Newydd) to the mainland and the Snowdonia range beyond, and the resultant magnitude of harm caused to the natural beauty of the AONB. Any such effect might also conflict with National Grid's statutory duty to have regard to the purposes of the AONB, namely the conservation and enhancement of this natural beauty. The potentially significant effects upon the setting of the cultural heritage features and tourism attractions of the area as described above were also taken into account.

8.4.41 In summary, it was concluded that the significant economic cost of using cables instead of overhead lines to cross the Menai Strait would be considered appropriate when set against the significant environmental effects of an overhead line option. Further work would be required at the detailed design stage to confirm the preferred SEC locations, crossing location and construction methodology for the Menai Strait crossing and link to Pentir Substation.

## 8.5 Refined Route Corridor Options for Appraisal

8.5.1 In order to compare route corridor options and select a preferred route corridor, five complete Wylfa to Pentir design solutions were considered. These were based upon the four route corridors, the mitigation measures that were appraised and subsequently assumed to be applied, including the potential combinations of Anglesey and mainland SEC areas that were identified as part of the process. The five assumed design solutions are described below:

- **Orange Route Corridor (~35km):** an overhead line in the corridor that broadly follows the existing 400kV overhead line between Wylfa and SEC N2, before crossing the Menai Strait to SEC S2 (via S3) using underground cables. An overhead line would be used between SEC S2 and Pentir Substation.
- **Blue Route Corridor (~43km):** an overhead line running through open countryside in the centre of Anglesey before turning east to follow the A55 to SEC N2. Underground cables would be used to cross the Menai Strait to SEC S2 (via S3), then an overhead line to Pentir Substation.
- **Yellow Route Corridor (~44km):** an overhead line from Wylfa, largely mirroring the direction of the existing 132kV overhead line and A5025 towards SEC N2. The existing 132kV would be removed between Tregel and Bodedern, with a new

substation built near Bodedern to retain the existing 132kV connection to Holyhead. Crossing the Menai Strait from SEC N2 to S2 (via S3) would be via underground cables, with an overhead line between SEC S2 and Pentir Substation.

- **Purple Route Corridor, via SEC S1 (~46km):** an overhead line between Wylfa and SEC N1, routing along the west of Anglesey, largely following the direction of the existing 132kV overhead line. The existing 132kV overhead line would be removed between Tregle and Bodedern. Crossing the Menai Strait would be via underground cables between SEC N1 to S1, with an overhead line between SEC S1 and Pentir Substation.
- **Purple Route Corridor, via SEC S2 (~44km):** the same as for the 'Purple Route Corridor, via SEC S1', except that the crossing of the Menai Strait would be underground cables between SEC N1 to S2, with an overhead line between SEC S2 and Pentir Substation.

8.5.2 The definition of crossing options for the Menai Strait was based on the shortest, most feasible crossing route, taking into account the need to minimise risks to Plas Newydd and Vaynol Registered Parks and Gardens, plus a crossing east of Britannia Bridge could be technically challenging to construct. Further work would be required at the detailed design stage to confirm the preferred SEC locations, crossing location and construction methodology for the Menai Strait crossing and link to Pentir Substation. Equally, it is important to remember that the crossing options were originally based on a wholly overhead line design. The findings of this further work would be used to inform a back-check of the route corridor appraisals, including the crossing options for the Menai Strait.



## 9 APPRAISAL OF ROUTE CORRIDORS

### 9.1 Introduction

9.1.1 This chapter describes the main findings from the appraisal of the route corridors and crossing options, with the inclusion of the high level mitigation measures identified in Chapter 8 (see Figure 9.1). The appraisal considered the following topics, as identified in Chapter 6:

- Environment
  - Landscape and Visual Amenity
  - Historic Environment
  - Ecology
- Socio-economics
  - Local Economy
  - Aviation and Defence
- Technical
- Cost

9.1.2 Appendix A contains plans illustrating baseline information for the environment and socio-economic topics, with annotations highlighting the main features. The main features for individual topics are also presented on figures within this chapter.

### 9.2 Environment

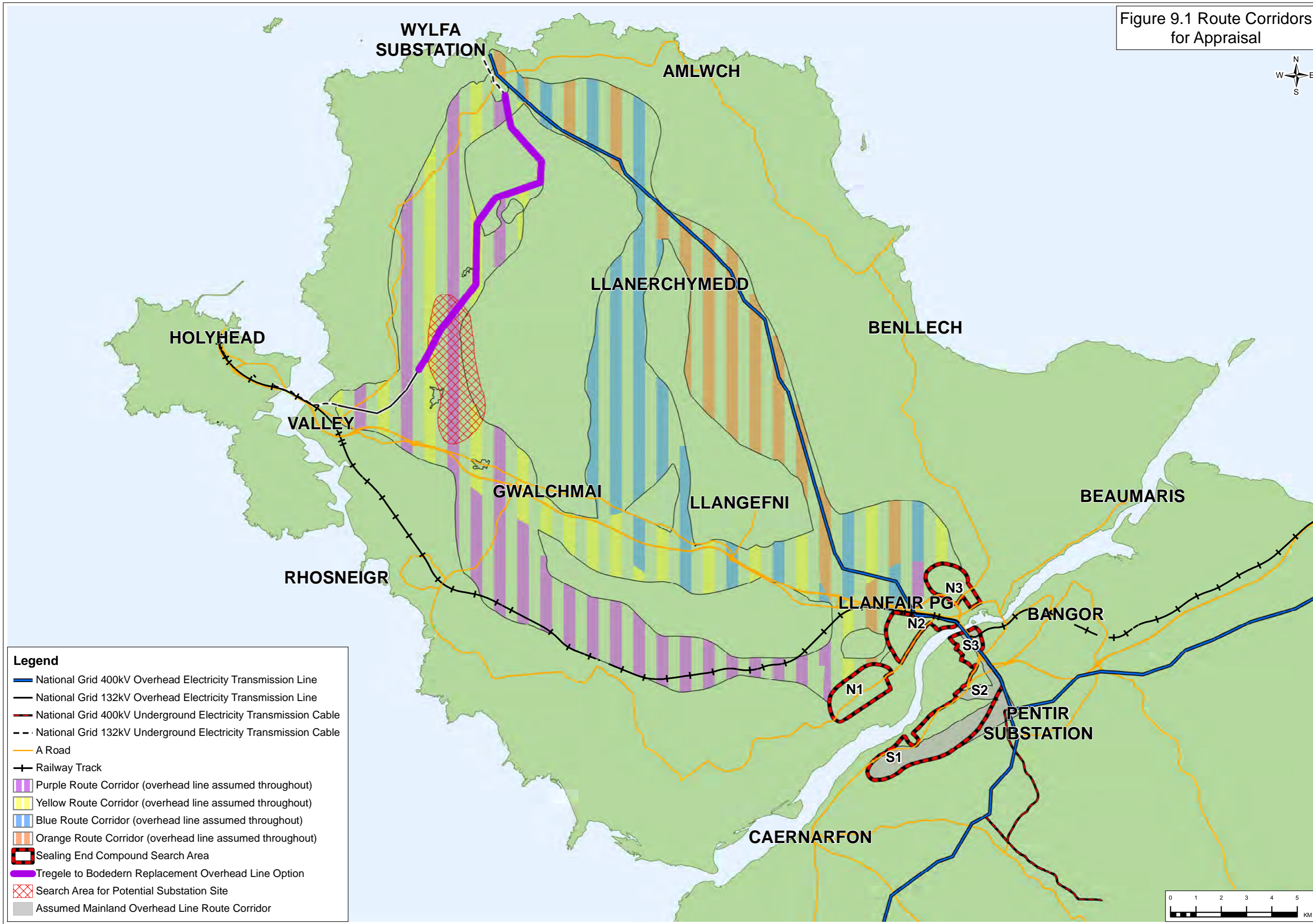
#### Landscape and Visual Amenity

9.2.1 Each landscape takes its character from a combination of elements, including landform, watercourses, land use and pattern, vegetation and habitats, and cultural and historical influences. Landscapes are important to the individuality of any local area. To a large extent, people experience the landscape visually and the quality and sensitivity of views varies greatly. Assessing the effect on views takes into account how a development would be visible from viewpoints such as surrounding houses, farms, footpaths and bridleways, roads, open spaces, community facilities and offices. This section considers the changes that might occur, both physically and visually, due to a new 400kV transmission line.

9.2.2 For all the route corridors, the main landscape and visual concerns were:

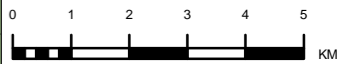
- Views from:
  - Residential areas.
  - Anglesey AONB.
  - Proposed Anglesey and Gwynedd SLAs.

Figure 9.1 Route Corridors for Appraisal



**Legend**

- National Grid 400kV Overhead Electricity Transmission Line
- National Grid 132kV Overhead Electricity Transmission Line
- - - National Grid 400kV Underground Electricity Transmission Cable
- - - National Grid 132kV Underground Electricity Transmission Cable
- A Road
- + + + Railway Track
- Purple Route Corridor (overhead line assumed throughout)
- Yellow Route Corridor (overhead line assumed throughout)
- Blue Route Corridor (overhead line assumed throughout)
- Orange Route Corridor (overhead line assumed throughout)
- Sealing End Compound Search Area
- Tregle to Bodedern Replacement Overhead Line Option
- Search Area for Potential Substation Site
- Assumed Mainland Overhead Line Route Corridor



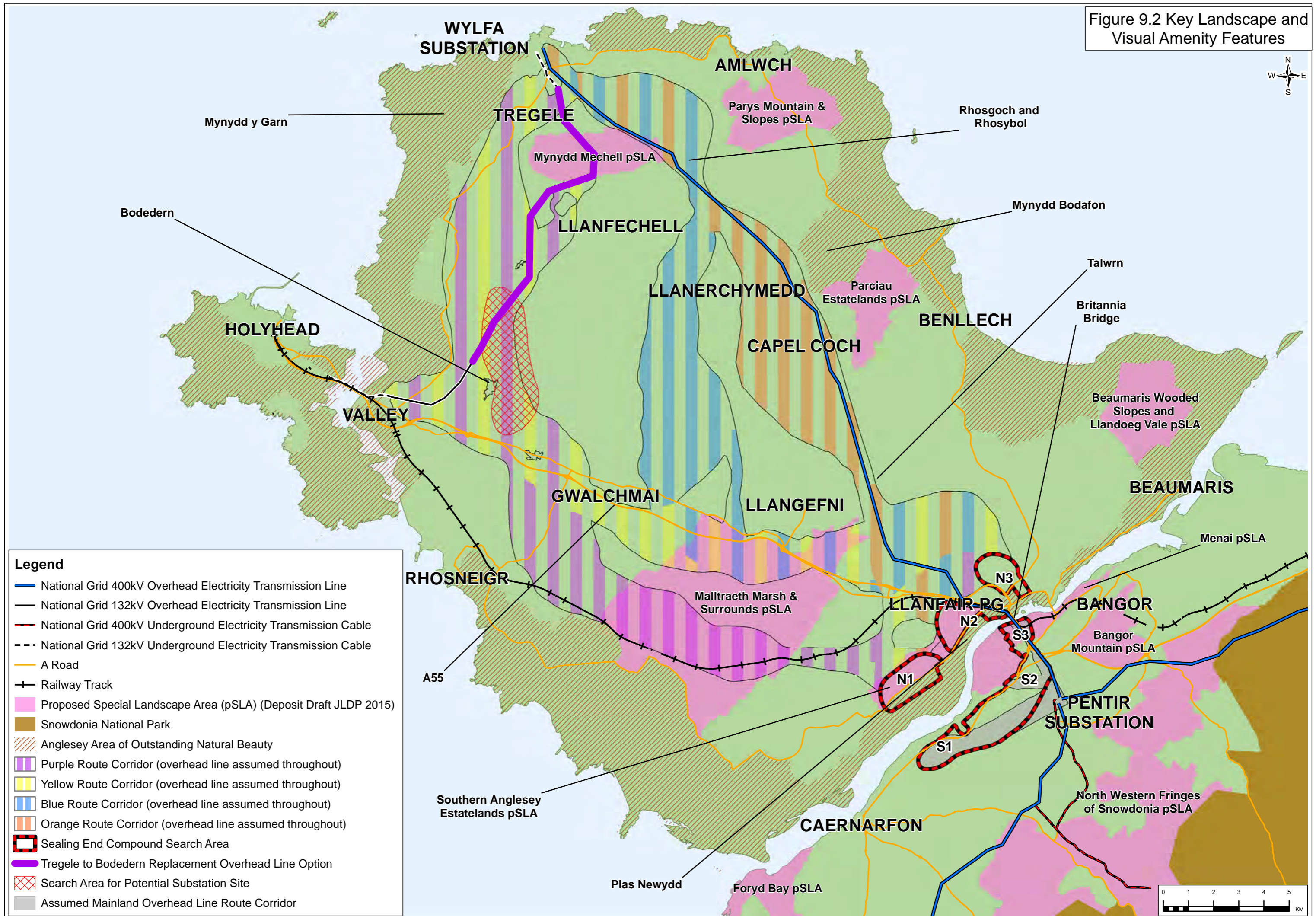
- The effect on the landscape and visual amenity between Wylfa and the Menai Strait due to adding a new overhead line to other similar types of structure that already exist. This could take one or more of the following forms:
  - Views of a new line close to other types of infrastructure developments (both existing and proposed) where the presence of both developments increases potential effects.
  - Two or more overhead lines within the same view creating multiple layers of wires, known as a wirescape effect.
- Views from the Wales Coast Path, the Isle of Anglesey Coastal Path and National Cycle Routes.
- Potential skylining when an overhead line runs along the top of a hill or ridgeline making it clearly visible against the sky from long distances, particularly around the Menai Strait.

9.2.3 The main landscape features and viewpoints that were identified during the appraisal process are illustrated on Figure A-1 in Appendix A. The following summarises the main potential effects and issues associated with each of the route corridors. The main features are indicated on Figure 9.2, whilst Figure 9.3 illustrates the landform and main topographical features crossed by the route corridors.

*Orange Route Corridor to Southern Common Area*

- Credible options to align a new 400kV overhead line close to the existing 400kV overhead line could be identified and offer the opportunity to avoid the risk of greater effects to landscape and visual receptors not currently affected by overhead lines (including the AONB and a number of the proposed SLAs). There were no potential effects so significant as to justify rejecting the Orange Route Corridor as a route corridor option based on the opportunity to closely align two 400kV overhead lines, which would be needed at least in the pinch points.
- There would be unavoidable visual effects to both close and longer range views from Capel Coch and at corridor pinch points near Rhosgoch, Rhosybol and Talwrn, as well as on a number of viewpoints as the route corridor passes adjacent to the eastern edge of the proposed Mynydd Mechell SLA and approaches the scenic Menai Strait area and Anglesey AONB.
- Effects to views may be reduced through careful alignment, taking advantage of the existing overhead line corridor, low lying ground and opportunities for screening and 'backdropping' where the line would be viewed against higher ground in the background.

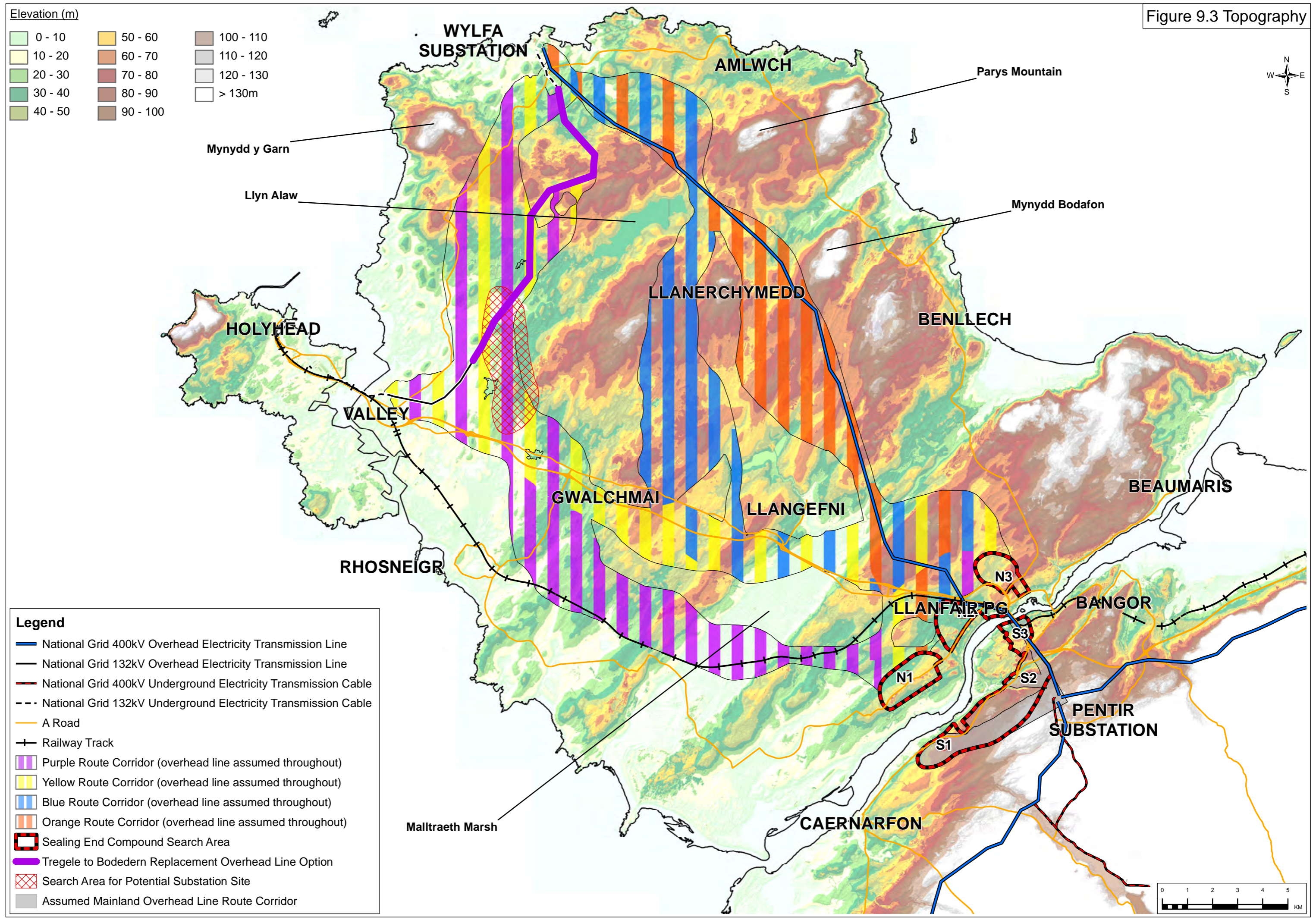
Figure 9.2 Key Landscape and Visual Amenity Features



**Legend**

- National Grid 400kV Overhead Electricity Transmission Line
- National Grid 132kV Overhead Electricity Transmission Line
- National Grid 400kV Underground Electricity Transmission Cable
- National Grid 132kV Underground Electricity Transmission Cable
- A Road
- Railway Track
- Proposed Special Landscape Area (pSLA) (Deposit Draft JLDP 2015)
- Snowdonia National Park
- Anglesey Area of Outstanding Natural Beauty
- Purple Route Corridor (overhead line assumed throughout)
- Yellow Route Corridor (overhead line assumed throughout)
- Blue Route Corridor (overhead line assumed throughout)
- Orange Route Corridor (overhead line assumed throughout)
- Sealing End Compound Search Area
- Tregelle to Bodedern Replacement Overhead Line Option
- Search Area for Potential Substation Site
- Assumed Mainland Overhead Line Route Corridor

Figure 9.3 Topography



### *Blue Route Corridor to Southern Common Area*

- In the northern-most section of the route corridor, credible options to align a new 400kV overhead line close to the existing 400kV overhead line could be identified and offer the opportunity to avoid the risk of greater effects to landscape and visual receptors not currently affected by overhead lines in this part of the island (including parts of the AONB and one of the proposed SLAs). The Blue Route Corridor passes adjacent to the eastern edge of the proposed Mynydd Mechell SLA and through the proposed Malltraeth Marsh SLA.
- Adverse visual effects would occur from elevated / open views across the route corridor (in particular the southern and western edges of Llanerchymedd) as well as close range views (for example at corridor pinch points near Rhosgoch, Rhosybol, Gwalchmai, Bodffordd, Rhostrehwfa and Llangristiolus).
- The Blue Route Corridor passes through the less developed centre of the island, with regards infrastructure developments.
- The approach to the Menai Strait would have potential adverse visual effects for a number of receptors even with careful alignment, and especially for panoramic views of Snowdonia from along the A55 corridor.
- As the route corridor approaches the Menai Strait, the adverse effects might be reduced by avoiding viewpoints not already affected by overhead lines, although the exact arrangement may lead to effects on views due to multiple overhead lines being visible together, particularly from Star.

### *Yellow Route Corridor to Southern Common Area*

- The northern section, running from Wylfa to the south-west (A55 corridor), would experience landscape and visual amenity effects from changing the 132kV overhead line to the larger 400kV line, which may be on a different alignment to the existing line. In addition, a new substation would be introduced to the landscape north of Bodedern.
- Introducing a new 400kV overhead line to areas where large pylons are not currently present would likely have a significant effect on landscape character and views, such as within the proposed Malltraeth Marsh SLA that the route corridor passes through.
- There was potential to reduce landscape and visual effects (in particular on the AONB along Anglesey's western coast) through careful alignment, taking advantage of the undulating topography and surrounding areas of higher ground.
- Adverse visual effects would remain for elevated or open views from across the route corridor as well as from settlements along the route corridor, such as Tregele, Llanrhyllad, Llanddeusant, Bryngwran, Llangristiolus and Pentre Berw, and around the approach to the Menai Strait area.
- The approach to the Menai Strait would have the same potential adverse visual effects as for the Blue Route Corridor, but extended over a longer length of the A55 corridor. When travelling eastwards along the A55 extensive views of the Snowdonia range experienced from several sections of the road would be significantly affected.

### *Purple Route Corridor to Southern Common Area*

- The northern section, running from Wylfa to the south-west (A55 corridor), would have the same adverse effects and opportunities as the Yellow Route Corridor with the removal of the existing 132kV overhead line and development of a new substation north of Bodedern.

- The southern section from the A55 corridor extends across lower, flatter land and over Malltraeth Marsh, and would affect a number of views, including those from the A4080; this is the primary access to the coastal tourist destinations of Malltraeth, Aberffraw and Rhosneigr. Introducing a new 400kV overhead line to areas where large pylons are not currently present would have a significant effect on landscape character and the proposed Malltraeth Marsh SLA; this may be partly reduced by careful alignment.
- There would still be effects on views, especially from the AONB along the western coast of Anglesey and towards Snowdonia.
- It may be possible to reduce adverse effects of the overhead lines upon views from within the AONB at the Menai Strait coastline by taking advantage of screening by mature woodland and shelterbelts as the line approaches.
- There would be effects to views from settlements along the route corridor, such as Treglele, Llanrhyllad, Llanddeusant, Bryngwran, Llanddaniel Fab and Brynsiencyn, and around the approach to the Menai Strait area.
- There would be potential for pylons and wires to be visible above the horizon in views from Menai and mainland, dependent upon the location of a SEC near the Menai Strait.

#### *Menai Strait Crossing Options to Pentir*

- All crossing options would likely have unavoidable adverse effects on the landscape of the Menai Strait (incl. Anglesey AONB and the proposed Southern Anglesey Estate Lands SLA) due to use of underground crossing technology. However, these would be largely temporary effects limited to the construction phase and would be significantly less than the permanent landscape and visual effects that an overhead line crossing would have.



**Figure 9.4 Looking North from Vaynol Estate, across Menai Strait towards Plas Newydd Estate**

- Underground cabling may affect mature hedgerows and trees, such as those within the Plas Newydd Estate. However, many of these effects could be avoided through careful routeing or offset through vegetation re-planting, though replanting of trees may not be possible close to the cabling route.
- Use of trenchless techniques (e.g. HDD or tunnelling) could further reduce construction effects on landscape features and viewpoints compared with those of directly buried cables, whether installed onshore or beneath the Strait. This could further reduce any potential harm to the AONB, such as removal of trees and hedgerows. However, this is dependent on the location of HDD drilling pits or tunnel shafts, as lengths of underground cabling in trenches would still be needed from the SECs to these sites if the two are not co-located.
- For tunnelling options, there would be adverse effects associated with the construction of shafts and head houses. These effects could be lessened through sensitive design and potentially screened with planting.
- Use of underground cabling would greatly reduce the effect on views which would arise from an overhead line. This would outweigh the adverse landscape and visual effects of underground cabling works, even if crossing through the Plas Newydd and Vaynol Registered Parks and Gardens. These effects would, in many instances, be reversible through hedgerow re-planting and restoration of field areas, though replanting of trees may not be possible close to the cabling route.
- There may be unavoidable effects on views to and from the settlements around the Menai Strait, such as Llanfair PG and Penrhosgarnedd, depending on the location of pylons, SECs and cable alignments.
- Use of an underground crossing west of Y Felinheli could result in a highly visible SEC near S1 requiring an overhead line crossing along the high ground to Pentir, potentially affecting local settlements and skylining against panoramic views of Snowdonia from the north.

9.2.4 The following is a comparative review of each route corridor with regards landscape and visual amenity effects.

- **Adverse effects on views from the AONB would be less for the Orange and Blue Route Corridors than for the Yellow and Purple Route Corridors** due to the availability of views, the skylining of views, the context of existing lines in views and conflict with expansive views of Snowdonia National Park.
- **The landscape character of the Orange and then Blue Route Corridors was generally more amenable to the routeing of overhead lines than that of the Purple or Yellow Route Corridors**, due to the nature of the undulating landform, vegetation and scale of the landscape.
- **Potential effects of two 400kV lines in close proximity within the Orange Route Corridor were considered to be less than a new, separate route elsewhere on Anglesey.** Constructing the new line close to the existing line would reduce the number of views currently unaffected by transmission infrastructure that would otherwise become affected. The wider apart the two lines, the greater would be the number of unaffected views that would become affected. This could also result in increased cumulative effects where a receptor would experience effects upon two discrete views rather than the one currently affected. Where a very wide separation can be achieved it may be possible to significantly reduce cumulative effects, for example where a receptor cannot view one (or both) of the lines due to intervening topography or vegetation. However, detailed design would be especially important when routeing two lines in close proximity to avoid a conflicting visual effect between



the two lines. Potential effects on views from residential properties within Rhosgoch and Rhosybol were a concern for the Orange and Blue Route Corridors; here other constraints to routeing, including the main settlement of Rhosybol and Llyn Alaw Reservoir, limited the ability to reduce effects by routeing further from properties. Cumulative effects with other, existing infrastructure would also occur locally in the Yellow and Purple Route Corridors due to the presence of the large Llyn Alaw wind farm that the existing 132kV overhead line passes through.

- **The Yellow Route Corridor was preferable to the Purple Route Corridor due to its visual separation from the AONB along the south-west coast.** However, there would be adverse visual effects on settlements and the potential for cumulative effects with other lower voltage lines. A route through the Purple Route Corridor, where it is separate from Yellow, would be less constrained due to the ability to route around receptors. Such a route would affect a significant number of residential viewpoints as the settlements in this location are scattered rather than concentrated into a few locations.
- **A further consideration relating to the Yellow Route Corridor was the need to avoid RAF Mona's safeguarding zone,** which may require an overhead line to cross the A55 in multiple locations. Though road users are usually considered to be less sensitive to changes in views of the landscape, due to the panoramic views to Snowdonia and the A55 being the main route for visitors into Wales and England from Holyhead, the receptors could be considered to have a higher sensitivity than usual.
- **Visual amenity concerns relating to Rhosgoch / Rhosybol** plus intrusion to previously undisturbed areas of the island would also all apply to the Blue Route Corridor, making it the least favoured option.
- **The Yellow and Blue Route Corridors** would require a transmission line to cross and re-cross the A55, affecting panoramic views of Snowdonia for those using and living along sections of the A55 corridor.

9.2.5 In addition to effects on up-close views, consideration was also given to the effects of a new overhead line on views over potentially longer distances. This was achieved by developing indicative ZTVs, or visual envelopes, to illustrate how many towers might be visible from the lower arms upwards (i.e. from a point on the tower 17m above ground level) within an area 5km either side of an indicative alignment in each route corridor. The potential, indicative alignment ZTVs were compared to the ZTV for the existing 400kV transmission line to show the potential change in visibility of a 400kV overhead line across Anglesey (see Figure 9.5). ZTVs were produced taking account of the local topography of hills and valleys and their potential to screen all, or a significant part of, the overhead line and associated towers from potential viewpoints. However, the ZTVs do not account for objects above ground level (natural or man-made) that might obscure views, thus representing a worst case scenario.

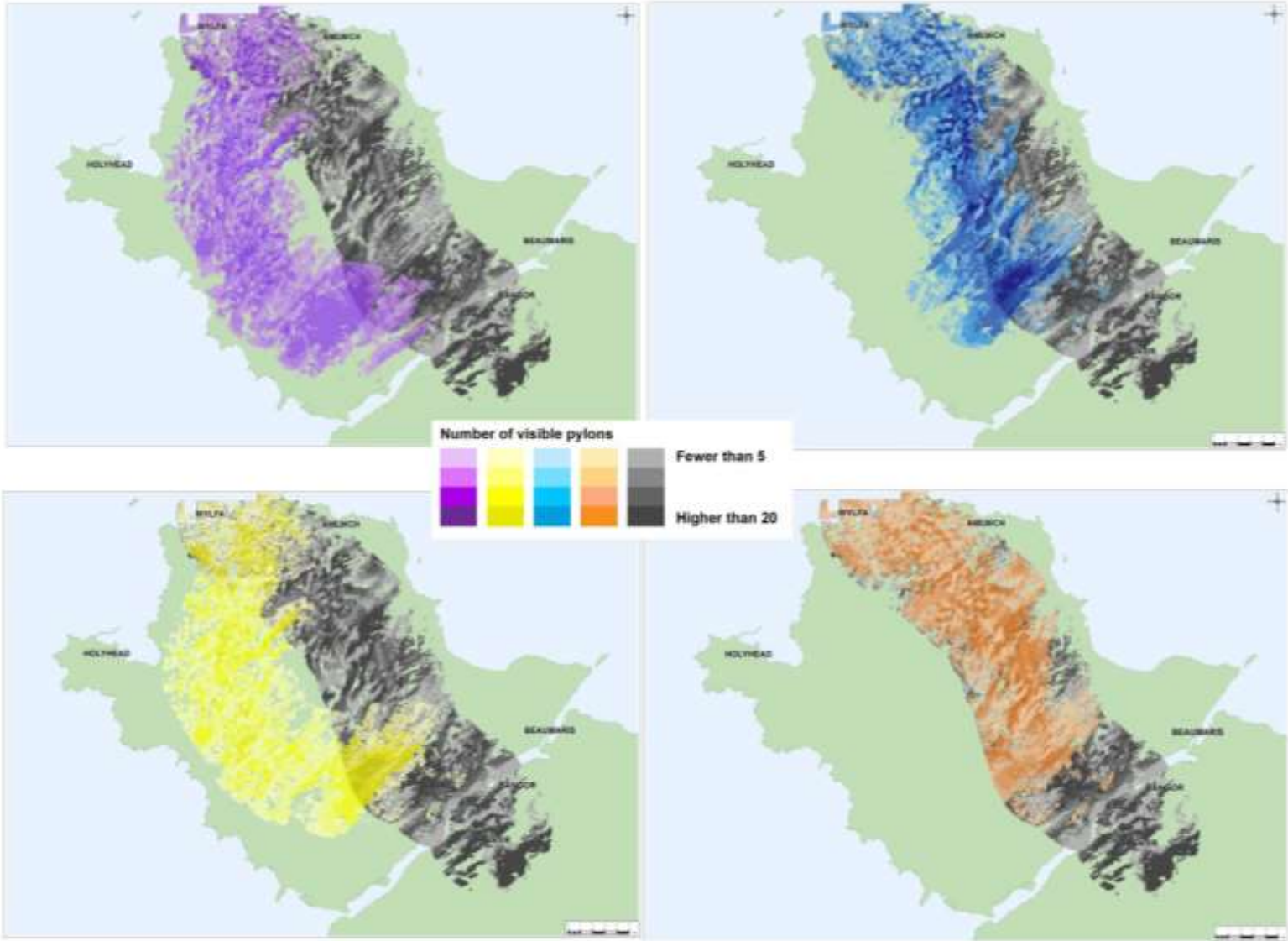
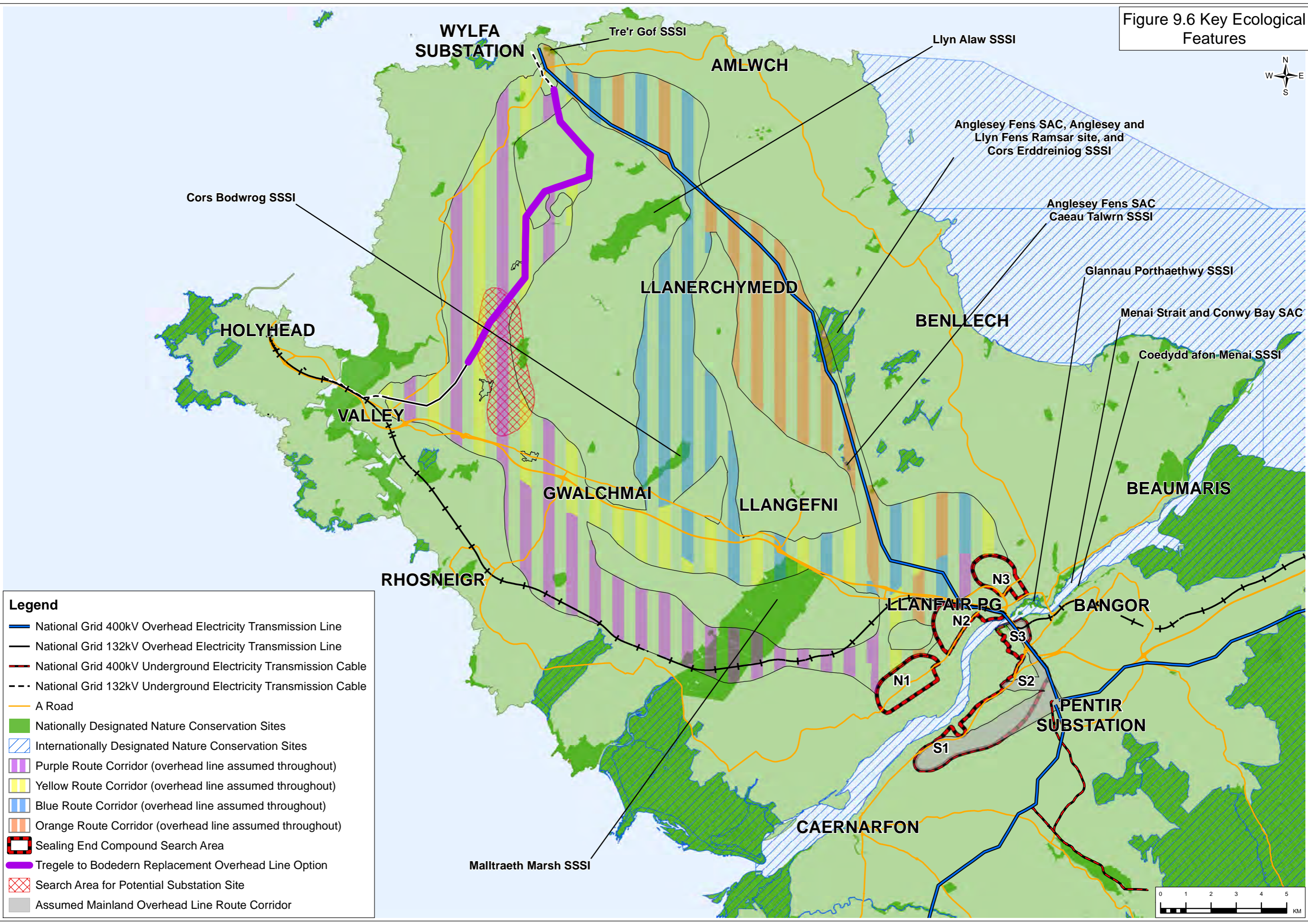


Figure 9.5 Indicative Zone of Theoretical Visibility Illustrating How Many Towers Could be Visible from 17m Above Ground Level

### Ecology (Terrestrial and Marine)

- 9.2.6 A number of designated sites (e.g. European sites and SSSIs) could be affected by the route corridors. There are between five and seven nationally and internationally designated sites within each route corridor, but the majority can be avoided through careful alignment and detailed design; see Figure A-2 in Appendix A. The main features are indicated on Figure 9.6.
- 9.2.7 All the route corridors encompassed Tre'r Gof SSSI east of Wylfa Power Station, whilst potential effects upon the following internationally or nationally designated nature conservation sites within each route corridor were considered with regards the development of an overhead alignment:
- **Orange Route Corridor / Cors Erddreiniog and Caeau Talwrn SSSIs** – both are part of the Corsydd Môn (Anglesey Fens) SAC, but Cors Erddreiniog is also part of the Corsydd Môn a Llyn (Anglesey and Llyn Fens) Ramsar site. Caeau Talwrn SSSI is avoidable, though it lies within the narrow section of the Orange Route Corridor, between Talwrn and Llangefni. The opportunity to route the new overhead line in close proximity to the existing 400kV overhead line along the Orange Route Corridor could result in a line that passed through Cors Erddreiniog SSSI and NNR, potentially affecting designated features of the SSSI and the SAC / Ramsar site. However, there is the potential to explore alignment options that may avoid significant effects on the Cors Erddreiniog and Caeau Talwrn SSSIs, and associated SAC and Ramsar designations.
  - **Blue Route Corridor / Cors Bodwrog SSSI** – routeing through this site would be unavoidable due to other constraints, especially around RAF Mona, that would be likely to prohibit a potential alignment elsewhere through the corridor.
  - **Blue and Yellow Route Corridors / Malltraeth Marsh SSSI** – an alignment within these route corridors may have to cross the northern end of the SSSI due to the position of the A55 junction south of Llangefni and the need to avoid RAF Mona's low fly zone.
  - **Purple Route Corridor / Malltraeth Marsh SSSI** – routeing through this site would be unavoidable as the full width of the route corridor passes through the SSSI.
- 9.2.8 All proposed route corridors posed a small risk of bird strike through the erection of overhead lines. The risk of bird strikes would be slightly greater in the west of Anglesey as wildfowl are likely to be commuting between sites designated for wildfowl in this area to a greater degree than in the east of the island. Therefore, the **Orange Route Corridor is considered to offer the lowest risk of bird strike, followed in turn by the Blue Route Corridor, Yellow Route Corridor and the Purple Route Corridor.** Any underground sections of the route corridors would remove the risk of bird strike

Figure 9.6 Key Ecological Features



**Legend**

- National Grid 400kV Overhead Electricity Transmission Line
- National Grid 132kV Overhead Electricity Transmission Line
- National Grid 400kV Underground Electricity Transmission Cable
- National Grid 132kV Underground Electricity Transmission Cable
- A Road
- Nationally Designated Nature Conservation Sites
- Internationally Designated Nature Conservation Sites
- Purple Route Corridor (overhead line assumed throughout)
- Yellow Route Corridor (overhead line assumed throughout)
- Blue Route Corridor (overhead line assumed throughout)
- Orange Route Corridor (overhead line assumed throughout)
- Sealing End Compound Search Area
- Tregele to Bodedern Replacement Overhead Line Option
- Search Area for Potential Substation Site
- Assumed Mainland Overhead Line Route Corridor

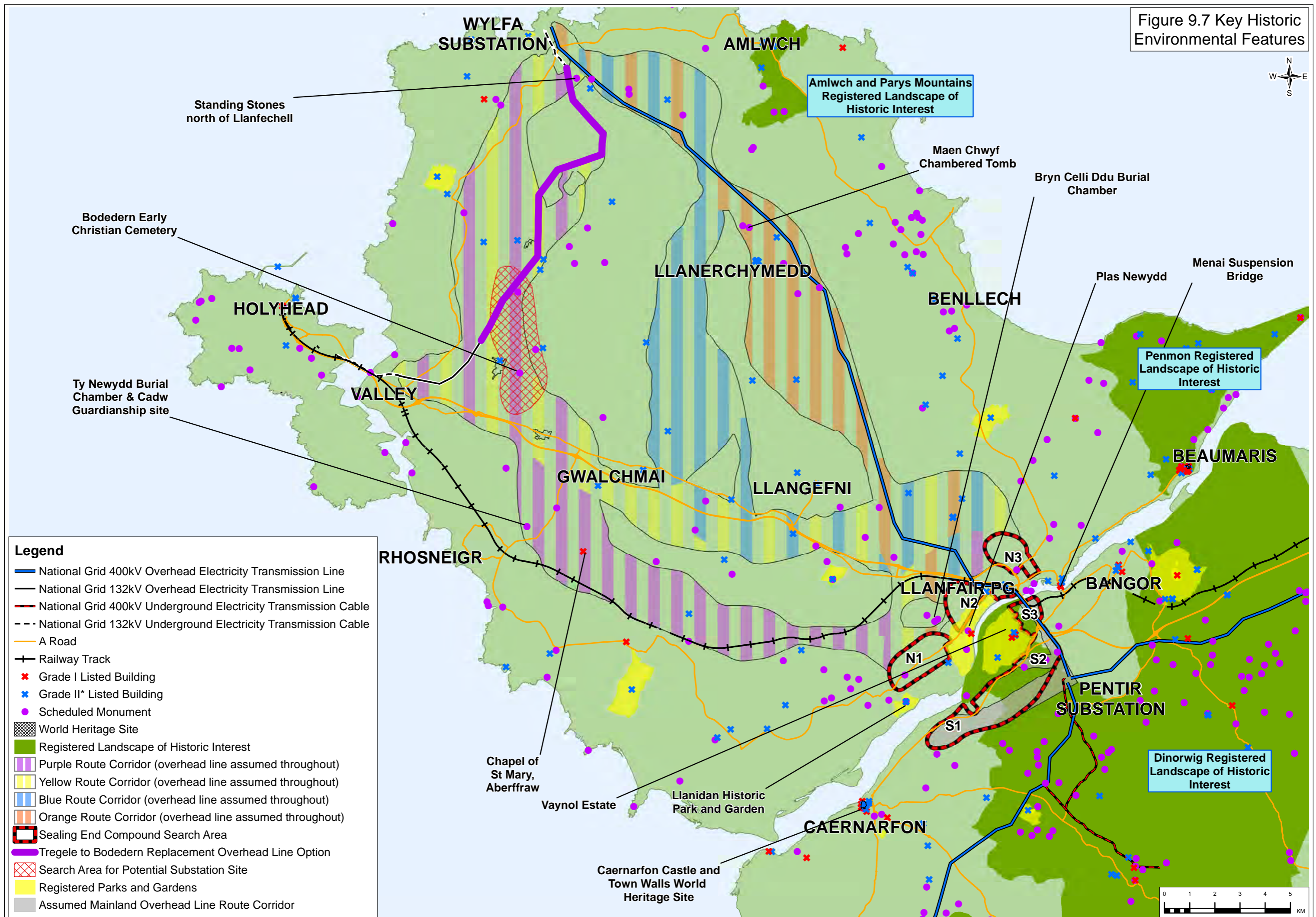


- 9.2.9 All the crossing options crossed the European designated Y Fenai a Bae Conwy / Menai Strait and Conwy Bay SAC. Coedydd afon Menai SSSI lies along the Gwynedd shoreline of the Menai Strait, either side of Britannia Bridge, between SECs N2/3 and S3. Glannau Porthaethwy SSSI covers the Anglesey side foreshore of the Menai Strait east of Britannia Bridge and lies between SECs N3 and S3. Trenching for a direct buried cable crossing of the Menai Strait near Britannia Bridge would be most likely to affect the SAC reef habitat features, and associated sensitive benthic communities, plus the shoreline SSSIs. Further to the west, these particularly sensitive designated features become less prevalent as the substrate becomes less rocky; the sandy substrate west of Y Felinheli was identified as having potentially less sensitive designated features, and likely to be capable of recovering faster than reef habitats from disturbance caused by trenching. Delivery of the proposed Menai Strait crossing by the adoption of trenchless techniques (e.g. HDD or tunnelling) would avoid the effects on these designated sites and habitat features, although a Stage 1 assessment under the Habitat Regulations would be needed to confirm this if such a design were taken forward.
- 9.2.10 All the proposed route corridors would be likely to affect unrecorded and non-designated ecological features (including protected species and Biodiversity Action Plan habitats and species) through direct habitat loss and disturbance. The Purple and Yellow Route Corridors would also require the permanent loss of open land to the associated substation development north of Bodedern. It should be possible to mitigate effects with good practice design and construction methods, and, if possible, permanent habitat creation and associated long term management. As the baseline terrestrial ecology of all the route corridors is relatively uniform, and excluding the consideration of designated sites, the relative effects of the route corridors is largely a function of the length of each route corridor – the longer the corridor, the greater is the likely effect.
- 9.2.11 In summary, the Orange Route Corridor offered the least ecological risk due to there being opportunities to avoid all designated ecology sites through routeing and having the shortest length and least risk of bird strike. Blue and Yellow Route Corridors vary in length, with Blue being the shortest. The Purple Route Corridor was the only route corridor that would definitely require works within a SSSI, and was the longest route corridor.

#### Historic Environment

- 9.2.12 The following historic environment and main designated features of consideration are illustrated in Figure A-3 in Appendix A, with some features also indicated on Figure 9.7.
- Scheduled monuments;
  - Listed buildings (Grades I, II\* and II);
  - Registered parks and gardens, including essential settings;
  - Registered landscapes of historic interest;
  - Conservation areas; and
  - National Trust boundaries.

Figure 9.7 Key Historic Environmental Features



**Legend**

- National Grid 400kV Overhead Electricity Transmission Line
- National Grid 132kV Overhead Electricity Transmission Line
- National Grid 400kV Underground Electricity Transmission Cable
- National Grid 132kV Underground Electricity Transmission Cable
- A Road
- Railway Track
- Grade I Listed Building
- Grade II\* Listed Building
- Scheduled Monument
- World Heritage Site
- Registered Landscape of Historic Interest
- Purple Route Corridor (overhead line assumed throughout)
- Yellow Route Corridor (overhead line assumed throughout)
- Blue Route Corridor (overhead line assumed throughout)
- Orange Route Corridor (overhead line assumed throughout)
- Sealing End Compound Search Area
- Tregele to Bodedern Replacement Overhead Line Option
- Search Area for Potential Substation Site
- Registered Parks and Gardens
- Assumed Mainland Overhead Line Route Corridor



9.2.13 With regard to the route corridors, north of the Southern Common Area and the Menai Strait, direct effects upon listed buildings and scheduled monuments would be avoided through detailed alignment. Therefore the appraisal considered the risks of a future transmission line affecting the settings of the above designated historic features in the route corridor or within 1km of the route corridor boundary. All the route corridors shared the same risks to settings of scheduled monuments, registered parks and gardens, listed buildings and conversation areas in and near the Northern and Southern Common Areas, such as to the Standing Stone Scheduled Monument north of Llanfechell (see Figure 9.8) and Llanfechell's listed buildings and conservation area. There were additional heritage assets specific to each route corridor outside these common areas:



**Figure 9.8 Standing Stones North of Llanfechell**

- **Orange Route Corridor** – shared four scheduled monuments plus Grade II\* and II listed buildings with the Blue Route Corridor, such as the Pen-y-Morwyd Round Barrow Scheduled Monument. Two scheduled monuments plus Grade II\* and II listed buildings were shared with the Blue and Yellow Route Corridors north of the Menai Strait. Elsewhere, the Orange Route Corridor alone contained five scheduled monuments, such as the Maen Chwyf Chambered Tomb and Maen Addwyn Standing Stone, and Grade II\* and II listed buildings, such as the clusters around Llandyfrydog, Llwydiarth Esgob Farm and Tregaian.
- **Blue Route Corridor** – further to those assets shared with the Orange Route Corridor, south of RAF Mona and Llangefni the Blue Route Corridor shared four scheduled monuments plus Grade II\* and II listed buildings with the Yellow Route Corridor. Within the Blue Route Corridor only section there were Grade II\* and II listed buildings, such as the Grade II\* Church of St Twrog at Bodffordd near RAF Mona and Grade II listed buildings between Gwalchmai and RAF Mona.
- **Yellow Route Corridor** – in addition to the above, the Yellow Route Corridor shared six scheduled monuments and multiple Grade II\* and II listed buildings with the Purple Route Corridor, including the early Christian Cemetery Scheduled Monument

in the substation search area near Bodedern and the Grade II\* Listed Church of St Peulan, near Bryngwran.

- **Purple Route Corridor** – the Purple Route Corridor only section contained three scheduled monuments, including the Ty Newydd burial chamber and Cadw Guardianship site, plus multiple listed buildings, including a the Grade I Listed Chapel of St Mary (Yal-y-llyn) and Churchyard Walls and Grade II\* Listed Church of St Beuno.

9.2.14 All Menai Strait crossing options would also have potential effects on the historic environment, including the settings of scheduled monuments and listed buildings, that would need to be considered during the detailed design and selection of a preferred crossing option as specific alignment options are developed. A new overhead line, SEC or significant vegetation loss between the Menai Strait and Pentir Substation would also have an adverse effect on the setting and features of the Dinorwig Registered Outstanding Landscape of Historic Interest. Though not in close proximity, consideration also needs to be given to the potential effects on long distance views from Caernarfon Castle and Town Walls World Heritage Site, especially from the western crossing options.

9.2.15 Proposed crossing works, irrespective of technology, between SEC zones N2 / N3 and S2 / S3 could pose a risk of adverse effects on the settings on most or all of the following:

- the Grade I Plas Newydd Historic Park and Garden (see Figure 9.9),
- the Grade I Vaynol Registered Historic Park and Garden,
- Y Felinheli Conservation Area,
- Vaynol Conservation Area, and
- Grade I listed buildings: Menai Suspension Bridge, Plas Newydd House, Chapel of St Mary, Vaynol Old Hall and Vaynol Hall.



Figure 9.9 Plas Newydd Grade I Listed House and Registered Park and Garden



- 9.2.16 A particularly important feature of concern, emphasised by Cadw, is the Bryn Celli Ddu Burial Chamber Scheduled Monument and Cadw Guardianship Site, between Llanddaniel Fab and Plas Newydd. The chamber is aligned to receive the rising sunlight of the summer solstice into the chamber, and this may be affected by developments to the east of the site.
- 9.2.17 A SEC in zone N1 or its overhead line connection could affect the setting of Llanidan (Grade II\*) Registered Historic Park and Garden, Caer Idris Hillfort Scheduled Monument and Aberbraint Grade II\* Listed Building. On the mainland, connections from SEC zone S1 could affect the settings of the following scheduled monuments: Gors y Brithdir Enclosed Hut Group; Fodol Ganol Enclosed Hut Group; and the Standing Stone, near Coed Nant-y-garth. Crossing between SEC zones N1 and S1 could also create adverse effects on views towards the south-west from the Grade I Listed Plas Newydd house and from the Grade II\* Anglesey viewing column towards the south-west.
- 9.2.18 Underground cabling with screening of the SECs and appropriate archaeological mitigation could partially mitigate the above adverse effects associated with the crossing options.
- 9.2.19 Both overhead line construction and the installation of underground cabling in the vicinity of the AONB and Menai Strait may have effects on unknown archaeological remains. In accordance with WO Circular 60/96, recording in advance of or during construction, and the dissemination of that record, may be required to mitigate effects on any remains that may be present.
- 9.2.20 In summary, all the proposed route corridors and crossing options were considered to have the potential to result in adverse effects of varying levels of significance on designated heritage assets, including scheduled monuments, registered parks and gardens, all grades of listed buildings and the Dinorwig Registered Outstanding Landscape of Historic Interest. Within the route corridors between Wylfa and the Menai Strait there is the potential for the alignments to be designed to minimise any potential effects on the settings of these designated heritage assets. Appropriate archaeological measures could be implemented to mitigate any effects on archaeological remains. Overall the Orange Route Corridor was considered to pose the least potential for significant effects on heritage assets. In addition, around the Menai Strait the preference from an archaeological perspective would be those route corridors and crossing options that pose the least potential effect on the setting of the Bryn Celli Ddu Scheduled Monument.
- 9.2.21 Access to potential crossing points within land owned by the National Trust (e.g. Plas Newydd Estate and Vaynol Estate) would require special consideration due to the land's importance as a designated Registered Park and Garden and due to its special legislative status as inalienable land.

### **9.3 Socio-Economic**

#### Local Economy

##### *Tourism*

- 9.3.1 The 'Tourism Strategy North Wales 2010-2015' emphasises the quality of the natural landscape and environment as the main selling points for attracting tourists to the region. Therefore, the Landscape, Visual Amenity and Ecology effects of the route corridor are likely to have a major bearing on the potential for effects on tourism and local economic activity.
- 9.3.2 While the assessment considered the outputs of the above assessment, it also considered the tourism receptors along each of the route corridors.

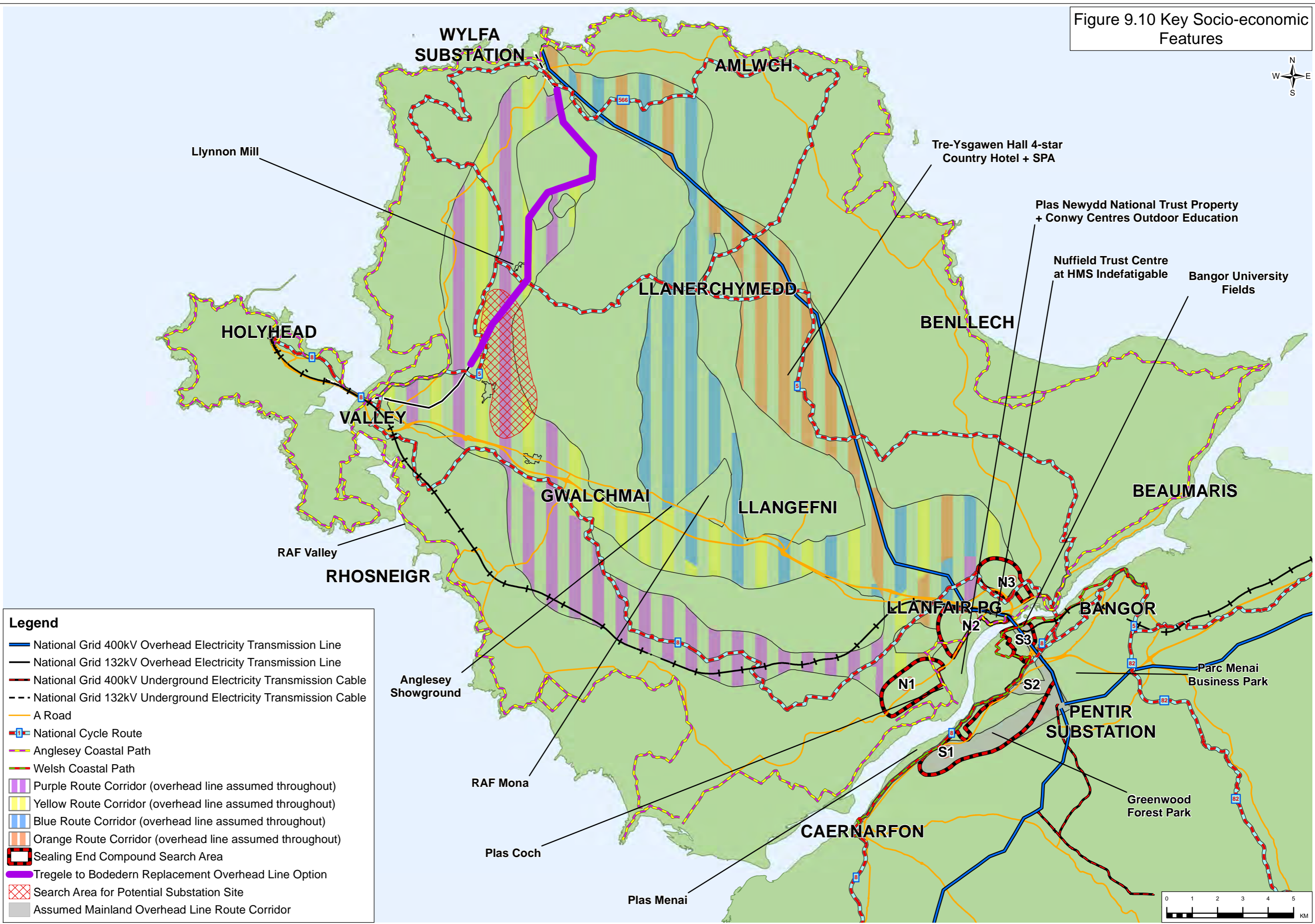
9.3.3 Notable tourism and recreational features and attractions on Anglesey and around the Menai Strait are illustrated in Figure A-4 in Appendix A. Table 9.1 and Figure 9.10 present the main tourism and recreation features, which are distributed across the route corridors.

Name	Facility / Attraction	Route Corridor / Crossing Options Affected
Tre-Ysgawen Hall Country Hotel and SPA	One of only two 4-star Hotels on Anglesey	Orange Route Corridor
Llynonn Mill	Regional tourist attraction	Yellow and Purple Route Corridors
Anglesey Showground	Agricultural showground; hosts annual Anglesey Show	Yellow and Blue Route Corridors
Bangor University Fields	Sports and playing fields	SEC zone N3
Nuffield Trust Centre at HMS Indefatigable	Holiday facility for service personnel	SEC zone N2
Plas Coch	Luxury holiday homes and caravan park	SEC zone N1
Plas Menai Outdoor Pursuit Centre	Nationally recognised centre for water sports	SEC zone S1
Anglesey Coastal Path and National Cycle Routes	National walking and cycle trails	All route corridors and SEC zones
Greenwood Forest Park	Regional Tourist Attraction. (Woodland-themed leisure park).	SEC zone S1

**Table 9.1 Tourism and Recreation Features**

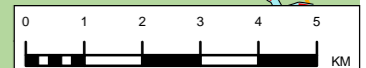
9.3.4 The main area of focus for tourism on Anglesey is the coastline, with Amlwch, Beaumaris and Rhosneigr all identified as potential tourism hubs; these areas are all outside the route corridors and crossing options. Outdoor pursuits, in particular water sports, are identified as a potential growth area (e.g. around Menai Strait). Menai Bridge and Britannia Bridge are viewed by stakeholders as important to developing Anglesey's brand as the gateways to the island.

Figure 9.10 Key Socio-economic Features



**Legend**

- National Grid 400kV Overhead Electricity Transmission Line
- National Grid 132kV Overhead Electricity Transmission Line
- National Grid 400kV Underground Electricity Transmission Cable
- - - National Grid 132kV Underground Electricity Transmission Cable
- A Road
- National Cycle Route
- Anglesey Coastal Path
- Welsh Coastal Path
- Purple Route Corridor (overhead line assumed throughout)
- Yellow Route Corridor (overhead line assumed throughout)
- Blue Route Corridor (overhead line assumed throughout)
- Orange Route Corridor (overhead line assumed throughout)
- Sealing End Compound Search Area
- Tregele to Bodedern Replacement Overhead Line Option
- Search Area for Potential Substation Site
- Assumed Mainland Overhead Line Route Corridor



9.3.5 All route corridors may affect many other forms of tourist accommodation, such as rental accommodation, caravan / camping sites and bed and breakfast facilities. A review of the distribution of self-catering properties, comprising a dataset of 64 Visit Wales accredited accommodation sites, revealed that such properties were concentrated around the coast, specifically around Rhosneigr, Benllech and Beaumaris. There was a relatively even distribution across the inland areas of the island, with approximately three to four properties in each of the route corridors, and an additional four properties in the common area approaching the Menai Strait crossing options. The Isle of Anglesey Destination Management Plan 2012-2016 (IADMP) confirmed that outdoor activities and visitor accommodation are concentrated along the coast, whilst there is less tourism activity in the rural hinterland. The IADMP also identified tourism as an 'economic lifeline' on Anglesey which is seen as a long-term solution for securing employment, along with the energy sector and makes the point that both sectors need to succeed without impeding the other. One of the main challenges identified is to control, through the planning process, developments which could threaten the quality of the coastal environment. The IADMP suggested that developments should not only comply with planning policy guidance, but should be of the highest quality in design terms.

#### *Potential Developments*

9.3.6 **The Local Development Plan for Anglesey identified development growth plans near Llangefni that could potentially affect the Yellow and Blue Route Corridors, whilst the Parc Menai Business Park lies between SEC zones S2 and S3.**

9.3.7 From details contained in local planning applications and developer published information, National Grid was aware of proposed onshore wind farms, solar farms, offshore tidal arrays and a consented biomass power generation development near Holyhead.

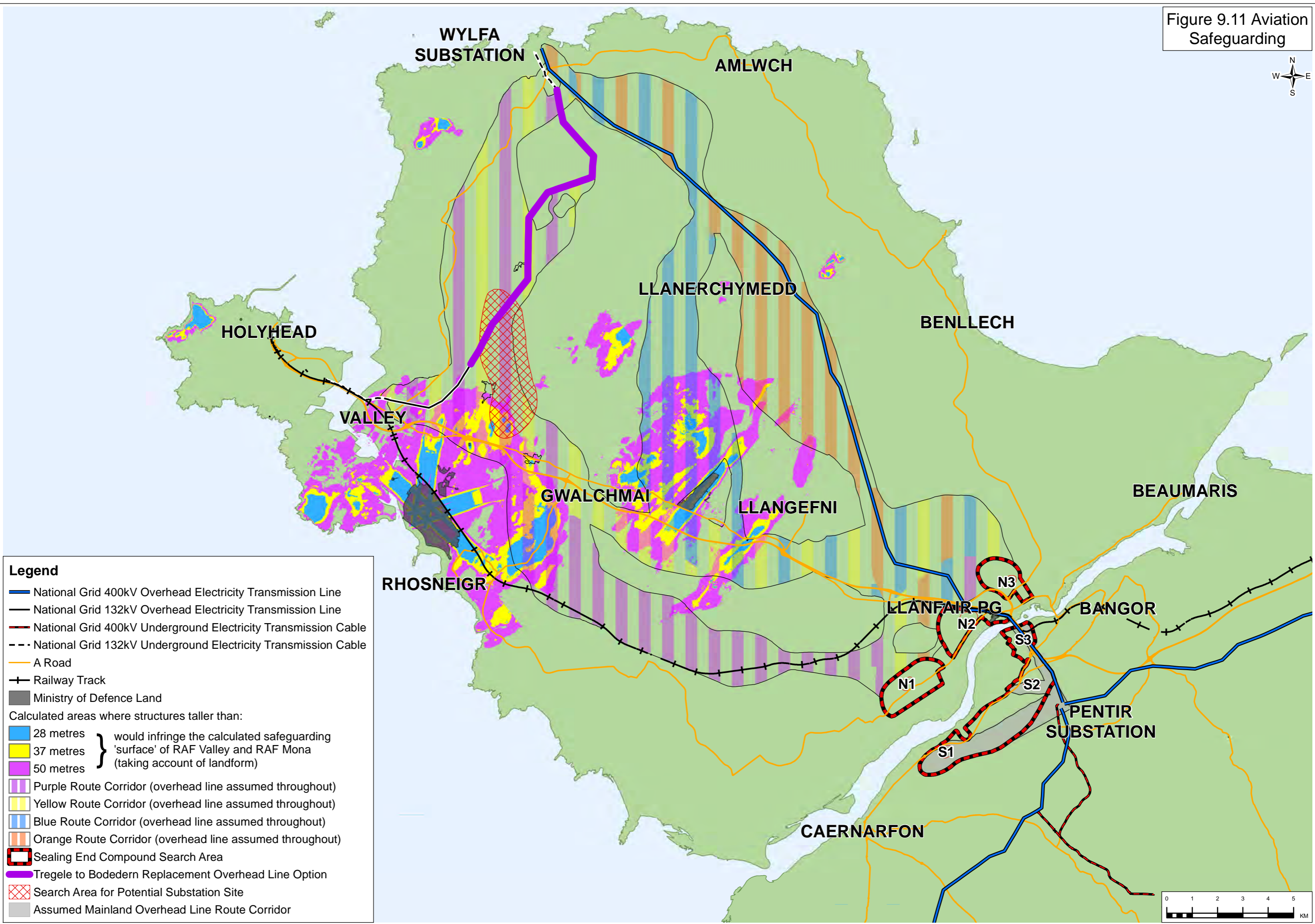
9.3.8 Other infrastructure developments in and around Anglesey would continue to be monitored to identify cumulative impacts associated with those of the transmission line. At this stage in the assessment process, only developments that are permitted for construction were considered. For example, the Welsh Government has committed to the Caernarfon bypass development, which would affect SEC zone S1. The Horizon Nuclear Power development at Wylfa was also considered in so far as the new overhead line is needed to support that development.

9.3.9 The Horizon development is expected to involve substantial construction activity in the east and north-east of Anglesey, which will include temporary worker accommodation development, logistic facilities and highways improvements, amongst other aspects. These Horizon developments pose the greatest risks of cumulative development effects along the Yellow and Purple Route Corridors. Until Horizon identifies its preferred locations for all aspects of its development it was not possible to say what cumulative effects could occur in relation to the Orange and Blue Route Corridors.

#### Aviation and Defence

9.3.10 There are two active RAF airfields on Anglesey (RAF Mona and RAF Valley) (see Figure 9.10). RAF Valley, on the west coast of Anglesey, is the larger of the two airfields and used for training pilots. In addition, RAF Valley is used for civilian flights. Search and rescue operations were carried out from RAF Valley, but from July 2015 these operations relocated to Caernarfon Airport. RAF Mona is an emergency runway for RAF Valley, otherwise is used primarily by light aircraft.

Figure 9.11 Aviation Safeguarding



**Legend**

- National Grid 400kV Overhead Electricity Transmission Line
- National Grid 132kV Overhead Electricity Transmission Line
- National Grid 400kV Underground Electricity Transmission Cable
- - - National Grid 132kV Underground Electricity Transmission Cable
- A Road
- + + Railway Track
- Ministry of Defence Land

Calculated areas where structures taller than:

<span style="background-color: blue; border: 1px solid black;"> </span>	28 metres	}	would infringe the calculated safeguarding 'surface' of RAF Valley and RAF Mona (taking account of landform)
<span style="background-color: yellow; border: 1px solid black;"> </span>	37 metres		
<span style="background-color: magenta; border: 1px solid black;"> </span>	50 metres		

- Purple Route Corridor (overhead line assumed throughout)
- Yellow Route Corridor (overhead line assumed throughout)
- Blue Route Corridor (overhead line assumed throughout)
- Orange Route Corridor (overhead line assumed throughout)
- Sealing End Compound Search Area
- Tregele to Bodedern Replacement Overhead Line Option
- Search Area for Potential Substation Site
- Assumed Mainland Overhead Line Route Corridor



- 9.3.11 Airfields are surrounded by safeguarding zones, within which it is necessary to consult with the Civil Aviation Authority or the Defence Infrastructure Organisation (Defence Estate) prior to submission of a planning application for development. While safeguarding zones do not prohibit development, the extent of these zones will be a factor in routeing of overhead lines. In order to understand the potential restrictions on overhead line development likely to be imposed by safeguarding constraints, flight line modelling was undertaken using industry standard assessment of take-off zones. This was based on the Ordnance Survey's topography data and the Defence Estate's safeguarding zones data for RAF Valley and RAF Mona; it was understood that the safeguarding zones data was in the process of being updated when it was acquired and any updates would be taken into consideration prior to confirming the final route alignment. Those safeguarding zones likely to restrict the height of pylons that could be used are shown in Figure 9.11.
- 9.3.12 All the route corridors include part of a safeguarding zone which, depending on exact route alignments, may require obstacle warning lights on the pylons to identify the aviation horizon. However, **only the Orange Route Corridor could avoid any need to manage risks of infringement of a safeguarding zone where development of tall structures is controlled to protect low flying aircraft.**
- 9.3.13 The **Blue Route Corridor poses the most significant risk of infringement of a safeguarding zone** as it passes to the west or east and south of RAF Mona. Two new single circuit low height lines or underground cabling may be required under this route corridor option.
- 9.3.14 Within the **Yellow Route Corridor two new single circuit low height lines or underground cabling may be required** south of RAF Mona and south of Llangristiolus to avoid infringement of safeguarded surfaces (i.e. stay below safe height for air traffic).
- 9.3.15 The **Purple Route Corridor could avoid aviation infringements with 50m pylons with the exception of a pinch point south of RAF Mona**, just north of Bethel on Anglesey, where some reduction in pylon height may be required.
- 9.3.16 If the Purple, Yellow or Blue Route Corridors were selected, during the detailed design stage further investigation and consultation with the Civil Aviation Authority and Defence Estate would be needed to determine if mitigation is required near RAF Mona. Careful alignment design would also be needed along the Yellow and Purple Route Corridors, south of Bodedern, where the RAF Valley safeguarding zone encroaches into these route corridors. Although the Defence Estate has not currently requested mitigation for an overhead line, it was expected that requests for reduced height options may be received once more specific design details are developed at a later stage.

## 9.4 Technical

- 9.4.1 A new overhead line could be constructed along all the route corridors, and all assumed an overhead crossing of the A55 and Holyhead to Bangor railway line to reach the Southern Common Area. The following route corridor specific issues were considered during the review of options, but none precluded a route corridor from being taken forward from a buildability perspective:
- Orange and Blue Route Corridors – would likely involve multiple interactions with the existing overhead line. Temporary stopping of electricity transmission along the existing overhead line (known as 'outages') may be required or temporary diversions of the route whilst construction took place.
  - Yellow and Purple Route Corridors – would require construction of a new substation near Bodedern.

- Purple Route Corridor – would require installation across difficult ground conditions through Malltraeth Marsh; this risk may also apply to the Blue and Yellow Route Corridors if an alignment is needed through Malltraeth Marsh.

9.4.2 All the route corridors need to cross Anglesey AONB and the Menai Strait and a commitment has been made to avoid crossing these with new overhead line infrastructure due to environmental and socio-economic considerations. All the route corridors could use any of the crossing locations and more detailed investigations are required at the next stage to determine the preferred crossing location and technology. Therefore, only the following technical issues were considered, at this stage, for the route corridor appraisals:

- For underground technologies, it was assumed six separate cables (two sets of three cables) would be required, with a SEC on each side of the Menai Strait where changing between overhead lines and cabling.
- SEC zones S2 and S3 would likely require shorter lengths of new overhead line to complete the connection compared to SEC zone S1.
- An option to install cables on Britannia Bridge may be technically possible, though challenging. This would depend upon not affecting existing use, acquiring support from Network Rail and the ability to route a cable to the bridge through constrained areas that include woodland, built development and operational Ministry of Defence land.
- The use of a potential new second road bridge crossing was dismissed as there was no current funding commitment from the Welsh Government for such a development.
- Crossing beneath the Menai Strait between SEC zones N2 and S3 was thought to be difficult, though not impossible, due to very challenging geology underlying the Menai Strait.
- Crossing between SEC zones N1 and S2 was identified as the crossing area likely to offer the least technical challenge for underground crossing technology, but access through National Trust property would require sensitive design to avoid long term landscape or visual effects.
- Crossing between SEC zones N1 and S1 was unlikely to suit a direct buried solution as the shifting sands in that area of the Menai Strait would risk either exposing the cables or burying them too deeply such that their operational characteristics would be affected.
- Welsh Government has committed to the Caernarfon bypass development, with commissioning of Contractors underway in 2014. The northern section of the bypass route falls within part of the area for SEC zone S1.

## 9.5 Costs

9.5.1 Table 9.2 presents the high level, estimated capital costs to construct each route corridor defined in Section 8.5, with the main causes of variation being length of corridor and assumed Menai Strait crossing location, as explained in Section 8.5.

Route Corridor	Approx. Length	Cost Estimate	Comment
Orange	35km	£175M	<ul style="list-style-type: none"> <li>• Risk of additional costs if underground cabling required near Rhosgoch / Rhosybol if unable to mitigate effects of a second overhead line route through this pinchpoint.</li> <li>• Underground cabling assumed for crossing Menai Strait.</li> <li>• Assumed refurbishment of 132kV route.</li> </ul>
Blue	43km	£199M	<ul style="list-style-type: none"> <li>• Risk of additional costs if low height towers or underground cabling required near RAF Mona to avoid intrusion within low flying zone.</li> <li>• Underground cabling through cut and cover trenching assumed for crossing Menai Strait.</li> <li>• Assumed refurbishment of 132kV route.</li> </ul>
Yellow	44km	£214M	<ul style="list-style-type: none"> <li>• Risk of additional costs if low height towers or underground cabling required near RAF Mona to avoid intrusion within low flying zone.</li> <li>• Underground cabling assumed for crossing Menai Strait.</li> <li>• Assumed removal of 132kV route, with a new substation in vicinity of Bodedern and a short section of new 132kV overhead line to maintain the connection.</li> </ul>
Purple, via SEC S2	44km	£300M	
Purple, via SEC S1	46km	£249M	

**Table 9.2 High Level, Estimated Costs to Construct Each Route Corridor**

9.5.2 The route corridor costs are based upon unit costs of £3 Million / km for the construction of a 400kV overhead line and £31.5 Million / km for the installation of 400kV underground cables (assuming direct burial in trenches). These both equate to the 'Hi' rating capacity as defined in the IET, PB/CCI Report<sup>26</sup>, broadly equivalent to the rating achievable from the existing overhead line between Wylfa and Pentir. This rating was required to provide sufficient capacity to meet the contracted generation at the time that the costs were produced.

9.5.3 More details on the costs associated with different rating capacities can be found in Appendix D of the Strategic Options Report.

9.5.4 Estimated budget costs that reflect the likely design for any new substation north of Bodedern have been included in the Purple and Yellow Route Corridor costs. Bespoke costs have also been included for the dismantling of the section of 132kV overhead line that has been assumed as part of these same route corridor designs.

9.5.5 In the medium term, the existing 132kV line on Anglesey will need to be fully refurbished. Therefore, if the Purple or Yellow Route Corridors were adopted, these costs would be avoided through the removal of the line. In order to ensure that this modest financial benefit would be reflected in the comparative route corridor costs, the

<sup>26</sup> "Electricity Transmission Costing Study – An Independent Report Endorsed by the Institution of Engineering & Technology" by Parsons Brinckerhoff in association with Cable Consulting



costs of the necessary refurbishment of the line have been added to the budget costs of the assumed Orange and Blue Route Corridor designs. For the construction of any new length of 132kV overhead line, a unit cost of £800,000 / km has been applied.

- 9.5.6 For all the route corridors there are sensitive areas, other than the Menai Strait, where further investigation is required to determine whether use of standard 50m high overhead line towers would be feasible, or if alternative options (e.g. underground cabling or low height towers) would be required. In addition, there were cost variables that it was not possible to account for at this stage; for example, compensatory costs as part of designated habitat consents or land access negotiations.
- 9.5.7 The requirement for a 'Hi' rating capacity has changed since the above costs were prepared. Whilst the above costs are those considered at the time that the preferred corridor was selected, the capital costs of achieving the reduced ratings now required to meet the revised levels of contracted generation have reduced for all five route corridor designs considered. Whilst the cost difference between the route corridor options has narrowed, the order of the options in cost terms has not altered. Given the relative movement of option costs and the fact that only limited weight has been given to the costs as a differentiating factor, the judgements made based upon the above costs continue to be valid. The capital costs of the options will be kept under review and back-checked as the project progresses and further design changes / refinements are identified.
- 9.5.8 Lifetime costs of the route corridors were not assessed in detail, but would result in the same ordering of corridors in cost terms, albeit with a greater cost range, especially where longer lengths of underground cables or additional electrical assets (e.g. a new substation) have been assumed.

## 10 SELECTION OF PREFERRED ROUTE CORRIDOR

### 10.1 Introduction

- 10.1.1 During the appraisal of the route corridors between Wylfa and Pentir (see Chapter 9), National Grid considered many potential constraints and opportunities for the routing of a new line. Many features or issues were common to all the route corridors and many of the likely effects could be adequately addressed during detailed design and alignment identification. Therefore, such issues would not influence the selection of the preferred route corridor.
- 10.1.2 This chapter outlines the selection of the preferred route corridor with reference to those issues identified as 'differentiators' between the route corridors, and which have influenced the selection of the preferred route corridor. National Grid gave particular consideration to factors identified within the NPSs EN-1 and EN-5. However, though the route corridors were shaped in accordance with the Holford Rules, as the exact overhead line alignment within these route corridors remains to be confirmed, further potential differentiators between the route corridors may arise at a later stage with respect to the Holford Rules. Back-checks on the selection of the preferred route corridor will be undertaken as the project develops.
- 10.1.3 In order to compare route corridors and select a preferred route corridor, National Grid considered the differentiators between the five Wylfa to Pentir design solutions presented in Section 8.5.

### 10.2 Stakeholder Feedback

- 10.2.1 National Grid acknowledges the importance of taking into account the views of stakeholders and the general public; therefore, feedback from statutory and non-statutory organisations and the public was considered during the appraisal process and in the selection of the preferred route corridor.
- 10.2.2 Chapter 7 outlines the stakeholder and public consultation, whilst the following summarises the feedback received and taken into account:
- For a wholly overhead line connection, those stakeholders (including the general public) who stated a preference indicated the Orange Route Corridor and Crossing Option B as the most appropriate; however, there was a preference to avoid an overhead crossing of the Menai Strait.
  - The Orange Route Corridor was favoured as it was the shortest, most direct route and followed the existing line (i.e. something is already there).
  - In discussions, the value of removing the existing 132kV overhead line between Wylfa and Valley was acknowledged by stakeholders.
  - Concerns were expressed about the effects of an overhead line on views of Snowdonia from the A55 corridor.
  - The Blue Route Corridor was viewed as the least preferred option.
  - Menai Strait area and Malltraeth Marsh in particular were regarded as sensitive areas.

### 10.3 Identification of Topic Differentiators

#### Environment - Landscape and Visual Amenity

- 10.3.1 Landscape and visual effects were acknowledged as the main and most sensitive effects of a new overhead transmission line development. The landscape value of

Anglesey's coastal areas is reflected by the AONB around much of the coast and the proposed JLDP SLAs, which include locations with panoramic views across the island towards Snowdonia National Park.

- 10.3.2 Consequently a number of landscape and visual amenity issues have influenced the selection of the preferred route corridor.

*Anglesey AONB*

- 10.3.3 With the undergrounding of the Menai Strait crossing, it was determined that no highly significant permanent effects on views from the AONB would be likely to occur from any of the route corridors. The effects of crossing at the Menai Strait depended on the method and alignment, so was a common risk to all the crossing options.

- 10.3.4 All the route corridors between Wylfa and the Menai posed landscape and visual amenity risks, but a **differentiating factor was the fact that the Yellow and Purple Route Corridors would be visible from long lengths of the Anglesey AONB along the north-west and south-west coastlines**; in addition, views from the AONB on the north-west coast had the Snowdonia National Park as a distant panoramic backdrop. In contrast, views of the Orange and Blue Route Corridors were limited to distant and restricted views from the AONB on the north coast and at Mynydd Bodafon.

*Panoramic Views of Snowdonia*

- 10.3.5 Consultation feedback indicated concerns relating to visual amenity effects on panoramic views of Snowdonia from Anglesey (see Figure 10.1). In addition to those from the AONB, covered above, panoramic views of Snowdonia from the A55 were considered as the Yellow and Blue Route Corridors may require an overhead line to cross and re-cross the A55.



**Figure 10.1** Panoramic View of Snowdonia National Park from A5152, beside the A55, on Anglesey

- 10.3.6 Due to consultation concerns relating to the perceived effect on tourists travelling along the A55, in particular those arriving through the Port of Holyhead or Anglesey Airport to visit Wales, users of the A55 were assigned a higher sensitivity than is usual for such a road, though not the highest level. Although the view is not specifically designated, the landscape could be deemed to have district or local value reflecting the concern being raised by statutory stakeholders.

- 10.3.7 It was ascertained that there could be effects on panoramic views of the Snowdonia mountain range from sections of the A55 corridor. The views vary depending on location as the road enters and leaves cutting and embanked sections and benefits from screen

planting in some places. Weather conditions play an important part given the length of the views towards Snowdonia. **Therefore, the risk of significant adverse effects on panoramic views of Snowdonia by an overhead line along Yellow or Blue Route Corridors was deemed a differentiating factor.**

#### *Residential Visual Amenity Effects*

10.3.8 Site visits were made by professional landscape advisers across all route corridors to better understand the nature and distribution of residential property. However, in order to fully appreciate the balance of close and distant visual amenity effects / issues, indicative ZTVs and photomontages were used to help visualise the following potential visual amenity effects / issues:

- Effects of two 400kV overhead lines in close proximity in one route corridor.
- Effects of replacing the 132kV line with a new 400kV overhead line through a wind farm.
- Effects of a new overhead line crossing along a previously unaffected skyline in the distance.
- How existing topography could screen the majority of a new line and pylons when crossing previously unaffected views.

10.3.9 The main issues drawn from the ZTVs (see Figure 9.5, in Chapter 9) and photomontages that influenced the choice of corridor were:

- The number of receptors across Anglesey with views of a 400kV overhead line increases proportionally according to how far the new 400kV overhead line moves away from the existing overhead line.
- Orange and Blue Route Corridors would be preferable as the range of views was more constrained due to the terrain; the east of Anglesey has a more undulating and hilly landscape, compared to the more open views across a relatively flatter landscape in the south-west of Anglesey.
- There is the potential for additional localised visual screening from buildings or vegetation, for which the ZTV does not account. Therefore, the Orange Route Corridor would also benefit from the greater presence of woodland vegetation over the east of Anglesey compared to other corridors to the west of the island.

10.3.10 **The above indicated that the potential difference in the number of receptors experiencing close and distant visual amenity effects was a differentiating factor. The Orange Route Corridor was the preferred route corridor on landscape and visual grounds due to the potential for the fewest number of new receptors experiencing visual amenity effects from an overhead line and lower net increase in the area of Anglesey as a whole that would be affected by views of 400kV overhead lines.**

#### Environment: Ecology

10.3.11 Between Wylfa and the Menai Strait, the Blue and Purple Route Corridors must cross Cors Bodwrog SSSI and Malltraeth Marsh SSSI, respectively. The Blue and Yellow Route Corridors also have a high possibility of having to cross Malltraeth Marsh SSSI.

10.3.12 Holford Rule 2 states: “*Avoid smaller areas of high amenity value, or scientific interests by deviation; provided that this can be done without using too many angle towers, i.e. the more massive structures which are used when lines change direction.*”

- 10.3.13 In contrast, **only the Orange Route Corridor could definitely avoid all internationally, European and nationally designated sites between Wylfa and the Menai; this was the differentiating ecology factor.**
- 10.3.14 All route corridors cross the European designated Y Fenai a Bae / Menai Strait and Conwy Bay SAC, whilst Coedydd afon Menai and Glannau Porthaethwy SSSIs lie along the Gwynedd shoreline and Anglesey foreshore, respectively, of the Menai Strait beside Britannia Bridge. Chapter 9 outlines differences between the risks to the SAC and SSSI features for each crossing option, but these only apply to techniques involving laying cables on the seabed or open cut trenching. Adoption of trenchless techniques (e.g. HDD or tunnelling) should avoid the effects on these designated sites and habitat features. Therefore, **while the crossing technology remained to be confirmed, the ecology risks with regard to the Menai Strait crossing option could not be considered as a differentiating factor.**

Environment: Historic Environment

- 10.3.15 All the proposed route corridors and crossing options were considered to have the potential to result in adverse effects on designated heritage assets, including scheduled monuments, registered parks and gardens, listed buildings and the Dinorwig Registered Outstanding Landscape of Historic Interest. Between Wylfa and the Menai Strait there was the potential for alignments to be designed to avoid direct effects and minimise any potential effects on the settings of these assets. Appropriate archaeological measures could also be implemented to mitigate any effects on archaeological remains.
- 10.3.16 All the route corridors shared the same Anglesey AONB and Menai Strait crossing option risks; for example, potential underground crossing of Plas Newydd and Vaynol Registered Parks and Gardens from SEC zone N2 and a mainland overhead connection through Dinorwig Registered Outstanding Landscape of Historic Interest from SEC zone S3 to Pentir.
- 10.3.17 A potential differentiator between the crossing options was the risk of skylining against panoramic views of Snowdonia from the north by an overhead line crossing the high ground between a SEC zone S1 and Pentir; for example, potentially affecting views from the Plas Newydd, Vaynol and Llanidan Registered Park and Gardens along the Menai Strait. However, this may be outweighed by the adverse landscape and visual effects of underground cabling works through the Plas Newydd and Vaynol Registered Parks and Gardens to reach SEC zones S2 and S3.
- 10.3.18 A potential route corridor differentiator was that the Purple Route Corridor included a Grade I listed building and was also most likely to go through the Plas Newydd and Vaynol Registered Parks and Gardens or require a significantly longer length of overhead line through the Dinorwig Registered Outstanding Landscape of Historic Interest.
- 10.3.19 However, no route corridor or crossing option was clearly able to avoid effects on any designated historic asset or its setting. Since further analysis of potential effects on settings required development of specific route alignments, it was determined that **there were no potential effects on the historic environment that were considered to be significant differentiators between route corridors.**

Socio-economic: Local Economy

- 10.3.20 **In terms of local economic activity, none of the route corridors were considered to pose a significant risk.** There was potential to affect some significant economic receptors, but all the route corridors posed risks to tourist accommodation facilities and important attractions. Similarly, all the potential effects could be mitigated so that the residual effects would be considered to be minor.

10.3.21 It was noted that the emerging Anglesey and Gwynedd JLDP identified growth plans near Llangefni that could potentially affect the Yellow and Blue Route Corridors. The Horizon new nuclear development at Wylfa is expected to involve a lot of development activity in the east and north-east of Anglesey, with socio-economic activities, highways improvements, etc. posing risks of cumulative development effects along the Yellow and Purple Route Corridors. However, at this stage in the assessment process, these proposals were not sufficiently progressed to be considered.

10.3.22 As such, **there were no potential effects on local economic activity that were considered to be differentiators in the preferred route corridor selection process.**

Socio-economic: Aviation and Defence (RAF Mona Low Flying Zone)

10.3.23 Unless an alignment for an overhead line could be developed as far away from RAF Mona as the Yellow or Blue Route Corridors allow, there would likely be a need to use underground cable or low height towers in some locations to stay below safe height for air traffic. However, to the south of RAF Mona, an overhead line along the southern extent of the combined Yellow and Blue Route Corridors may also require multiple crossings of the A55 and pass through the northern extent of Malltraeth Marsh SSSI. This would conflict with the need to avoid associated visual and ecological effects along the A55 corridor and on Malltraeth Marsh SSSI, respectively. **Only the Orange Route Corridor could avoid any need to manage risks of infringement of a safeguarding zone where development of tall structures is controlled to protect low flying aircraft, thus this was a differentiator.**

Technical Constraints

10.3.24 A new overhead line between Wylfa and Menai is buildable along all the route corridors. Each route corridor may require underground cabling or the use of low height towers to manage the risks for a currently proposed section of overhead line; at Rhosgoch and Rhosybol for the Orange and Blue Route Corridors; and near RAF Mona or RAF Valley for the Purple, Yellow and Blue Route Corridors. **The fact that the Blue Route Corridor contains both these risks is a differentiator.**

10.3.25 With regard to the Menai Strait undergrounding crossing options, some high level investigations were undertaken in 2014 (see Chapter 6) that identified the following technical issues of note:

- Using cables on Britannia Bridge to cross the Menai Strait remained an option for further consideration.
- Crossing underground between SEC zones N2 and S3 would be difficult, though not impossible, due to very challenging geology underlying the Menai Strait.
- Crossing between SEC zones N1 and S2 was identified as the crossing area likely to offer the least technical challenge for underground crossing technology, but access through National Trust property would require sensitive design to avoid long term landscape or visual effects.
- Crossing between SEC zones N1 and S1 was unlikely to suit a direct buried solution as the shifting sands in that area of the Menai Strait would risk either exposing the cables or burying them too deeply such that their operational characteristics would be affected.
- Welsh Government has committed to the Caernarfon bypass development, with commissioning Contractors underway in 2014. The northern section of the bypass route falls within part of the area for SEC zone S1.

10.3.26 It was determined that while technically challenging, a viable means to cross the Menai Strait using buried cabled could be found. However, further investigation is required to

ascertain the best technology and location to cross the Menai Strait and link to Pentir Substation. In addition, though an overhead crossing route was assigned to each route corridor to provide an end-to-end basis for comparing the route corridors at this stage, all the potential crossing technologies and routes could be linked to all the route corridors. Therefore, when identifying the preferred route corridor it was not possible to determine the preferred crossing option until progression of detailed design and preferred transmission alignment identification studies during the next stage. **As a consequence, the crossing of the Menai Strait was not taken forward as a differentiator.** Following the on-going Menai Strait crossing studies, a back-checking exercise would be completed.

#### Costs

- 10.3.27 Though there are estimated cost variations between the route corridors (see Table 9.2, in Chapter 9), after taking into consideration the potential for additional costs and margin for error it was deemed that **there was no significant cost differentiator.**

### **10.4 Selection of Preferred Route Corridor**

- 10.4.1 The selection of the preferred route corridor was determined through a qualitative review of the route corridor appraisal findings (see Chapter 9) and, in particular, the differentiators presented in Sections 10.2 and 10.3.
- 10.4.2 Further investigation will be required to ascertain the best technology (underground cabling, use of Britannia Bridge, etc.) and location to cross the Menai Strait and link to Pentir Substation. Therefore, in deciding on the preferred route corridor the preference was selected based on those route corridor differentiators between Wylfa and the Southern Common Area.
- 10.4.3 As a consequence, and following a review of differentiators between the route corridors, it was determined that the Orange Route Corridor was the preferred route corridor to be taken forward to develop a specific alignment and consent application.
- 10.4.4 The following is a summary of the reasons for selecting the Orange Route Corridor; see Chapter 9 and Sections 10.2 and 10.3 for the detailed appraisal:
- **Landscape and Visual Amenity:**
    - The Orange Route Corridor was the shortest route, thus requiring fewer towers, and offered the opportunity to develop within an area already affected by an existing overhead transmission line.
    - The terrain in the Orange Route Corridor offered better natural screening and compliance with Holford Rules compared to the more expansive, long distance views of the Yellow and Purple Route Corridors. Computer modelling indicated that fewer new visual amenity receptors were likely to be affected along the Orange Route Corridor compared with other route corridors.
    - The Yellow and Purple Route Corridors were also visible from long lengths of the Anglesey AONB, whilst there was less visibility of the Orange and Blue Route Corridors from the AONB.
    - Any new line within the Blue, Yellow and Purple Route Corridors would affect undeveloped landscapes and was more likely to affect undeveloped landscapes and panoramic views to Snowdonia; in particular, the Blue and Yellow Route Corridors posed a risk of effects on views for tourists travelling eastwards along the A55 (e.g. those entering Wales from Holyhead).

- It was noted that visual effects upon residential property at some locations within the Orange and Blue Route Corridors might limit opportunities to route further from communities.
- **Ecology:** The route corridor options were broadly similar in terms of their potential effects upon flora and fauna, especially protected species, and all options needed to cross the Y Fenai a Bae Conwy / Menai Strait and Conwy Bay SAC. The Orange Route Corridor was preferred as it provided opportunities for a line to avoid all other designated nature conservation sites, whilst the Blue, Yellow and Purple Route Corridors provided no opportunity for a line to avoid direct effects upon Malltraeth Marsh SSSI due to airfield low flying zone constraints (RAF Mona).
- **Historic Environment:** There were no potential effects on the historic environment considered to be differentiators between route corridors.
- **Socio-economics (Local Economy):** All route corridors contained sensitive tourism facilities and attractions, with most tourism receptors on the coast near the Menai Strait, which were common risks to all route corridors. Any risk to tourism is intrinsically linked to landscape and visual amenity concerns (refer to the previous Landscape and Visual Amenity text). From a landscape perspective the Orange Route Corridor was preferred and, given the lack of other differentiators, this was therefore also preferred from a Socio-economic perspective.
- **Socio-economics (Aviation and Defence):** The Blue and Yellow Route Corridors may need mitigation near RAF Mona in the form of two separate low height lines, whilst the Purple Route Corridor may also require low height towers depending on the final alignment. These risks were avoided by the Orange Route Corridor, which could avoid the need to manage risks of infringement of safeguarding zones, reinforcing the preference for the Orange Route Corridor.
- **Consultation Feedback:** Where members of the public gave feedback on the route corridor options, the majority of the 153 responses (79%) preferred the Orange Route Corridor as it was the shortest, most direct route and follows the existing line (i.e. something is already there). Blue and Yellow Route Corridors were also highlighted as posing a risk of effects on views for tourists entering Wales along the A55 from Holyhead.
- **Technical Constraints:** All the route corridor options had technical risks, but all were manageable so posed no differentiator.
- **Costs:** With no difference in identified risks that might pose significant cost increases between the route corridors, the Orange Route Corridor was preferred as the least cost option, although this wasn't considered a major differentiator, due to the uncertainty surrounding the ultimate costs of the final designs for consent application.

10.4.5 It was acknowledged that further work in the route alignment and detailed design stages would be required in respect of the Orange Route Corridor. However, all the route corridor options would have necessitated such work. Ultimately, it was concluded that the potential cumulative effects of constructing a second overhead line within the Orange Route Corridor, once detailed design and mitigation measures had been developed, would not be so great as to negate the advantages that the Orange Route Corridor offered over the three alternative corridors considered. This conclusion will be back-checked and reviewed as the project progresses.



## 11 WAY FORWARD

### 11.1 Next Steps

11.1.1 National Grid has gone on to identify a number of potential route options for a specific alignment within the Orange Route Corridor between the Wylfa and Pentir Substations. Further studies were undertaken to support option refinement:

- Desk based review and gap analysis of environmental and socio-economic data.
- Stakeholder engagement meetings and specialist studies / field surveys to better understand specific issues that may influence option screening.
- Technical engineering viability review.

11.1.2 The aim is to develop a set of technically viable alignment options taking into consideration environmental, socio-economic and cost considerations in line with NPSs EN-1 and EN-5. These options would be presented to stakeholders and the public to obtain their feedback to inform the selection of the preferred route.

11.1.3 These options are to be presented in National Grid's Route Options Report published in Autumn 2015 for public consultation; available at [www.northwalesconnection.com](http://www.northwalesconnection.com).

11.1.4 The preferred alignment would be taken forward for detailed design and environmental assessment prior to submission of appropriate applications for consent to build.

11.1.5 Throughout the next stages, there will be a back-checking process to confirm that the preceding decisions (e.g. selection of the preferred route corridor) remains valid.

### 11.2 On-going Scheme Development

11.2.1 Development of a scheme to deliver the new Wylfa to Pentir transmission connection has been and will continue to be in accordance with the National Grid '*Approach to the Design and Routeing of New Electricity Transmission Lines*'.

11.2.2 The next stage involves detailed surveys and assessment work to find the alignment of the transmission connection that best satisfies all of National Grid's obligations and the needs of stakeholders. The alignment seeks to reduce as far as possible effects on people, settlements and environmentally sensitive areas. Mitigation measures will be considered and could involve tree planting or alternative pylon design, or the removal of other electricity transmission or distribution infrastructure. Consultation with stakeholders and communities will be undertaken to seek the views of communities close to the potential route, and the outcomes of public consultations will be published to explain why selections have been made. Appropriate environmental assessments would be carried out in relation to the preferred route and stakeholders would be consulted on the scope and results of the study.

11.2.3 The results of the appraisal of the preferred alignment would be published in a report detailing the Preliminary Environmental Information that would be used in the statutory public consultation under the Planning Act 2008, which is currently planned for 2016.

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## GLOSSARY

The following is a brief definition to some technical terms that are used in this report:

Areas of Outstanding Natural Beauty (AONBs)		Areas of countryside, in England, Wales and Northern Ireland, designated for conservation due to their significant landscape value.
Bathymetry		The measurement of the depth of lakes or oceans, and the data obtained from this process.
Cadw		The Welsh Government's historic environment service.
Capital Costs		Fixed, one-time expenses incurred as part of a construction project, such as the purchase of land, buildings, materials and equipment.
Circuit		An electrical connection between two points on an electrical system which can be switched in or out of operation. A typical overhead transmission line carries two independently operated circuits, each comprising three separate phases (one on each pylon arm).
Climate Change		The change in climate over time, whether due to natural variability or as a result of human activity.
Consultation Feedback Report		Reports the consultation process for a proposed development along with stakeholder's comments on the proposals, amendments based on these comments and the developer's response to the stakeholder's comments.
Development Consent Order (DCO)		A statutory instrument that grants consents and other rights to build a Nationally Significant Infrastructure Project, as defined by the Planning Act 2008
Distribution Network		The regional electricity network that takes power from the national transmission system and smaller generators and distributes it to consumers such as local schools, hospitals, homes and businesses.
Easement		The right to use the land of another party for a specified purpose. In the context of electricity transmission, easements are often used to grant rights to install and retain equipment such as overhead lines or buried cables across the land of a third party.
Electricity Infrastructure	Generation	Facilities and equipment used to generate electricity, such as wind farms, power stations, solar panels.
Environmental Impact Assessment (EIA)		A statutory process to investigate and report upon the likely significant effects that a proposed development might have upon the environment. An EIA will usually set out measures that would reduce or mitigate the effects that could otherwise occur.

Environmental Statement (ES)	Reports the results of the Environmental Impact Assessment and any proposed measures to avoid or ameliorate significant environmental effects.
Excavated Material	Material such as clay, silt, sand, gravel, rock or concrete that have been removed from the ground.
Greenhouse Gas	A gas that contributes to the greenhouse effect (trapping of the Sun's warmth in the Earth's lower atmosphere) by absorbing infrared radiation.
Head House	A secure building that provides access to a tunnel; normally located above ground and covering the tunnel shaft.
Indicative Photomontages	Photos of an existing landscape, with illustrative images of a proposed development superimposed onto the photos.
Appraisal Zone	Study area for each route corridor option assessed against each of National Grid's Appraisal Topics and sub-topics.
Lifetime Costs	Total cost incurred to build and operate a new development over its foreseeable lifetime; combines operating, maintenance and capital costs.
Link Box Chambers	A kiosk (normally located above ground) that contains equipment used to monitor the performance of buried electricity transmission cables.
Listed Building	A building of special architectural or historic interest protected under the Planning (Listed Buildings and Conservation Areas) Act 1990.
Low Carbon Economy	An economy that is not dependent on fossil fuels as a main source of power, and which has a minimal output of greenhouse gas emissions.
National Grid	The operator of the high-voltage transmission system for the whole of Great Britain, and the owner of the high-voltage transmission network in England and Wales.
Nationally Significant Infrastructure Projects (NSIPs)	Usually a large scale development of national importance that requires development consent from The Secretary of State, under the Planning Act 2008.
National Nature Reserve (NNR)	Sites designated by Natural England as important places for wildlife and natural features.
National Policy Statement	Statement of Government policy under The Planning Act 2008.
Natural Resource Wales (NRW)	The Welsh Government body responsible for managing Wales resources, including nationally protected areas.
New Capacity	Additional ability of the transmission network to transmit electricity under the new service conditions.

Nuclear Power Station	An installation where power is generated by a self-sustaining nuclear reaction in a nuclear reactor.
Overhead Line	Comprise the towers (pylons) and the suspended conductors (wires) used to transport electrical power.
Preferred Route Corridor	The route corridor that is preferred in relation to environmental, socio-economic, technical and cost impacts and taking into account consultation feedback.
Pinch Point	A location at which a number of constraints pose a significant level of influence to narrow a route corridor.
Ramsar Site	Wetlands of international importance designated under the Ramsar Convention.
Registered Park and Garden	Those historic parks and gardens in Wales identified by Cadw as being of national importance have been included on the Register of Parks and Gardens of Special Historic Interest in Wales.
Route Corridor	A broad swathe of land, wider in some parts and narrower in others, within which a transmission line could be built.
Scheduled Monument	Nationally significant archaeological site or historic building protected under the Ancient Monuments and Archaeological Areas Act of 1979. The significance of ancient monuments derives not only from their physical presence, but also from their setting.
Sealing End Compounds (SECs)	A secure site within which overhead conductors ('wires') can be safely connected to the ends of underground cables.
Site of Special Scientific Interest (SSSI)	UK protected nature conservation sites, designated for their wildlife or geological value, under the Wildlife and Countryside Act 1981 (as amended).
Special Areas of Conservation (SACs)	Special Areas of Conservation are strictly protected sites designated under the European Commission Habitats Directive for their ecological importance.
Special Landscape Area	Valued local landscapes that are subject to planning policies that seek to protect or enhance their natural beauty.
Stakeholder	An individual or organisation that has a stake in a proposal.
Transmission Connection	A third party connection to the transmission system. This might allow export of power to the transmission system from a generation source, or allow power to be drawn from the system to supply local distribution networks for onward distribution to local consumers.

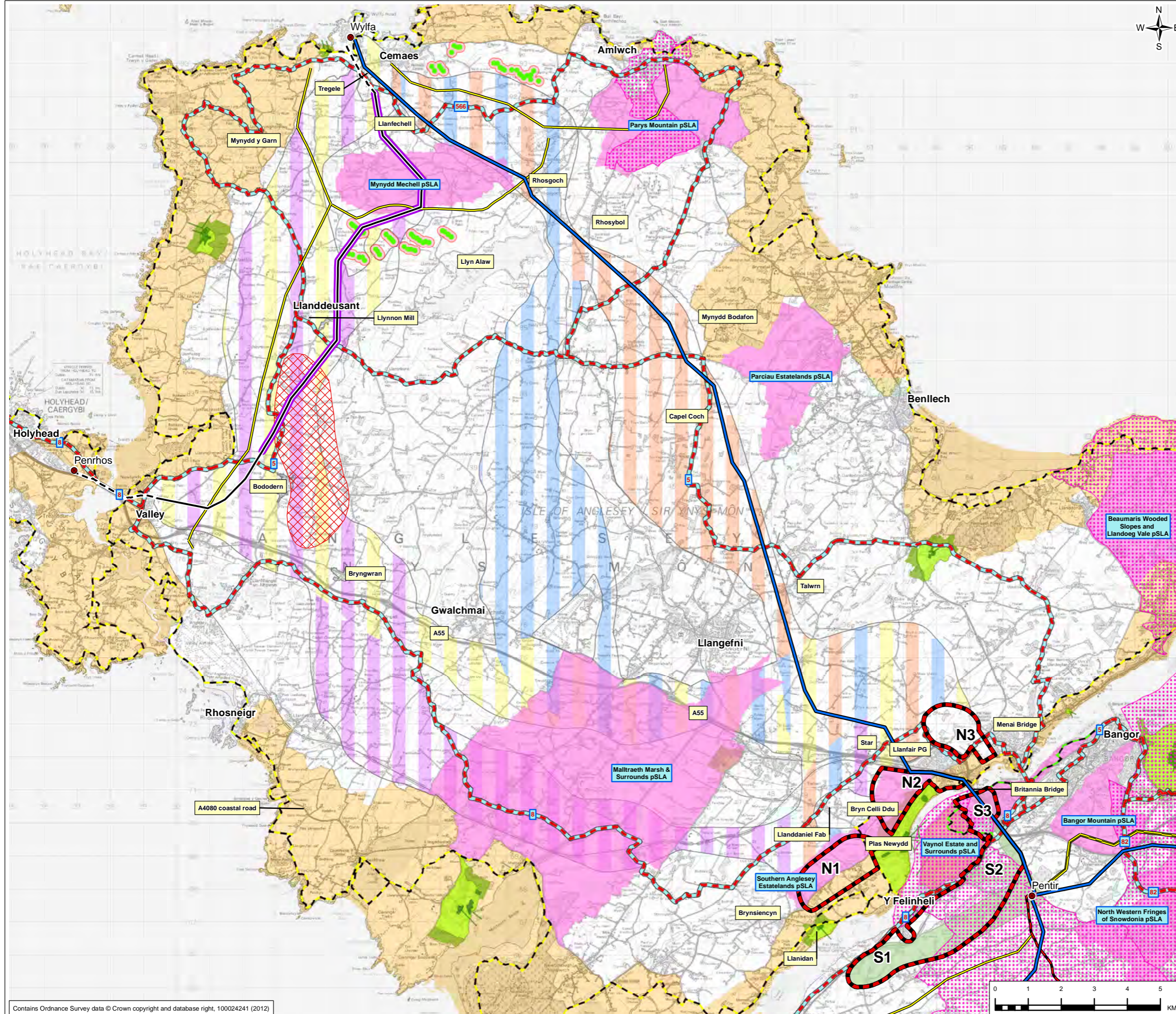
Transmission Infrastructure	Any plant and equipment required to transmit electricity at high voltages from a generating station to the distribution system (and to some large customers). For example, pylons and substations (where the voltage may be transformed and power flows controlled).
Transmission Network	That part of a transmission system owned and maintained by an individual transmission company. National Grid owns the transmission network in England and Wales, and operates the system across the whole of Great Britain.
Transmission Losses	Losses in electrical power during transmission between sources of generation and points of demand.
Transmission Projects	Any programme of work to the electricity transmission system that addresses a specific need for change, such as increased power flows or the connection of new sources of electricity generation or demand.
Transmission System	The network of electrical equipment comprising substations (where power flows can be controlled and transformed to different voltages) and the overhead lines and buried cables connecting them. The system moves bulk amounts of electrical power between points of generation and centres of large demand, such as major cities or large industrial consumers and in the UK operates at 275kV and 400kV.
Transposition	Reconfiguration of an existing overhead line to allow overhead line routes to cross without the need for a line 'duck-under' or crossing. Achieved by removing a section of the existing line and connecting the two newly formed 'ends' to two sections of new line approaching from either side.
Wirescape	Two or more overhead lines within the same view creating multiple layers of wires.
Zone of Theoretical Visibility (ZTV)	The area within which it is predicted that a new development could be seen. Identify the parts of a landscape that will be affected by a development.

# **APPENDIX A ENVIRONMENTAL AND SOCIO-ECONOMIC BASELINE PLANS**

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**FIGURE A-1**



- Legend**
- Existing National Grid Substation
  - National Grid 400kV Overhead Electricity Transmission Line
  - National Grid 132kV Overhead Electricity Transmission Line
  - National Grid 400kV Underground Electricity Transmission Cable
  - National Grid 132kV Underground Electricity Transmission Cable
  - SP Manweb 132kV Overhead Electricity Distribution Line
  - Tregele to Bodedern Replacement Overhead Line Option
  - ▨ Search Area for Potential Substation Site
  - ▭ Sealing End Compound Search Area
  - ▨ Purple Route Corridor (overhead line assumed throughout)
  - ▨ Yellow Route Corridor (overhead line assumed throughout)
  - ▨ Blue Route Corridor (overhead line assumed throughout)
  - ▨ Orange Route Corridor (overhead line assumed throughout)
  - ▨ Assumed Mainland Overhead Line Route Corridor
  - Wind Turbines
  - ▨ Wind Turbines 154m Stand Off
  - National Cycle Route
  - Isle of Anglesey Coastal Path
  - Wales Coastal Path
  - Registered Parks and Gardens - Significant View
  - ▨ Registered Parks and Gardens - Gardens and Kitchen Gardens
  - ▨ Registered Parks and Gardens - Park Boundary
  - ▨ Registered Parks and Gardens - Essential Setting
  - ▨ Area of Outstanding Natural Beauty
  - ▨ Registered Landscape of Historic Interest
  - Text Landscape features and viewpoints
  - Text pSLA Label

2	SEP 15	Final Issue	IM	MR	DB	MR
1	FEB 14	Revised Issue	AD	MR	CS	MR
0	NOV 14	Initial Issue	AD	MR	CS	MR
Rev.	Date	Purpose of revision	Drawn	Check'd	Rev'd	Appr'd

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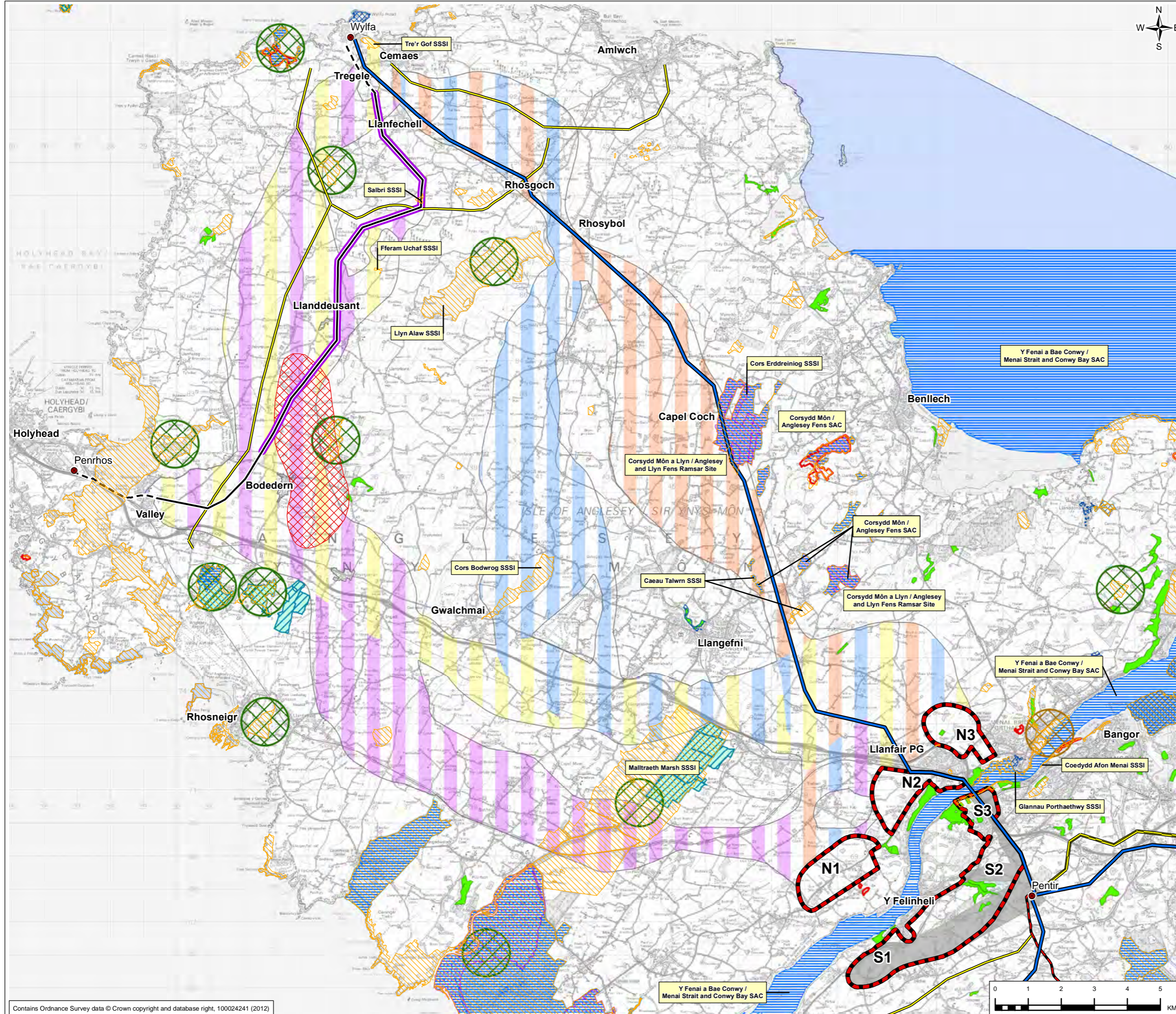
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**FIGURE A-2**



- Legend**
- Existing National Grid Substation
  - National Grid 400kV Overhead Electricity Transmission Line
  - National Grid 132kV Overhead Electricity Transmission Line
  - National Grid 400kV Underground Electricity Transmission Cable
  - National Grid 132kV Underground Electricity Transmission Cable
  - SP Manweb 132kV Overhead Electricity Distribution Line
  - Tregele to Bodedern Replacement Overhead Line Option
  - ⊠ Search Area for Potential Substation Site
  - ⊠ Sealing End Compound Search Area
  - ▨ Purple Route Corridor (overhead line assumed throughout)
  - ▨ Yellow Route Corridor (overhead line assumed throughout)
  - ▨ Blue Route Corridor (overhead line assumed throughout)
  - ▨ Orange Route Corridor (overhead line assumed throughout)
  - ▨ Assumed Mainland Overhead Line Route Corridor
  - ▨ Site of Special Scientific Interest (SSSI)
  - ▨ Special Area of Conservation (SAC)
  - ▨ Ramsar
  - ▨ Special Protection Area
  - ▨ Local Nature Reserve
  - ▨ National Nature Reserve
  - ▨ RSPB Reserve
  - ▨ Ancient Woodland
  - ▨ North Wales Wildlife Trust Reserves
  - ▨ Bird Sensitive Areas
  - ⊠ Ecological Sites Designated for Wildfowl
  - ⊠ Ecological Sites Designated for Waders

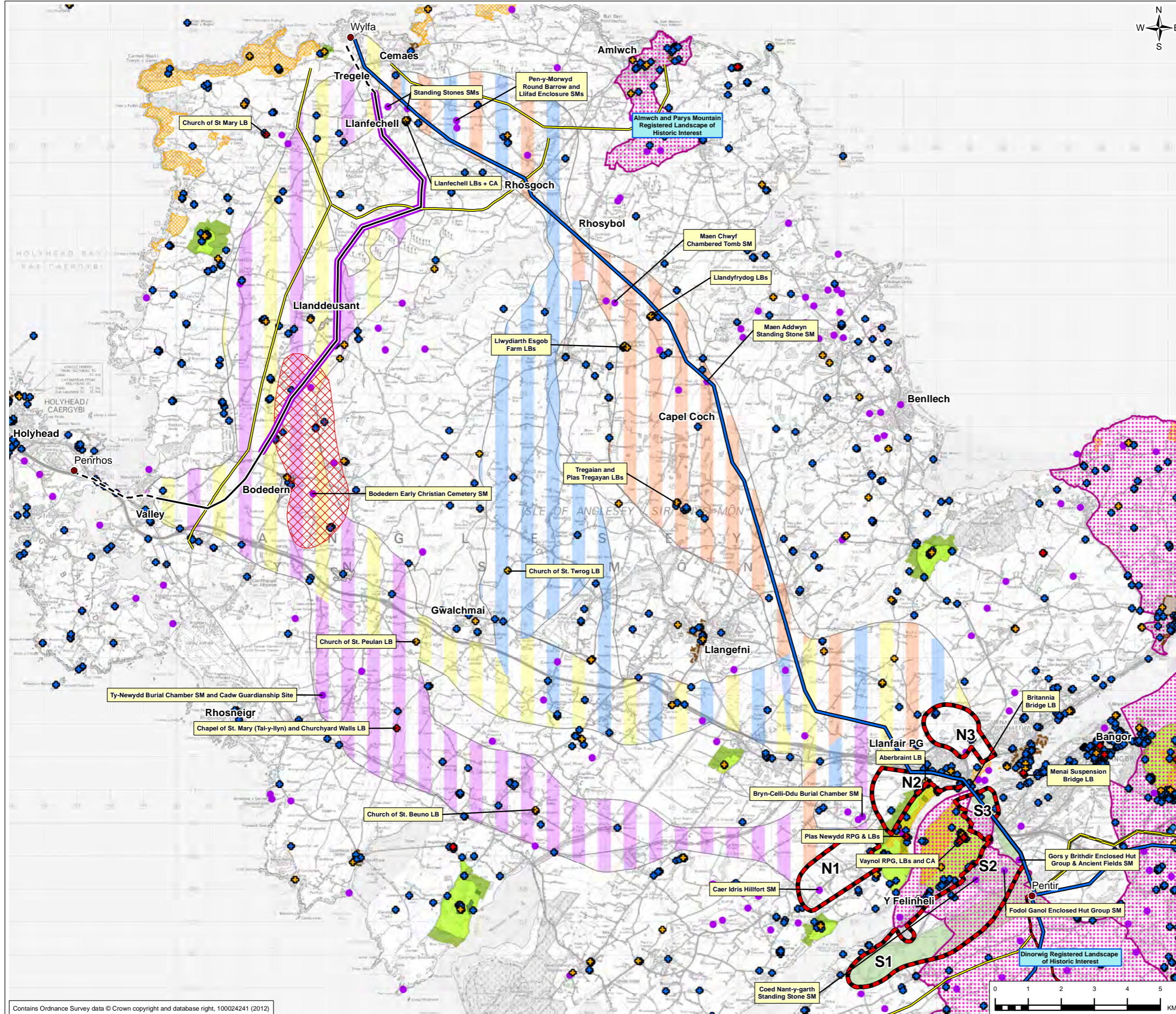
2	SEP 15	Final Issue	IM	MR	DB	MR
1	FEB 14	Revised Issue	AD	MR	CS	MR
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Project	NORTH WALES CONNECTION					
Drawing Title	WYLFA-PENTIR FULL CORRIDOR OPTIONS AND ECOLOGY FEATURES					
Drawing Status	FINAL					
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Jacobs No.	B2200000					
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**FIGURE A-3**



- Legend**
- Existing National Grid Substation
  - National Grid 400kV Overhead Electricity Transmission Line
  - National Grid 132kV Overhead Electricity Transmission Line
  - National Grid 400kV Underground Electricity Transmission Cable
  - - - National Grid 132kV Underground Electricity Transmission Cable
  - SP Manweb 132kV Overhead Electricity Distribution Line
  - Tregele to Bodelern Replacement Overhead Line Option
  - ▣ Search Area for Potential Substation Site
  - ▣ Sealing End Compound Search Area
  - ▨ Purple Route Corridor (overhead line assumed throughout)
  - ▨ Yellow Route Corridor (overhead line assumed throughout)
  - ▨ Blue Route Corridor (overhead line assumed throughout)
  - ▨ Orange Route Corridor (overhead line assumed throughout)
  - ▨ Assumed Mainland Overhead Line Route Corridor
  - Scheduled Monument (location) (SM)
  - Grade I Listed Building (LB)
  - Grade II\* Listed Building (LB)
  - Grade II Listed Building (LB)
  - ▣ Conservation Area (CA)
  - ▨ Registered Landscape of Historic Interest
  - ▨ National Trust Boundaries
  - ▨ Registered Parks and Gardens - Essential Setting (RPG)
  - ▨ Registered Parks and Gardens - Gardens and Kitchen Gardens
  - ▨ Registered Parks and Gardens - Park Boundary

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1	FEB 14	Revised Issue	AD	MR	CS	MR
0	NOV 14	Initial Issue	AD	MR	CS	MR
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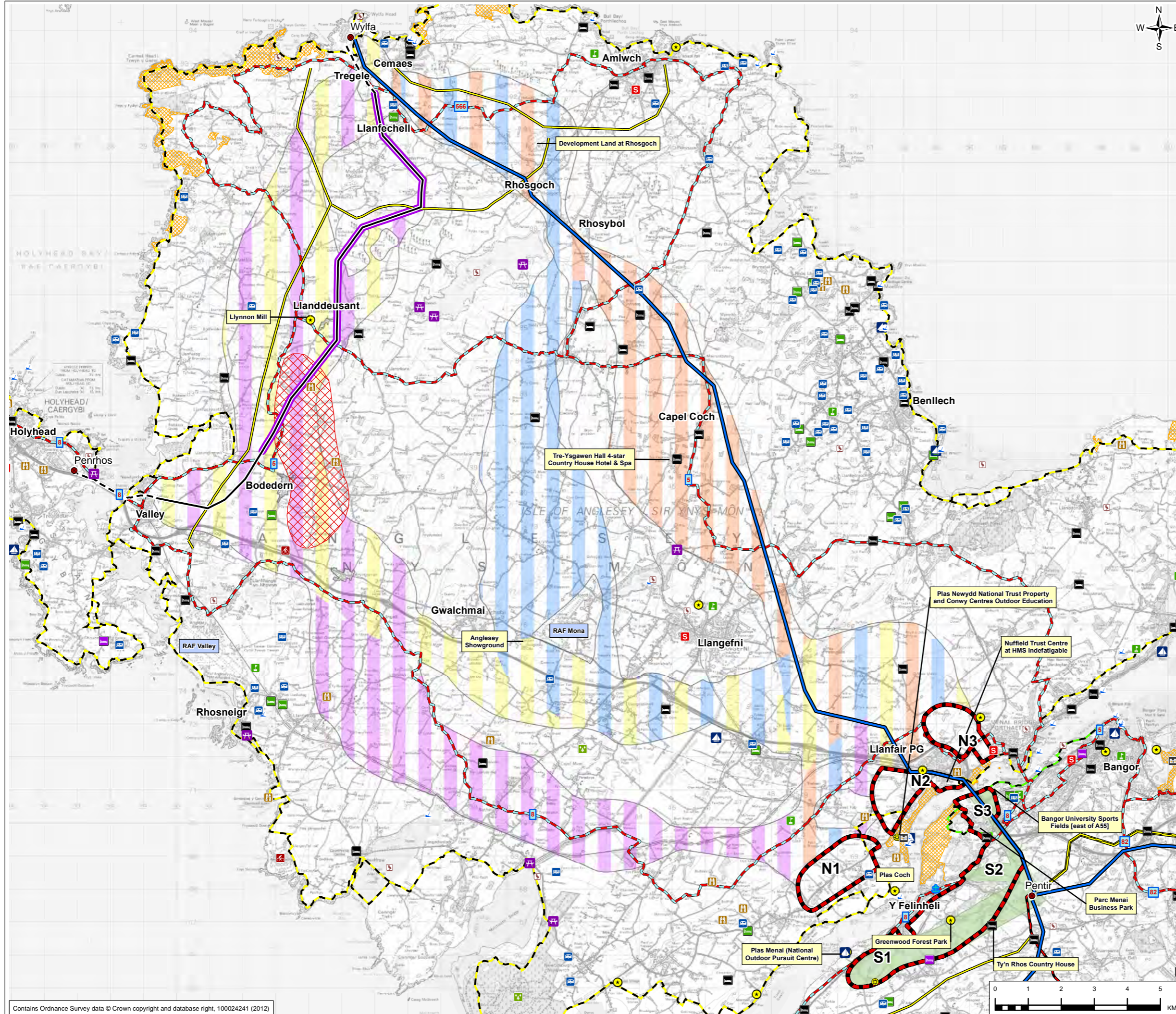
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**FIGURE A-4**



- Legend**
- Existing National Grid Substation
  - National Grid 400kV Overhead Electricity Transmission Line
  - National Grid 132kV Overhead Electricity Transmission Line
  - National Grid 400kV Underground Electricity Transmission Cable
  - National Grid 132kV Underground Electricity Transmission Cable
  - SP Manweb 132kV Overhead Electricity Distribution Line
  - Tregele to Bodedern Replacement Overhead Line Option
  - ▨ Search Area for Potential Substation Site
  - ▭ Sealing End Compound Search Area
  - ▭ Purple Route Corridor (overhead line assumed throughout)
  - ▭ Yellow Route Corridor (overhead line assumed throughout)
  - ▭ Blue Route Corridor (overhead line assumed throughout)
  - ▭ Orange Route Corridor (overhead line assumed throughout)
  - ▭ Assumed Mainland Overhead Line Route Corridor
  - Ⓜ Caravan/Camping Site
  - Ⓜ Castle or Historic House (open to the public)
  - Ⓜ Forest and Country Park
  - Ⓜ Garden (open to the public)
  - Ⓜ Golf Course
  - Ⓜ Landmark/Antiquity
  - Ⓜ Marina
  - Ⓜ Motor Sports
  - Ⓜ Nature Reserve
  - Ⓜ Picnic Site
  - Ⓜ Jetty or Slipway
  - Ⓜ Sports or Leisure Centre
  - Ⓜ Tourist Information Centre
  - Ⓜ Water Activities
- Tourist Accommodation by Visit Wales Website Category**
- Ⓜ Hotels, B&B and Apartments (Visit Wales Website)
  - Ⓜ Hostel and Campus Accommodation (Visit Wales Website)
  - Ⓜ Caravan, Camping or Holiday Park (Visit Wales Website)
  - Ⓜ Registered Visitor Attraction (Visit Wales Website)
- National Cycle Route
  - Isle of Anglesey Coastal Path
  - Wales Coastal Path
  - ▨ National Trust Boundaries

3	SEP 15	Final Issue	IM	MR	AD	MR
2	JUL 15	Revised Issue	IM	MR	DB	MR
1	FEB 15	Revised Issue	AD	MR	CS	MR
0	NOV 14	Initial Issue	AD	MR	CS	MR
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Drawing Title  
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## APPENDIX B      REVIEW OF LOCATIONS FOR ROUTE CORRIDOR DESIGN REFINEMENT

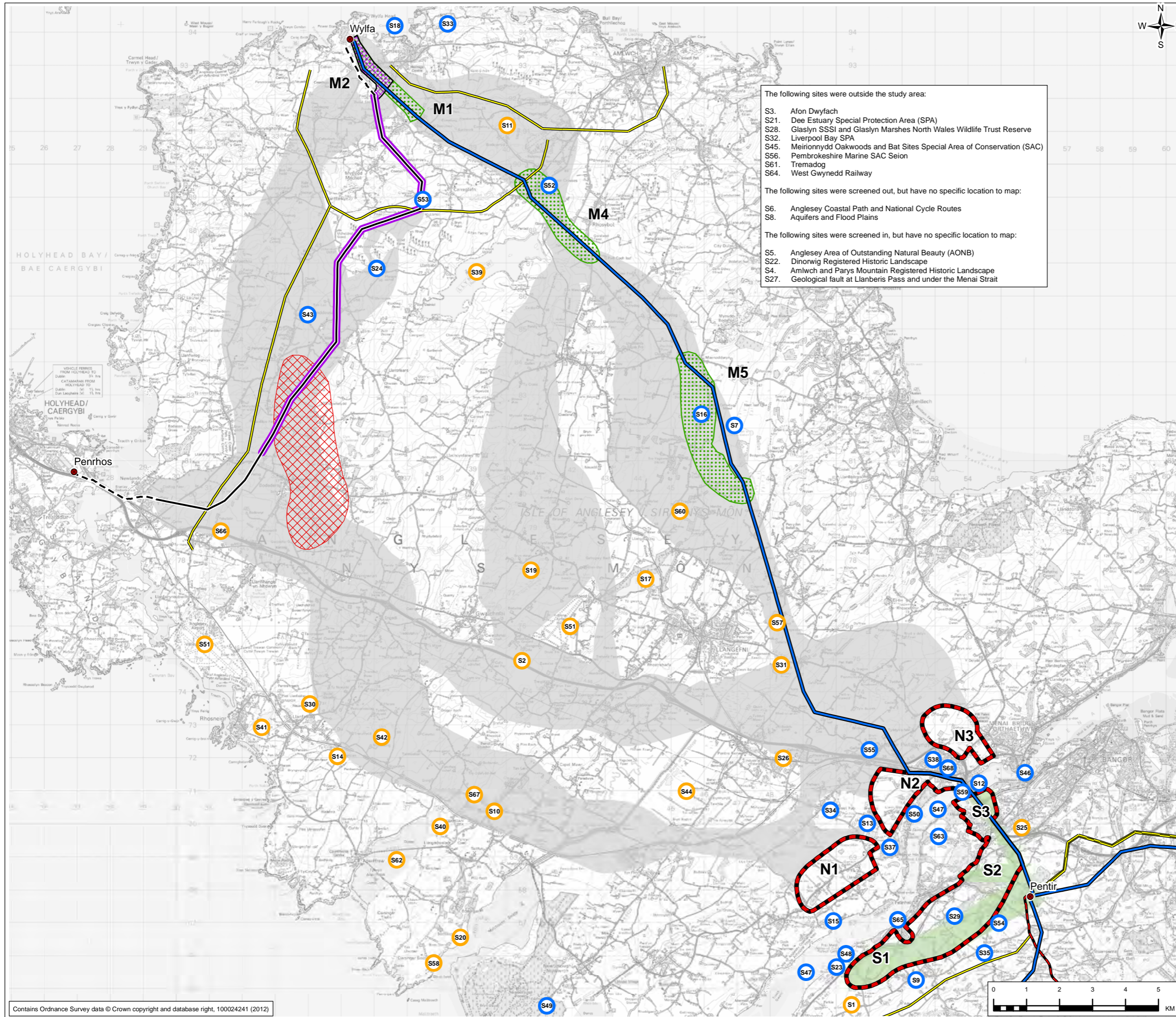
The table below summarises the potentially sensitive sites, features and areas that National Grid identified using stakeholder (including general public) consultation feedback, then considered for incorporation of high level mitigation measures (e.g. trenchless techniques and use of existing bridges) to avoid the risk of significant effects from an overhead line prior to the appraisal to identify the preferred route corridor. Figure B-1 illustrates the location of these sites, features and areas, and visually illustrates the results of the analysis reported in the Table B-1. The appraisal considered what the potential effects could be for each site, categorised them based on the nature of the effect, and then provided a recommendation on whether this effect could be reduced or avoided during the detailed design stages. Possible mitigation measures or recommendations were also identified in order to illustrate how adverse effects to sensitive locations could be reduced as far as reasonably practicable. The various 'Mitigation Zones', M1 – M6, taken forward and appraised for inclusion in the final route corridor appraisal are outlined in Chapter 8 of this report.

Where there were still risks presented (e.g. cultural heritage, geological, socio-economic risk etc.), but no high level mitigation was proposed, it was anticipated that either the detailed design stage can eliminate or reduce the risk, or that these risks were slight enough that Good Practice measures during the construction phase should be sufficient to reduce or remove any associated adverse effects. Good Practice measures include (but are not restricted to):

- adherence to relevant British Standards, Pollution Prevention Guidelines, ISO Publications and UK Best Practices;
- production of concise Construction Method Statements for review by relevant governing bodies;
- production of concise Pollution Prevention and Control Method Statements for review by relevant governing bodies;
- production of Construction-phase Environmental Management Plans for review by relevant statutory bodies;
- production of relevant risk assessments (Health, Environment etc.); and
- adherence to Health and Safety at Work Act 1974, Control of Substances Hazardous to Health Regulations 2002 (COSHH) etc.

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**FIGURE B-1**



The following sites were outside the study area:

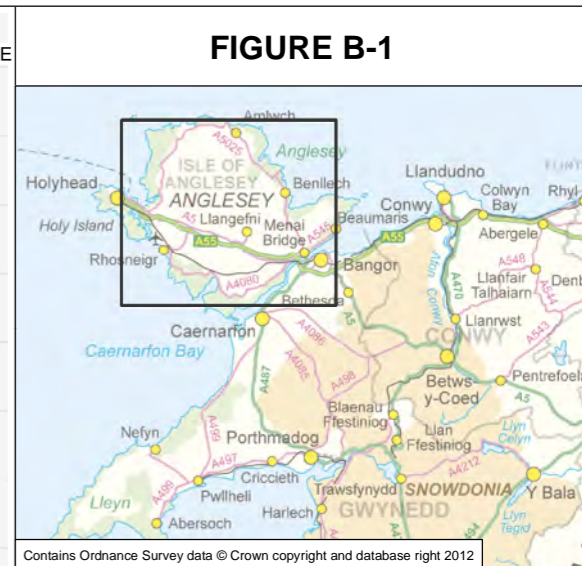
- S3. Afon Dwyfach
- S21. Dee Estuary Special Protection Area (SPA)
- S28. Glaslyn SSSI and Glaslyn Marshes North Wales Wildlife Trust Reserve
- S32. Liverpool Bay SPA
- S45. Meirionnydd Oakwoods and Bat Sites Special Area of Conservation (SAC)
- S56. Pembrokeshire Marine SAC Seion
- S61. Tremadog
- S64. West Gwynedd Railway

The following sites were screened out, but have no specific location to map:

- S6. Anglesey Coastal Path and National Cycle Routes
- S8. Aquifers and Flood Plains

The following sites were screened in, but have no specific location to map:

- S5. Anglesey Area of Outstanding Natural Beauty (AONB)
- S22. Dinorwig Registered Historic Landscape
- S4. Amlwch and Parys Mountain Registered Historic Landscape
- S27. Geological fault at Llanberis Pass and under the Menai Strait



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**Legend**

- Existing National Grid Substation
  - National Grid 400kV Overhead Electricity Transmission Line
  - National Grid 132kV Overhead Electricity Transmission Line
  - National Grid 400kV Underground Electricity Transmission Cable
  - National Grid 132kV Underground Electricity Transmission Cable
  - SP Manweb 132kV Overhead Electricity Distribution Line
  - Options M1, M4 and M5 Not Taken Forward at Stage 2
  - Option M2 Not Taken Forward at Stage 2
  - Tregele to Bodedern Replacement Overhead Line (Option M3)
  - Search Area for Potential Substation Site (Option M3)
  - Sealing End Compound Search Area (Option M6)
  - Anglesey Overhead Line Route Corridor
  - Mainland Overhead Line Route Corridor
- Appraisal Results (see table for site names)
- Screened In
  - Screened Out

2	SEP 15	Updated	IM	MR	DB	MR
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Drawing Title  
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Drawing Status  
 FINAL

Scale @ A3 1:110,000 Scale @ A1 1:70,000

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**Table B-1 Analysis of Mitigation for Sites, Features and Areas Identified by Stakeholders and the Public**

Site ID	Site Name	No Effect	Anticipated Avoidable During Detailed Design	Future Development / Planning Constraints	Apply Standard Construction Good Practice Measures to Manage Possible Effects										Risk of Significant Permanent Visual and Landscape Amenity Effects	Avoidance by Design Uncertain	Potential Failure to Comply With Legislation	Consider Site for Route Corridor Option Refinement?
					Navigation	Geological	Cultural Heritage	Ecological / Biodiversity	Water Quality / Flooding	Contaminated Land	Socio-Economic and Tourism	Residential / Community	Traffic Disruption	Localised, Temporary Visual and Landscape				
S1	A487 (proposed bypass near Caernarfon)		X	X														No
S2	A55		X										X					No
S3	Afon Dwyfach	X																No
S4	Amlwch and Parys Mountain Registered Historic Landscape		X				X							X				No
S5	Anglesey AONB													X	X	X		Yes - Refer to mitigation Zone M1, M2, M3 and M6
S6	Anglesey Coastal Path and National Cycle Routes		X							X				X				No
S7	Anglesey Fens (Corsydd Môn)						X				X			X	X	X		Yes – Refer to Mitigation Zone 5
S8	Aquifers and Floodplains							X										No
S9	Bethel (Gwynedd)						X				X			X	X			Yes – Refer to Mitigation Zone M6
S10	Bethel (Anglesey)		X		X		X				X		X					No
S11	Bodewryd		X										X					No
S12	Britannia Bridge													X	X			Yes – Refer to Mitigation Zone M6.
S13	Bryn Celli Ddu						X							X	X			Yes – Refer to Mitigation Zone M6
S14	Bryn Du		X		X						X		X					No
S15	Brynsiencyn Strait Crossing													X	X			Yes – Refer to mitigation Zone M6
S16	Capel Coch						X				X			X	X			Yes – Refer to Mitigation Zone M5
S17	Cefni Marshes and Reservoir		X		X		X	X		X								No
S18	Cemaes Bay									X	X			X	X			Yes – Refer to Mitigation Zones M1 and M2
S19	Cors Bodwrog SSSI		X				X											No
S20	Cwyfan		X								X							No
S21	Dee Estuary Special Protection Area	X																No
S22	Dinorwig Registered Historic Landscape						X							X	X			Yes – Refer to Mitigation Zone M6
S23	Ferodo Factory		X							X								No – However, refer to Mitigation Zone M6
S24	Fferam Uchaf SSSI						X							X	X	X		Yes – Refer to Mitigation Zone M3
S25	Fford Cynan (Menai Bridge) and Fford Crwys (Bangor)		X	X							X							No
S26	Gaerwen		X							X	X		X					No
S27	Geological fault at Llanberis Pass and under the Menai Strait					X								X	X			Yes – Refer to Mitigation Zone M6
S28	Glaslyn SSSI and Glaslyn Marshes North Wales Wildlife Trust Reserve	X																No



Appraisal of Need for Mitigation Measures																		
Site ID	Site Name	No Effect	Anticipated Avoidable During Detailed Design	Future Development / Planning Constraints	Apply Standard Construction Good Practice Measures to Manage Possible Effects										Risk of Significant Permanent Visual and Landscape Amenity Effects	Avoidance by Design Uncertain	Potential Failure to Comply With Legislation	Consider Site for Route Corridor Option Refinement?
					Navigation	Geological	Cultural Heritage	Ecological / Biodiversity	Water Quality / Flooding	Contaminated Land	Socio-Economic and Tourism	Residential / Community	Traffic Disruption	Localised, Temporary Visual and Landscape				
S29	Greenwood Forest Park											X				X	X	Yes – Refer to Mitigation Zone M6
S30	Grug Farm		X				X											No
S31	Hidre-Faig Ancient Monument		X				X											No
S32	Liverpool Bay SPA	X																
S33	Llanbadrig												X			X		Yes – Refer to Mitigation Zones M1 and M2
S34	Llanddaniel / Llanddaniel Fab												X			X		Yes – Refer to Mitigation Zone M6
S35	Llandeiniolen		X				X	X					X			X		Yes – Refer to Mitigation Zone M6
S37	Llanedwen / Llanedwen Church												X			X		Yes – Refer to Mitigation Zone M6
S38	Llanfair PG												X			X		Yes – Refer to Mitigation Zone M6
S39	Llyn Alaw SSSI		X		X		X	X										No
S40	Llyn Coron SSSI	X																No
S41	Llyn Maelog SSSI	X																No
S42	Llyn Padrig SSSI	X																No
S43	Llynonn Mill														X	X		Yes – Refer to Mitigation Zone M3
S44	Malltreath Marsh SSSI and RSPB Reserve						X	X							X	X	X	Yes – Mitigation to be discussed with NRW and RSPB at next stage if taken forward
S45	Meirionnydd Oakwoods and Bat Sites SAC	X																No
S46	Menai Bridge / Telford Suspension Bridge														X	X		Yes – Refer to Mitigation Zone M6
S47	Menai Strait										X				X	X		Yes – Refer to Mitigation Zone M6
S48	National Watersports Centre / Plas Menai										X					X		Yes – Refer to Mitigation Zone M6
S49	Newborough, Warren and Sands						X				X					X		Yes – Refer to Mitigation Zone M6
S50	Plas Newydd Country House and Gardens					X					X				X	X		Yes – Refer to Mitigation Zone M6
S51	RAF Mona and RAF Valley		X		X													No
S52	Rhosgoch						X					X			X	X		Yes – Refer to Mitigation Zone M4
S53	Salbri SSSI						X									X	X	Yes – Refer to Mitigation Zone M3
S54	Seion					X	X				X	X			X	X		Yes – Refer to Mitigation Zone M6
S55	Star		X									X						No – However located on approach to Menai Strait. Therefore, refer to Mitigation Zone M6.
S56	Pembrokeshire Marine Special Area of Conservation (SAC)	X																No
S57	Pinch Point Between Talwrn and Llangefni											X			X	X		Yes – Cumulative effects of two overhead lines in close proximity to be considered
S58	Plas Coch		X									X			X			No

Appraisal of Need for Mitigation Measures																		
Site ID	Site Name	No Effect	Anticipated Avoidable During Detailed Design	Future Development / Planning Constraints	Apply Standard Construction Good Practice Measures to Manage Possible Effects										Risk of Significant Permanent Visual and Landscape Amenity Effects	Avoidance by Design Uncertain	Potential Failure to Comply With Legislation	Consider Site for Route Corridor Option Refinement?
					Navigation	Geological	Cultural Heritage	Ecological / Biodiversity	Water Quality / Flooding	Contaminated Land	Socio-Economic and Tourism	Residential / Community	Traffic Disruption	Localised, Temporary Visual and Landscape				
S59	The Swellies and Ynys Gorad Goch														X	X	Yes – Refer to Mitigation Zone M6	
S60	Tregaian		X									X	X				No	
S61	Tremadog	X															No	
S62	Tywyn Aberffraw SAC and SSSI		X				X										No	
S63	Vaynol / Newydd / Vaynol Estate / National Trust Land						X								X	X	Yes – Refer to Mitigation Zone M6	
S64	West Gwynedd Railway	X															No	
S65	Y Felinheli									X	X				X	X	Yes – Refer to Mitigation Zone M6	
S66	Ysbyllidir, Caergeiliog		X									X					No	
S67	Ysgubor Newydd		X			X											No	
S68	Setting of Britannia Bridge, Nelson's Monument, St Mary's Church and the Marquis of Anglesey's Column														X	X	Yes – Refer to Mitigation Zone M6	