



Spiorad na Mara Offshore Wind Farm

Offshore Project

Environmental Impact Assessment Report

Chapter 3: Project Description, Volume 1a

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Contents

3	Project Description	3-1
3.1	Introduction.....	3-1
3.2	Project Overview	3-2
3.3	Design Envelope Overview	3-3
3.4	Embedded Mitigation	3-7
3.5	Offshore Infrastructure and installation.....	3-8
3.6	Onshore Transmission Works Project.....	3-39
3.7	Construction Programme and Sequencing.....	3-41
3.8	Operation and Maintenance	3-45
3.9	Decommissioning	3-51
3.10	Glossary of terms and abbreviations.....	3-55
3.11	References	3-60

List of Tables

Table 3-1:	Maximum Design parameters for Offshore Project Boundary.....	3-9
Table 3-2:	Maximum Design Parameters for Boulder Clearance	3-13
Table 3-3:	Maximum Design Parameters for Wind Turbine Generator Multi-Leg Jacket Foundations with Pin Piles.....	3-16
Table 3-4:	Maximum Design Parameters for Offshore Substation Platform Multi-Leg Jacket Foundation with Pin Piles.....	3-16
Table 3-5:	Maximum Design Parameters for Drill & Grout Wind Turbine Generator Pin Piles Installation.....	3-17
Table 3-6:	Maximum Design Parameters for Drill & Grout Offshore Substation Platform Pin Piles Installation.....	3-17
Table 3-7:	Maximum Design Parameters for Percussive Pile Installation	3-18
Table 3-8:	Maximum Design Parameters for Wind Turbine Generator Multi-Leg Jacket Foundations with Hybrid Gravity Base	3-19
Table 3-9:	Maximum Design Parameters for OSP Multi-Leg Jacket Foundations with Hybrid Gravity Base.....	3-20
Table 3-10:	WTG and OSP Foundations Scour Protection Parameters	3-21
Table 3-11:	Maximum Design Parameters for Wind Turbine Generators	3-23

Table 3-12: Maximum Design Parameters for WTG Oil and Fluid Consumption.....	3-23
Table 3-13: Jack-up Vessel Parameters.....	3-26
Table 3-14: Maximum Parameters for Offshore Substation	3-28
Table 3-15: Offshore Cable Parameters.....	3-30
Table 3-16: Offshore Cable Installation and External Cable Protection Parameters.....	3-33
Table 3-17: Offshore Cable Landfall Parameters and Assumptions.....	3-35
Table 3-18: Maximum Parameters for Vessel and Helicopter Movements during Construction Phase	3-38
Table 3-19: Indicative Construction Programme.....	3-43
Table 3-20: Project Design Envelope for Operation and Maintenance Activities	3-47
Table 3-21: Project Design Envelope for Vessel Activities Operation and Maintenance (O&M).....	3-51
Table 3-22: Likely Decommissioning Process	3-53
Table 3-23: Acronyms and abbreviations.....	3-55
Table 3-24: Glossary	3-56

List of Plates

Plate 3-1: Key components of the Project.....	3-7
Plate 3-2: Schematic of Wind Turbine Generator foundation types that may be deployed in the Turbine Area	3-15
Plate 3-3: Schematic of typical WTGs	3-22
Plate 3-4: Typical Wind Turbine Installation Vessel or Jack-up Vessel.....	3-25
Plate 3-5: Multicat Utility Vessel.....	3-25
Plate 3-6: Crew Transfer Vessel.....	3-26
Plate 3-7: Offshore Substation Installation with Jack-up Vessel	3-27
Plate 3-8: Indicative Landfall Profile.....	3-34

3 PROJECT DESCRIPTION

3.1 INTRODUCTION

- 3.1.1.1 Spiorad na Mara Limited (hereafter referred to as 'the Applicant') is developing the Spiorad na Mara Offshore Wind Farm (hereafter referred to as 'the Offshore Project') located to the northwest of the Isle of Lewis/*Eilean Leòdhais* in Scotland/*Alba*. The Project comprises both offshore and onshore components.
- 3.1.1.2 This Environmental Impact Assessment Report (EIAR) considers the Offshore Project which includes all infrastructure seaward of Mean High Water Springs (MHWS). This chapter provides a description of the components of the Offshore Project and their development, alongside the key activities that will be undertaken during Construction, Operation and Maintenance (O&M) and Decommissioning. Details of the consents and licences being sought by the Applicant are included in **Chapter 1: Introduction, Volume 1a**.
- 3.1.1.3 The Onshore Transmission Works (OTW) Project is subject to a separate EIAR however, to ensure the OTW and the Offshore Project are considered holistically and not in isolation, an overview of the OTW components is included in this chapter in Section 3.6. The design of the OTW Project is not as developed as that of the Offshore Project therefore a high-level description of key onshore components is provided. The information provided here forms the basis for the assessment of the effects resulting from both the development of the Offshore Project and the OTW Project. Details of the approach to this assessment are provided in **Chapter 5: Approach to EIA, Volume 1a** and the assessments themselves are contained within **Chapter 6: Socio-Economics, Volume 2a** to **Chapter 22: Offshore Human Health, Volume 2a** where there is potential for effects to arise.
- 3.1.1.4 An overview of each Section of this chapter is provided below:
- Section 3.2 provides an overview of the Project, providing a summary of the Project and approach to consenting;
 - Section 3.3 presents an overview of the Project Design Envelope (PDE) approach and key optionality retained in the envelope;
 - Section 3.4 introduces mitigation measures embedded into the PDE;
 - Section 3.5 outlines the design and installation parameters for the Offshore Project in detail for the key elements, including foundations, Wind Turbine Generators (WTGs), Offshore Substation Platform (OSP), offshore cable scenarios and landfall below MHWS. This section also provides details on installation vessels and helicopters and safety zones;
 - Section 3.6 provides details of the onshore transmission works (the Onshore Project) as far as they are known at this time in order to inform assessments;

- Section 3.7 describes the proposed construction programme and sequencing of activities required to deliver the Offshore Project;
- Section 3.8 provides a description of the key activities that will be undertaken during the O&M, and decommissioning phases respectively, and include key assessment parameters and indicative timescales relevant to the Environmental Impact Assessment (EIA);
- Section 3.9 defines the Applicant's approach to the consideration of repowering the Project at the end of its anticipated operational lifespan;
- Section 3.10 provides a glossary of terms and abbreviations used in this chapter;
- Section 3.11 provides information sources and documentation referred to in this chapter.

3.2 PROJECT OVERVIEW

- 3.2.1.1 The key components of the Project are illustrated in **Plate 3-1**. The Offshore Project consists of the infrastructure located within the Offshore Project Boundary (this includes the Array Area, Offshore Cable Area of Search (OCAS) and offshore elements of the Landfall below MHWS).
- 3.2.1.2 The OTW Project consists of onshore infrastructure located within the Onshore Transmission Works Boundary (OTWB) (this includes the onshore elements of the Landfall Area above MLWS, Landfall Substation, Grid Substation and the Onshore Cable Corridor). The OTWB runs broadly south from the Landfall to the Grid Connection approximately 3 km southwest of Stornoway/*Steòrnabhagh*, see **Figure 3.1a: Project layout - Overview, Volume 1b**.
- 3.2.1.3 Landfall is the interface between the Offshore Project and the OTW Project, where the Offshore Cables (either Array Cable to Landfall or Export Cable) come ashore at a coastal cliff at *Barvas/Barabhas* via Horizontal Directional Drilling (HDD) (see **Figure 3.1c: Landfall, Volume 1b**).
- 3.2.1.4 The Applicant has retained optionality around WTGs, foundations and electrical transmission resulting in a range of options and scenarios, meaning that not all components would be constructed in every scenario (see Section 3.3.2 for further details). The components included in the Offshore Project and OTW Project are outlined below.
- 3.2.1.5 The infrastructure included in the s.36 and/or Marine Licence applications for the Offshore Project is:
- WTGs;
 - Fixed Bottom Foundations and associated protection;
 - OSP and associated foundation and protection;
 - Either Array Cables and Array Cables to Landfall, or Array Cables and Export Cables, with associated cable protection (see Section 3.5);
 - HDD Exit Pits below MHWS (located in the Exit Pit Area);
 - Other associated infrastructure such as navigation markers.

3.2.1.6 Infrastructure included in the planning application for the OTW Project will include the following components:

- HDD Entry Pits and Transition Joint Bays (TJBs) (underground concrete chambers);
- Onshore Cables with jointing bays and link boxes;
- A haul road to enable construction of the Onshore Cables. This road will be either removed and the land re-instated or transformed into a multi-use pathway post construction of the Onshore Cables;
- A Landfall Substation and associated permanent access;
- A Grid Substation (and associated permanent access) connecting to the grid connection point at the planned new Scottish and Southern Electricity Networks (SSEN) Lewis Hub converter station via underground cables;
- Temporary construction compounds (TCCs).

3.3 DESIGN ENVELOPE OVERVIEW

3.3.1 PROJECT DESIGN ENVELOPE

3.3.1.1 The PDE follows the principles of the Rochdale Envelope approach, which allows for the definition of appropriate design parameters to inform assessment where details of a proposal have not yet been confirmed, such as the tip height or rotor diameter of a WTG. The Rochdale Envelope approach is discussed further in **Chapter 5, Volume 1a**. Following this approach, the PDE maintains flexibility for the Offshore Project to accommodate:

- Further refinement during detailed design;
- Opportunities afforded by technological advancements;
- Uncertainties in the development process.

3.3.1.2 The Applicant has defined a range of design parameters relating to the location, design and size of the Offshore Project, taking into account the guidance provided by the Scottish Government (Scottish Government, 2022a). This provides the basis for the Maximum Design Scenario (MDS) presented within the technical chapters of this EIAR (**Chapter 6, Volume 2a to Chapter 22, Volumes 2a**). The MDS defines the relevant minimum or maximum extent of a parameter within the Rochdale Envelope, for technical assessments to assess the most impactful case for a given impact-receptor pathway. A summary table for the parameters is also provided in **Appendix 3.2: Offshore Project Parameters, Volume 1c**.

3.3.1.3 The approach to assessment including the use of a PDE and MDSs are included in **Chapter 5, Volume 1a**. Each technical assessment presented within **Chapter 6, Volume 2a to Chapter 22, Volumes 2a** defines and justifies the MDS appropriate for that assessment. For example, in the case of **Chapter 14: Marine and Nearshore Ornithology, Volume 2a**, the MDS for collision risk is

based on the maximum number of the smallest turbines as this creates the greatest risk of collision. Conversely, in the case of **Chapter 18: Seascape, Landscape and Visual Impact Assessment, Volume 2a**, the maximum number of the larger turbines would represent the MDS because the scale and extent across the Zone of Theoretical Visibility (ZTV) of the maximum number of larger turbines would be likely to give rise to greater effects than a greater number of smaller turbines given that they occupy the same geographical extent.

- 3.3.1.4 Where the MDS is used to identify and assess impacts on a given receptor, it can be assumed that any other design parameter in the PDE, will result in environmental effects that are less than or equal to those assessed.
- 3.3.1.5 As the PDE forms the basis for the MDS to be defined, it is used to determine the extent to which the Offshore Project could result in impacts on the environment. Therefore, the final design of the Offshore Project will be required to fall within this envelope. This will be controlled through appropriate conditions that will be attached to the s.36 Consent and Marine Licences for the Offshore Project.
- 3.3.1.6 The PDE has been developed based on the industry knowledge and experience of the Applicant and its advisers along with site specific survey information relating to the ground and environmental conditions of the Array Area. It has been informed by multidisciplinary teams to develop the Offshore Project design iteratively, to appropriately consider the sensitive environmental and social nature of its setting.

3.3.2 KEY DESIGN OPTIONALITY RETAINED AT THIS STAGE

- 3.3.2.1 At this stage of the design evolution, optionality has been retained in respect of WTGs, foundations, and the energy transmission infrastructure.

Wind Turbine Generator Optionality

- 3.3.2.2 The Offshore Project considers a design envelope derived from a smallest and largest turbine type. The offshore wind industry continues to evolve in an effort to improve safety, efficiency and to reduce costs. Offshore wind projects are subject to many external factors that can influence the pace at which projects are deployed. The Applicant requires flexibility in respect of WTG choice to ensure that they are not precluded from taking advantage of new, safer or more cost-effective technology. To reflect this, the PDE presents 2 bounding scenarios that provide key maximum design parameters for assessment. Intermediate configurations (such as 52 WTGs with a blade tip height between 293.8 m and 338.4 m where the total rotor swept area falls within the defined swept area parameter) may also be deployed, on the basis that they fall within these bounding scenarios.
- 3.3.2.3 The WTG parameters are described in further detail in Section 3.5.4 and shown in **Plate 3-3**, in summary these include:

- Up to 44 of the largest offshore WTG type, with a maximum blade tip height of 338.4 m above mean sea level (MSL), with a minimum 30 m blade clearance above MSL, and associated foundations;
- Up to 60 of the smallest WTG type, with a maximum blade tip height of 293.8 m above MSL, with a minimum 30 m blade clearance above MSL, and associated foundations.

Foundation types

- 3.3.2.4 As with WTG technology, foundation design continues to evolve and the selection of a final foundation type and design is strongly influenced by ground conditions. The Applicant requires flexibility to select the most suitable foundation technology at the time of construction. This decision will be informed by further post-consent studies and supply chain engagement.
- 3.3.2.5 A range of foundation types and combinations of installation methods have been retained within the design envelope. The following foundation types remain within the envelope:
- Multi leg jacket with pin piles installed by:
 - Drilling and grouting; or
 - Percussive or vibratory driving;
 - Hybrid multi leg jacket with gravity base.
- 3.3.2.6 The foundation options are described in further detail in Section 3.5.5 and represent the basis for the MDS. For example, jackets with up to 4 legs are included meaning that jackets with 3 legs could be deployed.

Energy Transmission Infrastructure Optionality

- 3.3.2.7 The electrical design of the wind farm transmission system requires 2 High Voltage Alternating Current (HVAC) substations; one on the west side and one on the east side of Lewis/*Eilean Leòdhais*. These substations are required to transform and maintain the voltage of the electricity from the WTGs so that it is suitable for onward transmission and fulfil a critical role in the safe transmission of electricity.
- 3.3.2.8 A Grid Substation is proposed on the east side of Lewis/*Eilean Leòdhais* to connect the Project to the planned Lewis Hub Converter Station. On the west side of Lewis/*Eilean Leòdhais* however, there are currently 2 options retained by the Applicant: either an OSP or a Landfall Substation with associated cabling arrangements. These options are described below and shown on **Figure 3.1a, Volume 1b** and **Figure 3.2a: Indicative Turbine layout Option 1, Volume 1b**.
- 3.3.2.9 It is necessary to retain these options to allow further ground investigation and detailed design to be undertaken to ensure an optimal engineering and electrical design. A Landfall Substation would limit the work required offshore and avoid the health and safety risks associated with this during construction, O&M, and decommissioning. However, the OSP would reduce the number of

Offshore Cables and avoid complexity and technical risk associated with the construction works. The scenarios are as follows:

Scenario 1: WTGs connected to an OSP and then to Landfall

3.3.2.10 In Scenario 1, the substation on the west coast of Lewis/*Eilean Leòdhais* will be located offshore within the Turbine Area, referred to as the OSP. The key components of this option are:

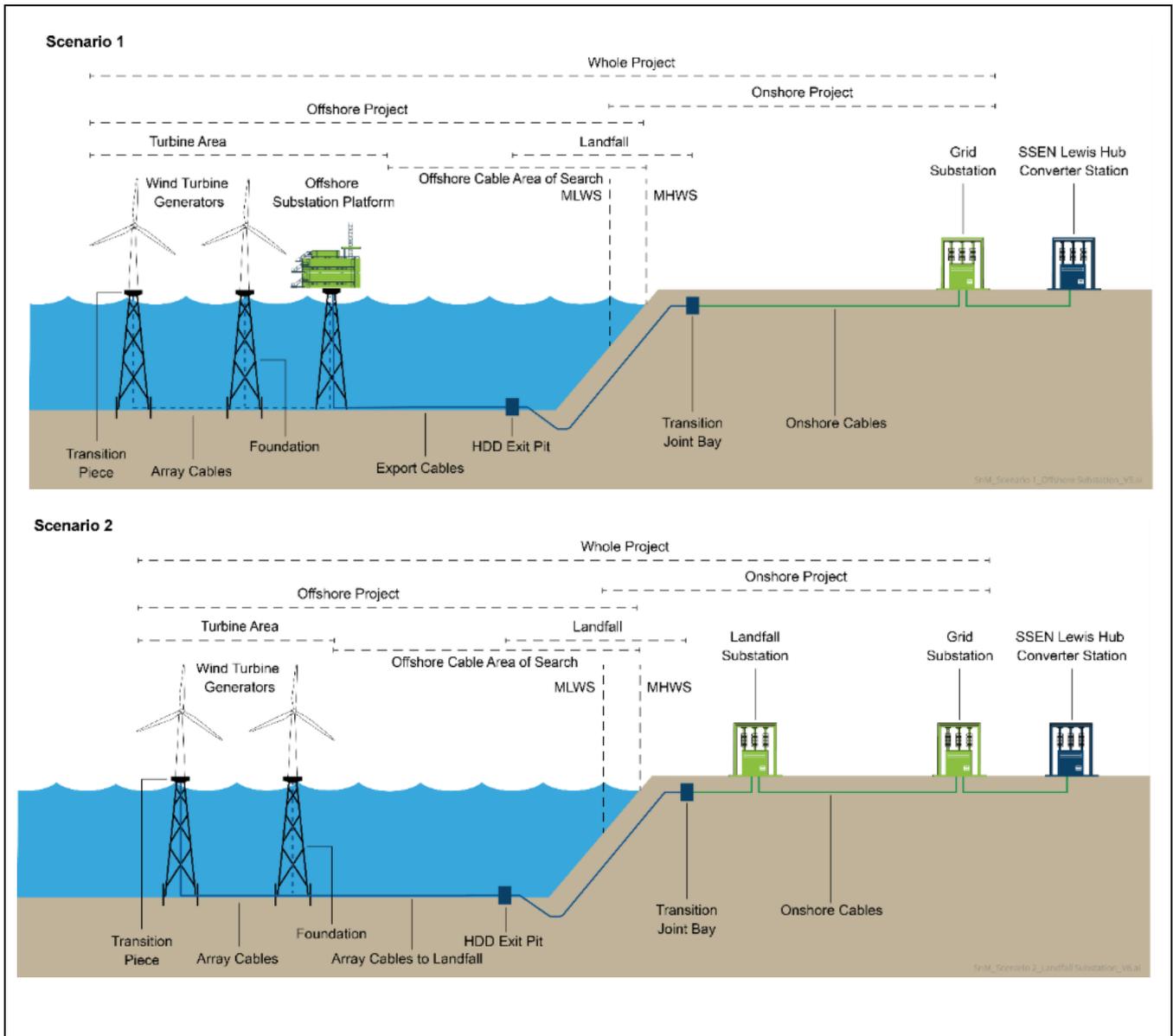
- Array Cables will be installed in a string circuit configuration, connecting multiple WTGs together. These cables (referred to as 'Array Cables') will transmit the generated power from each WTG to the OSP located within the Turbine Area;
- From the OSP, Export Cables, that are designed to transmit higher voltages over longer distances, will transmit the collected power to the Landfall;
- At the Landfall, the Export Cables will connect to the Onshore Cables at the TJBs, which are underground concrete chambers, used to house the interface joint between the Export Cables and the Onshore Cables. The Export Cables will be connected to the TJB at Landfall using a trenchless solution (HDD) from the HDD Exit Pit;
- From the TJBs, the buried Onshore Cables will connect to the Grid Substation on the east of the Isle of Lewis/*Eilean Leòdhais*. The Grid Substation will then connect to the National Grid connection point at the Lewis Hub Converter Substation.

Scenario 2: WTGs connected directly to an Onshore Landfall Substation

3.3.2.11 In Scenario 2, the substation on the west coast of Lewis/*Eilean Leòdhais* will be located onshore northeast of Barvas/*Barabhas*, referred to as the Onshore Landfall Substation. The key components of this option are:

- Array Cables will be installed in several string circuit configurations, connecting multiple WTGs together (referred to as 'Array Cables'). The final WTG in each chain will transmit the generated power from the WTG directly to the Landfall (referred to as 'Array Cables to Landfall');
- The Array Cables to Landfall will connect to the Onshore Cables at the TJBs;
- From the TJBs, the Onshore Cables will connect to the Landfall Substation on the west of the Isle of Lewis/*Eilean Leòdhais*;
- The collected power will be transmitted from the Landfall Substation to the Grid Substation via buried Onshore Cables;
- The Grid Substation will then connect to the National Grid connection point at the Lewis Hub Converter Substation.

Plate 3-1: Key components of the Project



3.4 EMBEDDED MITIGATION

3.4.1.1 Mitigation measures are strategies designed to minimise potential environmental effects from a project and can occur at multiple stages across a project’s lifespan. Embedded mitigation measures are those measures that are embedded into the design of the project to prevent or reduce negative impacts. They are embedded into the project design so are considered as part of the Offshore Project within the topic assessments of this EIAR.

3.4.1.2 These embedded mitigation measures have evolved over the design development process to address emerging technical and environmental challenges and in response to consultation. All

mitigation measures, including management plans (**Volume 3**), are described in each technical chapter of the EIA (Chapters 6, Volume 2a to Chapter 22, Volume 2a). A complete list of embedded mitigation measures for the Offshore Project is available in **Chapter 25: Summary of Offshore Mitigation/Statement of Offshore EIA Commitments, Volume 2a**. All activities described within this chapter will be undertaken adhering to these embedded mitigation measures.

3.5 OFFSHORE INFRASTRUCTURE AND INSTALLATION

3.5.1 INTRODUCTION

3.5.1.1 This section provides details of the components of the Offshore Project (see **Figure 3.2a, Volume 1b** and **Figure 3.2b: Indicative Turbine Layout Option 2, Volume 1b**) along with the preparation activities that require to be undertaken before construction commences. This section includes details of:

- Offshore Project Boundary;
- Site Preparation;
- WTGs;
- WTG foundations;
- OSP (if required);
- Scour Protection;
- Offshore Cables.

3.5.2 OFFSHORE PROJECT BOUNDARY AND LAYOUT CONSIDERATIONS

3.5.2.1 The Offshore Project consists of 3 areas. The Array Area is defined as the total area within which offshore WTGs, associated foundations, Array Cables and the OSP (if required) will be located. The Turbine Area (refined from the original Array Area presented in the Scoping Report (Sporad na Mara, 2023)), is a reduced area within the Array Area, within which all infrastructure visible above LAT will be located. The OCAS will accommodate the Array Cables to Landfall or the Export Cables along with the HDD Exit Pit Area. These are shown on **Figure 3.2a, Volume 1b** and **Figure 3.2b, Volume 1b**.

3.5.2.2 The coordinates of the areas described in this chapter are provided in **Appendix 3.3: Offshore Project Coordinates, Volume 1c**.

Array Area and Turbine Area

3.5.2.3 The Offshore Project includes the Array Area which, is located approximately 5-13 km from the coast and has an area of 161 km². Water depths across the Turbine Area generally range from 37-67 m, except for a localised depression in the southwest corner of the Array Area where depths reach approximately 72 m.

3.5.2.4 Within the Array Area, the Turbine Area has been defined through multidisciplinary workshops, which considered engineering and environmental factors along with stakeholder feedback, as outlined further in **Chapter 4: Consideration of Alternatives, Volume 1a**. All surface piercing infrastructure, including WTGs and OSP (if required), will be located in the Turbine Area to minimise environmental and human impacts.

Wind Turbine Generator Layout

3.5.2.5 Within the Turbine Area, the determination of the WTG layout is an iterative process of balancing key safety, technical, commercial and environmental sensitivities and where refinements are made throughout the development process. At this stage, taking into account known constraints and opportunities, an indicative perpendicular layout is presented in **Figure 3.2a, Volume 1b** and **Figure 3.2b, Volume 1b**.

3.5.2.6 Refinement of the layout will continue post-consent and turbines may be micrositied to take account of location specific ground conditions. The final layout will be developed in accordance with relevant guidance and finalised prior to the commencement of construction.

Offshore Cable Area of Search

3.5.2.7 The OCAS is approximately 47 km² which covers the area where Offshore Cables will be laid in order to connect the Offshore Substation (Scenario 1) or WTGs (Scenario 2) to the shore (see **Figure 3.2a, Volume 1b** and **Figure 3.2b, Volume 1b**). Whilst part of the offshore cabling will be located within the Array Area in order to connect to the WTGs or OSP (if required), these cables will ultimately be laid within the OCAS between the edge of the Array Area and the HDD Exit Pits.

3.5.2.8 Maximum design parameters for the Offshore Project Boundary are presented **Table 3-1**.

Table 3-1: Maximum Design parameters for Offshore Project Boundary

Parameter	Measurement
Array Area	161 km ²
Turbine Area	140 km ²
OCAS	47 km ²
Offshore Project Boundary (Array Area + OCAS)	208 km ²
Distance from shore to Array Area	5 - 13 km
Distance from shore to Turbine Area	6 - 13 km
Water depth range in Array Area/Turbine Area	37 to 67 / 72 m (MSL)

3.5.3 SITE PREPARATION

3.5.3.1 Prior to the construction phase of the Offshore Project, a number of site preparation activities will be required to be undertaken, including pre-construction surveys and seabed preparation.

Pre-construction surveys

- 3.5.3.2 Prior to the commencement of any installation works, pre-construction surveys of the Array Area and OCAS will be conducted to evaluate seabed conditions, identify potential hazards, and determine the suitability of the seabed for foundation installation, cable installation and any ancillary works, necessary in advance of construction.
- 3.5.3.3 These surveys will be undertaken by dedicated contractors, which will identify bedforms, sediment depth, archaeological features, obstacles and debris on the seabed within the Offshore Project Boundary. The assessment parameters for pre-construction surveys methods captured within the PDE include the following survey equipment:
- Seabed and downhole drilling system (borehole drilling);
 - Downhole geophysics (PS logger, Seismic Cone Penetration Testing).
- 3.5.3.4 Analysis of these factors will then inform the final design which will include final locations of WTGs and foundation installation method, cable routing design and installation methods, the target cable burial depth, and what (if any) additional cable protection will be required. Following final design, micrositing of infrastructure may be required to accommodate unexpected on-site conditions or avoid potential sensitive receptors identified as part of the EIAR, for example unknown archaeology. This is a standard approach in the construction of offshore wind farms and is considered in this EIAR.
- 3.5.3.5 Any licensing requirements for the removal of materials from the seabed will be identified following these pre-construction surveys and applied for by the Applicant under the Marine (Scotland) Act 2010.

Seabed Preparation

- 3.5.3.6 Requirements for seabed preparation will vary according to the specific ground conditions and the type of infrastructure being installed. As described in paragraph 3.5.3.2, detailed pre-construction surveys will be carried out prior to construction commencing to provide further detail and to clarify the presence of boulders, unexploded ordnance (UXO), and other obstructions on the seabed.
- 3.5.3.7 Seabed preparation will be the first element of the offshore construction process and will comprise the clearing of boulders that could obstruct landfall works, WTG/OSP foundation installation and the installation of Offshore Cables. Geotextile or mattresses may also be required to achieve a flat surface for foundation and/or offshore cable installation.

Unexploded Ordnance clearance

- 3.5.3.8 Following initial site investigations, it is not anticipated that UXO clearance will be required for the Offshore Project and as such clearance of UXO is not included in this EIAR or associated applications. Should UXO clearance be identified as a requirement following pre-construction

surveys, this activity would be consented separately to this Application, and ultimately safely disposed of from the seabed, ensuring safety during installation.

Boulder Clearance

WTG and OSP Foundations

- 3.5.3.9 Boulder clearance will be conducted at the foundation of each WTG and the OSP and in the working area adjacent to each location for up to 2 multi-leg jack-up vessels (JUVs). This will ensure a stable and secure installation. This process will involve the identification and clearance of boulders that could interfere with the JUV spudcans and turbine/OSP foundations. This preparatory work is essential to mitigate potential risks to the JUV and foundation/WTG/OSP installation process and ensure the integrity and longevity of the foundations.
- 3.5.3.10 There are 2 key methods of clearing boulders that will be adopted by the Offshore Project; boulder plough and boulder grab. Where a high density of boulders is seen, the expectation is that a plough will be required to clear the area. Where medium and low densities of boulders are seen, a subsea grab is expected to be employed allowing for precise and targeted clearance. Both methods are described as follows:
- Boulder Ploughs: These are designed to be towed along the seabed, effectively clearing large boulders and debris from the designated foundation area. The ploughs create a clear path, ensuring that the seabed is prepared for the subsequent installation activities;
 - Subsea Grabs: Operated from vessels, such as multicat vessels, subsea grabs are used to pick up and relocate boulders and other obstructions that are too large or dense for the boulder ploughs to handle.
- 3.5.3.11 Depending on the seabed conditions identified at the point of preconstruction surveys, geotextile and/or gravel mattresses may be installed on the seabed to create a level surface for foundation installation in addition to or as an alternative to boulder removal, depending on the specific conditions at the foundation location.

Cables

- 3.5.3.12 Boulder clearance will be required to be conducted within the Array Area and OCAS to reduce risks associated with damage to cable installation equipment and/or cable assets. Boulders that could interfere with safe cable laying operations will be cleared from the route of each cable installation.
- 3.5.3.13 Boulders may be removed from the seabed one by one using a grab tool or may be pushed out of the route of the proposed cable using a plough.
- 3.5.3.14 Not all cable techniques included with the PDE will require boulders to be cleared. Where boulder clearance is not required, geotextile or gravel mattresses may be laid instead. The Applicant may elect to adopt one or a combination of these methods as part of detailed design.

- 3.5.3.15 Following boulder clearance activities, a Pre-Lay Grapnel Run (PLGR) will be conducted along with a route clearance survey of the final cable route. A vessel equipped with grapnels, chains, a recovery winch, and a survey spread for vessel positioning and data logging will be deployed. Any items encountered will be retrieved onto the deck where feasible, and the survey results will determine if further clearance is necessary.
- 3.5.3.16 The extent of boulder clearance is intrinsically linked to the selected cable installation method. **Table 3-16** outlines the assessment parameters for seabed preparation activities based on the installation methods included within the PDE.
- 3.5.3.17 Pre-construction surveys will be used to determine whether boulder clearance is required and if it is feasible. If boulder clearance is not undertaken, then a geotextile and/or gravel mattresses will be laid to create a flat surface to provide stability for cable installation.
- 3.5.3.18 The design parameters for seabed preparation across both the Array Area and OCAS are set out in **Table 3-2**. This includes seabed preparation required for all offshore infrastructure. For transparency the parameters have been assigned an ID letter which has been used to set out the calculation applied to derive the maximum design parameter. For the seabed disturbance calculations, a percentage has been included where it is known that the total area of the cable corridor would not require boulder clearance. This is the percentage of the total area that would be subject to boulder clearance.

Table 3-2: Maximum Design Parameters for Boulder Clearance

Parameter		Maximum Design Parameter	
Structures (WTGs and OSP)			
Maximum boulder clearance WTGs and OSP foundation installation (includes foundations and installation Jack Up Vessels)		3,600,000 m ²	
Cables			
ID	Parameter	Cable Scenario 1 (OSP)	Cable Scenario 2 (Onshore Landfall Substation)
A	Maximum length Array Cables (to OSP)	160 km	N/A
B	Maximum length Export Cable	30 km	N/A
C	Maximum length Array Cables to Landfall	N/A	350 km
D	Maximum boulder clearance width	15 m	15 m
E	Maximum boulder clearance for Offshore Cables	2.76 km ² [(A x D) + (B x D x 80%)]	5.25 km ² [C x D]
F	Maximum corridor width of seabed disturbance (includes 15 m corridor plus 5m either side for spoil)	25 m	25 m
G	Maximum disturbed seabed Array Cables (to OSP)	4 km ² [A x F]	N/A
H	Maximum disturbed seabed Export Cables	0.75 km ² [B x F]	N/A
I	Maximum disturbed seabed Array Cables to Landfall	N/A	8.75 km ² [C x F]

3.5.4 WIND TURBINE GENERATOR AND OFFSHORE SUBSTATION PLATFORM FOUNDATIONS

Introduction

3.5.4.1 The WTGs and OSPs are secured to the seabed by fixed foundation structures. The foundation design for the WTGs is essential for ensuring stability and longevity. This section outlines the WTG foundation options under consideration for the Offshore Project.

Wind Turbine Generator Foundation Types

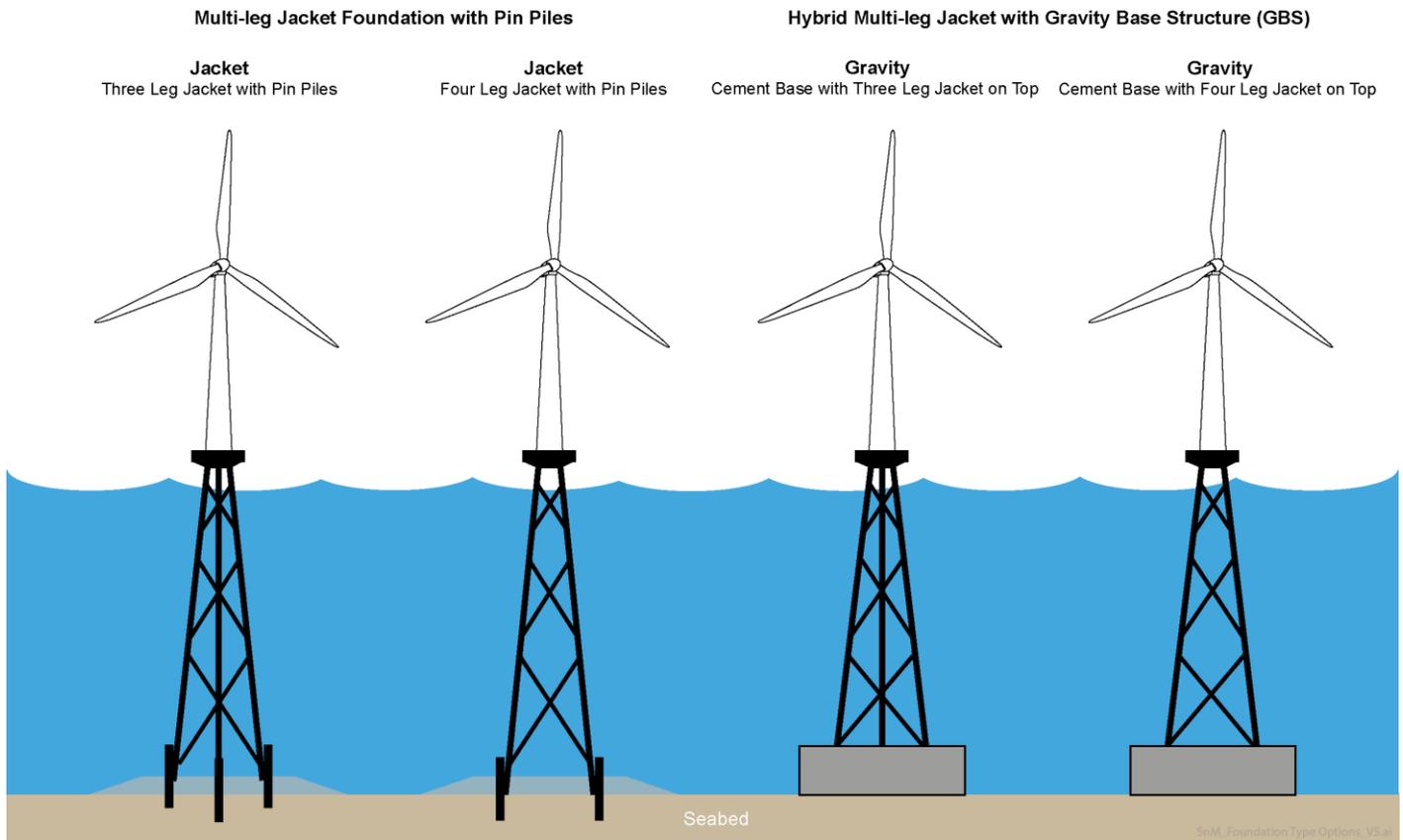
3.5.4.2 The Offshore Project will utilise fixed foundations for the WTGs. However, the exact foundation type to be deployed within the Turbine Area and its associated installation method will not be confirmed until the design of the Offshore Project has been finalised. The selection of WTG foundation types will be based on pre-construction surveys, environmental sensitivities, and final WTG specifications. It is possible that one or more foundation types may be used. At this stage, 2 fixed foundation design options are under consideration for WTGs (see **Plate 3-2**):

- Multi-leg jacket foundations with pin piles;
- Hybrid multi-leg jacket with GBS.

3.5.4.3 Multi-leg jacket foundations are a type of WTG foundation that consists of a steel lattice framework structure. The jacket structure will have either 3 or 4 legs and will be secured to the seabed via percussive installation or drilling of pin piles, or a gravity base described below.

3.5.4.4 The foundations will be manufactured offsite, stored at a suitable port facility, and transported to the installation site as required. Foundations will not be transported overland on Lewis and will be transported from the selected port to site. Specialised vessels will be employed for transporting and installing the foundations. These foundations will feature access facilities. **Plate 3-2** provides a schematic of the likely WTG foundation types in the PDE.

Plate 3-2: Schematic of Wind Turbine Generator foundation types that may be deployed in the Turbine Area



3.5.5 MULTI-LEG JACKET FOUNDATIONS WITH PIN PILES

Design

- 3.5.5.1 The multi-leg jacket foundation is secured to the seabed by pin piles which are installed into the seabed to provide stability and support to the jacket structure. The diameter of the pin piles will range from 3-5 m. The pin piles are connected to the multi-leg foundation legs via a grouted or deformed connection.
- 3.5.5.2 Pin piles will reach depths ranging from 15-70 m below the seabed, across much of the Turbine Area apart from an area referred to as the "buried channel" (deeper sections of seabed substrate within the Turbine Area) where depth will range from 15m-120 m. The final depth will depend on the seabed conditions and the required load-bearing capacity, achieved via drilling alone or via percussive piling of the pin piles to the appropriate depth. The parameters for multi-leg jacket foundations with pin piles for WTGs are outlined in **Table 3-3** and parameters for the OSP are in **Table 3-4**.

Table 3-3: Maximum Design Parameters for Wind Turbine Generator Multi-Leg Jacket Foundations with Pin Piles

Parameter	Maximum Design Parameter
Jacket leg spacing at MSL	15-35 m
Maximum number of legs per multi-leg foundation	Up to 4
Maximum number of multi-jacket legs	240
Maximum Leg diameter	5 m
Jacket leg spacing at seabed level	30-55 m
Maximum number of pin piles per multi-leg foundation	4
Maximum number of pin piles	240
Maximum Pin pile diameter	5 m
Embedment depth (below seabed) (turbine area outside of buried channel)	15-70 m
Embedment depth (below seabed) (turbine area inside buried channel)	15-120 m
Maximum seabed footprint per pile	30 m ²
Maximum total permanent seabed pile footprint	7,200 m ²

Table 3-4: Maximum Design Parameters for Offshore Substation Platform Multi-Leg Jacket Foundation with Pin Piles

Parameter	Maximum Design Parameter
Jacket leg spacing at MSL	10 - 40 m
Jacket leg spacing at seabed	30 - 60 m
Maximum number of legs per multi-leg foundation	8
Maximum number of pin piles per leg	2
Maximum leg diameter	6 m
Total number of pin piles for OSP	16
Pin pile diameter	6 m
Pile penetration depth (below seabed)	20 -120 m
Maximum dimensions of mud-mats (if required)	8 x 30 m
Seabed footprint per pile (including mud mats)	240 m ²
Total permanent seabed pile footprint (including mud mats)	1,920 m ²

Installation

3.5.5.3 The multi-leg jackets with pin piles will be installed either by drilling and grouting or by percussive piling. A brief summary of each installation method is set out below.

Drilling and Grouting

3.5.5.4 A temporary pile installation template will be installed to guide and support the installation. The template will be lowered into position on the seabed. As noted previously, this template will sit on a flat surface (either ploughed or mattress).

3.5.5.5 A casing may be installed at each pile location in soil, to prevent the borehole to collapse before the pile is installed. The casing may be installed by vibration, percussive piling, jacking or drilling.

The casing may be permanent (forming part of the pin pile on the long term) or temporary (i.e. used during installation, removed at this end of the process).

- 3.5.5.6 A hole will be drilled at the pile location to a target depth (engineered and location specific for each pile). Drill boring will create drill arisings that may be released into the water column.
- 3.5.5.7 Once the target depth is achieved the drill will be recovered. The pin pile will then be lowered into the pile socket. Once the pin pile is in position within the drilled hole it will be fixed into place using grout. The temporary installation template is then detached and removed from the seabed.
- 3.5.5.8 The pin piles will have a stick-up length above the seabed to allow for a connection between the jacket leg and pile. The stick-up length refers to the portion of the pin pile that extends above the seabed after installation. This length is crucial for ensuring a proper connection between the jacket leg and the pile, typically through grouting. The stick-up length allows for the jacket leg to be "stabbed" into the pile and then grouted to secure the connection.
- 3.5.5.9 Parameters associated with the installation option for drill and grout pin piles is presented in **Table 3-5** for WTGs and **Table 3-6** for OSPs.

Table 3-5: Maximum Design Parameters for Drill & Grout Wind Turbine Generator Pin Piles Installation

Parameter	Maximum Design Parameter
Drilling depth for drill & grout (turbine area outside of buried channel)	15 to 70 m
Maximum drill arising per pile per day (outside of buried channel)	1,374 m ³
Drilling depth for drill & grout (turbine area inside buried channel)	15-120 m
Maximum drill arising per pile per day (inside of channel)	2,356 m ³
No. piles per WTG	4
Assumed volume of drill arisings per pile (m ³) (average 30m penetration depth)	588 m ³
Assumed maximum volume of drill Arisings for OWF	141,120 m ³
Maximum hammer energy (kJ) (if required for drill casing installation)	5,000 kJ

Table 3-6: Maximum Design Parameters for Drill & Grout Offshore Substation Platform Pin Piles Installation

Parameter	Maximum Design Parameter
Drilling depth for drill & grout (turbine area outside of buried channel)	15 to 60 m
Maximum No. piles per OSP	16
Assumed volume of drill arisings per pile (m ³) (maximum 60 m penetration depth)	1,000 m ³
Assumed maximum volume of drill arisings for OSP	16,000 m ³
Maximum hammer energy (kJ) (if required for drill casing installation)	5,000 kJ

Percussive Piling

- 3.5.5.10 The percussive installation of pin piles involves positioning the pin piles within the Pile Installation Template (PIT) at the designated pile locations. A hydraulic pile hammer is then used to drive the

pin piles into the seabed, applying repeated impacts to the top of the pile to achieve the required depth. Vibratory driving could also be used for part or all of the pile embedment length.

- 3.5.5.11 If the pile encounters bedrock, an obstruction or the hammer refusal criteria before reaching the required depth, drilling may be undertaken to achieve the target depth. Throughout the process, continuous monitoring ensures that the piles are driven to the correct depth and alignment. The percussive pin piles will also include a stick-up length above the seabed to allow for a connection to the jacket leg.
- 3.5.5.12 The PIT is then detached and removed from the seabed.
- 3.5.5.13 The maximum hammer energy that will be used to install piles using percussive piling for the Offshore Project will be 5,000 kJ.
- 3.5.5.14 In the case of the OSP, it is possible that rather than the approach described above (known as pre-piling) that post piling may be undertaken. This would involve the complete OSP foundation structure being situated on the seabed (with the use of mud mats to stabilise the structure) then pin piles installed through the foundation's legs¹.
- 3.5.5.15 Only 1 vessel will undertake percussive piling activities at any one time and there will be a maximum of 5.5 hours of percussive piling within any 24-hour period. The maximum duration of offshore construction is up to 5 years, with percussive piling operations limited to April through October over a 2 year period, totalling 14 months of active work.
- 3.5.5.16 In the event that the pile reaches bedrock before it has achieved the appropriate depth, drilling may be required in order to achieve the target depth. Following installation, all drilling equipment including the PIT will be removed from site on completion of pile installation. The jacket will then be lowered onto the piles and secured.
- 3.5.5.17 Parameters associated with the installation option for percussive pin piles is presented in **Table 3-7**.

Table 3-7: Maximum Design Parameters for Percussive Pile Installation

Parameter	Maximum Design Parameter
Number of WTG and OSP foundations requiring percussive piling	Up to 36 (35 WTG + 1 OSP)
Total number of pin piles (WTG and OSP)	156
Maximum hammer energy	5,000 kJ
Initial hammer energy	550 kJ

- 3.5.5.18 Percussive piling operations have the potential to result in environmental effects and as such the Applicant has developed **Appendix 3.1: Percussive Piling Installation Approach, Volume 1c** to

¹ If the OSP is installed using drilling and grouting, a similar approach for installing the pin piles through the foundation's legs could also be undertaken.

manage these potential effects on the environment. The strategy outlines measures embedded in the project design to control underwater noise from percussive piling and provides detail on when and where installation by piling may occur within the Turbine Area, during which months of the year it could take place and the method for percussive piling operations e.g. soft start and ramp up.

3.5.6 HYBRID MULTI-LEG JACKET WITH GRAVITY BASE

Design

- 3.5.6.1 A hybrid gravity base (HGB) is a type of foundation that combines a GBS with a multi-leg jacket. This hybrid approach leverages the mass and stability of a gravity-based structure while incorporating the structural benefits of steel components. The gravity base will attach to the multi-leg jacket via stick-up structures (similar to the pin piles) secured on the top of the base.
- 3.5.6.2 **Table 3-8** presents the maximum design parameters associated with a HGB type foundation for WTGs and
- 3.5.6.3 **Table 3-9** presents them for the OSP.

Table 3-8: Maximum Design Parameters for Wind Turbine Generator Multi-Leg Jacket Foundations with Hybrid Gravity Base

Parameter	Maximum Design Parameter
Maximum Number of jacket legs per HGB foundation	4
Jacket leg spacing at MSL	15-35 m
Maximum size of top of HGB shaft	10 m x 10 m
Maximum height of shaft in water column	65 m
Maximum bottom of HGB shaft (foundation footprint)	55 x 55 m
Total seabed footprint of OWF foundations	181,500 m ²
Foundation height above seabed	5 m
Foundation penetration depth if no bedding material	0-5 m
Foundation bedding material	geotextile or mattress
Bedding depth	5 m
Volume of bedding material per WTG	15,000 m ³
Total Volume of bedding material for OWF	900,000 m ³
Height of platform above Lowest Astronomical Tide (LAT)	15-25 m

Table 3-9: Maximum Design Parameters for OSP Multi-Leg Jacket Foundations with Hybrid Gravity Base

Parameter	Maximum Design Parameter
Number of jacket legs per HGB foundation	8
Jacket leg spacing at MSL	15-35 m
Hybrid GBS footprint	5,000 m ²
Total seabed footprint for OSP	5,000 m ²
Foundation height above seabed	5 m
Maximum Foundation penetration depth if no bedding material	5 m
Maximum Foundation bedding material	geotextile or mattress
Maximum Bedding depth	5 m
Maximum volume of bedding material	15,000 m ³
Height of platform above LAT	15-25 m

Installation

3.5.6.4 The gravity base foundation will be fabricated offsite at a portside facility and transported to the Turbine Area for installation following site preparation as described in Section 3.5.3. Depending on the final design the gravity base will either be:

- Transported via barge and lifted and lowered on the seabed; or
- Transported via tugging then submerged to sink to the seabed by filling with seawater.

3.5.6.5 Material will be added to the gravity base structure once it has been sunk to provide ballast. Once the target weight of the gravity base has been achieved, the gravity base foundation will be grouted to seal the ballasted material into the structure.

3.5.6.6 Following installation of the gravity base, the jacket will be lifted into place using a heavy-lift vessel or crane and lowered onto the gravity base transition interface connection.

3.5.6.7 After the jacket structure is installed, final alignment checks will be performed to ensure the structure is correctly positioned and level.

3.5.7 SCOUR PROTECTION FOR FOUNDATIONS

3.5.7.1 Scour protection material may be required around the base of some or all foundations for WTGs and the OSP (if required) to protect against current and wave action, ensuring structural integrity. The types of scour protection currently being considered include rock or gravel placement and concrete mattresses.

3.5.7.2 **Table 3-10** presents the maximum parameters for scour protection required for the WTGs and OSP foundations described in Sections 3.5.4 and Section 3.5.5. Of the foundation types in the PDE the maximum parameters are derived from the hybrid multileg jacket with gravity base and the largest number of turbines.

Table 3-10: WTG and OSP Foundations Scour Protection Parameters

Parameter	Maximum Design Parameter
Scour protection type	Typical Inert Material (e.g. rock, concrete etc.)
Height of scour protection	3 m
Maximum scour protection footprint	105 m x 105 m
Scour protection area (excluding foundation) per WTG	8,000 m ²
Scour protection area (including foundation) per WTG	11,025 m ²
Scour protection area for OSP (excluding foundation)	1,500 m ²
Scour protection area for OSP (including foundation)	5,000 m ²
Area of foundation and scour protection (WTGs and OSP)	661,500 m ²
Volume of scour protection material per WTG	24,000 m ³
Volume of scour protection material for all WTGs	1,440,000 m ³
Volume of Scour protection material for OSP	4,500 m ³
Total volume of scour protection (WTGs and OSP)	1,444,500 m ³

3.5.8 WIND TURBINE GENERATORS

Introduction

3.5.8.1 Offshore WTGs are designed to harness wind energy efficiently. Each turbine consists of 3 blades connected to a horizontal rotor axis. These blades are attached to a nacelle, which is mounted onto a tower and houses key components like the gearbox, generator, and transformer. At the base of the tower a transition piece will be used to attach the tower to the chosen foundation type. Details of foundation types under consideration are provided in Section 3.5.5 and Section 3.5.6. To optimise energy capture, the nacelle can rotate or 'yaw' to face the wind direction. Additionally, WTGs are equipped with lights and markers for aviation and navigation safety.

3.5.8.2 Inside the nacelle, the transformer converts the electricity generated by the turbine from lower voltages to higher voltages in order to minimise electrical losses during transmission.

Design

3.5.8.3 The final design and capacity of the WTGs for the Offshore Project will be determined during the final design stage, adhering to the parameters set out in this chapter. As is typical for OWFs, the final selection of WTGs and the overall capacity of the wind farm will be determined through a procurement process conducted post consent.

3.5.8.4 A schematic showing the parts of a WTG is provided in **Plate 3-3**. A range of WTG options have been considered, with **Table 3-11** outlining the PDE values as defined for this EIAR.

Plate 3-3: Schematic of typical WTGs

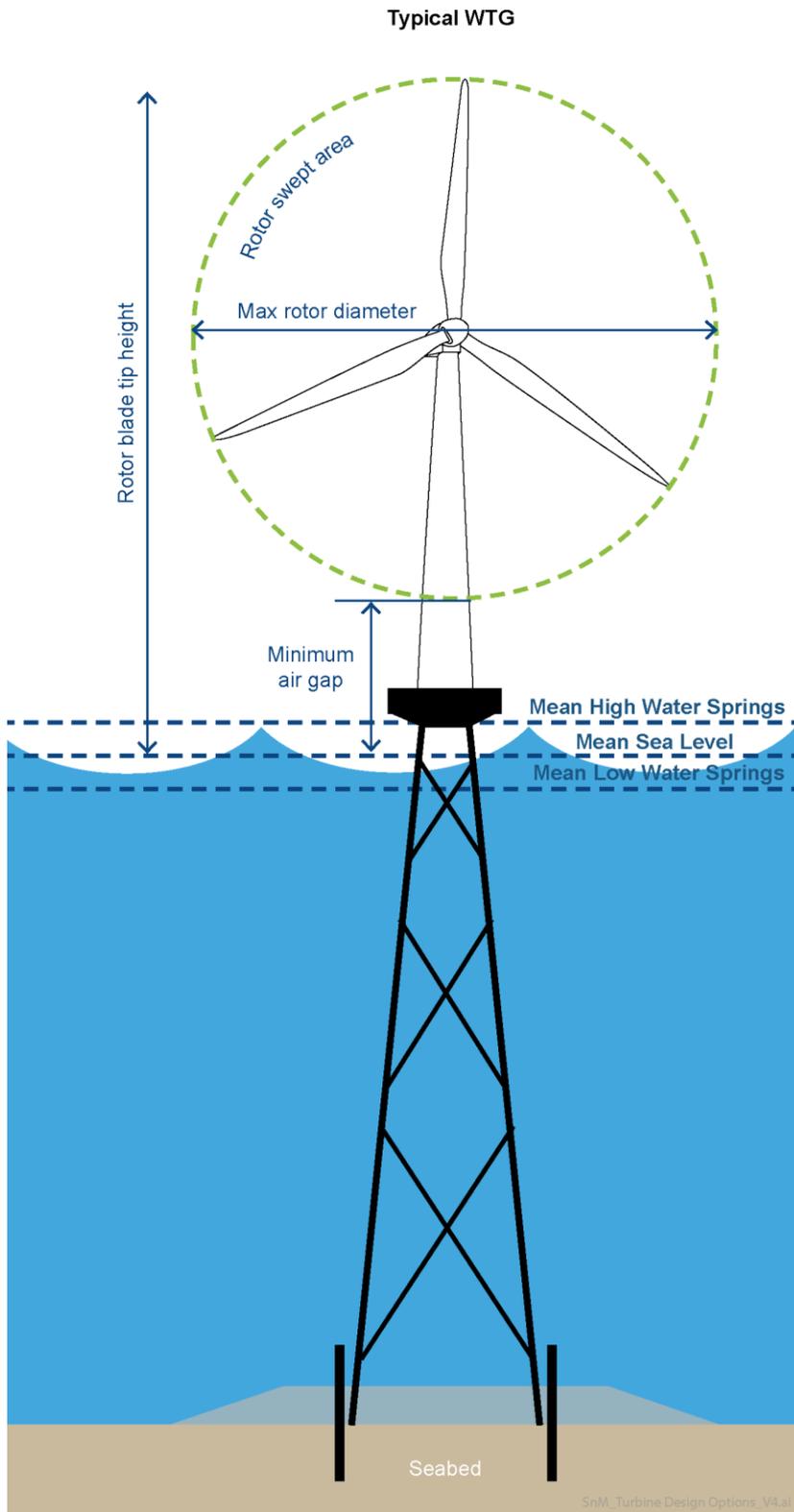


Table 3-11: Maximum Design Parameters for Wind Turbine Generators

Assessment Parameter	Smaller WTG type	Larger WTG type
Maximum Number of WTGs	60	44
Maximum Rotor Diameter	236 m	280 m
Maximum Blade Tip Height (above Mean Sea Level (MSL))	293.8 m	338.4 m
Maximum interface level	50 m AMSL	50 m AMSL
Minimum Air Gap (between minimum blade tip height and MSL)	30 m	30 m
Maximum Chord	5.3 m	8 m
Maximum rotation per minute	9.3 rpm	10 rpm
Minimum turbine spacing	900 m	900 m
Maximum Swept Area of Rotor	2,624,612 m ²	2,709,310 m ²

3.5.8.5 In order to ensure safe and reliable operation and to protect WTGs from wear and tear, grease and fluids are used in the gears of various components. These fluids are contained within closed systems with no planned discharge to the marine environment. Maximum oil and fluid consumption quantities for WTGs are outlined in **Table 3-12**.

Table 3-12: Maximum Design Parameters for WTG Oil and Fluid Consumption

Parameter	Exchange Intervals	Maximum per WTG
Grease (litres) per WTG	Up to 50 l / year	255 l
Hydraulic Oil (litres) per WTG	Every 10 years	1,100 l
Gear Oil (litres) per WTG	Every 10 years	2,700 l
Nitrogen (litres) per WTG	N/A	63,000 l
Water/Glycerol (litres) per WTG	N/A	1,400 l
Transformer Silicon/Ester oil (litres/kg) per WTG	N/A	12,000 l
Sulphur Hexafluoride 6 (SF6) (kg) per WTG	N/A	24

3.5.8.6 Each WTG is equipped with its own control system to manage functions such as yaw control and power reduction during high wind conditions. All WTGs are connected to a central Supervisory Control and Data Acquisition (SCADA) system, which allows for remote monitoring and control of the wind farm.

3.5.8.7 The SCADA system can shut down WTGs remotely if faults are detected. Communication between the SCADA system and the wind farm is facilitated through fibre optic cables, microwave, or satellite links. Additionally, individual WTGs can be manually controlled from within the nacelle or at the base of the tower for commissioning or maintenance purposes.

Colour scheme, lighting and marking

- 3.5.8.8 The WTGs will be designed to satisfy the marking, lighting and fog-horn specifications of the Maritime and Coastguard Agency (MCA), Civil Aviation Authority (CAA), and the Northern Lighthouse Board (NLB).
- 3.5.8.9 As per industry best practice, the WTGs will be marked by lights that are visible from 2 nautical miles (nm) from all angles during construction. It is intended that the site will be marked as a buoyed construction area with the buoy locations agreed with NLB.
- 3.5.8.10 The location and characteristics of lighting, on WTGs and Peripheral Structures will be dependent on the final WTG layout and determined in consultation with key stakeholders post-consent. All marking and lighting will meet relevant regulations and guidance, including aviation marking and lighting requirements (including Article 223 of the Air Navigational Order 2016), and maritime marking and lighting requirements (including International Association of Marine Aids to Navigation and Lighthouse Authorities (IALA) guidance G1162, and the MCA guidance on Offshore Renewable Energy Installations).
- 3.5.8.11 Final position of all offshore structures will be communicated to the UK Hydrographic Office (UKHO) for incorporation into Admiralty Charts and notification procedures.

Installation

- 3.5.8.12 The WTG towers, nacelles, and blades will be transported from a suitable port to the Turbine Area on a wind turbine installation vessel (WTIV) or on a separate transport vessel. Turbine components will not be transported overland on Lewis. The WTG installation vessel (WTIV) will be selected from the range of available vessels at the time of construction such as a dynamic positioning vessel however it is likely to be a multi-leg JUV (see **Plate 3-4**), whose spudcans will be deployed to provide stability for the vessel during the installation of each WTG. The JUV can transport multiple WTG sets per trip. The installation vessel will transit to the Turbine Area, and the components will be lifted onto the foundation substructure by a crane situated on the installation vessel. Each WTG will be assembled on site with technicians fastening components together after they are lifted into place. The exact methodology for the assembly is dependent on WTG type and installation contractor and will be defined post-consent. The total duration for WTG installation is expected to be around 2-3 years, accounting for suitable construction windows within this period. Section 3.7 provides further detail.

Plate 3-4: Typical Wind Turbine Installation Vessel or Jack-up Vessel



3.5.8.13 Vessels for WTG installation may require construction support vessels such as multicat vessels (see **Plate 3-5**), crew transfer vessels (CTVs) (see **Plate 3-6**), and barges, tugs. Multicat vessels are multifunctional all-purpose vessels, typically equipped with a winch and/or cranes.

Plate 3-5: Multicat Utility Vessel



Plate 3-6: Crew Transfer Vessel



3.5.8.14 JUVs interact with the seabed when their jack-up spud cans (base structure on each leg) are lowered into place. JUV parameters are presented in **Table 3-13**.

Table 3-13: Jack-up Vessel Parameters

Parameter	Maximum Design Parameter
Number of legs per vessel	4 legs
Area of spud cans	280 m ²
Leg penetration range	0-10 m
Number of jack-up positions per WTG	Up to 2
Number of jack-up positions per OSP	Up to 4

3.5.8.15 The maximum vessel assessment parameters, in respect of numbers of vessels for construction activities, are provided in Section 3.5.12.

3.5.9 OFFSHORE SUBSTATION PLATFORM

Introduction

3.5.9.1 As outlined in Section 3.3.2, the Offshore Project may include an OSP (Scenario 1). The OSP would serve as a centralised connection point for the Array Cables to OSP, which deliver electricity to the OSP, where the voltage is increased before being transmitted to landfall via Export Cables. The OSP (if required) will be located within the Turbine Area although the exact location will be determined during detailed design.

Design

3.5.9.2 The OSP topside houses the electrical equipment necessary for stepping up the voltage from the Array Cables. It also includes supporting functions such as storage, communications (including masts), and may feature a helipad. The structure will be equipped with appropriate navigation markings and lights in accordance with relevant guidance and legislation. Up to 12 Array Cables (dependent on the final layout and configuration) will enter the OSP via J-Tubes from WTGs, and up to 2 Export Cables (at either 220 kV or 275 kV) will exit the OSP.

Installation

3.5.9.3 The installation of the OSP involves installing the foundation then lifting the topside into place. The topside structure will be assembled at an onshore fabrication facility then transported directly from the fabrication yard to the Turbine Area using a transportation barge. The topside will then be lifted off the barge and installed onto the pre-installed foundations using a Heavy Lift Vessel (HLV) i.e. a floating crane or a JUV. A JUV may be stationed alongside the OSP structure to facilitate commissioning activities. A typical OSP and JUV is shown in **Plate 3-7**. JUV parameters are presented in **Table 3-13**.

Plate 3-7: Offshore Substation Installation with Jack-up Vessel



3.5.9.4 Array Cables will be connected to the OSP and Export Cables laid to transmit the electricity to Landfall. The substation will then be tested and commissioned to ensure it operates correctly and efficiently. Helicopters and/or CTVs may also be used to transport technicians during commissioning.

3.5.9.5 The maximum design parameters associated with the OSP are provided in **Table 3-14**.

Table 3-14: Maximum Parameters for Offshore Substation

Component	Parameter	Maximum Design Parameter
Topside	Number of OSPs	1
	Height of main structure and helideck above MSL	90 m
	Length & width of topside structure above MSL	70 m
	Height of lightning protection and ancillary structures	110 m
	Topside length and width	70 x 70 m
Consumables	Diesel fuel (litres)	160,000 ltr
	Transformer oil	900,000 kg
	SF6	6,000 kg
	Fire suppressant system	10,000 foam and 10,000 Argonite ltr
	HVAC cooling	5,000 ltr

3.5.10 OFFSHORE CABLES

Introduction

3.5.10.1 Offshore Cables carry the electrical current produced by the WTGs to the TJB (via the OSP in Scenario 1), where it is then transported via Onshore Cables to the grid connection point. The Offshore Cables will be located in the Array Area and OCAS and may include both Array Cables and Export Cables.

3.5.10.2 This section outlines the following:

- Cable design and optionality retained in the PDE;
- Details of external cable protection;
- Summary of installation methods for cables and cable protection.

Design and Optionality

3.5.10.3 The electricity generated by the WTGs will require to be transported to the National Grid connection point. This section outlines the offshore cable options being considered, each designed to ensure reliable and effective energy transfer. All Offshore Cables will utilise HVAC.

3.5.10.4 As outlined in Section 3.3.1, there are 2 electrical infrastructure Scenarios retained in the PDE for the Project which involve the construction of either an OSP within the Turbine Area (offshore) (Scenario 1) or an Onshore Landfall Substation near Barvas/*Barabhas* (onshore) (Scenario 2). Due to this, there are different combinations of Offshore Cables within the Project design.

3.5.10.5 Within Scenario 2, there is the option of utilising either a 66 kV connection or a 132 kV connection which would have different lengths of cable. The decision on the voltage of these cables will be made at the detailed design stage. For the purposes of assessment the 66 kV option is included in

the assessment parameters as it includes the greatest number and length of cables and represents the maximum parameters for cables in Scenario 2. The Offshore Cable Scenarios are presented in **Table 3-15**.

Array Cables

3.5.10.6 There are 2 types of Array Cables considered in the design envelope:

- Array Cables to OSP/final WTG - these will interconnect the WTGs in series. These cable strings will link the WTGs to either the OSP (Scenario 1) or the final WTG in the string (Scenario 2);
- Array Cables to Landfall – these will connect the final WTG in the string to Landfall (Scenario 2) and will not be required for Scenario 1.

3.5.10.7 The Array Cables are expected to be 3-core, armoured, and made with insulated copper or aluminium conductors and will transition from the inside to the outside of the foundation via a J-tube (or similar sleeve) which provides protection to the cable. The cables will include fibre-optic cores for protection, control, and communication systems. **Table 3-15** outlines the design parameters for these cables.

Export Cables

3.5.10.8 Scenario 1 (OSP used) requires Export Cables connecting from the OSP to Landfall. The cables are expected to be armoured and consist of 3-core cables with copper or aluminium conductors, insulated with cross-linked polyethylene (XLPE), supporting voltages up to 275 kV. They will transition from the inside to the outside of the foundation via a J-tube (or similar sleeve) which provides protection to the cable. Additionally, the Export Cables will include fibre-optic cores for protection, control, and communication systems. **Table 3-15** outlines the primary assessment assumptions for these cables. Export cables are not required in Scenario 2.

External Cable Protection

3.5.10.9 Where array cables or export cables are surface laid or have a shallow burial depth, external cable protection methods may be required, particularly where there is a risk of human interactions. This will protect cables from activities such as fishing, anchor placement or dropped objects, and limit effect of heat and/or electromagnetic fields. External Cable Protection Systems include but are not limited to concrete mattresses, or rock placement. The selection of cable protection measures will be dependent upon seabed conditions and any potential interactions with human activities which may occur within the Offshore Project Boundary.

3.5.10.10 Details of cable installation methods are provided in paragraphs 3.5.10.15 - 3.5.10.29.

Table 3-15: Offshore Cable Parameters

Assessment Parameter	Scenario 1 (OSP)	Scenario 2 (Landfall Substation)
Array Cables within the Array Area		
Maximum Cable voltage	132 kV	132 kV
Maximum Cable Diameter	300 mm	300 mm
Maximum Length of Cable	160 km	160 km
Maximum Trench Width (excluding jetting)	10 m	10 m
Maximum Trench Width (jetting)	7 m	7 m
Maximum Cable Burial Depth	2 m	2 m
Maximum Seabed Disturbance corridor width	25 m	25 m
Maximum Number of Circuits	12	12
Array Cables within the OCAS		
Maximum Cable voltage	N/A	132 kV
Maximum Cable Diameter	N/A	300 mm
Maximum Length of Cable	N/A	190 km
Maximum Number of Cable trenches	N/A	12
Maximum Trench Width (excluding jetting)	N/A	10 m
Maximum Trench Width (jetting)	N/A	7 m
Maximum Cable Burial Depth	N/A	2 m
Maximum Seabed Disturbance corridor width	N/A	25 m
Maximum Number of Circuits (HVAC)	N/A	12
Export Cable within the OCAS		
Maximum Cable voltage	275 kV	N/A
Maximum Cable Diameter (not including protection sleeve)	400 mm	N/A
Maximum Length of Cable	30 km	N/A
Maximum Number of Cable trenches	2	N/A
Maximum Trench Width (excluding jetting)	10 m	N/A
Maximum Trench Width (jetting)	7 m	N/A
Maximum Cable Burial Depth	2 m	N/A
Maximum Seabed Disturbance corridor width	25 m	N/A
Maximum Number of Circuits (HVAC)	2	N/A

Offshore Cable Installation

Overview

3.5.10.11 Following boulder clearance (where required) (see Section 3.5.3) Offshore Cables will be installed.

The installation of Offshore Cables includes a range of methods for Array Cables and Export Cables.

The installation will involve either:

- Burial of the cables below the seabed using a combination of ploughing, jet trenching, and mechanical cutting techniques, depending on the seabed conditions; or

- Surface laying the cables with stabilisation.

3.5.10.12 These methods will ensure that the cables are securely installed and protected from external factors. The final choice of burial or surface laid techniques will be subject to a review of the seabed conditions and the CBRA. It is likely that more than one method of installation will be used. This section outlines the parameters of the cable burial techniques retained in the PDE with an overview of the technique, followed by the parameters for surface laid cables.

3.5.10.13 The Offshore Cables will be produced by a specialised manufacturer. Once ready, the cables will be wound onto carousels on either a transport vessel or directly onto the installation vessel at a nearby port. If a transport vessel is used, the cables will be transferred to the installation vessel at a local port before heading to the Offshore Project Boundary.

3.5.10.14 No crossings between the Offshore Cables and any third-party infrastructure assets have been identified.

Cable Burial Techniques

3.5.10.15 A summary of each installation technique is provided below and **Table 3-16** outlines the assessment assumptions for cable burial techniques.

Ploughing

3.5.10.16 Ploughing involves cutting through the seabed with a blade, with the cable being laid behind it or in a separate cable laying operation. Ploughs are typically towed by a surface vessel or mounted onto a self-propelled tracked vehicle that runs along the seabed.

3.5.10.17 Ploughing may result in the cable being buried or it might result in boulders/rocks being cleared (or partially cleared) and the cable then be installed on the surface. The cables may require a cable protection sleeve (CPS) and/or to be "pinned" in place once laid to prevent movement of the cable. If pinning is required this will be achieved by using rock berms, concrete mattresses or rock bags in the Array Area and rock berms only in the OCAS. The measures may be required at intervals ranging from 5-15 m across the site.

3.5.10.18 Details of cable protection parameters are included in **Table 3-16**.

Jet Trenching

3.5.10.19 Jet trenching is generally used in areas where the seabed consists of softer sediments and involves directing high-pressure water jets towards the seabed to fluidise and displace the sediment, forming a trench into which the cable settles under its own weight. The water jets are usually deployed on jetting arms beneath a remotely operated vehicle (ROV) system that can be free-swimming or based on passive skids or active tracks.

3.5.10.20 Cable protection (including pinning) may be used in areas where minimum burial depth is unlikely to be maintained. Details of cable protection parameters (including pinning) are included in **Table 3-16**.

Mechanical Cutting

3.5.10.21 Outputs from CBRA will determine use of cable installation techniques, but it is considered that as a minimum this technique will be required in the nearshore areas where rock outcrops are present. Rock and mechanical cutters may be required to facilitate the installation of subsea cables. These specialised cutting tools are designed to handle the challenging conditions posed by hard substrates, ensuring a clear path for the cable.

3.5.10.22 The cutting process involves the deployment of the mechanical cutter from a support vessel. The cutter is guided along the predetermined route, using precise control systems to navigate and cut through the rock. This method ensures that the cable can be laid at the required depth and alignment, even in the presence of hard substrates.

3.5.10.23 Boulder clearance and cable protection will not be required in areas of mechanical cutting.

3.5.10.24 A description of cable protection (including pinning) and associated parameters for the project are provided below and in **Table 3-16**.

Surface Lay Technique

3.5.10.25 This technique involves laying cables on the seabed without burial. It is typically employed in areas where seabed conditions are unsuitable for jet trenching, mechanical cutting or ploughing **Table 3-16** outlines the assessment assumptions for the surface lay technique. Surface lay can be achieved either by the method outlined in ploughing (paragraph 3.5.10.17) and/or by creating a flat surface (man-made mattress/gravel bed) that the cable lays on top of and/or by having a CPS.

3.5.10.26 Boulder clearance prior to cable installation is outlined in Section 3.5.3. Where cables are surface laid it is possible that rather than clear boulders, a pre-lay rock carpet may be required. This will comprise of a mattress or carpet made of rock or other inert material laid on the seabed along the route of the cable before the cable is installed.

3.5.10.27 The CBRA will inform the approach to be taken and this may include combination of boulder clearance and pre-lay rock carpet. Parameters for boulder clearance are provided in **Table 3-2** and parameters for pre-lay rock carpet are included in **Table 3-16**.

3.5.10.28 Following boulder clearance and/or installation of a pre-lay rock carpet a cable laying vessel will position itself at the starting point then gradually deploy cable from the vessel, moving along the predetermined path, laying cable onto the prepared seabed.

3.5.10.29 To ensure stability, surface-laid cables may require intermittent stabilisation to “pin” the cables in place and prevent movement. This will be achieved by using rock berms or rock bags in the Array Area and rock berms only in the OCAS. The measures may be required at intervals ranging from 5-15 m across the site. There may also be a requirement for CPS.

3.5.10.30 The installation technique and the type of cable laying vessel that will be used to lay the Offshore Cables has not been selected at this stage. Therefore, the maximum design envelope considers the use of anchors during cable laying activities.

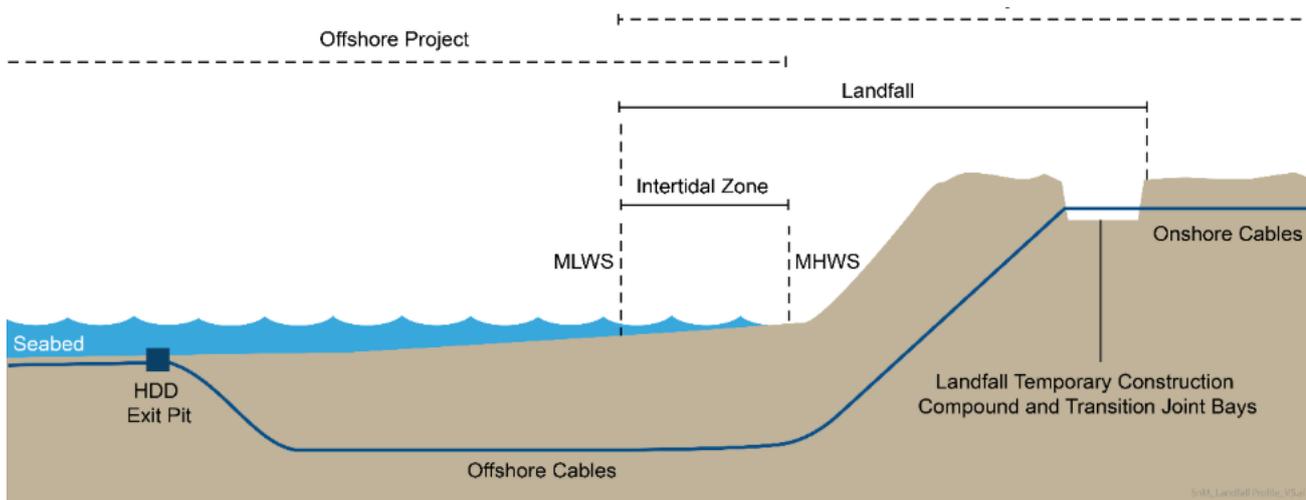
Table 3-16: Offshore Cable Installation and External Cable Protection Parameters

Parameter	Maximum Design Parameter		
Buried Cable Installation			
Installation technique	Ploughing	Jet Trenching	Mechanical Cutting
Maximum corridor width	10 m	7 m	2 m
Maximum burial depth	2 m		
Minimum burial depth	0.2 m		
Surface Laid Cable Installation			
Maximum % all cables to be surface laid cable	100%		
Pre lay carpet material	containing rock or other inert material		
Maximum width of pre lay carpet	5 m		
Maximum height pre lay carpet	0.3 m		
Maximum volume of pre lay carpet	1,130,000m ³		
Cable Protection (includes material used to “pin” cables in place)	Buried Cable Installation	Surface Laid Cable Installation	
Type of protection material	Inert material placement or CPS		
CPS material	Inert material such as polyurethane, steel, aluminium, hybrid materials		
Cable protection placement material	Rock berm, rock bags, concrete mattress or other inert material		
Maximum width of cable protection	3 m	3 m	
Maximum height of cable protection (including pre lay carpet)	0.5	1.1 m	
Maximum percentage of cables requiring cable protection	10%	100%	
Maximum cable protection volume (excluding pre lay carpet)	25,688 m ³	2,600,000 m ³	
Maximum total volume of material on seabed (carpet and protection)	25,688 m ³	3,730,000 m ³	
Offshore Cable laying anchorage			
Anchorage system	6-point mooring system with 3 m ² anchors		
Maximum number of anchor deployments	Deployed every 500 m of cable (700 total)		
Maximum anchor footprint	126,000 m ²		

3.5.11 OFFSHORE LANDFALL AREA

3.5.11.1 The Offshore Landfall Area refers to the landfall area below Mean High Water Springs (MHWS) within the OCAS that includes works associated with the Horizontal Directional Drill (HDD) installation, including HDD exit pit(s) (located below MLWS) and offshore cable connection to the onshore (TJB) which is located above MHWS and out to the Offshore Project Boundary shown in **Plate 3-8**. The Landfall Exit Pit Area refers to the location where the HDD exit pits are located. The onshore landfall area is described in Section 3.6.2. Section 3.2 outlines the infrastructure that is contained in the Offshore Project and this includes the landfall below MLWS.

Plate 3-8: Indicative Landfall Profile



3.5.11.2 The landfall is located at a coastal cliff, and therefore a trenchless solution (HDD) is required (see **Figure 3.1b: Offshore Project and Landfall, Volume 1b**). This trenchless solution avoids interaction with surface features and is used to install ducts through which cables can be pulled. All infrastructure and activities above MLWS will be considered as part of the EIAR for the OTW Project.

Design

3.5.11.3 Section 3.3.2 highlights that there are 2 offshore electrical infrastructure Scenarios included in the design envelope which means that there are two scenarios for Offshore Cables and Landfall arrangements, see Section 3.5.10 for further detail.

3.5.11.4 **Table 3-17** outlines the Offshore Cable (Export Cable and Array Cable to Landfall) assumptions considered and the parameters associated with the cables that will be brought ashore at Landfall.

Table 3-17: Offshore Cable Landfall Parameters and Assumptions

Parameter	Scenario 1 (OSP)	Scenario 2 (Landfall Substation)
Offshore Cable	Export Cable	Array Cable to Landfall
Maximum number of cables	2	12
Maximum number of bores	3	13
Maximum number of exit pits required	3	13
Exit pit dimensions	75 m length x 5 m width x 3.5 m depth	75 m length x 5 m width x 3.5 m depth
Maximum volume of sediment excavated per exit pit	1,312.5 m ³	1,312.5 m ³
Maximum total volume of sediment excavated from all exit pits	3,937.5 m ³	17,062.5 m ³
Maximum volume of bore	1,285 m ³ (per bore)	
Water usage	3,000 litres (per bore)	
Duct depth	0 m - 40 m	
Approximate duration of Landfall works	8 months	31 months
Approximate duration of drilling per duct	3 - 6 weeks	
Approximate duration of total drilling per scenario	9 - 18 weeks	39 - 78 weeks
Working hours	24 hour working, 7 days a week	

Installation

- 3.5.11.5 The trenchless installation (HDD) operations will be undertaken to install the cable ducts required to accommodate the cables associated with the Offshore Project. HDD will involve drilling along a pathway from the Landfall above MLWS (not part of this EIAR) to the HDD Exit Pits, avoiding the need to use an open trenching method of cable installation.
- 3.5.11.6 The HDD operations below MHWS and the exit pits form part of the PDE for this EIAR. The HDD operations design envelope for each Scenario is described in **Table 3-17**. The HDD will be pulled under the seabed from MHWS to the landfall exit pit area and located at a depth of approximately 10 - 40 m below the seabed. The Landfall Exit Pit Area is located approximately 500 - 1,500 m offshore, in water depths of 15 - 27 m MSL (13.5 - 24.7 m LAT), thereby avoiding disturbance of the intertidal zone entirely. The landfall exit pit area is shown on **Figure 3.1c, Volume 1b**.
- 3.5.11.7 The final location of the HDD Exit Pits will be determined post-consent, following pre-construction surveys, detailed design, and offshore vessel considerations. A detailed construction plan for the

HDD work will be produced for agreement with the appropriate regulatory authorities prior to work commencement.

Preparation of offshore exit pits

3.5.11.8 The offshore HDD Exit Pits will be prepared by rock cutting and/or grinding to the required depth by an appropriate vessel. To ensure an appropriate slope for the HDD Exit Pit is achieved, the installation of a gravel bed may be required. Side-cast material for backfilling will be stored adjacent to the HDD Exit Pit. The HDD Exit Pits are expected to be at approximately 15 - 27 m MSL (13.5 - 24.7 m LAT). The exit pit design parameters for each Scenario considered are described in **Table 3-17**.

3.5.11.9 Vessels will be stationed at the exit pit while each HDD exit pit is completed and each duct installed. The number and types of vessels to be used for landfall installation are included in Section 3.8.

Horizontal Directional Drilling Operations

3.5.11.10 The HDD operations will involve a staged process:

- A small diameter pilot hole will be drilled from the TJB to exit pits;
- The borehole will be enlarged through reaming;
- The cable duct will be pulled through the borehole;
- The Array Cables to Landfall or the Export Cable will be pulled through the duct.

3.5.11.11 Up to 2 HDD operations may be undertaken concurrently however works will be managed so that only 1 punch out activity (where the drill bit emerges from the seabed) is undertaken at once, allowing for drilling fluid to disperse prior to a second break out activity being undertaken.

3.5.11.12 Further explanation of the key stages is outlined below.

Reaming

3.5.11.13 Reaming operations will be carried out to enlarge the pilot hole to a size that is suitable for the cable duct. Depending on the cable duct size, multiple reaming operations may be necessary to reach the desired size as each progressively enlarges the hole. During the reaming operations, the hole will be progressed to punch out the HDD Exit Pit on the seabed.

3.5.11.14 During HDD operations, drilling fluid typically formed of water mixed with Bentonite (a non-toxic, inert natural clay) is used to stabilise the borehole, recover drill cuttings, and ensure the borehole does not collapse during creation of the pilot hole and reaming. The drilling fluid will be released into the environment at the exit pit break through, with the volume of suspended cuttings varying dependent upon drilling fluid density. Measures for managing the release of drilling fluid during the exit pit punch out activity (and subsequent duct and Offshore Cable pull-in activities) will limit the volume of drilling fluid released.

3.5.11.15 The chemical content of the drilling fluid will ensure that the composition of the fluid discharged is chemically inert. Drill cuttings (rock and soil fragments generated during the boring process) will be transported from the drill face through the annular space and re-circulated to the drilling rig(s) where it will be released into the marine environment, appropriately managed in accordance with relevant regulations (i.e. all drilling fluids are biodegradable, certified to relevant environmental standards - Centre for Environment, Fisheries and Aquaculture Science (Cefas) registered, and is on the Oslo/Paris convention "List of Substances Used and Discharged Offshore which are considered to Pose Little or No Risk to the Environment) and Marine Licence conditions. Further information regarding how this activity has been assessed and will be undertaken is in provided in **Chapter 9, Volume 2a** and **Chapter 10, Volume 2a**.

Duct Installation and Cable Pull-in

3.5.11.16 Following reaming operations, a cable duct (positioned offshore either on the seabed or on the sea surface) will be pulled into the hole by a drilling rig(s). Once the duct is installed, both ends of the duct will be capped (or plugged) until the Offshore Cables are ready to be installed.

3.5.11.17 The array to landfall cables or export cables (if an OSP is required) will be pulled through the installed ducts by winching equipment stationed onshore in the Landfall above MHWS. A cable lay barge will be stationed at the seaward end of the duct during the cable pulling activities. The seaward duct will be raised onto the vessel. The cable will be attached to a messenger wire and pulled through the duct.

3.5.11.18 Once in situ the cables will undergo final testing and commissioning.

Jointing and Commissioning

3.5.11.19 The Offshore Cable will be joined to the Onshore Cable within the TJB. The TJB provides a clean, dry environment where the Onshore and Offshore Cables are jointed, and to protect the joints once completed. Depending on the offshore cable configuration either 2, 6, or 12 pits will be dug into the ground and lined with concrete (see **Table 3-17**). Once the joint is completed, the TJBs are covered, and the land above reinstated.

3.5.12 INSTALLATION VESSELS AND HELICOPTERS

3.5.12.1 A number of installation vessels will be used during the construction phase and helicopters may also be used for crew transfers. The number of vessels and helicopters and their associated movements during the construction phase are presented in **Table 3-18** constitute the PDE, and it is anticipated that vessel and helicopter numbers will be less than those presented once the final design is confirmed.

3.5.12.2 The components of the Offshore Project are assumed to be mainly fabricated off-site, stored at a suitable port facility, and transported directly to the Offshore Project Boundary as required during construction.

Table 3-18: Maximum Parameters for Vessel and Helicopter Movements during Construction Phase

Parameter	Maximum Installation Vessel Number on Site at any One Time	Maximum Installation Vessel Movements (Return Trips) (per year)
Main Installation and Support Vessels		
WTG installation vessel	1	12-15 trips
Jacket installation vessel	1	2 trips
Drilling vessels	2	4 trips
Grout vessel and Pile Supply vessel	2	60-80 trips
Barges	2	50-80 trips
Pile install vessel	1	20-60 trips
Cable Lay Installation & Support Vessels	9	100 trips
Other vessels		
Tug/Anchor Handlers	2	60-180 trips
Guard Vessels	2	12-25 trips
Seabed preparation vessels for boulder removal, grapnel, pre-sweep/levelling	6	12-25 trips
Crew Transfer Vessels	3	250 trips
Scour Protection Installation Vessels	2	12-25 trips
Cable Protection Installation Vessels	2	12-25 trips
Helicopters	1	50 trips
Total (excluding helicopters)	35	871

3.5.13 SAFETY ZONES

3.5.13.1 During construction, safety zones of 500 m radius will be sought around each WTG, depending on activity, will be sought for the installation/construction of all offshore infrastructure during the construction phase. This will include, but not be limited to, the installation of the WTGs, the OSP (if required) as well as their associated foundations. If multiple construction activities are taking place at the same time separate safety zones will be sought for each activity.

3.5.13.2 Before any commissioning activities, a safety zone with a radius of 50 m will be established around each constructed WTG or OSP (if required), and their associated foundation structures. This measure ensures the safety of personnel and equipment during the final stages of construction. Further details will be provided in the Spiorad na Mara Safety Zone Statement which will be submitted post Consent.

3.5.13.3 An **Outline Navigational Safety and Vessel Management Plan, Volume 3** has been submitted as part of the Application. It will be updated post-Consent as more information becomes available and will be agreed upon with relevant stakeholders prior to construction.

3.6 ONSHORE TRANSMISSION WORKS PROJECT

3.6.1.1 This section provides details of the components of the OTW Project (see **Figure 3.1a, Volume 1b** and **Figure 3.2c, Volume 1b**). As noted in Section 3, the design of the OTW is not as advanced as the Offshore Project therefore it is not possible to provide a detailed description of the works. A summary of the key onshore components is however provided below.

3.6.2 ONSHORE LANDFALL AREA

3.6.2.1 The Landfall above MLWS will comprise of HDD Entry Pits, on the landward side of a coastal cliff at Barvas/*Barabhas* to house the HDD equipment necessary for drilling the ducts that connect to the offshore exit pits. This will be either up to 3 HDD entry points (for Scenario 1) or up to 13 HDD entry points (for Scenario 2). See Section 3.3.2 for further information on the optionality retained in respect of the Project's electrical transmission infrastructure.

3.6.2.2 The TJBs, which are underground concrete chambers, will be used to house the connection point of the Export Cables (Scenario 1) or Array Cables to Landfall (Scenario 2) to the Onshore Cables.

3.6.2.3 An onshore temporary construction HDD compound (approximately 465 m x 480 m) will be established. This compound will include storage for materials and equipment, facilities for personnel, and areas for temporary construction activities. An access road will be constructed to connect to the A857 and access along the Barvas/*Barabhas* Cemetery road may be required for a short period of time to avoid key bird breeding season.

3.6.2.4 The temporary compound and access will be in place from the start of construction through to completion of final cable testing activities.

3.6.2.5 All of the permanent works will be underground, however O&M access will be retained in the area throughout the Project's lifetime.

3.6.3 ENERGY TRANSMISSION INFRASTRUCTURE

3.6.3.1 The onshore energy transmission infrastructure consists of infrastructure required to transfer the power from Landfall to the SSEN Lewis Hub and will include 23-27 km of Onshore Cables crossing the Isle of Lewis/*Eilean Leòdhais*. These will be either of 2 scenarios:

Scenario 1

3.6.3.2 Comprising of up to 2 circuits of buried Onshore Cables connecting the TJBs to the Grid Substation northwest of Loch Cnoc a' Choilich; or

Scenario 2

3.6.3.3 Comprising of:

- Up to 12 circuits of buried Onshore Cables will connect from the TJBs to the Landfall Substation located near Barvas/*Barabhas*;

- A Landfall Substation with a platform of approximately 150m x 150 m and consists of 2 main buildings with a maximum height of 15 m to the apex of the tallest roof, plus several other, smaller buildings housing electrical and other equipment. Safety features such as lightning masts and access paths/roads will also be included. The construction timeline is expected to be approximately 36 months;
- A permanent road access to the substation from A857 will be constructed and this will form the cable route haul road and most of the access route to the Landfall for this scenario;
- From the Landfall Substation, up to 2 circuits of Onshore Cables will connect to the Grid Substation northwest of Loch Cnoc a' Choilich.

Onshore Cables

- 3.6.3.4 From landfall TJBs or Onshore Landfall Substation, 2 cable circuits (up to 275kV each) will connect to the Grid Substation. From the Grid Substation, 2 cable circuits (400kV each) will connect to SSEN Lewis Hub. See paragraph 3.6.3.10.
- 3.6.3.5 Joint bays and link boxes will be positioned every 500-1,500 m along the route to safely connect the cable sections together, these will be contained within underground concrete chambers.
- 3.6.3.6 The Onshore Cables will be buried, and it is anticipated that open cut trenching will be the primary installation method, however 12 locations have been identified within the route where trenchless crossing installations are anticipated to be required for crossings of roads, utilities and major watercourses. The length of the trenchless sections is anticipated to range from 125-600 m, subject to detailed crossing designs and following further engagement with landowners/stakeholders.
- 3.6.3.7 A haul road will be built to enable construction of the Onshore Cables. This road will be either removed and the land re-instated or transformed into a multi-use pathway post construction of the Onshore Cables.
- 3.6.3.8 Access to the construction haul road will be from bell-mouth junctions created from existing main roads, or from spurs created from proposed tracks associated with other developments (for example, the Stornoway Wind Farm). These will be located within the Onshore Cable Corridor boundary.
- 3.6.3.9 Where there is no suitable road access into the Onshore Cable Corridor between the River Laxdale and Abhainn a Ghlinne Dhuibh, upgrades will be required to existing residential roads and moorland tracks to create a running surface of suitable width (indicatively 15 m wide, however the actual width required will be <10 m) and turning radii for construction traffic.

Grid Substation

- 3.6.3.10 A Grid Substation will be constructed northwest of Loch Cnoc a' Choilich to increase the voltage to meet onward transmission requirements and enable it to connect to the grid connection point at the planned new SSEN Lewis Hub. The Grid Substation will consist of up to 6 buildings in total, with a maximum height of 20 m to the apex of the tallest roof, plus a number of other, smaller buildings

housing electrical and other equipment. Within the site compound, there will also be safety features such as lightning masts and access paths/roads. The construction timeline is expected to be approximately 36 months.

3.6.3.11 The substation will be accessed by a permanent road which will be built to the north-east of Loch Cnoc a' Choilich.

3.6.4 PEAT AND HABITAT RESTORATION WORKS

3.6.4.1 The peat and habitat restoration works, across all Energy Transmission Infrastructure, will be developed and covered under the onshore application.

3.7 CONSTRUCTION PROGRAMME AND SEQUENCING

3.7.1 OVERVIEW

3.7.1.1 An indicative construction programme for the Offshore Project is presented in **Table 3-19**. The programme illustrates the anticipated duration of the major construction/installation elements. The anticipated worst-case total construction duration is 5 years, during which construction works offshore and onshore would overlap.

3.7.1.2 It is anticipated that offshore construction works could commence in 2028/29. This approach ensures that construction activities are aligned with favourable weather conditions and minimises disruptions to the local marine environment. The final construction schedule will be determined by the Applicant based on a range of commercial and technical factors. An overview of the construction sequencing is outlined for the offshore works in Section 3.7.2 and the onshore works in Section 3.7.3.

3.7.1.3 Commissioning is the process during the construction stage of assuring that all systems and components of the Project are designed, installed, tested according to the requirements to enable safe operation. This will enable the Project to be connected to the National Grid network and handed over to the team responsible for its operation.

3.7.2 OFFSHORE PROJECT

3.7.2.1 An indication of offshore construction sequencing is provided below. Note that some of these activities would run in parallel and the precise timings are yet to be defined.

- Pre-construction surveys and site investigations, as required;
- Site preparation, foundation and substructure installation;
- OSP installation/commissioning (if required);
- Array and Export Cable installation – landfall and offshore;
- WTG installation/commissioning.

3.7.2.2 Detailed sequencing of Landfall works will be undertaken following detailed design, however it is expected to follow the approach set out below, noting that some onshore and offshore activities may be undertaken simultaneously:

- Onshore and Offshore site preparation;
- Construction of site access and Landfall TCC;
- Construction of TJBs;
- Preparation of HDD exit pits;
- Onshore and Offshore HDD operations;
- Offshore Cable pull-in through duct;
- Capping and burial of HDD duct end;
- Installation of and jointing in TJB;
- Backfill and reinstatement works.

3.7.2.3 A 5-year construction period is anticipated for offshore infrastructure, with work programmed within the Turbine Area between April and October to allow for optimal weather conditions. Construction is anticipated to commence in 2028/2029 with an estimated completion in 2032/2033, with working hours expected to be 24 hours, 7 days a week during the construction period. A provisional programme is provided in **Table 3-19**.

3.7.2.4 The total number of construction employees required for the Project has been estimated at an average of approximately 750 to 1,000 personnel. Estimated workforce for the Offshore Project is approximately 400 personnel.

Table 3-19: Indicative Construction Programme

Activity	Year 1				Year 2				Year 3				Year 4				Year 5			
	Q1	Q2	Q3	Q4																
Site Preparation		■	■			■	■			■	■									
Foundation Installation						■	■			■	■									
WTG and OSP (if required) Installation											■			■	■				■	■
Offshore Cable Installation										■	■			■	■					
Landfall HDD installation							■	■	■	■	■	■	■	■						
OTW Project Construction	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■



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3.7.3 OTW PROJECT

- 3.7.3.1 As the design of the OTW is not as advanced as the Offshore Project it is not possible to provide a detailed construction programme at this stage.
- 3.7.3.2 The total anticipated construction period for each onshore substation is around 36 months and the total expected duration of construction works relating to the cable route is 2-3 years. It is anticipated that the OTW Project construction will take up to 5 years.

3.8 OPERATION AND MAINTENANCE

3.8.1 INTRODUCTION

- 3.8.1.1 After commissioning, the operational lifetime of the Offshore Project is expected to be 35 years. O&M activities can be divided into 2 main categories:
- 3.8.1.2 **Scheduled maintenance:** activities that are carried out on a regular basis based on the manufacturer recommendations for equipment / infrastructure installed, and good practice.
- 3.8.1.3 **Unscheduled maintenance:** activities that may be required to carry out repairs or remedial works to return the infrastructure to serviceable condition.
- 3.8.1.4 The overall O&M strategy will be finalised once the O&M base location and technical specifications of the infrastructure (i.e. WTGs, cable option chosen) are known. Therefore, the Applicant has drawn on previous project experience from the O&M of other OWFs. This includes identifying potential synergies when developing the O&M strategy for the Offshore Project.
- 3.8.1.5 A key principle is that the Offshore Project will be designed to operate under minimum supervisory input. The chosen O&M concept will depend upon:
- The required O&M tasks determined by the operator and/or agreed with the main equipment suppliers to maintain operability and availability of the wind farm;
 - Health, safety, security and environmental (HSSE) legislation and best practice;
 - Requirements or constraints imposed by public authorities or other authorities;
 - Site specific weather and metocean conditions;
 - Industry best practice;
 - Optimum economic viability.
- 3.8.1.6 The EIA is based on reasonably foreseeable activities during O&M. O&M activities will take account of general practices as described in the **Outline Operation and Maintenance Plan, Volume 3**. Subsequent sections of this chapter provide further information regarding the anticipated O&M activities for the Offshore Project.

3.8.2 OFFSHORE OPERATION AND MAINTENANCE

- 3.8.2.1 The overall O&M strategy will be finalised once the Offshore Project design is finalised and a location for the onshore O&M base has been confirmed. Options for the O&M base are currently being considered, and work has already been undertaken to assess Scottish port capabilities to understand the viability of options available to meet the Offshore Project's requirements. This section, therefore, outlines the reasonably foreseeable scheduled and unscheduled maintenance activities for the Project (see **Table 3-20**).
- 3.8.2.2 All offshore infrastructure, including WTGs, foundations, cables and any required OSP and their ancillary infrastructure will be included in monitoring and maintenance programmes. O&M activities may be required at any time during the lifecycle of the Offshore Project.
- 3.8.2.3 Vessels will be required for the ongoing O&M of the Offshore Project. The PDE for vessel requirements are outlined in **Table 3-20**.
- 3.8.2.4 The total number of operational employees required for the Project has been estimated at an average of approximately 80-120 personnel.

Table 3-20: Project Design Envelope for Operation and Maintenance Activities

Component	Parameter	Description	Expected Frequency	
			Scenario 1 (OSP)	Scenario 2 (Onshore Landfall Substation)
Foundations (WTGs)	Scheduled Inspections	Inspections of foundations, including Transition Piece and ancillary structures (e.g. J-tubes), above and below sea level.	Up to 35 main scheduled inspection and maintenance visits per turbine across the Offshore Project's lifetime. To include topside and subsea inspection.	
	Site investigation surveys	Survey of seabed and assets.	As dictated by seabed mobility risks and design of foundations. These can be undertaken every 1-3 years. There may be extra surveys to support jack-up deployment or cable health monitoring.	
	Repairs and replacements of navigational equipment	Repairs and replacements of electrical equipment such as lighting, fog horns, navigation lights and transponders.	As required up to 10 times per year per turbine.	
	Removal of marine growth	Removal of marine growth from foundations, transition pieces, or access ladders.	As required annually per turbine.	
	Replacement of corrosion protection anodes	Remove and replace anodes required for corrosion protection.	As required every 5 years.	
	Painting	Application of paint or other coatings to protect the foundations from corrosion (internal/external), including surface preparation.	As required annually per turbine.	
	Replacement of access ladders and boat landings	Removal and replacement of ancillary structures (e.g. access ladders and boat landings).	As required throughout Offshore Project lifetime.	

Component	Parameter	Description	Expected Frequency	
			Scenario 1 (OSP)	Scenario 2 (Onshore Landfall Substation)
	Modifications to/replacement of J-tubes	Modifications to/ replacement of J-tubes e.g. during Offshore Cable repair works.	As required throughout Offshore Project lifetime.	
WTGs	Scheduled inspections	Inspections within the WTG/on the exterior of the WTG, e.g. blade inspections.	Up to 35 main scheduled inspection and maintenance visits per turbine across the Offshore Project lifetime.	
	Replacement of consumables	Replacement of consumables within the WTG (e.g. filters, oils, lubricants).	Up to 35 replacements per turbine undertaken during main scheduled inspection and maintenance visits.	
	Minor repairs and replacements within the WTG	Minor repairs and replacements (like-for-like) within the turbine e.g. motors, pumps, small electric equipment, circuit breakers, fuses.	Up to 10 times per year per turbine.	
	Major component replacement	Replacement of blades, gearboxes, transformers or generators.	Up to 3 replacements per turbine across the Offshore Project lifetime.	
	Painting or other coatings	Paint or other coatings applied (internal/external). Coatings on the blades and minor paint repairs to tower and nacelle.	As required annually per turbine.	
Foundations (OSP)	Removal of marine growth	Removal of marine growth from foundations or access ladders.	N/A	As required annually for the OSP.
	Replacement of corrosion protection anodes	Remove and replace anodes required for corrosion protection.	N/A	As required every 5 years.
	Painting	Application of paint or other coatings to protect the foundations from corrosion (internal/external), including surface preparation.	N/A	As required annual for the OSP.

Component	Parameter	Description	Expected Frequency	
			Scenario 1 (OSP)	Scenario 2 (Onshore Landfall Substation)
	Replacement of access ladders and boat landings	Removal and replacement of ancillary structures (e.g. access ladders and boat landings).	N/A	As required throughout Offshore Project lifetime.
	Modifications to/replacement of J-tubes	Modifications to/ replacement of J-tubes e.g. during Array or Export Cable repair works.	N/A	As required throughout Offshore Project lifetime.
OSP	Scheduled inspections	Inspections within the OSP/on the exterior of the OSP.	N/A	Up to 70 main scheduled inspection and maintenance visits across the Offshore Project lifetime. Up to 350 smaller scheduled inspections visits across the Offshore Project lifetime.
	Replacement of consumables and minor components.	Replacement of consumables (e.g., oils, lubricants) and minor components within the OSP.	N/A	Up to 70 undertaken during main scheduled inspection and maintenance visits.
	Major component replacement	Replacement of transformers, switchgear etc.	N/A	Up to 3 times across Offshore Project lifetime.
	Painting or other coatings	Paint or other coatings applied (internal/external).	N/A	As required annually for the OSP.
Offshore Cables (Array and Export)	Routine inspections	Inspections of the cable and any cable protection, including at their entry into J-tubes on offshore structures.	Up to 1 scheduled inspection visit per year.	
	Site investigation surveys	Survey of sea bed and cable protection (if present).	Up to once per year.	

Component	Parameter	Description	Expected Frequency	
			Scenario 1 (OSP)	Scenario 2 (Onshore Landfall Substation)
	Offshore Cable repair	Repair and replacement of Offshore Cable section/whole Offshore Cable.	Up to 6 times across Offshore Project lifetime.	Up to 9 times across Offshore Project lifetime.
	Offshore Cable remediation	Reburial/protection replacement of exposed Offshore Cable section.	Up to 6 times across Offshore Project lifetime.	

Table 3-21: Project Design Envelope for Vessel Activities Operation and Maintenance (O&M)

Aspect	Parameter	Maximum Design Envelope
Vessel numbers (maximum on site at any one time)	Crew Transfer Vessel / Workboats	3
	Jack-up Vessels	1
	Cable repair vessels	1
	Other vessels	4
	Excavators or backhoe dredger	1
	Helicopters	1
Total O&M Vessel Movements (Return Trips) (Total for lifetime of Offshore Project)	Crew Transfer Vessel / Workboats	31,850 movements
	Jack-up Vessels	140 movements
	Cable repair vessels	12 movements
	Other vessels	20 movements
	Excavators or backhoe dredger	12 movements
	Helicopters	70 movements
	Total (excluding helicopters)	32,034 movements
Fuel consumption during the O&M phase		CTVs typically use 500-800 litres per day SOVs typically use between 5,000-8,000 litres per day

3.8.3 ONSHORE OPERATIONS AND MAINTENANCE

- 3.8.3.1 As the design of the OTW is not as advanced as the Offshore Project it is not possible to provide a detailed description of onshore operations and maintenance proposals.
- 3.8.3.2 At this stage it is known that the infrastructure associated with the OTW will be present for the duration of the operational life of the Offshore Project. In terms of maintenance of the Onshore Cables, there will be joint bays every 500-1,500m along the cable route, allowing for long-term access for the purposes of maintenance and/or repair work if required. It is anticipated that maintenance visits will be required once every 3 years and the Project may use sensors within the Onshore Cables to monitor the health and performance.
- 3.8.3.3 The Landfall Substation (if required) will not be manned during operation and workers will only be at the substation during periods of scheduled or unplanned maintenance. For the Grid Substation, there will be a small number of workers on site during normal working hours.

3.9 DECOMMISSIONING

3.9.1 OFFSHORE DECOMMISSIONING

- 3.9.1.1 At the end of the operational lifetime of the Offshore Project, it is anticipated that all structures above the seabed will be removed. However, components of the Offshore Project may be left in-situ to avoid unnecessarily disturbing the seabed (i.e. where marine habitat has formed). This could

include scour protection associated with the WTG foundations and sections of the Offshore Cable. The potential for infrastructure to remain in-situ will be confirmed through consultation on the Decommissioning Programme to ensure the most suitable approach is taken. At this stage it is unconfirmed which components (if any) would remain in-situ.

- 3.9.1.2 The decommissioning sequence will generally be the reverse of the construction sequence and involve similar types and numbers of vessels and equipment. The decommissioning duration is anticipated to take a similar amount of time as the construction of the Offshore Project, although this indicative timing may reduce. Subsequent sections of this Chapter provide further information regarding the anticipated decommissioning activities for the Offshore Project, see **Table 3-22**.
- 3.9.1.3 The Energy Act (2004) and the Scotland Act (2016) contain statutory requirements in relation to the decommissioning of offshore renewable energy installations (OREI) and require the Offshore Project to provide a Decommissioning Programme, supported by appropriate financial security, prior to construction. The Decommissioning Programme will follow the relevant guidance in place at the time of decommissioning, at present this would include Marine Directorate (2022) Offshore Renewable Energy Installation decommissioning guidance for Scottish Waters Guidance Notes (Scottish Government) or in the Decommissioning of Offshore Renewable Energy Installations in the Scottish part of the Renewable Energy Zone, under The Energy Act 2004: Guidance notes for industry (in Scotland). Decommissioning activities will comply with all relevant legislation and guidance at that time.
- 3.9.1.4 The Decommissioning Programme will be reviewed and updated in line with relevant legislation and guidance at the time. Consultee bodies listed in the S55 Notices, and any additional consultees identified by Marine Directorate - Licensing Operations Team (MD-LOT) or the Applicant, will be provided with the opportunity to comment on the final decommissioning strategy.
- 3.9.1.5 Scottish Government's Decommissioning of Offshore Renewable Energy Installations in Scottish Waters expects that all relevant objects would be fully removed at the end of their operational life. The Scottish Ministers will consider exemptions on the presentation of compelling evidence that removal would create unacceptable risks to personnel or the marine environment, be technically unfeasible or involve extreme costs. The preferred decommissioning option would be as close to full removal as possible, whilst recognising that this would be subject to assessments and consultation closer to the time of decommissioning. Decommissioning activities would also need to comply with all relevant legislation and best practice at the time of decommissioning. The Decommissioning Programme will be developed and consulted on prior to it being finalised and it is anticipated that the final revision process will commence two years prior to the initiation of decommissioning activities. The potential offshore decommissioning processes are described below in **Table 3-22**.

Table 3-22: Likely Decommissioning Process

Element of the Offshore Project	Decommissioning process
Top side and WTG	WTGs will be removed by reversing the methods used to install them (as appropriate, it is assumed no drilling will be required).
Foundations	Jackets removed and piles cut 1 m below seabed level and sections above removed. Removal of entire pile likely to result in disproportionate environmental impacts however this will need to be confirmed through consultation on the Decommissioning Programme to ensure most suitable approach is taken. Scour protection may be left in situ to preserve marine habitat that has established over the lifetime of the Offshore Project but this would require confirmation through the Decommissioning Programme.
Scour Protection	The draft decommissioning guidance (Scottish Government, 2019) generally requires the full removal of installations, including scour protection and Offshore Cables. However, it notes that exceptions may be considered on a case-by-case basis, with the justification needing to be included in the decommissioning program, taking into account environmental conditions, risk balance, cost, and technological capabilities at that time. It is proposed that scour protection will be removed where feasible/appropriate, depending on the type and condition of the scour protection at the time of removal. This approach will be reviewed at the time of decommissioning in discussion with stakeholders, following the latest available guidance.
Offshore Cables	This will be discussed with stakeholders and regulators, however sections of cable may be left in situ to avoid unnecessarily disturbing the seabed particularly where marine habitat has formed. This would be confirmed through consultation on the Decommissioning Programme to ensure most suitable approach is taken.
Vessels	Expected to be the same as construction with the exception of the piling installation vessel.
Surveys	Surveys will be undertaken following decommissioning to ensure the Offshore Project is safely and effectively decommissioned and undertaken in accordance with Decommissioning Programme. If any infrastructure is left in situ then this may be monitored, although the requirement will be confirmed with consultees.

3.9.2 ONSHORE DECOMMISSIONING

3.9.2.1 Further details of the decommissioning of the Onshore Transmission Works will be provided in the Onshore Transmission Works Project EIAR.

3.9.3 REPOWERING

3.9.3.1 The anticipated operational lifespan of the Offshore Project is expected to be 35 years. At the end of the O&M phase, the Applicant will undertake an assessment to understand the viability for a design life extension (or repowering) versus decommissioning. If decision is made to extend the design life beyond what has been assessed in the EIAR, the legislation and guidance in place at that



time will be followed by the Applicant in consultation with regulators. Repowering beyond the operational lifespan would be outside the scope of this EIA.

3.10 GLOSSARY OF TERMS AND ABBREVIATIONS

3.10.1.1 A list of key terms and acronyms used in this chapter are provided in **Table 3-23** and **Table 3-24**.

Table 3-23: Acronyms and abbreviations

Term	Definition
CAA	Civil Aviation Authority
CBRA	Cable Burial Risk Assessment
CEA	Cumulative Effects Assessment
CPS	Cable Protection Sleeve
CTV	Crew Transfer Vessel
EIA	Environmental Impact Assessment
EIAR	Environmental Impact Assessment Report
GBS	Gravity base structure
HDD	Horizontal Directional Drilling
HGB	Hybrid gravity base
HVDC	High Voltage Direct Current
HSSE	Health, safety, security and environmental
IALA	International Association of Marine Aids to Navigation and Lighthouse Authorities
JUV	Jack-up vessel
LAT	Lowest Astronomical Tide
m	Metre
MCA	Maritime and Coastguard Agency
MD-LOT	Marine Directorate - Licensing Operations Team
MDS	Maximum Design Scenario
MHWS	Mean High Water Spring
MLWS	Mean Low Water Spring
MSL	Mean Sea Level
NLB	Northern Lighthouse Board
nm	Nautical Mile
nm ²	Square Nautical Mile
NSA	National Scenic Area
OCAS	Offshore Cable Area of Search
OREI	Offshore Renewable Energy Installation
OSP	Offshore Substation Platform
OTW	Onshore Transmission Works
OTWB	Onshore Works Transmission Boundary
OWF	Offshore Wind Farm
PAC	Preliminary Application Consultation
PDE	Project Design Envelope
PLGR	Pre-Lay Grapple Run
ROV	Remotely Operated Vehicle
RPM	Rotation per minute
SCADA	Supervisory Control and Data Acquisition

Term	Definition
SSEN	Scottish and Southern Electricity Networks
TCC	Temporary construction compound
TJB	Transition Joint Bays
UK	United Kingdom
UKHO	United Kingdom Hydrographic Office
UXO	Unexploded Ordnance
WTG	Wind Turbine Generator
WTIV	Wind turbine installation vessel
XLPE	Cross-linked polyethylene
ZOI	Zone of Influence
ZTV	Zone of Theoretical Visibility

Table 3-24: Glossary

Term	Meaning
The Applicant	Spiorad na Mara Limited (the Project owner)
Array Area	The offshore area within which the offshore wind turbine generators (WTGs), associated foundations, Offshore Cables, and Offshore Substation Platform (OSP) (if required), will be located. This area encompasses the Turbine Area that will contain all above water surface infrastructure (WTGs / OSP) and an additional area within which further below water infrastructure (foundations and cables) may also be located.
Array Cables	The offshore electrical and communication cables that connect infrastructure located within the Array Area, for: <ul style="list-style-type: none"> Scenario 1: Array Cables will used to connect Wind Turbine Generators (WTGs) to each other, and to connect WTGs to the OSP. Scenario 2: Array Cables will used to connect WTGs to each other.
Array Cables to Landfall	The offshore electrical and communication cables located in the Array Area and Offshore Cables Area of Search that connect the wind turbine generators (WTGs) directly to Landfall for Scenario 2.
Buried Channel	A buried channel refers to an ancient river or streambed that has been covered by sediment over time and now lies beneath the seabed. These channels are significant in geophysical studies because they can indicate past geological events, composition of seabed strata and influence seabed stability.
Cumulative Effects	Considers the likely significant effects of multiple impacts and activities from several developments.
Effect	Term used to express the consequence of an impact. The significance of an effect is determined by correlating the magnitude of the impact with the importance, or sensitivity, of the receptor or resource in accordance with defined significance criteria
Environmental Impact Assessment Report (EIAR)	The Environmental Impact Assessment Report (EIAR) prepared to assess the likely significant effects of the Project on the environment. Do not use EIA Report within the EIAR.

Term	Meaning
Embedded or 'Designed-in' Mitigation	Mitigation measures to avoid or reduce environmental effects that are directly incorporated into the preferred design for the Project. This can include standard practice in accordance with or without guidance. Embedded mitigation is considered as part of the impact assessment, before effect significance is identified.
Export Cables	The offshore electrical and communication cables located in the Array Area and Offshore Cables Area of Search that connect the Offshore Substation Platform (OSP) (if required) to Landfall for Scenario 1.
Grid Substation	The onshore substation located adjacent to and connecting to the SSEN Lewis Hub. This allows the voltage to be increased to meet onward transmission requirements.
Impact	Change that is caused by an action; for example, foundation installation (action) during construction which results in habitat loss (impact).
Jack-up vessel	A jack-up vessel is a barge with legs that can be raised and lowered to install offshore wind farm components and foundations.
Landfall	This consists of works from offshore Horizontal Directional Drill (HDD) exit pits (located below MLWS) to onshore at the Transition Joint Bays (TJB) (located above MHWS). The infrastructure and installation methods associated with the Landfall involves both onshore and offshore components.
Landfall Exit Pit Area	The offshore area in which all HDD Exit Pits will be located within.
Landfall Substation	The optional onshore substation located on the west side of the Isle of Lewis/ <i>Eilean Leòdhais</i> . Includes the platform, buildings and associated components which allows the voltage to be increased to meet onward transmission requirements.
Lease Area	Legal agreement from the Crown Estate Scotland whereby an option over an area of foreshore or seabed is granted to a developer for an agreed purpose. If required permissions are gained, the developer exercise their rights to enter into a lease. In this case this is the same spatial area as the Array Area.
Maximum Design Scenario	The scenario within the Project Design Envelope with the potential to result in the greatest impact on a particular topic receptor, and therefore the one that should be assessed for that topic receptor. See Chapter 3: Project Description, Volume 1a for detailed description.
Offshore Applications	The application for a marine licence under the Marine (Scotland) Act 2010 (between 0 and 12nm) and a Section 36 consent under the Electricity Act 1989.
Offshore Cables	Electrical and communication cables located within the Array Area and Offshore Cable Area of Search. The Offshore Cables consist of Array Cables, Array Cables to Landfall, and Export Cables.
Offshore Cable Area of Search (OCAS)	The area within which the offshore cable infrastructure between the Array Area and Landfall up to Mean High Water Springs (MHWS) will be located.
Offshore Landfall Area	The area seaward of Mean High Water Springs (MHWS) within the Offshore Cable Area of Search (OCAS) that includes works associated with the Horizontal Directional Drill (HDD) installation, including HDD exit pit(s) (located below MLWS) and offshore cable connection to the onshore (TJB) (located above MHWS).

Term	Meaning
Offshore Project	Components of the Project seaward of Mean High Water Springs (MHWS) which includes Array Area and Offshore Cable Area of Search.
Offshore Project Boundary	The 'red line boundary' encompassing the Offshore Project.
Offshore Substation Platform (OSP)	The optional offshore substation located within the Turbine Area. Includes the platform and associated components which allows the voltage to be increased to meet onward transmission requirements.
Onshore Application	The application for consent under the Town and Country Planning (Scotland) Act 1997 (as amended).
Onshore Cables	Electrical and communication cables located within the Onshore Cable Corridor.
Onshore Cable Corridor	The area within which Onshore Cables and associated infrastructure will be located. The onshore cable corridor is routed from the Landfall Substation to the SSEN Lewis Hub.
Onshore Landfall Area	The area which includes both the Landfall above Mean Low Water Springs (MLWS) and Landfall Substation (as defined separately), cabling from the Transition Joint Bays (TJB) to the Landfall Substation (if required) and construction related compounds and working areas.
Onshore Substation (ONS)	<p>A compound housing electrical equipment enabling connection to the grid. The onshore substation also contains equipment to help maintain stable grid voltage.</p> <p>Arnish/<i>Airinis</i>, an ONS, known as the 'Grid Substation', which is east of Creed Industrial Park, will be situated close to the Scottish and Southern Electricity Networks (SSEN) converter & substation, the 'Lewis Hub.' Here, the electricity will be converted to high-voltage direct current (HVDC) before being transmitted across the Minch/A' Mhaoil to mainland Scotland/<i>Alba</i>.</p>
Onshore Transmission Works (OTW) / Onshore Project	<p>The onshore components of the Spiorad na Mara offshore wind farm (the Project) located landward of Mean Low Water Springs (MLWS).</p> <p>The Applicant will seek consent for the OTW Project through a separate application and so does not form part of this application.</p>
Onshore Transmission Works Boundary	The 'red line boundary' encompassing all temporary and permanent works associated with the OTW/Onshore Project.
Percussive Piling	<p>A method of installing piles and pile casings into the seabed using an impact hammer. This form of piling can be solely used if ground conditions are suitable. If pile depth cannot be achieved through percussive piling alone, a pile-drill-pile technique can be used to reach desired depths.</p> <p>The percussive piling technique can be used for the installation of the Wind Turbine Generators (WTGs) and the Offshore Substation Platform (OSP) (if required) located within the Percussive Piling Area.</p>
Percussive Piling Area	The area within the Turbine Area where percussive and vibratory piling and drill and grout construction methods can be used for the installation of the wind turbine generators (WTGs) and the Offshore Substation Platform (OSP) (if required) fixed foundations.

Term	Meaning
Percussive Piling Exclusion Area	An area in the southwest of the Turbine Area where there will be no percussive or vibratory piling. Other methods including drill and grout can be used in this area.
Project	The Spiorad na Mara offshore wind farm development. This term describes the whole development, including all offshore and onshore components.
Project Boundary	The 'red line boundary' encompassing all offshore and onshore components of the Project.
Project Design Envelope (PDE)	A description of the range of possible components that make up the Project design options under consideration when the exact engineering parameters are not yet known.
Scoping Opinion	A report presenting the written opinion of the Scottish Ministers, with input from Comhairle nan Eilean Siar (CnES) for the OTW, as to the scope and level of detail of information to be provided in the Environmental Impact Assessment (EIA) for the Project.
Scottish and Southern Electricity Networks (SSEN) Lewis Hub	This is the National Grid Electricity Transmission (NGET) interface. A transmission system operator substation into which the Project will connect for onward transmission through the existing grid network.
Study Areas	Study Areas are determined for each technical discipline and are described within each technical chapter.
Transition Joint Bay (TJB)	The point at which Offshore Cables are connected to Onshore Cables. The TJB is located onshore above MHWS.
Turbine Area	A reduced area within the Array Area where above water surface infrastructure would be located i.e. wind turbine generators (WTG) or Offshore Substation Platform (OSP) (if required). This area has been developed and refined through stakeholder consultation and environmental assessment.
Wind Turbine Generator (WTG)	The wind turbines that generate electricity consisting of tubular towers and blades attached to a nacelle housing mechanical and electrical generating equipment.

3.11 REFERENCES

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