The Droves Solar Farm

Chapter 5: The Scheme (Clean)

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5 The Scheme

5.1 Introduction

5.1.1 This chapter of the Environmental Statement (ES) provides a description of the physical characteristics of the Scheme and the activities that would be undertaken during the construction, operation, and decommissioning phases. The description contained within this chapter informs each of the technical assessments within **ES Chapter 6** to **Chapter 16 [APP/6.2]**.

5.1.2 This chapter is supported by the following figures in **ES Volume 3 [APP/6.3]**:

- **ES Figure 5.1: Concept Masterplan**
- **ES Figure 5.2: Construction Masterplan**
- **ES Figure 3.3: Field Numbering Plan**

5.1.3 This chapter should be read alongside the following Development Consent Order (DCO) plans:

- **Location Plan [APP/2.1]**
- **Land Plan [APP/2.2]**
- **Works Plan [APP/2.3]**
- **Streets Plan [APP/2.4]**
- **Access and Rights of Way Plan [APP/2.5]**

5.1.4 This document has been updated at Deadline 1 to include references to include reference of the SuDS design, cross-reference to the Flood Risk Assessment, and clarify buffers and measures related to flood risk. The document references have not been updated from the original submission. Please refer to the **Guide to the Application [APP/1.3.2]** for the list of current versions of documents.

5.2 Description of the Scheme

The Scheme

5.2.1 The Scheme comprises the construction, operation, maintenance, and decommissioning of a solar photovoltaic (PV) electricity generating station and associated development comprising Battery Energy Storage System (BESS), a Customer Substation, and Grid Connection Infrastructure, including a new National Grid Substation. The Scheme would allow for the generation and export of over 50MW Alternating Current (AC) of renewable energy, connecting into the National Electricity Transmission System (NETS) overhead line that passes through the Site.

5.2.2 As the Scheme would have a generating capacity in excess of 50MW, it is considered to be a Nationally Significant Infrastructure Project (NSIP) under the Planning Act 2008.

5.2.3 The Scheme would be located within the Order limits, also referred to as 'the Site'. The Order limits contain all elements of the Scheme comprising the Solar PV Site, the Customer Substation, the National Grid Substation, the BESS, Grid Connection Infrastructure, Mitigation and Enhancement Areas, and the Highway Works (shown in **ES Figure 3.2: The Order limits [APP/6.3**] are described further in **ES Chapter 3: Order limits and Context [APP/6.1]**).

5.2.4 Highway Works are sections of the highway network that will contain localised improvements, such as improvements to road edge where it is deteriorated, or temporary highway and traffic works required to safely accommodate the Abnormal Indivisible Load (AIL) deliveries. These areas will support the movement of construction vehicles on narrower sections of the local highway network within parts of the construction vehicle routes to the Site (refer to **ES Chapter 9: Transport and Access [APP/6.2]**).

Works Areas

5.2.5 The Scheme is described in Schedule 1 of the **Draft DCO [APP/3.1],** where the 'authorised development' is divided into Works Areas. The works numbers for those areas are summarised below and referred to throughout this chapter. Note that the works package areas can and do overlap, as the Scheme components could fall within part of, or wholly within, each field.

Work No.1

5.2.6 The solar photovoltaic generating station contained within the Solar PV Site comprising an area of approximately 608ha to include the Conversion Units / 33kV Sub-distribution Switch Rooms and the cabling between these elements and the Customer Substation. The Solar PV Site is also expected to include Ancillary Buildings, which could include containers for storage of materials, as well as operational monitoring and maintenance equipment.

Work No.2

5.2.7 The energy storage facility comprising the BESS contained within Fields 24 and 27, including access and temporary construction compounds.

Work No.3

5.2.8 Works in connection with the Customer Substation located within Field 27, including access and temporary construction compounds, and cabling between Work No. 3 and Work No. 4.

Work No. 4

5.2.9 Works in connection with the new National Grid Substation located within Field 27, including access from the A1065, temporary construction compounds and associated mitigation planting.

Work No. 5

5.2.10 Grid Connection Infrastructure, including a diversion and potential decommissioning of the existing 400kV overhead line, removal of old pylons (if required) and installation of new pylons, including works to lay electrical cables, access, and temporary construction laydown areas for electrical cables.

Work No. 6

5.2.11 Works associated with the Solar PV Site, including boundary treatment; security and monitoring equipment; landscaping and biodiversity mitigation and enhancement measures; internal access tracks and improvement, maintenance and use of existing private tracks; access arrangements; footpaths, and roads; temporary footpath diversions; signage and information boards; earthworks; drainage and irrigation infrastructure and improvements to existing drainage and irrigation systems; electricity and telecommunications connections; and the potential undergrounding of the existing 11kV overhead line in Fields 20, 21, 25 and 26.

Work No. 7

5.2.12 Temporary construction and decommissioning compounds / laydown areas within the Solar PV Site and works associated with these comprising areas of hardstanding; car parking; site and welfare offices and workshops; security infrastructure, including cameras, perimeter fencing and lighting; area to store materials and equipment; site drainage and waste management infrastructure (including sewerage); and electricity, water, wastewater and telecommunications connections.

Work No. 8

5.2.13 Works to facilitate both temporary construction access and permanent access to the Order limits, including Highway Works.

Work No. 9

5.2.14 Works to create and maintain habitat management areas.

Work No. 10

5.2.15 Creation of permissive paths.

Work No. 11

5.2.16 Mitigation areas specifically for Skylark and Curlew, to allow continued agricultural use and associated access.

Associated Development

5.2.17 The Scheme also includes associated development in connection with Work No. 1 to 11 including fencing, gates, boundary treatment and other means of enclosure; bunds, embankment, trenching and swales; irrigation systems; drainage systems; services and utilities connections; means of access; security and monitoring measures; improvement, maintenance and use of existing private tracks; landscaping and related works; habitat creation and enhancement; site establishment and preparation works; earthworks and excavations; works for the protection of buildings and land; tunnelling, boring and drilling works; and other works to mitigate any likely significant adverse effects from the construction, maintenance, operational or decommissioning phases of the Scheme.

The Rochdale Envelope

5.2.18 The design of the Scheme is an iterative process based on environmental assessment and consultation with statutory and non-statutory consultees. **ES Chapter 4: Reasonable Alternatives and Design Evolution [APP/6.1]** describes this process further, including options that have been considered and discounted or amendments made to the Scheme design to date. The design of the Scheme has been developed within the framework provided by the **Design Principles, Parameters and Commitments [APP/5.8]**. The **Design Approach Document [APP/5.7]** describes the design evolution of the Scheme within this framework.

5.2.19 The EIA presented within this ES has been undertaken adopting the principles set out in the Planning Inspectorate's Advice Note Nine: Rochdale Envelope (REF 5-1) which provides guidance regarding the degree of flexibility that may be considered appropriate within an application for development consent under the Planning Act 2008 (REF 5-2). The advice note acknowledges there may be aspects of the Scheme design that are not yet fixed and, therefore, it may be necessary for the EIA to assess likely worst-case variations to ensure all foreseeable significant environmental effects of the Scheme are considered.

5.2.20 Aspects of the Scheme that require design flexibility include, but are not limited to, the arrangement of the:

- PV Panels and panel type/specification
- Conversion Units/33kV Sub-distribution Switch Rooms
- Associated Development such as the Battery Energy Storage System (BESS), Customer Substation and National Grid Substation; and
- Grid Connection Infrastructure.

5.2.21 It is necessary that there is some flexibility built into the design of the Scheme when submitting the DCO Application so that the detailed design of the Scheme can be informed by technical considerations, post-consent work, and take advantage of innovations in technology. This is of particular importance in order to maintain flexibility due to the rapid pace of change in solar PV and battery storage technology, whilst maintaining a robust and comprehensive assessment of potential effects. Where such flexibility or optionality is required, this is explained in **ES Chapter 2: EIA Process and Methodology [APP/6.1].**

5.2.22 The technical assessments, therefore, assess an 'envelope' within which the works would take place (the Rochdale Envelope). As such, the DCO Application and EIA is based on maximum and, where relevant, minimum parameters. These parameters are considered in detail by the technical authors as part of the EIA to ensure the realistic worst-case effects of the Scheme are assessed for each potential receptor. The Scheme parameters are set out in tabular form below and can be read alongside the **ES Figure 5.1: Concept Masterplan [APP/6.3]**, which sets out the indicative spatial extent of the Scheme components.

Scheme Parameters

5.2.23 Table 5-1 sets out the parameters that have been assessed within this ES. Each Scheme component is described in more detail in Section 5.3. Each technical assessment chapter has assessed the design identified to be the likely worst-case scenario for that discipline in order to determine effect significance. Where necessary and appropriate, the technical assessment chapter also sets out mitigation measures that would be implemented as part of the Scheme.

5.2.24 To assist with the assessment and to ensure good design, scheme outcomes and Design Principles have been developed that will guide (within the parameters) the size and extent of elements of the Scheme. The Design Principles will help secure design mitigation that has been identified through the EIA process. The **Design Principles, Parameters and Commitments** are set out at **APP/5.8.**

5.2.25 The Applicant recognises that good design will continue to inform the design beyond the DCO Application stage and into the detailed design stage. The Applicant has embedded the design principles, where relevant, into the outline management plans as described within the **Design Approach Document [APP/5.7].** The **Design Principles, Parameters and Commitments [APP/5.8]** document submitted as part of the DCO Application provides the principles and maximum and minimum parameters for the detailed design of the Scheme. It is secured by a requirement in the **draft DCO [APP/3.1]**. When the detailed design for the Scheme is submitted for approval to Breckland Council (BC), those details must accord with the **Design Principles, Parameters and Commitments [APP/5.8]**. This ensures that the environmental effects (of the detailed design) would be the same as, or no worse than, those assessed and reported in the ES.

Table 5-1 Scheme Parameters Used for the Environmental Statement

Scheme Component	Parameter Type	Maximum Design Parameter
PV Panels		
Single Axis Trackers	Maximum height of solar panels above ground level	4.5m at greatest inclination. 2.5m when horizontal.
	Minimum height of the lowest part of the solar panel above the ground level	0.4m.
	Indicative orientation and slope	The tracking solar modules will be aligned in north-south rows, and incline to the east or west up to a maximum inclination of 60 degrees from horizontal.
	Mounting Structure	Metal frames that hold solar panels in rows, either secured via metal posts driven or screwed into the ground to a depth of up to 4m or, subject to ground conditions and further environmental assessment, anchored using concrete feet.
	Solar panel type	Bifacial panels.
	Separation distance between rows	Separation distance between rows of tracking panels will be a minimum of 2.5m at the closest point, and there will be a maximum distance of 15.0m between solar module centrelines.
Fixed South Facing PV Arrays	Maximum height of solar panels above ground level	3.5m.

Scheme Component	Parameter Type	Maximum Design Parameter
	Minimum height of the lowest part of the solar panel above the ground level	0.4m.
	Indicative orientation and slope	The fixed solar modules will be aligned in east-west rows, and slope towards the south at a fixed slope of 10 to 35 degrees from horizontal.
	Mounting Structure	Metal frames that hold solar panels in rows, either secured via metal posts driven or screwed into the ground to a depth of up to 4m or, subject to ground conditions and further environmental assessment, anchored using concrete feet.
	Solar panel type	Bifacial panels.
	Separation distance between rows	Separation distance between rows of tracking panels will be a minimum of 2.5m at the closest point, and there will be a maximum distance of 14m between solar module centrelines.
Integrated Conversion Units / 33kV Sub-distribution Switch Rooms	Maximum dimensions	15m by 5m with a maximum height of 3.5m.
	Foundations	A concrete foundation slab, strips or footings up to 16m by 6m and a levelling layer of aggregate with a maximum depth of 1m, or a concrete plinth set onto the topsoil where non-ground penetrative works are required.
Standalone Conversion Units	Inverters	9m by 6.5m and a maximum height of 3.5m.
	Transformers	6.5 m by 5.5 m and a maximum height 3.5 m
	Switchgear	6.5 m by 2.5 m and a maximum height 3.5 m

Scheme Component	Parameter Type	Maximum Design Parameter
	Foundations	A concrete foundation slab, strips or footings up to a metre greater than the maximum dimension of the relevant piece of equipment and a levelling layer of aggregate with a maximum depth of 0.8m, or a concrete plinth set onto the topsoil where non-ground penetrative works are required.
Fencing and Security	Conversion Units, 33kV Sub-distribution Switch Rooms, BESS, Customer Substation and National Grid Substation fencing	Metal palisade security fencing around Conversion Units, BESS and substations, which will be 3m height.
	Solar PV Arrays and Conversion Units	Deer fence wire mesh and wooden post fencing with a maximum height of fencing will be 2.5m around individual fields or groups of fields.
	Security Surveillance	CCTV camera poles with a maximum height of 3m.
Substations		
Customer Substation	Maximum compound area	4ha (within Field 27).
	Maximum height	13m to the top of the busbars.
	Compound perimeter fencing	3m high metal palisade fencing around the compound.
	Access track	Maximum 6m wide constructed of hardcore or gravel over a levelling layer of substrate.
	Relay and Control Room – maximum dimensions	Maximum dimensions of 7m by 19m and maximum height of 4.2m.

Scheme Component	Parameter Type	Maximum Design Parameter
	33kV switch room	Maximum dimensions of 7m by 19m and max height of 4.2m.
	Foundations	Onsite infrastructure will be mounted on a concrete base or monolith plinth to a maximum depth of 1m. If a piling solution is required, piles to a maximum depth of 15m would be used.
National Grid Substation	Maximum compound area	4ha. (with Field 27)
	Maximum height	13m to the top of busbars.
	Compound perimeter	3m high metal palisade fencing around the compound.
	Access track	Maximum 6m wide constructed of hardcore or gravel over a levelling layer of substrate.
	Relay and Control Rooms – maximum dimensions	Maximum dimensions of 7m by 19m and maximum height of 4.2m.
	Foundations	Onsite infrastructure will be mounted on a concrete base or monolith plinth to a maximum depth of 1m. If a piling solution is required, piles to a maximum depth of 15m would be used.
	Construction Compound	130m x 130m (within Field 27).
Potential decommissioning of the existing 400kV overhead line and pylons (temporary works)	Working Width	Working Width of up to 150m (approx. 75m either side of the existing 400kV OHL). A haul road would be up to a maximum of 7 m wide and would run directly on the subsoil surface with temporary track matting used where required. Where passing places are incorporated into the haul road, these will be up to 12m wide.

Scheme Component	Parameter Type	Maximum Design Parameter
	Number of pylons removed	Up to 5.
	Temporary pylons	1 temporary pylon (4VV099T)
	Access	Haul Road
	Laydown Area	100 x 100m laydown area (with working zones surrounding each pylon)
New Electricity Pylons and OHL	Working Width	Working Width of up to 150m. A haul road would be up to a maximum of 7 m wide and would run directly on the subsoil surface with temporary track matting used where required. Where passing places are incorporated into the haul road, these will be up to 12m wide.
	Number	Up to 10.
	Height	Max height Above Ground Level (AGL) 55m (broadly similar to existing pylons)
	Working Width	Approximately 150m wide (variable).
	Construction Compound	100m x 100m
The BESS	BESS Units	16m (L) x 3m (W) x 3.5m (H).
	Single BESS compound	Up to 10.5ha (within Fields 24 and 27).
	Compound perimeter	3m high metal palisade fencing around the compound.

Scheme Component	Parameter Type	Maximum Design Parameter
	Access	Accesses required for permanent operation and maintenance access will be a minimum of 3.5m in width up to a maximum of 6.0m in width constructed of hardcore or gravel over a levelling layer of substrate. Parking bays will be provided
	Foundations	The foundations for the BESS Units will either be a reinforced concrete base to a maximum depth of 1m, or, if a piling solution is required, piles to a maximum depth of 12m would be used.
	Surfacing	The BESS compound surfacing will include a levelled platform where the BESS equipment will be placed on. Each unit will sit on a concrete base.
	Acoustic barrier	Acoustic barrier of 3.5m height along the western boundaries of Field 27 and partially along the western side of Field 24, between the Battery Energy Storage System compound and the PRoW.
Cable Circuits	Cable Type (low voltage)	Components such as PV Panels, Conversion Units and BESS Units would be connected with 33kV, 1.8kV, 400V and lower voltage control cables to suit the detailed design.
	Indicative cable trench dimensions	Up to 1.6m in width and up to 1.2m depth.
	Cable type (high voltage)	The Conversion Units, 33kV Sub-distribution Switch Rooms, Customer Substation, and the National Grid Substation would be connected with 33kV to 400kV Interconnecting Cables.
	Working width	25m. The Scheme allows for necessary spatial flexibility in the routing of the Interconnecting Cables. The working area for installation of the Interconnecting Cables is anticipated to be 25m sited within a typical 50m corridor. This will be widened or narrowed in places to

Scheme Component	Parameter Type	Maximum Design Parameter
		accommodate required operations (such as the crossing of watercourses, roads, utilities etc.) and to minimise removal of hedgerows. The working width includes the trench, soil, and spoil storage, and working area.
	Indicative dimensions (trench)	The open cut cable trench would be up to approximately 7m wide. This includes separation distances where multiple cables are running in parallel. The trench depth would be up to 2m deep.
	Horizontal Directional Drilling (HDD)	Assumed maximum depth of 15m. Launch / receptor pit working area 25m x 25m.

5.3 Components of the Scheme

5.3.1 Table 5-1 above describes the design parameters of the Scheme. Further details of the role and function of the Scheme components are presented below.

Solar PV Infrastructure (Work No.1)

PV Panels

5.3.2 Photovoltaic (PV) panels are made up of cells which convert the solar irradiance to electrical energy. The PV panels will be attached to Mounting Structures, which form PV Tables and are arranged in rows. PV panels would convert sunlight into electrical current (as direct current (DC)), which will be converted to alternating current (AC).

5.3.3 The PV panels would be bifacial, which are designed to let some sunlight through and have a transparent backing. The solar cells of bifacial panels are also able to absorb energy from the rear of the cell and any reflected light to increase energy production compared to monofacial panels.

5.3.4 Various factors (such as electrical design) inform the number and arrangement of PV panels in each table. Flexibility is required to accommodate future technology developments at the detailed design stage, as referenced above.

5.3.5 The Applicant does not propose a limit on the generating capacity of the Scheme in the DCO Application, as the environmental effects associated with the Scheme are determined by the relevant design parameters and not capacity.

Mounting Structures

5.3.6 Each PV panel would be mounted on a metal rack, known as a Mounting Structure. The most common installation solution on existing UK solar farms is to drive the piles directly into the ground without the need for the excavation for foundations and avoiding disturbance to the surrounding land surface (soils). This installation method, to a maximum depth of 4m (dependent on ground conditions), will be used other than in areas where archaeological protection is required, where concrete feet or other non-ground penetrative techniques will be used to secure the Mounting Structures.

5.3.7 The Scheme would utilise either Single Axis Trackers (Option A) or Fixed South Facing PV Arrays (Option B), described in further detail below.

5.3.8 For the purposes of assessment, the Single Axis Trackers have been assumed as a worst-case scenario given their larger scale. **ES Chapter 10: Noise and Vibration [APP/6.1]** also assesses Single Axis Trackers, given that fixed Solar PV Panels do not have any moving parts and therefore have no noise emission associated with them. Section 16.6 Glint and Glare of **ES Chapter 16: Other Environmental Matters [APP/6.2]** considers both fixed and tracker panel options, as either type of panel may constitute the worst case scenario.

Single Axis Trackers (Option A)

5.3.9 A tracker system involves attaching the PV panels to a motorised table that can move in relation to the sun. This allows for optimal power generation throughout the day. The PV panels would be stored horizontally overnight. The Scheme would utilise a Single Axis Tracker system, which tilts the PV panels around a horizontal north-south axis, thus tracking the movement of the sun from east to west, as illustrated in Plate 1 to Plate 3.

5.3.10 A comparative analysis undertaken by the Applicant has determined that east-west Single Axis Trackers are the most efficient and would be utilised within the Solar PV Site, unless there were practical or environmental constraints. This is due to ongoing technological advances and environmental and economic considerations. For example, recent studies by the Solar Energy Research Institute using world-wide data (REF 5-3) found single axis tracker systems significantly outperform fixed tilt configurations in terms of energy output, and that using single axis tracker systems with bifacial panels can produce 35% more energy than fixed tilt monofacial panels. Single axis trackers also have the benefit of being lower in height for most of the day compared to the fixed south facing arrangement.

5.3.11 The 4.5m tracker panel maximum envelope has been sought to provide better solar generation throughout the day, across different seasons, especially in the early morning and late afternoon. This leads to improved generation efficiency, delivering more energy from the same land footprint per MW than the 3.5m envelope and other solar technologies.

5.3.12 This height also helps reduce shading losses and makes it easier to combine the array with ecological or agricultural uses underneath.

Plate 1 Typical Tracker Solar PV Panels in an Angled Orientation

Plate 2 Typical Tracker Solar PV Panels in a Near Flat Orientation

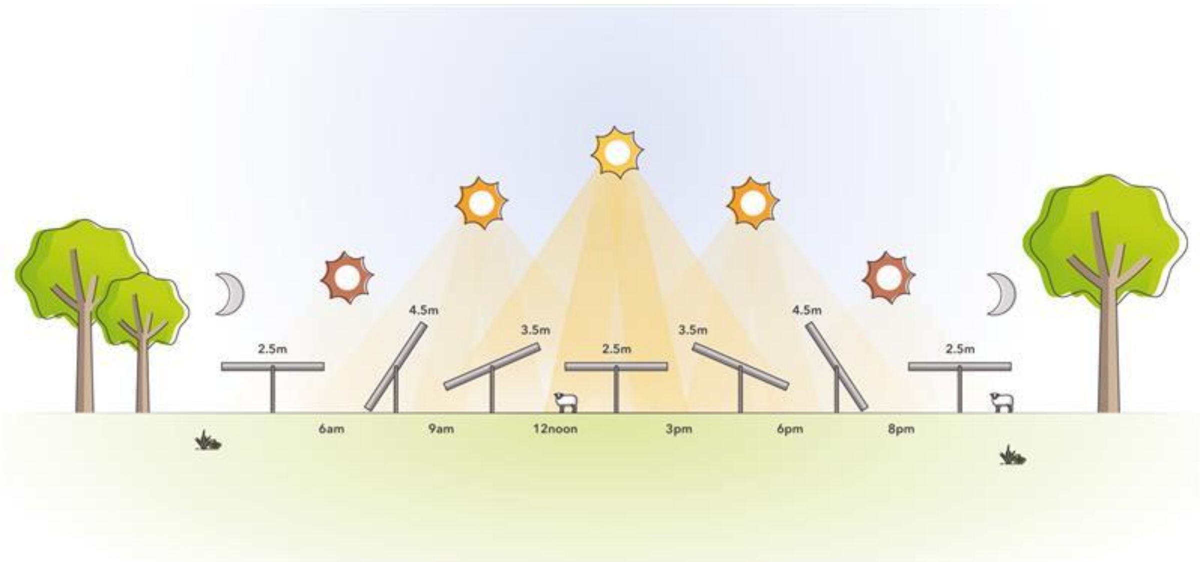

Plate 3 Illustration Tracker Solar PV Panels following the sun position

5.3.13 Tracker panels can include two rows of panels (2P) or one row of panels (1P). 1P are less efficient at converting sunlight into electrical current and provide a lower ground cover ratio. 1P are up to 3.5m in height and do not require as much support from their foundations. Therefore, 1P would be used where concrete feet (refer to Plate 4) or other non-ground penetrative techniques are identified as being required to mitigate impacts to buried archaeology. Each environmental discipline chapter defines the worst-case scenario for the purposes of assessment (refer to **ES Chapter 2: EIA Process and Methodology [APP/6.1]**).

Plate 4 Fixed Panels on Concrete Feet

Fixed South Facing Arrays (Option B)

5.3.14 Fixed South Facing Arrays are the most common approach for ground mounted solar PV facilities in the UK to date and involve installing PV panels to fixed tables, arranged in rows facing south. An example of fixed south facing arrangement is presented in Plate 5.

5.3.15 Fixed South Facing Arrays may be utilised at an individual field level where practical and/or environmental constraints prevent the use of Tracking Solar PV Tables.

5.3.16 As for Option A, concrete feet, or other non-ground penetrative techniques, may be used as archaeological mitigation to secure the Mounting Structures to the ground.

Plate 5 Typical Fixed South Facing Arrays (with Conversion Unit/Inverter)

33kV Sub-distribution Switch Rooms

5.3.17 33kV Sub-distribution Switch Rooms would be located throughout the Solar PV Site to collect the generated power and manage its delivery to the Customer Substation. The 33kV Sub-distribution Switch Rooms would be similar in appearance to the Conversion Units (refer to Plate 6) and be contained within the same design parameters (refer to Table 5-1) and locations indicated on the **Concept Masterplan Plan [APP/6.3]**.

Plate 6 Typical Conversion Unit / 33kV Sub-distribution Switch Room

Conversion Units

5.3.18 The Conversion Unit is a collective term used for the combination of electrical components, including the inverters, transformers and switchgear, which are required to manage the electricity generated by the PV panels. These would either be standalone equipment or they would be housed ('integrated') together within a container. The Scheme parameters allow for both options (as set out in Table 5-1). For the purposes of assessment, it is assumed there would be up to 134 Conversion Units. Indicative locations are shown in **ES Figure 5.1: Concept Masterplan [APP/6.3]**. The locations of the Conversion Units are not fixed; their position can change within the envelope of the Solar PV Site, but they are located via embedded mitigation measures so as not to be located too close to residential dwellings, as set out within the **Design Approach Document [APP/5.7].**

5.3.19 Inverters are required to convert the DC electricity collected by the PV panels into alternating current (AC), which allows the electricity generated to be exported to the National Grid. Transformers are required to step up the voltage of the AC electricity generated by the PV panels before it reaches the Customer Substation. Switchgear is the combination of electrical disconnect switches, fuses or circuit breakers used to control, protect and isolate electrical equipment. Switchgear is used both to de-energise equipment to allow work to be done and to clear faults.

5.3.20 An integrated Conversion Unit would comprise one or two central inverters, transformers and switchgear, all housed within a complete, preassembled and preconfigured unit. Monitoring and control systems would consist of manual controls at the Conversion Units, and automatic and centralised monitoring and control features at the control rooms on the onsite substations. Plate 7 provides an illustration of a typical integrated Conversion Unit.

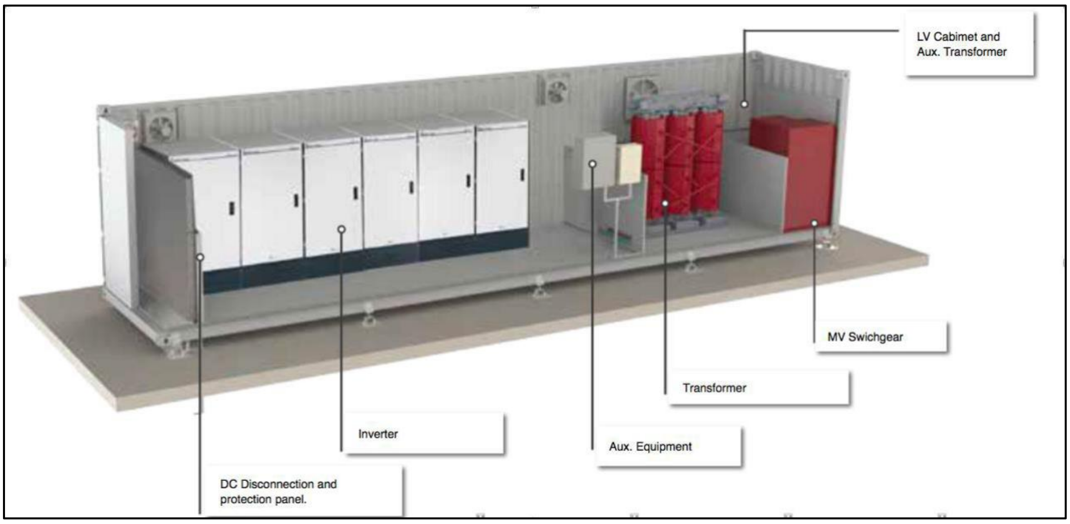

Plate 7 Typical Integrated Conversion Unit

5.3.21 Standalone inverters, transformers and switchgear collectively making up a Conversion Unit may also be implemented individually. Plate 8 provides an illustration of typical standalone equipment.

Plate 8 Typical Standalone Equipment Making Up a Conversion Unit

5.3.22 Both integrated and standalone options would sit on a concrete foundation slab, strips or footings for each of the units and a levelling layer of aggregate; or a concrete plinth set atop the topsoil where non-ground-penetrative works are required.

Battery Energy Storage System (BESS) (Work No.2)

5.3.23 The BESS would be situated within a compound within Fields 24 and / or 27 (refer to **ES Figure 5.1: Concept Masterplan [APP/6.3]**). The BESS will be designed to provide peak generation and grid balancing services to the National Grid. The BESS allows excess electricity generated from the PV Panels or excess energy in the grid to be stored in the batteries and exported at strategic times of the day to provide flexibility and enhance grid reliability.

5.3.24 Plate 9 shows an example image of a BESS arrangement with associated infrastructure.

Plate 9 Typical Battery Energy Storage System

5.3.25 The batteries would be housed within containers (referred to as ‘BESS Units within this ES). The BESS Units would be mounted on concrete foundations. However, other types of foundations, such as compacted gravel, metal pile, or ground screw pile, may be used depending on ground conditions.

5.3.26 The Scheme is anticipated to include approximately 393 BESS Units. The precise number of BESS Units will depend upon the level of power capacity of energy storage that the Scheme will require. Regardless, the BESS compound will not exceed the maximum area defined in Table 5-1.

5.3.27 To ensure the efficiency of the batteries and ensure optimum operating conditions, each of the BESS Units would have an integrated heating and cooling system (Thermal Management System). The Thermal Management System would be integrated into the units within which they are housed.

5.3.28 Similar to the PV Panels, the BESS Units would be connected to inverters, transformers and switchgear, which may be integrated into a single container or as standalone components. The maximum parameters for the inverters, and transformers and switchgear would be the same as those associated with the PV Panels located within the main battery energy storage system compound and the **Works Plan [APP/2.3]**.

5.3.29 The inverters, transformers, and switchgear would convert the electricity between AC and DC and would step the voltage up or down depending on the direction of the energy flow, allowing the BESS Units to receive electricity from the Customer Substation for storage, and to release the stored energy via the Customer Substation to the National Grid. A separate control building would also be located within the BESS.

5.3.30 Cabling between BESS Units and other infrastructure within the BESS will either be above ground in cable trays or laid in a trench up to 1.2m in depth and 1.6m wide.

5.3.31 The BESS and components used to construct the facility will be certified to UL 9540 (2023) (REF 5-4) and/or BS EN IEC 62933-5-2 (REF 5-5) standards. Future standards which supersede these standards will be used as appropriate. BESS Units would have installed fire detection, explosion prevention, and suppression systems in accordance with National Fire Protection Association (NFPA) 855 requirements and National Fire Chiefs Council guidance, as confirmed in the **outline Battery Safety Management Plan (oBSMP) [APP/7.14]**.

5.3.32 Other fire safety measures include spacing requirements between the BESS Units and other infrastructure has also been included within the **oBSMP [APP/7.14]**. Provision would also be made for fire water containment, which is considered further in **ES Chapter 12: Water Resources [APP/6.1]**.

Customer Substation (Work No. 3)

5.3.33 The Customer Substation would be located within Field 27 of the Solar PV Site (refer to **ES Figure 5.1: Concept Masterplan [APP/6.3]**).

5.3.34 The Customer Substation would comprise electrical infrastructure such as the transformers, switchgear and metering equipment required to facilitate the export of electricity from the Scheme to the National Grid.

5.3.35 The Customer Substation is also expected to include Ancillary Buildings, which will include office space and welfare facilities, as well as operational monitoring and maintenance equipment. The switchgear within the Customer Substation will either be air insulated switchgear or gas insulated switchgear substations. An example of an air insulated substation is shown in Plate 10.

5.3.36 The indicative maximum size of the Customer Substation compound is 4ha, with an approximate height of 13m that allows for the associated electrical infrastructure, control buildings and office/storage buildings.

Plate 10 Air Insulated Substation

National Grid Substation (Work No.4)

5.3.37 A new National Grid Substation, indicatively shown in Plate 11, will be required to connect the Customer Substation to the National Grid. The National Grid Substation will monitor and manage the export and import of electricity between the National Grid and the Scheme and will be operated by National Grid Electricity Transmission plc (NGET).

5.3.38 The indicative zone for the National Grid Substation is shown as Field 27 on the **ES Figure 5.1: Concept Masterplan [APP/6.3].**

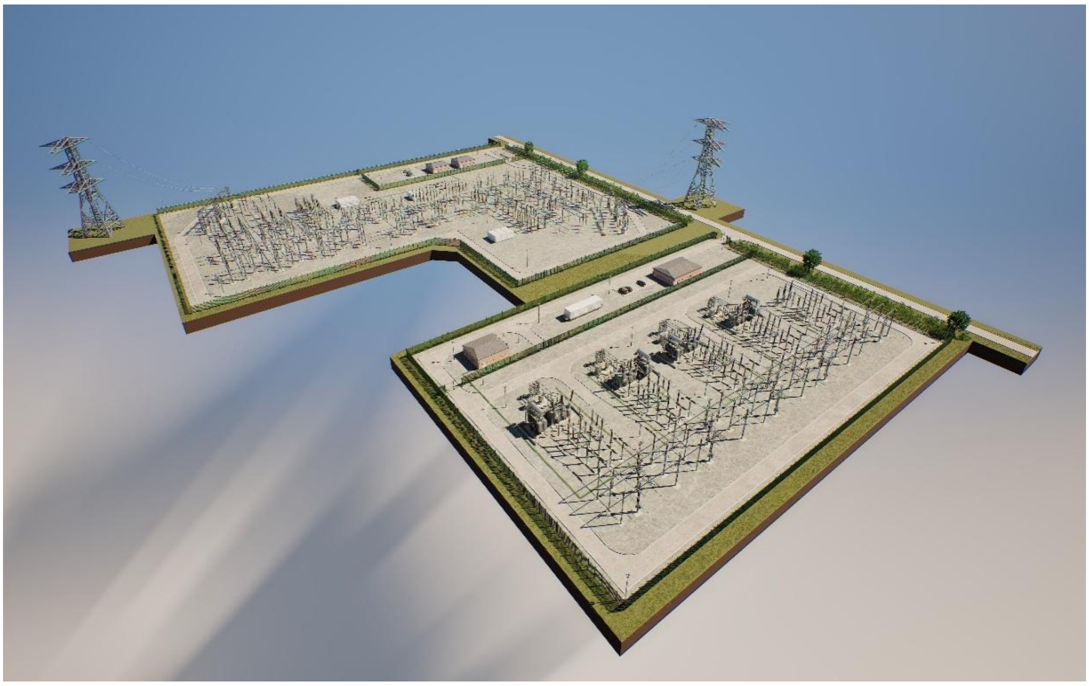

Plate 11 Indicative Substation Layout

Grid Connection Infrastructure (Work No.5)

5.3.39 New Grid Connection Infrastructure will be required between the National Grid Substation and the existing 400kV overhead lines (Norwich Main – Walpole 1).

5.3.40 The Scheme proposes diverting the existing dual circuit 400kV overhead line (OHL) (Work No 5a) into a newly constructed double busbar substation (the National Grid Substation). The works will be delivered in carefully planned stages to maintain safety, minimise disruption, and ensure continuity of supply throughout.

5.3.41 Before any electrical work begins, up to 10 new pylons will be built along the proposed diversion route leading into the new National Grid Substation. These pylons will eventually carry the circuits away from the old alignment and into the new infrastructure. Temporary pylons may also be installed to help maintain the flow of electricity during the transition. This ES assumes one temporary pylon is required to facilitate the replacement of Tower 99 (4VV099T) as illustrated in **ES Appendix 5-1: Illustrative Technical Information [APP/6.3].**

5.3.42 Where the route crosses public roads, footpaths, or rights of way, scaffolding and protective netting will be erected to ensure public safety during overhead works. Fibre optic cables will be rerouted or extended to match the new alignment.

5.3.43 The Applicant has developed a concept design that would divert both of the 400kV circuits along the proposed alignment of the new pylons so to allow for a double turn of both circuits into the National Grid Substation, located within Field 27. A double turn in solution is the Applicant’s preferred design concept as the existing circuits cannot be ‘teed’ into the National Grid Substation as both of the existing circuits are three ended) Norwich –

Walpole teed Necton). Network design therefore will not allow for additional teed circuits into the National Grid Substation.

5.3.44 The Applicant has developed a double turn solution as this enhances the operational efficiency and resilience of the transmission network and delivers long term maintenance benefits whilst also allowing for the decommissioning and removal of the existing section of overhead line, thereby reducing long term visual and environmental impacts on the local area.

5.3.45 Consultation with NGET has confirmed that this is the likely technical configuration for the National Grid Substation located within the Site, further detail can be found within the **Grid Connection Statement [APP/7.1**]. This would enable the decommissioning of up to five existing pylons. Both 400kV circuits would be diverted using the proposed pylons which would increase the distance between the Grid Connection Infrastructure and South Acre / Castle Acre, which would be a benefit of the Scheme. It would also result in the removal of a section of woodland oversailing on the existing OHL alignment in close proximity to where the OHLs cross over the A1065, allowing this area of woodland to grow naturally and remove the need for maintenance with regard to the oversailing OHLs.

5.3.46 Whilst the Applicant has developed a concept design for a 'double turn in' which is their preferred approach, engagement with NGET is ongoing due to the Connection Reform process and therefore the Applicant has allowed flexibility for a 'single turn in' where only the southern 400kV circuit (circuit 2) would be diverted into the National Grid Substation. In this scenario, the northern 400kV circuit (circuit 1) would remain on its existing alignment and the existing pylons would not be removed. As a worst case scenario, this ES assesses the possibility that a double line of pylons and overhead cables may be present.

5.3.47 To allow for decommissioning of the existing OHL once the diversion is in place, this is covered within Work No 5(b).

5.3.48 The potential temporary working areas for the Grid Connection Infrastructure allows for the potential restring of the transmission lines to the west beyond the point of diversion. The potential temporary working area allows for the working areas including pulling zones for the transmission cables, Access Tracks and laydown areas. This also includes a section of Low Road and Petticoat Road, which has been included within the Order limits, to allow for temporary residential access to Finger Hill Cabin and Keepers Cottage should Washpit Drove require temporary closure to allow for the erection of scaffolding and netting to facilitate the restringing of the transmission cables.

Cabling

On-Site Cables

5.3.49 Low voltage distribution cabling between Solar PV panels and the Conversion Units / 33kV Sub-distribution Switch Rooms will typically be fixed to the Mounting Structures (above ground), and then underground between the Mounting Structures and the Conversion Units / 33kV Sub-distribution Switch Rooms. High Voltage cables are required between the Conversion Units / 33kV Sub-distribution Switch Rooms, BESS and the Customer Substation.

5.3.50 The high voltage cables will be routed alongside the Access Tracks and / or use existing gaps in hedgerows where practicable to minimize hedgerow loss.

5.3.51 The dimensions of trenching will vary subject to underground cabling and the associated number of ducts they contain and will be dependent on the method of installation and ground conditions. There may be a requirement for trenchless technology such as horizontal directional drilling (HDD) within the Site, for example to cross beneath existing underground utilities.

5.3.52 Communication cables will be required throughout the Solar PV Site to allow for monitoring during operation, such as the collection of data on solar irradiance from pyranometers. The communication cables would typically be installed within the same trench and alongside the electrical cables.

5.3.53 Joint bays will link sections of underground cables. These will be a minimum of 250m to a maximum of 2km apart. The dimensions of these are determined by how many sets of cables will be in the jointing bay. A joint bay would be approximately 10m long and 6m wide and approximately 3m deep. The base of the joint bay must be level and a concrete pad installed (approximately 150mm thick with light reinforcement) as a working surface. The sides of the excavation are shored to prevent collapse.

5.3.54 Fibre communications chambers will be required and are likely to be provided every 500 to 750m, but could be every 2,000m apart if required. These will be located in hard surface or at edges of fields with the final location to be determined at detailed design. The excavation for this type of chamber would be approximately 1.5m length, 1m wide and 1.5m deep. The appearance is provided in Plate 12 below. These would stand 10mm to 20mm above ground.

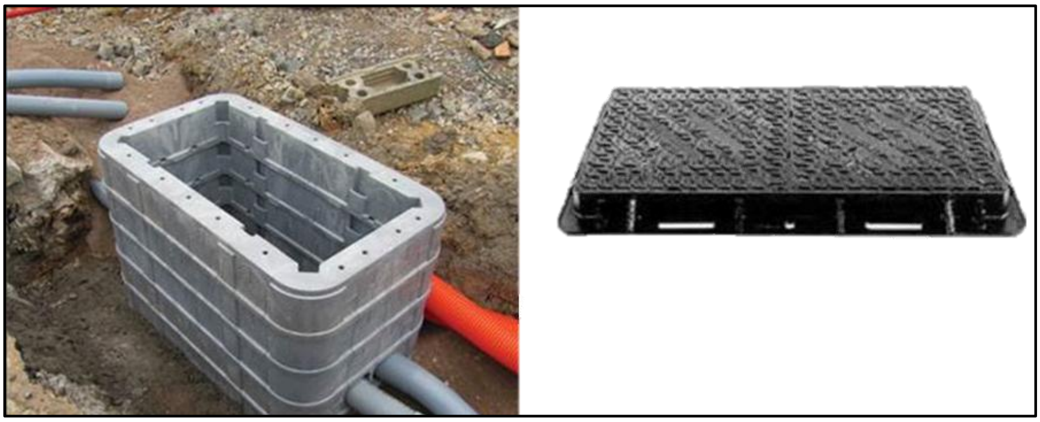

Plate 12 Fibre Chambers (construction and external appearance)

5.3.55 Following installation of the cables the construction working area would be fully reinstated back to grassland.

Interconnecting Cables

5.3.56 The Conversion Units would be connected to the 33kV Sub-distribution Switch Rooms, and on to the Customer Substation via underground Interconnecting Cables. The voltage of the Interconnecting Cables would be between 33kV and 400kV.

Grid Connection Cables

5.3.57 The electricity generated by the PV Panels and/or stored by the BESS would be exported from or imported to the Customer Substation to the National Grid Substation via underground Grid Connection Cables. The voltage of the Grid Connection Cables would be 400kV.

Site Access (Work No.6 and Work No. 8)

5.3.58 Wherever practicable, existing field accesses will be utilised for access to the Order limits. If a suitable field access does not exist, for example, due to poor highway visibility, new accesses would be constructed. Accesses would be designed to ensure there are no impacts on veteran or protected trees as a result of vehicle movements, however, there may be localised removal of sections of hedgerows as required, e.g. for visibility splays.

5.3.59 The access points into the Solar PV Site have been designed to accommodate articulated heavy goods vehicles (HGV) with a maximum length of 16.5m (excluding accesses which would be used for ecological/landscape mitigation and therefore would not require HGV access). Visibility splays have been included and based on the recorded speed of the vehicles on the road network (85^{th} percentile speeds) to ensure safety. There may be some variation on visibility splays based on site specific conditions.

5.3.60 A number of deliveries within the Order limits during the construction phase would be Abnormal Indivisible Loads (AILs). An AIL is where the vehicle exceeds 44 tonnes, the width is over 2.9m or the length is more than 18.65m. These are likely to include deliveries of transformers and cable drums.

Solar PV Site Accesses

5.3.61 Two points of access to the Solar PV Site are located off the A1065 utilising existing agricultural access points, and will provide access to the Solar PV Site, the Customer Substation, National Grid Substation, and BESS, and be suitable for AILs. The proposed point of access will incorporate a security gate, which will be set back from the highway to allow sufficient room for an articulated HGV to leave the highway before entering the Site.

5.3.62 These will comprise a track up to 6m wide (with up to 8m wide passing places) constructed of asphalt over a levelling layer of substrate. The access points from the public highway and bends in the track would be wider to accommodate abnormal indivisible loads turning space. AIL access routes to the Order Limits are considered in **ES Chapter 9: Transport and Access [APP/6.2].**

5.3.63 A secondary point of access is required to facilitate the crossing of Narford Lane, along with internal crossing points throughout the Scheme.

5.3.64 A network of internal Access Tracks will be provided to allow access to the Solar PV Site. It is anticipated that internal Access Tracks will follow the alignment of the existing agricultural tracks, where practicable, with the exception of the Droves, which will not be used for routing construction traffic apart from crossing points.

5.3.65 The indicative crossing points are shown on the **ES Figure 5.1: Concept Masterplan [APP/6.3].**

5.3.66 New internal Access Tracks are likely to be up to 6m wide, where passing bays are provided along the internal Access Tracks. The internal Access Tracks will likely be constructed of compacted stone with excavation kept to a minimum. Where drainage is required a ditch or a swale may be located downhill of the internal access track to control any potential for surface water run-off.

Highway Works (Work No. 8)

5.3.67 Highway improvements will be made to facilitate the construction of the Scheme. The location of the Highway Works is shown in **ES Figure 3-2: The Order limits [APP/6.2]** and consists of land at the A47 / A1065 junction to the south of the Scheme.

5.3.68 Works within the Highway Works comprise improvements to the existing highway such as improvements to road edge where it is deteriorated, minor works to enable construction vehicle movements such as widening within the highways boundary, traffic management, and provision of visibility splays.

Fencing and Security (Work No. 6)

5.3.69 During operation, a perimeter fence will enclose the operational area of the Scheme. A Deer fence will enclose the PV Arrays, whilst a Palisade fence will enclose the Conversion Units, 33kV Sub-distribution Switch Rooms, BESS, Customer Substation and National Grid Substation. The deer fence will be wooden or metal posts with a wire mesh up to 2.5m in height, as shown on Plate 13. Palisade fencing would be up to 3m in height.

Plate 13 Typical Deer Fencing

5.3.70 Pole mounted internal facing closed circuit television (CCTV) systems installed at a height of up to 3m will be deployed around the perimeter of the Site. The CCTV cameras would use night-vision technology, which would be monitored remotely and avoid the need for night-time lighting of the Solar PV Site.

5.3.71 Clearances above ground or mammal gates will be included within the deer fence to permit the passage of wildlife. Vehicular access gates will be of similar construction and height as the perimeter fencing. Fencing during the construction phase will also be required, the details of which will be confirmed as part of the detailed design post consent.

Mitigation and Enhancement Areas (Work No.9)

5.3.72 The Solar PV Site comprises of arable and pastoral fields. There are features within the Solar PV Sites such as hedgerows, field margins, ditches and watercourses which are considered to have some ecological value.

5.3.73 The masterplan for the Scheme is provided in**, ES Figure 5-1: Concept Masterplan [APP/6.2]** with principles for how the land will be managed throughout the operation phase set out within the **outline Landscape and Ecological Management Plan (oLEMP) [APP/7.11]**.

5.3.74 The following ecological mitigation and enhancement measures will be implemented:

- Land between and under the arrays to be sown as grassland and meadow management with limited cutting and a mix of some areas being grazed and others not
- Gaps within existing hedgerows would be filled with additional native species to increase diversity, and hedgerows would be managed on a rotational basis to enable wildlife to benefit from them year-round

- Appropriate vegetated buffers would be maintained comprising native planting; and
- Installation of bird nest and bat boxes on trees would be located around the Solar PV Sites to provide opportunities for a range of species recorded within the local area.

5.3.75 The Scheme will involve new planting, field boundary enhancement and planting of seed mixes within the Solar PV Site as described in the **oLEMP [APP/7.11]**. Planting will also be used to provide screening through:

- The creation of new woodland blocks and belts
- Planting new hedgerows
- Reinforcing existing boundary hedgerows; and
- New tree planting.

5.3.76 The enhancements and planting would increase biodiversity and contribute to the Scheme achieving Biodiversity Net Gain (BNG). Further information is provided within **ES Chapter 7: Ecology and Biodiversity [APP/6.2]** and **ES Chapter 6: Landscape and Visual [APP/6.2]**.

5.3.77 The **oLEMP [APP/7.11]** sets out the principles for managing and reinstating the land within the Order limits during the operation and maintenance phase after construction is completed. Prior to the commencement of any phase of development, a detailed LEMP will be prepared and submitted to and approved by the relevant planning authority, and this will be secured by requirement in the DCO. This will ensure the potential construction and operational impacts are minimised and that, where practicable, opportunities for beneficial effects are secured as part of the Scheme. The LEMP must be prepared substantially in accordance with the **oLEMP [APP/7.11]** submitted as part of the DCO application.

Permissive Paths (Work No.10)

5.3.78 Permissive paths are incorporated into the Scheme design, as described in the **oLEMP [APP/7.11].** The permissive paths will contribute to the wider network of footpaths in the area and facilitate greater public access to the countryside during the lifetime of the Scheme. The design and implementation of the permissive paths is set out in the **outline Public Right of Way and Permissive Path Management Plan (oPROWPPMP) [APP/7.12]** and **oLEMP [APP/7.11]** and secured by a requirement in the **draft DCO [APP/3.1]**.

Mitigation Areas (Work No. 11)

Skylark Mitigation

5.3.79 The Applicant has identified approximately 80ha of land (Fields 35 - 38) within the northern part of the Order limits which is to provide mitigation land suitable for Skylark. This land would remain in agricultural use containing Skylark plots at a rate of two plots per hectare, formed by 4m x 6m crop free areas to provide safe nesting areas for Skylarks. If plots cannot be created in a given year, for example, due to crop rotation, the land will be managed in a way that remains suitable for Skylarks, such as organic set-aside.

Curlew Mitigation

5.3.80 The northern part of Field 33 will provide habitat suitable for Curlew, who prefer open areas away from tall vegetation and field boundaries. The area comprises approximately 8.8ha of agricultural land which will remain in agricultural use, providing suitable mitigation for Curlew, throughout the Operational Phase of the Scheme.

5.3.81 The land within Work No. 11 will remain in agricultural use throughout the operational phase of the Scheme, and will be managed appropriately via measures as set out within the **oLEMP** [**APP/7.11**].

Green Infrastructure

5.3.82 The existing hedgerows, vegetation, woodland, trees, ditches, ponds, Marl pits and field margins will be retained within the layout of the Scheme where practicable, with the exception of removals and/or crossings required for new Access Tracks, perimeter fencing and Cabling. Access points from the highway and Access Tracks will be designed to use existing agricultural gateways/tracks between the fields where practicable and the width of any new accesses will be kept to a minimum where practicable.

5.3.83 The following minimum offsets/buffers from existing landscape features have been embedded within the design of the Scheme, see Table 5-2, with the exception of where Access Tracks, perimeter fencing, Cabling and/or Grid Connection Cables are required to cross an existing feature.

Table 5-2 Minimum offsets/buffers from existing landscape features

Landscape feature	Buffer/Offset
Hedgerows Hedgerows – with trees	8m 10m
Woodland (Non-ancient)	15m
Ditches	10m
Badger setts (main) Badger sett (outlier)	30m 20m
Individual trees and groups of trees	10m
Ponds	10m

Landscape feature	Buffer/Offset
Non-Statutory Designated sites and Local Wildlife sites	10m
Veteran and Ancient trees	15x width of tree stem diameter
Curtilage of residential properties	Bespoke Design Response based on Residential Visual Amenity Assessment
Public Rights of Way (PRoWs)	15m

5.3.84 These offsets/buffers will be used to deliver a combination of embedded mitigation and enhancement in the form of hedgerow planting and/or grass/wildflower planting. The buffers/offsets will be a minimum and for example may be increased to deliver further mitigation or enhancements and/or respond to root protection areas where required.

5.4 Construction Phase

Construction Programme

5.4.1 The construction phase will be up to 24 months. The final programme will be dependent on the detailed layout design and potential environmental constraints on the timing of construction activities. However, the Scheme is anticipated to energise in Q4 2033 or as early as National Grid are able to offer. Based on Q4 2033 energisation, it is anticipated that the earliest the Construction Phase would commence would be Q3 2031. There is likely to be a pre-construction period preceding the Construction Phase of approximately six months (Q1 and Q2 2031) to allow site preparation works.

Construction Activities

Grid Connection Infrastructure

5.4.2 Indicative Step-by-Step Process

- Step 1: Pre-Outage Works
  Installation of new pylons along the diversion route. Fibre optic bypasses and joint boxes will be prepared, and access routes will be set up to support construction activities.
- Step 2: Temporary Diversion of Circuit 1
  Circuit 1 will be temporarily taken out of service and rerouted via a temporary tower (4VV099T) positioned to the north of the existing line. This allows a bypass of tower 4VV099 while keeping the circuit live. Once the diversion is complete, Circuit 1 will be re-energised.

- Step 3: Circuit 2 Outage and Tower Replacement
  Circuit 2 will be de-energised. Removal of existing tower 4VV099 and installation of replacement pylon (4VV099R) in its place. Conductors will then be transferred to the new pylons and connected into the substation. Circuit 2 will then be brought back online via the new route.
- Step 4: Final Transfer of Circuit 1
  Circuit 1 will be de-energised again to enable the removal of the temporary diversion and connection to the new permanent route into the National Grid Substation. Once complete, Circuit 1 will also be re-energised.

Post-Diversion Works

5.4.3 With both circuits now running through the new substation, the existing pylons between 4VV100 and 4VV103 may be dismantled and the land reinstated. Any temporary pylons used during the works will also be removed. As a worst-case assumption, this ES assumes that the existing and proposed circuits will remain in situ leaving a double line of Overhead Lines.

Optional Enhancement: Avoiding Mid-Span Joints

5.4.4 To improve long-term reliability, The Applicant retains the flexibility to extend the diversion further up the existing line to include 4VV095 to 4VV098. This would allow for the pulling of a new conductor from 4VV095, avoiding the need for mid-span joints.

Pylon Construction Overview

5.4.5 Each new 400kV pylon is built in several stages:

- Foundations: Reinforced concrete footings are poured for each pylon leg or Piles are used where required
- Steelwork: The steel lattice structure is assembled on-site by specialist teams
- Lifting: Cranes are used to lift and position pylon sections into place
- Fittings: Insulators, arcing horns, and other accessories are installed to support the conductors
- Fibre Optics: Joint boxes are mounted where fibre optic cables are required
- Earthing: An earth mat is installed to safely dissipate fault currents into the ground

Conductor Stringing Overview

5.4.6 Once the pylons are in place, the conductors are installed using a carefully controlled process:

- Pilot Wires: Lightweight pilot wires are pulled through the insulators first
- Main Conductors: These are then pulled through using the pilot wires, under controlled tension to avoid sagging or damage

- Tensioning: Conductors are adjusted to meet exact clearance and performance requirements
- Clamping: Once in position, the conductors are clamped to the insulators and terminated at the appropriate pylons
- Accessories: Vibration dampers, spacers, and arcing horns are added to protect the system and ensure long-term reliability
- Fibre Optics: the Fiber Optical Wire is strung in a similar way, usually at the top of the pylon

Site Preparation and Enabling/Civil Engineering Works for the Solar PV Site

5.4.7 The following activities would be required as part of the site preparation and civil engineering works:

- Preparation of land for construction, including localised site levelling (where required). The land level changes would be localised and minor
- Import of construction materials, plant and equipment to site
- Establishment of the perimeter fence
- Establishment of the Temporary Construction Compounds
- Construction of the internal Access Tracks; and
- Marking out the location of the Scheme infrastructure.

5.4.8 The following activities would be required as part of the enabling works (not necessarily in order):

- Construction of site entrance(s) and construction vehicle delivery holding area
- Establishment of the temporary construction compounds, which includes site offices/welfare area and parking area
- Upgrade, modification or improvement of highways where required for site construction
- Diversion and/or connection to existing 11kV and/or 33kV power lines as required for construction
- Preparation of land for construction, including localised site levelling (where required) and vegetation clearance
- Import of construction materials, plant and equipment to site
- Establishment of the Temporary Construction Compounds within the Solar PV Site; and
- Marking out the location of the operational infrastructure.

Installation of PV Panels

5.4.9 The following activities would be required to install the PV panels:

- Import of components to site

- Piling and erection of Mounting Structures
- Mounting of PV panels undertaken using hand-held power tools
- Trenching and installation of Cabling
- Conversion Units foundation excavation and construction
- Installation of Conversion Units. Cranes would be used to lift equipment into position; and
- Installation of control systems, monitoring and communication.

Construction of Electrical Infrastructure

5.4.10 The following activities would be required to construct the onsite electrical infrastructure comprising the Cabling and Conversion Units:

- Site preparation and civils for the Customer Substation and the National Grid Substation and control buildings
- Trenching and installation of Cabling
- Pouring of the concrete foundations and plinths for the electrical equipment
- Import of components to site
- Cranes would be used to lift the components into position; and
- Installation of the Conversion Units / 33kV Sub-distribution Switch Rooms.

Construction of Electrical Cables

5.4.11 For cables between the Conversion Units / 33kV Sub-distribution Switch Rooms and the Customer Substation:

- Interconnecting cables, including High Voltage power cables, would be laid to provide a link between the Solar PV Arrays, the Conversion Units and the Customer Substation where the main switchgear panels are located. There would also be interconnecting cables from the BESS to the Customer Substation
- Generally on-site cables would be laid underground in excavated trenches adjacent to on-site tracks where practicable and between the rows of PV panels. They would be laid at a suitable depth and positioned at a distance far enough away from the Mounting Structures to allow future repair or maintenance. Some sections of cable may be installed in ducting if required to provide additional protection or where other infrastructure such as roads and hardstanding would be built over the top
- Where practicable, trenching would be carried out using a trapezoidal bucket to ensure stability during installation. Trenching and cable laying would be carried out progressively across the Order limits and be phased to not interfere with other site operations such as piling, Mounting Structure assembly or PV Panel installation; and

- Care would be taken to ensure cable trench excavations can be managed and backfilled in a timely manner to avoid collapse. Trenching may be curtailed in periods of wet weather to avoid collapse of trenches of excessive contaminated run off.

Energy Storage Construction

5.4.12 The following activities would be required to construct the BESS.

- Installation of electric cabling
- Construction of foundations
- Import of components to site
- Installation of transformers
- Installation of batteries, inverters and switchgear; and
- Installation of fire safety measures.

Fencing and Security

5.4.13 The perimeter deer fence and security system would be established during the construction phase. The fencing would be installed early on in the works where practicable to reduce the amount of temporary fencing needed. Where required, temporary fencing would be installed to secure work areas not naturally contained by existing hedgerows or fencing.

Cabling Construction

5.4.14 The following activities would be required to construct the Cabling:

- Site preparation and appropriate surveys
- Haul road construction
- Excavation would be undertaken using an appropriately sized tracked excavator, excavation will be carried out in layers
- Topsoil would be segregated and stored on site to be reused
- The trench would be cleared and bottomed out, ensuring there are no hard protrusions
- Sand bedding would be installed at the bottom of the trench; and
- Cable installation will be conducted once joint bay locations have been established. However, it is not expected that cable installation would be continuous. Cables would be installed in groups or sections to ensure that works are completed in the most efficient manner practicable.

5.4.15 Aggregates would be stored within the temporary construction laydown areas, while cables and ducts would be stored at the secure compound area.

5.4.16 To construct the joint bays:

- Excavation activities would be as listed above
- Joint bay locations would be re-measured to verify their position before excavation commences
- Joint bays would be approximately 20m by 6m dependant on ground conditions; and
- Joint bay excavation would be coordinated with the cable pulling programme to ensure that jointing bays are not left open for longer than necessary.

5.4.17 Where the need for trenchless technologies has been identified at crossing points or avoidance areas, feasibility studies will be carried out to identify the appropriate technology. Trenchless technologies may include tunnelling, HDD, Pipe Jacking and Horizontal Auger Boring. Of the trenchless technologies which could be selected, HDD is considered to be a reasonable worst-case scenario and is assumed for the purposes of assessment. The following construction methodology activities would be required:

- Site preparation and appropriate surveys
- Launch and reception pits would be excavated using a suitable excavator, with any required shoring or battering installed. Plant and spoil would be placed a safe distance away from the edge of the excavation so as to minimise the risk of the trench sides collapsing
- Once both the launch and receive pits has been excavated, work would then commence on the initial drill (the 'pilot bore')
- Upon completion of the pilot bore connecting the launch and reception pits the drill head would be removed from the drill string and a reamer would be attached. Reamers would be used to widen the bore until it is of an acceptable size to accept the duct; and
- Once the bore is enlarged to the required size the product pipe would then be connected to the reamer via a swivel for installation.

5.4.18 If field conditions are not suitable to track plant and equipment to the launch and reception pits, 'trackway' or similar ground protection mats would be employed to facilitate access and egress. An area of up to 25m by 25m would be required at the launch pit and the reception pit.

5.4.19 It is anticipated that water-based drilling and bentonite would be utilised. During drilling operations the fluids pumped through the drill string would be closely monitored by checking volume of returns flowing back to the launch pit. Visual checks would also be carried out across the drill line. If a leak of drilling fluid is identified, the pumping activities would be stopped and appropriate control measures will be actioned.

Testing and Commissioning

5.4.20 Commissioning of the Scheme would include testing and commissioning of the process equipment. Commissioning of the PV panels, BESS Units, and Associated Infrastructure would involve mechanical and visual inspection, electrical and equipment testing, and commencement of electricity supply into the National Grid. Individual sub-systems would be commissioned separately with each having its own procedures and prerequisite lines, and it may be necessary to commission these elements separately or at the same time, depending on the end technology utilised at the time of construction.

5.4.21 This process would take place prior to the operational phase of the Scheme.

Construction Staff

5.4.22 For the purposes of assessment, it is assumed that the construction of the Scheme elements would happen concurrently, maximising the estimated potential numbers of construction staff working on the Scheme.

5.4.23 Based on the phasing assumptions and the Applicant's experience of other similar sized solar projects, it is currently estimated that the Scheme would generate a peak of 740 construction workers and 366 Full Time Equivalent (FTE) jobs during the construction phase. The size of the workforce is based on the activities required and would fluctuate during the construction period.

Construction Hours of Work

5.4.24 The core construction working hours (not including start-up and shut-down works) are defined as:

- Monday to Friday from 07:00 to 18:00 (daylight hours permitting)
- Saturday from 08:00 to 13:30 (daylight hours permitting); and
- No Sunday or Bank Holiday working unless crucial to construction (for example, for HDD, System testing and commissioning, which must be a continuous activity) or in an emergency.

5.4.25 Start-up and shut-down activities on site will involve low-noise tasks, including security checks, unlocking and locking gates, and conducting toolbox talks.

5.4.26 Where practicable, construction deliveries would be coordinated to avoid HGV movements during the traditional peak morning (08:00 to 09:00) and peak afternoon (17:00 to 18:00) hours.

5.4.27 Some activities may be required outside of these times such as the delivery of abnormal loads, concrete pours for foundations, night working for cable construction works in public highways and/or HDD activities.

Construction Traffic and Site Access

5.4.28 Construction traffic and Site access is discussed further in **ES Chapter 9: Transport and Access [APP/6.2]**.

5.4.29 The construction traffic associated with the Scheme will be subject to measures and procedures defined within a Construction Traffic Management Plan (CTMP). This will be secured by a requirement in the DCO and prepared substantially in accordance with the **oCTMP [APP/7.7]**. This defines information such as the routes that construction traffic must take and the measures that will be implemented to reduce the effect of the construction phase on the local highway network.

5.4.30 A Travel Plan (TP) is contained within the **oCTMP [APP/7.7]**. and sets out proposed measures, including establishing a car share scheme and shuttlebuses for construction workers, identifying cycle and bus routes to the Order limits, and appointing a Travel Plan Coordinator. Construction workers are also be encouraged to travel outside of peak highway network hours and use electric vehicles, where practicable. This aims to minimise the impact on the strategic and local highway network.

5.4.31 For the purposes of the ES and in order to assess a reasonable worst-case, the peak construction vehicle movements for the Scheme is estimated to be 628 two-way movements per day, comprising 532 two-way LGVs (associated with staff and smaller deliveries) and 96 two-way HGVs, which would capture both construction staff trips and deliveries.

Temporary Construction Compounds (Work No. 7)

5.4.32 Temporary construction compounds would be established within the Solar PV Site (refer to **ES Figure 5.1: Construction Masterplan [APP/6.3]**). The temporary construction compounds would comprise:

- Temporary portacabins for construction operatives (the dimension of the portacabins would vary and the maximum size for individual units is expected to be 12m by 3m with a typical maximum height of 3m) (we will have multiple of these)
- Perimeter security fencing with a typical maximum height of 3m
- Parking area for construction and workers vehicles
- Secure compound for storage
- Temporary hardstanding
- Wheel washing facilities
- Temporary gated compound
- Storage bins for recyclables and other waste; and
- Lighting (as set out below).
- Storage area
- Fuel bowsers

5.4.33 There will be temporary laydown areas provided within the Solar PV Site. The purpose of each one will be to service the local works. This includes but is not limited to storage for materials, fuel, equipment needed for such works as well as welfare facilities, office space required to avoid unnecessary internal movement of personnel over long distances. The temporary laydown areas will typically be set up ahead of the installation of the Solar PV

Site, electrical components and cabling and will be decommissioned as the relevant works in their locality progress and become completed.

5.4.34 It is anticipated that goods would be delivered by HGV to the construction compounds within the Solar PV Site and then distributed to the point of need within the Order limits using lighter vehicles (e.g. tractor and trailer) as required.

5.4.35 Temporary compounds will be required for the Grid Connection Infrastructure, the National Grid Substation, and the Customer Substation (refer to **ES Figure 5.1: Construction Masterplan [APP/6.3]**), along with laydown areas. The laydown areas will allow construction vehicles to turn off the public highway and park safely. Laydown areas would be up to a maximum of 100m x 100m and include parking bays, portacabins, welfare facilities, unloading and storage areas and power generators. The areas will be secured using heras fencing and security cameras. Upon completion of construction, the compound and laydown areas will be removed and the land reinstated.

Construction Environmental Management Plan

5.4.36 An **outline Construction Environmental Management Plan (oCEMP) [APP/7.6]** has been prepared to support the DCO Application. The CEMP describes the framework of mitigation measures to be followed and to be carried forward to a detailed CEMP prior to construction. The aim of the CEMP is to avoid and/or reduce environmental impacts from:

- Use of land for temporary laydown areas, accommodation etc.
- Construction traffic (including parking and access requirements) and any changes to access and temporary road or footpath closure
- Noise and vibration
- Utilities diversion
- Dust generation
- Handling of soil resources
- Spillages of oil and other chemicals
- Run off and drainage
- Lighting; and
- Waste generation.

5.4.37 Measures to prevent fugitive emissions from temporary construction compound(s) from impacting controlled waters are set out in the **oCEMP [APP/7.6.1]**.

5.4.38 The **oCEMP [APP/7.6]** will be used as the basis for the contractor to prepare a detailed CEMP prior to construction and following the detailed design of the Scheme.

5.4.39 The detailed CEMP would be approved by BC following the grant of the DCO and prior to the start of construction. It would identify the procedures to be adhered to and managed by the contractor throughout construction and would clearly define roles and responsibilities. Production of the detailed CEMP is secured through a requirement in the **draft DCO [APP/3.1]**.

5.4.40 Contracts with companies involved in the construction works would incorporate environmental control, health and safety regulations, and current guidance. This would ensure that construction activities are sustainable and that all contractors involved with the construction phase are committed to agreed good practice and meeting all relevant environmental legislation.

5.4.41 Records would be kept and updated regularly, ensuring that all waste transferred or disposed of has been appropriately processed with evidence of signed Waste Transfer Notes (WTNs) that would be kept on-site for inspection whenever requested. Furthermore, all construction works would adhere to the Construction (Design and Management) Regulations 2015 (CDM).

Construction Lighting

5.4.42 Temporary site lighting would be used during construction to enable safe working during construction in hours of darkness or where natural lighting is unable to reach (such as sheltered/confined areas). Mobile lighting towers with a power output of 8 kilo volt-amperes (kVA) would be used for construction work, along with lighting at the construction compounds while construction is underway.

5.4.43 All construction lighting will be deployed in accordance with the following recommendations to prevent or reduce the impact on human and ecological receptors:

- The use of lighting will be minimised to that required for safe site operations
- Lighting will utilise directional fittings to minimise outward light spill and glare (e.g. via the use of light hoods/cowls which direct light below the horizontal plane, preferably at an angle greater than 20° from horizontal); and
- Lighting will be directed towards the middle of the Order limits rather than towards the boundaries.

5.4.44 Measures to control lighting are set out in the **oCEMP [APP/7.6]**.

Spoil Management

5.4.45 There will be no site wide reprofiling required, however there may be a need to level out some areas within the Order limits. Topsoil, subsoil and spoil material is only expected to be generated from cable trenches, temporary and permanent compounds, internal access tracks, the BESS, Customer Substation, and National Grid Substation areas, and supporting infrastructure.

5.4.46 The earth that is removed to enable the construction of the Customer Substation and National Grid Substation will be placed into a bund alongside the BESS to create a noise buffer.

5.4.47 During construction of the Cabling, spoil will be stored temporarily within designated areas adjacent to the cable route and within the construction compounds. The spoil will be utilised to backfill the cable trenches, HDD launch and exit pits, reinstate the temporary construction compounds and any temporary access roads. Should contaminated spoil be identified during construction, this would be transported off site to a licenced waste facility for treatment.

5.4.48 Measures to manage soil are set out in the **outline Soil Management Plan (oSMP) [APP/7.13].**

Waste

5.4.49 Solid waste materials generated during construction would be segregated and stored on-site in containers prior to transport to approved, licensed third party waste management facilities. This would primarily comprise packaging associated with the electrical items. During construction, the removal of waste has been accounted for in the estimated HGV deliveries a day.

5.4.50 Waste is considered further in **ES Chapter 16: Other Environmental Matters [APP/6.2]**. The construction of the Scheme will be subject to measures and procedures defined within a detailed CEMP and Site Waste Management Plan (SWMP). These measures will include the implementation of industry standard practice and control measures for material and waste management on-site. These measures are set out in the **oCEMP [APP/7.6]** submitted with the DCO Application.

Fuel

5.4.51 Fuel for machinery and generators would be delivered by a fuel bowser as required and stored in integrally bunded above ground fuel storage tanks (cubes) which comply with the Oil Storage Regulations (REF 5-6). The double skinned fuel storage tanks would be fully covered , secured from unauthorised access, and equipped with integral bunding capable of holding 110% of the volume of the tank (i.e. it would have 10% more capacity than needed). Spill kits would be carried by all plant and would be available at the fuelling point and other strategic locations of the Order limits to allow for prompt clean up. All construction workers would be trained in pollution prevention and spill kit use. Oil storage areas would not be created in areas susceptible to flooding.

Water

5.4.52 An estimated 17,296m^3 total of water would be required during construction to support welfare facilities on-site and other uses.

5.4.53 Water will be transported to the Order limits by road from an existing nearby licenced water abstraction source and stored on site. Where mains water is available this would also be utilised.

5.4.54 During construction self-contained portable welfare units which store foul/wastewater for collection/emptying by specialist licenced contractors would be used.

Surface Water Drainage During Construction

5.4.55 The **oCEMP [APP/7.6]** describes water management measures to control surface water run-off and drain hardstanding and other structures during the construction of the Scheme. These measures will be further developed and set out within a Water Management Plan (WMP) to be included within the detailed CEMP.

Power Supply

5.4.56 To facilitate construction, connecting to existing overhead power lines will be considered to provide power to the construction compounds where feasible. Compounds will be equipped with diesel generators where connection to power lines cannot be made.

Site Reinstatement, Biodiversity and Landscaping

5.4.57 Following construction, a programme of site reinstatement will commence. Embedded mitigation measures for soil management are set out in the **oCEMP [APP/7.6]** and the **oSMP [APP/7.13]** including measures such as construction and exclusion zones in relation to retained vegetation, ensuring a tidy and neat working area, covering stockpiles and storing topsoil in accordance with good practice measures.

5.4.58 An **oLEMP [APP/7.11]** accompanies the DCO Application. This document sets out the principles for how the land will be managed throughout the operation phase, following the completion of construction. Should the DCO be granted, a detailed Landscape and Ecological Management Plan will be produced prior to the start of construction.

5.5 Operational Phase

5.5.1 The Applicant is seeking a time-limited consent with respect to the operation of the Scheme, which will start from the date of the final commissioning phase of the Scheme. The operational life of the Scheme is anticipated to be 60 years.

5.5.2 During the operational phase, two scenarios have been considered within the ES:

- General operational maintenance activities; and
- Programme of replacement activities.

General Operational Maintenance

Operational Activities

5.5.3 During operation, other than in the context of a programme of replacement, activity on the Solar PV Site would be restricted principally to vegetation management, equipment maintenance and servicing, ad hoc replacement and renewal of any components that fail or reach the end of their lifespan, periodic fence inspection, vegetation management along accesses, permissive paths and landscape ecological mitigation maintenance, and monitoring to ensure the continued effective operation of the Scheme.

5.5.4 Along the Grid Connection Infrastructure, operational activity may consist of routine inspections, vegetation management, and any reactive maintenance from National Grid.

5.5.5 The frequency of regular maintenance visits would reasonably be expected to be limited to no more than five visits per month to the Solar PV Site. Limited use of HGVs may be required for the ad-hoc replacement of components.

5.5.6 An **outline Operational Environmental Management Plan (oOEMP) [APP/7.8]** has been prepared as part of the DCO Application. The oOEMP sets out the environmental principles to be followed during the operation of the Scheme. The oOEMP will be used as the basis for a detailed OEMP to be prepared prior to commencement of operation.

Operational Staff

5.5.7 No permanent on-site staff will be required to operate the Scheme. There will be limited staff facilities located in the control room associated with the Customer Substation and the National Grid Substation. Equipment for monitoring the Solar PV Site will be located in the Relay and Control Rooms. Whilst this would typically be accessed remotely, it would be available for occasional physical access during routine visits. A limited number of FTE staff jobs would be created, which would not be based on site.

Operational Traffic and Site Access

5.5.8 During the operational phase, other than during the operational replacement of PV panels, there will be a small number of daily vehicle trips, with additional staff attending when required for maintenance and cleaning activities.

5.5.9 Those arriving to undertake general operational maintenance activities would generally be expected to travel by car, appropriate 4x4 type vehicle or light van. The frequency of maintenance visits would reasonably be expected to be up to five visits per month to the Solar PV Site. HGVs may be required for the ad-hoc replacement of batteries, inverters and transformers associated with the substations and the BESS, which would be up to 33 two-way HGV movements per day during replacement activities.

Operational Lighting

5.5.10 Lighting is not required within the Solar PV Site during the operational phase of the Scheme.

5.5.11 All routine maintenance activities would be scheduled for daylight hours as far as is practicable. Focussed task specific lighting would only be required in the event of emergency works or equipment failure requiring night-time working.

5.5.12 Motion sensing security lighting would be provided within the Customer Substation, the National Grid Substation, and within the BESS to maintain safe working conditions in winter months, for security purposes, and for maintenance activities.

5.5.13 The lighting commitments for the operational phase are set out in the **oOEMP [APP/7.8]**, including details on lighting design to minimise light spill.

Operational Waste

5.5.14 Solid waste materials generated during Scheme operation and maintenance would primarily be general (household type) waste from the staff visiting site. However, there would also be a limited volume of packaging waste associated with the delivery of spare components. In accordance with legislation and guidance applicable at the time, all general and packaging type waste would be segregated prior to transport to an approved, licensed third party landfill and recycling facilities.

5.5.15 Additionally, any waste components (e.g. faulty or damaged PV Panels, batteries, cables, connectors and mounting structures) would also be removed and recycled as far as practical and in accordance with legislation and guidance applicable at the time.

5.5.16 Paragraph 5.5.34 summarises the anticipated design life and replacement frequency for the main elements of the Scheme (PV Panels, BESS etc.), based on other similar solar Nationally Significant Infrastructure Project (NSIP) schemes.

5.5.17 Waste is discussed further in **ES Chapter 16: Other Environmental Matters [APP/6.2].**

5.5.18 The operation of the Scheme will be subject to measures and procedures defined within an OEMP secured by a requirement in the DCO. The detailed OEMP will include the implementation of industry standard practice and control measures for material and waste management on-site. These measures are set out in the **oOEMP [APP/7.8]** submitted with the DCO Application.

Operational Water

5.5.19 During the operational phase, the Scheme is likely to be supplied by a combination of Anglian Water Mains, the landowners' existing agricultural supply and a water tankered option. Self-contained portable welfare units which store foul/wastewater for collection/emptying by specialist licenced contractors would be deployed on an ad hoc basis (e.g. if required by maintenance crews).

5.5.20 The volume of stored fire water will be maintained to ensure there is sufficient water for firefighting purposes. Details of fire water supply and storage are provided within the **oBSMP [APP/7.14]** which accompanies the DCO Application.

Surface Water Drainage

5.5.21 Access Tracks will be served by trackside drainage ditches. Along the access tracks, drainage channels on the down-slope would shed track run-off to adjacent ground approximately every 30m, to attenuate flow and allow natural filtration to remove sediments.

5.5.22 SuDS will be designed for the BESS Compound, Customer Substation and National Grid Substation during the detailed design phase of the Scheme and designed to the 1% AEP +40% climate change allowance event.

5.5.23 The detailed operational drainage design would be carried out pre-construction with the objective of ensuring that drainage of the land to the present level is maintained. It would follow either the design of a new drainage system taking into account the proposed new infrastructure (access tracks, cable trenches and structure foundations) to be constructed or, if during the construction of any of the infrastructure there is any interruption to existing schemes of land drainage, new sections of drainage would be constructed.

5.5.24 The design of new drainage systems would be based on the hydrological assessment undertaken as part of the ES. Infrastructure would be placed at least 10m away from watercourses, as set out within the proposed buffers.

5.5.25 Management of fire water is further described in **ES Chapter 12: Water Resources [APP/6.2]** and the **oBSMP [APP/7.14].**

Cleaning of Panels

5.5.26 Due to the wet UK climate, PV Panels are largely self-cleaning and deterioration in PV system output due to dust or dirt is generally low. The requirement for, and the frequency of, cleaning of the Solar PV Panels due to the build-up of dust and dirt varies depending upon site specific conditions. For example, the presence of fine dust emitters such as quarries, agricultural operations (harvesting), coastal salt water, and the volume and proximity of nearby woodland can all impact the level of dust deposition. However, the main factor influencing cleaning requirements in the UK is lichen growth which again is influenced by site specific and climatic factors.

5.5.27 The requirement for cleaning due to loss of output is balanced against cost of the cleaning operation. Some sites can operate without the need to be cleaned, whereas some sites require cleaning annually. The cleaning requirements for the Scheme can only be accurately determined once operational and, therefore, to present a worst case for the assessments presented in this ES, a two-year cleaning cycle is assumed.

5.5.28 The PV panels would be cleaned using water only. Up to 776.5m^3 of water would be required to clean the panels annually. Deionised water transported to the site by tanker would be used. No chemical cleaning products would be used, with stubborn dirt brushed or wiped off the panels.

Grazing

5.5.29 For the purposes of assessment and reporting of effects, as a reasonable worst case, it is assumed that vegetation will be managed with machinery and there will be no grazing at the Solar PV Site during the operation and maintenance phase.

5.5.30 However, should consent be granted, grazing by sheep will be explored, noting that there are no known landowner restrictive covenants or other reasons that would prevent such use.

Operational Programme of Replacement Activities

Design Life

5.5.31 During the anticipated 60-year operational life of the Scheme, it is expected that there will be a requirement for periodic replacement of some of the electrical infrastructure.

5.5.32 It is not expected that an extensive replacement of all components will be required across the entirety of the Scheme during one period; instead, the programme for replacement of equipment across the Scheme is anticipated to be staged to maintain the electrical export to the National Grid. However, in order to maximise the flexibility for how a programme of replacements may be conducted, for example, to coincide with planned repairs to the grid infrastructure, each chapter has considered the relevant worst case scenario as set out below.

5.5.33 The assessments in the ES chapters confirm that, however the programme of replacements is conducted, the replacement activity would be considerably less intensive than during construction, and any environmental effects identified can be appropriately mitigated with similar measures to those identified for the construction of the Scheme.

5.5.34 The following assumptions have been made for the programme of replacement activities:

- It is expected that the operational life of PV panels is 40 years or more, and that all the PV panels will be replaced once during the operational phase. The PV panels are anticipated to be replaced over a maximum 12 to 24 month period
- It is expected that the BESS Units could be replaced up to five times during the operational phase
- Accesses to the Solar PV Site defined for construction would be used. If any abnormal loads are required for the replacement of equipment, consultation will be carried out, and approvals will be sought from the relevant local planning and highways authorities
- Components such as Mounting Structures, Cabling and the Customer Substation, National Grid Substation, and BESS buildings are not anticipated to be replaced during the operational phase
- No intrusive ground works are anticipated to replace the PV panels or BESS Units; and
- It is anticipated that the Scheme will create 125 Full Time Equivalent employees, with a peak month requiring up to 360 construction workers on-site during the replacement activities.

5.5.35 The programme of replacement activities is assessed in **ES Chapters 6** to **Chapter 16 [APP/6.2]**. The assessments in these chapters have considered a reasonable worst-case scenario for operational replacement with regard to frequency and duration of replacement activities. Where a shorter or longer operational replacement programme is anticipated to result in a greater level of likely significant effects in respect of a particular EIA topic, the reasonable worst-case programme has been assumed for the purposes of the assessment of that topic.

5.5.36 Mitigation measures associated with the programme of replacement activities will be outlined within the **oOEMP [APP/7.8]**.

5.6 Decommissioning

5.6.1 Decommissioning is expected to take between 12 and 24 months, and for the purposes of the assessment, is expected to occur after the 60-year design life of the Scheme in 2093. A requirement to decommission the Scheme is secured via a requirement in the **draft DCO [APP/3.1]**.

5.6.2 An **outline Decommissioning Strategy (oDS) [APP/7.10]** has been prepared and submitted with the DCO Application. This sets out the general principles to be followed in the decommissioning phase of the Scheme, which will include measures to prevent fugitive emissions from temporary decommissioning compound(s) from impacting controlled waters, which are set out in the **oDS [APP/7.10.1]**.

5.6.3 . The **draft DCO [APP/3.1]** includes a requirement that a detailed Decommissioning Strategy would be prepared substantially in accordance with the **oDS [APP/7.10]** and approved by BC at the time of decommissioning, in advance of the commencement of decommissioning works, and would include timescales and transportation methods. The detailed Decommissioning Strategy would ensure that decommissioning was undertaken safely and with regard to the environmental legislation at the time of decommissioning, including relevant waste legislation.

5.6.4 When the operational phase ends, the Solar PV Site would be decommissioned and the land returned to the landowner. All PV panels, Mounting Structures, above ground cabling (not including the Grid Connection Infrastructure), Conversion Units / 33kV Sub-distribution Switch Rooms, BESS and the Customer Substation would be removed from within the Order limits and recycled or disposed of in accordance with good practice and market conditions at that time. Foundations and other below ground infrastructure will be cut to 1.2m below the surface to enable future ploughing. Any piles would be removed.

5.6.5 The National Grid Substation, and the Grid Connection Infrastructure would remain in situ. Mitigation planting specifically required to support the location of the National Grid Substation, as identified on the **Construction Masterplan [APP/6.3],** would be handed over to National Grid who would be responsible for its maintenance and management.

5.6.6 Post-decommissioning, the landowners would choose how the land is to be used and managed; the landowner may return all of the land to agricultural use, although it is likely that established habitats such as hedgerows and woodland would be retained, given their potential benefits to agricultural land and the wider farming estate. Permissive paths would be removed during decommissioning, with the precise timing to be determined by the contractor(s) and communicated to NCC in accordance with the **oDS [APP/7.10]**.

5.6.7 The mode of removing the Cabling would be dependent upon government policy and good practice at that time. Currently, the most environmentally acceptable option is leaving the cables in situ, as this avoids disturbance to overlying land and habitats and to neighbouring communities. Alternatively, the cables can be removed by opening up the ground at regular intervals and pulling the cable through to the extraction point, leaving the ducting and jointing bays in place, avoiding the need to open up the entire length of the cable route.

5.6.8 Some soil profiling may be required, and the land will be contoured in agreement with the landowner and in accordance with the **oDS [APP/7.10]**, approximately similar to the current topography. Excavations will be backfilled, using appropriate imported soil if required, otherwise with soil sourced on site, using appropriate soil management techniques as set out in the detailed Decommissioning Strategy. Areas where grass does not exist because of the footprint of the previous infrastructure (e.g. the BESS and Customer Substation) shall be reseeded with suitable native species, in liaison with the landowner and in accordance with the Decommissioning Strategy.

5.6.9 The effects of decommissioning are expected to be similar or of a lesser magnitude than construction effects, and are considered in the relevant sections of this ES. The specific method of decommissioning the Scheme at the end of its design life is uncertain at present, as the engineering approaches to decommissioning would evolve over the design life of the Scheme. Assumptions have therefore been made where appropriate.

Waste

5.6.10 The waste generated at decommissioning would primarily be from the Solar PV Site, including electrical components, the Mounting Structures, and fencing. Waste would be managed in accordance with the relevant legislation and guidance at the time and in accordance with the **oDS [APP/7.10]**. Waste would be safely and securely stored. It is anticipated that waste would either be segregated and stored on-site in containers or would be stored within secure storage buildings prior to transport to an approved, licensed third party landfill and recycling facilities.

5.6.11 At this time, it is not possible to identify either the waste management routes or specific facilities that would be used, as these are liable to change over such a timescale. Other than the Scheme elements, the waste types generated, and effects of decommissioning are likely to be similar to or lesser than the construction effects.

5.7 References

Ref 5-1 Planning Inspectorate (2018) Nationally Significant Infrastructure Projects - Advice Note Nine: Rochdale Envelope.

Ref 5-2 The Planning Act 2008 (as amended).

Ref 5-3 Rodriguez-Gallegos, C.D, et al. (2020) Global Techno-Economic Performance of Bifacial and Tracking Photovoltaic Systems. Joule, Volume 4, Issue 7, P1514 – 1541.

Ref 5-4 Underwriters Laboratories (2023) UL 9540 Energy Storage Systems and Equipment.

Ref 5-5 British Standards Institute (BSI) (2020) BS EN IEC 62933-5-2 Electrical energy storage (EES) systems - Safety requirements for grid-integrated EES systems. Electrochemical-based systems.

Ref 5-6 The Control of Pollution (Oil Storage) (England) Regulations 2001.

THE DROVES
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