SP MANWEB

Reinforcement to the North Shropshire Electricity Distribution Network

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Environmental Statement Chapter 3
The Proposed Development

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November 2018

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CHAPTER 3
THE PROPOSED DEVELOPMENT

Environmental Statement

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The Planning Act 2008

The Infrastructure Planning (Applications: Prescribed Forms and Procedure) Regulations 2009

Regulation 5(2)(a)

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Environmental Statement: Chapter 3 – The Proposed Development

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CONTENTS

Environmental Statement Documents

ENVIRONMENTAL STATEMENT		
DCO Document	**Chapter**	**Document**
6.1	1	Introduction
6.2	2	Alternatives and Design Evolution
6.3	3	The Proposed Development
6.4	4	Approach and General Methodology
6.5	5	Planning Considerations
6.6	6	Landscape and Visual
6.7	7	Ecology and Biodiversity
6.8	8	Historic Environment
6.9	9	Flood Risk, Water Quality and Water Resources
6.10	10	Socio-Economics
6.11	11	Land Use and Agriculture
6.12	12	Cumulative Effects
6.13	13	Summary of Environmental Effects
6.14		Environmental Statement Figures
6.15		Non-Technical Summary
6.16		Glossary

Reference is also made to the following documents:

DCO Document	Document
2.3.0 – 2.3.16	Works Plans
2.4.0 – 2.4.16	Access And Rights Of Way Plans
7.2	Construction Report

CHAPTER 3: THE PROPOSED DEVELOPMENT

3.1 INTRODUCTION

3.1.1 This Chapter describes the Proposed Development and its components as shown on Figure 1.2 'The Proposed Development' (**DCO Document 6.14**) and the Works Plans (**DCO Documents 2.3.0 – 2.3.16**).

3.1.2 Further details relating to this chapter are presented in:

- Appendix 3.1: Proposed Pole Schedule (**DCO Document 6.3.1**); and
- Appendix 3.2: Draft Construction Environmental Management Plan (CEMP) (**DCO Document 6.3.2**).

3.2 OVERVIEW

3.2.1 The Proposed Development comprises a new 132kV electrical circuit between Oswestry and Wem Substations in North Shropshire, together with associated temporary construction works. The circuit would be a combination of underground cables and overhead line. Works are also required at the existing Oswestry and Wem Substations to accommodate the new circuit.

3.2.2 The Proposed Development includes the following elements:

- Works within the boundary of the existing SP Manweb Substation at Oswestry including underground cable and the installation of electrical switchgear and associated equipment:
- Approximately 1.2km of 132kV underground cable between Oswestry Substation and a 132kV terminal structure at Long Wood (SJ 31132 29877);
- Approximately 21.3km of 132kV of overhead line supported by Trident wood poles from the terminal structure at Long Wood (SJ 31132 29877) to the existing SP Manweb Substation at Wem; and
- Works within the existing SP Manweb Substation at Wem including the installation of a new 132kV to 33kV transformer.

3.2.3 The Proposed Development also includes work to facilitate the new electrical circuit including:

- Undergrounding six short sections of existing SP Manweb lower voltage overhead lines in order to ensure safe electrical clearance for the new overhead line; and
- Temporary works required for the construction of the new overhead line including seven temporary laydown areas, welfare unit, security cabin, access tracks, vegetation clearance and reinstatement planting.

3.2.4 The construction compound for the Proposed Development would be located at the existing SP Manweb depot at Maesbury Road, Oswestry Industrial Estate, where site offices and welfare facilities are already in place. As this is an existing depot this compound is not included within the application. The construction compound would cater for the following:

- Bulk delivery (HGV) and storage of materials, the main components being wood poles, wood baulks, conductor, stay wire, cross arm assemblies and insulators; and
- Storage of construction plant and equipment.

3.2.5 It is anticipated that the construction compound would be in place in the SP Manweb Maesbury Road Depot for a maximum of 18 months. As the depot already serves as a maintenance and construction compound for other SP Manweb works it is not included within the application for an Order granting development consent. The construction compound was considered in the Transport and Highways Technical Note (September 2018), (Appendix 1.1 (**DCO Document 6.1.1**)). This concluded that construction traffic associated with the Proposed Development would not result in significant effects.

3.3 ORDER LIMITS AND FINAL ROUTE ALIGNEMNT

Order Limits

3.3.1 The 'Order Limits' identify the area for which DCO consent is being sought. These Order Limits are in effect a construction and operation corridor, where

all the proposed work would be undertaken. The Order Limits include land for the permanent installation of the new 132kV circuit (including works at the existing substations, the overhead Trident wood pole line, the section of undergrounding and the six sections of undergrounding for existing lower voltage lines, the seven laydown areas and the construction accesses.

3.3.2 The width of the Order Limits (excluding the substations) is for the most part 25m wide for the overhead line section and 20m wide for the underground cable section. The Order Limits for this type of development are often in the region of 100m in width. SP Manweb has worked hard (through careful design, avoidance of constraints, targeted consultation and landowner discussions) to develop a 25m wide corridor for this project that minimises the required extent of land take and land rights.

3.3.3 The width of the Order Limits extends at changes in direction on the reflex angle of the line, i.e., the larger angle on the outside of the line, as shown in Diagram 3.1 below. This is to allow for the conductors to be fixed to the wood poles by means of a winch. The width of the Order Limits allows for some flexibility to allow for small changes to the design. These changes could, for example, be in response to identification of unsuitable ground conditions during construction or previously undiscovered archaeological features. This degree of flexibility has been taken into consideration in the EIA.

3.3.4 The Order Limits also include construction accesses from public roads. These utilise existing accesses onto the public highway and generally follow farm accesses and field tracks or pass alongside existing field boundaries on the edge of fields. Each construction access would generally be between 3m and 5m wide and, apart from two locations where new temporary gates would be installed, would use existing field gates or openings.

3.3.5 Seven temporary lay-down areas, where poles and construction materials would be temporarily stored, have been identified at regular intervals along the route. These are located adjacent to construction accesses. The

temporary laydown area on the edge of Wem would also accommodate a security cabin and self-contained welfare facilities.

3.3.6 The Order Limits also extend at the terminal pole to allow for the conductors to be fixed to the wood poles by means of a winch.

3.3.7 The development of the Order Limits has had the benefit of input from line design engineers who, working alongside the environmental team, have been able to balance the need between the technical requirements of a Trident overhead line and the avoidance of environmental constraints; whilst considering issues raised through statutory and non-statutory consultations and landowner discussions. This has resulted in the Proposed Development, which respects the competing interests between landowners, technical requirements and environmental considerations.

3.3.8 Within the Order Limits the poles would, wherever possible, be located where indicated along the Final Route Alignment (see below for definition). It is anticipated however that post consent it may be necessary and desirable to refine the final vertical and horizontal profile of the conductors and pole positions (known as micro-siting) to reflect the following:

- Following consent and pre-construction, environmental constraints would be reviewed (for example for protected species which may be present);
- Following consent and pre-construction, micro-siting would take place involving more detailed technical survey information, particularly for unconfirmed ground conditions; and
- Agreements on minor alterations suggested by landowners.

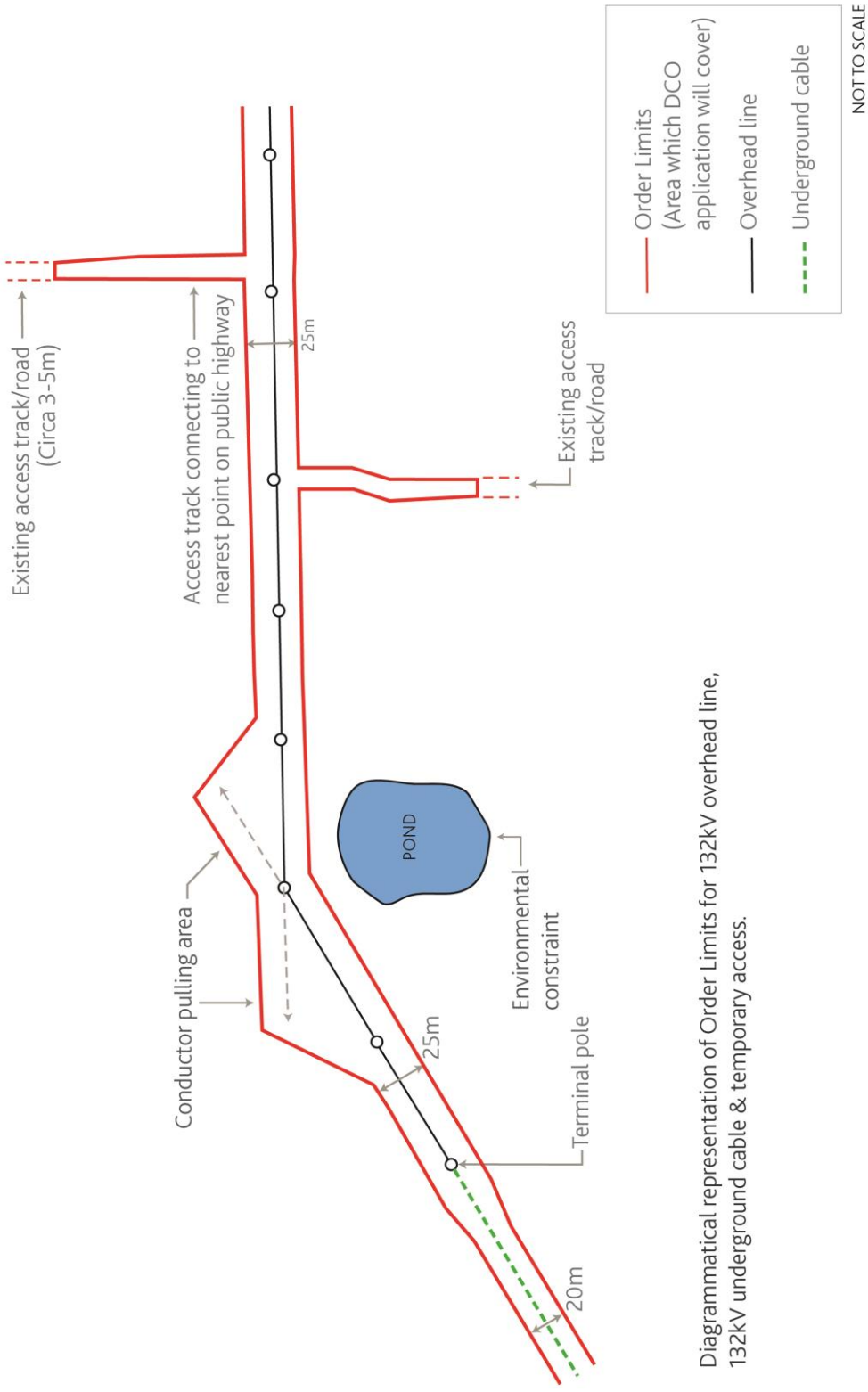

Diagram 3.1 – Diagrammatic representation of the Order Limits

3.3.9 In response to any need for micro-siting and notwithstanding any constraints, the Order Limits allow for the following:

- To move any pole structure by no more than 5m from its indicative position (as shown on the Works Plans (**DCO Documents 2.3.0 – 2.3.16**)), and not within 1m of the outside edge of any hedgerows; and
- To increase vertically in height any pole structure (not exceeding 2 metres) from the heights shown in the Proposed Pole Schedule (Appendix 3.1 to the ES (**DCO Document 6.3.1**)).

3.3.10 The indicative location of the 132kV underground cable is shown on the Works Plans (**DCO Document 2.3.1**).

Final Route Alignment

3.3.11 The Final Route Alignment provides the indicative pole positions and alignment of the Proposed Development. The indicative pole locations are shown on Figure 1.3 (**DCO Document 6.14**).

3.4 PURPOSE OF THE CHAPTER

3.4.1 The remainder of this chapter provides an overview of the following:

- Wider setting of the Proposed Development;
- A description of the Final Route Alignment ;
- Design of the Proposed Development;
- Temporary construction works;
- Operation and maintenance;
- Decommissioning; and
- Indicative programme.

3.5 WIDER SETTING OF THE PROPOSED DEVELOPMENT

3.5.1 The Proposed Development is situated within the administrative county area of Shropshire. It passes through a scenic, farmed landscape of arable fields

and pasture with occasional villages, scattered residential properties and woodland.

3.5.2 Shropshire's geology is diverse. The Proposed Development crosses part of the Shropshire Plain, which covers much of North Shropshire. The plain is a basin of Permian and Triassic New Red Sandstone, overlain by a small area of Jurassic Sandstone near Wem.

3.5.3 The landform of the area through which the Proposed Development passes is typical of the Shropshire Plain, being low lying and relatively flat or gently undulating. There are some areas of higher ground (between 90 – 110m AOD) in the north-west, close to Oswestry, and in the central areas of the study area, close to Stanwardine in the Wood.

3.5.4 The Proposed Development passes within the floodplain of the Rivers Perry and Roden.

3.6 DESCRIPTION OF THE PROPOSED DEVELOPMENT

Oswestry Substation

3.6.1 The existing Oswestry Substation is located on the north-eastern edge of the town. Works at Oswestry Substation would comprise the installation of electrical switchgear and associated equipment (132kV outdoor circuit breaker, isolator and associated busbar, cable sealing ends) and 132kV underground cable. The Proposed Development would be routed from a vacant bay within the substation as a 132kV underground cable, which would then continue to Long Wood (grid reference SJ 31132 29877).

3.6.2 The proposed works at Oswestry Substation will use the existing and recently upgraded vehicular accesses into the substation site off of the B4580. Construction vehicles using this access will move through the substation site to the proposed works. No new or alteration works to these accesses is required.

3.6.3 The modifications to Oswestry and Wem Substations would normally be considered permitted development (under the Town and Country Planning

(General Permitted Development) (England) Order 2015). SP Manweb have however included the substation works within the Proposed Development and they are considered within this ES. This is because SP Manweb has taken the view that this is all part of the installation of a new 132kV overhead line, which is regarded as a Nationally Significant Infrastructure Project and therefore forms part of the Proposed Development. As such, it is development that is included in the EIA.

Underground Cable

3.6.4 The section of the proposed electrical circuit that exits Oswestry Substation and passes south and then east towards Long Wood near Middleton, is to be undergrounded in order to avoid physical constraints and likely visual impacts arising from a new overhead line close to two existing 132kV overhead lines. It also avoids a planned extension to an existing employment area to the north-east of the town. The route for the underground cable (as shown on the Works Plans (**DCO Documents 2.3.0 – 2.3.16**) and illustrated on Figure 1.3 (**DCO Document 6.14**)) runs roughly parallel to the western edge of the A5(T) for a distance of approximately 600m before passing south-east under the A5(T) (100m). For the remaining 500m it heads south roughly parallel to the eastern edge of the A5(T) then east towards Long Wood where it transfers to an overhead line at pole no.1.

3.6.5 Undergrounding would normally be considered permitted development (under the Town and Country Planning (General Permitted Development) (England) Order 2015). SP Manweb have however included the underground section within the Proposed Development and it is assessed within this ES.

Overhead Line Route

3.6.6 The Final Route Alignment (including the pole positions) for the overhead line is shown on the Figure 1.2 and 1.3 (**DCO Document 6.14)** and the Works Plans (**DCO Documents 2.3.0 – 2.3.16**).

3.6.7 The Final Route Alignment for the new overhead line originates in fields to the east of the A5(T) near Oswestry, to the south-west of Long Wood, with a

terminal pole at pole no. 1 accessed via an existing track off of the A5(T), where a temporary laydown area would be located. The working area extends east of pole no. 1 in order to provide an area for positioning winching equipment to pull the conductors onto the wood poles for this first straight section of line (pole no's. 1 to 8). From pole no. 1 the Final Route Alignment runs in an easterly direction, passing through hedged fields with occasional blocks of trees, including Middleton Coppice, which lies to the south of the route. To the north-west of Middleton Coppice an existing 11kV overhead line would be undergrounded, at the point where the existing and proposed overhead lines would cross. There are temporary laydown areas in Middleton, south of pole no. 2 between Cabin House and Top House Farm, and at Brookfield Farm, located at the southern end of Coalpit Lane north of pole no. 12. Between pole no. 11 and pole no. 22 the route continues in a broadly east-south-easterly direction, with access via Bryn-y-plentyn. The Final Route Alignment continues across fields before crossing the B5009 and the Shrewsbury to Crewe rail line that lies north of the fuel oil distribution yard, and south of Babbinswood. South of Babbinswood pole no. 22 is an angle pole which gently changes the direction of the line to the east. At this location the main construction accesses are via Berkhill Lane and Perrymoor Farm. From pole no. 22 the route continues through fields, running through some smaller, low-lying fields to the north-east of The Oaks and north-west of Decoy Farm, and passing a small woodland block and frequent mature hedgerow trees.

3.6.8 Continuing in an easterly direction across farmland the overhead line approaches and crosses the Montgomery Canal and The Shropshire Way regional trail, a long distance walking trail promoted by the Long Distance Walking Association. The Shropshire Way regional trail forms part of the Shropshire Way Route 27, and part of the locally promoted 53km Oswestry Round Trail. The route crosses the Montgomery Canal to the north of Green Wood which is situated on the eastern banks of the canal in the privately owned Woodhouse Estate. East of the canal, the route crosses an area of

slightly elevated hedged fields to the north of Woodhouse Estate (which is the single largest landholding crossed by the route). The accesses west of the canal would be via Perrymoor Farm, and east of the canal would be via existing tracks through the Woodhouse Estate via both Berrywood (in the south) and Rednal Mill (in the east). The route continues in an easterly direction, crossing the River Perry and passing between the residential properties at Rednal Mill, Misty Meadows (pole nos. 49 to 51 take the route across the river and between the properties). It then crosses a lower-lying road (Woodhouse Drive) north of the industrial estate at Rednal. To the east of Rednal Mill, between pole nos. 52 and 53, a 134m section of existing 11kV line which currently oversails Rednal Mill Cottage would be removed and undergrounded 50m west along the parallel local road.

3.6.9 From pole no. 54 (east of Rednal Mill) the route runs broadly to the east for 1km, across the agricultural moorland either side of the River Perry. The Final Route Alignment then passes north of Lower Lees Farm, through an area of lower lying land to the south of the River Perry. Throughout this area the landscape generally comprises low-lying, large scale arable fields, bounded by mature hedgerows. At pole no. 64 the route turns north-east, where it again crosses the River Perry and heads for 1km towards Dandyford Farm and to the north of Lower Hordley mostly following the hedged boundaries of the large arable fields. A further temporary laydown area is located at Dandyford Farm.

3.6.10 Between the village of Lower Hordley and south of the residential property and farm at Dandyford the landform begins to rise again. Here the route straightens (at pole no. 73) and a further small section of an existing 11kV overhead line is undergrounded to the immediate north of Lower Hordley. At this point, as the landform continues to rise, the route heads in a roughly south-easterly direction for 3.3km (from pole nos. 73 to 100 (near Stanwardine), crossing arable fields and the rural lanes to the north-east of Lower Hordley. It follows the grain of the field pattern on the approach to Top House Farm. From here it continues south-east before crossing areas of

slightly more elevated farmland south of Top House Farm near Whinnett Hill and Ferney Hough. The landscape in this area has a smaller and more irregular field pattern, and more mature trees. The accesses along this section are via Top House Farm, where there is a temporary laydown area, north of pole no. 88.

3.6.11 As the route continues in an easterly direction it approaches a localised (north-west to south-east) ridgeline near Kenwick Lodge. This is in an area of small to medium scale fields with scattered mature hedgerow trees, including a distinctive line of oaks. The route gently changes direction twice, whilst continuing in a broadly south-easterly direction. At pole no. 100, south of Kenwick Lodge, the route changes to a generally straight easterly direction, for 2.1km, passing to the north of Stanwardine Hall, until it reaches pole no. 115 north of Wackley Lodge. From pole no. 97 the route crosses a shallow localised ridgeline to the north of Stanwardine in the Wood and Stanwardine Hall, and descends into the lower lying fields near Cockshutt and Stanwardine Grange, passing through small to medium scale fields with scattered mature hedgerow trees. The localised ridge continues east-south-east of Stanwardine in the Wood. From here it would cross an unnamed lane and the A528 in relatively quick succession, before continuing east to the north of Wackley Lodge. A small section of an existing 11kV overhead line would be undergrounded to the immediate north-east of Wackley Lodge, at pole no. 116.

3.6.12 For approximately 700m the overhead line would head north-east (between pole nos. 115 and 120) across lower lying farmland near to Wackley Brook. This is a landscape which comprises some large open fields with occasional mature hedgerow trees. Between pole nos. 120 and 138 the route heads south-eastwards for approximately 2km. Temporary accesses along this section of the line would typically be short because the route is close to public roads. The route would skirt to the north of a large pond before continuing south-eastwards, crossing a lane and passing through an area of slightly elevated land to the north of the residential properties at The Wood and Malt

Kiln Farm. The route is located broadly equidistant between The Runner's Rest and The Wood. The route would avoid the many ponds scattered throughout this area. The route continues on the far side of a row of mature hedgerow trees. It then continues in a south-easterly direction, crossing fields with some individual mature trees, before oversailing the B4397 and crossing open fields (with no hedgerow boundaries). At this point it lies over 200m south of Coppice Farm farmhouse where a further temporary laydown area is located and a section of 11kV overhead line would be undergrounded (at pole no. 132).

3.6.13 The route continues in a south-easterly direction skirting around the southern edge of Moor Fields Local Wildlife Site. Moor Fields is an area of distinctive field patterns with mature hedgerows and trees and is important for its grassland habitats.

3.6.14 At pole no. 138 the route turns to the north-east, passing through an area of small-medium scale pastures and arable farmland to the east of Bentley Farm and running largely parallel to an existing 33kV wood pole overhead line. Between pole nos. 143 and 164 the route deviates north away from Noneley with pole no. 150 located approximately equidistance between Loppington and Noneley. Field boundaries contain mature hedgerows and trees and there are scattered individual mature trees within the fields which are often associated with ponds. The route passes to the west of the residential property, farm and listed buildings at The Shayes, before turning sharply east at pole no. 150 south of the residential property at Chapel House, and close to a large pond bordered by trees.

3.6.15 Between pole no. 150 and pole no. 176 there are two broadly straight sections of line as the route avoids Noneley and Commonwood.

3.6.16 The line crosses a rural lane before heading east for 1.3km between pole no. 150 and 162 through an area of more open, larger scale arable fields and occasional strips of trees and hedgerows. To the north of Commonwood the route turns south-east at pole no. 162 before crossing the River Roden

between pole nos. 164 and 165. At pole no. 164 the line turns north-east and heads towards Wem substation, with minor route turns at pole nos. 166 and 172. This is an open, sparsely populated, level and low-lying landscape.

3.6.17 South of the residential property at Pools Farm, a section of the existing wood pole 33kV overhead line would be placed underground close to pole no. 172. The line crosses the B5063 Ellesmere Road before entering Wem substation. This latter section lies close to the western edge of Wem, including the individual residential properties (Avondale, Harley House and Overfields) that are close to the B5063. A temporary laydown area is located adjacent to Wem sub-station close to pole no. 175.

Wem Substation

3.6.18 The modifications required within the existing Wem Substation boundary comprise the installation of a 132kV cable gantry, line isolator, associated busbars, a 132kV to 33kV transformer, 33kV cable and a 33kV circuit breaker.

3.7 DESIGN OF THE PROPOSED DEVELOPMENT

3.7.1 A summary of the design is provided below from paragraph 3.7.2 to 3.7.23. Further information is provided in the Construction Report (**DCO Document 7.2**).

Oswestry Substation

3.7.2 Oswestry Grid Substation was recently modernised and therefore the works required here to accommodate the new circuit are minimal.

3.7.3 The works include installing a 132kV outdoor circuit breaker, isolator and associated busbar, cable sealing ends and 132kV underground cable.

3.7.4 The above equipment will be located in an existing empty bay approximately 10m x 20m bolted on a number of new concrete plinths. Further information is provided in the Construction Report (**DCO Document 7.2**).

Underground Cable

3.7.5 Three 132kV single core cables together with fibre optic communication cables would be laid in the cable route to Long Wood. The fibre optic communication cable is for internal operational use by SP Manweb only, and is related to the running of its network.

Overhead Line

3.7.6 The proposed design for the overhead line is to use Trident wood poles, as illustrated below in diagram 3.2.

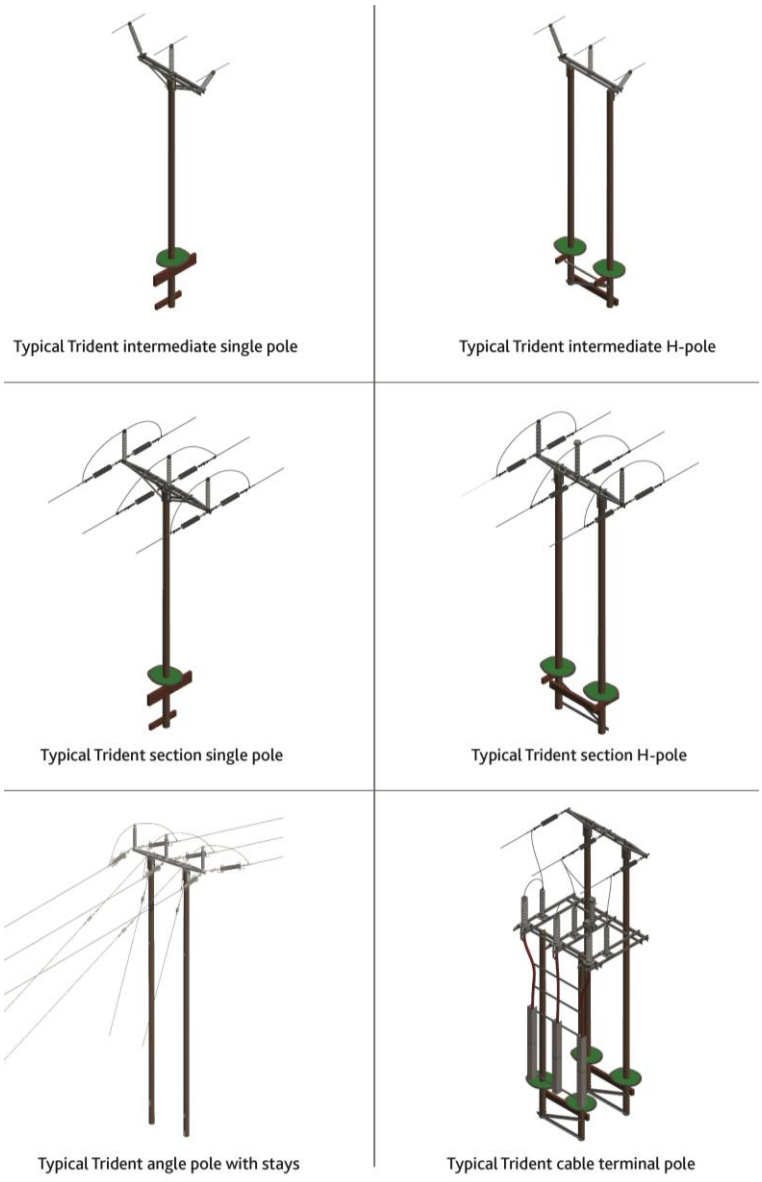

Diagram 3.2 – Illustration of different Trident pole types

3.7.7 As explained in section 2.3 of Chapter 2 'Alternatives and Design Evolution' (**DCO Document 6.2**) this design is lower in height and has a more slender and simple appearance than steel lattice towers or alternative heavier duty wood poles (the HDWP design). Wood poles are easily screened by trees and are less likely to be visible from the surrounding landscape than heavy duty wood poles and, particularly steel towers. Trident poles are also more flexible in terms of routeing around obstacles, thereby enabling a better landscape 'fit'. Wood poles have a further advantage in that they do not generally have concrete foundations and so construction methods are typically less intrusive.

3.7.8 SP Manweb has constructed a number of Trident lines across England, Wales and Scotland, including most recently in 2015 between Legacy (Wrexham) and Oswestry Substations.

3.7.9 The Trident design comprises three phase conductors supported on tension insulators which are secured to galvanised steel cross-arms assemblies. The upper structures are approximately 3.8m wide (in total) for a single intermediate wood pole structure and 5.2m wide for a double pole structure.

3.7.10 A range of wood pole structures is available within the Trident specification of either single wood pole or double wood pole ('H-pole') structures. The structure used at each location is chosen to accommodate the design factors at that location such as span length, landform and angles of deviation.

3.7.11 Galvanised steel stay wires ('stays') are installed to resist the lateral mechanical forces acting on the pole structures in order to keep the structures vertical. These stay wires are used where the line changes direction and at terminal positions. Stay wires are attached near to the top of the structures and anchored in the ground by a below ground timber foundation block.

3.7.12 Structures can be categorised as intermediate, section, angle or terminal, as described below and illustrated in diagram 3.2 and listed in Appendix 3.1 'Proposed Pole Schedule' (**DCO Document 6.3.1**):

- Intermediate - used where the overhead line follows a straight line and where the landform along the route is comparatively level. Options include single pole or H-pole structures with the majority being single poles. The single pole supports a steel cross arm of 3.0m overall length. The intermediate 'H-pole comprises two poles set 2.5m apart, with a similar overall cross arm length. In some situations the H-pole structure can be secured further with stays, allowing span lengths to increase. The 'footprint' of the structure, however, would be increased as a result. Conductors are continuous at these structures and are secured using a clamp arrangement at the top of a vertically mounted post insulator. There is no general requirement to fit stays to intermediate structures.
- Section - used where the overhead line follows a straight line but where the forces applied to the structure by the conductors due to, for example, the landform or long spans are too great for intermediate structures. In section structures the conductors are secured to horizontally mounted tension insulators. The conductors on either side of a section structure are joined using a short length of conductor ('jumper') supported on a vertically mounted insulator. There is no general requirement to fit stays to section structures.
- Angle poles - can be single or H-pole structures, and can provide a maximum angle of deviation of 75 degrees. The conductors at these locations are secured to horizontally mounted tension insulators with a jumper connecting either side of the structure. These structures are fitted with up to four stays to enable changes of direction in the overhead line.
- Terminal structures - used at either end of an overhead line. The terminal structure allows the overhead line to be connected either to an underground cable or directly to a substation gantry (as at the Wem Substation). For an underground cable the terminal structure comprises a stayed four wood pole construction consisting of an H-

pole with a smaller support H-pole immediately in front to support the cable sealing end terminations. The terminal structure would have a four stay arrangement to provide a balance against the weight and tension of the conductors. Where the terminal structure connects to a gantry only a single H-section structure is required.

3.7.13 The proposed overhead line includes a total of 176 structures as detailed in Table 3.1 below:

Table 3.1 – Trident Wood Pole Structure Types

Structure Type	Pole Type	No. of Structures
Terminal H-pole	Double H-pole	1
Intermediate	Intermediate (2.5m arm)	120
	Intermediate H-pole	9
Section	Section Single	6
	Section H-pole	3
Angle	Angle Single	4
	Angle H-pole	33

Pole Sizes

3.7.14 The wood poles would be between 300mm and 450mm in diameter. The diameter varies subject to the height of the pole

3.7.15 The overall height of the line is dependent on a number of criteria, including the need to maintain a statutory ground clearance of 6.7m, geographical location, topography, height above sea level, wind and ice loading and span length and conductor type. Including the steelwork on top of the pole (which is around 2m tall), the Trident wood poles used scheduled for this project are typically about 14m above ground. The maximum overall height of the poles including the steelwork is not expected to exceed 18m, and the minimum overall height is expected to be just over 11m.

3.7.16 The poles used for the structures are between 10m and 17m in length (of which approximately 0.7 to 2.5m is buried, depending on the structure). All wood poles are fully seasoned and treated with an appropriate preservative.

3.7.17 The galvanised steelwork is assembled using galvanised high tensile steel bolts with nuts and locking devices.

Span Lengths

3.7.18 Span length is dependent on the same criteria as line height.

3.7.19 The average distance between the wood pole structures ('span length') is 122m. The longest span length along the Proposed Development is approximately 200m and the shortest 51m.

Insulators and Conductors

3.7.20 The single-circuit comprises three separate phase conductors which are attached to the pole top structure on insulators, made of a suitable electrical insulating material and are used to support the conductor and provide the necessary electrical clearance between the conductor and the supporting galvanized steel cross-arm.

3.7.21 The proposed design would support an aluminium conductor of 200mm^2 cross sectional area (industry name 'POPLAR') with an optical fibre included in one of the phase conductors. The fibre optic communication cable is for electrical protection and communication systems and as noted previously, is for internal operational use by SP Manweb only, and is related to the running of its network. The line is only earthed at the terminal poles, using copper conductor and copper rods beneath the ground in a grid formation around the feet of the poles.

Foundation Design

3.7.22 In good ground conditions, the line would be directly embedded into the ground and the hole backfilled with excavated topsoil or an appropriate crushed-stone aggregate. Additional support where required is provided by

a below ground timber foundation block to be fitted at a minimum of 500mm below ground level.

3.7.23 It is not anticipated that significant volumes of rock would be present at any locations along the 132kV overhead line route, though the design of the foundations for the 132kV overhead line is guided by the ground conditions at each pole location. For poor ground conditions, the excavated material is considered not to possess the required bearing strength characteristics so it will be necessary to design the foundation so that the excavated material is replaced with a granular material. For some areas where the ground is very poor it may be necessary to design additional measures such as using concrete. These works are no more intrusive than the standard excavations proposed for the majority of the foundations. The final pole positions may be microsited to minimise the extent of the foundation works necessary at any particular location. This movement of the pole position may require an adjustment in the pole height and head size to ensure statutory ground clearance is maintained. Micro-siting is subject to the Order Limits as described above.

Wem Substation

3.7.24 The proposed new plant will be located within the existing substation boundary. The plant to be installed is a 132kV gantry, line isolator, associated busbars, a 132kV to 33kV transformer, 33kV cable to existing 33kV outdoor bay and a 33kV circuit breaker. An indicative layout of these works is provide shown in the Construction Report (**DCO Document 7.2**).

3.8 TEMPORARY CONSTRUCTION WORKS

3.8.1 This section provides a brief description of the temporary construction works. More detailed information is provided in the Construction Report (**DCO Document 7.2**).

Construction Compound

3.8.2 The construction activities would be served by a construction compound at the existing SP Manweb depot at Maesbury Road on the Oswestry Industrial

Estate. As noted in paragraph 1.2.4 of Chapter 1 'Introduction' (**DCO Document 6.1**) this is an existing depot which already serves as a construction compound for other SP Manweb works and therefore it is not included within the DCO.

Construction Accesses

3.8.3 Construction activities would be served by construction accesses. Full details of all the works relating to the accesses, including those necessary for the works at Oswestry Substation and Wem Substation, for the construction of the underground 132kV cable and the 132kV overhead line, are given in Section 7.1 of the 'Construction Report' (**DCO Document 7.2**).

3.8.4 Construction vehicles will move from the public highway to the laydown areas and to the work sites via construction accesses which will be typically 5m wide and slightly wider where there is a swept path requirement. Construction accesses have been designed to access every pole site on the route.

3.8.5 In line with SP Manweb's approach to avoid breaching hedgerows along field boundaries and minimise the number of hedgerow crossings, the design of construction accesses takes into account the need to access the works areas from the existing public highway and suitable farm accesses. These existing farm accesses are all currently in use to access various fields and as such there is either an existing surfaced track, a stoned track or grassed track through existing field gates. The construction accesses have been designed to ensure pedestrian and vehicular access can be obtained to each pole location. Where it is not possible to access the next adjacent pole location due to the presence of a hedgerow on the field boundary between the pole positions, access is taken via the next available existing field access to minimise removal of hedgerows.

3.8.6 If required, due to the time of year and/or adverse wet weather, there may be a need to create a temporary surface within the construction width shown. This would be in the form of temporary trackways or temporary stoned accesses that are commonly used. Any such temporary access

improvements will be removed following the construction and re-laid temporarily the next time they might be needed for operational maintenance.

3.8.7 There is very limited work required in the Proposed Development in relation to the public highway. The Proposed Development benefits from using existing accesses at both the substation sites and from utilising existing farm accesses elsewhere along the route of the 132kV underground cable and 132kV overhead line as well as the lower voltage diversions along the route. Where these accesses are not suitable at the time that construction or subsequent maintenance is taking place, then SP Manweb will lay temporary tracks. This approach results in their being no need to create new or alter existing accesses along the public highway (or 'streets' requiring consent under relevant street works regulations).

Underground Cable

132kV Underground Cable

3.8.8 At Oswestry Grid substation, the cable system starts with special weatherproof terminations, known as Cable Sealing Ends, which are connected to the busbars. Three 132kV single core cables together with fibre optic communications cables would then be laid in a cable trench to a terminal structure at Long Wood. The fibre optic communication cable is for electrical protection and communication systems, is for internal operational use by SP Manweb only, and is related to the running of its network.

3.8.9 Site preparation works includes vegetation clearance where necessary within the working area.

3.8.10 The 132kV underground cable would typically be laid at a depth of 1m below ground level in a trench approximately 1m wide.

3.8.11 The cable would be installed in 200mm diameter ducts formed of polyethylene, which is chemically inert and does not contain any fluids. The ducts would be laid in a trefoil arrangement at a depth of about 1.4m in agricultural land to ensure a final minimum depth of 975mm can be maintained. The cable trench would be excavated by a JCB type excavator.

A working area of 7-10m for the cable installation would be required to accommodate a trench about 1m wide together with the excavated material. Topsoil excavated from the cable trench would be segregated and then used to complete the backfilling. Dependent on the ground conditions, suitable imported backfill material may be used to backfill the trench. An appropriate trench support system may be required dependent on the ground conditions. During cable laying operations, suitable crossing points would be provided as necessary to ensure access to properties local to the trench is maintained.

3.8.12 Access would typically be required for an excavator (JCB and/or tracked 360 degree excavator) JCB or similar agricultural 'loader', 4x4 Hiab lorry (Hiab is the common term for a lorry loader crane) and 4x4 pick-ups. Access would also be required for 1 tractor, 1 mobile elevated working platform (MEWP) and cable trailers.

3.8.13 Materials would be removed from site using general purpose 4-wheel drive cross-country vehicles which have incorporated lifting devices and tractors with trailers.

3.8.14 The underground cable would be protected by precast tiles laid at such a distance above the cable to ensure as far as is reasonably practical that any person inadvertently excavating the ground above the cable would receive a warning of its presence. The cable route would be indicated by above ground markers located at the centre of the cable trench and which would be placed at field boundaries to indicate the cable route. Such markers would be located so as not to interfere with normal farming activities.

3.8.15 It is expected that the underground cable would at some point intersect with existing underground services, such as water mains or sewage pipes. The normal procedure in such cases is to provide a deeper trench for the underground cable and tunnel under the existing services. Excavation and reinstatement local to existing services would be carried out with due care and in accordance with HSE guidance document 'HSG 47 – Avoiding danger from underground services'.

3.8.16 The cable would be delivered on cable drums on a flatbed lorry and then positioned as required in order to allow the cable to be pulled through the ducts by a cable winch attached to a steel wire bond.

3.8.17 For the A5(T) crossing SP Manweb intend to use horizontal directional drilling (referred to as HDD). HDD works by sending a boring head from a send pit (entry pit) to navigate along a predetermined alignment to a receive pit. After a small diameter passageway exists, the machine is outfitted with a reaming head to widen the tunnel. Fluids keep the machinery cool and lubricated while underground material is collected along its path. Certain drill heads are made for cutting through solid rock. The drill head can also be steered to form large radius bends. The entry and receive pits are typically between 7m and 10m long and approximately 2m wide and would be located either side of the A5(T) and within the Order Limits.

3.8.18 Diagram 3.3 below illustrates a typical HDD profile.

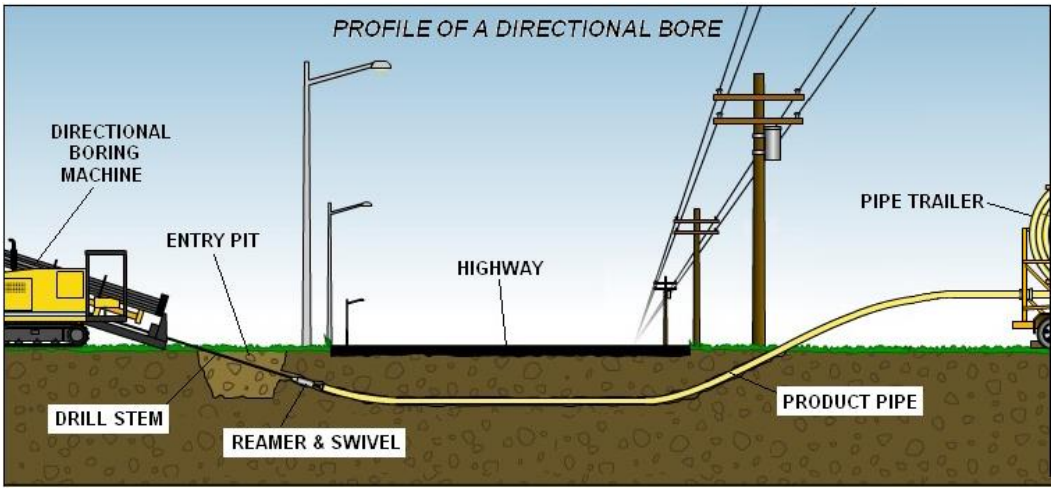

Diagram 3.3 – Illustration of a typical HDD profile

3.8.19 The HDD would also cross under an existing high pressure gas main.

3.8.20 The existing highway and access off the A5(T) is suitable to meet the requirements of this part of the Proposed Development and no part of the existing highway needs to be altered for this purpose.

3.8.21 The underground cables will be connected to the overhead line at the terminal pole by way of cable sealing ends.

3.8.22 The work to construct the 132kV underground cable will take approximately 2 months.

Lower Voltage Diversions

3.8.23 In six locations where the new 132kV overhead line would cross existing lower voltage overhead lines, these lower voltage lines would be taken down and relocated underground to ensure safe electrical clearance for the new overhead line. These locations are close to Top House Farm north of Middleton, Rednal Mill Cottage, Dandyford Farm near Lower Hordley, near Wackley Lodge, near Coppice Farm at Moor House Farm, and south of Pools Farm near Wem. Further details are provided on the Works Plans (**DCO Documents 2.3.0 – 2.3.16**)

Phase 1 – Installation of lower voltage cables

3.8.24 Lower voltage cables would be installed in agreed locations to divert required sections of lower voltage overhead line.

3.8.25 The lower voltage underground cables would typically be laid at a depth of 0.8m below ground level in a trench approximately 0.6m wide. New terminal poles would be erected on the existing lower voltage overhead line at the points where the diversions start and finish. These terminal poles would be used to support the overhead conductor and transition between overhead conductor and underground cable.

3.8.26 The cables would be installed in 160mm diameter ducts formed of polyethylene, which is chemically inert and does not contain any fluids. The trench would be dug to a depth of 800mm and a single duct laid within the trench. The cable would be pulled through the duct and the trench reinstated. The cable trench would be excavated by a JCB type excavator. A 7m wide working area for the cable installation would be required to accommodate the 0.6m wide trench and the excavated material. Topsoil excavated from the cable trench would be segregated and then used to complete the backfilling. Dependent on the ground conditions, suitable imported backfill material may be used to backfill the trench. During cable laying operations,

suitable crossing points would be provided as necessary to ensure access to properties local to the trench is maintained.

3.8.27 Access would typically be required for an excavator (JCB and/or tracked 360 degree excavator) JCB or similar agricultural 'loader', 4x4 lorry (often with Hiab) and 4x4 pick-ups. Access would also be required for 1 tractor, 1 mobile elevated working platform (MEWP) and cable trailers.

3.8.28 Materials would be removed from site using general purpose 4 wheel drive cross-country vehicles which have incorporated lifting devices and tractors with trailers.

3.8.29 The underground cable would be protected by marker tape laid at such a distance above the cable to ensure as far as is reasonably practical that any person inadvertently excavating the ground above the cable would receive a warning of its presence.

3.8.30 It is expected that the underground cable would at some point intersect with existing underground services, such as water mains or sewage pipes. The normal procedure in such cases is to provide a deeper trench for the underground cable and tunnel under the existing services. Excavation and reinstatement local to existing services would be carried out with due care and in accordance with HSE guidance document HSG 47 – Avoiding danger from underground services.

3.8.31 The connection of the newly laid underground cable to the existing lower voltage network would be completed under 'outage' conditions where the existing lower voltage network is switched off temporarily.

Phase 2 – Dismantling and removal of the Installation of lower voltage cables

3.8.32 The second phase of the diversion works involves dismantling and removal of the section of lower voltage overhead line that has been diverted.

3.8.33 All conductor, fittings, wood poles, stay wires etc. would be dismantled and removed from site to the main construction compound. Localised filling may

be required to fill foundation holes using suitable imported material. Topsoil would also be imported to reinstate the ground locally at each pole location.

Overhead Line

3.8.34 As explained in section 3.3 of this chapter, construction of the overhead line would all take place within the Order Limits.

3.8.35 Overhead line construction follows a standard sequence of activities. For single-circuit wood pole lines these activities include:

- Preparation of accesses;
- Excavation of foundations;
- Delivery of poles;
- Erection of poles;
- Undergrounding/deviation of lower voltage lines where necessary for safety clearances;
- Delivery of conductor drums and stringing equipment;
- Insulator and conductor erection and sagging; and
- Clearance and reinstatement.

3.8.36 Prior to construction of the overhead line a precise ground survey will be carried out to determine the ground profile along the final route alignment and for 7m on either side where the ground profile slopes. This is to ensure that the location selected for poles and stays and their relationship with each other comply with the technical limits laid down for maximum span lengths, maximum sums of adjacent spans and safe clearance to live conductors.

3.8.37 Where the overhead line passes over or in close proximity to trees that could infringe safe clearances to 'live' conductors, the trees will be pruned or felled prior to the construction of the line. In order to reduce the likelihood of trees falling and causing damage to the power line during abnormal weather conditions, the Energy Networks Association has recommended that cutting back of vegetation incorporates an allowance for growth (ENA Engineering

Technical Report 132, 2006). Details of the necessary tree and hedgerow clearance works can be found in Chapter 7 of the ES 'Ecology and Biodiversity' (**DCO Document 6.7**).

3.8.38 As noted above, access for construction of the 132kV overhead line would be required and maintained to each pole position and temporary laydown area during the construction phase. Existing field entrances from existing access tracks and minor roads would be used. Construction accesses would typically be 3m – 5m wide and would follow existing farm tracks wherever possible. Where appropriate temporary trackway systems or temporary stone improvements on existing access tracks may be used. Any such temporary access track improvements would be removed following construction.

3.8.39 For single-circuit wood pole construction an area of 225m^2 is required at pole sites. Additionally a working area of 250m^2 (25m x 10m) is required at angle locations along the overhead line route to accommodate the winches required for stringing the conductors. These working areas are located depending on the availability of access and the terrain, number of angle structures and severity of angle deviations. These working areas would not extend more than 80m beyond the last wood pole being strung in that section and would be within the Order Limits.

3.8.40 At convenient places along the route, seven temporary laydown areas have been identified. These are spread along the overhead line route and would be used to service the construction of specific sections of the overhead line[1]. These are located short distances from the public highway and accessed via the construction accesses using the existing accesses to the farms. The laydown areas would be used to support the construction on site and provide flexibility to avoid travelling to and from the main construction compound. Construction traffic movements would be minimal as the laydown areas will

[1] See Appendix 1.1 (**DCO Document 6.1.1**) for further information on traffic movements during construction of the Proposed Development.

only be used when there is a need to store plant overnight to save going back to the compound. The laydown areas are likely to be used for a short space of time as places where workers drive to and park their vehicles before transferring into construction vehicles and driving to the work site.

3.8.41 Plant and vehicles will be stored at these temporary laydown areas for only the period of construction of that section of the cable and/or overhead line. These areas will be fenced off with temporary fencing and depending on their condition, may require some form of temporary surfacing. For the site in the field south of Wem Substation a self-contained welfare unit and a security cabin will also be required during the construction works at Wem Substation. This is to provide local facilities for the workforce given the distance of Wem substation from the construction compound at Maesbury Road, Oswestry. This laydown area will also require some static security. It is anticipated that this laydown area will be used for up to 6 months.

3.8.42 They are located at:

- East of the A5(T) near Long Wood at Middleton;
- In Middleton between Cabin House an Top House Farm;
- At Brookfield Farm, at the southern end of Coalpit Lane;
- At Dandyford Farm near Lower Hordley;
- At Top House Farm;
- At Coppice Farm, southwest of Loppington; and
- On the western edge of Wem, in the field south of Wem Substation.

3.8.43 Design of the foundations for the 132kV overhead line is guided by the ground conditions at each pole location. Intrusive ground condition surveys would be carried out prior to construction to determine ground condition.

3.8.44 The installation of wood poles requires excavation to allow buried timber foundation blocks to be fitted at a minimum of 500mm below ground level.

3.8.45 In excavating foundation holes, the minimum amount of soil is disturbed in order to take advantage of the load bearing value of the surrounding ground as far as possible.

3.8.46 For good ground conditions standard wood pole foundations can be designed using below ground timber foundation blocks. Where there are poor ground conditions it would be necessary to design the foundation so that the excavated material is replaced with an appropriate crushed-stone aggregate. For some areas where the ground is very poor it may be necessary to design additional measures such as using concrete. These works are no more intrusive than the standard excavations proposed for the majority of the foundations.

3.8.47 Once the pole is installed the excavation is backfilled and consolidated in layers, normally with the original materials. Topsoil is reserved for the top layer and any surplus subsoil or rock is removed from the site. Where the quality of backfill material is unsuitable it would be replaced with a suitable crushed-stone aggregate, or an approved soil additive may be used to improve the quality of poor soil.

3.8.48 Once all poles within the section of line under construction have been erected, all poles are fitted with insulator supports. Running blocks are fitted to the top of the insulator support and the conductors are fitted using the following techniques:

- Drums of conductor and a tensioner with a hydraulic brake are located at one end of the line section, with the pulling winch at the other;
- The conductor is joined to a single, heavy-duty pilot wire and drawn through the section, one conductor at a time, under constant tension; and
- Radio communication during stringing is maintained between the operators of the pulling winch, the tensioner, hydraulic brake and intermediate observation points so the pulling can be stopped if problems arise.

3.8.49 By using the 'Continuous Tension Stringing' method the conductors are held aloft at all times and do not touch the ground or any other structures.

3.8.50 Overhead line conductors are usually erected from one end of the line, in short sections (dependent upon the terrain and complexity of the design). Temporary stays would be required along the line to balance the conductors as the build progresses to the other end. These stays would be installed and removed along the length of the line as the individual sections are completed.

Transport of Materials

3.8.51 For the construction of the underground 132kV cable and 132kV overhead line and related lower voltage diversions, construction traffic will travel from the Maesbury Road construction compound along the local highway and using existing farm accesses to temporary laydown areas. From here, plant and materials will be transferred to smaller vehicles which will then travel to the work sites via the construction accesses. Where possible, materials may also be moved from the compound using smaller vehicles direct to the work sites via local roads and the construction accesses.

3.8.52 During construction the wooden poles are transported to the temporary laydown areas or pole locations on general purpose four wheel drive cross-country vehicles which have incorporated lifting devices.

3.8.53 Typically access is required for an excavator (JCB and/or tracked 360 degree excavator) JCB or similar agricultural 'loader', 4x4 lorry (often with Hiab) and 4x4 pick-ups. During the stringing phase of the works, there is also a need for access for one tractor, one tensioner and one MEWP (mobile elevated working platform) and cable trailers to gain access to several locations along the line. These works are sequential and this plant would move from one location to the next until the stringing is completed.

3.8.54 Drums of conductors would be delivered as close as possible to the angle or tension pole sites from which the conductors are pulled. If necessary tractors adapted to carry such loads are used to transport drums to the pole sites.

Staff and Vehicle Numbers

3.8.55 It is envisaged that the overhead line works would be undertaken by a team of approximately 25 staff using the vehicles identified above and a transit van or similar to transport the staff to site.

Working Hours

3.8.56 Working hours are Monday to Friday between 0700 and 1900 hours during the months of March to October and between 0730 and 1730 hours or during daylight hours, whichever is the shorter, during the months of January to February and November to December and between 0700 and 1300 hours on Saturdays with no works to take place on Sundays or bank or public holidays. The following operations may take place outside the working hours:

- The installation and removal of scaffolding and protective netting across railways, highways and watercourse;
- Stringing of the line across the highway subject to the prior written approval of the relevant planning authority; and
- The completion of operations commenced during working hours which cannot be safely stopped.

3.8.57 The works to construct the overhead line will take approximately 6 months to complete.

Crossing Roads, Railways, Waterways, Footpaths and other Services

3.8.58 Where the proposed overhead line crosses roads, railways, and other infrastructure (e.g. the existing 400kV overhead line and telephone wires) certain precautionary works have to be completed prior to the commencement of conductor stringing. Scaffolding and nets would normally be erected over major roads and railways to enable the conductors to be pulled out unhindered. On minor roads temporary traffic lights are sufficient to control traffic during stringing activities.

3.8.59 These temporary works are completely removed upon completion of the construction of the section of line where the oversail is situated.

3.8.60 Where the proposed overhead line crosses the River Perry and River Roden and the Montgomery Canal, the conductors will be strung across without the need to access the water or banks. To enable conductor stringing, a pilot wire will be fired across from one bank to the other, with conductors subsequently pulled over under tension. The conductors will not touch the water during this operation. Scaffolding or netting is not required to complete the conductor stringing across the Montgomery Canal.

3.8.61 All points where Public Rights of Way (PRoW) follow access tracks or cross the Proposed Development, as shown on the Access and Rights of Way Plans (**DCO Documents 2.4.0 – 2.4.16**), would have appropriate signage advising of dates and hours of work. Management would involve the use of construction staff at those crossing points where and when construction works affect a PRoW. In these instances PRoW users may have to wait for a short period of time whilst the PRoW is in use by the construction team. Users would be advised when works are completed and it is safe to cross the PRoW by staff at the crossing point. Scaffolding or netting is not required to complete the conductor stringing across any PRoW.

3.8.62 No permanent PRoW closures are required as part of the Proposed Development and none are sought under the DCO.

Reinstatement

3.8.63 Upon completion of the construction works it will be necessary to carry out a number of tasks to ensure construction areas are fully reinstated. All construction equipment will be removed from site and suitable reinstatement will be undertaken. Areas of ground disturbed by the construction works would be reinstated. Subject to programme requirements, some sections of the construction may be reinstated earlier than the final construction completion.

3.9 OPERATION, INSPECTION AND MAINTENANCE

3.9.1 132kV wood pole overhead lines and underground cables generally require very little maintenance.

3.9.2 Inspection and maintenance activities for the Proposed Development are driven by the type of equipment (overhead line, underground cable etc.) and current adopted practice outlined within SP Energy Networks policy documents.

3.9.3 Individual policies are reviewed and updated (if required) every 3 to 5 years. As such, the information presented below is based on SP Energy Network's current policy.

Table 3.2 – Inspection and Maintenance

Location	Inspection Frequency (ASSET-01-021)	Maintenance Intervals (SUB-01-009 and
Oswestry Substation	Monthly (foot)	Between 1 and 3 years depending on type of plant
132kV underground cable	Annual (foot)	None
132kV Overhead Line	Annual visual inspection, Thermographic inspection every 2 years	Hazards/Defects raised will be rectified in timescales depending on category (immediately to 8 years)
Wem Substation	Monthly (foot)	Between 1 and 3 years depending on type of plant

3.9.4 The typical asset life expectancy of a conductor is 54 years, insulators 40 years, steel work 70 years and wood poles 40 years.

3.9.5 Permanent access rights would be secured through the DCO. Future access arrangements for periodic maintenance and fault repairs would be arranged with the relevant landowners as required.

3.9.6 Underground cables are categorised High Importance, Category A or Category B depending on their importance. The underground cable in the Proposed Development would be considered Category B and therefore the

cable route would be subject to an annual visual inspection (by foot) to identify any change in land use, excavations, new structures etc., that may demand that additional security or constructional measures need to be implemented.

3.9.7 The additional infrastructure within the substations would be operated and maintained in accordance with SP Manweb's standard substation operating and maintenance procedures.

3.10 CONSTRUCTION MANAGEMENT

3.10.1 A Draft Construction Environmental Management Plan (CEMP) (**DCO Document 6.3.2**) has been produced to outline the means by which the effects on the environment would be minimised. The Draft CEMP (**DCO Document 6.3.2**) would help to control and guide the working practices used during the construction of the development, and would be reviewed and amended as necessary throughout construction. The Draft CEMP (**DCO Document 6.3.2**) incorporates Natural England, Historic England and Environment Agency guidelines, as appropriate, reflecting current best practice in protecting the environment during the works.

3.10.2 Where sections of hedgerow need to be removed, hedgerow replacement/replanting is classed as a standard construction practice. If hedgerows have to be removed to allow a pole to be positioned (i.e., for section poles close to a hedge), these would be lifted, temporarily stored to one side whilst the area is excavated and the pole installed, and replaced within 48 hours using specialist lifting equipment. Where it would not be possible to replant within 48 hours (e.g. where hedges have to be removed for construction access), replanting would take place as soon as possible, as agreed with landowners. The Draft CEMP (**DCO Document 6.3.2**) includes a Hedgerow Management Plan.

3.10.3 It is not considered that any hedgerows would have to be permanently removed to facilitate access.

3.11 DECOMMISSIONING

3.11.1 As the connection is required for network reinforcement purposes it would be permanent infrastructure and therefore decommissioning has not been considered further. In the unlikely event that decommissioning was required the activities would be very similar to those for construction, i.e. creation of construction access tracks and temporary working areas, traffic movements, and working hours.

3.12 INDICATIVE PROGRAMME

3.12.1 It is currently anticipated that (subject to consent being granted) work on site would commence in mid-2020. The construction phase is anticipated to be completed within 12 months following commencement on site. The target isbab for the Proposed Development to be operational in 2021.

3.12.2 It is further anticipated that the works would be undertaken during the following months:

2020							2021				
June	July	Aug	Sept	Oct	Nov	Dec	Jan	Feb	Mar	April	May
Enabling Works											
	Main Construction Activities										
									Reinstatement and Commissioning		