Green Hill Solar Farm

EN010170

Environmental Statement
Chapter 4: Scheme Description
Revision ~~A~~B (Tracked)

Prepared by: Lanpro

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APFP Regulation 5(2)(a)

Schedule of Changes

Revision	Section Reference	Description of Changes	Reason for Revision
A	[cover]	Updated to Revision A	As required for submission at Deadline 1.
	[throughout]	Updates to document references	As required for submission at Deadline 1.
	p.20	Updates to description of colour palette for onsite infrastructure	Applicant due diligence
	p.26	Updated approach to BESS fire safety	Applicant due diligence
	p.68	Updated the excavation depth from 1 metre to 1.2 metres.	Applicant due diligence
B	[cover]	Updated to Revision B	As required for submission at Deadline 6.
	[throughout]	Updates to document references	As required for submission at Deadline 6.
	p.9	Update to Work No. 10 to include Work No.10c.	Update to include Work No. 10C— creation of permissive paths for the exclusive use of pedestrians, cycle and equestrian users.
	P.23	Update to DC electrical boxes/Combiner box parameters	Updated to reflect updated technology.
	p.47-49	Update to Permissive Paths (Work No.10)	Update to include Work No. 10C— creation of permissive paths for the exclusive use of pedestrians, cycle and equestrian users. Update to include Permissive Path FF33.

Contents

Issue Sheet

Report Prepared for: Green Hill Solar Farm

Deadline ~~1~~6

Chapter 4: Scheme Description
Revision ~~A~~B

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4 Scheme Description

4.1 Introduction

4.1.1 This chapter provides a description of Green Hill Solar Farm (the 'Scheme'). The physical characteristics of the Scheme are described alongside the key activities that would be undertaken during construction, operation (including maintenance) and decommissioning. The description of the Scheme as set out in this chapter informs the technical assessments included in this Environmental Statement ('ES') (Chapters 7 to 24 **[APP-044** to **APP-061]**).

4.1.2 This chapter is supported by the following appendices:

- Appendix 4.1: Engineering Drawings and Sections **[APP-076]**.

4.1.3 This chapter should be read alongside the following plans and figures:

DCO Plans

- Location Plan **[~~APP-006~~REP3-004];**
- Land Plan **[~~AS-003~~REP5-004];**
- Crown Land Plan **[APP-008]**;
- Works Plan **[~~EX1~~EX6/GH2.4_~~B~~G];**
- Streets Plan **[~~AS-007~~REP3-010];**
- Public Rights of Way Plan **[~~AS-009~~REP3-012];** and
- Access to Works Plan **[~~APP-012~~REP3-014]**.

Chapter 4 Figures

Illustrative Layouts

- Figure 4.1: Illustrative Layout Green Hill A **[APP-193]**;
- Figure 4.2: Illustrative Layout Green Hill A.2 **[APP-194]**;
- Figure 4.3: Illustrative Layout Green Hill B **[APP-195]**;
- Figure 4.4.1: Illustrative Layout Green Hill C Option A Revision A **[~~EX1/GH6.4.4.4.1_A~~REP1-107]**;
- Figure 4.4.2: Illustrative Layout Green Hill C Option B **[APP-197]**;
- Figure 4.4.3: Illustrative Layout Plan Green Hill C Energy Storage Layout **[APP-198];**
- Figure 4.5: Illustrative Layout Green Hill D **[APP-199]**;
- Figure 4.6: Illustrative Layout Green Hill E **[APP-200]**;
- Figure 4.7: Illustrative Layout Green Hill F Revision A **[~~EX1/GH6.4.4.7_A~~APP-201]**;
- Figure 4.8: Illustrative Layout Green Hill G **[APP-202]**;

- Figure 4.9.1: Illustrative Layout Green Hill BESS Option A **[APP-203]**;
- Figure 4.9.2: Illustrative Layout Plan Green Hill BESS Option B **[APP-204]**;
- Figure 4.9.3: Illustrative Layout Plan Green Hill BESS Energy Storage Layout Option A **[APP-205]**; and
- Figure 4.9.4: Illustrative Layout Plan Green Hill BESS Energy Storage Layout Option B **[APP-206]**.

Landscape and Ecology Mitigation Plans

- Figure 4.10: Landscape and Ecology Mitigation Plan A **[~~APP-207~~EX6/GH6.4.4.10_D]**;
- Figure 4.11: Landscape and Ecology Mitigation Plan A.2 **[~~APP-208~~EX6/GH6.4.4.11_C]**;
- Figure 4.12: Landscape and Ecology Mitigation Plan B **[APP-209]**;
- Figure 4.13.1: Landscape and Ecology Mitigation Plan C and D_Option A Revision ~~A~~ **[~~EX1/GH6.4.4.13.1_A~~C [REP3-046]**;
- Figure 4.13.2: Landscape and Ecology Mitigation Plan C and D_Option B **[APP-211]**;
- Figure 4.14: Landscape and Ecology Mitigation Plan E_Sheet 1 **[~~APP-212~~EX6/GH6.4.4.14_C]**;
- Figure 4.15: Landscape and Ecology Mitigation Plan E_Sheet 2 **[~~APP-213~~EX6/GH6.4.4.15_C]**;
- Figure 4.16.1: Landscape and Ecology Mitigation Plan BESS_Option A **[APP-214]**;
- Figure 4.16.2: Landscape and Ecology Mitigation Plan BESS_Option B **[APP-215]**;
- Figure 4.17: Landscape and Ecology Mitigation Plan F_Sheet 1 **[~~APP-216~~REP3-052]**;
- Figure 4.18: Landscape and Ecology Mitigation Plan F_Sheet 2 Revision ~~A~~ **[~~EX1/GH6.4.4.18_A~~B [REP1-113]**;
- Figure 4.19: Landscape and Ecology Mitigation Plan F_Sheet 3 Revision ~~A~~ **[~~EX1/GH6.4.4.19_A~~D [REP3-054]**; and
- Figure 4.20: Landscape and Ecology Mitigation Plan G **[~~APP-219~~EX6/GH6.4.4.20_B]**.

Other Supporting Figures

- Figure 4.21: Indicative Sections **[APP-220]**.
- Figure 4.22: Indicative Permissive Paths **[APP-221]**.

4.2 The Order Limits

4.2.1 The Order limits, shown on Location Plan **[~~APP-006~~REP3-004]**. identify the maximum extent of land anticipated to be acquired or used for the construction, operation and maintenance, and decommissioning phases. The Scheme comprises the two main elements further detailed below.

4.2.2 In total, the Order limits comprise approximately 1,441.4 hectares (ha) of land.

The Sites

4.2.3 The total and combined area of the nine Sites is approximately 1,200.6 ha. A naming system has been applied to fields within the Sites, as presented in Figure 3.1 Field Numbering Plan **[APP-191]**.The Sites are referred to as Green Hill A, Green Hill A.2, Green Hill B, Green Hill C, Green Hill D, Green Hill E, Green Hill F, Green Hill G and Green Hill BESS.

4.2.4 The Scheme consists of a series of Solar Arrays across Green Hill A, A.2, B, C, D, E, F and G, Battery Energy Storage Systems (BESS), two 400kV substations and a number of 132kV and 33kV substations.

4.2.5 Illustrative layouts of the Sites are provided in Figures 4.1 to 4.9 **[APP-193** to **APP-206, REP1-107]**, which show an illustrative layout of solar photovoltaic (PV) infrastructure throughout the Sites. The illustrative layout of the solar PV infrastructure has been determined through a comprehensive iterative design process that has included the assessment of various environmental constraints and consultation with stakeholders, landowners and utilities asset owners.

4.2.6 The design process for the Sites has incorporated a number of offsets from features such as drainage ditches, watercourses, water bodies, hedgerows and tree lines, tree canopies, utilities, public rights of way, and residential dwellings, as identified in the Concept Design Parameters and Principles Revision ~~A [EX1~~C **[EX6/GH7.17_~~A~~C]**.

The Cable Route Corridor

4.2.7 The Cable Route Corridor is shown on the Location Plan **[~~APP-006~~REP3-004]**. The Cable Route Corridor will comprise underground electrical cables to connect the Sites to the Point of Connection (PoC) at Grendon Substation. The Cable Route Corridor runs for approximately 31km from the Green Hill A site at its most northern extent to Green Hill G at its southernmost point.

4.2.8 Cables, ranging in voltages from 11kV to 400kV, will be located within the Sites and the Cable Route Corridor.

4.2.9 The Cable Route Corridor has a typical width of 50m, however the Cable Route Corridor incorporates a number of wider areas, for example to allow additional working area for trenchless techniques such as Horizontal Directional Drilling (HDD), enable flexibility around areas of environmental sensitivity and temporary construction compounds. The Cable Route Corridor also narrows at certain points to avoid sensitive receptors such as habitat designations.

4.2.10 Whilst the Cable Route Corridor width varies along its length for reasons discussed above, it is also wider than the final required construction working area,

to allow flexibility in the final location (micro-siting) of the cables. The final construction working area width will be 30m. The location of the construction working area and cables will be identified at the detailed design stage carried out following determination of the DCO Application. This approach provides flexibility to the Applicant at this stage to take account of any unexpected, localised issues whilst providing certainty to affected landowners that effects will be no greater than those assessed in the ES.

4.2.11 The land within the Cable Route Corridor is predominantly agricultural in nature and, where practicable, cable routing would be to the edge of fields to minimise impacts on farming. All cables will be buried; there is no requirement for overhead electricity cables to be used or constructed as part of the Scheme.

Lifespan of the Scheme

4.2.12 The Scheme currently has a grid connection date of 2029. It is anticipated that construction works will commence, at the earliest, in Q1 2027 and will run to 2029.

4.2.13 The operational life of the Scheme will be a maximum of 60 years. Once the Scheme ceases to operate, it will be decommissioned. A 60-year period for the operational phase of the Scheme has been assessed within the ES.

4.2.14 Decommissioning is expected to take between 12 and 24 months. A 24-month decommissioning period has been assumed for the purposes of a worst-case assessment in this ES, unless specifically stated otherwise.

Works Packages

4.2.15 The Scheme is described in Schedule 1 of the draft Development Consent Order (DCO) Revision ~~A [EX1~~E [EX6/GH3.1_~~A~~E] where the "authorised development" is divided into works packages. The works numbers for those packages are summarised below and referred to throughout this chapter (note that the works package areas overlap):

Work No.1

4.2.16 Solar Photovoltaic Generating Station known as 'Green Hill A to G' or collectively as 'Sites' for ease of reference throughout this ES.

- Green Hill A (173.7 ha);
- Green Hill A.2 (65.2 ha);
- Green Hill B (64.7 ha);
- Green Hill C (56.4 ha);
- Green Hill D (42 ha);
- Green Hill E (308.6 ha);
- Green Hill F (275.8 ha); and
- Green Hill G (170.9 ha).

Work No.2

4.2.17 Energy Storage Facility at Green Hill BESS with option to also install BESS at Green Hill C.

Work No.3

4.2.18 Works in connection with onsite substations at each Site including:

- Work No. 3A — substations up to 400 kV;
- Work No. 3B — substations up to 132 kV; and
- Work No. 3C — substations up to 33kV.

Work No.4

4.2.19 Works to the National Grid substation to facilitate connection of the authorised development to the National Grid including population of the substation bay.

Work No.5

4.2.20 Grid connection cable works between the nine Sites and connecting to the National Grid Grendon Substation including works to lay electrical cables, accesses, and temporary construction laydown areas for the electrical cables.

Work No.6

4.2.21 Works associated with each of the Sites including fencing, gates, boundary treatment and other means of enclosure; the provision of security and monitoring measures such as CCTV columns, lighting columns and lighting, cameras, weather stations, communication infrastructure, and perimeter fencing; landscaping and biodiversity mitigation and enhancement measures including planting; improvement, maintenance and use of existing private tracks; laying down of internal access tracks, ramps, means of access, footpaths, cycle routes and roads, including the laying and construction of drainage infrastructure, signage and information boards; temporary footpath diversions; earthworks; SuDs Ponds, runoff outfalls, general drainage and irrigation infrastructure and improvements or extensions to existing drainage and irrigation systems; electricity and telecommunications connections; and secondary temporary construction compounds.

Work No. 7

4.2.22 Temporary construction and decommissioning laydown areas within each of the Solar Farm Sites and works associated with these including 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

4.2.23 Works to facilitate both temporary construction access, and permanent access to the Sites and Cable Route Corridor.

Work No.9

4.2.24 Works to create and maintain habitat management areas.

Work No.10

4.2.25 Creation of permissive paths for use of pedestrian, cyclists and equestrian users.

4.2.26 The Scheme also includes further associated development in connection with Work Nos. 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; works to alter the course of non-navigable rivers, streams or watercourses; ramps, bridges and means of

access; security and monitoring measures; improvement, maintenance and use of existing private tracks; footpath diversions and enhancement; 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.

4.3 Rochdale Envelope

Scheme Flexibility

4.3.1 To maintain flexibility in the design, the Applicant has assessed the impacts of the Proposed Development within the maximum parameters set out in this ES. The ES adopts a maximum design scenario approach, assessing the Scheme on the basis of the maximum project design parameters relevant to the technical discipline i.e. the reasonable worst-case scenario for impacts (known as the "Rochdale Envelope"). The Application has incorporated flexibility into the design of the Scheme to allow the latest technology to be installed at the time of construction. The ES considers the use of fixed and tracker panels for the Solar Arrays.

4.3.2 The need for flexibility in design, layout and technology is recognised in National Policy Statement EN-1 (Ref 4.1) as elements of a development may not be finalised. Further detail about the 'Rochdale Envelope' approach can be found in the Planning Inspectorate Advice Note Nine (Ref 4.2). By assessing the maximum (and where relevant, the minimum) parameters for the Scheme where flexibility needs to be retained, the ES ensures that all potentially significant effects (positive or adverse) are considered. The principles and justification for this approach are set out in Chapter 2: EIA Process and Methodology **[APP-039]** of this ES. The maximum design scenarios are identified from the range of potential options for each design parameter for the Scheme. The maximum design scenario assessed is therefore the scenario which would give rise to the greatest potential impact. The maximum design scenarios are set out in the Concept Design Parameters and Principles Revision ~~A~~ **~~[EX1~~**C **[EX6/GH7.17_~~A~~C]** which is secured by a Requirement in the draft DCO Revision ~~A~~ **~~[EX1~~**E **[EX6/GH3.1_~~A~~E]**.

4.3.3 Whilst it is inherent in the DCO process that flexibility can be built into the Scheme, the Works Plans Revision ~~B~~ **~~[EX1~~**G **[EX6/GH2.4_~~B~~G]** indicate the maximum extents within which different types of development (i.e., panels, substations, cabling) can be located and this has informed the assessment of environmental impacts.

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

- The arrangement of the Solar PV Panels and panel type/specification, including Solar PV Panel heights. Maximum parameters are therefore assessed;

- The arrangement of associated development such as the Conversion Units/Inverters; Battery Energy Storage System (BESS) Area; Substations; and
- The arrangement of the Grid Connection Cables, i.e. the exact routing of the Grid Connection Cables within the Cable Route Corridor.

4.3.5 The parameters that have been assessed in the ES are summarised below in **Table 4.1** and are provided in more detail in the Concept Design Parameters and Principles Revision ~~A [EX1~~C **[EX6/GH7.17_~~A~~C]**.

4.3.6 These parameters are considered in detail by technical authors during the EIA to ensure the realistic worst-case effects of the Scheme are assessed for each potential receptor. This is of particular importance 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.

Design Parameters

4.3.7 The design of the Scheme has been an iterative process, based on the various environmental assessments and consultation with statutory and non-statutory consultees. Chapter 5: Alternatives and Design Evolution **[APP-042]** of this ES describes this process further, including options that have been considered and discounted or considered and amendments then made to the Scheme design. The Design Approach Document **[APP-560]** also outlines the preparation and evolution of the Scheme design. The Design Approach Document submitted with the DCO Application also explains the design process, rationale and solution.

4.3.8 Whilst illustrative layout plans have been included in the DCO Application Figures 4.1 to 4.9.4 **[APP-193** to **APP-206, REP1-107]**, this represents one example of how the Scheme could be developed in accordance with the Concept Design Parameters and Principles Revision ~~A [EX1~~C **[EX6/GH7.17_~~A~~C]**. The ability of the Applicant to micro-site during construction is an important consideration and this may be required to reflect any technological advancement or changes in plant design or shape. The draft DCO Revision ~~A~~E submitted with the application **[~~EX1~~EX6/GH3.1_~~A~~E]** includes in Schedule 2 pre-commencement Requirements obliging the Applicant to submit to the relevant planning authority for approval the final detailed design proposals prior to commencement of construction of the Scheme. These Requirements would have the effect of demonstrating that the final detailed design remains within the design parameters (and therefore the Rochdale Envelope standards considered in this ES) and accords with the design principles identified within the Concept Design Parameters and Principles Revision ~~A [EX1~~C **[EX6/GH7.17_~~A~~C]**.

4.3.9 The ES and the assessments within it are based on the works proposed in the draft DCO Revision ~~A~~E Schedule 1 **[~~EX1~~EX6/GH3.1_~~A~~E]**, the Works Plans **[~~EX1~~EX6/GH2.4_~~B~~G]** and the Concept Design Parameters and Principles Revision ~~A [EX1~~C **[EX6/GH7.17_~~A~~C]**. Each Scheme component is described in more detail in section 4.4 below.

Table 4.1 Summary of Scheme Design Parameters

Scheme Component	Parameter Type	Maximum Design Parameter
Solar PV Panels		
Option A Tracking Panels	Maximum height of Solar PV Panels above ground level	4.5m when at greatest inclination. 2.5m when horizontal.
	Minimum height of the lowest part of the Solar PV Panel above the ground level	0.4m.
	Indicative orientation and slope	Solar PV Panels aligned in north-south rows. The panels will rotate to the east and west and tilt up to a maximum inclination of 60° from horizontal.
	Solar PV Panel mounting structure	Metal frames that hold Solar PV Panels in rows, either secured via metal posts driven into ground to a depth of 1.5-4m (dependant on ground conditions) or, in areas where archaeological protection is required, weighed down using concrete feet or other non-ground penetrative techniques.
	Solar PV Panel type	Bifacial monocrystalline panels.
	Separation distance between rows	Separation distance between rows of tracking panels will be a minimum of 2.5m at the closest point, and a maximum distance of 15m.
Option B Fixed Panels	Maximum height of Solar PV Panels above ground level	3.5m
	Minimum height of the lowest part of the Solar PV Panel above the ground level	0.4m
	Indicative orientation and slope	Solar PV Panels aligned in east-west rows with panels facing south at a fixed tilt angle of between +10 to +35° from horizontal.

Scheme Component	Parameter Type	Maximum Design Parameter
	Solar PV Panel mounting structure	Metal frames that hold Solar PV Panels in rows, either secured via metal posts driven into ground to a depth of 1.5-4m (dependant on ground conditions) or, in areas where archaeological protection is required, weighed down using concrete feet or other non-ground penetrative techniques.
	Solar PV Panel type	Bifacial monocrystalline panels
	Separation distance between rows	Separation distance between rows of fixed panels will be a minimum of 2.5m at the closest point, and there will be a maximum distance of 14m.
Conversion Units/Inverters	Maximum dimensions	15m by 6.5m with a maximum height of 3.5m. Electrical infrastructure associated with the panels will be elevated by mounting structures so that it is no less than 0.6m above the 0.1% Annual Exceedance Probability (AEP) flood level or, where this is not possible as high as practicable.
Fencing and Security	Compound fencing	Palisade fencing around the compound with a maximum height of 3m.
	Perimeter fencing	Deer type wire and mesh and wooden post fencing with a maximum height of 2.5m.
	Security	CCTV camera poles with a maximum height of 3m. Poles to be galvanized steel painted green.
Substations		
400kV Substations	Maximum compound area	6.0 ha
	Maximum height	12.5m max height of substation infrastructure
	Compound perimeter	3m high palisade fencing around the compound. 2.5m high deer type wire mesh and wooden post fencing outside of the palisade fencing.
	Access track	Maximum 6m wide constructed of hardcore or gravel over a levelling layer of substrate.

Scheme Component	Parameter Type	Maximum Design Parameter
	Relay and control Rooms – maximum dimensions	Maximum dimensions of 14m by 26m and maximum height of 7m
	132kV switch room	Maximum dimensions of 4m by 10m and maximum height of 3.2m * Based on two containers positioned in parallel.
	33kV switch room	Maximum dimensions of 5m by 20m and maximum height of 4.5m
	Gas Insulated Switchgear (GIS) Room (for GIS substation only)	Maximum dimensions of 15m by 40m and maximum height of 12.5m
132kV Substations	Maximum compound area	3.5ha
	Maximum height	6.8m to the top of the busbars
	Compound perimeter	3m high palisade fencing around the compound.
	Relay and control rooms – maximum dimensions	Maximum dimensions of 5m by 12m and maximum height of 4.5m
	33kV switchgear	Maximum dimensions of 4m by 10m and maximum height of 4m
33kV Substations	33kV substation	Maximum dimensions of 3.5m by 12.5m and maximum height of 3.5m
	Maximum height	3.5m
	Compound perimeter	3m high palisade fencing around the compound.
The BESS	BESS units	24m by 3m and maximum height of 3.5m
	Single BESS compound	Up to 6.5 hectares (based on BESS 1)
	Compound perimeter	3m high palisade fencing around the compound.

Scheme Component	Parameter Type	Maximum Design Parameter
	Access	Maximum 6m wide constructed of hardcore or gravel over a levelling layer of substrate. An appropriate number of parking bays will be provided.
Cable Infrastructure within the Cable Route Corridor	Maximum open cut trench width	3.5m width (per trench)
	Maximum typical width of construction working area	30m* *May be wider access where the Cable Route Corridor crosses roads, rivers and other utilities.
	Minimum depth of trench (open cut trench)	1.2m (where unconstrained)
	Horizontal Directional Drilling (HDD)	Assumed maximum depth of up to 12m. This is with the exception of the River Nene where cables will be installed at a maximum of 25m depending on final ground investigation studies. Laydown areas – 25m x 25m.

4.4 Components of the Scheme

4.4.1 The following components will be required for the Scheme, with further description of each component presented within sections below.

- Solar PV Panels;
- Solar PV Panel Mounting Structures;
- Conversion Units/Inverters;
- Substations;
- Battery Energy Storage System;
- Fencing and Security;
- Lighting;
- Cabling;
- District Network Operation Connections;
- Site Access;
- Ecological Mitigation and Enhancement;
- Surface Water Drainage;
- Landscaping; and
- Permissive Paths.

Solar Photovoltaic Panels (Work No.1)

4.4.2 The solar photovoltaic panels (Solar PV Panels) will convert sunlight/daylight into electrical current. They are made up of a series of photovoltaic cells beneath a layer of toughened glass. Other PV technology is developing rapidly and may be available at the time of construction.

4.4.3 The Scheme will utilise bifacial panels, which have PV cells and toughened glass on both the upper and lower surface, allowing sunlight to be converted to electricity on both sides of the panel.

4.4.4 The draft DCO seeks consent for both tracker panels (**Option A outlined in Plate 4.1**) and fixed panel options (**Option B outlined in Plate 4.2**) within the array Sites. The use and distribution of these across the Sites will be subject to further consideration as part of the detailed design of the Scheme.

4.4.5 Solar tracking systems are engineered to adjust the orientation and tilt of the Solar PV Panels to follow the sun's path throughout the day as illustrated in **Plate 4.3**. In contrast, fixed panel systems remain stationary, maintaining a constant angle.

4.4.6 The number and arrangement of PV Modules are influenced by various factors, and some flexibility will likely be needed to incorporate future technological advancements during the detailed design phase. The Applicant does not propose a limit on the generating capacity of the Scheme in the DCO Application, as the

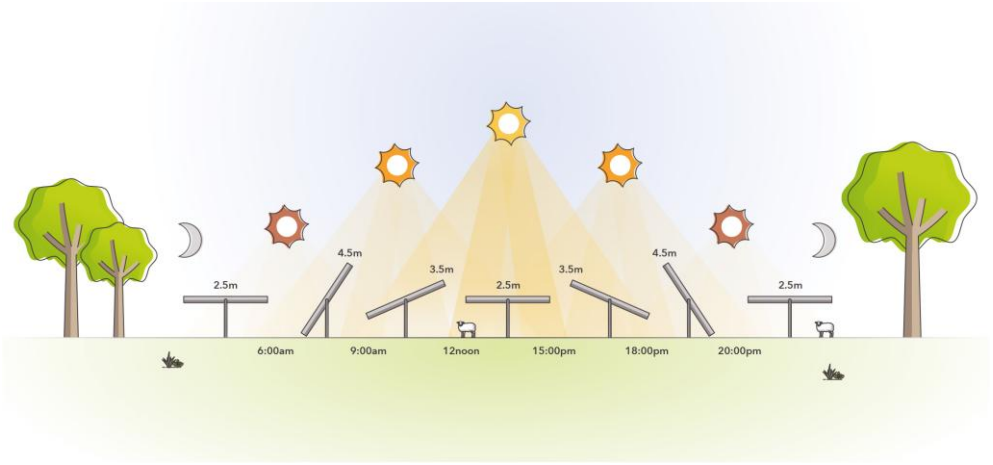
environmental impacts of the Scheme are determined by the relevant design parameters rather than the capacity.

4.4.7 For the purposes of the ES, the tracker panels have been assessed in Chapter 8: Landscape and Visual **[APP-045]** as a worst-case scenario given their larger scale. Chapter 14: Noise and Vibration **[APP-051]** also assesses tracker panels given that fixed Solar PV Panels do not have any moving parts and therefore have no noise emission associated with them. Chapter 15: Glint and Glare **[APP-052]** considers both fixed and tracker panel options as either type of panel may constitute the worst case scenario.

Option A (Tracking Panels)

Plate 4.1 Typical Tracking Panels

Plate 4.3 Illustration of tracking panels throughout the day



Option B (Fixed Panels)

Plate 4.2 Typical Fixed Panels (with Conversion Unit/Inverter)

Solar PV Panels Mounting Structures

4.4.8 The Solar PV Mounting Structures will be metal frames, typically aluminium or steel. The metal frames are typically installed by driving the piles directly into the ground to a maximum depth of up to 4m.

Tracking Panels

4.4.9 A tracker system involves attaching the Solar PV Panels to a motorized table that can move in relation to the sun. This allows for optimal power generation

throughout the day. The Solar PV Panels would be stored horizontally overnight. The Scheme would utilise a single-axis tracker system which tilts the Solar PV Panels around a horizontal north-south axis thus tracking the movement of the sun from east to west.

Fixed

4.4.10 Fixed south facing solar panels have historically been the most common approach for utility scale solar PV facilities in the UK to date (and therefore are the most commonly seen layout) and involve installing the Solar PV Panels to fixed tables, arranged in rows facing south.

4.4.11 In areas where archaeological protection is required, the use of concrete feet, a non-ground penetrative technique, is to be used as an archaeological mitigation to secure the mounting structures to the ground, with the use and implementation of concrete feet further discussed in the Archaeological Mitigation Strategy **[~~APP-146~~CR2-006]**, a draft of which has been provided with the DCO Application.

4.4.12 This approach will also be used across areas of high-risk unexploded ordnance within Green Hill G, an example of panels on concrete feet are outlined in **Plate 4.4** below.

Plate 4.4 Panels on Concrete Feet

4.4.13 The Solar PV Mounting Structures are engineered to endure wind and snow loads, as well as other environmental impacts anticipated throughout the operational life of the Scheme. Solar PV modules are built and tested to withstand and operate in some of the most extreme environments.

Conversion Units/Inverters

4.4.14 The Conversion Units incorporate the inverters, transformers and associated equipment and are required to manage the electricity generated by the PV

Panels. The conversion unit converts the Direct Current ('DC') electricity produced by the arrays into Alternating Current ('AC') electricity required for export to the National Grid. These would either be standalone equipment, or they would be housed ('integrated') together within a container. The Concept Design Parameters and Principles Revision ~~A [EX1~~C [EX6/GH7.17_~~A~~C] allow for both options. Both options would sit on a concrete foundation slab, strips, or footings for each of the units and a levelling layer of aggregate with a maximum depth of 0.8m; or a concrete plinth set atop the topsoil where non-ground-penetrative works are required. 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.

4.4.15 Transformers are required to step up the voltage of the AC electricity generated by the inverters across the solar sites before it reaches the site substation.

4.4.16 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.

4.4.17 An integrated Conversion Unit would comprise one or two central inverters, transformers and switchgear all housed within a complete, pre-assembled and pre- configured unit with maximum dimensions as set out in the Concept Design Parameters and Principles Revision ~~A [EX1~~C [EX6/GH7.17_~~A~~C] of 15m in length by 6.5m in width and a maximum height of up to 3.5m. The external finish for the integrated containers will be in keeping with the prevailing surrounding environment. 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 4.5** and **Plate 4.6** below show a typical conversion unit.

4.4.18 The maximum parameters of an inverter will be 9m in length by 6.5m in width and 3.5m in height. Inverters will sit in containers, externally finished to be in keeping with the prevailing surrounding environment. The exact colour will be subject to manufacturer specifications and agreed with the relevant planning authority prior to construction but will be carefully selected in subdued, non-reflective tones to sit as discreetly as possible within the landscape.

4.4.19 The following design parameters apply to standalone transformers:

- The maximum parameters of the transformer will be 5.5m in length by 6.5m in width and 3.5m in height.
- Externally finished to be in keeping with the prevailing surrounding environment. The exact colour will be subject to manufacturer specifications and agreed with the relevant planning authority prior to construction but will be carefully selected in subdued, non-reflective tones to sit as discreetly as possible within the landscape.

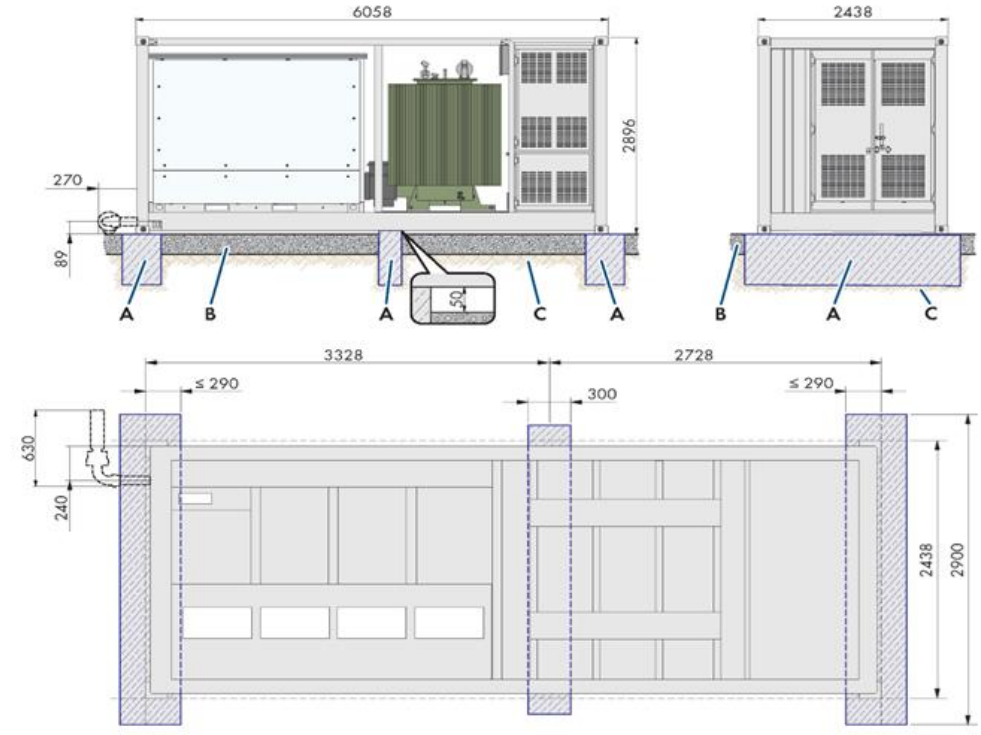
4.4.20 The following design parameters apply to standalone switchgear equipment:

- The maximum footprint will be 2.5m in width by 6.5m in length and a maximum height of 3.5m. There will be one switchgear at every inverter location.
- Externally finished to be in keeping with the prevailing surrounding environment. The exact colour will be subject to manufacturer specifications and agreed with the relevant planning authority prior to construction but will be carefully selected in subdued, non-reflective tones to sit as discreetly as possible within the landscape.

Plate 4.5 Typical Conversion Unit (independent equipment)

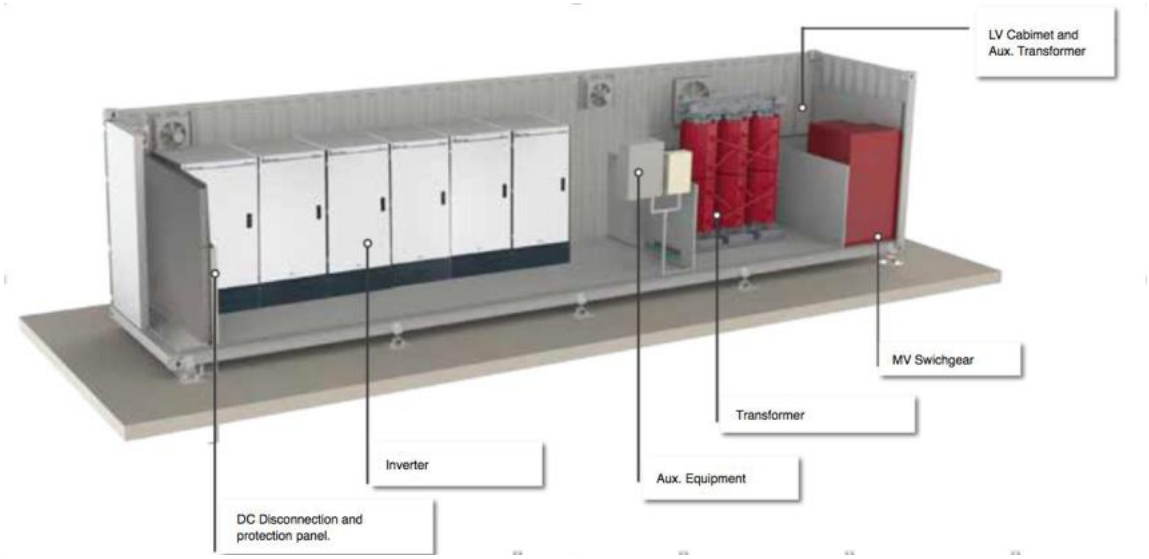
Plate 4.6A Typical Inverter Unit

SMA Solar Technology AG



Position	Designation
A	Strip foundation
B	Pea gravel ground
C	Solid ground, e.g., gravel

Plate 4.6B Integrated Conversion Unit



4.4.21 Conversion units will be required on each Site at a maximum rate of one conversion unit per 2.5 MW of peak solar energy generation. Resultantly a maximum number of conversion units would be required as follows:

- Green Hill A (Work No. 1): 40.
- Green Hill A.2 (Work No. 1): 20.
- Green Hill B (Work No. 1): 14.
- Green Hill C (Work No. 1): 10.
- Green Hill D (Work No. 1): 7.
- Green Hill E (Work No. 1): 60.
- Green Hill F (Work No. 1): 56.
- Green Hill G (Work No. 1): 54.

DC Electrical Combiner Boxes

4.4.22 These are required to combine the cables from the Solar PV Panels to link to the Conversion Units. The maximum width of the boxes is 0.~~55m~~9m, maximum length ~~0.65m~~1.1m and maximum height 0.~~26m~~4m.

Inter PV Panel Electrical Cabling

4.4.23 Electrical cabling will be required between the PV panels, conversion units and onsite substations. This will be a combination of above ground and underground cabling. For example, suspended cabling may be required in areas of archaeological sensitivity an example of which is outlined in **Plate 4.7**. Above ground, suspended cabling does not require the use of overhead cables. An example of suspended cabling is shown below.

4.4.24 Additional low voltage auxiliary cabling would supply the CCTV and monitoring equipment. This will be underground.

Plate 4.7 Suspended Cabling System

Battery Energy Storage System (Work No.2)

4.4.25 The Scheme will include a Battery Energy Storage System (BESS). This is designed to provide peak generation and grid balancing services to the electricity grid. It will allow excess electricity generated from the Solar PV Panels to be stored in the batteries and exported to the grid when required. Excess energy from the grid can also be imported to the batteries. The energy storage facility will therefore provide flexibility and enhance grid reliability.

4.4.26 Work No.2 proposes the Energy Storage Facility for the Scheme. This is shown on the Works Plan **[~~EX1~~EX6/GH2.4_~~B~~G]**.

4.4.27 The BESS will utilise a lithium-ion energy storage system. The batteries will be housed within containers. The batteries, inverters, transformers and switchgears ('conversion units') will be mounted on a concrete foundation in a single compound. A piling solution may be required, depending on the results of geotechnical surveys.

4.4.28 The preferred location for the BESS is at Green Hill BESS as shown on Figure 4.9: Illustrative Layout Plan Green Hill BESS **[APP-203** and **APP-204]**, however BESS may also be located on Green Hill C as shown on Figure 4.4 Illustrative Layout Plan Green Hill C **[APP-196** and **APP-197]**. The draft DCO Revision ~~A~~ **[~~EX1~~E [EX6/GH3.1_~~A~~E]** seeks consent for both locations.

4.4.29 **Plate 4.8** shows an example of a BESS arrangement with associated infrastructure. The final layout of the BESS compound will be determined during detailed design. The precise number of individual battery storage containers will depend upon the level of power capacity and duration of energy storage that the

Scheme will require. However, the maximum total surface area for the energy storage is limited to the area shown on the Works Plan **[~~EX1~~EX6/GH2.4_~~B~~G]** through Work No.2.

Plate 4.8 Typical BESS Units

4.4.30 The batteries will be housed within containers. An interconnector container provides connection between the batteries as well as temperature management and protection. The maximum dimensions of modular battery storage and interconnector container strings within a BESS compound is 24.0m by 3.0m footprint and up to 3.5m in height. The batteries may be positioned in a singular container or may be modular and joined depending on equipment choice to be determined at detailed design stage.

4.4.31 The BESS will require Heating, Ventilation and Cooling (HVAC) systems to ensure optimum operating conditions. These features are integrated into the units within which they are housed. The battery system will comprise bi-directional AC/DC inverters to control the charge of the batteries from the solar PV energy output or the charge of the batteries when drawing energy from the grid.

4.4.32 Similar to the Solar PV Panels, the BESS compound would be connected to inverters, and transformers and switchgear packaged into shipping-container type enclosures. These units 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 Battery Containers to receive electricity from the 400kV Substation for storage, and to release the stored energy via the Substation to the national grid. A separate BESS Control Building would also be located within the BESS compound, with maximum parameters of 3.5m by 12.5m and maximum height of 3.5m.

4.4.33 The monitoring and control system operates, isolates, and controls the exported power from the BESS. This will comprise a building of similar dimensions to the containers; either an adapted container or built from Glass Reinforced Plastic (GRP), located within the main BESS compound within the same container or room as the HVAC or liquid cooling system or in its own container or control room.

This is incorporated within the maximum parameters for the BESS compound. The likely configuration of equipment will be determined, post consent, during detailed design and will be based upon environmental and technical factors. A reasonable worst-case scenario has been assessed based on maximum parameters.

4.4.34 Onsite cabling will be required between battery stations, battery containers, as well as the onsite substation as outlined below.

- Cabling between battery containers, battery stations, and onsite stations may be either above ground in cable trays or laid in an underground trench.
- Cabling between battery stations and the onsite substation will be laid in an underground trench.

4.4.35 The underground cable trench dimension will be a minimum depth of 0.4m and maximum width of 3.5m wide.

BESS – Failure Safety

4.4.36 The Outline Battery Storage Safety Management Plan (OBSSMP) Revision ~~A~~ **~~[EX1/GH7.7_A~~**B **[REP5-075]** provides the requirements for the BESS in the event of credible failure scenarios. It outlines the requirement for two sources of firefighting water:

- Internal dry pipe sprinkler or spray system; and
- Firefighting water for boundary cooling by the Fire and Rescue team.

4.4.37 Each BESS enclosure may be fitted with an internal dry pipe sprinkler or spray system for fire protection in the event of a fire. The water supply for this system will be integrated into the design of each BESS enclosure and located externally (centralised or decentralised) to each BESS, water supply would not be taken from storage tanks designated for external firefighting water. The containment of this water would be within a sump integrated into the BESS enclosure.

4.4.38 External firefighting water storage tanks accommodating no less than 230,000 litres in capacity (as agreed with the Northamptonshire Fire and Rescue Services), will be provided for use by firefighters in case of a fire in the BESS compound. Water storage will either be stored in sectional steel panel tanks, or cylindrical steel tanks, above or below ground.

4.4.39 Each BESS area would be lined with a bunded impermeable surface or other form of containment system to prevent water used during firefighting operations infiltrating into the soils underlying the BESS area. Surface water would run from the impermeable surface to a bunded lagoon capable of capturing 242.5m3 of fire water. The lagoon would have a volume of approximately 410m3, which would allow the water to be stored following an emergency event and removed from Site if contaminated.

Substations (Work No.3)

4.4.40 Substations may be required at each Site. The Works Plan **[~~EX1~~EX6/GH2.4_~~B~~G]** identify the areas where the substations can be located and the indicative layouts include an example configuration for each substation.

4.4.41 The substations will consist of electrical infrastructure such as the transformers, switchgear and metering equipment required to facilitate the export of electricity from each respective Site. They will include office space and welfare facilities and may also include operational monitoring and maintenance equipment (operational monitoring equipment may be housed separately in its own container). Wastewater associated with welfare facilities at the substations will be contained in a septic tank to be emptied as and when required, by tanker. The control buildings will be a painted block building with external colours and finishes subject to manufacturer specifications and agreed with the relevant planning authority prior to construction. Hardstanding and vehicle parking bays will be provided at each substation.

4.4.42 There are different types of substation required across the Scheme as noted in **Table 4.1**. Maximum parameters for the onsite substations, including control building or containers, welfare facilities, hardstanding areas and hardstanding parking areas therein, but excluding the full extent of the cabling, are outlined and further detailed below.

400kV Substation

4.4.43 The Scheme includes two 400kV Substations. These substations are to be located within Green Hill BESS and Green Hill C. Green Hill C 400kV substation will have air insulated switchgear, whereas Green Hill BESS will either have air insulated switchgear or gas insulated switchgear. An example of an air insulated substation is shown in **Plate 4.9**.

4.4.44 The 400kV Substations would consist of electrical infrastructure such as transformers, switchgear and metering equipment. The two 400kV Substations would be connected to each other and to the 33kV and 132kV Substations via underground cables within the Sites and the Cable Route Corridor. The 400kV Substations step up the voltage from 33kV and 132kV to 400kV ready to be exported to the Existing National Grid Grendon Substation.

4.4.45 The 400kV Substations would also step down the voltage from 400kV to 132kV and 33kV. This would allow for both electricity provided from the grid at 400kV and provided from the Sites to be stored within the BESS.

4.4.46 The DCO seeks consent for either air insulated switchgear or gas insulated switchgear substation options within Green Hill BESS. For the purposes of the ES and to ensure that the DCO considers the environmental impacts in full a worst-case scenario has been assessed using the maximum parameters set out in **Table 4.1** above.

Plate 4.9 Typical (large 400kV) power transformer

132kV Substation

4.4.47 On Green Hill A, B, F and G, there will be the need for a 132kV substation on each of the Sites. On Green Hill E there will either be a 132kV or 33kV substations, the electrical design will be determined at the detailed design phase, for the purposes of the ES and to ensure that the DCO considers the environmental impacts in full, a worst-case scenario has been assessed using the maximum parameters set out in **Table 4.1**. An example of a 132kV substation is shown in **Plate 4.10**.

Plate 4.10 Typical 132kV Substation Compound

33kV Substation

4.4.48 There will be a requirement for 33kV substations on Green Hill A.2 and D. An example of a 33kV substation is shown on **Plate 4.11**

Plate 4.11 Typical 33kV Substation Compound

Grid Connection Works at Grendon Substation (Work No.4)

4.4.49 Works will be required within the existing 400kV AIS substation including the population of the bay onto the existing busbars. The works required are anticipated to consist of the provision of:

- A 400 kV 3-phase 4000 A circuit breaker for control and protection of the outgoing circuit serving the new scheme;
- A 3-phase set of current transformers for protection of the new outgoing 400 kV feeder circuit and the overlap with the National Grid system;
- A 3-phase High Accuracy Metering Current and Voltage Transformer assembly for commercial metering of the connection;
- A 3-phase 400 kV Line disconnector/earth switch for isolation and earthing of the outgoing 400 kV feeder circuit;
- A 3-phase set of 400 kV high voltage cable sealing ends and cables connecting the National Grid site with the Scheme's site at Green Hill BESS; and
- A 3-phase Power Quality ready Capacitor Voltage transformer.

4.4.50 Also required is protection, control and ancillary apparatus for the circuit to be housed within a stand-alone building sized approximately 6 m x 3 m, comprising duplicate feeder protection systems, commercial metering systems, National Grid owned protection and control equipment and User Remote Control and data acquisition apparatus.

Distribution Network Operator Connections

4.4.51 It is envisaged that local grid connections to the distribution network (operated by National Grid Electricity Distribution ('NGED')) will be made for all substations.

4.4.52 These will allow the generating station to connect to the local grid network to obtain short-term auxiliary power to the substations to maintain operation in the event that there is a technical problem with the connection to the National Grid.

4.4.53 Where connections to the local grid network are not possible the substations will be equipped with a backup diesel generator. This generator is intended to operate in the event of a grid connection failure (power outage). It will also maintain communication and protection systems to ensure a safe restart when power is restored.

4.4.54 Reinstating grid connection after a failure can be quite challenging and complex as a power supply is required for the maintenance of a stable frequency and voltage levels, as well as the coordination of multiple power sources. Diesel generators provide immediate power to essential systems, including communication and protection systems, which are vital for coordinating the restart process. Generators are reliable and can operate independently of the grid and while BESS can store and discharge energy, BESS may not always have sufficient capacity to handle prolonged outages or the initial surge in demand during a restart. Diesel generators supplement BESS to ensure continuous power

supply and maintain critical infrastructure, facilitating a smoother and safer restart.

Cable Route Corridor (Work No.5)

4.4.55 The electricity generated and stored by the Scheme will be exported to the National Grid at the existing Grendon Substation. The Sites will be linked to Grendon Substation via underground cables within the Cable Route Corridor. The underground cables will also transfer electricity from the National Grid to the BESS.

4.4.56 Works No. 5A and 5B cover works to lay electrical cables of up to 132 and 400 kilovolts, the routing and lengths of these cables are further detailed below and further described in the Grid Connection Statement **[~~APP-557~~EX6/GH7.13_B]**.

Works No.5A – Works to lay electrical cables up to 400 kilovolts accesses, and temporary construction laydown areas for the electrical cables including:

- A single 400 kV circuit, consisting of three cables, will run underground from the Green Hill C substation to the Green Hill BESS substation.
- A single 400 kV circuit, consisting of three cables will run underground from the Green Hill BESS substation to the adjacent Grendon 400 kV Air Insulated Switchgear (AIS) substation at Grendon National Grid Substation.

Work No. 5B— works to lay electrical cables up to 132 kilovolts, accesses, and temporary construction laydown areas for the electrical cables including:

- The electricity generated at Green Hill A is collected by a substation then exported to the Green Hill C substation via a 132 kV circuit of underground cables.
- The electricity generated at Green Hill A.2 is collected by a substation on site is then exported to the Green Hill A substation via a 33 kV circuit of underground cables.
- The electricity generated at Green Hill B is collected by a substation on site and then exported to the Green Hill C substation via a 132 kV circuit of underground cables.
- The electricity generated at Green Hill D collected by a substation on site is then exported to the Green Hill C substation via a 33 kV circuit of underground cables.
- The electricity generated at Green Hill E is collected by a substation on site and then exported to the Green Hill C substation via a single 132 kV circuit, or a maximum of four 33 kV circuits, of underground cables.
- The electricity generated at Green Hill F is collected by a substation on site and then exported to the Green Hill BESS substation via a 132 kV circuit of underground cables.

- The electricity generated at Green Hill G is collected by a substation on site and then exported to the Green Hill BESS substation via a 132 kV circuit of underground cables.

4.4.57 The exact location of the cable circuits within the 50m Cable Route Corridor will be determined at the detailed design stage. For assessment purposes, the placing of the cable anywhere within the Cable Route Corridor (Work No.5) has been considered, including the avoidance of environmentally sensitive locations.

4.4.58 The voltage of the cables and the number of circuits will affect the width and number of cable trenches required. The range of typical cable trench width is between 0.4m and 3.5m. However, the width and spacing of the cable trenches may differ depending on environmental constraints, engineering requirements or if crossing third party apparatus (e.g. existing cables and pipelines) which is subject to final detailed design and environmental considerations following ground investigation.

4.4.59 The design parameters for the Cable Route Corridor include:

- Where set in opencut trench, the maximum width of the dug cable trench for a single 132kV circuit is 0.5m set within the 30m working cable corridor. This applies except where jointing bays or horizontal directional drilling sections are located.
- Where set in opencut trench, the maximum width of the dug cable trench for two parallel 132kV circuits is 1.0m set within the 30m working cable corridor. This applies except where jointing bays or horizontal directional drilling sections are located.
- Where set in opencut trench, the maximum width across the dug cable trenches for a single 400kV circuit is 1.4m set within the 30m working cable corridor. This applies except where jointing bays or horizontal directional drilling sections are located.
- Where set in opencut trench with no constraints, the minimum depth of the dug cable trench is 1.2m below ground level. Where crossing existing buried utilities or apparatus, the maximum depth of the dug cable trench is 2m below the level of the existing apparatus.
- Where set in horizontal directional drilling sections, the maximum bore of a single drilled cable tunnel is 1.0m.
- Where multiple circuits are directional drilled along parallel paths, the minimum separation distances between drilled cable circuits is 3.0m.
- Where set in horizontal directional drilling sections, the maximum depth of the drilled cable tunnel is 25m below ground level. This depth is required because the River Nene is tidal and has high riverbanks owing to its flow rate. The water surface level can be 6m below the riverbank level, which constitutes the ground level. The surface water level can be 5m deep to the silt level. The silt level is likely to be 1m deep before the riverbed level has been achieved. A minimum depth for a HDD is 5m below riverbed level. Launch and receive pits are anticipated to be some distance away from the

river, and so 25m gives some flexibility to account for the depths of the river and that the ground will likely have a gradient.

- Smaller obstacles such as ditches and hedgerows which require HDD would only be drilled to a depth of 5m or less below ground level.
- Electrical cables will be direct buried or set in ducts arranged as either a single or multiple parallel circuits, with each circuit set in trefoil formation.
- Trenches will be cut with vertical walls.

4.4.60 The voltage of the cables and the number of circuits will affect the width and number of cable trenches required. However, the width and spacing of the cable trenches may differ depending on environmental constraints, engineering requirements or if crossing third party apparatus. Drawings are provided of typical cable arrangements within Appendix 4.1 Engineering Drawings and Sections **[APP-076]**.

4.4.61 In terms of installation, the cables will be laid directly into the trenches, or ducting will be installed, and the cables pulled through the ducting. Where the cable route encounters obstacles such as tree root systems, the width of the cable route (both permanent and temporary) may change locally. Jointing bays 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 for six cables / joints would be approximately 20m 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.

4.4.62 Fibre communications chambers will be required and are likely to be provided every 500 to 750m, but could be every 2000m apart if required, along the cable route. 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 the **Plate 4.12** below. These would stand 10mm-20mm above ground.

Plate 4.12 Fibre Chambers (construction and external appearance)

4.4.63 The cable route will need to cross a range of existing infrastructure such as major roads, minor roads and tracks, PRoW, existing buried/underground utilities (such as medium and high-pressure gas mains), rivers, field drains and main drains.

4.4.64 All potential crossings are identified in the Crossing Schedule **[~~APP-562~~EX6/GH7.18_B]**. Open cut trenching will be primarily utilised for crossings. The open cut technique may require the temporary closure of PRoWs, and minor roads and tracks. All temporary closures of PRoWs will be avoided as far as possible.

4.4.65 It is anticipated that works will be carried out via a combination of open cut trenching and trenchless solution such as HDD, with the latter used if needed to avoid and reduce adverse environmental effects, such as when crossing watercourses or cabling under protected hedgerows.

4.4.66 Trenchless solutions will require a launch pit to be excavated at the starting point for the machinery to drill from, to a 'reception pit' to be excavated at the end point where the machinery will drill to. These launch pits and reception pits will be up to 2m deep, 8m in length and 4m wide, subject to surveys and detailed design. Both launch and reception pits will be a minimum distance of 10m from a watercourse and will be backfilled and reinstated following installation of the cables. The precise location and dimensions of the launch and reception pits will be determined during detailed design.

4.4.67 In addition to the trenches, land will be required for access, soil storage and material 'lay down' areas. The 30m construction working area will include land for the cable trench, haul roads either side of the trench, soil storage, trenchless solution send and receive pits and laydown areas. The typical working area for the Cable Route Corridor is anticipated to be 30m wide but a wider area may be required in some locations such as those required for HDD.

4.4.68 Construction compounds along this route will also be required as indicated set out in Work No. 7 on the Works Plans **[~~EX1~~EX6/GH2.4_~~B~~G]**. The following construction compounds will be provided at the following locations to support the construction of the cable route:

- CC1: Off the A43 near Holcot
- CC2: Adjacent to the A45/B573 Junction
- CC4: located South of Grendon, accessed via an internal haul route accessed via Station Road.

4.4.69 Figures 13.13 to 13.17 **[APP-444** to **APP-448]** of Chapter 13: Transport and Access **[~~APP-050~~REP2-003]** outline the proposed locations of the compounds and proposed accesses.

4.4.70 The Outline Construction Traffic Management Plan (OCTMP) Revision ~~A~~ **[~~EX1~~C [EX6/GH7.9_~~A~~C]** and Outline Public Rights of Way and Permissive Paths Management Plan (OPRoWPPMP) Revision ~~A~~ **[~~EX1~~C [EX6/GH7.10_~~A~~C]** provide further detail regarding closure of PRoWs and minor roads and tracks.

Various Works Within the Sites (Work No.6)

Fencing and Security

4.4.71 During operation, perimeter fencing will be in place. The design principles of the fencing within the Sites will be wire mesh and wooden post fencing with a maximum height of 2.5m as illustrated in **Plate 4.13**. There will be palisade fencing around the substations and BESS compounds which will have a maximum height of 3m as illustrated in **Plate 4.14**.

4.4.72 Fencing during the construction phase will also be required, the details of which will be confirmed as part of the detailed design post-consent.

Plate 4.13 Typical Wire Mesh Fencing

Plate 4.14 Typical Palisade Fencing

4.4.73 Pole mounted internal facing CCTV systems will be used around the perimeter of the operational elements of the Sites. It is anticipated that these will be galvanised steel painted green poles with a maximum height of 3m.

4.4.74 Additional security measures will be provided for temporary construction, and replacement works compounds during their respective phases. This may include solid timber fencing or hoarding around construction compounds with lockable gates to protect against theft of stored materials or equipment. Furthermore,

during construction and replacement works, onsite security staff will be employed to patrol and monitor the Sites and temporary works compounds.

Lighting

4.4.75 Lighting is not required within the Solar Arrays for the operational phase. Motion sensing security lighting will be provided within substations and within the BESS to be used only for maintenance and security purposes.

4.4.76 Temporary site lighting during construction will be required to enable safe working during construction and decommissioning during hours of darkness and will be designed as far as reasonably practicable to minimise potential for light spillage outside the Sites and Cable Route Corridor, particularly towards houses, traffic and ecological habitats.

4.4.77 Standard good practice measures would be employed to minimise light spill, including glare during construction, operation and decommissioning.

Internal Access Tracks

4.4.78 Access tracks will be constructed within each of the Sites. The width of internal access tracks will be a minimum of 3.0m and a maximum of 6.0m.

Surface Water Drainage

4.4.79 A Flood Risk Assessment and a Drainage Strategy Report Revision ~~A~~ **~~[EX1/GH6.3.10.1_A~~**B **[REP5-021]** supports this application and has been developed as part of the design process for the Scheme. The assessments identify and outline how the Scheme will manage surface water and not increase flood risk. The Drainage Strategy details the measures to manage the surface water drainage from the Scheme.

4.4.80 Chapter 10 of the ES: Hydrology, Flood Risk and Drainage Revision ~~A~~ **~~[EX1/GH6.2.10_A~~**B **[REP5-015]** addresses surface water drainage. Given the nature of the Scheme, the increase of permanent impermeable area on the Site will be negligible, however equipment such as the proposed substations and BESS will generate increased surface water runoff when compared to the current undeveloped nature of the Site. There can be no offsite detriment in terms of surface water runoff rates and volumes and therefore it is proposed to maintain the predevelopment surface water regime post development. This will be achieved through several mitigation measures including:

- Utilising permeable surfacing for the Site access;
- Linear infiltration trenches will be incorporated around isolated infrastructure (e.g. cable jointing pillars) within panelled areas to manage surface water at source, mimic the undeveloped state, and prevent lateral surface water migration; and
- The Solar PV Panels have the potential to concentrate rainfall under the leeward edge of the panels themselves. Research in the United States by Cook & McCuen (Ref 4.3), suggested this increase would not be significant however, there is a potential increase in silt ladened runoff. With the

implementation of suitable planting (such as a wildflower or grass mix) the underlying ground cover is strengthened and is unlikely to generate surface water runoff rates beyond the baseline scenario.

4.4.81 Given the nature of the battery storage within the scheme, there is a potential risk of fire which could result in the mobilisation of pollution within surface water runoff.

4.4.82 Runoff from the battery storage area will be contained by local bunding and attenuated within gravel subgrade of lined permeable SuDS features prior to being passed forward to the local land drainage network. In the event of a fire, a system of automatically self-actuating valves at the outfalls from the battery storage areas will be closed, isolating the battery storage areas drainage from the wider environment. The water contained by the valves can then be tested and either treated and released or tankered offsite as necessary and in consultation with the relevant consultees at the time.

Ecological Mitigation and Enhancement

4.4.83 The Sites and Cable Route Corridor currently comprise predominantly arable and pastoral fields. There are features within the Sites and Cable Route Corridor such as hedgerows, field margins, ditches and watercourses which are considered to have some ecological value.

4.4.84 As a general principle, the Scheme has adopted the following ecological mitigation and enhancement measures typically used on solar farms:

- Land between and under the Solar PV Panels 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 will be filled with additional native species to increase diversity, and hedgerows will be managed on a rotational basis to enable wildlife to benefit from them year-round;
- Appropriate vegetated buffers will be maintained comprising native planting; and
- Installation of bird nest and bat boxes on trees located around the Sites to provide opportunities for a range of species recorded within the local area.

4.4.85 Figure 4.21 presents illustrative cross-sections of the Sites, highlighting the various parameters and buffer zones incorporated into the Scheme design.

4.4.86 An Outline Landscape and Ecological Management Plan (OLEMP) Revision ~~A~~ **~~[EX1~~**E **[EX6/GH7.4_~~A~~E]** has been developed to support the DCO Application. This outlines 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 the Scheme, a Landscape and Ecological Management Plan ('LEMP') will be prepared in accordance with the OLEMP and submitted to and approved by the relevant planning authority, and this will be secured by a 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.

Habitat Management Areas (Work No.9)

4.4.87 New areas of habitat creation and management are proposed within the Scheme as shown as Work No. 9 on the Works Plans **[~~EX1~~EX6/GH2.4_~~B~~G]**. Across the Order limits, the following approximate areas will be planted for habitat creation, landscaping and visual screening:

- 14.45ha of Green Corridor & Woodland Planting;
- 12.81ha Enhanced Riparian Native Planting;
- 43.14km of Hedgerow Reinforcement and Reinforced Roadside Vegetation;
- 15.61km of Proposed Hedgerows;
- 6 proposed Ponds and Wader Scrapes; and
- 1,079.53ha of Groundcover.

4.4.88 Offsetting provisions have been embedded within the Scheme design for skylark which includes:

- Approximately 167.2ha of grassland, spring-sown cereal or set-aside habitat suitable for skylark nesting at high densities situated within large fields containing no Solar PV Panels or BESS infrastructure.

4.4.89 The OLEMP Revision ~~A [EX1~~E **[EX6/GH7.4_~~A~~E]** sets out the principles for how the land will be managed throughout the operational phase, following the completion of construction. A detailed LEMP will be produced and submitted to the relevant planning authority for approval following the granting of the DCO and prior to the start of construction and is secured by a Requirement in the draft DCO Revision ~~A [EX1~~E **[EX6/GH3.1_~~A~~E]**.

4.4.90 In terms of Biodiversity Net Gain (BNG), the Scheme will commit to a minimum 10% across the Scheme with further details on the BNG assessment detailed within the Biodiversity Net Gain Assessment Revision A **[~~EX1/GH6.3.9.13_A~~REP1-043]**.

Landscaping

4.4.91 The Scheme has been designed to integrate with and enhance the local green infrastructure network, improving ecological and recreational connectivity across the Order limits. The proposed planting design has responded to landscape and ecological character.

4.4.92 Areas under the Solar PV Panels and around the perimeter of the Sites will be planted with native grassland mix, and hedgerows will be planted or augmented to provide visual screening (see Figures 4.10 to 4.20 **[~~APP-207 to APP-219~~EX6/GH6.4.4.10_D, EX6/GH6.4.4.11_C, APP-209, REP3-046, APP-211, EX6/GH6.4.4.14_C, EX6/GH6.4.4.15_C, APP-214, APP-215, REP3-052, REP1-113, REP3-054, EX6/GH6.4.4.20_B]**).

4.4.93 As a general principle, the Scheme had adopted the following landscape enhancements and mitigation typically used on solar projects:

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

4.4.94 The Scheme's design will seek to increase the green infrastructure and link up ecological networks. This includes enhancing PRoWs to improve access to the countryside and the creation of new permissive paths.

4.4.95 An OLEMP Revision ~~A [EX1~~E [EX6/GH7.4_~~A~~E] has been prepared to accompany the DCO application. This document sets out the principles for how the land will be managed throughout the operational phase, following the completion of construction. A detailed LEMP will be produced and submitted to the relevant planning authority for approval following the granting of the DCO and prior to the start of construction, which is secured by a Requirement in the draft DCO Revision ~~A [EX1~~E [EX6/GH3.1_~~A~~E].

Site Access (Work No.8)

4.4.96 Existing access points are proposed to be used wherever practicable, with upgrades to improve visibility splays where required. Additional access points will be provided where existing access points are not available or are unsuitable.

4.4.97 Work No. 8 comprises works for the creation of permanent and temporary (construction) access to Sites and the Cable Route Corridor from the public highway; the creation of visibility splays; works to alter the layout of any street or highway temporarily; and offsite works for the facilitation of movement of any abnormal loads.

4.4.98 Permanent and temporary access points are described and assessed in detail in the Transport Assessment **[APP-151** to **APP-153]**, OCTMP Revision ~~A [EX1~~C [EX6/GH7.9_~~A~~C] and Outline Operational Traffic Management Plan (OOTMP) Revision A [~~EX1/GH7.25_A~~REP1-157].

4.4.99 The access locations are outlined in in detail in the Transport Assessment **[APP-151** to **APP-153]**.

4.4.100 A total of 47 access points across the Scheme are proposed for construction and operation purposes for the Sites, Cable Corridor and Cable Construction Compounds. The majority of access points will be improved existing field accesses.

4.4.101 The accesses and their use are described in the **Table 4.2** below.

4.4.102 Where possible, existing junctions and agricultural field accesses have been utilised. Most field access points require widening and formalisation to provide suitable construction access as appropriate.

4.4.103 Some of the accesses, particularly those to the Sites will be retained for use by maintenance vehicles, once the Scheme is operational. The remainder will be

returned to their original condition but may be retained with the agreement of the landowner should they provide a more suitable longer-term solution for their current use.

4.4.104 Cable Route Corridor accesses, whilst generally utilising existing access points, are temporary insofar as they are only required for the construction of the cable connection. Once used, they can be returned to a previous state or instances where, for example, the changes constitute a betterment to an existing access, may remain in situ.

Table 4.2 Proposed Accesses

Access Ref.	Location	Description	Use
Green Hill A			
Access-A-1	Broughton Road	Improved existing field access	• Construction • Operation • Cable Route Corridor
Access-A-2	Broughton Road	Improved existing field access	• Operation
Crossing-A-1 (E)	Newland Road	New access	• Construction • Operation
Crossing-A-1 (W)	Newland Road	Improved existing field access	• Construction • Operation
Green Hill A.2			
Access-A.2-1	Kettering Road	Improved existing field access	• Construction • Operation • Cable Route Corridor
Green Hill B			
Access-B-1	Sywell Road	Improved existing field access	• Construction • Operation • Cable Route Corridor
Access-B-2	Moulton Road	Existing farm access	• Operation
Green Hill C			

Access Ref.	Location	Description	Use
Access-C-1	Sywell Road	Existing access to solar farm	• Construction • Operation • Cable Route Corridor
Green Hill D			
Access-D-1	Highfield Road	Improved existing field access	• Construction • Cable Route Corridor
Access-D-2	Highfield Road	Improved existing field access	• Construction • Operation
Access-D-3	Highfield Road	Improved existing field access	• Construction
Access-D-4	Highfield Road	Improved existing field access	• Operation
Access-D-5	Highfield Road	Improved existing field access	• Construction
Green Hill E			
Access-E-1	Highfield Road	Improved existing field access	• Construction • Operation • Cable Route Corridor
Access-E-2	Earls Barton Road	Improved existing field access	• Construction • Operation
Crossing E-1 (N)	Wilby Road	New access	• Construction • Operation
Crossing-E-1 (S)	Wilby Road	Improved existing field access	• Construction

Access Ref.	Location	Description	Use
			• Operation
Green Hill BESS			
Access-BESS-1	Station Road	Improved existing field access	• Emergency
Access-BESS-2	Station Road	Improved existing field access	• Construction • Operation • Cable Route Corridor
Access-BESS-3	Station Road	Improved existing field access	• Construction • Operation
Access-BESS-4	Station Road	New access	• Emergency
Green Hill G			
Access-G-1	A428	Improved existing field access	• Construction • Operation
Cable Route Corridor			
CR1	Kettering Road	Improved existing field access	• Cable Route Corridor
CR2	Kettering Road	Improved existing field access	• Cable Route Corridor
CR3	Red House Lane	Improved existing field access	• Cable Route Corridor
CR4	A43	Improved access to Northampton Shooting Ground	• Cable Route Corridor • Construction Compound
CR5	Sywell Road	Improved existing field access	• Cable Route Corridor
CR6	Moonshine Gap	Improved existing field access	• Cable Route Corridor

Access Ref.	Location	Description	Use
CR7	Sywell Road	Improved existing field access	• Cable Route Corridor
CR8	Mears Ashby Road	Improved existing field access	• Cable Route Corridor
CR9	Mears Ashby Road	Improved existing field access	• Cable Route Corridor
CR10	A4500	Improved existing field access	• Cable Route Corridor
CR11	A4500	Improved existing field access	• Cable Route Corridor
CR12	Doddington Road (B573)	New access	• Cable Route Corridor • Construction Compound
CR13	Doddington Road (B573)	New access	• Cable Route Corridor
CR14	Doddington Road (B573)	Improved existing field access.	• Cable Route Corridor
CR15	Station Road	Improved existing field access.	• Cable Route Corridor
CR16	Station Road	Improved existing access to quarry	• Cable Route Corridor
CR17	Station Road	Existing access to Grendon Sub-Station	• Cable Route Corridor
CR18	Station Road	Improved existing field access.	• Cable Route Corridor • Construction Compound
CR19	Yardley Road	Improved existing field access.	• Cable Route Corridor
CR20	Yardley Road	New Access	• Cable Route Corridor
CR21	Yardley Road	Improved existing field access.	• Cable Route Corridor
CR22	Yardley Road	Improved existing field access.	• Cable Route Corridor
CR23	Easton Lane	Improved existing field access.	• Cable Route Corridor

Access Ref.	Location	Description	Use
CR24	A509	Improved existing field access.	• Cable Route Corridor

4.4.105 The following design parameters are proposed for permanent and temporary accesses:

- Construction and decommissioning access points will be a minimum of 5.0m in width for two-way movements up to a maximum of 6.5m in width where passing places are required.
- 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.
- Access tracks will be trackpad covered ground; compacted earth, hardcore, or gravel over a levelling layer of substrate; or metalled surface if pre-existing, subject to ground load-bearing capacity and archaeological features, and utilising of existing accesses.

Abnormal Loads

4.4.106 There will be a number of abnormal load movements associated with the construction of the Scheme as outlined in **Table 4.3**. Abnormal load specialist consultants have prepared a report detailing the required movements. This is included in Appendix E of the Transport Assessment **[APP-152]**.

Table 4.3 Summary of Abnormal Load movements for Green Hill Sites

Green Hill Site	Substation voltage	Transformer sizes	Number	Access
Green Hill A	132kV	120/140MVA 132/33 kV – L: 7.6m, W: 2.7m, H: 4.5m – Weight: 95 tonnes	2	Broughton Road
Green Hill B	132kV	60/90MVA 132/33kV L:7m, W:2.6m, H:4m – Weight: 65 tonnes	1	Sywell Road
Green Hill C	400kV	150MVA 400/33 kV – L: 8m, W: 4m, H: 4.9m – Weight: 155 tonnes	4	Sywell Road
		240MVA 400/132kV – L: 10m, W: 3.8m, H: 4.7m – Weight: 183 tonnes	1	
Green Hill E	132kV	120/140MVA 132/33 kV – L: 7.6m, W: 2.7m, H: 4.5m – Weight: 95 tonnes	2	Highfield Road
Green Hill F	132kV	120/140MVA 132/33 kV – L: 7.6m, W: 2.7m, H: 4.5m – Weight: 95 tonnes	2	Easton Lane
Green Hill G	132kV	120/140MVA 132/33 kV – L: 7.6m, W: 2.7m, H: 4.5m – Weight: 95 tonnes	2	A428

Green Hill BESS	400kV	4 x 150MVA 400/33 kV – L: 8m, W: 4m, H: 4.9m – Weight: 155 tonnes	4	Station Road

4.4.107 30 tonne cable drums will be required to deliver the connection between the Sites to Grendon National Grid Substation. The drums will be delivered on a Cable Reel Trailer and this vehicle, together with its material is classified as an abnormal load. The vehicle is smaller than those required to deliver the transformers at around 26m in length. Multiple deliveries will be required across the Cable Route Corridor.

4.4.108 The abnormal load movements will be co-ordinated with the local highway authorities and police prior to being undertaken. However, they will be managed and take place during quieter periods on the local highway network. The effect on the local highway network will be temporary.

4.4.109 Traffic management will be required at various locations for all abnormal load movements destined for the Site. The exact nature of the traffic management will be agreed with the local highway authorities and police prior to the movement taking place.

Permissive Paths (Work No.10)

4.4.110 Several permissive paths are incorporated into the Scheme design, as shown as Work No.10 on the Work Plans **[~~EX1~~EX6/GH2.4_~~B~~G].** An overview of the proposed permissive paths is outlined below. The permissive paths will contribute to the wider network of Public Rights of Way in the area and facilitate greater public access to the Countryside. The design and implementation of the permissive paths is set out in the Landscape and Ecology Mitigation Plans **[EX6/GH6.4.4.10_D, EX6/GH6.4.4.11_C, APP-~~207 to~~209, REP3-046, APP-~~219~~211, EX6/GH6.4.4.14_C, EX6/GH6.4.4.15_C, APP-214, APP-215, REP3-052, REP1-113, REP3-054, EX6/GH6.4.4.20_B]** and OLEMP Revision ~~A [EX1~~E **[EX6/GH7.4_~~A~~E]** and secured by a Requirement in the draft DCO Revision ~~A [EX1~~E **[EX6/GH3.1_~~A~~E]**.

4.4.111 The OPRoWPPMP Revision ~~A [EX1~~C **[EX6/GH7.10_~~A~~C]** provides a framework for the management of PRoWs throughout the Order Limits. ES Figure 4.22 **[APP-221]** outlines the permissive paths proposed as part of the Scheme.

Green Hill A

4.4.112 Permissive path for pedestrians connecting Broughton Road and Newland Road.

4.4.113 Permissive path for pedestrian, cyclists and equestrian users, providing a loop through Green Hill A (fields AF17 to AF29), connecting to Newland Road near to its junction with Broughton Road, and to the green lane north of the Acorn Centre.

Green Hill A.2

4.4.114 Proposed permissive path for pedestrian, cyclists and equestrian users, providing a loop around the perimeter of Green Hill A.2, with access to Kettering Road, and to bridleway WN|CT|3.

Green Hill D

4.4.115 Proposed permissive path for pedestrians to align with an existing walked route across Green Hill D, parallel to footpath NN|TN|3, and connecting to the continued route of NN|TN|3 north of Green Hill D.

Green Hill E

4.4.116 Proposed permissive path for pedestrian, cyclists and equestrian users, to connect Mears Ashby at byway open to all traffic NN|TN|10 to Earls Barton (A4500). Throughout non-statutory consultation it became apparent this route is already used in part by local residents and would address the request for a route to connect the two villages.

4.4.117 Proposed permissive path for pedestrians, cyclists and equestrian users between the proposed permissive Mears Ashby-Earls Barton route, to Wilby Road via Field EF13, and a continued permissive footpath for pedestrians parallel to Wilby Road through Field EF9 and EF10. Providing these new permissive paths within the field margins east of Mears Ashby Road, would allow for safer access and would provide an alternative to walking along the road.

4.4.118 Proposed permissive path for pedestrians parallel to Mears Ashby/Earls Barton Road in Fields EF33 and ~~EF33~~EF34, connecting footpath NN|TN|1 to the termination point of footpath NN|TN|2 and to the junction of Mears Ashby Road and Washbrook Lane. Providing this new permissive footpath within the field margins would allow for safer access and would provide an alternative to walking along the road.

Green Hill F

4.4.119 Proposed permissive path for pedestrians within field FF6 to provide connection between the existing PRoWs, these being footpaths NN|TA|1 and NN|TA|4.

4.4.120 Proposed permissive path for pedestrians within field FF11 to provide connection between the existing PRoWs, these being footpaths NN|TD|2 and NN|TD|3.

4.4.121 Proposed permissive path for pedestrians connecting an existing PRoW – footpath NN|TD|2 at field FF8 to Easton Way (Easton Maudit) at field FF13, and continuing parallel to Easton Way within field FF15 to meet Yardley Road.

4.4.122 Proposed permissive path for pedestrian and equestrian users from Easton Lane at field FF25 at the entrance to the proposed onsite substation, along the eastern boundaries of fields FF26, FF27 and FF28 to the point existing PRoW, bridleway NN|TD|8, enters Horn Wood.

4.4.123 Proposed permissive path for pedestrians continue from both the north and south end of the proposed permissive route for pedestrians~~, cyclists~~ and horse riders. The northern path extends from the entrance to the proposed onsite substation to Easton Lane approximately 50 m west of its bridge over the A509. This provides an off-road alternative for users. The southern permissive footpath extends from existing PRoW, bridleway NN|TD|8 to the junction of existing PRoWs, footpaths NN|TD|5 and NN|TD|7.

4.4.124 Proposed permissive path for pedestrian users from the A509, the permissive path along the northern boundary of FF33 will connect footpath NN|TD|5 to bridleway NN|TD|8.

~~4.4.124~~4.4.125 A Definitive Map Modification Orders (DMMO) has been identified, the DMMO (ref: NOR-0183) proposes alter the status of the existing from a footpath

to a bridleway, this is relevant for Footpath LE9, TD7 and TD5. This is further detailed in the OPRoWPPMP Revision ~~A~~ **[~~EX1~~C [EX6/GH7.10_~~A~~C].**

~~4.4.125~~4.4.126 It is to be noted that a series of existing private hacking routes for horse riders will be kept open around the perimeter of FF26, FF27, FF28, FF32, FF31 and FF33 for existing users. The series of routes surrounding the six fields within Green Hill F have been incorporated into the Scheme in response to consultation with the neighbouring liveries, reflecting routes which are currently permitted for access and are currently utilised for hacking along hedgerow verges. A proposed 15m offset from existing hedgerows to proposed fence lines would allow for sufficient space for the private hacking routes to be maintained.

4.4.127 Permissive access through Field FF19 for the use of the International Waendel Walk Weekend event will be available during construction wherever practicable and safe to do so. The Site will be made secure during the event as outlined in the Outline Construction Environmental Management Plan **[EX6/GH7.1_C]**. This route is demarcated by the light purple dashed line on ES Figure 4.18: Landscape and Ecology Mitigation Plan F – Sheet 2 **[REP1-113]**.

4.4.128 Permissive access along the eastern boundary of Field FF19 has been retained for use during the International Waendel Walk Weekend only during the Scheme's operational lifetime.

Green Hill G

~~4.4.126~~4.4.129 Proposed permissive path for pedestrians connecting existing PRoWs, footpath Lavendon|~~FP1~~FP5 and bridleway Lavendon|BW2, running along the northern boundaries of fields GF1 and GF2.

~~4.4.127~~4.4.130 Proposed permissive path for pedestrians also connecting existing PRoWs, footpath Lavendon|~~FP1~~FP5 and bridleway Lavendon|BW2, between fields GF6 and GF9.

4.5 Construction Phase

Construction Programme

4.5.1 The Scheme currently has a grid connection date of 2029. It is anticipated that construction works will commence, at the earliest, in Q1 2027 and will run to 2029. The construction programme for the entire Scheme is anticipated to be 24 months with overlapping construction works on the different Scheme Sites. **Table 4.4** indicates the potential construction durations across the different parts of the Scheme, showing a series of overlapping stages.

4.5.2 Outside of the main construction period, there will be commissioning and connection to the National Grid. The timing of these works is dependent on National Grid.

4.5.3 The different elements of the construction works shown at **Table 4.4** mean that enabling works do not need to be complete in all areas of the construction site before solar farm construction commences in another part of the site.

4.5.4 During the construction phase, several temporary construction laydown areas will be required as well as temporary roadways to facilitate access to all land within the Order limits.

Table 4.4 Indicative Construction Programme

	Months																							
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25
Green Hill A																									
Green Hill A.2																									
Green Hill B																									
Green Hill C Solar																									
Green Hill C BESS																									
Green Hill D																									
Green Hill E																									
Green Hill F																									
Green Hill G																									
Green Hill BESS																									
Northern Cable Route Corridor Works																									
Southern Cable Route Corridor Works																									

Construction Activities

Site Preparation and Enabling/Civil Engineering Works – Solar Farm Sites (Work No.7)

4.5.5 The following activities will 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 will be localised and minor);
- Import of construction materials, plant and equipment to site;
- Establishment of the perimeter fence;
- Establishment of the construction laydown areas;
- Construction of the internal access roads; and
- Marking out the location of the Scheme infrastructure.

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

- Construction of site entrance and construction vehicle delivery holding area;
- Establishment of the main temporary construction laydown areas, which includes site offices/welfare area and parking area;
- Upgrade, modification or improvement of highways where required for site 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 construction area fence where required for construction works to progress (the installation of the perimeter fence will progress with site construction in each area and therefore will not be complete at the start of site construction);
- Establishment of the secondary temporary construction laydown areas within the Sites;
- Construction of the internal access roads; and
- Marking out the location of the operational infrastructure.

Installation of Solar PV Panels

4.5.7 The following activities will be required to install the PV Panels:

- Import of components to site;
- Piling and erection of module mounting structures;
- Mounting of modules, undertaken using hand-held power tools;

- Trenching and installation of electric cabling;
- Transformer, inverter and switchgear foundation excavation and construction;
- Installation of transformers, inverters and switchgears. Cranes will be used to lift equipment into position; and
- Installation of control systems, monitoring and communication.

4.5.8 The following activities will be required to construct the onsite electrical infrastructure comprising the cabling and Conversion Units:

- Site preparation and civils for the onsite substations and control building;
- Trenching and installation of electric cabling;
- Pouring of the concrete foundations and plinths for the electrical equipment;
- Import of components to site. Cranes will be used to lift the components into position; and
- Installation of the Conversion Units.

Construction of Electrical Cables

4.5.9 For cables between the Conversion Units and the substation within the Solar Farm Sites, the following methodology and works description applies:

- Underground cables, including high voltage (HV) power cables, will be laid to provide a link between the PV arrays, the transformer/inverter stations and the substations where the main switchgear panels are located. Where required, above ground, suspended cabling will be installed, particularly in areas of archaeological sensitivity.
- Generally, onsite cables will be laid underground in excavated trenches adjacent to onsite tracks where possible and between the rows of photovoltaic panels. They will be laid at a suitable depth and positioned at a distance far enough away from the PV 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 will be built over the top.
- Where at all possible, trenching will be carried out using a trapezoidal bucket to ensure stability during installation. Trenching and cable laying will be carried out progressively across the site and be phased to not interfere with other site operations such as piling, PV mounting structure assembly or PV panel installation.
- Care will 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, excessive contaminated run off and soil compaction.

Energy Storage Construction

4.5.10 The following activities will 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 drainage and diffuse pollution measures including, local bunding, permeable SuDS and provision of local fire water.

Fencing, Security and Lighting

4.5.11 The permanent deer fence and security system will be established during the solar farm installation. The fencing will be installed early on in the works where practicable to reduce the amount of temporary fencing needed. Where required, temporary fencing will be installed to secure work areas not naturally contained by existing hedgerows or fencing.

Cable Route Corridor Construction

4.5.12 The following activities would be required to construct the cable circuits:

- Site preparation and appropriate surveys;
- Excavation, undertaken using an appropriately sized tracked excavator and normally carried out in layers;
- Topsoil will be segregated and stored on site to be reused;
- The trench will be cleared and bottomed out, ensuring there are no hard protrusions;
- Sand bedding will be installed at the bottom of the trench; and
- Cable installation will follow behind excavation in the same sequence. However, it is not expected that cable installation will be continuous. Cables will be installed in groups or sections to ensure that works are completed in the most efficient manner possible.

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

4.5.14 The following activities would be required to construct the jointing bays:

- Excavation activities will be as listed above;
- Jointing bay locations will be re-measured to verify their position before excavation commences; and
- Jointing bay excavation will be coordinated with the cable pulling programme to ensure that jointing bays are not left open for longer than necessary.

4.5.15 For trenchless cabling / HDD methods of construction, the following activities would be required:

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

4.5.16 If field conditions are not suitable to track plant and equipment to the launch and reception pits, trackway or similar will be employed to facilitate access and egress. An area of up to 25m by 25m will be required at the launch pit and the reception pit. The area of hardstanding will be removed and the area reinstated following construction.

4.5.17 It is anticipated that water-based drilling and bentonite will be utilised. During drilling operations, the fluids pumped through the drill string will be closely monitored by checking volume of returns flowing back to the launch pit and visual checks across the drill line. If required, the pumping activities will be stopped until any issues are rectified.

Testing and Commissioning

4.5.18 Testing and commissioning of the Scheme would include the commissioning of the PV Modules, BESS, and associated infrastructure. Commissioning would involve mechanical and visual inspection, electrical and equipment testing, and commencement of electricity supply into the National Grid. This process would take place prior to the operational phase of the Scheme.

Construction Staff

4.5.19 Based on the Applicant's experience of other similar sized solar projects, it is currently estimated that the Scheme would generate an 455 full time equivalent (FTE) employees per annum, onsite per day during the construction phase, assuming the approximate two year construction timeline.

4.5.20 The size of the workforce is based on the activities required and would fluctuate during the period, therefore will be both higher and lower than average at times.

4.5.21 The peak construction workforce (in 2028, when construction activities are likely to include construction of the substations, cable route, and solar PV infrastructure) is estimated to be approximately 876 employees in the middle of the construction period. This may represent an overestimate of the maximum

number of jobs during peak construction and has been accounted for in Chapter 17 Socio-Economics, Tourism and Recreation **[APP-054]**.

Construction Hours of Working

4.5.22 Construction activities will be carried out Monday to Friday 07:00-18:00 and between 08:00-13:30 on Saturdays (not including start-up and shut-down works).

4.5.23 Start-up and shut-down activities on site will involve low-noise tasks, including security checks, unlocking and locking gates, and conducting toolbox talks. However, some activities may be required outside of these times (such as the delivery of abnormal loads, night time working for cable construction works in public highways or HDD activities).

4.5.24 Construction deliveries by HGV will arrive between 09:30-16:30. They will be coordinated to avoid construction vehicle movements during the traditional AM peak hour (08:00-09:00) and PM peak hour (17:00-18:00). In addition, construction worker shift patterns will be coordinated to avoid travel during the network peak hours of 08:00-09:00 and 17:00-18:00. These provisions are set out in the OCTMP Revision ~~A~~ **~~[EX1~~**C **[EX6/GH7.9_~~A~~C]** and Outline Construction Environment Management Plan (OCEMP) Revision ~~A~~ **~~[EX1~~**C **[EX6/GH7.1_~~A~~C]** and will be secured via a Requirement in the DCO.

Construction Traffic, Plant and Site Access

4.5.25 Construction accesses have been described above. Site entrances will include a security gate and kiosk to manage access and egress. The site entrance will allow HGVs to drive off the public road and park up before entering site without causing queueing on the public highway.

4.5.26 Site access and routing strategies have been discussed with the Highways Authorities as set out within the OCTMP Revision ~~A~~ **~~[EX1~~**C **[EX6/GH7.9_~~A~~C]**.

4.5.27 There are existing surfaced tracks within the Order limits currently utilised for farm machinery, which are proposed to be upgraded for use to minimise the use of the network of minor roads around the Order limits.

4.5.28 In order to access all of the construction sites, a network of tracks will be used, comprising:

- Construction and decommissioning access points will be a minimum of 5.0m in width for two-way movements up to a maximum of 6.5m in width where passing places are required;
- 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;
- Existing access tracks will be widened or resurfaced for temporary accesses; and
- Existing tracks will be used where already suitable.

4.5.29 The Transport Assessment **[APP-151** to **APP-153]** examines construction phase traffic. It is expected that there will be a relatively flat profile of deliveries

throughout the construction period. Notwithstanding this, a peak HGV activity has been identified through the indicative programme with the delivery of modules.

- Average HGV Deliveries per Day – 24 Movements.
- Peak HGV Daily Movements (two-way) – 141 Movements.

4.5.30 The Transport Assessment **[APP-151** to **APP-153]** also shows that there could be a peak of up to 787 construction worker arrivals by car and shuttle bus associated with the Scheme on a busy day. These are likely to arrive in the morning, with the same amount of the departures in the afternoon/evening. Shift patterns will be coordinated to avoid construction work travel during the traditional network peak hours of 08:00-09:00 and 17:00-18:00.

4.5.31 Temporary car parks will be provided for construction workers within the main construction laydown areas shown on the Work Plans **[~~EX1~~EX6/GH2.4_~~B~~G]** (Work No.7) and shown indicatively on the 'Temporary Construction and Decommissioning Laydown Area Illustrative Layout' drawing included at Appendix 4.1 to this Chapter **[APP-076]**.

4.5.32 As noted above, an OCTMP Revision ~~A [EX1~~C [EX6/GH7.9_~~A~~C**]** has been developed as part of the ES which will guide the delivery of materials and staff onto the Scheme during the construction phase.

Construction Laydown Areas

Main Construction Laydown Areas

4.5.33 Main construction laydown areas (sometimes referred to as 'construction compounds') will be located within each Site as indicated on the Works Plans (Work No.7) **[~~EX1~~EX6/GH2.4_~~B~~G]**. Construction laydown areas will also be established at locations along the Cable Route Corridor as shown as Work No.5 on the Works Plans **[~~EX1~~EX6/GH2.4_~~B~~G]**.

4.5.34 The Site laydown areas will consist of compounds of approximately 13000m^2 and will contain offices, mobile welfare units, canteens, storage and waste skips, parking areas and space for storage, download and turning area.

4.5.35 No long-term onsite storage of materials is anticipated during the construction phase. Materials will be delivered via HGVs at regular intervals to the construction compounds and transported directly to where it is required within the Order limits using smaller LGVs. Short term storage of materials and plant can be accommodated within the construction compound until it is required. Topsoil, spoil and other construction materials will be stored outside of the 1 in 100-year floodplain extent and only moved to the temporary works area immediately prior to use.

Secondary Laydown Areas (Work No.8)

4.5.36 A network of access tracks will be progressively built across the Sites to allow access to all internal areas from the site entrance. The main temporary construction laydown areas will be established close to the site entrance to allow control of deliveries, parking and material storage.

4.5.37 There will be secondary temporary laydown areas progressively established across the Sites in each working area. These will be located across the Sites and the purpose of each one will be to service the local works. This includes but 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.

4.5.38 The secondary laydown areas will typically be set up ahead of the installation of the PV Arrays, electrical components and cabling and will be decommissioned as the relevant works in their locality progress and become completed.

Surface Water Drainage During Construction

4.5.39 The OCEMP Revision ~~A [EX1~~C [EX6/GH7.1_~~A~~C] describes water management measures to control surface water run-off and drain hardstanding and other structures during the construction, operation and decommissioning of the Scheme. This will form part of a Pollution Prevention Plan (PPP) to be implemented for the Scheme.

Water

4.5.40 An estimated 19 million litres total of water would be required during construction to support welfare facilities onsite and other uses. Water will be transported to the Site by road from an existing nearby licensed water abstraction source and stored on site. Where mains water is available this would also be utilised.

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

Soil and Spoil Management

4.5.42 There will be no site wide reprofiling required, however there may be a need to flatten areas within the Order limits. Topsoil, subsoil and spoil material is only expected to be generated from cable trenches, temporary and permanent compounds, internal roads, BESS and substation compounds, and supporting infrastructure.

4.5.43 During construction the topsoil, subsoil and spoil will be stored temporarily within designated areas adjacent to the cable route and within the construction laydown areas. The topsoil, subsoil and spoil will be utilised to backfill and reinstate the soil profile in the cable trenches, reinstate the soil profile on the temporary laydown areas and any temporary access roads. Any excess topsoil, subsoil and spoil will be utilised across the Order limits. Utilisation of the material in the reinstatement should be in accordance with the requirements of the Outline Soil Management Plan **[APP-550]**. It is not anticipated that any material would be removed from the Order limits.

Construction Lighting

4.5.44 Construction temporary site lighting, in the form of mobile lighting towers with a power output of 8 kilo volt-amperes (kVAs), will be required in areas where natural lighting is unable to reach (such as sheltered/confined areas) and during core working hours within winter months. Artificial lighting will be provided to maintain

sufficient security and health and safety for the Order limits, whilst adopting the mitigation principles to avoid excessive glare and minimise spill of light to nearby receptors (including human and ecological) outside of the Order limits as far as reasonably practicable. 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.

4.5.45 Measures to control lighting are set out in the OCEMP Revision ~~A [EX1~~C **[EX6/GH7.1_~~A~~C]**.

Waste

4.5.46 Chapter 24 Other Environmental Matters Revision A **[~~EX1/GH6.2.24_A~~REP1-027]** considers waste. The chapter considers waste arising during construction including paint, solvents, chemical cans and containers, vegetation, pallet wood, mounting structure packing and other packaging, pallet nails, mixed wood, plastic, metal and cable drums.

4.5.47 Solid waste materials generated during construction will be segregated and stored onsite in containers prior to transport to approved, licensed third-party landfill and recycling facilities. The removal of waste from the Sites is likely to generate additional traffic movements on the local highway network. These impacts are assessed to be of a low magnitude during the construction and decommissioning stages, given the geographic spread of the Scheme.

Fuel

4.5.48 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 4.4). The fuel storage tanks would be sheltered, 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 Site 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.

Construction Environmental Management Plan

4.5.49 As noted above, an OCEMP Revision ~~A [EX1~~C **[EX6/GH7.1_~~A~~C]** has been prepared. This aims to provide a clear and consistent approach to the control of construction activities in the Order limits. A range of 'standard' or best practice

mitigation and construction management measures are accounted for in the ES and OCEMP.

4.5.50 The OCEMP Revision ~~A [EX1~~C [EX6/GH7.1_~~A~~C] details the construction mitigation measures and sets out the monitoring and auditing activities designed to ensure that such mitigation measures are carried out, and that they are effective. The OCEMP details measures to control construction impacts, including impacts relating to:

- Climate change;
- Cultural heritage;
- Ecology;
- Water Environment;
- Landscape and Visual Amenity;
- Noise and vibration;
- Socio-economics and Amenity;
- Transport and Access;
- Air quality;
- Ground conditions and contamination;
- Major accidents and disasters;
- Telecommunications, Television Reception and Utilities; and
- Waste.

4.5.51 The detailed Construction Environmental Management Plan (CEMP) will be produced by the appointed construction contractor following granting of consent and prior to the start of construction. It will be submitted to the relevant planning authority for approval (as part of a Requirement under the DCO [~~EX1~~EX6/GH3.1_~~A~~E]). The CEMP will identify the procedures to be adhered to and managed by the Principal Contractor throughout construction. It may be that more than one CEMP is produced, as individual CEMPs may be produced and approved for different parts of the Scheme.

4.5.52 Contracts with companies involved in the construction works will incorporate environmental control, health and safety regulations, and current guidance and will ensure that construction activities are sustainable and that all contractors involved with the construction stages are committed to agreed best practice and meet all relevant environmental legislation including: Control of Pollution Act 1974 (COPA), Environment Act 1995, Hazardous Waste (England and Wales) Regulations 2005 (as amended) and the Waste (England and Wales) Regulations 2011.

4.5.53 Records will be kept and updated regularly, ensuring that all waste transferred or disposed of has been correctly processed with evidence of signed Waste Transfer Notes (WTNs) that will be kept onsite for inspection. Furthermore, all

construction works will adhere to the Construction (Design and Management) Regulations 2015 (CDM).

Site Reinstatement and Commissioning

4.5.54 Following construction, a programme of site reinstatement will commence. Embedded mitigation measures for the construction phase are set out in the OCEMP Revision ~~A~~ **[~~EX1~~C [EX6/GH7.1_~~A~~C]** 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 best practice measures.

4.5.55 An OLEMP Revision ~~A~~ **[~~EX1~~E [EX6/GH7.4_~~A~~E]** has been prepared and supports the DCO Application. This document sets out the principles for how the land will be managed throughout the operational phase, following the completion of construction. A detailed Landscape and Ecological Management Plan will be produced following the granting of consent and prior to the start of construction (this is secured by a Requirement in the draft DCO) **[~~EX1~~EX6/GH3.1_~~A~~E]**.

4.5.56 Testing and Commissioning of the Scheme will include testing and commissioning of the process equipment. Commissioning of the Solar PV infrastructure will involve mechanical and visual inspection, electrical and equipment testing, and commencement of electricity supply into the grid. Individual sub-systems will 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.

4.6 Operational Phase

4.6.1 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.

4.6.2 An Outline Operational Environmental Management Plan (OOEMP) Revision ~~A~~ **[~~EX1~~C [EX6/GH7.2_~~A~~C]** and OOTMP Revision A **[~~EX1/GH7.25_A~~REP1-157]** have been produced to demonstrate how any mitigation and management measures will be implemented. They also set out the monitoring and auditing activities designed to ensure that such mitigation measures are carried out, and that they are effective. In addition, landscaping will be managed in accordance with the OLEMP Revision ~~A~~ **[~~EX1~~E [EX6/GH7.4_~~A~~E]**. Operational safety risks will be managed in accordance with the OBSSMP Revision ~~A~~ **[~~EX1/GH7.7_A~~B [REP5-075]**. These plans will be secured by a Requirement attached to the DCO **[~~EX1~~EX6/GH3.1_~~A~~E]**.

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

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

General Operational Maintenance

4.6.4 During the operational phase, other than in the context of a programme of replacement activities, onsite activity within the Scheme will be restricted to general maintenance activities, monitoring and inspections, repair or ad hoc replacement and renewal of equipment, and vegetation management along accesses, permissive paths and landscape ecological mitigation.

4.6.5 No onsite staff will be required to operate the Scheme but there will be limited staff facilities located in the control rooms associated with the substations. Some permanent equipment for monitoring the Scheme will be located on Site within the control rooms within the substations. Whilst this would typically be accessed remotely, it would be available for occasional physical access during routine maintenance visits.

4.6.6 General maintenance and servicing activities will include the cleaning of Solar PV Panels and equipment, the removal, reconstruction, refurbishment or replacement of faulty or broken equipment.

4.6.7 Transformers are assumed to have a design life of 30 years, transformers may require replacement once during the lifetime of the Scheme although, replacement will only be carried out if required for performance or health and safety reasons.

4.6.8 Along the Cable Route Corridor, the maintenance activities will consist of routine inspections and any reactive repair work should any cables be damaged.

4.6.9 The OOEMP Revision ~~A [EX1~~C [EX6/GH7.2_~~A~~C] sets out the environmental management and monitoring actions to prevent pollution and avoid, minimize and reduce adverse environmental effects.

4.6.10 The general maintenance and replacement of equipment is considered within the assessment scenarios and presented in this ES.

4.6.11 It is anticipated that the Scheme will create in the region of 15 Full Time Equivalent staff jobs per annum. It is expected that these staff will not be permanently based on Site but will visit as and when required during the operational phase. This will lead to a very small number of daily vehicle trips, with additional staff attending when required for maintenance and cleaning activities.

Traffic and Access

4.6.12 Following construction, outside of a programme of replacement activities, traffic associated with any Site that forms part of the Scheme will be associated with ongoing maintenance. This is expected to be infrequent and result in limited vehicle movements. Those arriving to undertake maintenance would generally be expected to travel by car, appropriate 4x4 type vehicle or light van. Suitable access will be retained from the public highway to enable ongoing maintenance to take place.

4.6.13 The frequency of more regular maintenance visits would reasonably be expected to be limited to no more than two visits per month to any of the Sites.

4.6.14 Limited use of HGVs may be required for the ad-hoc replacement of batteries, inverters and transformers associated with the substations and the BESS.

Programme of Replacement Activities

4.6.15 Across the 60-year lifetime of the Scheme, it is expected that alongside the regular maintenance of equipment, infrastructure such as panels and batteries will require replacement. As Scheme components approach the end of their design life, an evaluation will be conducted to determine if they require maintenance or replacement across the Scheme.

4.6.16 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 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.

4.6.17 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.

4.6.18 The following assumptions have been made regarding the equipment replacements needed at the Scheme:

- Solar PV Panels typically have a lifespan of up to 40 years or more, and it has been assumed that Solar PV Panels will be replaced once during the lifetime of the Scheme. The Solar PV Panels are anticipated to be replaced over a 24 month period.
- The BESS and inverters could be replaced up to five times during the operational phase.
- No intrusive ground works will be required to replace Solar PV Panels or BESS.

4.6.19 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.

4.6.20 Operational replacement activities are assessed in the ES (Chapters 7 to 24 **[APP-044** to **APP-061]**). 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 topic, the reasonable worst case programme has been assumed for the purposes of the assessment of that topic.

4.6.21 It is anticipated that the Scheme will create an operational peak of 182 Full Time Equivalent employees, with a peak month requiring up to 412 gross onsite employees, employment associated with the Scheme is further detailed in Chapter 17: Socio-Economics Tourism and Recreation **[APP-054]**.

4.6.22 Any mitigation measures associated with the programme of replacement activities will be outlined within the OOEMP Revision ~~A [EX1~~C [EX6/GH7.2_~~A~~C].

Traffic and Access

4.6.23 The replacement of equipment within the Sites will essentially require the delivery of new modules and, separately, the removal of old modules for recycling. Battery equipment will also need to be removed, and new equipment installed.

4.6.24 Chapter 13: Transport and Access **[APP-050]** identifies that both HGV and worker daily vehicle movements are forecast to be lower during the replacement phase than during the construction phase. HGV movements associated with the BESS sites are forecast to be higher by one HGV trip for Green Hill C and BESS. However, a single HGV trip is not considered to be significant.

4.6.25 An OCTMP Revision ~~A [EX1~~C [EX6/GH7.9_~~A~~C] has been prepared those details operational access and measures to control potential transport impacts during any programme of replacement activities.

Operational Lighting

4.6.26 Lighting is generally not required within the Sites during the operation and maintenance phase of the Scheme. All routine maintenance activities would be scheduled to be carried out during daylight hours as far as is practicable. It is anticipated that night time working should only be necessary in the event of emergency works/equipment failure.

4.6.27 Motion sensing security lighting would be provided within the substations and BESS to ensure safe working conditions during winter months as well as enhance security and facilitate maintenance activities. Light spill from internal lighting is anticipated to be minimal.

4.6.28 It is anticipated that temporary lighting may be required across the Sites for replacement activities during the operational phase, which will not be a permanent fixture. Lighting will be minimised to that required for safe operations and standard good practice measures will be employed to minimise light spill, measures will reflect those proposed for the construction phase which will be further detailed within the OOEMP Revision ~~A [EX1~~C [EX6/GH7.2_~~A~~C].

4.6.29 The lighting strategy for the operation and maintenance phase will be set out in the OOEMP Revision ~~A [EX1~~C [EX6/GH7.2_~~A~~C] which will include details on lighting design and will be provided as part of the DCO Application.

Operational Waste

4.6.30 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.

4.6.31 Additionally, any waste components (e.g. faulty or damaged Solar 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.

4.6.32 Section 4.6 summarises the anticipated design life and replacement frequency for the main elements of the Scheme (Solar PV Panels, BESS), based on other similar solar schemes. The waste generated as part of the programme of replacement activities, as well as further discussion of the environmental impacts of waste generated by the Scheme, is set out in Chapter 24: Other Environmental Matters Revision A **[~~EX1/GH6.2.24_A~~REP1-027]**.

4.6.33 The operation of the Scheme will be subject to measures and procedures defined within an OEMP secured by a Requirement in the DCO. The OEMP will include the implementation of industry standard practice and control measures for material and waste management onsite. These measures will be set out in the OOEMP Revision ~~A [EX1~~C [EX6/GH7.2_~~A~~C]. submitted with the DCO Application and secured by a Requirement in the draft DCO **[~~EX1~~EX6/GH3.1_~~A~~E]**.

Operational Water

4.6.34 During operation and maintenance, 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).

4.6.35 Due to the nature of the Scheme, there is no requirement for a permanent water supply during operation. However, water will be temporarily required for periodic panel washing. It is anticipated that the water supply for operational staff facilities would be transported to the Sites by road from an existing nearby licenced water abstraction source and stored on site. For the purposes of the EIA, a precautionary approach has been taken and it is estimated 7.05 million litres per annum of water will be used for cleaning of Solar PV Panels and drinking supply.

4.6.36 Welfare facilities will be required at the substations. It is not proposed to have a permanent discharge to sewer. Any wastewater will be removed via tanker to local licenced wastewater treatment works.

4.6.37 The volume of stored fire water (as described in Paragraph 4.4.38) will be maintained to ensure there is sufficient water for firefighting purposes. More details on fire water supply and storage are provided within the OBSSMP Revision ~~A [EX1/GH7.7_A~~B **[REP5-075]**.

Cleaning of Panels

4.6.38 Due to the wet UK climate, Solar PV modules 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 modules 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.

4.6.39 The requirement for cleaning due to loss of output is balanced against the cost of the cleaning operation. Some sites can operate without the need to be cleaned, whereas some sites require cleaning every year. The cleaning requirements for the Scheme can only be accurately determined once operational and, therefore, to present a worst case for the assessment, an annual cleaning cycle is assumed.

4.6.40 The Solar PV Panels would be cleaned using water only. De-ionized water would be used as preference. No chemical cleaning products would be used, with stubborn dirt brushed or wiped off the panels.

Grazing

4.6.41 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 Array Sites during the operation and maintenance phase.

4.6.42 However, should consent be granted, grazing sheep will be explored, noting that there are no known landowner restrictive covenants or other reasons that would prevent such use. It is noted that there is already a small herd of sheep across Green Hill A. Details in regard to grazing is further discussed in the OLEMP Revision ~~A [EX1~~E [EX6/GH7.4_~~A~~E].

4.6.43 The Applicant will look to engage with local shepherd in order to progress discussions on the availability of sheep.

4.6.44 In 2023, the East Midlands had a significant sheep population, with 8.2% of England's sheep located in this region. The predominant farm types were grazing livestock, which accounted for 34% of the region's holdings (Ref 4.5).

4.6.45 The solar panel installation will allow a sheep herd to be developed, which means agricultural output from the land can continue, and the land being moved into being planted with grass for sheep grass, and away from arable cropping will improve the soil resilience over time. The use of sheep grazing and impacts on soils are further discussed in the Farming Report **[APP-571]**.

4.7 Decommissioning Phase

4.7.1 It has been assumed for the purposes of the EIA that the Scheme will cease generating in 2089 after 60 years of operation, and decommissioning phase activities will be completed by 2091. Decommissioning is expected to take between 12 and 24 months. A 24-month decommissioning period has been assumed for the purposes of a worst-case assessment in this ES, unless specifically stated otherwise. A requirement to decommission the Scheme is secured via a Requirement in the draft DCO **[~~EX1~~EX6/GH3.1_~~A~~E]**.

4.7.2 The Solar Array Works Area and related components, substations, BESS and all associated works (with the exception of the cable ducts) will be removed and recycled or disposed of in accordance with good practice and market conditions at that time.

4.7.3 The underground cable, cable ducts and joint bays will be decommissioned in accordance with the applicable guidance and regulations at the time. Currently,

the most environmentally acceptable option is considered to be 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 interval 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. The decommissioning of the Scheme will be addressed within the Outline Decommissioning Statement (ODS) Revision ~~A~~ **~~[EX1~~**C **[EX6/GH7.3_~~A~~C]**.

4.7.4 The effects of decommissioning are similar to, or of a lesser magnitude than, construction effects and are considered in the Chapters 7 to 24 of this ES. The assessment within the relevant topic chapters of this ES has been based on the worst-case parameters for each technical topic and justification is presented within the relevant chapter. However, there is a high degree of uncertainty regarding decommissioning as engineering approaches and technologies are likely to change over the operational life of the Scheme.

Removal of Waste

4.7.5 The number of vehicles associated with the decommissioning phase is not anticipated to exceed the number set out for the construction phase.

4.7.6 The infrastructure, such as PV panels and battery storage units, will be recycled as far as practical and in accordance with legislation and guidance applicable at the time, or if more suitable at the time, sold for refurbishment and reuse. A Decommissioning Resource Management Plan (DRMP) will be put in place and is included in the ODS Revision ~~A~~ **~~[EX1~~**C **[EX6/GH7.3_~~A~~C]** secured by a Requirement in the draft DCO **[~~EX1~~EX6/GH3.1_~~A~~E]** to manage the disposal of waste from the Order limits, but the approach to and content of this will be driven by the relevant legislative and policy requirements at the time of decommissioning.

Land Reinstatement

4.7.7 Upon decommissioning, the above-ground physical infrastructure at the Sites will be removed and each Site restored to its current use and returned to the landowner. This will include the areas of agricultural land where the agricultural resource has been maintained (and potentially improved) during operation, and the established habitats. Post-decommissioning, the landowners would choose how the land is to be used and managed, the landowner may return the land to arable 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.

4.7.8 The 33kV, 132kV and 400kV cables may be left in situ, depending on the least environmentally damaging approach at the time. If these are removed this would be achieved by pulling the cables out of the ducts, limiting the locations where the surface would need to be disturbed. This same principle will apply to the low voltage cabling throughout the Order limits. Any cabling removed will be taken to an appropriate facility for recycling.

4.7.9 Foundations and other below ground infrastructure will be cut to 1.2m below the surface to enable future ploughing. Any piles would be removed.

4.7.10 Permissive paths would be removed during decommissioning, with the precise timing to be determined by the contractor(s) and communicated to the relevant local authority in accordance with the Decommissioning Plan approved under a Requirement in the draft DCO **[~~EX1~~EX6/GH3.1_~~A~~E]**.

4.7.11 Some soil profiling may be required, and the land will be contoured in agreement with the landowner and in accordance with the Decommissioning Plan approved under a Requirement in the draft DCO **[~~EX1~~EX6/GH3.1_~~A~~E]**, 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 Decommissioning Plan approved under a Requirement in the draft DCO **[~~EX1~~EX6/GH3.1_~~A~~E]**. If necessary, the soil will be tilled to mitigate for any compaction. Areas where grass does not exist because of the footprint of the previous infrastructure (e.g. the BESS and onsite substations) shall be reseeded with suitable native species, in liaison with the landowner and in accordance with the Decommissioning Plan approved under a Requirement in the draft DCO **[~~EX1~~EX6/GH3.1_~~A~~E]**, in order to integrate the newly restored soil into agricultural use.

4.7.12 A detailed Decommissioning Plan, to include timescales and transportation methods, and to be substantially in accordance with the ODS **[~~EX1~~EX6/GH7.3_~~A~~C]**, is secured by a Requirement in the draft DCO **[~~EX1~~EX6/GH3.1_~~A~~E]** and must be approved by the relevant planning authority.

References

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