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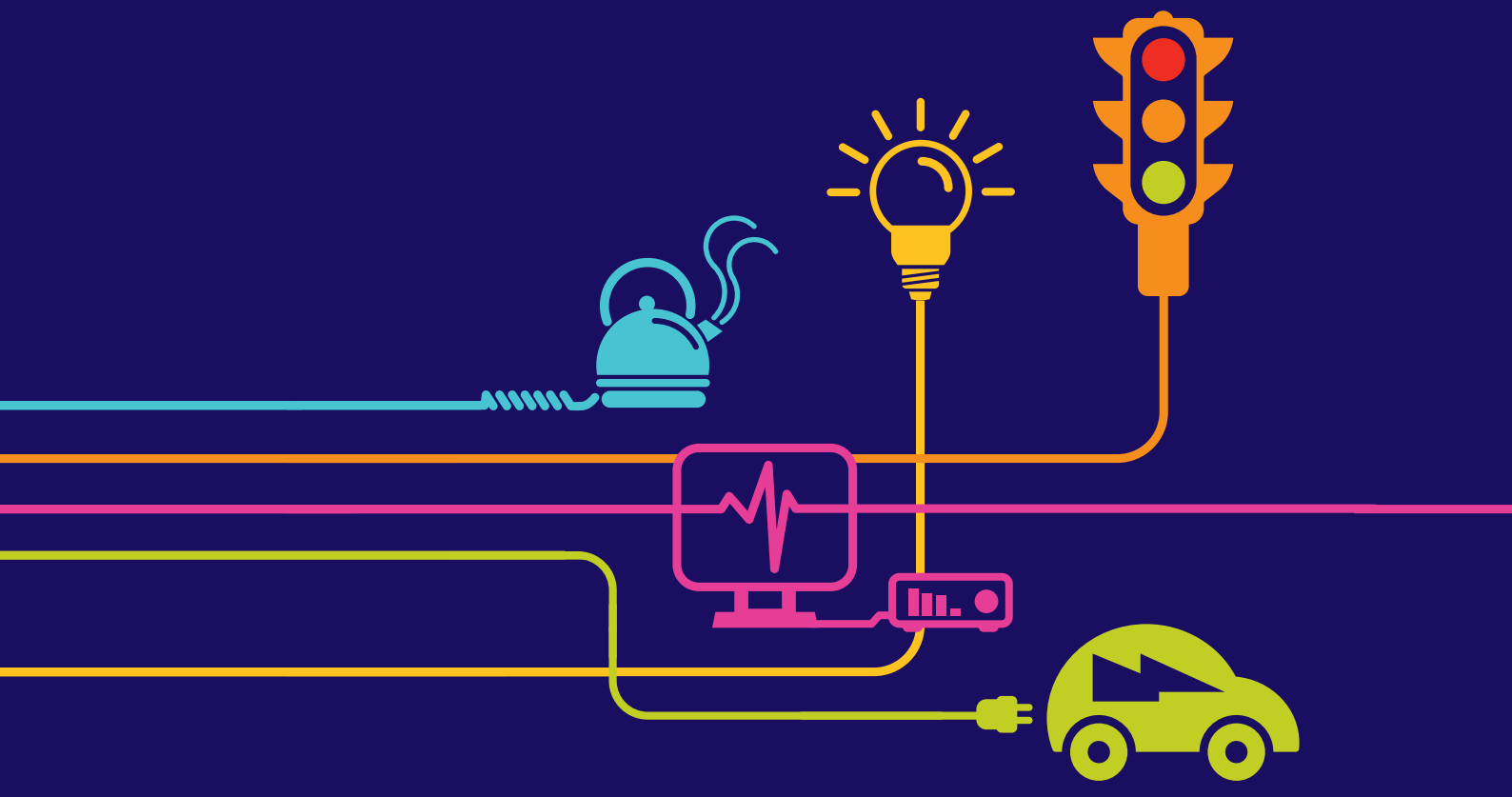
Environmental Statement Project Need and Alternatives Appendices 2Q to 2R

Hinkley Point C Connection Project

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



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May 2014

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Environmental Statement

Hinkley Point C Connection Project

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Appendix	Title
2S	Western Power Distribution Connection between the Proposed Sandford Substation and the Existing N Route Overhead Line Technical and Environmental Appraisal (2013)
2T	Western Power Distribution 132kV W Route Undergrounding Options Report (2013)
2U	Western Power Distribution Undergrounding Cable Sealing End Platform Pylon Location Technical and Environmental Appraisal (2013)
2V	Western Power Distribution Undergrounding of Sections of 132kV Overhead Lines G, BW Route and Seabank Line Entries Technical and Environmental Appraisal (2013)

Appendix 2Q – Western Power Distribution Connection between the Proposed Sandford Substation and the Existing AT Route Connection Options Report (2013)

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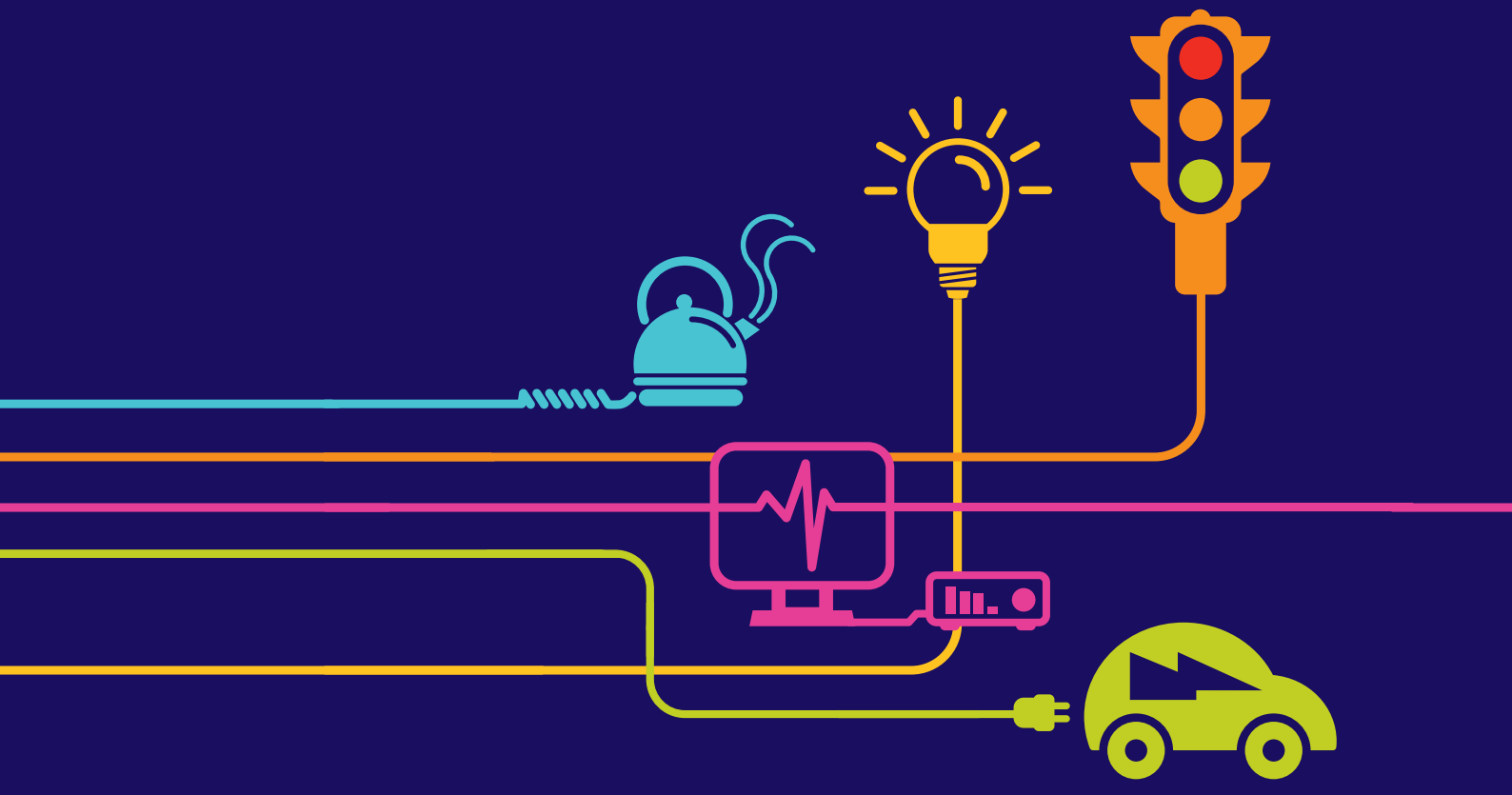
Western Power Distribution Connection between the proposed Sandford Substation and the existing AT Route Connection Options Report

Hinkley Point C Connection Project



August 2013

Hinkley Point C Connection Project

Western Power Distribution

Connection between the Proposed Sandford Substation and the Existing AT-Route Overhead Line

Connection Options Report

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August 2013

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1 INTRODUCTION

1.1 Introduction

1.1.1 This report has been prepared jointly by Western Power Distribution (South West) Plc (WPD) and National Grid Electricity Transmission Limited (National Grid).

1.1.2 To accommodate the connection of a new nuclear power station at Hinkley Point, Somerset, a new 400kV transmission connection is required between Bridgwater, Somerset and Seabank substation, near Avonmouth. Information on the project can be found at http://www.hinkleyconnection.co.uk/

1.1.3 The preferred route for this new transmission connection broadly follows the route of an existing 132kV overhead line between Bridgwater and Avonmouth. This 132kV overhead line is operated by WPD and is to be removed as part of the Hinkley Point C Connection Project.

1.2 Purpose of this Report

1.2.1 The removal of WPD's 132kV overhead line between Bridgwater and Avonmouth would result in the disconnection of electricity supplies across North Somerset unless remedial works are completed, including the construction of a new Grid Supply Point (GSP) 400/132kV substation.

1.2.2 The purpose of this report is to inform statutory consultees and other stakeholders of the range of options considered by WPD and National Grid for maintaining supplies between the new GSP at Sandford and the existing 132kV AT Route overhead line near Puxton in North Somerset which is required to provide secure electricity supplies to Weston-super-Mare.

1.2.3 This report follows the production of two earlier documents: the WPD 132kV Route Corridor Study for Public Consultation (May 2012)[1] and the "Local Electricity Network – Preferred Options Report"[2] (October 2012) which, following public consultation in the summer 2012, identified the Preferred Route Corridor for the AT Route connection. The length of the route is approximately 2.9 km, which starts with 600 metres of underground cable before connecting into either 2.3 km of overhead line or further underground cable to reach the existing AT Route. A plan showing the route is enclosed at Figure 1.

1.2.4 In order to assess whether undergrounding the 132kV connection or sections of the connection can be justified, taking account of particular local landscape and visual sensitivities, it was first necessary to develop potential alignments for overhead line solutions and assess the potential effects of these alignments. Following this, the case for undergrounding is then assessed taking into account the landscape and visual impacts, together with the other environmental, technical and cost implications of

[1] National Grid: Hinkley Point C Connection Project. Route Corridor Study for Public Consultation. May 2012.

[2] National Grid: Hinkley Point C Connection Project. Local Electricity Network Preferred Options Report. October 2012.

underground cable solutions, as required by National Policy Statements EN-1[3] and EN-5[4]. Further information on policy background can be found in Appendix A.

1.3 Structure of the Report

1.3.1 The remainder of this report is structured as follows:

- Chapter 2 – sets out the background on the need for the proposed works to the 132kV network;
- Chapter 3 – describes the study area and outlines the factors/principles adopted in defining overhead line and underground cable options and the reasons why other options were excluded;
- Chapter 4 – provides details of the appraisal topics;
- Chapter 5 – presents the findings of the appraisals; and
- Chapter 6 – sets out the conclusions.

[3] Department for Energy and Climate Change : Overarching National Policy Statement for Energy : July 2011

[4] Department for Energy and Climate Change : National Policy Statement for Electricity Networks Infrastructure : July 2011

2 BACKGROUND TO THE APPEAL

2.1 The Hinkley Point C Connection Project

2.1.1 National Grid's preferred option for the connection of the proposed Hinkley Point C Power Station utilises the corridor of the existing WPD 132kV overhead line between Bridgwater and Avonmouth. As a result the existing WPD 132kV overhead line between Bridgwater and Avonmouth substations will be removed and its corridor used for a new 400kV overhead line and underground cables connection. The removal of the 132kV overhead line results in the need for additional works to the 132kV distribution network to maintain supplies.

2.2 Distribution System Options Report

2.2.1 A Distribution System Options Report[5] was produced in 2011 to consider the various options for maintaining supplies to the local distribution network. The Report concluded that an option which incorporates a new 400/132kV GSP substation in the Churchill/Sandford area best meets the range of technical, economic and environmental criteria and should be taken forward for further investigation. The Report proposed that detailed studies should be undertaken to identify potential locations for a new 400/132kV Grid Supply Point (GSP)[6] substation in the area between Sandford and Churchill, but focussed close to the corridor of the proposed 400kV connection to minimise the amount of additional infrastructure required. This also required a new connection between the new substation and the existing 132kV AT Route near Puxton in North Somerset which provides secure electricity supplies to Weston-super-Mare.

2.3 400/132kV Substation Siting Study

2.3.1 In response to the findings of the Distribution System Options Report, a Substation Siting Study[7] was produced to identify options for siting the 400/132kV GSP substation in the Churchill/Sandford area of North Somerset. This Study concluded that a new 400/132kV GSP substation in the area of search to the West of Nye Road in the vicinity of Sandford represents the least environmentally constrained option primarily because it would minimise the extent of new 400kV connections and infrastructure required. The Substation Siting Study is separately reported.

2.4 WPD 132kV AT Route Corridor Study for Public Consultation

2.4.1 In response to the findings of the 400/132kV Substation Siting Study a Route Corridor Study (RCS)[8] was produced. This report examined potential route corridors for making a 132kV connection between a new 400/132kV GSP in the vicinity of Sandford and the existing 132kV AT Route overhead line.

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[5] National Grid and Western Power Distribution: Hinkley Point C Connection Project Distribution System Options Report (December 2011).

[6] A Grid Supply Point (GSP) is a substation forming part of the national electricity transmission system, which supplies electrical power to a distribution network operator (e.g. Western Power Distribution) or other directly connected customer.

[7] 1TEP: Churchill/Sandford Grid Supply Point Substation Siting Study for Public Consultation (May 2012)

[8] TEP: Western Power Distribution 132kV Route Corridor Study for Public Consultation. (May 2012).

2.4.2 The study identified four broad corridors for achieving a double circuit connection. The study recommended that the least environmentally constrained corridor was Corridor B and that this should be taken forward for detailed consideration of route alignments.

2.5 Local Electricity Network Preferred Options Report

2.5.1 Following a period of public consultation in summer 2012, a Local Electricity Network Preferred Options Report was produced[9]. This report explains how a range of factors, including consultation representations, environmental effects and cost issues were used to identify the preferred location for the substation and the preferred route corridor to accommodate the 132kV connection to the existing AT Route overhead line.

2.5.2 The report concluded that:

- Corridor B (as identified in the WPD RCS for Public Consultation explained in 2.4) was the Preferred Route Corridor to accommodate the 132kV connection from the new substation to the existing AT Route overhead line; and
- The area of land adjacent to Nye Road within Area of Search 2 (AoS2) is the preferred location for a new substation.

2.6 The Duties of Western Power Distribution and National Grid

2.6.1 At each stage of project development and appraisal, National Grid and WPD must be mindful of their duties under the Electricity Act and of other guidance documents. These are introduced briefly below.

2.6.2 Section 9 of the Electricity Act 1989 requires National Grid and WPD to develop the transmission and distribution systems in an efficient, coordinated and economical manner.

2.6.3 In order to meet this statutory obligation, National Grid and WPD seek to make the most efficient use of its existing infrastructure by measures such as managing power flows and investing in upgrading existing connections and substations, before considering investment in new connections. They then consider the implications for efficiency, co-ordination and cost effectiveness in evaluating a range of options in its strategic decision making. The lowest cost solutions are not always adopted, as other considerations, such as effects on the environmental, may favour alternative solutions therefore a balance needs to be struck.

2.6.4 Under section 38 of the Electricity Act 1989, both National Grid and WPD have a duty, when putting forward proposals for new development, to consider the preservation of amenity, including the natural environment, cultural heritage, landscape and visual quality. Appendix B of this report includes the Western Power Distribution and National Grid Role and Obligations' which are to be followed when considering the siting and installation of new infrastructure

2.6.5 In producing this report National Grid and WPD have balanced technical, socio-economic, environmental and cost considerations in selecting project options.

[9] National Grid: Hinkley Point C Connection Project. Local Electricity Network Preferred Options Report. (October 2012).

2.7 Planning Policy and Guidance

2.7.1 In developing its plans, National Grid and WPD have also taken into account the guidance contained in National Policy Statements, the National Planning Policy Framework and the Development Plan for the area. Further information on this policy background can be found in Appendix A.

2.7.2 The Holford Rules provide specific guidance for routeing overhead lines and were applied to the identification of route alignments, including underground alignments. Further details on these can be found in Appendix C.

3 STUDY AREA AND OPTIONS

3.1 Definition of Study Area

3.1.1 The study area is entirely within the administrative area of North Somerset Council. It consists of the Preferred Route Corridor (see Figure 1) as previously identified in the WPD 132kV Route Corridor Study for Public Consultation (May 2012) and the "Local Electricity Network – Preferred Options Report" (October 2012).

3.1.2 The corridor passes through farmland bordered by low hedgerows and trees. Immediately north of the 400/132kV GSP substation the corridor travels along the north eastern edge of Towerhead Brook Wildlife Site. The corridor passes to the west of Rookery Farm East and east of a small woodland copse before crossing Nye Drove (a small track and public right of way). The corridor includes a small water body surrounded by trees to the south of Rockers Rhyne.

3.1.3 The corridor continues in a northerly direction across farmland comprising fields bordered by ditches and rhynes with few hedgerows or trees. Some trees are present along Havage Drove and the adjacent watercourse which provide some vertical structure in the landscape. The corridor continues through relatively open farmland with occasional trees to its connection point with the AT Route. There are long views south towards the Mendip Hills AONB throughout this corridor.

3.1.4 There are no properties in this corridor although it passes to the west of Rookery Farm East and to the east of a cluster of farmsteads, agricultural buildings, a depot and a Bungalow around Box Bush Farm.

3.2 Overhead Line Design Options

3.2.1 There are a number of 132kV overhead line technology options, however, not all are able to meet the technical requirements of the WPD network in this area and therefore not all have been taken forward for detailed appraisal.

3.3 Options Not Taken Forward – Wooden Pole Design

3.3.1 In previous reports, it was indicated that two circuits of wooden poles would be used to achieve the connection between the substation and the existing AT Route. Wood pole lines were considered to be preferable to an overhead line supported on steel lattice pylons as the wood poles would be smaller and easier to integrate into the landscape and would result in the least effect on views from residential properties. However, as the project has developed new information has come to light that prevents this technology being taken forward, and this is explained below.

3.3.2 Wood poles are a common technology used to carry 132kV overhead lines and are used extensively on the WPD network. However, in this area, due to a high risk of lightening strike and the consequential risk to electricity supplies in Weston-super-Mare, the overhead line must be shielded by an earth wire. An earth wire is present on the existing steel lattice pylons 132kV circuits in the area.

3.3.3 As well as carrying an earth wire, each individual wooden pole would have to be connected to earth via a copper earth tape.

3.3.4 There is no "off-the-shelf" design of wooden pole to meet these combined requirements and therefore any design would be bespoke/customised to meet the need.

3.3.5 Further, the preferred route corridor travels through agricultural land and there would therefore be an on-going risk of damage to the earth tape from farm machinery. In

addition there would be a risk of theft occurring as the copper earth tape would be accessible. Damage or theft of the earth tape could result in serious damage to the wooden pole with a consequential effect on electricity supplies to Weston-super-Mare.

3.3.6 The risk of theft or damage would warrant an increase in inspection/testing and an increase in associated maintenance costs of the wooden poles.

3.3.7 Given the bespoke technical design requirements, the risks of damage and theft associated with the earth tape, and the consequential risk to electricity supplies in Weston-super-Mare, neither National Grid nor WPD consider a wooden pole design to be an option that should be pursued.

3.3.8 In light of the above, the following two overhead line technologies were taken forward for detailed appraisal:

- two steel "monopole" lines (also referred to as the "alternate folded plate" option); and
- one line of "steel lattice" pylons.

3.3.9 The two options are described below and illustrated at Figure 2.

3.4 132kV Steel Monopole Pylons

3.4.1 These structures consist of hollow steel monopoles with short arms at the top to support insulators. They would typically be 22 metres high. The average span between structures would be approximately 250 metres.

3.4.2 Double circuit monopole designs are not common in the UK as there is a restriction on maintenance access because of the safety clearance between the cross arms. In this case two single circuit overhead lines would be required if a connection using monopoles was taken forward as this would avoid the need for a two-circuit outage that would disconnect electricity supplies to Weston-super-Mare.

3.4.3 These two single circuit overhead lines could either be parallel to each other (25 metres apart) or separated and routed elsewhere within the Preferred Route Corridor.

3.4.4 The foundations for steel monopoles would either consist of a single pile or screw pile group.

3.5 132kV Steel Lattice Pylons

3.5.1 A double circuit 132kV overhead line could be carried on a single line of lattice pylons approximately 29m high. The span between each pylon would be approximately 300m which would be longer and result in fewer line support structures than would be necessary for the steel monopoles. On average the span between lattice pylons will be 300m unless an obstacle has to be crossed.

3.5.2 With steel lattice pylons, if the overhead line needs to change direction, or where the overhead lines are transferred to an underground connection, stronger pylons are required to accommodate the increased structural strain. (These pylons are referred to respectively as "angle" pylons and "cable sealing end platform pylons (CSEPP)"; please see Figure 3 for details of these pylons). These types of pylon have heavier steelwork and larger footprints compared to standard steel "suspension" lattice pylons (which are typically pylons located in a straight-line). The angle pylons would be marginally smaller than the suspension pylons at approximately 26 metres for the angle pylon at the southern end of the route and 29 metres for the angle pylon on the AT Route.

3.5.3 Steel lattice pylons need steel tube pile foundations that would be driven in the ground to a depth of approximately 15m. Angle pylons and CSEPP pylons are likely to require numerous piles per leg with a pile cap. Suspension pylons would require one pile per leg without a pile cap.

3.6 T Pylon

3.6.1 The T Pylon design was developed following a competition by the Royal Institute of British Architects (RIBA) for the Department of Energy and Climate Change (DECC) and National Grid. The competition focussed on redesigning 400kV lattice pylons, rather than lower voltage pylons such as 132kV connections. As a result, a T Pylon for the 132kV AT Route connection is not currently available.

3.7 Generic Access Issues Associated with the Construction of Overhead Lines

3.7.1 For the construction of an overhead line for either steel lattice pylons or monopoles, temporary access roads (or a trackway) and working areas would need to be installed at each pylon location. Each temporary access road may provide access to one or more pylon locations. To minimise lorry movements and material handling, the steel pylon material would be delivered directly to site. Delivery of conductors (wires) would be initially to a centralised storage facility before being transported to its pulling position. Normal construction traffic routes will be agreed in advance with the Highway Authority. Some minor works to adopted highways may be required to improve the alignment, clearances and standard of roadbed in order to facilitate access for construction traffic.

3.8 132kV Underground Cable Design

3.8.1 The higher cost of underground cables, , suggests that the most direct route should be adopted where possible.

3.8.2 Underground cables affect environmental constraints differently to overhead lines. For example, hedges are oversailed by an overhead line and the most sensitive habitats or areas of high archaeological potential may be avoided when siting pylons. For underground cables, the hedgerows are typically removed to make way for the cable trenches and the installation of a haul road which is used to construct the underground connection. Archaeology, if present, is recorded before being removed to make way for the cables.

3.8.3 A number of technical constraints were also considered in devising cable alignments. For example, the ability of the cable to deviate sharply is restricted by its maximum bending radius. Potential locations for cable joint bays (required approximately every 1km for a 132kV connection) were also considered although these were assumed to be contained in the overall cable swathe. For the purposes of the appraisals, it has been assumed that the cable installation will require two sets of three cables generally laid in open trenches. The cables will be insulated by Cross Linked Polythene (XLPE) as insulation.

3.8.4 The area of land required for the construction of the cables would be up to 30 metres wide. The trenches are separated by a temporary haul road which would run along the entire route and serve as a traffic route for construction vehicles. The use of a haul road will limit the impact on local transport infrastructure.

3.8.5 It has been assumed that, in exceptional circumstances, horizontal directional drilling (HDD) would be used to cross, for example, water bodies. HDD is a steerable trenchless method of installing underground cables by using a surface launched drilling rig, with minimal impact on the surrounding area which allows vegetation to be retained. For underground cable installations, a number of ducts are installed using the HDD method and the cables are then pulled through the pipes during the cable installation phase. Once the cables have been installed the pipes are filled with bentonite to maintain the cable rating.

3.9 Generic Access Issues Associated with the Construction of Underground Cables

3.9.1 The construction of the underground cable route would require specific temporary site access locations to be established at the ends and along the route of the cables. They would be chosen on the basis of proximity to a highway of an appropriate standard. Access to the construction sites therefore needs to be suitable for large loads. There would be a requirement to import construction materials and export waste materials using HGVs whose size can be accommodated by local vehicular routes. Normal construction traffic routes will be agreed with the highway authorities. Some minor works to adopted highways may be required to improve the alignment, clearances and standard of roadbed in order to facilitate access for construction traffic.

3.10 Defining the Overhead Line and Underground Cable Routes and the Factors that have been Considered

3.10.1 All the routes (both overhead line and underground cable) start immediately west of the existing 132kV F Route and are connected to an underground cable that runs to a point north of the proposed Sandford Substation. For the overhead line options, the underground cable would connect into a CSEPP pylon (see Figure 3). For the underground route option a CSEPP pylon would be required in line with the existing AT Route overhead line. A short section of underground cable is required at the entry to the substation for construction, operational reasons and to provide safety clearance with the proposed 400kV Bridgwater to Seabank overhead line.

3.10.2 The starting point in defining potential alignments for overhead lines was to consider options which lay within the limits of the preferred route corridor as set out in the Local Electricity Network Preferred Options Report (October 2012). The corridor boundaries formed the basis for informing local communities of the proposal to be taken forward.

3.10.3 However, it was recognised that situations might arise where localised environmental constraints suggest that a more acceptable alignment for a possible overhead line route might marginally extend outside the defined corridor. In this regard, both overhead line options step marginally outside the preferred route corridor in order to achieve the most direct route and to minimise the use of angle pylons. Alignments extending significantly beyond the defined limits of the corridor were not considered on the basis that any substantial changes in deviation would relocate the alignments into the other corridors that have been considered but discounted in the past on the basis they did not represent the least environmentally constrained corridor.

3.10.4 Three routes were identified based on the three technologies set out in section 3.3 and 3.8 above.

Steel Monopole Pylon Route

3.10.5 The route would start with a CSEPP just to the north west of the existing overhead 132kV F Route. It then travels in a north westerly direction to a point north Hardmead Rhyne where the route changes to a more northerly direction. It travels over Nye Drove and then passes marginally outside the corridor to avoid a small water body to the west of Rookery Farm. It continues in a north westerly direction passing over Rockers Rhyne and Havage Drove where the route then moves a more central position in the corridor. It passes east of Box Bush Farm and connects into the AT Route with a steel lattice angle pylon to the east of pylon AT25. A plan of the route is enclosed at Figure 4.

3.10.6 In total this option would require 26 monopoles with one steel lattice angle pylon required at the northern end of the route to achieve the transition from the existing overhead AT Route to the monopoles and a CSEPP at the southern end of the route to achieve the transition to underground cables.

Steel Lattice Pylon Route

3.10.7 The route would start with a CSEPP just to the north west of the existing overhead 132kV F Route. It travels in a north westerly direction to a point south of Hardmead Rhyne. At this point an angle pylon is required to change direction. The route continues in north west direction to a point south of Nye Drove where a further angle pylon will be used to achieve a more northerly alignment. (After this point, all the pylons would be suspension pylons as the route travels in a straight line towards the AT Route). The route then passes east of the small water body to the west of Rookery Farm and continues north passing over Rocker Rhynes and Havage Drove. It passes further east of Box Bush Farm than the steel monopole. On the approach to the AT Route it oversails a Public Right of Way (PRoW) and connects onto the AT Route with a steel lattice angle pylon west of tower AT26. A plan of the route is enclosed at Figure 4.

3.10.8 In total nine lattice pylons would be required, which includes the angle pylon and CSEPP at the start and end of the AT Route connection.

Underground Cable Route Options

3.10.9 One underground cable route was identified. The underground cable route follows an easterly alignment within the corridor. It connects into the AT Route with a CSEPP east of tower AT26. A plan of the route is enclosed at Figure 4.

3.11 Other Routes Considered but Discounted

3.11.1 A more westerly alignment for the overhead lines within the corridor would have taken the routes closer to Box Bush Farm and Box Bush Stables, which would have resulted in increased potential for disturbance during the construction period. A more westerly alignment, would also have involved greater changes in direction to avoid passing over the water body in the middle of the corridor. If this had been pursued, it would have required the permanent loss of a number of trees to ensure electrical safety clearances. Such an approach was considered unnecessary on the basis that an overhead route within very close proximity to the Preferred Route Corridor could be achieved that avoided the water body resulting in a reduced environmental effect, increased cost and technical complexity.

4 TOPICS SCOPED IN AND SCOPED OUT OF THE APPRAISAL

4.1.1 The options appraisal process considers the technical and economic, planning and environmental constraints, and socio-economic issues associated with each potential connection option. These criteria are consistent with National Grid and WPD's statutory and licence obligations as explained in Appendix B and are explained below

4.1.2 The options appraisal is not an Environmental Statement (ES) reporting on an Environmental Impact Assessment (EIA). Such an assessment will be applied to the detailed scheme design at a later stage in the process and an ES will be submitted to accompany the application for an Order granting Development Consent for the Hinkley Point C Connection project, which includes works to the existing WPD local electricity network. The scope of the EIA has been agreed with the Planning Inspectorate by way of a scoping opinion[10]. The scope of the EIA[11] includes topics which are not material differentiators in the current options appraisal.

4.1.3 Where the consideration of certain topics is not likely to assist in determining which of the options under consideration should be taken forward, these topics may be "scoped out".

4.2 Topics 'Scoped In'

4.2.1 The following topics have been addressed in the appraisal of the AT Route options :

Environment

- Landscape and Visual Amenity
- Historic Environment
- Ecology

Socio-economic

- Local economic impact

Cost

- Capital cost
- Lifetime cost

4.2.2 Effects on **landscape and visual amenity** are recognised as important factors in determining the merits of different options. This was confirmed by responses during all stages of consultation to date for the Bridgwater to Seabank Connection and is recognised by the establishment of a Landscape and Views Thematic Group. The effects of underground cable options on landscape and visual amenity are generally considerably less than the effect of overhead line options.

4.2.3 The importance of assessing effects on the **historic environment** is recognised by the establishment of a Historic Environment Thematic Group. Underground cable options have the potential for greater effects on unknown archaeology than overhead line options because of the greater extent of ground disturbance.

[10] The Planning Inspectorate: Scoping Opinion. Proposed Hinkley to Seabank Grid Connection (May 2013)

[11] National Grid: Hinkley Point C Connection Project. Environmental Impact Assessment Scoping Opinion. (April 2013).

4.2.4 The importance of assessing effects on **ecology** is recognised by the establishment of an Ecology and Biodiversity Thematic Group. Underground cable options have the potential for greater effects on ecology than overhead line options because of the extent of land affected during cable installation and associated habitat disturbance.

4.2.5 Consultation has emphasised the importance of assessing the effects of the scheme on the **local economy**, including tourism. The potential for local economic effects will vary depending on the proximity of options to local businesses and tourism facilities and the degree of potential temporary disturbance during construction or longer term effects on business premises and operations or visitor attractions.

4.2.6 **Capital cost** is an estimate of the cost of equipment and installation costs. The cost estimates are based on generalised unit costs for the key elements of the option, reflecting recent contract values or manufacturers/consultant budget estimates. This is sufficient to allow a broad order of relative costs to be established for the options and is not intended to provide a detailed cost for each option which can only be obtained at the detailed design stage.

4.2.7 The **lifetime cost** is an estimate of the capital cost plus the distribution losses and maintenance costs for the specific elements of the connection options over a 40 year lifetime. The lifetime cost estimate methodology is explained in Appendix D.

4.3 Topics 'Scoped Out'

4.3.1 Overhead lines and underground cables would have no effects on **local air quality** during the operational phase. During construction, there is the potential to generate dust and emissions from plant and traffic movements. However these effects would be temporary and dust and other emissions are capable of mitigation using well established techniques. There is therefore unlikely to be a significant difference between the effects of different options on air quality and therefore this criterion cannot be used to distinguish between options.

4.3.2 Overhead lines and underground cables would not give rise to significant **noise and vibration** during the operational phase. Construction activities have the potential to generate noise and vibration. However these effects would be temporary and are capable of mitigation using well established techniques. There is unlikely to be a significant difference between the effects of different options on noise and vibration and therefore these criteria cannot be used to distinguish between options.

4.3.3 There are no sites designated for their geological/geomorphological interest in the study area and the local **soils and geology** pose no particular constraint to either overhead line or underground cable installation.

4.3.4 Once operational, overhead lines and underground cables are not expected to have significant effects on the **water** environment. During construction there is the potential for different effects on the water environment, depending on the nature and extent of construction activity. However acknowledged mitigation measures are available and any residual differences would be insufficient for them to be material differentiators in options selection. The effects on aquatic ecology will be addressed under the ecology topic heading.

4.3.5 Once operational, the effects on **traffic and transport** will be negligible for all options. During the construction phase, issues such as the movement of plant, equipment and materials will vary dependent on the nature and extent of the option. The transport network in the vicinity of options will also have different characteristics which may be more or less able to cope with the traffic flows associated with construction activities. Initial studies have shown that it would be possible to provide access to the whole of the

study area being considered and that this topic would not be a material differentiator in options selection.

4.3.6 Through consultations to-date, no **aviation or defence** interests have been identified or brought to the attention of the project team which would be adversely affected by development in the study area.

4.3.7 The **technical** topic area covers a range of issues mainly relating to the buildability of the option, for example its technical complexity, construction delivery risk, use of resources, programme implications and outage requirements. While each may vary from option to option, as will ease of maintenance, these issues will not be a material differentiator in options selection.

4.3.8 Consideration of **electro-magnetic fields** is excluded from the options appraisal because both National Grid and WPD design their system to be compliant with ICNIRP guidelines[12] on exposure to electric and magnetic fields. An assessment of the potential impact of electric and magnetic fields will be included in the EIA.

4.4 Assessing In-combination Effects

4.4.1 The appraisals have considered the potential in combination effects of the following Proposed Development components in the vicinity of the AT Route:

- A new Grid Supply Point (GSP) 400/132kV substation at Sandford.
- A 400kV overhead line connection from the new GSP substation travelling north.
- The 400kV underground cables from the south travelling into the GSP substation from the Mendip Hills.
- The N Route Turn-in to the GSP at Sandford.
- The dismantling of the 132kV F Route.
- The dismantling of approximately 1kn of the existing 132kV AT Route.
- The dismantling of a section of the132kV N Route.

[12] International Commission on Non-Ionising Radiation Protection : Guidelines for limiting exposure to time-varying electric, magnetic and electromagnetic fields : 1998

5 APPRAISALS

5.1 Environment – Landscape and Visual Assessment

5.1.1 For the purposes of this report, the study area for the landscape and views appraisal extended 1.5km from the proposed routes.

Baseline Landscape Character Conditions

5.1.2 The landscape in the preferred route corridor is not designated but it is considered to be of local value. The southern boundary of the preferred route corridor is approximately 1km from the Mendip Hills AONB an area of national landscape importance. The Overarching National Policy Statement for Energy (EN-1) states that consideration should be given to the purposes of nationally designated areas when siting development in close proximity to the boundaries of an AONB designation.

5.1.3 Land at the southern end of the preferred route corridor to the north of Sandford, falls within local landscape character area River Yeo Rolling Valley Farmland (Area J2[13], as defined by North Somerset Council), which is described as being a peaceful pastoral landscape with the presence of waterways signalled by lines of willows. The land contains scattered farmsteads and larger villages on higher land. This character is being eroded in places by ribbon development.

5.1.4 Immediately north of Area J2 the land in the preferred route corridor is in local landscape character area Locking and Banwell Moors (Area A4 as defined by North Somerset Council). The landscape is described as pastoral with a regular network of hedges, ditches and rhynes, numerous mature trees and sparse settlement creating a strong sense of remoteness and isolation. It notes that the character is influenced by marginal activities such as horse grazing, scrap yards and caravan parks.

5.1.5 North of Nye Drove the land is within local landscape character area Kingston, Seymour and Puxton Moors (Area A1 as defined by North Somerset Council). This area is described as having a strong remote and rural character. It is a pastoral landscape with hedgerow trees and a network of waterways, winding rivers, rhynes and ditches. There is a scattered settlement pattern of small hamlets and villages.

5.1.6 The landscape in the preferred route corridor is consistent with the published descriptions of a pastoral landscape with fields bound by low clipped hedgerows, with scattered mature trees in hedgerows and within fields. More mature scrub and trees are present along larger drains and rhynes. The Mendip Hills form a backdrop in distant southern views. Built development is present as individual farms or small groups of buildings often with mature trees and garden boundary hedges. There is a cluster of residential properties at Rookery Farm, Nut Tree Farm and Nye Farm to the east of the preferred route corridor and to the west around Box Bush Stables along Havage Drove and Puxton Lane.

[13] North Somerset Council Landscape Character Assessment (2005)

Assessment of Potential Effects of Overhead Lines on Landscape Character

Both Overhead Line Designs

5.1.7 The proposed route for both overhead line options would mainly cross farmland extending southeast from the AT route west of existing pylon AT25. A section of AT route east from AT25 to F route would be removed as part of the proposals. Overhead lines would typically oversail existing features such as hedges without adverse effect although there may be some localised effects involving pruning or cutting back vegetation to enable safety clearances, stringing of conductors and temporary construction access. In the main, there is scope to site pylons or poles and access roads away from features such as ponds, trees and hedges. Where possible existing access points would be used to accommodate construction access. This would minimise effects including the need to fell and or remove vegetation.

5.1.8 There are existing steel lattice pylons and wood pole mounted overhead lines present in the local landscape surrounding the proposed overhead line route(s) and forming part of the baseline conditions. The landscape characteristics include, hedges with trees and some mature trees which together reduce visibility of some pylons and screen lower height overhead lines. These characteristics have the effect of minimising overall negative effects on landscape character.

5.1.9 The proposed routes for overhead lines follow a similar alignment although they vary slightly to accommodate the different designs. The routes are not so significantly different to be material in considering overall potential effects on landscape character.

5.1.10 The land on which the overhead line would be routed is not designated but is of local value. The land is approximately 1km from the Mendip Hills AONB which is a highly sensitive area of landscape importance. The preferred route corridor is of moderate to low sensitivity to change.

5.1.11 There would be removal of a short length of the existing AT route (approximately 1 km) overhead line which would result in a small beneficial effect although this would be balanced by addition of the proposed new overhead line(s). This would generally result in limited change to landscape character of the local area.

5.1.12 The magnitude of effect on the AONB resulting from the installation of overhead line(s) in this location would be low to negligible because overhead lines are already a feature in the landscape in countryside to the north of the AONB and there would be a negligible effect on landscape features which combine to form the special character of the AONB. The Mendip Hills would remain prominent as a backdrop to the landscape of the preferred route corridor and this prominence would not be diminished by the presence of an overhead line along the preferred route corridor. The character of landscape to the north of the AONB would experience little change and there would be a negligible effect on the setting of the AONB.

5.1.13 There would be a neutral or minor negative overall effect on landscape character as a consequence of installing overhead line(s) in the proposed location. However there may be slightly greater effects in relation to monopole design, and this is discussed further below.

5.1.14 Whilst this assessment considers the effects of the proposed 132kV connection the effects of the selected option would require further consideration as part of EIA for the project.

Steel Lattice Pylons

5.1.15 This type of pylon is used on the existing AT and F route 132kV overhead lines and therefore is present in the local landscape and those pylons form part of the baseline

conditions. As a consequence the magnitude of effect resulting from introduction of steel lattice pylons on the proposed route would be low. The proposed section of overhead line would replace that removed further north on the AT route with a similar feature, albeit a longer section comprising a greater number of pylons than the removed section.

5.1.16 There would be a total of 9 new structures needed for this option, which would be fewer than the steel monopole option. However steel lattice pylons are taller structures, at approximately 29 metres in height, than the steel monopole design. Taking account of the removal of the existing section of AT route there would be a small increase in pylons in this area. The nature of the landscape including, mature hedges and trees mean that effects could be minimised and mitigated to some extent. Pylon tops would tend to be visible above tree canopies and would slightly increase the perception of overhead lines as a feature of this area.

5.1.17 The magnitude of effect of this design would be low, affecting an area of low to moderate sensitivity, resulting in an overall minor negative scale of effect.

Steel Monopole

5.1.18 This type of pylon is not currently present in the local landscape. The design is a single steel pole of solid appearance with three arms to carry a single circuit. Two rows of steel monopoles at approximately 22 metres high would be required for this option. These would be lower in height than steel lattice pylons by approximately 7 metres. The top of the monopoles would likely extend above tree canopies in places.

5.1.19 The proposed route for an overhead line option using monopoles would cross farmland and the lines would carry one circuit each and extend north west from the existing overhead 132kV F Route and connect into the AT route west of existing pylon AT25.

5.1.20 A total of 26 monopoles and 2 lattice structures would be required. For this option the monopoles would appear as new features in the landscape as pylons of this type are not currently used in the locality. However, they share similar characteristics with the other option and existing overhead lines, albeit the supports differ to those found on steel lattice structures. Similarities include vertical structures comprising conductors suspended from arms on supports. There are existing overhead lines in the landscape where the route would be proposed and therefore it would not be totally uncharacteristic.

5.1.21 The magnitude of effect on the landscape of the Preferred Route Corridor and immediate surroundings resulting from 26 steel monopoles would likely be greater than the steel lattice option. The magnitude of effect of introducing steel monopoles would be low to moderate.

5.1.22 The proposed section of overhead line would replace that removed further north on the AT route with a similar feature, albeit a longer section comprising a greater number of supporting structures than the removed section. Taking account of the removal of the existing section of AT route there would be an increase in overhead lines in this area. The nature of the landscape including hedges and trees mean that effects could be minimised and mitigated to some extent. Monopole tops would tend to be visible above tree canopies and would slightly increase the perception of overhead lines as a feature of this area.

5.1.23 The magnitude of effect of this design would be low, affecting an area of moderate sensitivity, resulting in an overall minor negative scale of effect.

Baseline Visual Assessment

5.1.24 Views in and around the preferred route corridor are relatively open. Mature trees are present and create a filtering effect in views. Trees are generally restricted to hedgerows, along drains and in gardens. Views over long distances from areas of raised ground are possible and sections of the preferred route corridor are visible from roads, footpaths and properties in the wider area.

5.1.25 There are few visual receptors close to the preferred route corridor. A number of public rights of way (PRoW) run parallel with a short section of the corridor close to its connection point with the AT Route, these are PRoW AX29/48, AX3/42 and AX3/43. For the avoidance of doubt, these PRoWs are not the Strawberry Line. Nye Road which becomes Drove Way is approximately 350m to the east of the preferred route corridor, Box Bush Lane and Puxton Road are approximately 250m to the west.

5.1.26 Rookery Farm and Rookery Farm East are immediately east of the preferred route corridor, the properties are set within mature gardens which filter and provide screening in views to the west which is most effective in the summer when there are leaves on the trees. There are mature trees in the gardens of Nut Tree Farm and Nye Farm which in combination with other trees and hedgerows such as those alongside ditches provide filtering of views towards the preferred route corridor.

5.1.27 There are a cluster of properties at Box Bush Farm, where views are enclosed and foreshortened by mature trees in gardens or associated agricultural buildings. Other views towards the preferred route corridor largely comprise farmland with occasional groups of trees filtering views.. There is one bungalow on the eastern edge of agricultural buildings that has open views across adjacent pastoral farmland and would have views towards the preferred route corridor.

5.1.28 Properties along Puxton Lane are generally enclosed by mature garden trees and trees along rhynes and ditches. As a result the majority of residents experience heavily filtered views towards the preferred route corridor.

5.1.29 South Farm is to the north of the preferred route corridor and is associated with a caravan park. Views towards the preferred route corridor are heavily filtered by trees (including evergreen species) along a ditch immediately adjacent to the access road into the caravan park.

5.1.30 The existing 132kV AT Route and F Route (proposed for removal as part of the Hinkley Point C Connection project) overhead lines form components of baseline views.

Assessment of Potential Visual Effects of Overhead Line Options

Visual Effects - Both Overhead Line Designs

5.1.31 As described above, the proposed route for an overhead line(s) of either design would mainly cross farmland extending southeast from the AT route west of existing pylon AT25, enabling a section of AT route to be removed. There are wood pole mounted overhead lines present in the vicinity of the proposed route which form part of baseline views often appearing in the foreground. The existing AT and F route overhead lines supported by steel lattice pylons also form part of baseline views.

5.1.32 Overhead lines would typically oversail existing features such as hedgerow trees without adverse effect which generally provide screening in views. There may be a requirement for some localised pruning or cutting back of vegetation to enable safety clearances, stringing of conductors and temporary construction access. In the main, there would be scope to minimise effects through careful planning and inclusion of replacement planting.

5.1.33 The proposed routes for the two overhead line options follow a similar alignment and both would oversail PRoW AX3/42 although at different points.

5.1.34 The land on which the overhead line would be routed is approximately 1km (the southern end) from the edge of Mendip Hills AONB. Views to and from the AONB are of importance and the potential effects on these views is broadly considered. A new overhead line using any of the proposed designs would be visible although to different extents from higher ground on the edge of the AONB such as from Sandford Hill, Banwell Hill and Dolebury Warren. The overhead line of either design would be seen distantly and as a small part of wide long distance views. Effects on specific viewpoints in the AONB have not been appraised at this stage.

5.1.35 Removal of a short length of the existing AT route overhead line (which has pylons that are approximately 12.5 metres higher than the new proposed pylons) would result in a beneficial effect on views in the locality although this would be balanced by the addition of the proposed new overhead line(s). This would generally result in an overall limited change to the components of views but could bring overhead lines closer or further away from a receptor in a view and thereby increase or reduce prominence.

5.1.36 The sensitivity of receptors is considered. Residents and users of public rights of way are judged to be of high sensitivity to changes in views. Receptors experiencing views in designated landscapes such as the AONB are also highly sensitive to changes in those views. Road users are generally considered to be of low sensitivity. Views from locations closest to the overhead line would likely be affected to a greater degree than viewpoints further away.

5.1.37 The overhead line routes would oversail AX29/48 at Nye Drove. Users of this route would experience a notable change in views at this point and views north and south of the overhead lines would be possible.

5.1.38 The overhead line(s) would typically be visible with limited filtering provided by hedgerow trees from PRoW AX3/48 where it runs parallel with the proposed routes and between Nye Drove and Nye Road. This would result in a moderate magnitude of effect on views.

5.1.39 AX3/42 runs approximately parallel in part to the proposed overhead line routes between Havage Drove and the connection point with the existing AT route to the north. AX3/42 joins AX24/11 at the northern end of the line where AT route oversails. Through farmland surrounding AX3/42 PRoW, hedgerows are generally maintained at a low height and there are few hedgerow trees to filter or screen views of new overhead lines. The existing AT route to the north forms a component of baseline views, a section of which would be removed as part of this connection. The new overhead line(s) would be closer in the views from this location than the existing section of AT route to be removed. There would also be views towards the new overhead line(s) from Puxton Lane to the east of this PRoW as hedgerows are maintained low in height. The overhead line(s) would be visible from Puxton Lane where it connects with the existing AT route albeit views would be filtered by hedgerows and trees on intervening land.

5.1.40 Views from Box Bush Lane are enclosed by existing roadside hedgerows with trees. Views across surrounding countryside from the road are restricted to points where there are existing breaks in vegetation such as farm accesses, field entrances and along an access track into Box Bush Stables.

5.1.41 The proposed overhead line(s) would be visible from some properties close to the routes. Rookery Farm and Rookery Farm East are the closest properties to the routes. However, they are surrounded by mature trees and views are typically screened and

heavily filtered in the direction of the proposed overhead line(s). There would generally be effects on views of low to moderate magnitude at this location.

5.1.42 Receptors at Nye Farm and Nut Tree Farm would experience views of the proposed overhead line(s) in a westerly direction. These views are filtered by existing mature garden trees around the properties and trees and hedgerows on intervening land. The magnitude of effect on these views would generally be low to moderate.

5.1.43 Views generally to the east and toward the proposed overhead lines are filtered by mature trees along ditches and rhynes albeit residents of properties off Box Bush Lane such as Boxbush Farm and Box Bush Stables would experience views of the routes. Where there are trees, the overhead lines would be partly visible extending above this vegetation with steel lattice pylons being visible to a greater extent.

5.1.44 From Boxbush Farm the AT route forms a component of baseline views, part of which would be removed under the proposals. The AT route to the north would be removed from views experienced by residents of these properties, although this would be offset by the introduction of the proposed new overhead lines. The new overhead line(s) would be closer in these views than the existing AT route.

5.1.45 There is a bungalow at Box Bush Stables from where open views across farmland are currently possible. There is relatively little filtering of views provided by intervening hedgerows and trees between the property and the proposed overhead lines and as a result residents of this property would experience open views of the new overhead lines at close proximity. The magnitude of effect would generally be moderate as the more distant AT route pylons would be removed from the view but would be replaced with a closer overhead line(s).

5.1.46 The next section of this assessment considers the existing baseline against each of the proposed designs to make an overall judgement of potential effects on views from the local area assuming that receptors are of high sensitivity. This assessment will be used to identify a preferred design of which a detailed assessment will be undertaken as part of EIA for the project.

Steel Lattice

5.1.47 Steel lattice pylons would be taller than the other design option and as such have potential to have a greater effect on views. Fewer structures would be required than for the steel monopole option. Steel lattice pylons would be taller than the majority of hedges and trees and the tops would extend above these in the majority of views.

5.1.48 Although the lattice design allows some ‘permeability’ in views as background features are seen through the structure, there would be limited scope to utilise trees and shrubs for screening of steel lattice pylons as they would typically be taller and extend above canopies. As a result steel lattice pylons would typically form some part of most views in the local area and would be visible over relatively long distances. Views from nearby residential properties would likely change to include views of some part of pylons. Where there is existing screening around properties pylons would likely be partially screened, some views could include pylons extending above trees and hedges in the middle distance.

5.1.49 A low magnitude of effect on views to and from the AONB would result from the installation of an overhead line using steel lattice pylons. This type of pylon is already present in the background of views. The proposed route would extend closer than the existing AT route toward the AONB. The number of pylons present in views would increase which would have a limited adverse effect on views of the setting and views in the AONB.

5.1.50 The magnitude of effect of this design on views generally would be low to moderate, affecting receptors of high sensitivity, resulting in an overall moderate negative scale of effect.

Steel Monopole

5.1.51 Steel monopoles would be approximately 7m metres lower than steel lattice pylons. They are as tall as or are taller than some mature trees and are generally taller than hedges and shrubs in the local area. The tops of monopoles would typically be visible extending above tree canopies. Steel monopoles are not currently a pylon design used in the local area and would introduce a new element in views, although noting that overhead lines are already present sharing similar characteristics. Monopoles would likely result in a greater magnitude of effect in some views than a steel lattice option, particularly from close proximity and along the length of the line because there would be more structures present in the views and the solid appearance of supporting columns would be prominent.

5.1.52 There would be limited scope to utilise trees and shrubs for screening of steel monopoles due to their height. As a result they would typically form some part of most views and would be visible over relatively long distances. Views from nearby residential properties would likely change to include partial views of monopoles.

5.1.53 The proposed route would extend monopoles toward the AONB and are likely to be notable in views above tree canopies. The overhead line would introduce a new feature to views (26 monopoles) which would be visible from some areas on high ground in the AONB although this would not have a significant overall effect on the character of wide and panoramic views from the AONB.

5.1.54 The magnitude of effect of this design on views generally would be low to moderate, affecting receptors of high sensitivity, resulting in an overall moderate negative scale of effect.

Assessment of Potential Effects of an Underground Route

5.1.55 Generally there would be limited visual effects and landscape effects as a consequence of installing underground cables to make this connection.

5.1.56 There would be some temporary effects on landscape character and views during construction through the removal of shrubs and trees where present along the proposed route. Mitigation in the form of replacement planting would be included, although planting would be restricted directly above cable swathes. The removal of vegetation would be restricted to short sections for construction of trenches to install underground cables. Permanent effects would be minimal and localised and would not have a significant negative effect on landscape character.

5.1.57 On completion of the works, replacement planting would be undertaken and this would result in short term effects on views until the planting has re-established. With mitigation in place there would be negligible to low overall effects on views as landscape features would be restored to a similar condition to existing. In addition, the removal of a section of AT Route to the north would have a beneficial effect on views as overhead lines would not be visible or would be more distant than in baseline conditions.

5.1.58 A replacement pylon would be required at the connection point with the existing AT route. This would be a CSEPP which would be a steel lattice structure with a platform to enable the conversion of underground cables to overhead lines. The platform on this type of pylon means that it would be different in appearance to other pylons on the

existing AT Route but would not be so significant to be out of place with the existing structures or appear incongruous in views.

5.1.59 **Consideration of the Potential In Combination Effects of the Other Proposed Development Components**

5.1.60 If an underground connection is selected the potential visual and landscape effects would be negligible post mitigation and therefore there would be very limited opportunity for in combination effects to occur with any of the other identified developments.

5.1.61 If an overhead line was selected to be taken forward for consultation, there would potential for in combination effects with other development components as parts of one or more of the developments could be present in views and there would be a new substation in the landscape although these are not anticipated to be a significant factor in highlighting a preference for one option over the other. The in combination effects of the developments would be largely restricted to the landscape and views in close proximity to the proposed GSP substation as this is where they would be closest together. The potential in combination effects would be limited on the basis that the proposed AT Route would have low levels of effect on landscape character and views, the receiving landscape is not highly sensitive to change and landscape mitigation would form part of the developments. The nature of the landscape, which includes hedges and trees, means that in combination effects could be minimised and mitigated to some extent..

5.1.62 Overall there would be a slight preference for choosing an underground connection. However as noted there is limited potential for in combination effects to occur and they are also limited in relation to overhead line options. Overall, there is no strong preference from the landscape and visual assessment for a particular overhead line design option when taking into account in combination effects.

Potential for Mitigation

5.1.63 For both the overhead (all design options) and underground options it would be possible to minimise permanent negative effects on views through careful planning of access to avoid the need for road improvements to the local lane network, by utilising existing gaps in hedgerows and by reinstating roads to their original condition once construction is complete. Some short term and permanent negative visual effects would be unavoidable until re-establishment.

Overhead Lines

5.1.64 Siting overhead lines to maximise filtering effects and backgrounding by higher ground or woodland and by avoiding or minimising sharp changes in direction would assist in reducing potential negative effects and has been used in all route options.

5.1.65 Mitigation by way of additional hedgerow and tree belt planting in the vicinity of a new overhead line(s), subject to landowner agreement, would be in keeping with the existing landscape character and could assist in reducing potential effects on views.

5.1.66 There would be some permanent visual effects associated with the use of steel lattice pylons and monopoles for which there would be limited scope to provide mitigation.

Underground Cables

5.1.67 The visual effects of an underground cable route would largely be temporary, subject to the avoidance of woodland through routeing. Loss of some trees and hedgerow would be minimised through careful routeing and replacement hedgerow planting within the cable swathe and compensatory tree planting outside the cable swathe, subject to landowner agreement, could assist in reducing potential effects.

Landscape Character and Visual Assessment Conclusion

5.1.68 An underground connection would be preferable for minimising overall effects on landscape character and views. There would be scope to minimise effects of sealing end platform pylons through careful siting and new planting if appropriate. There would be fewer effects on landscape character and views, including potential effects on views to and from the Mendip Hills AONB, from the underground cables route in comparison with either of the overhead line options.

5.1.69 There are temporary and permanent negative visual effects associated with both of the overhead line options. Both overhead line options perform similarly overall in this assessment. However, overall there would be a slight preference for the use of steel lattice pylons. This is because there would be fewer structures required and the visual 'permeability' of the lattice design would benefit from backgrounding.

5.2 Environment – Ecology

Ecology Baseline

5.2.1 For the purposes of this report, the study area for the ecology appraisal extended 1 km from the proposed routes. Although as the consultation zone for the North Somerset and Mendip Bats SAC fell within this, it was considered necessary to refer to the component sites of the SAC which were all over 1km away.

Designated Sites

5.2.2 There are no nationally or internationally designated nature conservation sites along the proposed route. However, there are two nationally designated sites within 1km. These are:

- Puxton Moor Site of Special Scientific Interest (SSSI), (approximately 400m east) which is a network of ditches and rhynes supporting a diverse range of aquatic plants and invertebrates; and
- Yanal Bog SSSI (approximately 780m east) which is a calcareous lowland mire.

5.2.3 In addition to this, the proposed route falls within the 5km consultation zone of the North Somerset and Mendip Bats Special Area of Conservation (SAC). The presence of both lesser and greater horseshoe bats is a primary reason for the designation of the SAC and component parts of the internationally designated site are present to the north east and south west of the corridor. These are:

- Banwell Ochre Caves SSSI (approximately 1.5km to the south west);
- Banwell Caves SSSI (approximately 3.5 km to the south east); and
- Kings Wood and Urchin Wood SSSI (approximately 4.6km to the north east).

5.2.4 There is one Site of Nature Conservation Importance (SNCI) adjacent to the proposed alignment. This site is valued at the County level:

- Towerhead Brook and Adjacent Land SNCI designation includes the river and adjacent habitats which support a diverse range of flora and invertebrates.

5.2.5 There are three further SNCIs located within 1km of the proposed alignment. These are:

- Puxton Moor SSSI and Surrounding Rhynes SNCI (approximately 400m east) includes unimproved and semi-improved neutral grassland, ditches and notable plant and invertebrate species. Puxton Moor SSSI and an Avon Wildlife Trust nature reserve sit within the boundaries of this designation.

- Cheddar Valley Railway Walk Local Nature Reserve (LNR) (approximately 180m southeast) includes a range of habitats supporting birds, amphibians and reptiles.
- Yanal Bog and adjacent rhyne SNCI (approximately 780m east) includes calcareous lowland mire, ditches and marshy grassland and supports a diverse flora. Yanal Bog SSSI sits within the boundaries of this designation.

Habitats and Species

5.2.6 The proposed route travels for approximately 2.4km through an area mainly comprised of semi-improved grazed pasture and arable fields. The intrinsic value of this agricultural land is low, but could be increased by association with visiting faunal species. However, breeding and wintering bird surveys[14][15] have not highlighted any areas of ornithological importance within the preferred route corridor. The grassland habitat is therefore valued at the local level only.

5.2.7 A network of interconnecting ditches, is crossed by and adjacent to the proposed route and these, along with the associated hedgerows, comprise the boundaries of the agricultural fields.

5.2.8 Although predominantly species-poor, the ecological value of the hedgerows is increased by their association with the ditch habitat and, taken together, they form valuable wildlife corridors providing potential foraging and commuting opportunities for a wide range of species.

5.2.9 Species recorded in the wider area which may be present amongst the ditch habitat include otter, water vole and amphibians. The hedgerows may provide suitable opportunities for farmland birds, dormice (if present) and foraging/commuting opportunities for bats (potentially including those species associated with the North Somerset and Mendip Bats SAC).

5.2.10 The network of hedgerows and ditches is valued at the district level, but the value of individual hedgerows and ditches will vary depending on associations with other species. Several ditches within the corridor fall within the edge of Towerhead Brook and adjacent land SNCI. Ditches within the local wildlife site are valued at the County level.

5.2.11 Semi-natural broadleaved woodland habitat along the proposed route is restricted to a tree belt around a pond, between Rockers.

Assessment of Effects

Overhead Line (Both Options)

5.2.12 Many of the effects from construction and operation of an overhead line are similar for both the steel lattice and steel monopole options.

5.2.13 The proposed overhead line routes would pass in close proximity to the Towerhead Brook SNCI. No pole or pylon positions for either of the options would be within the designated site. However, potential would remain for construction works to lead to a reduction in water quality within the ditch network and disturbance to potential protected species habitat, resulting in a low negative, temporary magnitude of effect.

[14] TEP Report Ref: 1979.213 Hinkley Point C Connection Project – Winter Ornithological Assessment 2012

[15] Breeding Bird Survey Data presented on TEP drawings G1979.1431 to G1979.1433

5.2.14 It is unlikely that removal of hedgerow habitat would be required during construction, although mature trees are present within several of the hedgerows and to achieve the required electrical safety clearances the loss of individual trees and/or tree works (e.g. lopping or coppicing) may be necessary with any of the pylon options. The permanent loss of hedgerow trees would result in a low negative, long-term magnitude of effect.

5.2.15 The overhead line routes would not cross any areas identified as being important for birds or any woodland habitats.

5.2.16 Differences in potential effects on ecology may arise between pylon options in relation to the difference in the number pylons required, the construction footprint for the pylons, the construction period to erect the pylons and the height of the pylons.

5.2.17 The steel lattice option has the fewest pylons with nine in total proposed. The steel monopole option would require 26 monopoles plus two steel lattice pylons, one at each end of the route. A steel lattice pylon would have a larger footprint and require a greater working area in comparison with the other pylon option. However as there would be fewer pylons, this reduces the overall working areas. It is assumed that temporary construction access would be online for the entire route and therefore there is little difference between options despite the range in the number of pylons/poles required.

5.2.18 The grassland habitats and the species they support would experience a low negative, temporary magnitude of effect during construction from ground disturbance and disturbance from human activities during the installation of the pylon infrastructure.

5.2.19 The pylon options are of differing height and the steel lattice has the greatest theoretical zone of risk for bird collision (distance between the lowest and highest conductors or earth wire). However, ornithological assessments in the vicinity of the route did not highlight any areas of ornithological importance and bird collision is unlikely to differ between options.

5.2.20 With the adoption of an overhead line option, notable variations in the level of ecological impact between a steel mono-pole and steel lattice designs are considered to be unlikely. The habitat which would be affected during the construction period is predominantly comprised of improved agricultural grasslands of low intrinsic value. The construction of an individual steel lattice pylon would result in greater levels of ground disturbance, and a longer construction period, in comparison to the other option, however fewer steel lattice structures would be required along the route compared to the monopoles and, as a result fewer locations would be disturbed.

5.2.21 In combination the low magnitude of effects on receptors of local to County value across all options, would result in an overall minor negative scale of effect on ecology as a result of the overhead line options prior to mitigation.

Underground Cable Option

5.2.22 An underground cable option could result in impacts to SNCI habitat. Towerhead Brook SNCI is adjacent to the proposed alignment, using an open-cut method, would require the crossing of Hardmead Rhyne and a ditch immediately to the north which are both hydrologically linked to the SNCI. As a result of this, the SNCI would likely experience reductions in water quality (from run-off and pollution events) during the works, leading to adverse impacts upon botanical communities and disturbance to species using the wetland habitats within the SNCI. This would result in a moderate negative, medium-term magnitude of effect on SNCI habitat.

5.2.23 Losses of bankside habitat, with associated disturbance and reductions in water quality would occur to all ditches and rhynes within the corridor that would be crossed using

open-cut methods. The proposed underground cable would also pass within 50m of a pond. Great crested newt (GCN) records exist within 250m (south) of the proposed route but surveys during 2013 have not found any GCN within this pond nor within any of the ditches crossed by the proposed alignment. Therefore no breeding habitat or core terrestrial habitat would be affected. The impacts to aquatic features, and the resulting temporary fragmentation effects, would lead to a moderate negative, medium-term magnitude of effect prior to mitigation.

5.2.24 The use of open-cut construction techniques would also result in losses of hedgerow habitat at each crossing. Due to the relatively short length of the route only a small number of predominantly species-poor hedgerows (<10) would be impacted. However, even small scale habitat losses may still impact upon protected species, including dormice and breeding birds. The hedgerows may also provide foraging/commuting habitat for bats.

5.2.25 Removal of hedgerow habitat would lead to temporary habitat fragmentation and a reduction in connectivity between habitats within, and adjacent to, the proposed alignment. The resulting fragmentation impacts on protected species, such as dormice and bats (if present), would be of particular significance, resulting in a moderate negative, long-term magnitude of effect.

5.2.26 Losses and disturbance to grassland habitats would occur during the construction period. Habitat survey and wintering bird surveys have found that the affected fields are of negligible nature conservation value. It is therefore considered that undergrounding through the grassland habitat would lead to a low negative, temporary magnitude of effect prior to mitigation.

5.2.27 No losses to semi-natural broadleaved woodland surrounding the pond would be anticipated as a result of the underground cable option, although it is likely that increased levels of disturbance would be experienced leading to a low negative, short-term magnitude of effect.

5.2.28 In combination, the low to moderate magnitude of effects on receptors of local to County value would lead to an overall moderate negative scale of effect on ecology as a result of the underground option prior to mitigation.

Consideration of the Potential In Combination Effects of the Other Proposed Development Components

5.2.29 The potential in combination effects on ecological receptors as a result of the other Proposed Developments would not be a significant factor in determining which option should be taken forward for consultation. However, if an overhead line is selected it would avoid substantial impacts on ecology because the amount of habitat removal and disturbance required would be minimised, in comparison to the undergrounding option.

Potential for Mitigation

5.2.30 For all connection options, existing field access points and watercourse crossings would be used for works traffic wherever possible and standard environmental protection measures implemented. This would include timing works to avoid sensitive periods, preventing work activities from encroaching onto retained habitats and the implementation of pollution control methods.

5.2.31 Where appropriate, prior to habitat clearance works, licensed temporary exclusion methods would be used to prevent death or injury to protected species, such as dormice, great crested newt and water vole if present.

Overhead Line Option

5.2.32 Installing an overhead line (using either of the two connection options) would substantially avoid impacting on ecology, with impacts largely restricted to minor hedgerow tree loss and temporary effects on arable and pasture fields during construction. The losses of any mature trees would be minimal. Where hedgerow trees would be impacted, pollarding or coppicing of these could be undertaken to avoid losses and habitat fragmentation. The use of existing field access routes and standard protection measures during construction activities to prevent encroachment of works and pollution/run-off entering ditches would also reduce effects. Although effects would be reduced, the overall scale of effects on ecology from any of the overhead line options would remain in the minor negative category.

Underground Cable Route

5.2.33 The underground cable option would result in losses in hedgerow habitat and damage to bankside habitat at route crossings. Impacts on protected species, including bats, dormice and water voles, would likely occur. Temporary measures could be adopted to reduce fragmentation effects in the short-term and habitat reinstatement, including hedgerow planting, could reduce longer-term effects.

5.2.34 Working areas would be minimised when crossing valued habitat features to avoid or reduce impacts, habitats within the permanent easement would be reinstated on completion of works (with the exception of trees), although varying establishment periods will apply and the loss of mature trees cannot be mitigated within a reasonable timeframe.

5.2.35 Temporary fragmentation impacts on bats and dormouse (if present) caused by hedgerow removal could be mitigated through the use of aerial bridges (across short distances). Where hedgerow losses are likely to impact on important bat flyways or important dormouse connections, then ducting could be used to install the underground cables which could minimise disruption to hedgerows.

5.2.36 Measures would be taken to ensure that drainage conditions outside the permanent easement are unaltered, which would be particularly important where the route runs adjacent to SNCI designations.

5.2.37 Overall, with the adoption of mitigation and the undertaking of compensatory measures, it is considered that residual impacts on ecology from the underground cable route would result in a minor negative scale of effects.

Ecology Conclusion

5.2.38 Substantial impacts can be avoided with all of the connection options resulting in only minor negative scale of effect following mitigation. However, there is a preference for either of the overhead line design options compared to the underground cable option as these avoid more ecological impacts prior to mitigation. There would be no notable difference in the scale of ecological effects between the two proposed overhead line connection options.

5.3 Environment – Historic Environment

5.3.1 In appraising the effects on the historic environment, we have gathered baseline data from study areas that vary in size according to the sensitivity of the receptors. Data regarding Scheduled Monuments, Grade I and II* Listed Buildings, and Grade I Registered Parks and Gardens has been gathered from within 10km of the route options. Data regarding Grade II Listed Buildings, Grade II* and II Registered Parks and

Gardens, Conservation Areas, and Registered Battlefields has been gathered from within 2km of the route options. Data regarding non-designated heritage receptors has been gathered from within 100m of the route options. Data regarding non-designated receptors of equivalent sensitivity to designated receptors has been collected, primarily through consultation, from the same study areas as apply to the designated receptors This area will be referred to as the 'historic environment appraisal area'.

Historic Environment Baseline

5.3.2 There are no Listed Buildings within 250m of the proposed route.

5.3.3 Two Grade I Listed Buildings have settings that include the proposed route. St Saviour's Church is located within the historic core of Puxton village, approximately 700m north of the existing AT Route 132kV overhead line, which is partially visible above vegetation screening from five intervening hedge lines, across the flat, open landscape. St. Andrew's Church, Banwell, is enclosed by adjacent mature trees and buildings, but an extension plot of its churchyard has views across the North Somerset Levels, including the proposed route, approximately 2km away. The churchyard is approximately 10m higher than ground level at the proposed route. These two receptors are of very high sensitivity.

5.3.4 No Grade II* Listed buildings have settings that include the proposed route.

5.3.5 One Grade II Listed Building has a setting that includes the proposed route. A Grade II Listed outhouse adjacent to Puxton Moor Farmhouse has views southwest including the existing AT Route 132kV overhead line, which passes approximately 280m away. This view is obscured by a high hedge line adjacent to the receptor, and other vegetation screening. This receptor is of high sensitivity.

5.3.6 There are two Scheduled Monuments whose setting would include the proposed route. The setting of Nye Farm medieval moated site includes modern buildings and trees, which effectively screen it from the existing F Route 132kV overhead line, approximately 200m away (proposed to be replaced as part of the new 400kV connection between Bridgwater and Seabank near Avonmouth). The second Scheduled Monument is a former medieval farmstead located near Gout House Farm, south of East Rolstone. This receptor comprises an area of raised ground ('island') surrounded by a ditch, which has yielded Roman as well as medieval remains. Its setting is the North Somerset Moors divided into irregular pastures, bounded by 'rhynes' and hedgerows. The existing 132kV F Route overhead line forms a very minor element of this receptor's setting, being approximately 1.2km to the east. These two Scheduled Monuments are both of very high sensitivity.

5.3.7 One Conservation Area has a setting that would include the proposed route. Banwell Conservation Area is largely contained within a dip between hills, and is predominately a streetscape in character, with some fields and wooded areas on the outskirts. Since it rises to approximately 22m AOD (above Ordnance Datum), some points have views across much of the surrounding landscape, including the proposed route approximately 1.9km to the north-west. This receptor is of moderate sensitivity.

5.3.8 No Registered Parks and Gardens or Registered Battlefields have a setting that includes the proposed route.

5.3.9 No non-designated receptors within 10km of the proposed route have been identified being demonstrably of equivalent sensitivity to designated heritage assets (i.e. potentially of Listable or Designatable quality).

5.3.10 There are five non-designated heritage receptors within 100m of the proposed route recorded in the North Somerset Historic Environment Record (HER). Remains of medieval enclosures are recorded west of the proposed connection with the AT Route,

in the vicinity of Puxton Road and Box Bush Lane. Also in the northern part of the proposed route, a Roman pottery scatter has been located in a field north of Havage Drove. A scatter of medieval pottery and stone artefacts has been recovered from north of Nye Drove, and the site of a possible medieval building is located south of Nye Drove, west of Rookery Farm (which is itself a 'historic core settlement'). The rhyne that runs adjacent to Nye Drove has been suggested to be of medieval origin (Liddy Yeo, Banwell Marsh). The wider landscape contains undated prehistoric earthwork mounds and evidence of Roman occupation. There is moderate potential for encountering previously unknown archaeological remains elsewhere along the route corridor.

5.3.11 The historic landscape character of the route corridor is characterised in the North Somerset Historic Landscape Characterisation as being derived predominately from the enclosure of anciently reclaimed inland moors during the Post-medieval (15th - 17th century) period, although it extends a short distance into a medieval zone near Sandford. The northern part of the route is within a zone (including Rolstone and East Rolstone) in which the enclosure formed irregular fields. The remainder of the route crosses a large zone in which this enclosure was more organised and regular in form, although there is a small zone west of Nye Farm that is characterised by irregular enclosure. The southern end of the route corridor (<150m) extends into a zone characterised as being of late medieval enclosed open fields, created by local arrangement and exchange. The post-medieval historic landscape zones are of low sensitivity, while the later medieval zone around Sandwell is of moderate sensitivity.

5.3.12 Hedgerows associated with the Scheduled Monuments at Nye Farm and Gout House Farm, Banwell Conservation Area, the historic core of Puxton village, parish boundaries, or any archaeological sites described in the HER, may all be regarded as 'important' (cf. Hedgerow Act, 1997). 'Important' hedgerows are receptors of low sensitivity.

Assessment of Effects

Effects Equal for the Two Overhead Line Options

5.3.13 The two overhead line options would result in negligible magnitude negative effects on Banwell Conservation Area as a result of changes to its setting. The proposed route would be visible from the higher streets and dwellings on the western side of the Conservation Area, which have views across a wide area extending to the Bristol Channel. This setting incorporates a palimpsest of numerous elements from different historic periods, including modern energy infrastructure, of which the proposals would form a very minor addition. For both options, the magnitude of effect would be reduced by the distance of separation. The magnitude of effect of the steel lattice pylon option would be reduced by the benefit from backgrounding caused by the lattice pylon's permeability. However, the magnitude of effect of the steel lattice pylon option would be increased due to their greater height.

5.3.14 For both options, there is potential for negative effects on buried archaeological remains at ancillary work locations (including access tracks). The magnitude of effect would be high - low on receptors of moderate - negligible sensitivity.

5.3.15 For both options, improvements to the road network necessary for construction activities could cause negative effects to historic landscape elements such as 'important' hedgerows and historic lanes. The magnitude of these effects would be low on receptors of low sensitivity.

Effects That Differ Between the Two Overhead Line Options

5.3.16 The steel lattice pylon option and steel monopole option would result in negligible magnitude negative effects on the Grade I Listed St. Saviour's Church, Puxton, as a result of changes to its setting. The proposed route would connect with the AT route approximately 700m away. For both options, the magnitude of effect would be reduced by partial vegetation screening and the presence in the foreground of the view of the existing AT route, which already forms part of the receptor's setting. The permeability of the steel lattice pylon option would result in a reduction in magnitude of effect, due to backgrounding against surrounding topography. However, the magnitude of effect of the steel lattice pylon would be increased relative to the steel monopole option due to its greater height and consequent decreased benefit from screening by vegetation adjacent to the receptor.

5.3.17 The steel lattice pylon option and steel monopole option would result in negligible magnitude negative effects on the Grade I Listed St. Andrew's Church, Banwell, as a result of changes to its setting. The proposed route would connect with the new Sandford substation approximately 2km away. For both options, the magnitude of effect would be reduced by the distance of separation. The magnitude of effect of the steel lattice pylon option would be reduced by the benefit from backgrounding caused by the lattice pylon's permeability.

5.3.18 The steel lattice pylon option and steel monopole option would result in negligible magnitude negative effects on the Grade II Listed outhouse at Puxton Moor Farmhouse as a result of changes to its setting. The new infrastructure would connect with the existing AT route approximately 425m south west of this receptor. For both options, the magnitude of effect would be reduced by existing vegetation screening and the presence in the receptor's setting of the existing AT route, closer to the receptor than the proposals. The magnitude of effect of the steel lattice pylon would be reduced by the benefit from backgrounding caused by the lattice pylon's permeability. The steel monopole option may be visible from some locations, but the magnitude of effect would be reduced as the view of most of the poles would be filtered by intervening vegetation.

5.3.19 The steel lattice pylon option and steel monopole option would result in negligible magnitude negative effects on two Scheduled Monuments as a result of changes to their settings. The proposed route would pass approximately 470m to the south-west of Nye Farm; the magnitude of the effect for all options would be reduced by screening from four hedge lines and a wooded property off Nye Drove. (Note that replacement of the nearby F Route is assessed elsewhere). The medieval farmstead at Gout House Farm is approximately 740m west of the proposed route; the magnitude of effect for both options would be reduced by screening from four hedge lines. For both receptors, the magnitude of effect would be reduced because most or all of the visible poles/pylons would be viewed in side elevation, and this effect is considerably more marked for the steel monopole option than the steel lattice pylon option. For both receptors, the magnitude of effect of the steel lattice pylon option would be reduced due to backgrounding along much of the proposed route against distant topography.

5.3.20 The steel lattice pylon option and steel monopole option would result in low magnitude negative effects on the historic landscape. Creation of a new 132kV overhead line would affect the comprehensibility and appreciability of the existing landscape of post-medieval enclosures. The magnitude of effect of the steel lattice pylon option would be greater than that of the steel monopoles due to the former's greater height, as a result of which they would be experienced over a wider area. However, when compared with the steel lattice pylons the magnitude of effect of the steel monopoles would be increased at close distances due to their greater number.

5.3.21 There is potential for both options to have negative effects on buried archaeological remains at pylon locations and ancillary work locations. While the area affected by

pylons is small, they may be placed in an area of high potential near Rookery Farm (Nye Drove), as well as areas of moderate potential elsewhere. The steel monopoles would be more frequent than the steel lattice pylons (26 compared to 9 steel lattice pylons). However, the steel lattice pylon option would result in the most widespread negative effects on archaeological remains because their construction would require a larger working area at each pylon site. This would result in effects (on moderate - negligible sensitivity receptors) of low - negligible magnitude for the steel monopole compared to moderate - negligible magnitude for steel lattice towers.

Effects of the Underground Cable Option

5.3.22 The underground cable option would have no effect on Listed Buildings, Scheduled Monuments or Conservation Areas.

5.3.23 The underground cable option would result in negative effects on buried archaeological remains. This includes a medieval rhyne, a scatter of medieval pottery and flint artefacts, and a scatter of Roman pottery. The potential for encountering previously unknown archaeological remains is moderate throughout the route corridor. The magnitude of effect of the underground cable option on buried archaeological remains would be high - moderate on receptors of moderate - negligible sensitivity.

Consideration of the Potential In Combination Effects of the Other Proposed Development Components

5.3.24 The potential in combination effects of the other Proposed Developments would not make a difference to which option should be taken forward for consultation. We have reached this view on the basis that if an underground route is selected, the impact on the historic environment would be a direct result of the undergrounding works and not the in combination effects of the other Proposed Developments.

5.3.25 If an overhead line is selected it would have the benefit of limiting the effects on archaeology and would therefore outweigh any in combination effects that may arise from constructing an overhead line for the new AT Route connection in the vicinity of the other Proposed Developments. Therefore, overall, there is no preference from an historic environment perspective for a particular option when taking into account in combination effects.

Potential for Mitigation

5.3.26 Scope to mitigate effects on the setting of heritage receptors is limited. The feasibility of measures to reduce visual effects (off-site landscape planting being the primary measure) cannot be guaranteed at this stage of the assessment. The scale of effect does not therefore take mitigation into account.

5.3.27 For all options, a programme of archaeological monitoring and investigation would be required to mitigate effects on buried archaeological remains. The programme would be proportionate to the level of ground disturbance and the archaeological potential of the areas where work is taking place.

5.3.28 Alternative construction designs for access roads could reduce considerably or avoid some negative physical effects on buried archaeological remains. For example, if a mobile steel trackway was employed to create access roads, this is likely to reduce or avoid the compression, truncation and dewatering likely to result from stripping and stoning. The effectiveness of this mitigation by design would depend on a variety of factors including the type of steel trackway used and the existing sub-surface conditions;

however, for the underground cable, steel monopole and steel lattice pylon options this form of design would be preferred from an historic environment perspective.

5.3.29 For all options, physical effects on historic landscape elements (i.e. physical features) could be avoided, or mitigated through archaeological recording, careful reinstatement and, in the case of some hedgerow loss, translocation or replanting (note that some hedgerow loss may not be capable of being mitigated).

Historic Environment Conclusion

5.3.30 The underground cable option would result in a greater negative scale of effect on the historic environment than either of the overhead line options, due to greater disturbance of archaeological remains. The overall scale of effect of the underground cable option would be moderate negative.

5.3.31 Both overhead line options would result in an overall minor negative scale of effect on the historic environment. The steel lattice pylon option would result in more widespread effects, because of the larger working area required at each pylon, and effects of greater magnitude than the steel monopole option

5.3.32 The steel lattice pylon and steel monopole options would have a minor negative scale of effect on Listed Buildings, including two Grade I Listed Buildings. The underground cable option would have no effect on these receptors.

5.3.33 Both overhead line options would have a minor negative scale of effect on one Conservation Area. The underground cable option would have no effect on this receptor.

5.3.34 The steel lattice pylon and steel monopole options would have a minor negative scale of effect on two Scheduled Monuments.

5.3.35 The underground cable option would result in more widespread effects on buried archaeological remains than both overhead line options due to the larger area that would be disturbed. The overall scale of effect of the underground cable option would be moderate negative, including effects on four known receptors and two areas of high potential.

5.3.36 The steel lattice pylon option would result in greater disturbance of archaeological remains than the steel monopole option. This would lead to more widespread effects and may lead to a greater negative scale of effect. The scale of effect of the steel lattice pylon option would be neutral – moderate negative, whereas for the steel monopole option the scale of effect would be neutral – minor negative.

5.3.37 All three options (overhead and underground) would result an overall minor negative scale of effect on the historic landscape. For the underground cable option, this would be caused by removal of hedgerows, which may not be capable of mitigation. For the overhead line, this would be caused by the addition of new infrastructure to the landscape.

5.3.38 Mitigation of the indirect visual effects of the overhead line options cannot be guaranteed at this stage of assessment, but these effects are reversible (lasting the lifetime of the infrastructure). While mitigation of negative effects on buried archaeological remains and historic landscape elements is achievable, preservation *in situ* is preferred. This is because they are permanent effects on a finite, non-renewable resource, and because investigation and recording can never capture the entire 'significance' (i.e. research value) of archaeological receptors. The underground cable option would require considerably more mitigation with respect to undesignated heritage receptors, and result in greater direct physical effects (as opposed to indirect visual effects) than the overhead line option. The effects of the underground cable option and the overhead line option are very different in relation to heritage receptors, and a clear

comparison cannot be made. However, given the high probability of direct, permanent effects and more substantial mitigation requirements, the scale of effect is considered to be greater for the underground cable option than for the overhead line option.

5.4 Socio economic – Economic activity

5.4.1 For the purposes of this report, the study area for the appraisal extended 250 metres from the proposed routes.

Socio-economic Baseline

5.4.2 No internationally important socio-economic features have been identified within the study area. The study area is characterised by its location in The Somerset Levels and Moors to the north of the Mendip Hills AONB which are popular tourist attractions, with many walking and cycling routes. Of particular relevance to the AT route options appraisal is the Strawberry Line (Sustrans National Cycle Network Route 26) which is of high sensitivity, albeit it lies outside the preferred route corridor. The business resource of greatest relevance to the AT route options is Thatcher's Cider Factory at Sandford which also represents a tourist attraction. It is noted as an important local employer and contributor to the local economy. This receptor has been considered as being of moderate sensitivity. There is a mineral resource area allocation at Sandford Hill approximately 2km to the south of the start of the AT Route connection.

5.4.3 The study area includes other existing low voltage infrastructure including the WPD 132kV F, N and AT Route overhead lines.

Assessment of Effects

Overhead and Underground Routes

5.4.4 None of the overhead line or underground cable options directly conflict with the current socio-economic planning or policy context of the study area and impacts on the mineral resource area allocation at Sandford Hill are not anticipated.

5.4.5 Construction activities and surface infrastructure could reduce the amenity value of the Somerset Levels and Moors and northern areas of the AONB. However, the magnitude of this is not anticipated to affect the area's popularity within the context of tourist offerings in the region and the short connection length being considered in this option appraisal. Construction activities may have temporary low magnitude negative effects through reduced local amenity value from elevated noise levels and visual intrusion. There may also be localised low magnitude effects on access to business activities, tourism resources and local amenities; particularly Thatcher's Cider Factory, individual farms within the study area, and those in Sandford and Banwell.

5.4.6 Construction activities may result in a need to temporarily divert local PROWs to maintain access. Assuming good construction practice, these temporary low magnitude effects are not anticipated to adversely affect the routes' popularity due to the local landscape context with trees and high bushes along sections of the highway network, the short section of the overall walking/cycle routes which are proximal to the overhead lines, the presence of the existing 132kV F Route overhead lines, and potential to implement screening mitigation.

5.4.7 Localised temporary low magnitude effects on some agricultural operations during construction activities may arise. All options are located in Grade 3 agricultural land which could be considered to be one of the Best and Most Versatile (BMV) agricultural

land types (i.e. Grades 1-3a). The quantum of BMV land affected by each of the options will be small, in comparison with the overall agricultural context of the area.

Overhead Line Supported by Lattice Steel Pylons

5.4.8 Construction of the steel lattice pylons would have the greatest potential for disruption to access during construction due to the larger foundation structures and associated equipment required. Direct effects on Thatcher's Cider Orchards are not anticipated during or post construction.

5.4.9 Occasional temporary low magnitude effects from disruption to access due to maintenance activities may arise during the operational lifetime.

5.4.10 The lattice steel pylons required for this option will typically be 7 metres taller than the steel monopole option giving the greater potential for open and filtered views of the line from adjacent socio-economic receptors such as the Strawberry Line. However, existing vegetation along the Strawberry Line is likely to largely screen users from the overhead line and views are anticipated to have a negligible effect on the viability of this recreation resource.

5.4.11 This option has the least number of permanent built structures (approximately 9) within agricultural land holdings. Therefore whilst the individual pylons would have larger individual footprints, this option could reduce the potential longer term effects on the functionality of the affected agricultural land holdings. At this stage of options appraisal the operational sensitivity of the land use activities (e.g. arable or livestock) has not been considered in detail.

5.4.12 Construction is anticipated to take 6-7 months. It is estimated that 61 contractors will be on site during installation, although different specialist contractors will work on site for different durations through the construction period. Low magnitude temporary positive effects are anticipated from local expenditure by contractors during the construction period.

Overhead Line Supported by Steel Monopoles

5.4.13 Construction of the steel monopoles would have some potential for disruptions to access during construction due to the foundation structures and equipment required. Direct effects on Thatcher's Cider Orchards are not anticipated during or post construction.

5.4.14 Occasional temporary low magnitude effects from disruption to access due to maintenance activities may arise during the operational lifetime.

5.4.15 The monopoles required for this option are approximately 22m high, there would potential for visual connections with adjacent socio-economic resources. Any open and filtered views of the overhead line from the Strawberry Line are anticipated to have a negligible effect on the viability of this recreation resource.

5.4.16 This option has 26 permanent built structures including two lattice pylons within agricultural land holdings. Therefore there is potential for low magnitude long term effects on the functionality of agricultural land. At this stage of options appraisal the operational sensitivity of the land use activities (e.g. arable or livestock) has not been considered in detail.

5.4.17 Construction is anticipated to take 5-6 months. It is estimated that 47 contractors will be on site during installation, although different specialist contractors will work on site for different durations through the construction period. Low magnitude temporary positive effects are anticipated from local expenditure by contractors during the construction period.

Underground Cable

5.4.18 An underground cable is anticipated to have greater temporary construction effects than the overhead lines due to the need to dig a trench along the whole route corridor, lay the cable and import material to backfill the trench. Construction of an underground cable route is anticipated to cause disruption to access along Nye Road and to agricultural activities during this time. The effects associated with this option are considered to be low magnitude temporary effects.

5.4.19 Post-construction, visual connections will arise solely from the CSEPP, and will therefore be less than for the overhead line options. Occasional temporary low magnitude effects from disruption to access for maintenance activities may arise during the operational lifetime. No long term effects are anticipated from the underground option on the viability, popularity of any specific recreational resources identified through this study. The underground option would only have one above ground built structure within agricultural land holdings and thus have the least potential for effects on the functionality of land holdings.

5.4.20 Construction of the underground cable is anticipated to take a maximum of 9 months. Low magnitude temporary positive effects are anticipated from local expenditure by 30 contractors during the construction period.

Consideration of the Potential In Combination Effects of the Other Proposed Development Components

5.4.21 Taking into account the potential in combination effects of the other Proposed Developments in conjunction with the proposed AT route works would not further differentiate the effects identified and which option should be taken forward for consultation from a socio economic perspective.

Potential for Mitigation

5.4.22 Careful implementation of mitigation measures would be required to ensure that conflicts with North Somerset's tourism strategy and policies relating to the preservation of the Somerset Levels and Moors, agricultural land and the AONB to the south of the study area do not occur. Consultation with Thatcher's Cider and agricultural land owners is recommended to better understand the likely nature of potential effects to its operations, in order to avoid or mitigate them as far as possible. National Grid has a mechanism to appropriately compensate individuals for temporary loss of crops and for permanent easements for its infrastructure. It is anticipated that this would appropriately mitigate the loss of agricultural land and disruption to agricultural activities for each option.

5.4.23 There are a number of measures that can be put in place to mitigate the temporary construction impacts on socio-economic receptors in the area. These include:

- Routeing construction traffic to minimise disruption to local business, tourism and recreation resources.
- Where construction disrupts PROWs alternative/ diversionary routes should be provided and clearly signed.
- Adopting good construction practice to minimise noise and dust generation.
- Maximising socio-economic benefits by seeking to appoint local contractors.

5.4.24 Planting vegetative screening, by agreement, could reduce the opportunities for visual connections between users of local tourism and recreation resources and proposed and existing electricity infrastructure. Restoration and soil management techniques should

ensure that, post construction, the agricultural land along the length of the connection is restored to the same quality as prior to construction.

Socio-economic Conclusions

5.4.25 The socio-economic appraisal of the above options does not identify any effects which would be of greater than low magnitude and the majority of these are considered to be temporary. It is therefore reasonable to conclude that socio-economics should not be a primary determining factor between the overhead line and underground cable options. It is considered possible to progress all of the proposed options with only minor socio-economic impacts, provided that suitable mitigation measures are integrated into the design and construction. The socio-economic effects identified are not considered to present a risk to progression of any of the options.

5.4.26 It is assumed that effects to agricultural land would be appropriately mitigated through Western Power Distribution's compensation mechanism and construction and soil management where required. The overall scale of socio-economic effect for the AT route technology options are considered to be minor negative to neutral during both construction and operation. Underground cables are considered the most preferable option from a socio-economic perspective due to the removal of visual connections between the AT Route overhead line and socio-economic receptors in the locality and minimal long term effect on the functionality of agricultural land.

5.5 Cost Analysis

5.5.1 Both Capital and Lifetime costs are calculated for each technical option.

5.5.2 The Capital Costs have been estimated based on an engineering assessment of the route options. The lifetime costs include the costs associated with distribution losses and maintenance over a 40 year period.

5.5.3 The costs of each option are given below:

Option	Capital Cost (£m)	Lifetime Cost (£m)
Steel Lattice Pylons	£1.54	£ 1.66
Steel Monopoles	£2.66	£ 2.78
Underground Cables	£3.00	£ 3.12

5.5.4 For the steel lattice pylons and the monopoles the Lifetime cost includes a maintenance component of £0.08m and a distribution loss component of £0.04m. For the underground cable the Lifetime cost includes a maintenance component of £0.10m and a distribution loss component of £0.02m.

5.5.5 On the basis of Capital and Lifetime costs, the steel lattice pylon overhead line is the most economic. Underground cables are the least economic due to the significantly higher capital costs.

6 CONCLUSIONS AND RECOMMENDATIONS

6.1 Summary of the Appraisal Conclusions

6.1.1 An underground cable would be preferred from a landscape and views perspective compared to an overhead line connection.

6.1.2 An overhead line option would be preferred from an ecological and archaeological perspective as it avoids the negative effects of the larger construction swathe required for installing underground cables.

6.1.3 From a socio-economic perspective there are no marked differences that would favour one option in preference to the other.

6.1.4 On the basis of Capital and Lifetime costs, the steel lattice pylon overhead line is the most economic. Underground cables are the least economic due to the significantly higher capital costs.

6.1.5 In combination effects would not be a significant factor in determining which of the options should be taken forward for consultation.

6.2 Recommendation

6.2.1 In deciding whether to take forward an underground or overhead line connection for consultation, the context of the existing landscape needs to be taken into account. The proposed connection does not lie in a sensitive area (in terms of landscape designations) and it already contains overhead lines, which means they form part of the baseline conditions. The effects of an overhead line on landscape and views are not so significant so as to justify the use of underground cables. When this is taken into account, alongside the significantly higher cost of putting the line underground, which would incur capital costs approximately £1.5m higher than those of the steel lattice pylon and approximately £0.5m higher than those of the steel monopole, National Grid and WPD consider the benefits from using underground cables as an alternative to an overhead line in this location will not outweigh any extra economic, social and environmental impacts. Moreover from an ecological and archaeological perspective the larger construction swathe of underground cables would result in a greater level of effect than for the overhead line options.

6.2.2 Having concluded that the use of underground cables is not justified in this area a comparison then needs to be made between the two overhead line options.

6.2.3 Whilst the steel monopoles are lower in height than the steel lattice pylons (approximately 22 metres compared to approximately 29 metres), there would be three times the number of monopoles in the landscape compared to the steel lattice structures. The use of monopoles would also require two separate sets of overhead lines extending across the landscape in parallel approximately 25 metres apart, whereas a steel lattice pylon would only require one set of lines. The steel lattice structures also have greater permeability than the monopoles allowing views of background features to seen through the pylons. Steel lattice pylons are already present in the landscape on the existing AT Route and F Route. As a result, the scale of change would be minimised by using steel lattice pylons compared to monopoles. Furthermore, a key factor in deciding which overhead line technology to take forward to consultation is that steel lattice pylons would cost approximately £1M less than steel monopoles.

6.2.4 On the basis of the above environmental and socio economic assessments, including the potential in combination effects of the Proposed Developments in the vicinity of the

AT Route, together with the cost estimates, National Grid and WPD consider that steel lattice pylons are the preferred option for the Section 42/47 consultation stage

FIGURE 1

PLAN SHOWING THE PREFERRED ROUTE CORRIDOR

AT ROUTE 132kV PREFERRED ROUTE CORRIDOR

PROPOSED AREA FOR SUBSTATION AND CABLE SEALING END

PROPOSED N ROUTE 132kV OVERHEAD LINE ALIGNMENT

Key

Proposed Infrastructure

- Proposed 400kV Overhead Line Alignment
- Proposed 132kV Overhead Line Alignment
- Proposed 132kV Temporary Overhead Line Alignment
- Proposed 400kV Underground Cable Alignment
- Proposed 132kV Underground Cable Easement
- Proposed Sandford 400/132kV Substation and Cable Sealing End Compound Works
- Proposed Compound / Laydown Area
- Preferred Route Corridor
- 132kV Preferred Route Corridor

Existing Infrastructure

- Existing Western Power Distribution Overhead Line on Pylons
- Existing Western Power Distribution 132kV Overhead Line for Removal

Section Boundary

- Section Boundary

Environmental Constraints

- Area of Outstanding Natural Beauty
- Special Area of Conservation
- Site of Special Scientific Interest
- Site of Special Scientific Interest (Ditches and Rhynes)
- Scheduled Monument
- Historic Building (Listed I, II* & II)
- Conservation Area
- Local Nature Reserve
- Woodland

The following environmental constraints do not occur:
- World Heritage Site
- National Park
- Ramsar
- Special Protection Area
- Registered Park and Garden
- Registered Battlefield
- Heritage Coast
- Protected Wreck
- Airfield/Airport

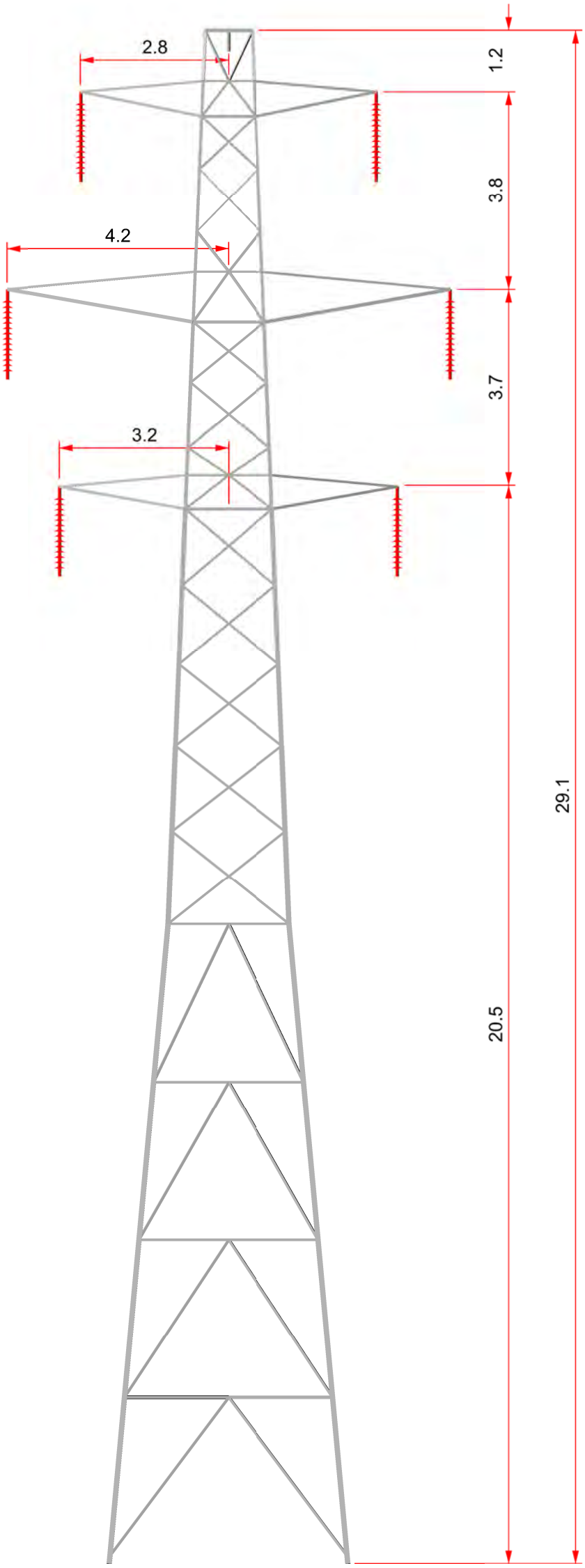
Metres
0 200 400 800

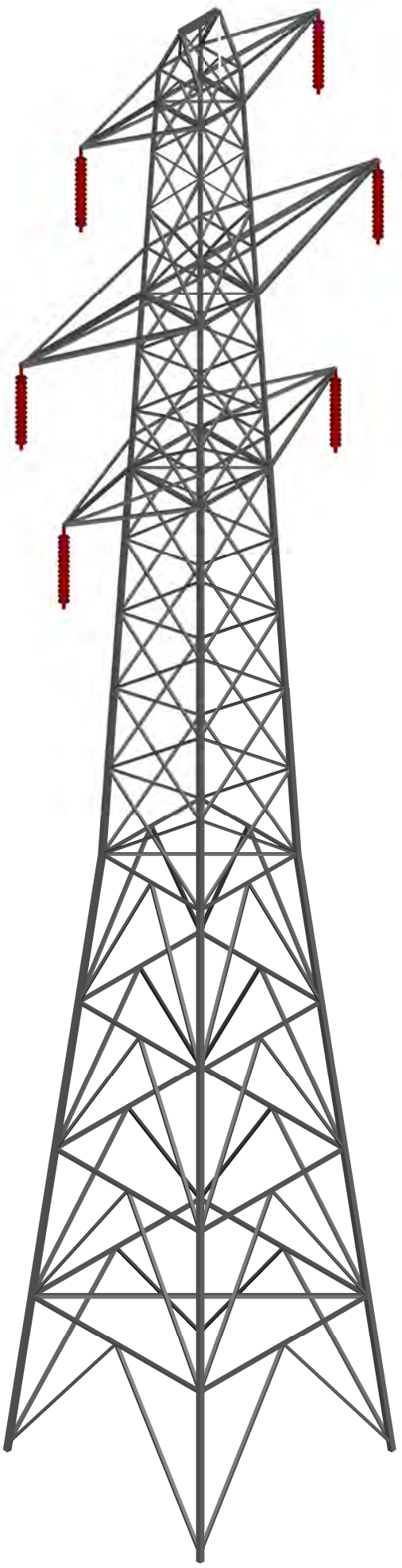
G1979.1741

FIGURE 2

ELEVATION DRAWINGS OF STEEL LATTICE PYLONS AND STEEL MONOPOLES

DESCRIPTION	FIRST ISSUE			
REV A	DATE 07/06/2013	BY CFK	CHKD --	APPD --





General Notes:
1. All dimensions in metres

CLIENT: National Grid	TITLE: L4m D E3 Tower	SCALE: 1:100 (UNLESS OTHERWISE STATED)	DESIGNED: A4
PROJECT: NG WPD WORKS AT ROUTE DIVERSION		DATE: 07/06/2013	CHECKED: --
		DRAWN: CFK	APPROVED: --
		ORIGINAL SIZE: A4	DRAWING NUMBER: 39_12342_50
			REV: A

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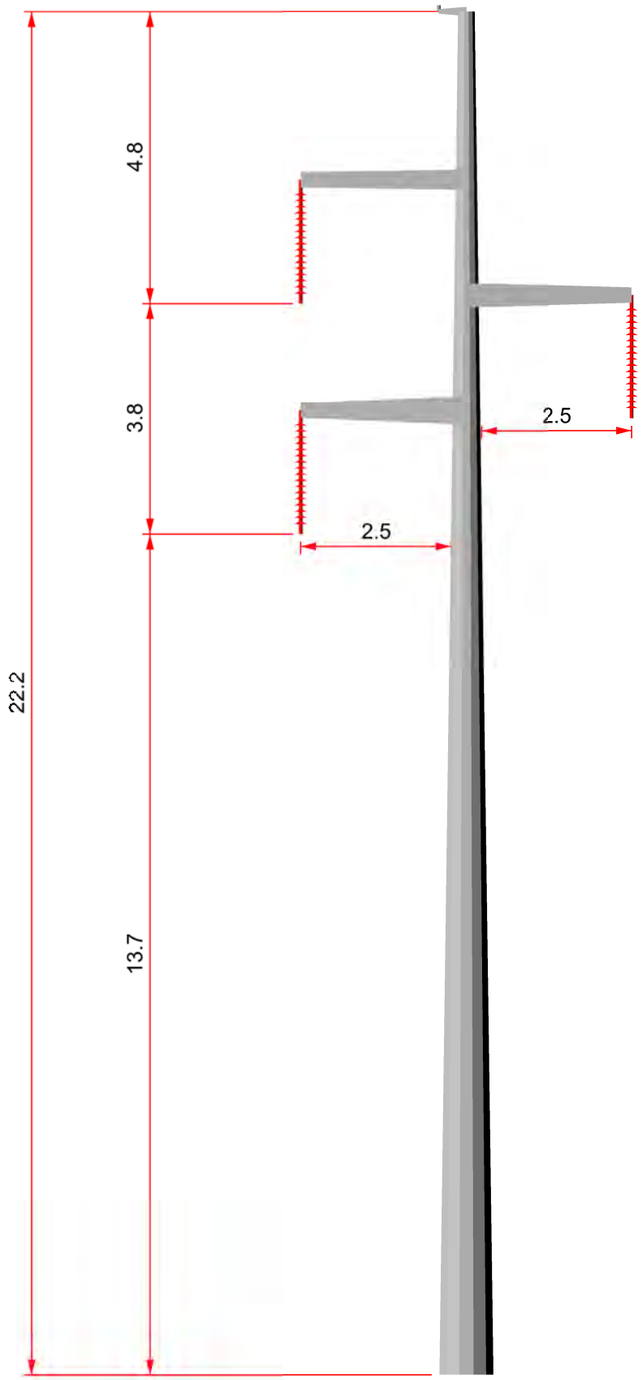
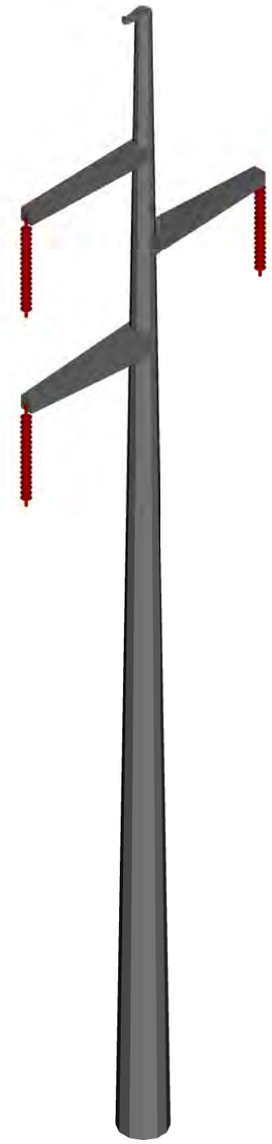
DESCRIPTION				
FIRST ISSUE				
REV	DATE	BY	CHKD	APPD
A	25/04/2013	CFK	GY	GY
DESCRIPTION				
WATERMARK MOVED TO GENERAL NOTES				
REV	DATE	BY	CHKD	APPD
B	24/07/2013	CFK	GY	GY





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GENERAL NOTES:

1. All dimensions in metres
2. Structure model is conceptual only
3. Typical design for basic span of 250m

CLIENT: National Grid

PROJECT: NG WPD WORKS AT ROUTE DIVERSION

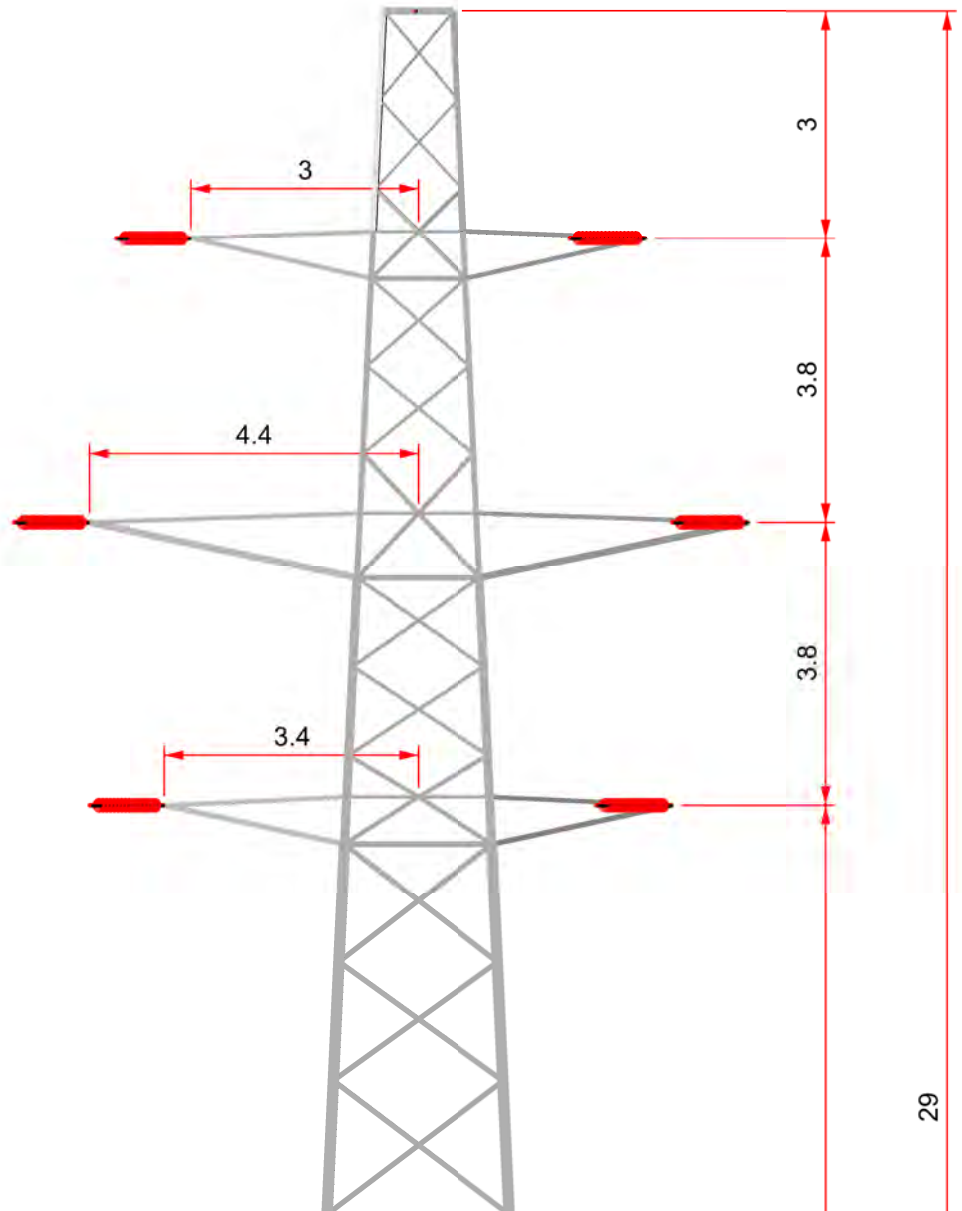
TITLE: 132kV Alternate Folded Plate Suspension Structure

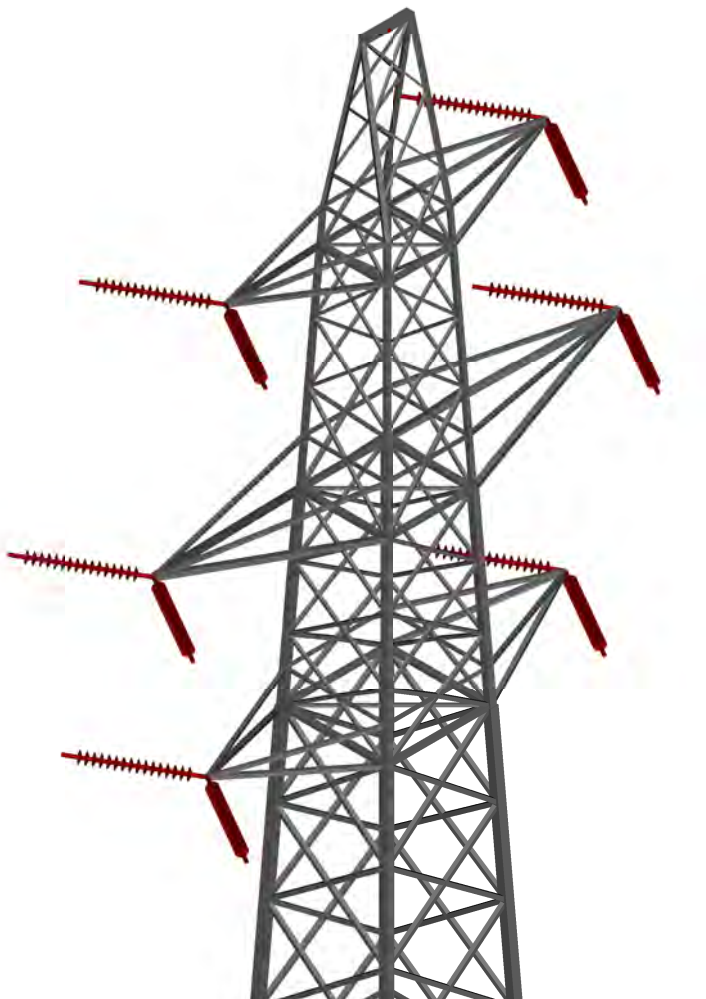
SCALE: 1:100 (UNLESS OTHERWISE STATED)		DESIGNED: --	
DATE: 25/04/2013		CHECKED: GY	
DRAWN: CFK		APPROVED: GY	
ORIGINAL SIZE: A3	DRAWING NUMBER: 39_12342_41		REV: A

FIGURE 3

ELEVATION DRAWINGS OF STEEL LATTICE ANGLE PYLONS AND A STEEL LATTICE CABLE SEALING END PLATFORM PYLON

DESCRIPTION	FIRST ISSUE			
REV A	DATE 07/06/2013	BY CFK	CHKD --	APPD --





General Notes:
1. All dimensions in metres

CLIENT: National Grid	TITLE: L4m D30 E3 Tower	SCALE: 1:100 (UNLESS OTHERWISE STATED)	DESIGNED: A4
PROJECT: NG WPD WORKS AT ROUTE DIVERSION		DATE: 07/06/2013	CHECKED: --
		DRAWN: CFK	APPROVED: --
		ORIGINAL SIZE: A4	DRAWING NUMBER: 39_12342_51
			REV: A

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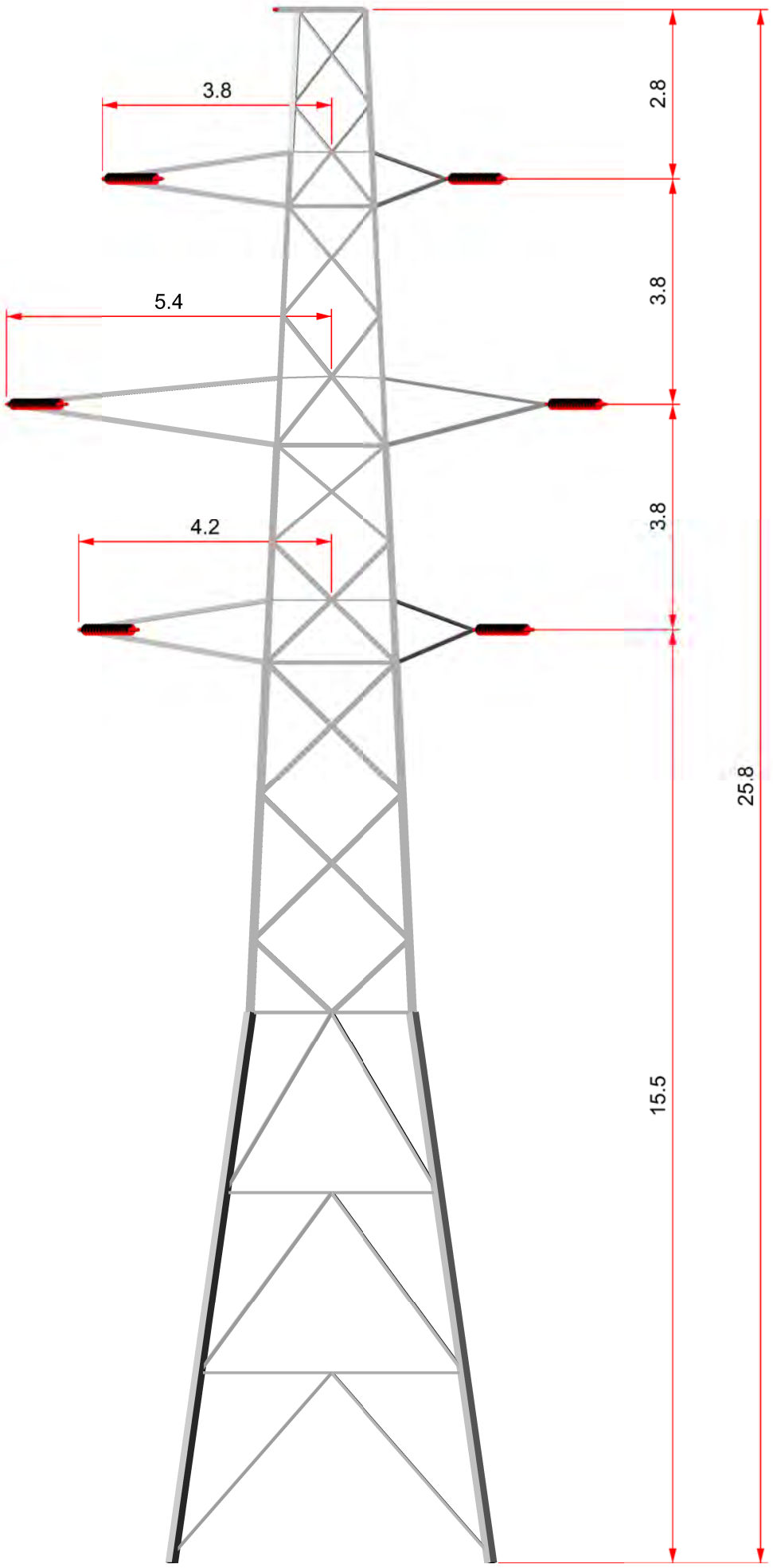
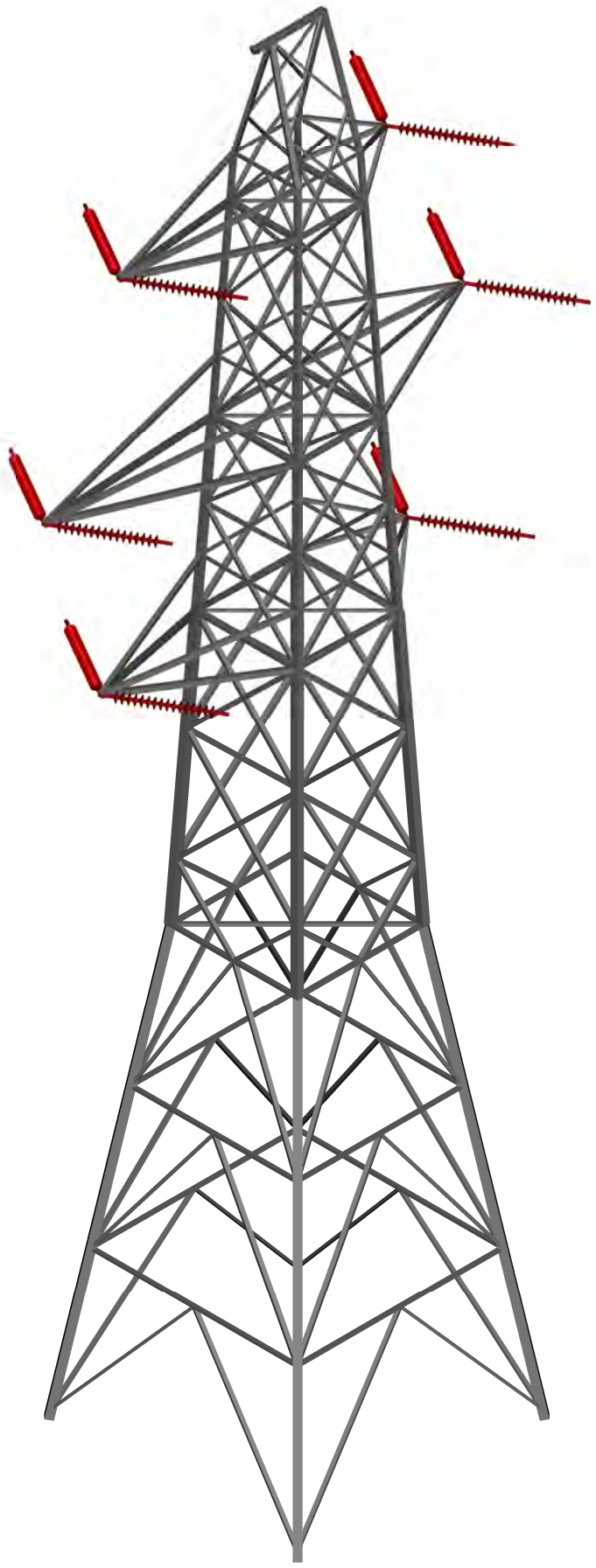
DESCRIPTION	FIRST ISSUE			
REV A	DATE 07/06/2013	BY CFK	CHKD --	APPD --





General Notes:
1. All dimensions in metres

CLIENT: National Grid	TITLE: L4m D60 STD Tower	SCALE: 1:100 (UNLESS OTHERWISE STATED)	DESIGNED: A4
PROJECT: NG WPD WORKS AT ROUTE DIVERSION		DATE: 07/06/2013	CHECKED: --
		DRAWN: CFK	APPROVED: --
		ORIGINAL SIZE: A4	DRAWING NUMBER: 39_12342_52
			REV: A

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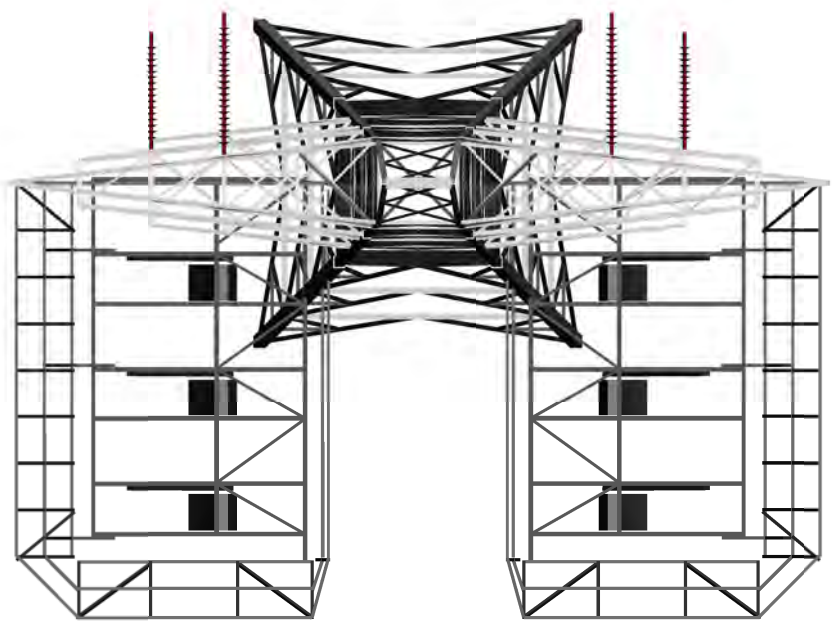
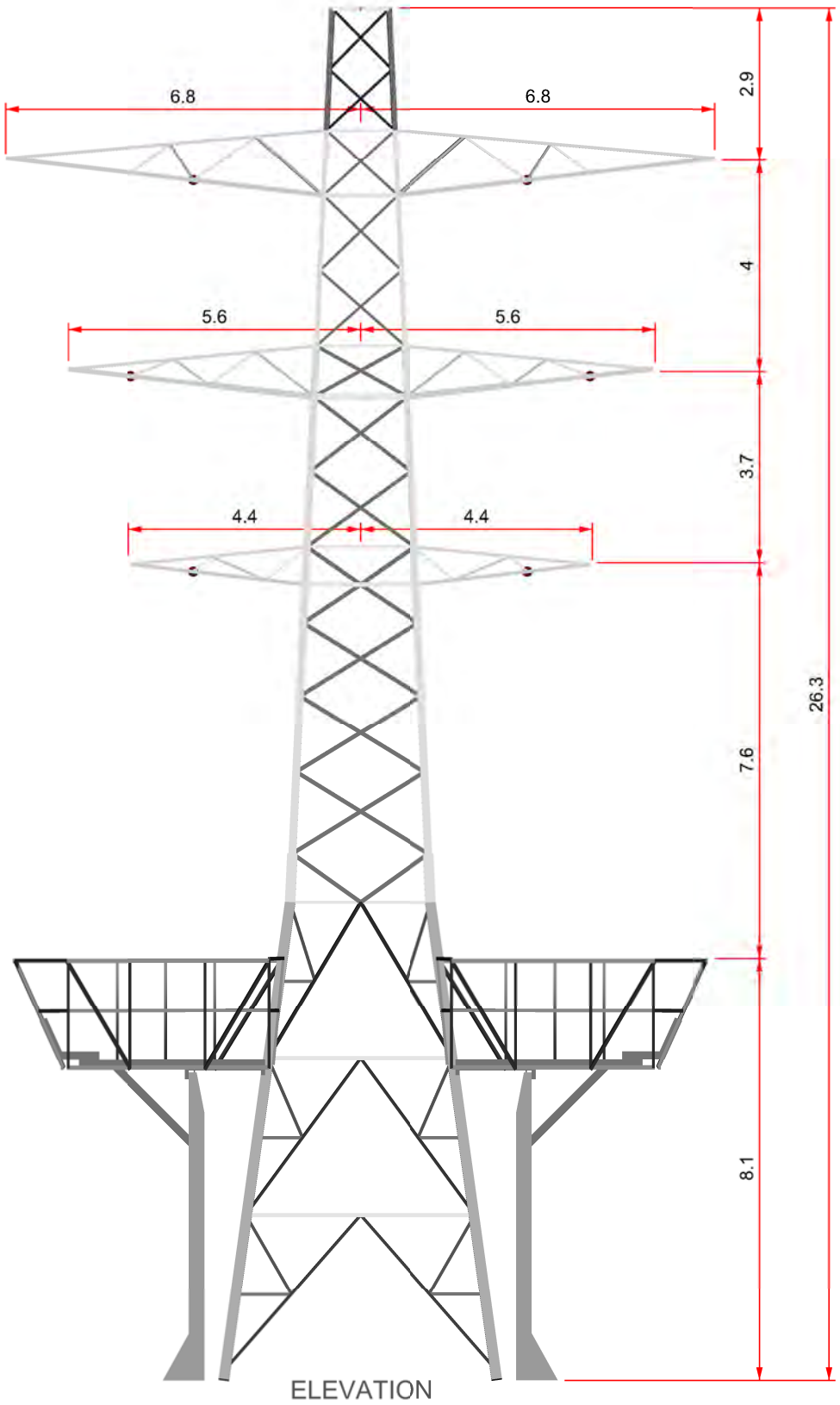
DESCRIPTION				
	FIRST ISSUE			
REV	DATE	BY	CHKD	APPD
A	19/06/2013	LK	CFK	--

General Notes:

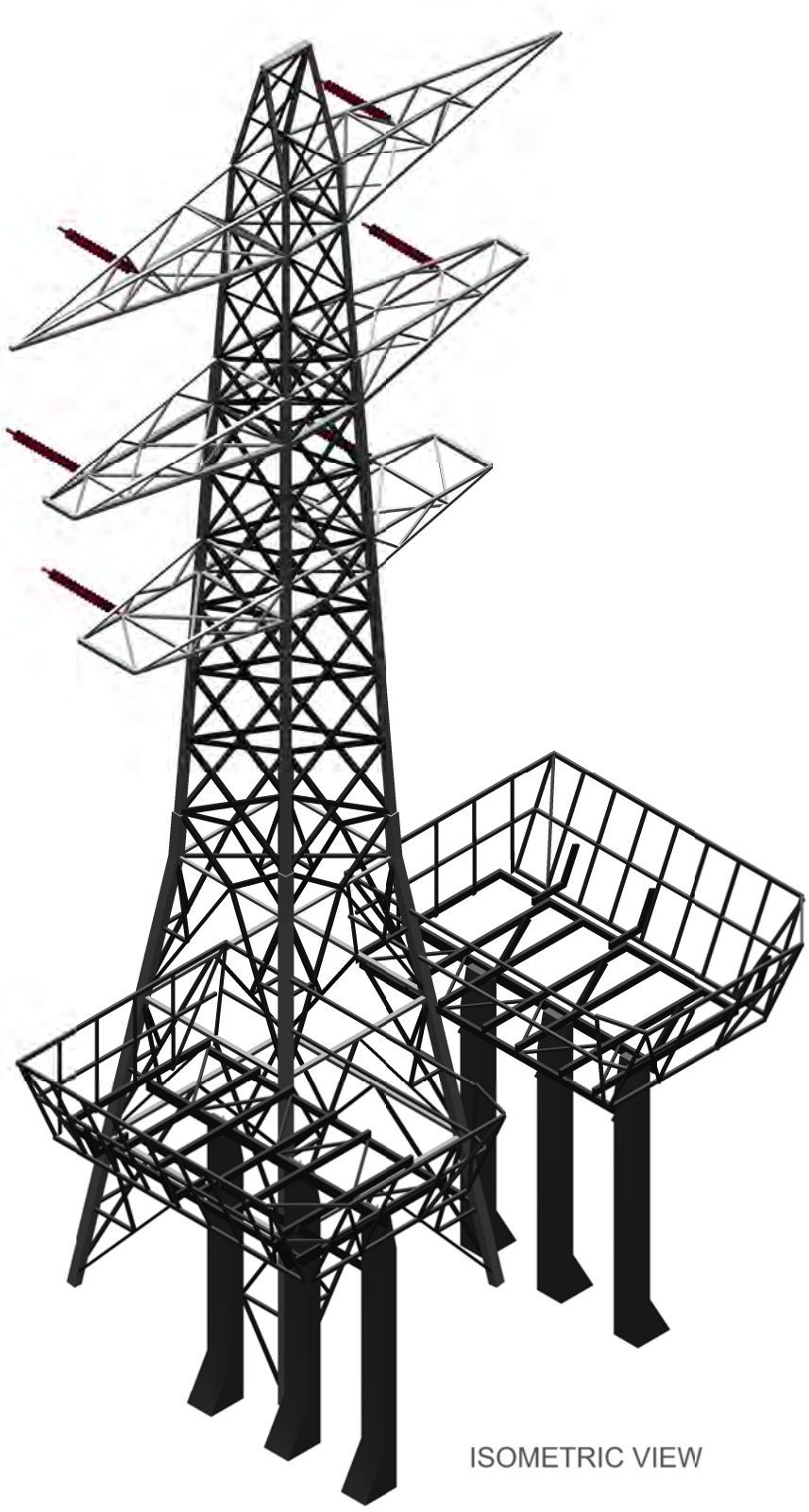
1. All dimensions in metres



PLAN



ELEVATION



ISOMETRIC VIEW

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CLIENT

National Grid

PROJECT

NG WPD WORKS
AT ROUTE DIVERSION

TITLE

L4m DT STD Tower
with SEP

SCALE	DESIGNED
1:125 (UNLESS OTHERWISE STATED)	--
DATE: 19/06/2013	CHECKED: CFK
DRAWN: LK	APPROVED: --

ORIGINAL SIZE	DRAWING NUMBER	REV
A3	39_12342_55	A

FIGURE 4

ROUTE PLANS OF THE THREE OPTIONS (STEEL LATTICE PYLONS, STEEL MONOPOLES AND UNDERGROUND CABLES)

DESCRIPTION				
FIRST ISSUE				
REV	DATE	BY	CHKD	APPD
A	06/11/2012	JY	GY	--

AT25R
L7c DT STD

250.5

AT25
(TO BE REMOVED)

L4m
D60 STD

AT26

AT27

AT28

F69

300

L4m
D E3

300

F70

L4m
D E3

F71

300

L4m
D E3

F72

CLD42

290

L4m
D30 E3

300

CLD41

F73

L4m
D E3

270

CLD40

218

F74

L4m
DT E3
SEP

CABLE

CLD39

CLIENT	TITLE	SCALE: NTS (UNLESS OTHERWISE STATED)	DESIGNED: --
	TOWER OPTION AT ROUTE DIVERSION FROM TOWER AT25R TO SANDFORD SUBSTATION	DATE: 06/11/2012	CHECKED: GY
		DRAWN: JY	APPROVED: --
PROJECT 132kV OHL MODIFICATIONS FOR 400kV HINKLEY - SEABANK CONSTRUCTION		ORIGINAL SIZE: A3	DRAWING NUMBER: 31/12342/11 Sht 2 — REV: A

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DESCRIPTION				
	FIRST ISSUE			
REV	DATE	BY	CHKD	APPD
A	24/05/13	LK	CFK	GY
DESCRIPTION				
	OS MAPPING ADDED			
REV	DATE	BY	CHKD	APPD
B	19/07/13	LK	CFK	GY

AT25R
L7c DT E3

112.7

AT25
(TO BE
REMOVED)

AT26

AT27

AT28

1

199.9

2

200

3

200

2 SINGLE CIRCUIT ROUTES
AT 25m. SEPARATION

4

200

5

200

6

200

7

200

8

188.2

9

177.8

148.4

10

148.2

11

L4m
DT E3
SEP

12

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CLIENT

NATIONAL GRID

PROJECT

132kV OHL MODIFICATIONS FOR
400kV HINKLEY - SEABANK
CONSTRUCTION

TITLE

ALTERNATE FOLDED PLATE
OPTION
AT ROUTE DIVERSION
FROM TOWER AT25R
TO SANDFORD SUBSTATION

SCALE	1 : 5000 (UNLESS OTHERWISE STATED)
DESIGNED	--
DATE	24/05/13
CHECKED	CFK
DRAWN	LK
APPROVED	GY
ORIGINAL SIZE	A3
DRAWING NUMBER	31_12342_48
REV	B

DESCRIPTION				
FIRST ISSUE				
REV	DATE	BY	CHKD	APPD
A	02/11/2012	JY	GY	--

AT25

AT26
(TO BE REMOVED)

AT26R
L7c DT STD

AT27

AT28

F69

F70

F71

F72

F73

F74

CLD42

CLD41

CLD40

CLD39

CABLE

CLIENT: NATIONAL GRID	TITLE: CABLE OPTION AT ROUTE DIVERSION FROM TOWER AT26R TO SANDFORD SUBSTATION	SCALE: NTS (UNLESS OTHERWISE STATED)	DESIGNED: --
		DATE: 02/11/2012	CHECKED: GY
PROJECT: 132kV OHL MODIFICATIONS FOR 400kV HINKLEY - SEABANK CONSTRUCTION		DRAWN: JY	APPROVED: --
		ORIGINAL SIZE: A3	DRAWING NUMBER: 31/12342/12 Sht 2
			REV: A

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APPENDIX A

POLICY BACKGROUND

Appendix A **POLICY BACKGROUND**

A.1 National Policy Statements

A.1.1. The context for any options appraisal relating to energy infrastructure is provided by the Overarching National Policy Statement for Energy (EN-1). This states that in considering any proposed development, and in particular when weighing its adverse impacts against its benefits, the Infrastructure Planning Commission (IPC)16 should take into account:

- its potential benefits including its contribution to meeting the need for energy infrastructure, job creation and any long term or wider benefits; and
- its potential adverse impacts, including any long term and cumulative adverse impacts, as well as any measures to avoid, reduce or compensate for any adverse impacts.

A.1.2. It goes on to note that, in this context, the IPC should take into account environmental, social and economic benefits and adverse impacts, at national, regional and local levels. EN-1 provides guidance on assessment on a topic basis relevant to all energy projects which is supplemented by guidance specific to the project type. EN-1 recognises that "in most cases, there will be more than one technological approach by which it is possible to make such a connection or reinforce the network (for example, by overhead line or underground cable) and the costs and benefits of these alternatives should be properly considered as set out in EN-5 (in particular section 2.8) before any overhead line proposal is consented." (EN-1 paragraph 3.7.10).

A.1.3. In the case of the Hinkley Point C Connection, the relevant guidance for electricity transmission connections is to be found in the National Policy Statement for Electricity Networks Infrastructure (EN-5). Paragraph 2.8.2 of the Electricity Networks National Policy Statement (EN-5) states that:

A.1.4. "Government does not believe that development of overhead lines is generally incompatible in principle with developers' statutory duty under section 9 of the Electricity Act to have regard to amenity and to mitigate impacts. In practice new above ground electricity lines, whether supported by lattice steel towers/pylons or wooden poles, can give rise to adverse landscape and visual impacts, dependent upon their scale, siting, degree of screening and the nature of the landscape and local environment through which they are routed. For the most part these impacts can be mitigated, however at particularly sensitive locations the potential adverse landscape and visual impacts of an overhead line proposal may make it unacceptable in planning terms, taking account of the specific local environment and context."

A.1.5. EN-5 also says that although Government expects that overhead lines will often be appropriate and their effects can often be mitigated:

> *"Where there are serious concerns about the potential adverse landscape and visual effects of a proposed overhead line, the IPC will have to balance these against other relevant factors, including the need for the proposed infrastructure, the availability and cost of alternative sites and routes and methods of installation (including undergrounding)".*

[16] The functions of the IPC were transferred to the Planning Inspectorate in April 2012

A.1.6. EN-5 states that consent should only be refused for overhead line proposals in favour of an underground line if "…the benefits from the non-overhead line alternative will clearly outweigh any extra economic, social and environmental impacts and the technical difficulties are surmountable". In this context it should consider:

- the landscape in which the proposed line will be set, (in particular, the impact on residential areas, and those of natural beauty or historic importance such as National Parks, AONBs and the Broads);
- the additional cost of any undergrounding; and
- the environmental and archaeological consequences of undergrounding.

A.1.7. The options appraisal that has been undertaken for the AT Route includes consideration of these particular factors in reaching a recommendation on where undergrounding can be justified.

A.1.8. EN-5 does not seek to define "particularly sensitive locations". However, in proximity to the Preferred Route Corridor for the new AT Route connection, the only area which might clearly be considered to be particularly sensitive is the Mendip Hills AONB, which is nationally designated and lies some 0.5km to the south of the proposed substation and the start of the route corridor.

A.2 National Planning Policy Framework

A.2.1. The National Planning Policy Framework17 (NPPF) may be considered as an "important and relevant"18 matter in decision making for Nationally Significant Infrastructure Projects (NSIPs). Paragraph 6 of the NPPF states that "the purpose of the planning system is to contribute to the achievement of sustainable development". It goes on to note that planning has a key role to play in "supporting the delivery of renewable and low carbon energy and associated infrastructure".

A.2.2. The Hinkley Point C Connection is intended to provide additional transmission capacity to permit the connection of wind and nuclear powered generation and thereby assist the UK to meet its renewable energy targets. While the NPPF does not include policies specifically related to electricity transmission infrastructure, it does include policies for conserving and enhancing the natural and historic environment which have been taken into account in planning and assessing potential alignments.

A.2.3. Paragraph 115 states that "great weight should be given to conserving landscape and scenic beauty in National Parks and Areas of Outstanding Natural Beauty, which have the highest status of protection in relation to landscape and scenic beauty. The conservation of wildlife and cultural heritage are important considerations in all these areas…."

[17] Department for Communities and Local Government : National Planning Policy Framework : March 2012

[18] National Planning Policy Framework paragraph 3

A.2.4. Paragraph 116 states that "planning permission should be refused for major developments in these designated areas except in exceptional circumstances and where it can be demonstrated that they are in the public interest." It goes on to state that applications for such development should be accompanied by assessments of the need for the development; the scope for meeting the need outside the designated area; and the effects of the development on landscape and recreational opportunities and the extent to which these could be mitigated.

A.2.5. Paragraph 118 calls on local planning authorities to aim to conserve and enhance biodiversity in determining planning applications by protecting nationally and internationally designated sites from development which would have an adverse effects upon them and, in all locations, by refusing development which could result in significant harm to biodiversity and which cannot be avoided or adequately mitigated or compensated. Specific mention is made of the need to protect irreplaceable habitats, including ancient woodland and veteran trees.

A.2.6. Paragraph 128 states that in determining applications, local planning authorities should require an applicant to describe the significance of any heritage assets affected, including any contribution made by their setting. Paragraph 132 states that "when considering the impact of a proposed development on the significance of a designated heritage asset, great weight should be given to the asset's conservation. The more important the asset, the greater the weight should be given during the decision making process. Significance can be harmed or lost through alteration or destruction of the heritage asset or development within its setting."

A.3 Development Plans

Regional Policy

A.3.1. The Government revoked the Regional Strategy for the South West on 20th May 2013. As a result, the strategy no longer forms part of the Development Plan.

Structure Plan Policy

A.3.2. The Government also revoked Structure Plans on 20th May 2013, and as such they no longer form part of the Development Plan.

North Somerset Replacement Local Plan

A.3.3. Whilst the North Somerset Core Strategy was adopted in April 2012, a number of policies of the North Somerset Replacement Local Plan19 are yet to be replaced. The intention is that such policies will be incorporated into the Sites & Polices Development Plan Document which is scheduled for adoption in summer 2014. The policies that remain in force, and are relevant to the proposals, include the following.

A.3.4. Policy ECH/4 seeks to achieve development that preserves a listed building's special architectural and historic interest and its setting.

A.3.5. Policy ECH/6 seeks to prevent development from causing damage to nationally important archaeological remains or their settings.

[19] North Somerset Council : North Somerset Replacement Local Plan (March 2007)

A.3.6. Policy ECH/7 aims to ensure that development does not adversely affect the particular character of a landscape.

A.3.7. Policy ECH/11 seeks to prevent development that could harm nationally or internationally protected species of flora or fauna or the habitats used by such species, unless that harm could be avoided or mitigated and the species protected by use of planning conditions or planning obligations.

A.3.8. Policy ECH/12 explains that development that is likely to have adverse effects on a Special Protection Area (SPA), Special Area of Conservation (SAC) or a Ramsar Site will not be permitted, unless adverse impacts on the integrity of the site can be avoided or there is no alternative solution and there are imperative reasons of overriding interest that enable the project to proceed.

A.3.9. Policy ECH/13 aims to protect Sites of Special Scientific Interest (SSSI) and National Nature Reserves from development that would have an adverse effect, unless other material considerations outweigh the loss of biodiversity.

A.3.10. Policy ECH/14 aims to protect wildlife and geological sites from development that would have an adverse effect, unless the importance of the development outweighs the value of the substantive interest present.

North Somerset Core Strategy

A.3.11. The North Somerset Core Strategy[20] was adopted in April 2012. The document contains a number of environmental protection policies and draws attention to the particular characteristics of the North Somerset environment.

A.3.12. Policy CS4 aims to protect and enhance biodiversity, including seeking to protect, connect and enhance important habitats, particularly designated sites, ancient woodlands and veteran trees.

A.3.13. Policy CS5 aims to protect landscape character and the historic environment.

A.3.14. Policy CS6 confirms that the boundaries of the Green Belt will remain unchanged for the plan period.

A.3.15. Policy CS9 seeks to safeguard and enhance areas of green infrastructure and, in this context, draws attention to a number of specific areas including :

A.3.16. the promotion of the north slopes of the Mendip Hills AONB as sub-regional corridors for biodiversity, recreation and landscape retention;

A.3.17. the promotion of the Congresbury Yeo, River Banwell, North Somerset Levels and Moors, and Grumblepill Rhyne as local corridors for biodiversity and landscape enhancement

A.3.18. The Proposals Map highlights the range of environmental constraints in the vicinity of the corridor including protected rhynes at Puxton Moor.

[20] North Somerset Council : Local Development Framework – Core Strategy Corrected Version : April 2012

APPENDIX B

WESTERN POWER DISTRIBUTION SCHEDULE 9 STATEMENT

Appendix B **WESTERN POWER DISTRIBUTION STATUTORY OBLIGATIONS**

B.1 **Western Power Distribution and National Grid Role and Obligations**

B.1.1. Both the distribution and transmission of electricity in Great Britain requires permission by a licence granted under Section 6(1)(b) and (c) of the Electricity Act 1989 ("the Electricity Act").

B.1.2. The legislative and regulatory framework is designed to ensure coordination and efficient investment by the distribution and transmission companies. These principles are central to the respective licences and industry codes.

B.2 **WPD Role and Obligations**

B.2.1. WPD has been granted a distribution licence and is therefore bound by the legal obligations set out in the Electricity Act and their distribution licence.

B.2.2. WPD owns and operates the distribution system in the South West, South Wales and the Midlands.

B.2.3. WPD has statutory duties to develop and maintain an efficient, coordinated and economical system of electricity distribution under Section 9 of the Electricity Act. These duties, which are documented in Standard Licence Conditions[21], are summarised in the following paragraphs.

B.2.4. Standard Condition C24 (Distribution System planning standard and quality of performance reporting) of WPD's distribution licence requires WPD to plan and develop its distribution system in accordance with standards set out in Engineering Recommendation P2/6[22].

B.2.5. P2/6 is a document that defines the minimum standards that WPD must apply when planning and operating the distribution system. The criteria include the type of faults (or breakdowns) and combinations of faults that the distribution system must be able to withstand, the impact on customers in terms of maximum level of supply interruptions, and the impacts on supply quality that are permissible.

B.2.6. P2/6 is open to industry and public scrutiny, is subject to periodic review and consultation and any changes are implemented by a change to the licence Standard Conditions and approved by the industry regulator, Ofgem[23].

B.2.7. As well as the technical standards described above, Section 38 and Schedule 9 of the Electricity Act 1989 requires WPD, when formulating proposals for new lines and other works, to:

[21] **http://epr.ofgem.gov.uk/document_fetch.php?documentid=15184**

[22] P2/6 can be purchased from www.energynetworks.org

[23] **http://www.ofgem.gov.uk/Pages/OfgemHome.aspx**

"*…have 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; and shall do what [it] reasonably can to mitigate any effect which the proposals would have on the natural beauty of the countryside or on any such flora, fauna, features, sites, buildings or objects*"[24]

B.2.8. A1.10 WPD's Schedule 9 statement25 (the "Statement") sets out how the company will meet the duty to the environment placed upon it. These commitments include:

- minimise the impact of its activities on communities and the historic and natural environment;
- only seeking to build new lines along new routes, or substations in new locations where the existing distribution system infrastructure cannot be economically upgraded to meet distribution security standards;
- where new infrastructure is required seek to avoid, where reasonably practicable, areas which are nationally or internationally designated for their landscape, wildlife or cultural significance;
- site overhead lines with care and consider both the visual impact and the impact on nature conservation as far as possible; and
- continually work with partners to selectively underground lines in appropriate sensitive locations to improve the appearance of countryside, towns or villages, whilst taking account of sites of particular archaeological or nature conservation interest.

B.2.9. Effective consultation with stakeholders and the public is also promoted by the Statement

[24] Schedule 9 of the Electricity Act (http://www.legislation.gov.uk/ukpga/1989/29/contents).

[25] WPD Schedule 9 Statement: http://www.westernpower.co.uk/getdoc/c4856406-1794-4e34-81a0-9f2b593cdd4a/schedule9.aspx

APPENDIX C

HOLFORD RULES

Appendix C **HOLFORD RULES**

C.1 **The Holford Rules**

C.1.1. The Holford Rules[26] provide specific guidance for routeing overhead lines and were applied to the identification of route alignments. They comprise of seven Rules and related explanatory and supplementary notes that primarily relate to minimising the effects on landscapes. Whilst the Rules were written to apply to overhead lines, they are also appropriate to consider when routeing underground cables. National Policy Statement EN-5[27] highlights that the Rules should be followed by developers when designing their proposals.

C.1.2. The 7 Rules on minimising landscape effects when routeing overhead lines are summarised below:

- Avoid altogether, if possible, the major areas of highest amenity value.
- Avoid smaller areas of high amenity value or scientific interest by deviation where this can be done without using too many angle towers.
- Other things being equal, choose the most direct line, with no sharp changes of direction to minimise use of angle towers.
- Choose tree and hill backgrounds in preference to sky backgrounds, wherever possible.
- Prefer moderately open valleys with woods where the apparent height of towers will be reduced and views of the line will be broken by trees.
- Where land is flat and sparsely planted, keep high voltage lines as far as possible independent of smaller lines, converging routes, distribution poles and other masts, wires and cables, to avoid 'wirescape'.
- Approach urban areas through industrial zones, where they exist.

[26] National Grid: The National Grid Company plc and new high voltage transmission lines – guidelines for line routeing (the Holford Rules) and undergrounding

[27] Paragraph h 2.8.5, National Policy Statement for Electricity Networks Infrastructure (EN-5), July 2011

APPENDIX D

LIFETIME COST METHODOLOGY

Appendix D **LIFETIME COST METHODOLOGY**

D.1 **Lifetime Costs**

D.1.1. The lifetime valuation for each of the connection options and applicable technology includes the lifetime cost of energy losses and lifetime operation and maintenance costs.

D.1.2. The following formula was used to assess the lifetime cost of each type of connection.

Total Cost, CTot = CDC + CL + COM

Where

CDC = The capital cost of the equipment, delivered, installed and commissioned

CL = The net present value of the cost of losses over the lifetime (40years) of the assets

COM = "The net present value of the typical cost of operation and maintenance over the lifetime (40 years) of the assets

D.1.3. The discount rate used in the net present value calculations, 3.5%, being the figure recommended in Her Majesty's Treasury's Green Book for discounting future benefits and costs in project appraisal.

D.1.4. For the purposes of the losses calculations the average load of circuits and SGTs has been assumed to be 65% of the peak group demand of 149MVA.

D.2 **Costs**

D.2.1. The cost used to assess losses on the system is the price of £60 per MWh as assumed by Ofgem in the Project Discovery documents.

D.2.2. The available transmission technologies, as explained in Section 3 are:

a. Overhead Lines;

b. AC Underground Cables, and

c. Gas Insulated Lines.

D.2.3. For each technology, costs comprise:

a. the capital cost of procuring, installing and commissioning the transmission or distribution lines, or substation assets;

b. the on-going costs of the electrical energy lost in overcoming the electrical resistance in the conductors; and

c. the on-going other costs of operations and maintenance.

D.2.4. Decommissioning and reinstatement costs are not included in the lifetime costs.

D.3 **Overhead Lines**

D.3.1. Overhead line designs vary by the number and cross-sectional area of the conductors used for each phase of each circuit. The requirements for 400kV and 132kV lines in this case are:

b. 400kV double-circuit 2 x 850mm^2 (resistance = 0.0184Ω/km), and

c. 132kV double-circuit 1 x 300mm^2 (resistance = 0.1Ω/km).

D.3.2. Operations and maintenance costs consist principally of the cost of repainting the transmission pylons, which is scheduled to happen every 18 years, and the costs of regular inspection both from the ground and by helicopter. The annual costs are estimated to £0.80k/km at both 400kV and 132kV.

D.4 AC Underground Cables

D.4.1. AC underground cables installations vary principally by how the cables are laid. The principal methods employed by National Grid are direct burial and deep bore tunnels.

D.4.2. The Cable requirement for a Bridgwater – Seabank connection is for two cores per phase 2500mm2 cables, 12 cables in total for two circuits (resistance = 0.0065Ω/km).

D.4.3. However with each circuit generating 20MVAr per km of capacitive gain, each circuit would require 2 x 200MVAr reactors (4 in total for two circuits). Each Reactor has 0.4MW of losses associated with it (1.6MW for 4 reactors).

D.4.4. At 132kV, 650mm2 cables are required (resistance = 0.05Ω/km)

D.4.5. O&M costs have an approximate annual cost of £2.80 k/km for 400kV and £1.5 k/km at 132kV.

D.5 Gas Insulated Lines

D.5.1. Like underground cables, gas insulated lines may be direct-buried or installed in tunnels. As with cables, tunnel installation is used where direct burial is impracticable.

a. The GIL requirement for the Bridgwater - Seabank connection is for 4000A, 2400MVA rated equipment (resistance = 0.0086Ω/km).

D.5.2. The annual maintenance costs for gas insulated lines are estimated to be £1k per km.

D.6 Supergrid Transformers

D.6.1. Losses in transformers are split into two types:

D.6.2. No load losses which are fixed and due to magnetic losses in the transformer core, and

D.6.3. Load related losses which are variable with current and due to the resistance of the copper and effect of eddy currents.

D.6.4. The annual maintenance costs for transformers are estimated to be £5k per transformer.

D.7 Substations (GSP)

D.7.1. Substations form the hubs at which transmission circuits and supergrid transformers meet. They are installations which are generally compact. Transmission losses in

substations are assumed to be negligible but annual maintenance costs are estimated to be £50k per GSP.

D.8 Calculation of the Cost of Transmission Circuit Losses

D.8.1. The cost of transmission losses are calculated as follows:

Step 1: Calculate the Average Circuit Loading

Peak Circuit Power Flow * Average Circuit Utilisation (34%)

Generic Example: 3100MW x 0.34% peak load would be 1054MW Average Loading

Step 2: Calculate the Average Loading per Circuit in KW:

Average Loading per Circuit kW =

(Average Loading (MW) / number of circuits) * 1000 (to convert to kW)

There are 2 circuits in most cases.

Example: (1054MW / 2) x 1000 = 527,000 kW

Step 3: Calculate the Average Current per Circuit in Amps:

I = Average Loading Per Circuit kW / (√3 X Operating Voltage in kV)

Operating Voltage 400kV or 275kV

Example: 527,000/ (√3 x 400) = 760.7 Amps

Step 4: Calculate the Resistance per Circuit:

R = resistance/km * circuit length kms

Example: 2 x 850mm Overhead Line = 0.0184Ω/km x 60km = 1.104 Ω

Step 5: Calculate the Three Phase Lost Power per Circuit in MW:

Three Phase Lost Power per circuit = $3 \times I^2 \times R$

Example: $3 \times 760.7^2 \times 1.104 = 1.9$MW

Step 6: Calculate the Lost Power in a 2 Circuit Route:

This is multiplied by 2 to get the losses in a two circuit route

Example: 1.9 x 2 = 3.8MW

Step 7: Calculate the Annual Cost of Losses:

Annual Loss Cost = Lost Power x Cost per MWh x 24hrs x 365 days a year

Example: 3.8 x £60 per MWh x 24hrs x 365 days a year = £2m per annum

Step 8: Calculate the Average Loading per Circuit in KW:

The net present value of transmission losses is then derived by applying a discount rate of 3.5% to the annual cost over 40 years.

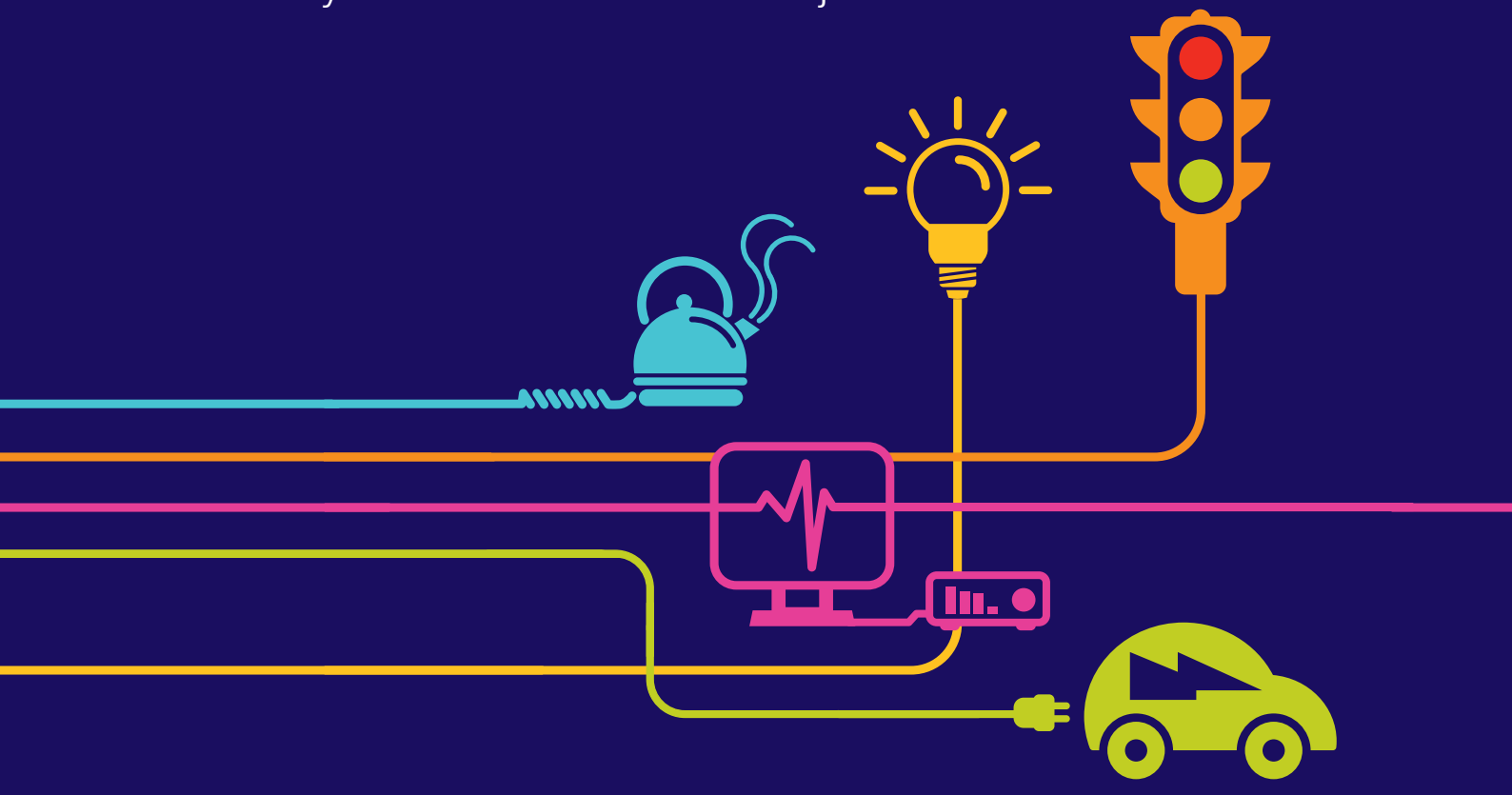
Appendix 2R – Western Power Distribution Modification Works at Churchill Substation and Turn-in of Y and W Routes Technical and Environmental Appraisal (2013)

Document 5.7

nationalgrid

Western Power Distribution Modification works at Churchill Substation and turn-in of Y & W Routes Technical and Environmental Appraisal

Hinkley Point C Connection Project



August 2013

Hinkley Point C Connection Project

Western Power Distribution

Technical & Environmental Options Appraisal:

Modification works at Churchill Substation and turn-in of Y & W Routes

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August, 2013

Table of Contents **Page**

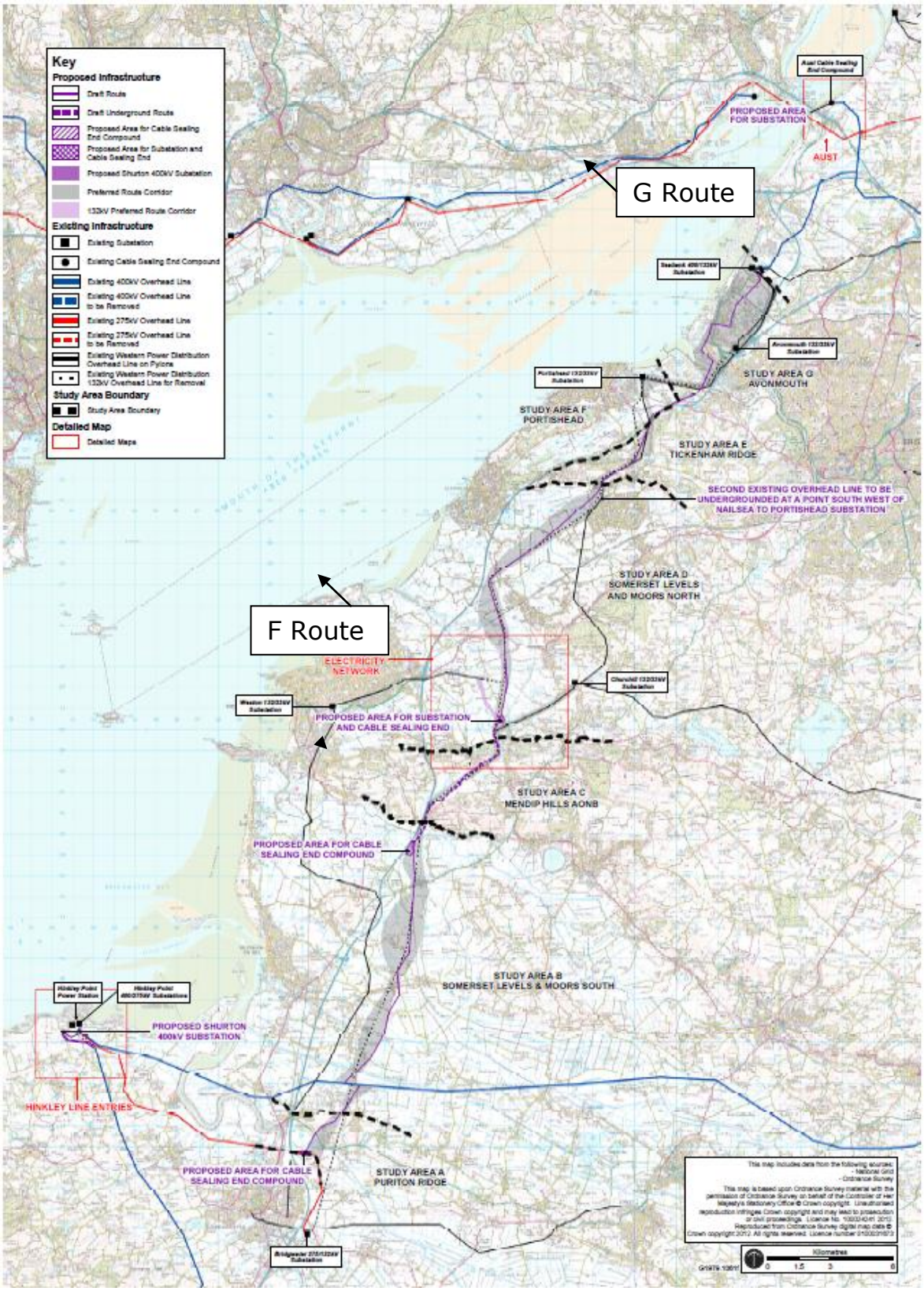
1. Introduction

1.1 This report has been prepared jointly by National Grid Electricity Transmission Limited (National Grid) and Western Power Distribution (South West) Plc (WPD).

1.2 To enable the connection of a new nuclear power station at Hinkley Point, Somerset, a new 400kV transmission connection is proposed between Bridgwater, Somerset and Seabank substation, near Avonmouth. Information on the project can be found at www.hinkleyconnection.co.uk

1.3 The preferred route for this new transmission connection broadly follows the route of an existing 132kV overhead line (see Figure 1.1 below). This 132kV overhead line is operated by WPD and is to be removed between Bridgwater and Avonmouth substations as part of the Hinkley Point C Connection project.

Figure 1.1 Preferred Route Corridor showing existing F and G Routes that will be removed between Bridgwater and Avonmouth Substations



1.4 The removal of WPD's 132kV double circuit overhead line between Bridgwater and Avonmouth Substation disconnects the electricity supply to consumers in the Weston-super-Mare and Churchill areas of North Somerset. As a result National Grid and WPD must restore supplies to the electricity distribution system in these areas.

1.5 A Distribution System Options Report was produced by National Grid and WPD which set out the options for restoring supplies[1]. The preferred option required a new Grid Supply Point (GSP) substation in the vicinity of Sandford and, amongst other works, modifications at the existing Churchill Substation.

1.6 Purpose of the Report

1.6.1 This report looks at the infrastructure modifications that are required in the vicinity of Churchill Substation to maintain the local distribution system's security of supply for customers at existing levels.

1.6.2 The structure of this document is as follows:

- Section 1 provides an introduction;
- Section 2 provides background on the need for the modification works that are required;
- Section 3 outlines the modification works required at Churchill Substation;
- Section 4 outlines options to turn-in one of the circuits from both the W & Y Routes;
- Section 5 provides details of the appraisal methodology;
- Section 6 provides a summary of the appraisals;
- Section 7 confirms the preferred technical and environmental option.

[1] Hinkley Point C Connection Project: Distribution System Options Report

2. Background to the Proposal

2.1 Duties of Western Power Distribution and National Grid

2.1.1 Section 9 of the Electricity Act 1989 (known as the "Electricity Act" from this point forwards) requires National Grid and WPD to develop the transmission and distribution systems in an efficient, coordinated and economical manner.

2.1.2 In order to meet this statutory obligation, National Grid and WPD seek to make the most efficient use of its existing infrastructure by measures such as managing power flows and investing in upgrading existing connections and substations, before considering investment in new infrastructure. They then consider the implications for efficiency, coordination and cost effectiveness in evaluating a range of options in its strategic decision making. The lowest cost solutions are not always adopted, as other considerations, such as environmental impacts, may favour alternative solutions therefore a balance needs to be struck.

2.1.3 Under section 38 of the Electricity Act, both National Grid and WPD have a duty, when putting forward proposals for new development, to consider the preservation of amenity, including the natural environment, cultural heritage, landscape and visual quality. Appendix A of this report includes the WPD and National Grid Roles and Obligations' which are to be followed when considering the siting and installation of new infrastructure.

2.1.4 In producing this report National Grid and WPD have balanced technical, socio-economic, environmental and cost considerations in selecting project options. The technical and environmental appraisal process is explained in Chapter 5.

2.1.5 In developing its plans, National Grid and WPD have also taken into account the guidance contained in National Policy Statements, the National Planning Policy Framework and the Development Plan for the area. Further information on this policy background can be found in Appendix E.

2.2 The Holford Rules

2.2.1 The Holford Rules provide specific guidance for routeing overhead lines and were applied to the identification of route alignments. Further details on these can be found in Appendix B.

2.3 The need for infrastructure modifications at Churchill Substation

2.3.1 The connection of the National Grid transmission network and local distribution networks occurs at Grid Supply Points (GSP). These are typically substations where power is transformed from 400kV or 275kV to 132kV or below for onward distribution to consumers.

2.3.2 Bulk Supply Point (BSP) substations operate at 132kV and 66kV and provide a distribution hub where power is transformed to voltages for onward distribution to local towns, villages, farms and industry.

2.3.3 The removal of the existing WPD 132kV double circuit overhead line which runs between Bridgwater and Avonmouth Substations means that the distribution supply to Churchill Substation will be lost. As a result a new connection must be established.

2.3.4 To achieve this it is planned that a new 400/132kV GSP substation is developed near to the proposed Bridgwater to Seabank 400kV connection (see Figure 2.1 below). Connection from this GSP to Churchill Substation would be via an existing 132kV double circuit overhead line, the N Route.

2.3.5 Another WPD 132kV double circuit overhead line (the W and Y Routes) runs to the east of Churchill Substation. This overhead line connects Portishead Substation to Radstock Substation. To maintain system security and network flexibility in the event of a circuit outage it is proposed to 'turn-in' one of the circuits from each of the W and Y Routes to provide a connection to Churchill Substation.

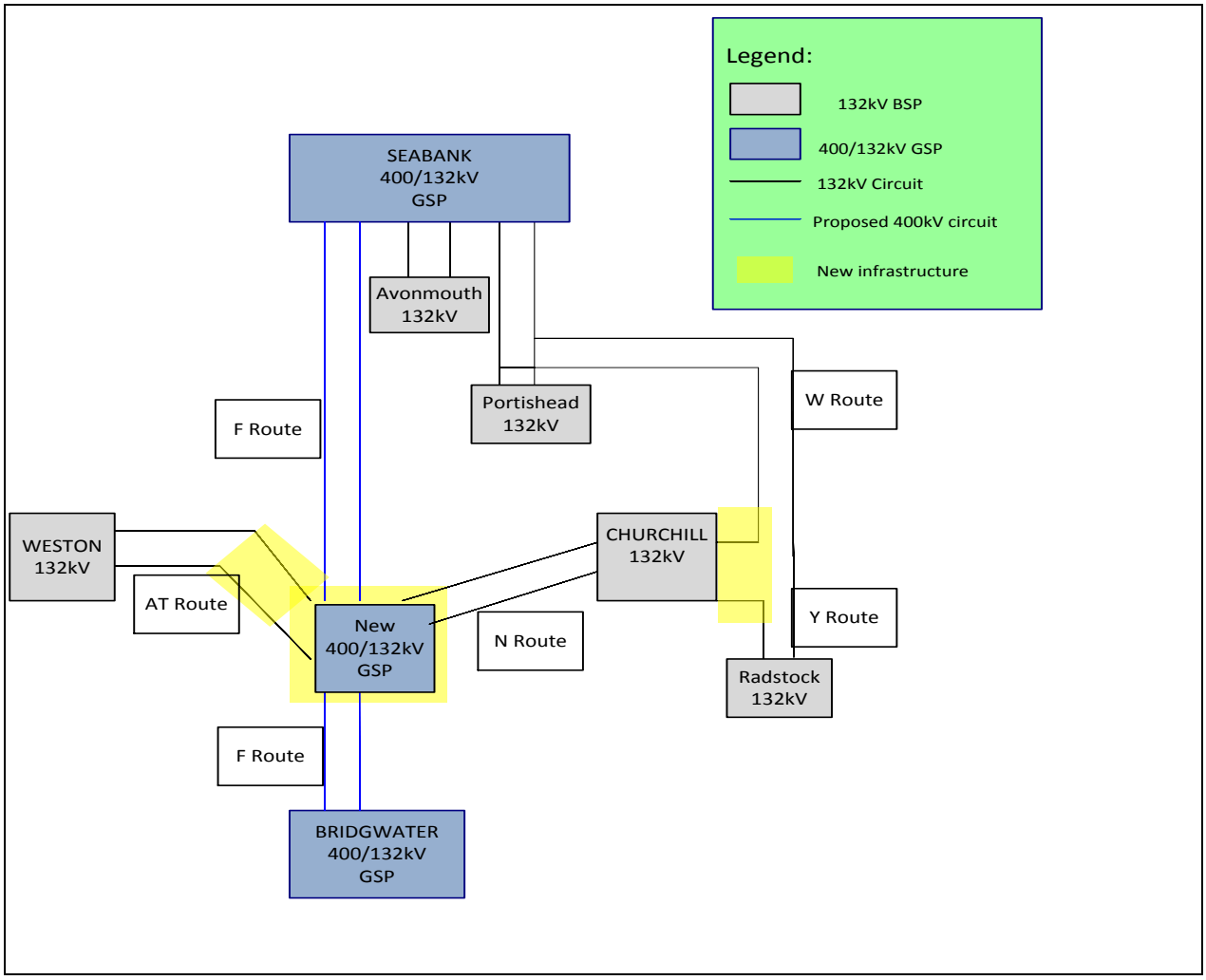
2.3.6 This would mean that the W Route would connect Churchill Substation to Portishead Substation and the Y Route would connect Churchill to Radstock Substation (see Figure 2.1).

2.3.7 To connect these additional circuits to Churchill Substation the existing substation will need to be modified and additional equipment installed.

2.3.8 This report outlines the modification works required at Churchill Substation and considers options available to turn-in one of the circuits from each of the W and Y Routes. The report outlines the appraisal that has been

completed to identify the preferred turn-in option and confirms the preferred option.

Figure 2.1 – Schematic of proposed changes to infrastructure in Churchill area

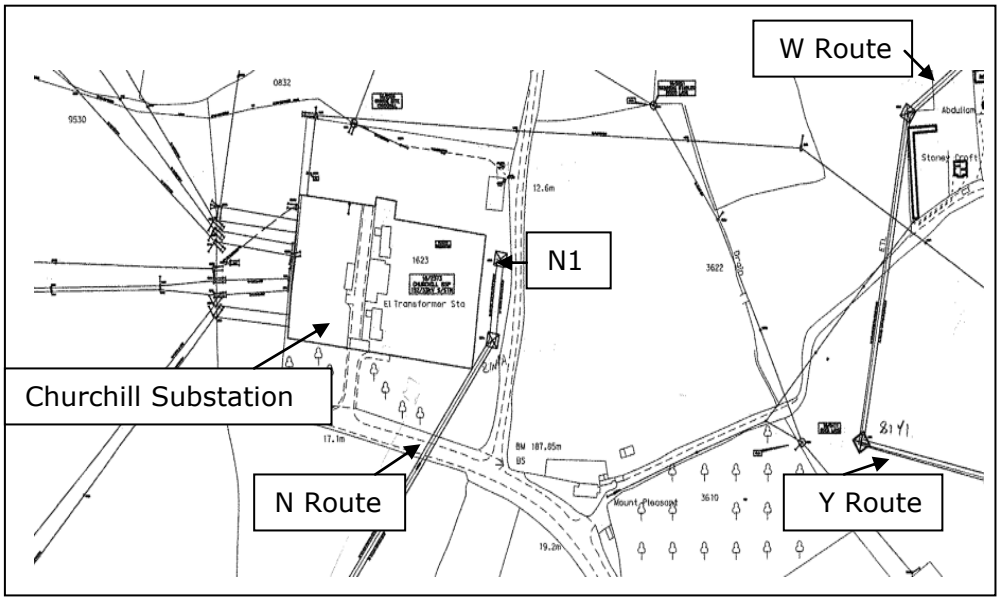


3. Churchill Substation Works

3.1 Modification work required at Churchill Substation

3.1.1 To support the proposed connection of one circuit from each of the W and Y Routes, the 132kV Churchill Substation will require alterations. The current substation consists of a double circuit 132kV overhead line (the N Route) turning into the substation. The N Route terminates at an overhead line pylon (N1) to the east of the substation as indicated in Figure 3.1 below.

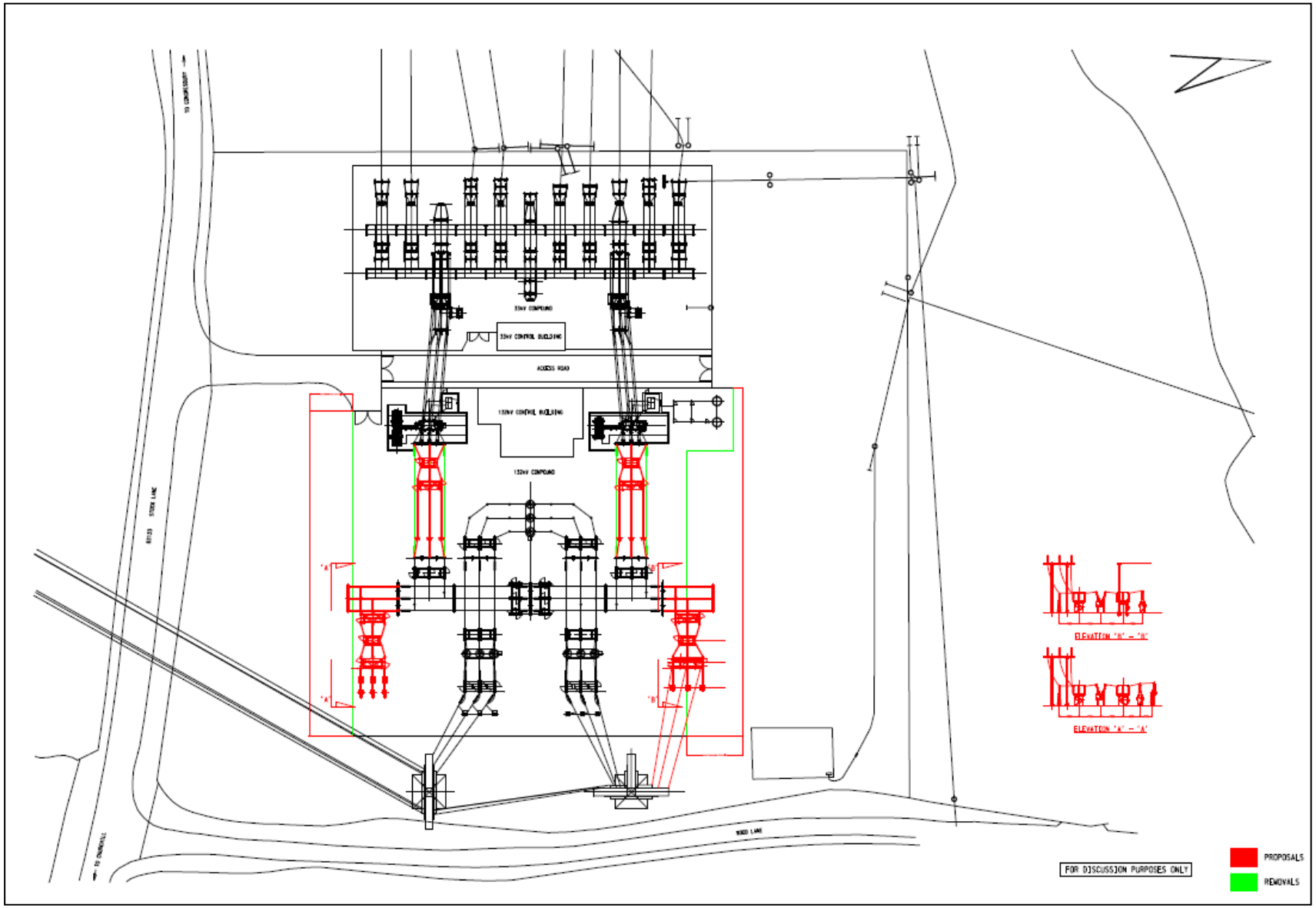
Figure 3.1 Existing Churchill 132kV Substation and existing 132kV N Route connection



3.1.2 The footprint of the existing substation is approximately 70 metres x 120 metres. The land available on both sides of the existing equipment is large enough to accommodate an extension for the connection of the 132kV W and Y Route circuits.

3.1.3 Figure 3.2 below shows the existing layout of the Churchill Substation with the proposed extensions for the W and Y Route connections highlighted in red. The existing substation boundary fence will need to be extended.

Figure 3.2: Proposed extension to Churchill Substation



4. Options to turn-in the W & Y Routes

4.1 Routeing Factors that have been considered

4.1.1 Figure 3.1 above indicates the proximity of the existing W and Y overhead line routes to Churchill Substation. At the closest point they are approximately 250 metres from the substation.

4.1.2 The Y Route and W Route turn-ins will connect on either end of Churchill Substation. This is to provide connection diversity which means that for a fault at the substation not all of the circuits feeding a certain area are disconnected. To minimise the length of new circuit the Y Route will have to cross the existing N Route 132kV overhead line (see Figure 3.2). This means that an underground cable turn-in for the Y Route is required and considered in each option below.

4.1.3 A number of technically compliant options have been considered to turn-in one circuit of both the W & Y Routes to the modified Churchill Substation.

4.1.4 Two technology options have been considered to meet the requirements for the turn-in in this area. These are overhead line using the existing steel lattice pylons or an underground cable.

4.2 Types of Technology

4.2.1 132kV Steel Lattice Pylon Design

4.2.1.1 The span between a double circuit 132kV steel lattice pylon is approximately 250 metres.

4.2.1.2 With steel lattice pylons, if the overhead line needs to change direction, or where the overhead lines are transferred to an underground connection, stronger pylons are required to accommodate the increased structural strain. These pylons are referred to respectively as "angle" pylons and "cable sealing end platform pylons" (CSEPP); please see Appendix F for details of these pylons. These types of pylon have heavier steelwork and larger footprints compared to standard steel "suspension" lattice pylons (which are typically pylons located in a straight-line). These are approximately 29 metres in height.

4.2.2 132kV Underground Cable Design

4.2.2.1 Underground cables affect environmental constraints differently. For example, hedges are oversailed by an overhead line and the most sensitive habitats or areas of high archaeological potential may be avoided when siting pylons. For underground cables, the hedgerows are typically removed

to make way for the cable trenches and the installation of a haul road which is used to construct the underground connection. Archaeology, if present, is recorded before being removed to make way for the cables.

4.2.2.2 For the purposes of the appraisals, it has been assumed that the cable installation for a double circuit will require two sets of three cables generally laid in open trenches. For a single circuit it will require one set of three cables. The cables will be insulated with Cross Linked Polythene (XLPE) cables as opposed to fluid filled cables.

4.2.2.3 The area of land required for the construction of the cables would be up to 30 metres wide for a double circuit. The land required for the construction of a single circuit would be approximately 15 metres. Typically for a double circuit the trenches are separated by a temporary haul road which would run along the route and serve as a traffic route for construction vehicles.

4.2.2.4 In cases where there is an obstacle identified as an engineering difficulty the use of horizontal directional drilling (HDD) may be employed. HDD is a steerable trenchless method of installing underground cables by using a surface launched drilling rig, with minimal impact on the surrounding area which allows vegetation to be retained. For underground cable installations, a number of ducts are installed using the HDD method and the cables are then pulled through the pipes during the cable installation phase. Once the cables have been installed the pipes are filled with bentonite to maintain the cable rating.

4.2.2.5 In this case HDD may be required to cross Iwood lane and bring the cables into Churchill Substation. This is because the cables will need to go underneath a man-made embankment inside the substation compound.

4.2.2.6 The construction of the underground cable route would require a specific temporary site access location to be established for the route of the cables. There would be a requirement to import construction materials and export waste materials using HGVs whose size can be accommodated by local vehicular routes. Normal construction traffic routes will be agreed with the highway authorities. Some minor works to adopted highways may be required to improve the alignment, clearances and standard of roadbed in order to facilitate access for construction traffic.

4.3 Proposed Route Options

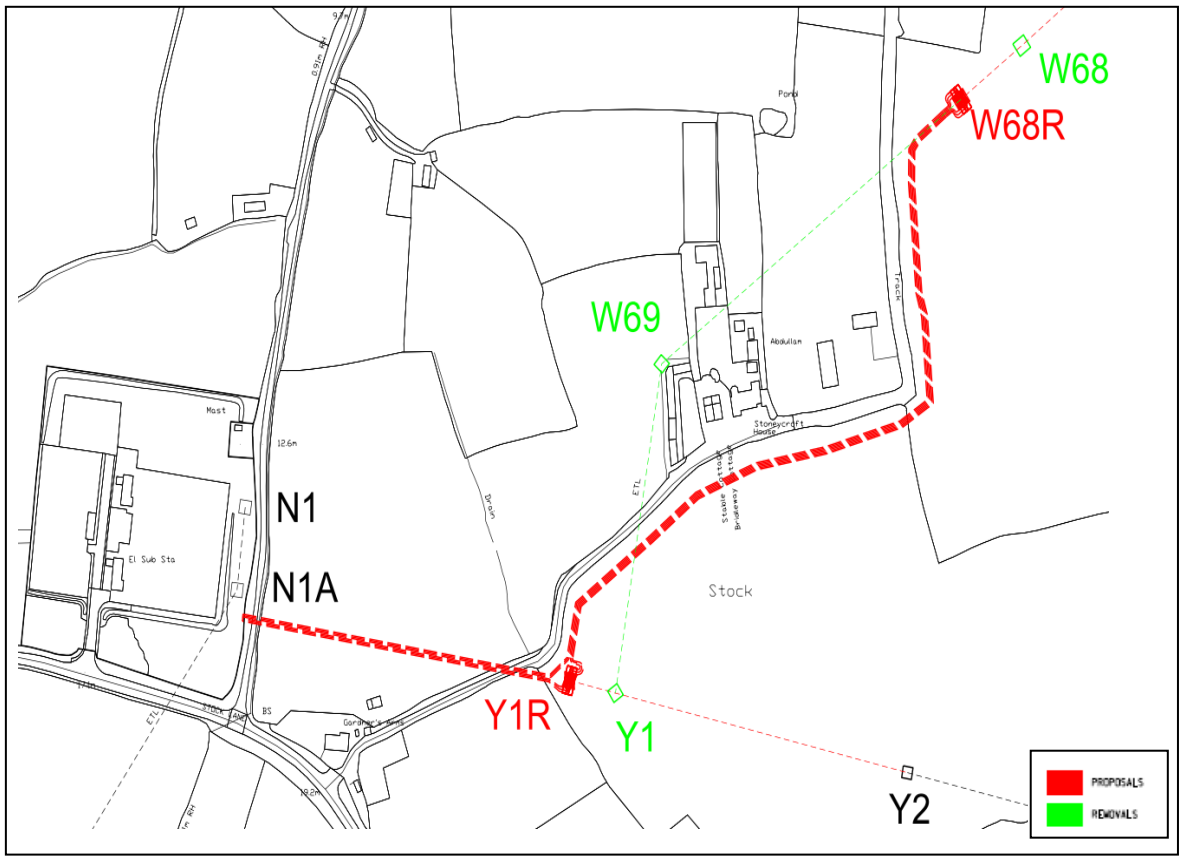
4.3.1 Option 1

4.3.1.1 Option 1 outlined in Figure 4.1 below is to install a double circuit 132kV underground cable as indicated by the red dotted line from a point marked by W68R to join with the Y Route at Y1R then run eastwards to connect with Churchill Substation. A schematic of a typical 132kV underground cable section can be seen in Appendix C.

4.3.1.2 The transition from overhead line to underground cable needs to be made at a CSEPP (see Appendix F). The existing pylons on the W Route and Y Route (shown as W68 and Y1) are too short to accommodate a CSEPP. These would be removed and replaced with slightly taller (approximately 4 metres taller) CSEPP pylons at W68R and Y1R.

4.3.1.3 The existing overhead line between pylons W68R and Y1 would be removed, together with the existing angle pylon W69.

Figure 4.1: W & Y Route turn-in Option 1

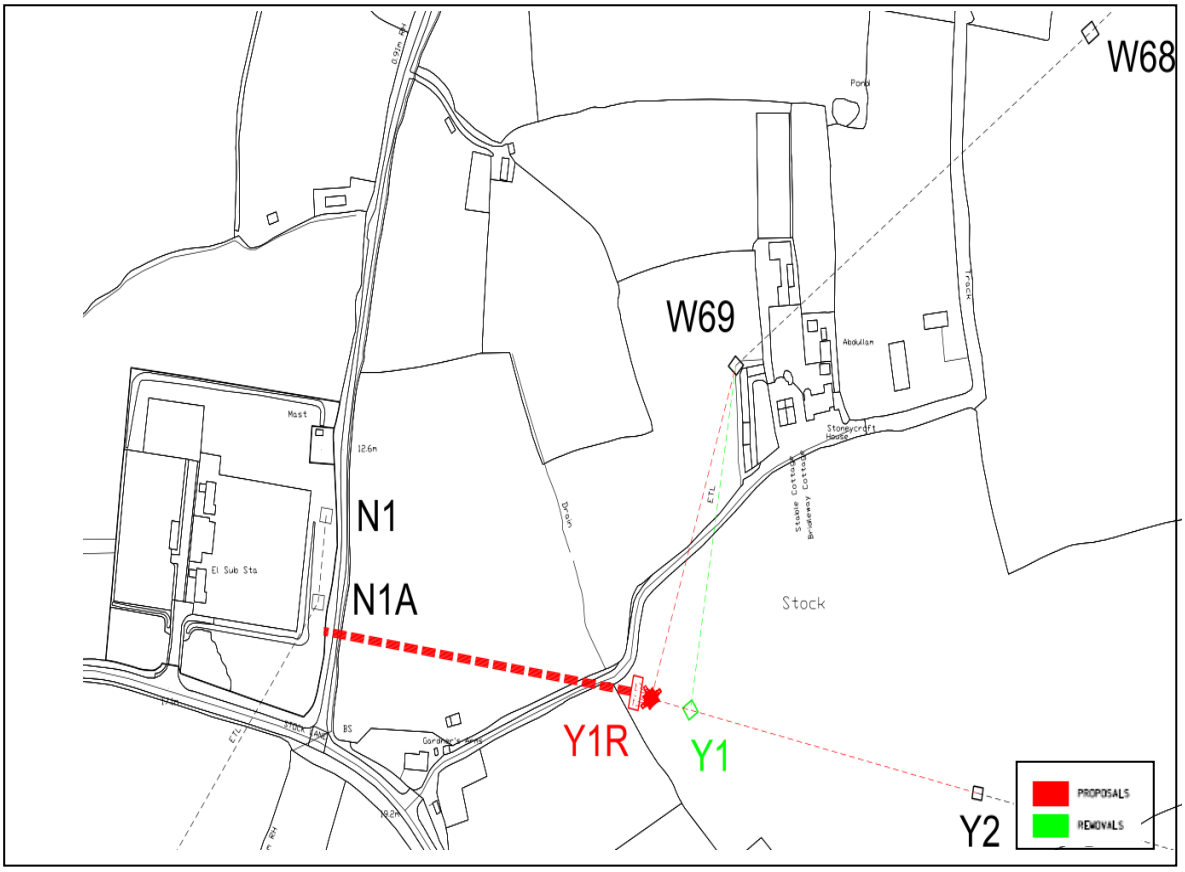


4.4 Option 2

4.4.1 Option 2 outlined in Figure 4.2 below is to replace existing pylon Y1 with a new CSEPP at Y1R. This CSEPP would be approximately 4 metres taller than the existing pylon Y1. The new CSEPP would have a platform to take the conductors to underground cables to connect the cables running into the substation.

4.4.2 The existing 132kV W Route would be retained as an overhead line connection, but would be re-routed from pylon W69 to the new CSEPP Y1R where one W circuit and one Y circuit would be turned into the substation by a double circuit underground cable. The existing pylon Y1 and the overhead line between pylons W69 and Y1 would be removed.

Figure 4.2: W & Y Route turn-in Option 2



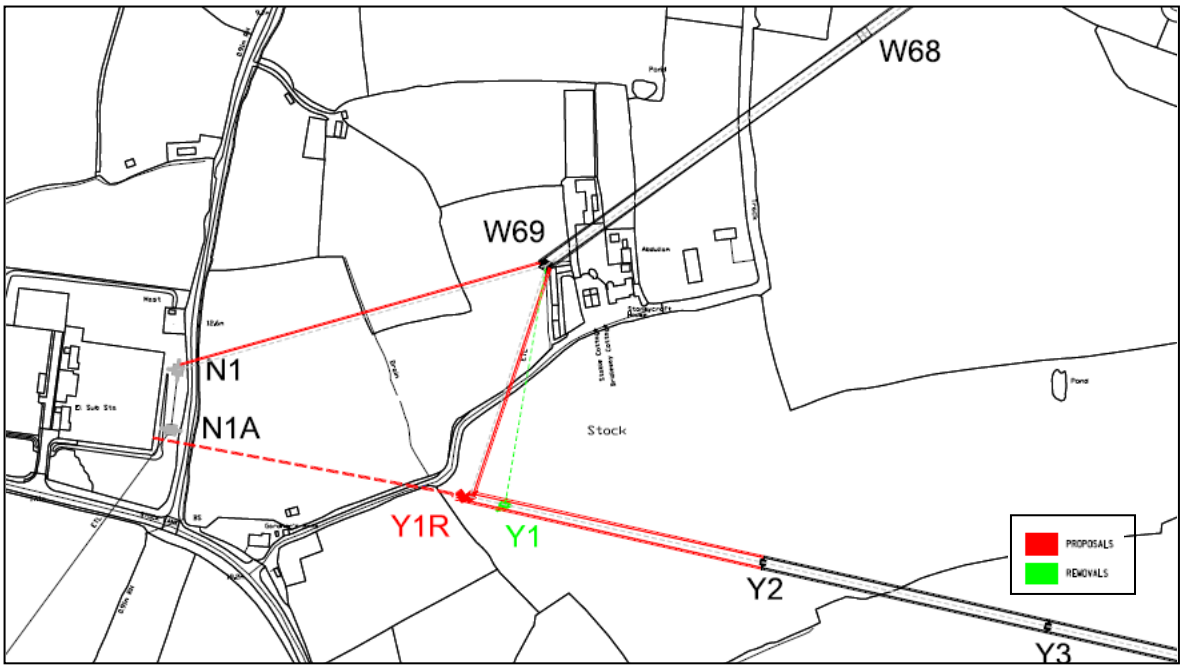
4.5 Option 3

4.5.1 Option 3 is outlined in Figure 4.3 below. Similarly to Option 2 existing pylon Y1 would be replaced by a CSEPP at Y1R. One circuit of the Y Route would be turned into the substation by underground cable.

4.5.2 One of the W Route circuits is diverted via an overhead line direct from pylon W69 to the existing N Route pylon (N1) adjacent to Churchill Substation.

4.5.3 The other W Route circuit is re-routed to a new pylon at Y1R as in Option 2. The existing pylon Y1 and the overhead line between pylons W69 and Y1 would be removed.

Figure 4.3: W & Y Route turn-in Option 3

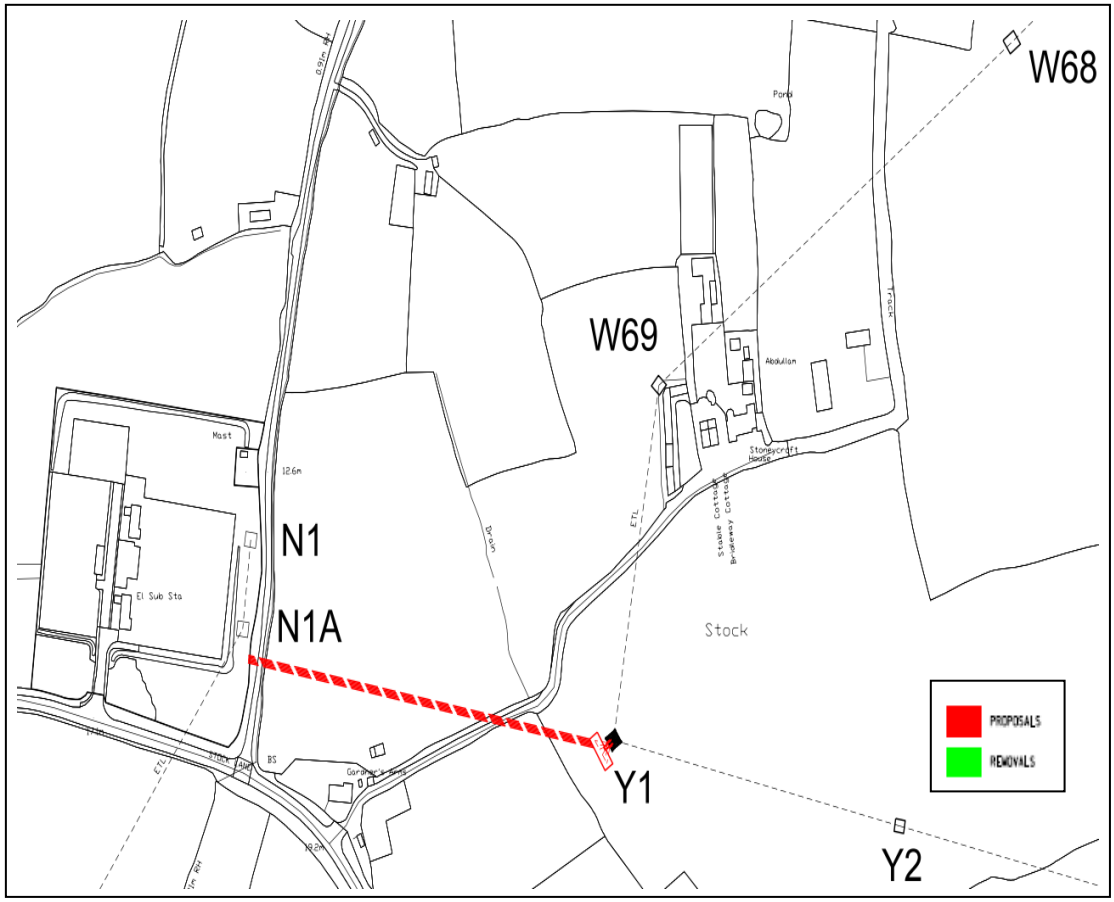


4.6 Option 4

4.6.1 Option 4 outlined in Figure 4.4 below proposes the retention of the existing pylon at Y1. The pylon would be strengthened to accommodate downleads to a cable sealing end compound located adjacent to the pylon from where a double circuit underground cable would connect with the substation.

4.6.2 The existing overhead line connection between pylons W69 and Y1 would be retained.

Figure 4.4: W & Y Route turn-in Option 4



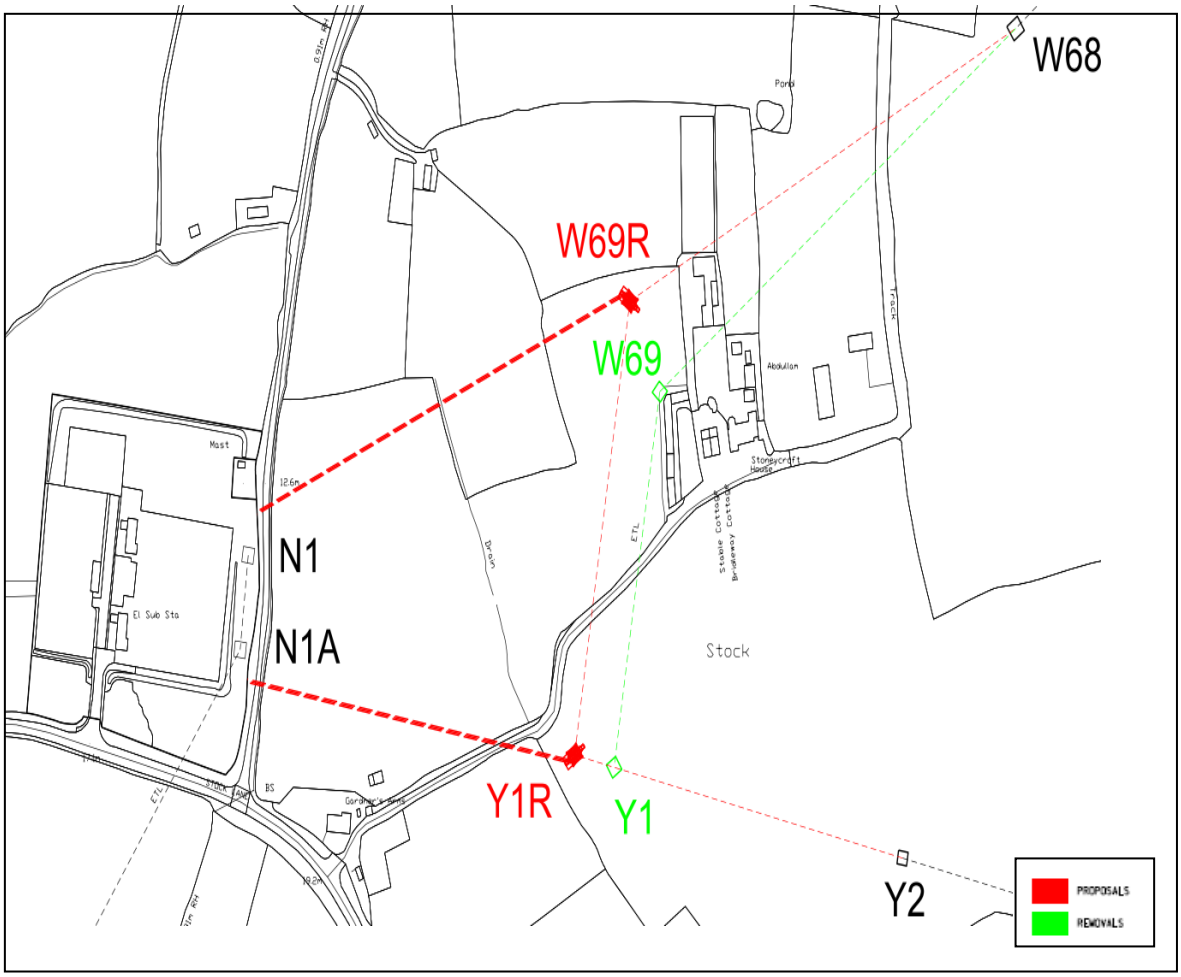
4.7 Option 5

4.7.1 Option 5 outlined in Figure 4.5 below is to create two 132kV single circuit underground cable connections from pylons W69R and Y1R to Churchill Substation.

4.7.2 The existing pylons at W69 and Y1 will have to be replaced with new CSEPP, because they are not strong enough or tall enough to allow for the transition to underground cables. The new CSEPPs will be approximately 4 metres taller than the existing pylons. This new CSEPPs will also have to accommodate for the angle of deviation required for the circuit not connecting to the substation (shown below as the red dotted line running between W69R and Y1R).

4.7.3 Existing pylons W69 and Y1 would be removed. The existing line, in green, between pylons W68, W69 and Y1 would also be removed.

Figure 4.5: W & Y Route turn-in Option 5



5. Overview of Appraisal of Options

5.1 Overview of appraisal

5.2 This appraisal is an analysis which considers relevant technical, environmental and socio-economic issues and the costs associated with each technology option. Analysis of these factors allows the assessment of which option best meets National Grid and WPD's statutory and licence obligations (see Appendix A).

5.2.1 Technical Appraisal

5.2.1.1 Each option has been assessed initially to ensure that it would comply with the standards set out in P2/6[2]. This means that the implications on both the local and wider distribution network are fully assessed before connection options are appraised.

5.2.2 Economic Appraisal

5.2.2.1 Once the scope of works associated with each connection option is identified, an estimate of the capital and lifetime cost of that scope of works is made.

5.2.2.2 The capital cost of the modification works to Churchill Substation will be similar for each option. These costs are estimated at £750,000.

5.2.2.3 Capital cost is an estimate of the cost of equipment and installation costs. These costs are provided in current financial year prices applicable at the time of publication of this Report. For the purposes of reviewing technical options, the cost estimates are based on generalised unit costs for the key elements of the option, reflecting recent contract values or manufacturers' or consultants' budget estimates.

5.2.3 Lifetime cost is an the capital cost plus the estimate of the distribution losses and maintenance costs for the specific overhead line, underground cable elements of the connection options over a 40 year lifetime. The lifetime cost estimate methodology is explained in Appendix D.

5.2.4 Environmental Appraisal

5.2.4.1 A high level environmental appraisal (see Appendix G), has been undertaken which identifies potential environmental constraints which are relevant to routeing overhead lines and underground cables. The high level

[2] P2/6 can be purchased from www.energynetworks.org

environmental constraints present in the local area are illustrated in Appendix H.

5.2.4.2 National planning policy requires developers when proposing new projects to have regard to potential environmental impacts which include consideration of effects on the historic environment, landscape and views and biodiversity. National Policy Statement EN5 at paragraph 2.8.7 also requires developers to take into account the principles included in the Holford Rules (see Appendix B) when siting new overhead lines.

5.2.4.3 Where the consideration of certain topics is not likely to assist in determining which of the options under consideration should be taken forward, these topics may be "scoped out".

5.2.4.4 Once operational, the effects on traffic and transport will be negligible for all options. During construction the impacts on traffic and transport are not anticipated to differentiate between the options given the scale and localised nature of the works.

5.2.4.5 At this stage consideration of electro-magnetic fields is excluded from the options appraisal because both National Grid and WPD design their system to be compliant with ICNIRP guidelines[3] on exposure to electric and magnetic fields.

5.2.4.6 Consultation has emphasised the importance of assessing the effects of the scheme on the local economy, including tourism. The impact on local tourism would not represent a significant factor in choosing between the different options given the scale and localised nature of works and their location close to the existing Churchill Substation.

5.2.4.7 Consideration of socio-economic factors do not help to differentiate between the different options that have been considered. Therefore they have been scoped out.

5.2.5 **Cumulative Impact**

5.2.5.1 The potential cumulative impact of other National Grid and WPD works in the area have been considered. However, these are taking place over 4km from these specific works and therefore not considered to have any influence on the choice of the preferred option.

[3] International Commission on Non-Ionising Radiation Protection : Guidelines for limiting exposure to time-varying electric, magnetic and electromagnetic fields : 1998

6. Consideration of Options

6.1 This chapter presents the assessment of all the Options.

6.2 Technical & Economic

6.2.1 All the options are technically compliant.

6.2.2 The Capital and Lifetime Cost estimates for each option are provided in the table below.

6.2.3 The cost of undergrounding a single circuit 132kV underground cable is £1M per kilometre, per circuit.

Table 6.1: Capital and Lifetime Costs for each Option

Option	Option Description	Capital Cost	Lifetime Cost
1	2 circuits approx 750 metres underground cable 2 new pylons Remove 3 pylons	£1.5M + £180K +£20K **Total Capital Cost = £1.7M**	£1.74M
2	2 circuits approx 250m underground cable 1 CSEPP Remove 1 pylon	£500k + £90k + £20k **Total Capital Cost = £610K**	£620K
3	Approx 250 m underground cable 1 circuit 400 metres new OHL 1 new pylon Remove 1 pylon	£250k +£16k + £90k +£20k **Total Capital Cost = £376K**	**£386K**

4	2 circuits underground cable approx 250 metres Pylon strengthening works / CSEPP	£500k +30k **Total Capital Cost = £530K**	**£540K**
5	2 circuits underground cable approx 250 metres 2 new pylons Remove 2 pylons	£500k + £180k + £20k **Total Capital Cost = £700K**	**£710K**

6.3 Environment

6.4 There are issues that are common to each option under environmental topics as described below.

6.4.1 Historic Environment

6.4.1.1 There are no designated historic features in the vicinity of each potential option that could be affected. There are listed buildings in the local area but these are typically in settlements or as part of a group of buildings. The nearest listed building is approximately 800m west of the substation, Brinsea Batch Farmhouse (Grade II). Its setting is unlikely to be affected as the works would be on the opposite side of the existing substation and views would generally be screened or obscured to and from the listed building.

6.4.1.2 There is potential to encounter and effect unknown buried archaeology in the undeveloped fields to the east of substation. This is relevant to underground cable installation, excavations for pylon positions and any other ground disturbance associated with construction works such as installation of temporary access and working areas.

6.4.2 Ecology

6.4.2.1 There are no nationally designated sites in the area immediately surrounding the substation that would be directly affected. The options are within the 5km consultation zone for the North Somerset and Mendip Bats Special Area of Conservation (SAC).

6.4.2.2 There may be resulting effects from removal of hedgerows etc on protected species associated with affected habitats and potential effects on the qualifying features of the SAC (namely Lesser and Greater Horseshoe bats) which would also need to be considered as required by the Conservation of Habitats and Species Regulations 2010 (as amended).

6.4.2.3 Effects are likely to be a combination of temporary and permanent and appropriate mitigation would need to be appraised dependent on the option being taken forward. Standard good working practice, careful routeing and inclusion of mitigation measures could minimise overall potential effects.

6.4.3 Landscape and Visual Assessment

6.4.3.1 The substation site and immediate surroundings where the options are proposed are not in a designated area of landscape importance. The Mendip Hills Area of Outstanding Natural Beauty (AONB) is approximately 3km to the south of the substation. The proposed works would form part of some wide panoramic views from the high ground in this area.

6.4.3.2 Further consideration of potential effects on landscape and views will be undertaken as part of detailed studies in the Environmental Impact Assessment whichever option is taken forward.

6.5 Assessment of Each Option

6.5.1 The following paragraphs look at the specific environmental considerations for each option.

6.6 Option 1

6.6.1 This option includes the installation of underground cables from near the existing W Route pylon W68, joining with the Y Route near existing pylon Y1 and extending eastwards to connect to the existing Churchill Substation. The 132kV underground cables to the substation would be routed across fields and cross an existing track. New CSEPPs will be required.

6.6.2 Historic Environment

6.6.2.1 There is potential to encounter and effect unknown buried archaeology. Should this option be taken forward further investigation into the potential risks to buried archaeology and consideration of appropriate feasible mitigation would need to be undertaken.

6.6.3 Ecology

6.6.3.1 The underground cable would travel through agricultural fields, with low ecological value, although this value could be increased through association with protected species. The installation of underground cables could however affect ecological receptors of higher value, such as drainage ditches, trees and hedges on the route and in working areas. Six hedgerows would require crossing and at least one of these, along the eastern boundary of the substation, is known to be species-rich. There would be limited effects associated with construction of replacement pylons as they would be close to existing pylon positions which are in open field locations although there may be effects on features as a result of creating new construction accesses and temporary tracks.

6.6.3.2 Standard good working practice, careful routeing and inclusion of mitigation measures could minimise overall potential effects. Temporary fragmentation impacts caused by hedgerow removal could be mitigated through the use of aerial bridges.

6.6.3.3 Habitats could be reinstated following the completion of works, although, tree planting would not be possible within the permanent cable easement or close to overhead lines.

6.6.4 **Landscape and Visual Assessment**

6.6.4.1 Underground cables to the substation would not be visible and would therefore have no notable effects on views to and from the AONB. The CSEPPs would form a very small part of wide long-distance views from the AONB and the change from the existing pylons W68 and Y1 are unlikely to be discernible at such distance.

6.6.4.2 The proposed underground cables would be routed in an area already affected by existing electrical infrastructure development. Resultant effects on landscape character and views would be temporary and land would be restored on completion. There would be some permanent adverse effects on landscape character and visual amenity as a result of installing new CSEPPs although this would be replacement for existing pylons and overall effects would not be significant.

6.6.4.3 There would be some positive permanent effects on landscape character and visual amenity as sections of existing overhead line would be removed.

6.6.4.4 There could be some minor negative localised effects associated with the removal of existing features including hedges and trees during construction. These effects could be mitigated by careful routeing to retain trees where possible, replanting hedges and or planting of new trees and shrubs. Tree planting on land above underground cables is restricted but where practical and appropriate (with landowner permission) trees could be planted on land close by.

6.7 Option 2

6.7.1 This option involves part overhead line and part underground cables to the substation. Existing Y Route pylon Y1 would be replaced with a new taller CSEPP Y1R.

6.7.2 The W Route would be retained as an overhead line but would be re-routed slightly to the west from pylon W69 to the new CSEPP Y1R. There would not be a significant change in alignment. The connection from Y1R west to the substation would be made via a short length of double circuit 132kV underground cable. The new underground connection would cross an existing farm access track approximately 150m to the east.

6.7.3 **Historic Environment**

6.7.3.1 There is potential to encounter and effect unknown buried archaeology in the fields to the substation during installation of underground cables and new CSEPP.

6.7.4 **Ecology**

6.7.4.1 The realignment of the existing W Route between pylons W68 and Y1R would oversail hedges and there may be some limited effects during construction works. The installation of 132kV double circuit underground cables could adversely affect habitats and features such as drainage ditches and trees and hedges on the route and in working areas. The scale of proposed works would be relatively minor and the associated impacts would be low. The majority of the proposed underground cable route crosses agricultural fields which have limited ecological value, although this value could be increased should protected species be present. Potential effects would be likely to be restricted to features on field boundaries, including a species-rich hedgerow on the eastern boundary of the substation. Standard good working practice, careful routeing, inclusion of mitigation measures and compensatory planting could minimise overall effects.

6.7.4.2 Habitats could be reinstated following the completion of works. Although, tree planting would not be possible within the permanent cable easement or close to overhead lines.

6.7.4.3 Temporary fragmentation impacts caused by hedgerow removal could be mitigated through the use of aerial bridges.

6.7.5 **Landscape and Visual Assessment**

6.7.5.1 There would be some small-scale effects on landscape character and visual amenity as a result of installing Option 2. These would be in the area immediately east of the existing substation to the W and Y Routes and would not result in a significant change from baseline conditions. Generally there would be a neutral effect on landscape character and views including those from the AONB.

6.7.5.2 The baseline character of the area is already affected by overhead lines which would restrict overall effects. Effects could be minimised by avoidance and reinstatement of affected features such as hedges and trees.

6.7.5.3 There could be some minor negative effects associated with cutting back or removal of hedges and trees to ensure safety clearances for the amended alignment and installation of the new CSEPP. It could be possible to minimise long term effects by providing replacement planting although this may be restricted for safety reasons close to and beneath the line.

6.8 Option 3

6.8.1 Option 3 would include one of the W Route circuits being diverted via overhead line across fields in a southwest direction from the existing pylon W69 to pylon N1 adjacent to Churchill Substation. The other W Route circuit would be routed to a new cable sealing end platform pylon at Y1R similar to Option 2. The Y Route circuit would be underground to Churchill Substation

6.8.2 **Historic Environment**

6.8.2.1 There is potential to encounter and effect unknown buried archaeology in the fields to the substation during installation of underground cables and new CSEPP.

6.8.3 **Ecology**

6.8.3.1 Adding a new section of overhead line could affect existing features and habitats such as hedges and trees, which may support protected species, to ensure safety clearance and to install conductors. Potential effects would be likely to be permanent and temporary and largely restricted to relatively small areas and features on field boundaries. This option would connect to an existing pylon at the substation and as such flexibility in routeing an alignment would be limited. Scope to provide mitigation in the form of replacement habitat in the same locations could also be restricted.

6.8.3.2 Installing a single circuit underground cable from pylon Y1R to the substation could also affect existing features and habitats although the majority of the proposed underground cable route crosses agricultural fields which have limited ecological value. This value would increase should protected species be present. Potential effects would be likely to be restricted to features on field boundaries, including a species-rich hedgerow on the eastern boundary of the substation. The replacement CSEPP would be on agricultural land, of low ecological value. Standard good working practice, careful routeing, inclusion of mitigation measures and compensatory habitat creation could minimise overall effects.

6.8.3.3 Habitats could be reinstated following the completion of works. Although, tree planting would not be possible within the permanent cable easement or close to overhead lines.

6.8.4 **Landscape and Visual Assessment**

6.8.4.1 There would be some permanent and temporary effects on landscape character and visual amenity as a result of installing Option 3. These effects would relate to the installation of the overhead line connection from pylon W69 to the substation and the replacement CSEPP Y1R which would have a

platform. Effects would be in the area immediately east of the existing substation and would result in a small increase in the amount of overhead lines present from baseline conditions. There would be no new supporting structures installed but overhead conductors would be visible to the east of the substation.

6.8.4.2 The baseline character area of the concerned is already affected by overhead lines which would restrict overall effects. Effects could be minimised by avoidance and reinstatement of affected features such as hedges and trees. Generally there would be a neutral effect on landscape character.

6.8.4.3 Effects on views are likely to affect receptors at the nearest locations such residents of properties ant Nye Road and Stoneycroft House. There could be some minor negative effects associated with cutting back or removal of hedges and trees to ensure safety clearances for the conductors which could increase visibility of the overhead lines and new CSEPP in some views. It could be possible to minimise long term effects by providing replacement planting although this may be restricted for safety reasons close to and beneath the lines.

6.9 Option 4

6.9.1 Option 4 is similar to Option 2 but would include the retention of the existing pylon at Y1 and the installation of a sealing end compound. The pylon would be strengthened to accommodate downleads to a sealing end compound on land adjacent to the pylon from where a double circuit underground cables would extend west connecting to the substation.

6.9.2 Historic Environment

6.9.2.1 There is potential to encounter and effect unknown buried archaeology in the fields to the substation during installation of a double circuit underground cables and cable sealing end compound.

6.9.3 Ecology

6.9.3.1 The installation of this option could adversely affect habitats and features such as drainage ditches and trees and hedges on the route and in working areas. The scale of the proposed work would be relatively minor and the associated impacts would be low. The majority of the proposed underground cable route crosses agricultural fields which have limited ecological value, although this value would increase should protected species be present. Potential effects would be likely to be restricted to features on field

boundaries, including a species-rich hedgerow on the eastern boundary of the substation. The cable sealing end compound would be on agricultural land, of low ecological value. Standard good working practice, careful routeing inclusion of mitigation measures and compensatory habitat creation could minimise overall effects.

6.9.3.2 Habitats could be reinstated following the completion of works. Although, tree planting would not be possible within the permanent cable easement or close to overhead lines.

6.9.3.3 Temporary fragmentation impacts caused by hedgerow removal could be mitigated through the use of aerial bridges.

6.9.4 **Landscape and Visual Assessment**

6.9.4.1 Under this option a cable sealing end compound would be built adjacent to the pylon Y1. As for Option 2 there would be some small-scale effects on landscape character and visual amenity as a result of installing this option. Effects would be similar to those described for Option 2. There could be effects as a result of a larger 'footprint' for the construction of the sealing end compound on landscape character in the local area and close views such as those from the property to the southeast of the substation on Nye Road and Stoneycroft House.

6.9.4.2 Changes in views would comprise the sealing end compound at the base of the existing pylon Y1 to which would be seen in context with the existing substation and W and Y Routes. Screening of the sealing end compound in the form of new planting and or supplementary planting to existing hedges could be feasible and provide effective mitigation in views of this new feature.

6.9.4.3 There could be some minor negative effects associated with cutting back or removal of hedges and trees to ensure safety clearances for the conductors which could increase visibility of the overhead lines in some views. It could be possible to minimise long term effects by providing replacement planting although this may be restricted directly underneath them.

6.10 Option 5

6.10.1 Option 5 would involve constructing two single circuits of underground cables from pylons W69 and Y1 to the substation. Replacement CSEPPs with platforms would be required at pylons W69 and Y1 (W69R and Y1R). At W69R one circuit would be routed via underground cables to the substation and the other circuit would be retained as overhead line to Y1R on a slightly

amended alignment to the west. Similarly at Y1R one circuit would be routed west to the substation via underground cables, the other circuit would join with W Route as existing overhead line.

6.10.2 **Historic Environment**

6.10.2.1 There is potential to encounter and effect unknown buried archaeology in the fields to the substation during installation of underground cables and new CSEPPs.

6.10.3 **Ecology**

6.10.3.1 The realignment of the existing W Route between pylons W68, W69R and Y1R would generally oversail existing features and could be carefully routed to minimise effects such as the need to cut back or remove trees. The installation of underground cables could adversely affect habitats and features such as drainage ditches and trees and hedges on the route and in working areas.

6.10.3.2 The majority of the two proposed underground cable routes cross agricultural fields which have limited ecological value, although this value would increase should protected species be present. Replacement CSEPPs would also be sited on agricultural land. Potential effects would be likely to be restricted to features on field boundaries, including a species-rich hedgerow on the eastern boundary of the substation which would have to be crossed at two locations. Standard good working practice, careful routeing inclusion of mitigation measures and compensatory habitat creation could minimise overall effects.

6.10.3.3 Habitats could be reinstated following the completion of works. Although, tree planting would not be possible within the permanent cable easement or close to overhead lines.

6.10.3.4 Temporary fragmentation impacts caused by hedgerow removal could be mitigated through the use of aerial bridges.

6.10.4 **Landscape and Visual Assessment**

6.10.4.1 There would be some permanent and temporary effects on landscape character and visual amenity as a result of installing Option 5. These would be in the area immediately east of the existing substation to the W and Y Routes and would not result in an increase of in the amount of infrastructure present from baseline conditions. The general effect on views would be similar to baseline conditions in that the W and Y Routes would remain present. However, the overhead line would be re-routed further west than

existing which would move them further away from Stoneycroft House but closer to the property on Nye Road to the southeast of the substation. This option would involve installing two CSEPPs which would be visible together in some views from the surrounding area.

6.10.4.2 The baseline character of the area of the concerned is already affected by overhead lines which would restrict overall effects. Effects could be minimised by avoidance and reinstatement of affected features such as hedges and trees. Generally there would be a neutral effect on landscape character.

6.10.4.3 There could be some minor negative effects associated with cutting back or removal of hedges and trees to ensure safety clearances for the conductors which could increase visibility of the overhead lines in some views. It could be possible to minimise long term effects by providing replacement planting although this may be restricted for safety reasons close to and beneath the line and directly above cables.

6.11 Comparison of Options

6.11.1 Historic Environment

6.11.1.1 Options 1-5 would each involve some underground cable installation and therefore have the potential for effects on unknown buried archaeology in undeveloped agricultural land to the east of the substation. Therefore there is little to differentiate between the routes.

6.11.2 Ecology

6.11.2.1 Options 1-5 would involve trenching and ground disturbance to install the underground cables which could effect existing habitats and features such as ditches and hedges. The removal of hedgerow habitat as a result of undergrounding could potentially result in greater impacts to protected species. As all the options involve undergrounding there is little to differentiate between the options and there is no preference between a double or single circuit undergrounding.

6.11.3 Landscape and Visual Assessment

6.11.3.1 Options 1-5 would involve either entirely or partly making the connection via underground cables which would limit overall effects on landscape character and views. Option 1 involves an entirely underground connection to the substation and the removal of existing overhead line, although a CSEPP would be required. Options 2 and 4 would represent limited changes in views and would restrict effects on landscape character.

6.11.3.2 Option 5 would move the 132kV W Route further from receptors at Stoneycroft House but this has limited overall benefit because it would be nearer to other receptors. Option 5 would also introduce 2 new CSEPP to enable underground connections to the substation. Options 3 would involve a new overhead line and would therefore result in some visual effects.

6.11.3.3 Option 1 aside, Options 2 and 4 would represent limited changes in views and restrict effects on landscape character.

7. Identification of the preferred turn-in option

7.1 Conclusion

7.1.1 This Technical and Environmental appraisal has summarised the need for infrastructure modifications around Churchill Substation, outlined the changes required to the substation and considered the technical alternatives, environmental effects and estimated capital and lifetime costs of five options for connecting the W and Y Routes to the substation.

7.1.2 Each of the options considered is compliant with technical standards.

7.1.3 The environmental appraisal concluded that there would be positive and negative environmental effects associated with all the options for the connection.

7.1.4 Overall the appraisal has shown that environmental effects would generally be low and that there are few high level environmental constraints in this area that would help distinguish a preference between the options. Any of the options could be taken forward whilst having due regard to environmental effects and there are feasible mitigation measures that could be put in place to minimise resultant effects.

7.1.5 Estimated capital and lifetime costs has been considered as part of the appraisal of the five turn-in options. Visual impact has also been taken into account.

7.1.6 Having regard to relevant statutory duties and all the factors considered as part of the appraisal process, Option 3 is identified as the preferred option that best balances all of the information and Government guidance available to us at this time. Under this option the W Route is turned in from pylon W69 by overhead line and the Y Route by underground cable from a new CSEPP at Y1R. This option is the lowest cost and would not result in environmental effects greater than any of the other options.

7.1.7 This will be reviewed throughout the development of the project and following consultation with statutory consultees and local communities who will have the opportunity to comment on all the options considered in this Report as part of the formal consultation.

8. Glossary

AONB	Area of Outstanding Natural Beauty
BSP	Bulk Supply Point
CSEPP	Cable Sealing End Platform Pylon
GSP	Grid Supply Point
HDD	Horizontal Directional Drill
Km	Kilometre
kV	Kilovolt
M	Metre
SAC	Special Area of Conservation
WPD	Western Power Distribution
XLPE	Cross Linked Polythene

Appendix A Western Power Distribution Schedule 9 Statement

A.1 Western Power Distribution and National Grid Role and Obligations

A.1.1. Both the distribution and transmission of electricity in Great Britain requires permission by a licence granted under Section 6(1)(b) and (c) of the Electricity Act 1989 ("the Electricity Act").

A.1.2. The legislative and regulatory framework is designed to ensure coordination and efficient investment by the distribution and transmission companies. These principles are central to the respective licences and industry codes.

A.2 WPD Role and Obligations

A.2.1. WPD has been granted a distribution licence and is therefore bound by the legal obligations set out in the Electricity Act and their distribution licence.

A.2.2. WPD owns and operates the distribution system in the South West, South Wales and the Midlands.

A.2.3. WPD has statutory duties to develop and maintain an efficient, coordinated and economical system of electricity distribution under Section 9 of the Electricity Act. These duties, which are documented in Standard Licence Conditions[4], are summarised in the following paragraphs.

A.2.4. Standard Condition C24 (Distribution System planning standard and quality of performance reporting) of WPD's distribution licence requires WPD to plan and develop its distribution system in accordance with standards set out in Engineering Recommendation P2/6[5].

A.2.5. P2/6 is a document that defines the minimum standards that WPD must apply when planning and operating the distribution system. The criteria include the type of faults (or breakdowns) and combinations of faults that the distribution system must be able to withstand, the impact on customers in terms of maximum level of supply interruptions, and the impacts on supply quality that are permissible.

[4] http://epr.ofgem.gov.uk/document_fetch.php?documentid=15184

[5] P2/6 can be purchased from www.energynetworks.org

A.2.6. P2/6 is open to industry and public scrutiny, is subject to periodic review and consultation and any changes are implemented by a change to the licence Standard Conditions and approved by the industry regulator, Ofgem[6].

A.2.7. As well as the technical standards described above, Section 38 and Schedule 9 of the Electricity Act 1989 requires WPD, when formulating proposals for new lines and other works, to:

> "…have 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; and shall do what [it] reasonably can to mitigate any effect which the proposals would have on the natural beauty of the countryside or on any such flora, fauna, features, sites, buildings or objects"[7]

A.2.8. WPD's Schedule 9 statement[8] (the "Statement") sets out how the company will meet the duty to the environment placed upon it. These commitments include:

- minimise the impact of its activities on communities and the historic and natural environment;
- only seeking to build new lines along new routes, or substations in new locations where the existing distribution system infrastructure cannot be economically upgraded to meet distribution security standards;
- where new infrastructure is required seek to avoid, where reasonably practicable, areas which are nationally or internationally designated for their landscape, wildlife or cultural significance;
- site overhead lines with care and consider both the visual impact and the impact on nature conservation as far as possible; and
- continually work with partners to selectively underground lines in appropriate sensitive locations to improve the appearance of countryside, towns or villages,

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[6] http://www.ofgem.gov.uk/Pages/OfgemHome.aspx

[7] Schedule 9 of the Electricity Act (http://www.legislation.gov.uk/ukpga/1989/29/contents).

[8] WPD Schedule 9 Statement: http://www.westernpower.co.uk/getdoc/c4856406-1794-4e34-81a0-9f2b593cdd4a/schedule9.aspx

whilst taking account of sites of particular archaeological or nature conservation interest.

A.2.9. Effective consultation with stakeholders and the public is also promoted by the Statement.

Appendix B Holford Rules

B.1 The Holford Rules9 provide specific guidance for routeing overhead lines and were applied to the identification of route alignments. They comprise of seven Rules and related explanatory and supplementary notes that primarily relate to minimising the effects on landscapes. Whilst the Rules were written to apply to overhead lines, they are also appropriate to consider when routeing underground cables. National Policy Statement EN-510 highlights that the Rules should be followed by developers when designing their proposals.

B.2 The 7 Rules on minimising landscape effects when routeing overhead lines are summarised below:

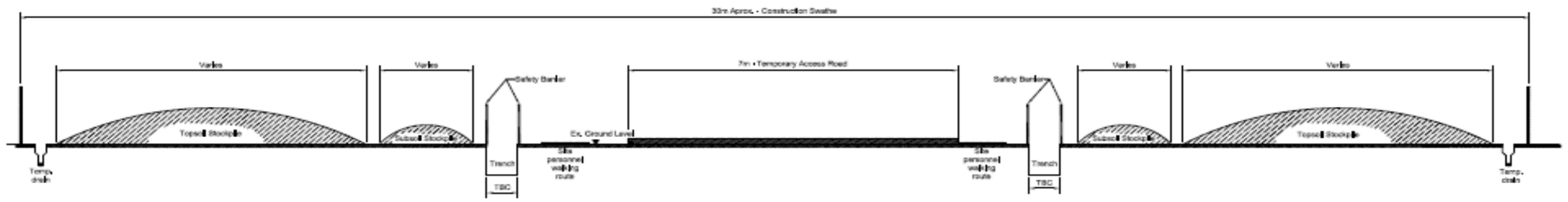
- Avoid altogether, if possible, the major areas of highest amenity value.
- Avoid smaller areas of high amenity value or scientific interest by deviation where this can be done without using too many angle pylons.
- Other things being equal, choose the most direct line, with no sharp changes of direction to minimise use of angle pylons.
- Choose tree and hill backgrounds in preference to sky backgrounds, wherever possible;
- Prefer moderately open valleys with woods where the apparent height of pylons will be reduced and views of the line will be broken by trees.
- Where land is flat and sparsely planted, keep high voltage lines as far as possible independent of smaller lines, converging routes, distribution poles and other masts, wires and cables, to avoid 'wirescape'.
- Approach urban areas through industrial zones, where they exist**.**

[9] National Grid: The National Grid Company plc and new high voltage transmission lines – guidelines for line routeing (the Holford Rules) and undergrounding

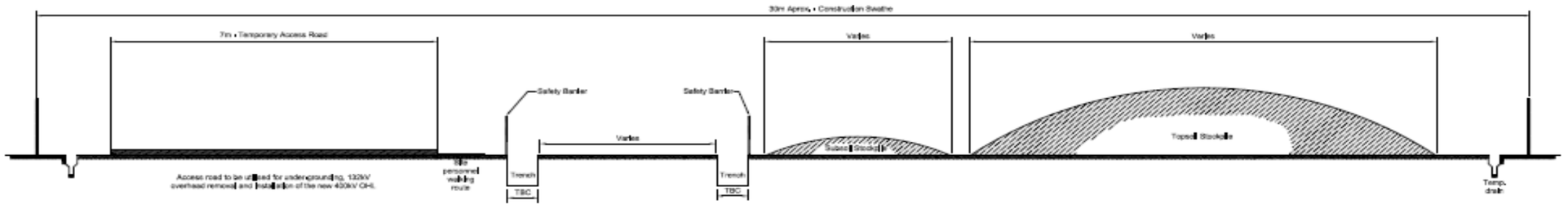
[10] Paragraph 2.8.5, National Policy Statement for Electricity Networks Infrastructure (EN-5), July 2011

Appendix C 132kV Underground Cable Installation - Cross Section

NATIONAL GRID (HINKLEY POINT C CONNECTION) ORDER
DETAILED DESIGN DRAWINGS
(REGULATION 5(2)(o))
SHEET 7 OF 53



Typical Construction Swathe for 132kV Cabling Works



Typical Construction Swathe for 132kV Cabling Works
With Access Road to be Utilised for Cabling and OHL Works

Notes:
1. Proposed arrangement shown for indicative purpose only. Dimensions and design may vary depending on site and installation conditions.
2. Dimensions and overall width could increase or decrease

PRELIMINARY DESIGN NOT TO BE USED FOR CONSTRUCTION

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TITLE:
TYPICAL GENERAL ARRANGEMENT OF CONSTRUCTION SWATHE FOR 132kV UNDERGROUND CABLE INSTALLATION

nationalgrid

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C.1 The underground cables would typically be installed in a cable trench with a depth of 750 mm (see Figure above). During construction an easement width of around 30m would be required to allow for access, trench construction and soil displacement.

Appendix D Lifetime Costs

D.1 The lifetime valuation for each of the connection options and applicable technology includes the lifetime cost of energy losses and lifetime operation and maintenance costs.

D.2 The following formula was used to assess the lifetime cost of each type of connection.

Total Cost, CTot = CDC + CL + COM

Where

CDC = The capital cost of the equipment, delivered, installed and commissioned

CL = The net present value of the cost of losses over the lifetime (40years) of the assets

COM = "The net present value of the typical cost of operation and maintenance over the lifetime (40 years) of the assets

D.3 The discount rate used in the net present value calculations, 3.5%, being the figure recommended in Her Majesty's Treasury's Green Book for discounting future benefits and costs in project appraisal.

D.4 For the purposes of the losses calculations the average load of circuits and SGTs has been assumed to be 65% of the peak group demand of 149MVA.

D.5 **Costs**

D.6 The cost used to assess losses on the system is the price of £60 per MWh as assumed by Ofgem in the Project Discovery documents.

D.7 The available distribution technologies, as explained in Section 3 are:

a. Overhead Lines;

b. AC Underground Cables.

D.8 For each technology, costs comprise:

a. the capital cost of procuring, installing and commissioning the transmission or distribution lines, or substation assets;

b. the on-going costs of the electrical energy lost in overcoming the electrical resistance in the conductors; and

c. the on-going other costs of operations and maintenance.

D.9 Decommissioning and reinstatement costs are not included in the lifetime costs.

D.10 **Overhead Lines**

D.11 Overhead line designs vary by the number and cross-sectional area of the conductors used for each phase of each circuit. The requirements for 400kV and 132kV lines in this case are:

b. 400kV double-circuit 2 x 850mm^2 (resistance = 0.0184Ω/km), and

c. 132kV double-circuit 1 x 300mm^2 (resistance = 0.1Ω/km).

D.12 Operations and maintenance costs consist principally of the cost of repainting the distribution pylons, which is scheduled to happen every 18 years, and the costs of regular inspection both from the ground and by helicopter. The annual costs are estimated to £0.80k/km at both 400kV and 132kV.

D.13 **AC Underground Cables**

D.14 AC underground cables installations vary principally by how the cables are laid. The principal methods employed by Western Power Distribution are direct burial and deep bore tunnels.

a. The Cable requirement for a Bridgwater – Seabank connection is for two cores per phase 2500mm^2 cables, 12 cables in total for two circuits (resistance = 0.0065Ω/km).

b. However with each circuit generating 20MVAr per km of capacitive gain, each circuit would require 2 x 200MVAr reactors (4 in total for two circuits).

Each Reactor has 0.4MW of losses associated with it (1.6MW for 4 reactors).

c. At 132kV, 650mm2 cables are required (resistance = 0.05Ω/km)

D.15 O&M costs have an approximate annual cost of £2.80 k/km for 400kV and £1.5 k/km at 132kV.

D.16 ***Substations (GSP)***

D.17 Substations form the hubs at which transmission circuits and supergrid transformers meet. They are installations which are generally compact.

D.18 Distribution losses in substations are assumed to be negligible but annual maintenance costs are estimated to be £50k per GSP.

D.19 Calculation of the Cost of Distribution Circuit Losses

D.20 The cost of distribution losses are calculated as follows:

Step 1: Calculate the Average Circuit Loading

- Peak Circuit Power Flow * Average Circuit Utilisation (34%)

Generic Example: 3100MW x 0.34% peak load would be 1054MW Average Loading

Step 2: Calculate the Average Loading per Circuit in KW:

- Average Loading per Circuit kW =

  (Average Loading (MW) / number of circuits) * 1000 (to convert to kW)

  There are 2 circuits in most cases.

  Example: (1054MW / 2) x 1000 = 527,000 kW

Step 3: Calculate the Average Current per Circuit in Amps:

- I = Average Loading Per Circuit kW / (√3 X Operating Voltage in kV)

  Operating Voltage 400kV or 275kV

Example: 527,000/ (√3 x 400) = 760.7 Amps

Step 4: Calculate the Resistance per Circuit:

- R = resistance/km * circuit length kms

Example: 2 x 850mm Overhead Line = 0.0184Ω/km x 60km = 1.104 Ω

Step 5: Calculate the Three Phase Lost Power per Circuit in MW:

- Three Phase Lost Power per circuit = 3 x I^2 x R

Example: 3 x 760.7^2 x 1.104 = 1.9MW

Step 6: Calculate the Lost Power in a 2 Circuit Route:

- This is multiplied by 2 to get the losses in a two circuit route

Example: 1.9 x 2 = 3.8MW

Step 7: Calculate the Annual Cost of Losses:

- Annual Loss Cost = Lost Power x Cost per MWh x 24hrs x 365 days a year

Example: 3.8 x £60 per MWh x 24hrs x 365 days a year = £2m per annum

Step 8: Calculate the Average Loading per Circuit in KW:

- The net present value of distribution losses is then derived by applying a discount rate of 3.5% to the annual cost over 40 years.

Appendix E National Policy Statements

E.1 The context for any options appraisal relating to energy infrastructure is provided by the Overarching National Policy Statement for Energy (EN-1). This states that in considering any proposed development, and in particular when weighing its adverse impacts against its benefits, the Infrastructure Planning Commission (IPC)11 should take into account:

- its potential benefits including its contribution to meeting the need for energy infrastructure, job creation and any long term or wider benefits; and
- its potential adverse impacts, including any long term and cumulative adverse impacts, as well as any measures to avoid, reduce or compensate for any adverse impacts.

E.2 It goes on to note that, in this context, the IPC should take into account environmental, social and economic benefits and adverse impacts, at national, regional and local levels. EN-1 provides guidance on assessment on a topic basis relevant to all energy projects which is supplemented by guidance specific to the project type. EN-1 recognises that "in most cases, there will be more than one technological approach by which it is possible to make such a connection or reinforce the network (for example, by overhead line or underground cable) and the costs and benefits of these alternatives should be properly considered as set out in EN-5 (in particular section 2.8) before any overhead line proposal is consented." (EN-1 paragraph 3.7.10).

E.3 In the case of the Hinkley Point C Connection, the relevant guidance for electricity transmission connections is to be found in the National Policy Statement for Electricity Networks Infrastructure (EN-5). Paragraph 2.8.2 of the Electricity Networks National Policy Statement (EN-5) states that:

E.4 "Government does not believe that development of overhead lines is generally incompatible in principle with developers' statutory duty under section 9 of the Electricity Act to have regard to amenity and to mitigate impacts. In practice new above ground electricity lines, whether supported by lattice steel pylons or wooden poles, can give rise to adverse landscape and visual impacts, dependent upon their scale, siting, degree of screening and the nature of the landscape and local environment through which they are routed. For the most part these impacts can be mitigated, however at particularly sensitive

[11] The functions of the IPC were transferred to the Planning Inspectorate in April 2012

locations the potential adverse landscape and visual impacts of an overhead line proposal may make it unacceptable in planning terms, taking account of the specific local environment and context."

E.5 EN-5 also says that although Government expects that overhead lines will often be appropriate and their effects can often be mitigated:

E.6 "Where there are serious concerns about the potential adverse landscape and visual effects of a proposed overhead line, the IPC will have to balance these against other relevant factors, including the need for the proposed infrastructure, the availability and cost of alternative sites and routes and methods of installation (including undergrounding)".

E.7 EN-5 states that consent should only be refused for overhead line proposals in favour of an underground line if "…the benefits from the non-overhead line alternative will clearly outweigh any extra economic, social and environmental impacts and the technical difficulties are surmountable". In this context it should consider:

- the landscape in which the proposed line will be set, (in particular, the impact on residential areas, and those of natural beauty or historic importance such as National Parks, AONBs and the Broads);
- the additional cost of any undergrounding; and
- the environmental and archaeological consequences of undergrounding.

E.8 The options appraisal that has been undertaken for the AT Route includes consideration of these particular factors in reaching a recommendation on where undergrounding can be justified.

E.9 EN-5 does not seek to define "particularly sensitive locations". However, in proximity to Corridor B, the only area which might clearly be considered to be particularly sensitive is the Mendip Hills AONB, which is nationally designated and lies some 0.5km to the south of the proposed substation and the start of the route corridor.

E.10 **National Planning Policy Framework**

E.11 The National Planning Policy Framework[12] (NPPF) may be considered as an "important and relevant"[13] matter in decision making for Nationally Significant

[12] Department for Communities and Local Government : National Planning Policy Framework : March 2012

[13] National Planning Policy Framework paragraph 3

Infrastructure Projects (NSIPs). Paragraph 6 of the NPPF states that "the purpose of the planning system is to contribute to the achievement of sustainable development". It goes on to note that planning has a key role to play in "supporting the delivery of renewable and low carbon energy and associated infrastructure".

E.12 The Hinkley Point C Connection is intended to provide additional transmission capacity to permit the connection of wind and nuclear powered generation and thereby assist the UK to meet its renewable energy targets. While the NPPF does not include policies specifically related to electricity transmission infrastructure, it does include policies for conserving and enhancing the natural and historic environment which have been taken into account in planning and assessing potential alignments.

E.13 Paragraph 115 states that "great weight should be given to conserving landscape and scenic beauty in National Parks and Areas of Outstanding Natural Beauty, which have the highest status of protection in relation to landscape and scenic beauty. The conservation of wildlife and cultural heritage are important considerations in all these areas…."

E.14 Paragraph 116 states that "planning permission should be refused for major developments in these designated areas except in exceptional circumstances and where it can be demonstrated that they are in the public interest." It goes on to state that applications for such development should be accompanied by assessments of the need for the development; the scope for meeting the need outside the designated area; and the effects of the development on landscape and recreational opportunities and the extent to which these could be mitigated.

E.15 Paragraph 118 calls on local planning authorities to aim to conserve and enhance biodiversity in determining planning applications by protecting nationally and internationally designated sites from development which would have an adverse effects upon them and, in all locations, by refusing development which could result in significant harm to biodiversity and which cannot be avoided or adequately mitigated or compensated. Specific mention is made of the need to protect irreplaceable habitats, including ancient woodland and veteran trees.

E.16 Paragraph 128 states that in determining applications, local planning authorities should require an applicant to describe the significance of any

heritage assets affected, including any contribution made by their setting. Paragraph 132 states that "when considering the impact of a proposed development on the significance of a designated heritage asset, great weight should be given to the asset's conservation. The more important the asset, the greater the weight should be given during the decision making process. Significance can be harmed or lost through alteration or destruction of the heritage asset or development within its setting."

E.17 **Development Plans**

E.18 **Regional Policy**

E.19 The Government revoked the Regional Strategy for the South West on 20th May 2013. As a result, the strategy no longer forms part of the Development Plan.

E.20 **Structure Plan Policy**

E.21 The Government also revoked Structure Plans on 20th May 2013, and as such they no longer form part of the Development Plan.

E.22 **North Somerset Replacement Local Plan**

E.23 Whilst the North Somerset Core Strategy was adopted in April 2012, a number of policies of the North Somerset Replacement Local Plan[14] are yet to be replaced. The intention is that such policies will be incorporated into the Sites & Polices Development Plan Document which is scheduled for adoption in summer 2014. The policies that remain in force, and are relevant to the proposals, include the following.

E.24 Policy ECH/4 seeks to achieve development that preserves a listed building's special architectural and historic interest and its setting.

E.25 Policy ECH/6 seeks to prevent development from causing damage to nationally important archaeological remains or their settings.

E.26 Policy ECH/7 aims to ensure that development does not adversely affect the particular character of a landscape.

[14] North Somerset Council : North Somerset Replacement Local Plan (March 2007)

E.27 Policy ECH/11 seeks to prevent development that could harm nationally or internationally protected species of flora or fauna or the habitats used by such species, unless that harm could be avoided or mitigated and the species protected by use of planning conditions or planning obligations.

E.28 Policy ECH/12 explains that development that is likely to have adverse effects on a Special Protection Area (SPA), Special Area of Conservation (SAC) or a Ramsar Site will not be permitted, unless adverse impacts on the integrity of the site can be avoided or there is no alternative solution and there are imperative reasons of overriding interest that enable the project to proceed.

E.29 Policy ECH/13 aims to protect Sites of Special Scientific Interest (SSSI) and National Nature Reserves from development that would have an adverse effect, unless other material considerations outweigh the loss of biodiversity.

E.30 Policy ECH/14 aims to protect wildlife and geological sites from development that would have an adverse effect, unless the importance of the development outweighs the value of the substantive interest present.

E.31 **North Somerset Core Strategy**

E.32 The North Somerset Core Strategy[15] was adopted in April 2012. The document contains a number of environmental protection policies and draws attention to the particular characteristics of the North Somerset environment.

E.33 Policy CS4 aims to protect and enhance biodiversity, including seeking to protect, connect and enhance important habitats, particularly designated sites, ancient woodlands and veteran trees.

E.34 Policy CS5 aims to protect landscape character and the historic environment.

E.35 Policy CS6 confirms that the boundaries of the Green Belt will remain unchanged for the plan period.

E.36 Policy CS9 seeks to safeguard and enhance areas of green infrastructure and, in this context, draws attention to a number of specific areas including :

[15] North Somerset Council : Local Development Framework – Core Strategy Corrected Version : April 2012

E.37 the promotion of the north slopes of the Mendip Hills AONB as sub-regional corridors for biodiversity, recreation and landscape retention;

E.38 the promotion of the Congressbury Yeo, River Banwell, North Somerset Levels and Moors, and Grumblepill Rhyne as local corridors for biodiversity and landscape enhancement.

E.39 The Proposals Map highlights the range of environmental constraints in the vicinity of the corridor including protected rhynes at Puxton Moor.

Appendix F Example of a Cable Sealing End Platform Pylon

Appendix G Environment Background Information

G.1 **Public Rights of Way**

G.1.1. There is a public footpath which follows the route of the existing farm track to Stoney Croft House, then continues in a northerly direction. An overhead line option would oversail this path and underground cables would cross the path and may cause temporary disturbance. A further public footpath extends south from the farm track toward Stock Farm. Both footpaths are currently oversailed by either W or Y Route.

G.1.2. Generally options that minimised effects on public rights of way would be preferable. Effects may be direct construction effects such as trenching for underground cables and visual effects on users of the public footpaths.

G.2 **Historic Environment**

G.2.1. The study involved undertaking searches for designated historic features including:

- World Heritage Sites;
- Scheduled monuments;
- Listed buildings (Grade I, II* and II);
- Conservation Areas; and
- Registered Parks and Gardens.

G.2.2. There are no designated historic features in the area immediately surrounding Churchill Substation and in the area to the east where the W and Y 132kV routes meet.

G.2.3. The closest designated asset is Brinsea Batch Farm, a Grade II listed building, approximately 900m to the west. The setting of this feature is unlikely to be affected due to the distance from the building and because the 'turn-in' would be on the east side of the substation away from the listed building. There are also existing features on the intervening land between the substation and the listed building including other development, trees and hedges which provide separation and screening.

G.2.4. The proposed modification works particularly any proposed underground cable installation could significantly and adversely affect unknown buried archaeology. The potential and significance of encountering buried features would need to be appraised during further assessment having regard to relevant national and local planning policies. Intrusive investigations and mitigation may be required including trial trenching and the findings may affect the final positioning of equipment such as pylons.

G.2.5. Ecology

G.2.6. National planning policy (EN-1 and EN-5) requires developers to consider potential effects of a project on 'Biodiversity and Geological Conservation'. This study included undertaking searches for features designated at the highest levels that could be affected **by** the proposed works. These included:

- Special Area of Conservation, Special Protection Area, Ramsar sites;
- Sites of Special Scientific Interest; and
- National Nature Reserves.

G.2.7. There are no designated sites in or immediately around the substation, although there are designated sites of international nature conservation importance, the North Somerset and Mendips Bats Special Area of Conservation to the south within a specified 5km consultation zone.

G.2.8. The Conservation of Habitats and Species Regulations 2010 (as amended) requires an appropriate assessment to be undertaken where a plan or project is likely to have a significant effect upon a European site, individually or in

combination with other projects . Further study and consultation with the relevant statutory consultees about the special interest of these sites would inform the process.

G.2.9. A document outlining the proposed appropriate assessment methodology, in relation to the entire Hinkley Point C Connection project, is currently in production and will shortly be circulated to statutory consultees for comment. This will describe the field and desk-based studies which have been undertaken to inform the assessment and will include the provisional identification of impact pathways, in-combination impacts and cumulative impacts.

G.2.10. Potential effects to European sites could include impacts on bat species, through hedgerow and/or tree removal, which are associated with the North Somerset and Mendip Bats SAC and/or the Mendip Limestone Grasslands SAC. An overhead line option may also present a collision risk to bird species which are a qualifying feature of the Severn Estuary SPA and Ramsar site. However, the increase in the extent of overhead line would not be significant, compared to the existing situation and ornithological assessments undertaken by TEP during winter 2012/13 have not highlighted any areas of importance for birds in the vicinity of the site.

G.2.11. Non-designated features of local level importance that could be affected by the proposed works on the substation site and immediate surroundings would include field boundary hedges, ditches and trees. Further investigations would be required to appraise the significance of effects and whether there is suitable habitat potential for protected species.

G.2.12. Overhead lines may oversail existing features such as ditches without adversely affecting them and pylons may be carefully sited to avoid conflict with species and habitats and therefore at this stage this would present no significant constraints to routeing or differentiate between overhead line options.

G.2.13. The installation of underground cables could adversely affect existing landscape features, hydrology and associated habitats and species. Effects could be temporary or permanent and may depend on construction methods employed. Open trenching methods for installation of cables could involve the removal and clearance of hedges trees, cutting into ditch banks and temporary diversion of water. It is feasible to carefully route away from features as far

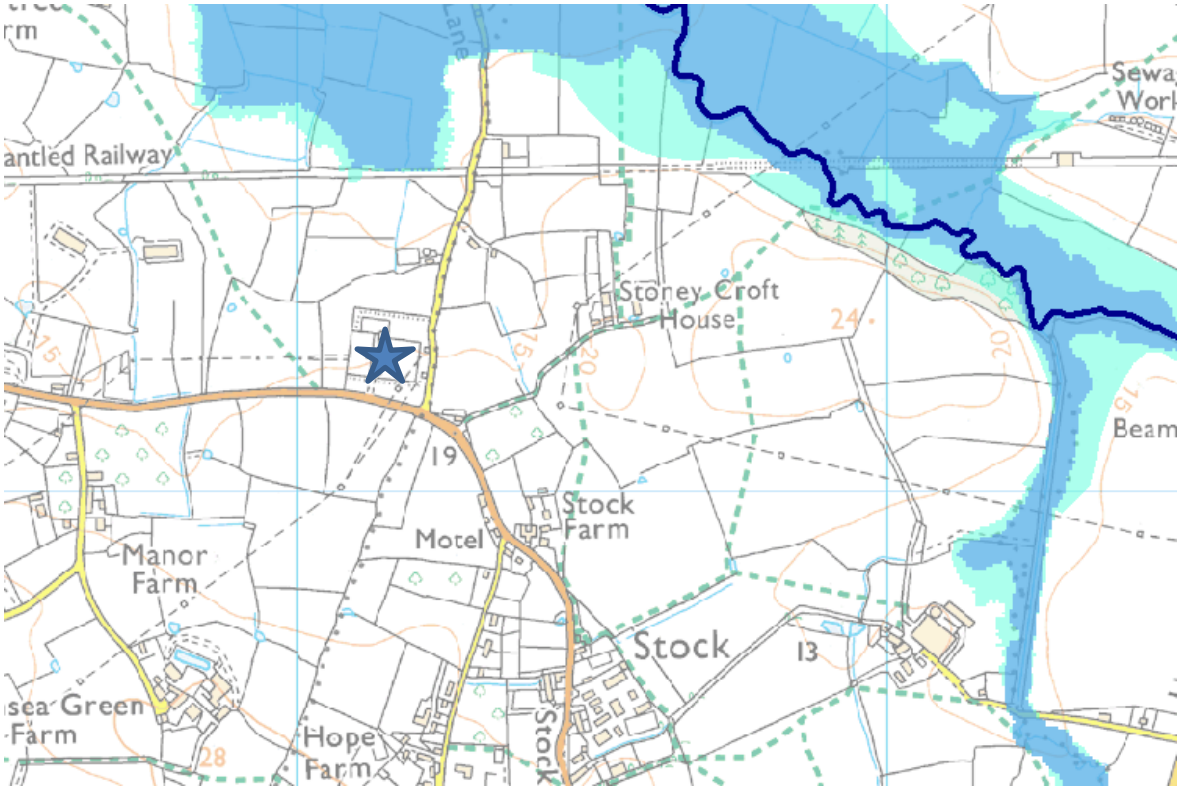
as possible and to include standard mitigation measure to minimise damage during construction and to restore and replace some features on completion.

G.2.14. Appropriate ecological mitigation measures as part of the works are likely to be required to minimise effects on species and habitats having regard to relevant international, national and local policies and guidance. The significance of potential effects and feasibility of mitigation measures would need to be considered further as the project design progresses.

G.3 **Hydrology and Flooding**

G.3.1. The area does not fall within Flood Zones 2 or 3, the areas at highest risk of flooding, as identified on the Environment Agency's flood map below.

G.4 Extract from the Environment Agency Flood Map



Existing substation

G.4.1. The installation of overhead lines or underground cables to the substation is unlikely to present a significant constraint or differentiate between options.

G.5 Landscape Character and Views

G.5.1. Churchill Substation and the surrounding area is in the national landscape character area 118 Bristol Avon Valley Ridges and the local landscape character area J2 River Yeo Rolling Valley Farmland.

G.5.2. The Bristol Avon Valley Ridges character area is described as a landscape of 'confused undulations' which is strongly influenced by the Avon Valley, Bristol at its centre and by its industrial history. The key characteristics defining the landscape are shallow valleys which contrast with limestone ridges and scarps. In rural areas there are substantial stone farmsteads and a variable hedgerow pattern, with woodlands mainly on steep valley sides. Settlement pattern is generally very dense, especially in the south. Many villages have become enlarged as commuter settlements and have abrupt edges with the countryside. Other important features characteristic of this area are waterside mills and reclaimed areas which represent the landscape's industrial heritage.

G.5.3. The River Yeo Rolling Valley Farmland is an extensive area of undulating lowland running across this part of North Somerset. Prominent landscape features in this area include the River Yeo flowing from east to west and the wooded limestone ridges to the north and south. This area is a rural pastoral landscape with irregular medium sized fields, a result of medieval enclosure. Hedgerows are a prominent feature with frequent hedgerow trees.

G.5.4. Each of the proposed options has potential to similarly affect the landscape character of the area where they are situated. The works could be designed to minimise effects on character by avoiding features or reinstating any affected. Overall effects would be limited because the character is already affected by the existing overhead lines and as a result this landscape is not highly sensitive to changes that would include installing similar features to those existing. Landscape character and is not a significant factor in determining a preference between options.

G.5.5. The modification works have potential to affect views in and around the substation and W and Y Routes. Effects on views and sensitivity of receptors would be considered in more detail in the EIA.

G.5.6. Options include the installation of new overhead line pylons and/or sealing end compound(s) which would be visible from the surrounding area and have potential to affect views. Views from the closest properties could be affected and residents are considered to be receptors of high sensitivity. Residents who could experience a change in views as a result of installing an overhead line to connect the substation (although not restricted to these) are those at the closest properties including Stoney Croft House, Bellway Cottage and Stock Farm.

G.5.7. Baseline views include existing overhead lines and development. There are significant blocks of trees and hedges in the local area which provide screening in views. The wooded slopes of the Mendip Hills AONB provide a backdrop to views south. Although options may include an increase of overhead lines in some views in most the new pylons would be seen within the context of existing overhead lines and the substation and would not have a significantly adverse effect on views. Installation of underground cables to the substation would have no significant permanent effect on views.

G.5.8. Mitigation in the form of new tree and hedgerow planting is feasible and could be effective in minimising long term effects around the substation and a connection option using an overhead line.

G.5.9. Installation of underground cables to the substation would have no significant permanent effect on views and would be a preferable option for minimising effects.

Appendix H Environment Constraints Map