Spiorad na Mara Offshore Wind Farm

Offshore Project

Environmental Impact Assessment Report

Chapter 4: Consideration of Alternatives, Volume 1a

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Contents

List of Tables

4 CONSIDERATION OF ALTERNATIVES

4.1 INTRODUCTION

4.1.1.1 The Environmental Impact Assessment (EIA) Regulations (as defined in **Chapter 2: Policy and Legislative Context, Volume 1a**) state that an Environmental Impact Assessment Report (EIAR) should include:

"A description of the reasonable alternatives (for example in terms of development design, technology, location, size and scale) studied by the developer, which are relevant to the proposed project and its specific characteristics, and an indication of the main reasons for selecting the chosen option, including a comparison of the environmental effects".

4.1.1.2 The consideration of alternatives is a fundamental aspect of the EIA process, as it allows for the identification and assessment of different scenarios that could achieve Spiorad na Mara's (the 'Project') objectives while minimising environmental effects. The overarching Project objectives are provided in **Table 4.1**.

Table 4.1 Project Objectives

Objective no.	Spiorad na Mara Wind Farm Objectives	Basis of Objective
1	Support Scottish Government targets to deliver 50% renewable energy by 2030 and an additional 40 GW of offshore wind in Scotland by 2035-2040, while also supporting UK government objectives to reduce greenhouse gas emissions by 78% by 2035.	• Urgent action is required to achieve Scottish and UK decarbonisation targets
2	Support the Scottish Government's ambition to achieve near decarbonisation by 2050, with the intention of providing a secure energy supply for the future while reducing Scotland/*Alba*'s impact on the climate through the deployment of renewable energy infrastructure such as offshore wind farms.	• Production of renewable electricity at scale will be required to enable achievement of targets
3	Maximise generation and export capacity within the constraints of limited available seabed for fixed foundation offshore wind in Scottish and UK waters	• Seabed availability for fixed foundation offshore wind is limited, and must be maximised to assist in the achievement of Scottish and UK decarbonisation targets.

Objective no.	Spiorad na Mara Wind Farm Objectives	Basis of Objective
	to maximise benefits for Scottish and UK decarbonisation targets.	• Fixed foundation offshore wind is a proven technology which can provide low carbon electricity generation at scale in the short to medium term, at lower cost than other technologies (e.g. floating offshore wind). • There is greater capacity within the supply chain for fixed foundation wind projects
4	Support and develop the local supply chain to maximise the economic benefits of renewables build out to the Isle of Lewis/*Eilean Leòdhais*, Outer Hebrides/*Na h-Eileanan Siar* west coast of Scotland/*Alba*, providing a significant contribution to the growth of the industry in an area where offshore wind currently has limited presence; the Offshore Project is one of 4 proposed for the west coast of Scotland/*Alba* region, only 2 of which are fixed bottom.	• Development of the local supply chain is a key priority for Scottish Government • The Offshore Project represents a strategic opportunity to anchor a western cluster of renewable energy projects, as most Offshore Wind Farm projects are clustered on the east or northern coasts of the country. • Temporary and local jobs will be available to support local people, and supported by the employment of new workers in the region • Development of new skills within the region
5	Deliver a significant volume of domestically produced, low cost, low carbon renewable electricity to the national grid from 2031, with the potential to meet the average annual electricity needs of up to 1.2 million Scottish homes, providing energy security for the future and reducing exposure to volatile fossil fuel markets, to deliver a just and fair energy transition.	• Geopolitical uncertainty highlights the need for a secure, home-generated supply of energy • Cost effective energy is needed across Great Britain

4.1.1.3 The Project will include both offshore and onshore infrastructure. This EIAR supports the application for the offshore components of the Project as outlined in **Chapter 1: Introduction, Volume 1a**. The offshore components of the Project (the 'Offshore Project') includes all infrastructure and activities located seaward of Mean High Water Springs (MHWS) within the Offshore Project Boundary, the area that consists of the Array Area and Offshore Cable Area of

Search (OCAS) (**Figure 1.2: Offshore Project Location, Volume 1b**). Further detailed information on the components of the Offshore Project is provided in **Chapter 3: Project Description, Volume 1a**.

4.1.1.4 This chapter of the EIAR describes the site selection process, design refinements, and the reasonable alternatives considered by Spiorad na Mara Limited (hereafter referred to as 'the Applicant') for the location and design of the components of the Offshore Project and the onshore components of the Onshore Transmission Works (OTW) Project insofar as they are key factors in determining the Offshore Project.

4.1.1.5 It outlines the multi-disciplinary design development process including the technical, economic, functional, and environmental factors that have been taken into account and the outcomes of the process that have led to the refinement of the Project. The design decision process has utilised constraints analysis and Black, Red, Amber, Green (BRAG) appraisals, where relevant. BRAG appraisals were undertaken in specific instances where two or more comparable options were being considered and allowed each discipline to rate the options against discipline criteria.

4.1.1.6 As described in **Chapter 3, Volume 1a**, the Applicant has adopted a maximum Project Design Envelope (PDE) approach (also known as the 'Rochdale Envelope') (Scottish Government, 2022). The design parameters have been informed through the assessment of alternatives as described within this chapter, alongside early and continuous stakeholder consultation. The Applicant has endeavoured to take on board points raised by stakeholders during the consultation process, both for site selection and design. A description of consultation and engagement undertaken as part of the EIA is found in **Chapter 5: Approach to EIA, Volume 1a,** and **Appendix 5.4: Stakeholder Consultation and Engagement, Volume 1c**.

4.1.1.7 This chapter has been structured to provide an overview of the development of the key elements of the Offshore Project across the timeline from site selection, through EIA Scoping, the outcomes of Pre-Application Consultation (PAC), and refinement based on site surveys and the EIA results undertaken by the Applicant. Each section considers the application of alternative technologies where appropriate. The chapter also describes the need for the Project and consideration of a 'do nothing' scenario, this refers to a situation where the Project is not progressed. This chapter should be read in conjunction with **Chapter 3: Volume 1a**.

4.1.1.8 The key elements of the Project that are relevant for the EIA of the Offshore Project are described below and the remainder of this chapter is structured as follows:

- Section 4.2: Project Need;
- Section 4.3: Site Selection;
- Section 4.4: Project Design Alternatives, this section is further divided into:
  - Section 4.4.1: Introduction;
  - Section 4.4.2: Array Area Refinement;
  - Section 4.4.3: Wind Turbine Generators;

- Section 4.4.4: Turbine Layout;
- Section 4.4.5: Foundation Types;
- Section 4.4.6: Landfall Cable and Substation;
- Section 4.4.7: Offshore Cable Area of Search Refinement;
- Section 4.4.8: Energy Transmission Infrastructure;

- Section 4.5: Summary.

4.2 PROJECT NEED

4.2.1 OVERVIEW

4.2.1.1 The main objective of the Project is to support the supply of secure, low carbon, and renewable electricity, aiming to decarbonise the UK's energy sector. Implementation of the Project is anticipated to have a net beneficial effect on atmospheric Greenhouse Gas (GHG) emissions compared to the 'do nothing' scenario.

4.2.1.2 In the move toward low carbon energy production including renewable sources, key drivers in both Scotland/*Alba* and the wider UK focus on the following needs:

- To tackle climate change;
- For a secure energy supply, through increasing renewable electricity capacity;
- To provide new energy infrastructure;
- To maximise economic opportunities of the transition to a low carbon economy.

4.2.1.3 The need for a secure and green renewable energy supply to combat climate change has driven the development of legislation and policies aimed at both addressing climate change, and accelerating the deployment of renewable energy infrastructure such as offshore wind farms. A detailed assessment of the Offshore Project's compliance with the relevant national and local policies is outlined in **Chapter 2, Volume 1a** and the accompanying **Offshore Planning Statement**.

4.2.1.4 Scotland/*Alba's* long-term climate change targets require net zero GHG emissions by 2045, in line with advice from the Committee on Climate Change and the statutory requirements defined by the Climate Change (Scotland) Act 2009 (Scottish Government, 2019).

4.2.1.5 The Scottish Offshore Wind Energy Policy (Scottish Government, 2020a) sets out the Scottish Government's ambition to capitalise on the potential that offshore wind development can bring to Scotland/*Alba* and the role this technology could play in meeting Scotland/*Alba's* commitment to reach net zero by 2045.

4.2.1.6 The Scottish and UK governments aims to enhance the UK's energy security and resilience, capitalise on economic opportunities, and meet net zero commitments (Scottish Government, 2021; BESS, 2022; HM Government, 2023). The increase in new renewable energy generation, including offshore wind, to enhance the UK's energy security will reduce the dependency on fossil

fuel energy usage will reduce market volatility, and provide greater energy security for Scotland/*Alba* and the UK.

4.2.1.7 The Project will make an important contribution to Scotland/*Alba's* efforts to tackle the global climate emergency, helping to achieve the climate change policy aims and legislative requirements, contributing to Scotland/*Alba* and UK net zero targets as well as offshore wind overall delivery targets. The Project also benefits Scottish communities, providing greater energy security nationally and generating additional investment for the local, regional, and national economies.

4.2.2 DO NOTHING SCENARIO

4.2.2.1 Although not strictly required by the EIA regulations, good practice suggests the consideration of a 'do nothing' scenario. This scenario is a projection of the existing baseline where the Project is not progressed and developed. An assessment of the future baseline under the 'do nothing' scenario is provided for all technical aspects within the EIAR.

4.2.2.2 The Sectoral Marine Plan (SMP) (Scottish Government, 2020b) also considered a 'do nothing' option and identified that to 'do nothing' would not meet strategic net zero policies.

4.2.2.3 Economically, the 'do nothing option' would mean foregoing substantial benefits such as job creation and local investment, impacting the resilience and growth of coastal communities. Environmentally, while avoiding potential impacts from construction, it would also mean missing out on the long-term benefits of renewable energy, such as reduced greenhouse gas emissions and climate change mitigation. As a result, the 'do nothing' option was not pursued.

4.2.2.4 Overall, the Project will contribute to Scotland/*Alba's* and UK net zero targets as well as offshore wind overall delivery targets.

4.3 SITE SELECTION

4.3.1 SECTORAL MARINE PLAN OPTION AREAS AND SCOTWIND LEASING

4.3.1.1 The SMP for Offshore Wind Energy (Scottish Government, 2020b) set the strategic framework for the first cycle of seabed leasing by Crown Estate Scotland (CES) for commercial-scale offshore wind and provides the strategically planned spatial footprint for offshore wind development in Scotland/*Alba*. The SMP identified 15 Plan Options (PO) for the future development of commercial-scale offshore wind energy in Scotland/*Alba*, which formed the basis of the ScotWind leasing round launched in June 2020.

4.3.1.2 The POs were developed using Opportunity and Constraints Analysis to identify Areas of Search which were subject to scoping and consultation exercises leading to the identification of an initial 17 Draft Plan Options (DPOs). The DPOs were subject to Sustainability Appraisal that include Strategic Environmental Assessment, plan-level Habitats Regulations Appraisal (HRA), and Socio-

Economic Assessment which was consulted on in December 2019 to March 2020. Analysis of the consultation responses led to amendments to the DPOs before the final POs were published in the SMP and adopted by CES. The SMP provides further information on the assessments and identification of the final POs (Scottish Government, 2020b).

4.3.1.3 The Applicant commissioned a series of desk-based studies to better understand the constraints, risks, and opportunities associated with each of the POs identified in the SMP. These studies included assessments of environmental sensitivities, consenting risks, geological and bathymetric conditions, grid capacity, and stakeholder feedback. A key output of these studies was the identification of the N4 PO as the most suitable location for a fixed-bottom offshore wind development, based on wind resource, grid capacity and preferable water depths. These factors made fixed-bottom foundations technically and economically viable, in contrast to other POs where deeper waters and more complex seabed conditions would necessitate floating platform technology. Based on the outputs of these studies, the Applicant submitted a bid into the ScotWind process for the 200 km^2 N4 PO, which was accepted by CES. **Figure 4-1: Offshore Site Selection – Array Area, Volume 1b** shows the location of the N4 PO.

4.3.1.4 The maximum extent of the N4 PO is predetermined by the SMP and is defined as the development area within the Option to Lease Agreement held between the Applicant and CES. As such, the location and boundary of the N4 PO is fixed.

4.3.2 Array Area Development

4.3.2.1 Iterative analysis within the N4 PO through a constraints mapping exercise was undertaken by the Applicant to identify an Option Agreement Area (OAA) within the N4 PO, within which the Array Area is located. Key offshore constraints were considered and used to identify the Array Area, this included:

- **Technical**: bathymetry and slope, ground conditions, met-ocean conditions, windspeed, constructability and installation and maintenance;
- **Environmental**: seascape, landscape and visual designations, marine ecology, and ornithology;
- **Human**: shipping and navigation routes, marine archaeology, unexploded ordnance, and fishing activities (both leisure and commercial);
- **Energy yield**: the Array Area was designed to balance maximising wind farm generation capacity whilst managing consideration of environmental factors. As a result of such engagement with stakeholders (environmental, fisheries, supply chain) setbacks and area reductions were introduced, but to a size that will still be able to achieve delivery of viable and efficient clean energy within the permitted parameters.

4.3.2.2 From this assessment, a preferred 161 km^2 Array Area was identified within the N4 PO, as shown in **Figure 4.1, Volume 1b**. Key contributing factors to the selection of the Array Area were:

- Increasing sea room to reduce risk to marine traffic nearshore;

- Increasing the distance of Wind Turbine Generators (WTG) from the shoreline;
- Maximise sea room to reduce overlap with possible nearshore salmon migration routes;
- Best utilisation of wind resource.

4.3.2.3 The further design evolution and consideration of alternatives for the Offshore Project is described in Section 4.4.

4.3.3 GRID CONNECTION

4.3.3.1 A grid connection point is required in order to transmit the electricity generated offshore to the grid. The National Energy System Operator (NESO) is responsible for the recommended design of the electricity network to facilitate offshore wind and onshore connections through the Holistic Network Design (HND) process. This includes projects that secured seabed leases in the CES ScotWind Leasing Round.

4.3.3.2 In 2022, the National Grid Electricity Systems Operator (NGESO), predecessor prior to establishment of NESO) published the recommendations in Pathway to 2030: Holistic Network Design (HND) (NGESO, 2022) which included the North Scotland region, of which the Project is a part. The HND considers four key objectives in the development of the design which require that it is economic and efficient; deliverable and operable; considers impact on the environment and considers impact on communities. The North Scotland/*Alba* region of the design contains 2 offshore wind farms (including the Project) that are approximately 150 km apart. A co-ordinated approach linking the 2 was considered but ruled out as it did not perform well against the network design objectives. Options to connect to the west coast of Scotland/*Alba* were identified to not be economically justifiable. The recommended design for the Project was therefore a radial connection to a new substation at Arnish/*Àirini*, on the Isle of Lewis/*Eilean Leòdhais*.

4.3.3.3 The Project will connect to the grid at the proposed Scottish and Southern Electricity Networks (SSEN) Lewis Hub (Alternating Current Substation and High-Voltage Direct Current Converter Station). A planning application for SSEN Lewis Hub was submitted in February 2025 to Comhairle nan Eilean Siar/Western Isles Council (CnES) which includes consideration of alternatives for that project. Onward connection to the mainland is proposed via the SSEN Western Isles Connection Project.

4.3.3.4 The location of the Array Area and the grid connection at the SSEN Lewis Hub requires the transmission infrastructure for the Project to be located between the Array Area on the west coast of the Isle of Lewis/*Eilean Leòdhais*, and the SSEN Lewis Hub location in Arnish/*Àirinis* on the east coast of the Isle of Lewis/*Eilean Leòdhais*. The design and alternatives considered relevant for the Offshore Project are detailed in Section 4.4**.** The onshore transmission infrastructure for the Project is subject to the separate OTW Project application in which the design and alternatives of the OTW Project will be detailed. The consenting approach for the Project is provided in **Chapter 1, Volume 1a:** Section 1.2.2.

4.4 PROJECT DESIGN ALTERNATIVES

4.4.1 INTRODUCTION

4.4.1.1 This section describes the consideration of alternatives during the development of the Offshore Project including refinement of the Array Area, Wind Turbine Generator (WTG), foundation type options, the offshore cable corridor, Landfall, and the scenarios for the Energy Transmission Infrastructure (Offshore Substation Platform (OSP) or Landfall Substation) considered in this EIAR.

4.4.1.2 The Project Design Envelope (PDE) was established following the Rochdale Envelope approach, allowing for flexibility in design parameters to accommodate ongoing refinement during detailed design and consultation. The PDE was initially defined in the Scoping Report (Spiorad na Mara Limited, 2023) and subsequently refined in response to new environmental and engineering data, as well as stakeholder feedback. Further development and refinement of the PDE in this EIAR ensures that the PDE reflects both regulatory requirements and best practice in environmental impact assessment.

4.4.1.3 Key refinements included reducing the spatial extent of the WTGs, increasing setback distances from the coast and National Scenic Area, increasing the minimum blade tip clearance (Air Gap), refining the OCAS, and reducing the maximum number and size of WTGs to minimise environmental impacts.

4.4.1.4 Stakeholder consultation played a critical role in shaping the scheme, with feedback from NatureScot, CnES, Historic Environment Scotland, and local Community Councils leading to further design iterations. The consideration of alternatives encompassed WTG location and layout scenarios, foundation types, cable routeing, and Landfall options, with decisions justified by technical, environmental, engineering, economic, and stakeholder factors.

4.4.2 ARRAY AREA REFINEMENT

4.4.2.1 The Scoping Opinion (MD-LOT, 2024) included consultation responses from stakeholders including Marine Directorate – Licensing Operations Team (MD-LOT), NatureScot, CnES, Historic Environment Scotland as well as local Community Councils. Feedback from these stakeholders highlighted the visual impact of the WTGs resulting from the proximity of the Array Area from the coastline of the Isle of Lewis/*Eilean Leòdhais* (5-13 km from the coastline at its closest point). NatureScot also raised concerns with regard to the proximity of the WTGs to the South Lewis, Harris and North Uist National Scenic Area (NSA) /*Siorrachd Leòdhais a Deas, na Hearadh agus Uibhist a Tuath*.

4.4.2.2 The NSA was highlighted by NatureScot as being particularly susceptible to this type of development and that design iteration should include early consideration of the coastal Special Landscape Qualities (SLQs), including the strong wild character, and that the relationship of the

array to the NSA and its coast should be a key design objective, aiming to minimise effects on the scenic small-scale settled coast.

4.4.2.3 Further consultation meetings were also held with NatureScot, who reiterated its advice in the Draft Sectoral Plan (2019) and the Scoping Opinion (MD-LOT, 2024) to consider smaller scale turbines as part of a design led approach and to consider developing only part of the Array Area, to reduce effects on the NSA and the 'regionally distinctive' coast (between Shawbost/*Siabost* and Carloway/*Càrlabhagh*). Following this consultation advice, the Project undertook further design reviews including the most suitable parts of the Array Area for development as well as layout options and the number and height of WTGs, which were reviewed against a number of landscape and visual design principles (see Sections 4.4.3 and 4.4.4 for further detail).

4.4.2.4 The design reviews incorporated a set of landscape and visual design principles developed in response to statutory consultee and community feedback. These included maximising setback distances from sensitive receptors, specifically, implementing an 11 km setback from the NSA and a 6 km setback from the coastline, to reduce visual and landscape impacts. The Project also reduced the scale and height of WTGs, considered only part of the Array Area for development of surface piercing infrastructure, and optimised turbine layout to minimise visual prominence and cumulative effects.

4.4.2.5 Additional objectives included avoiding ornithological hot spots, minimising offshore airborne and underwater noise, and responding to cultural heritage settings such as the Callanish Stones. The objectives integrated within these design reviews allowed for the design to consider and balance technical and engineering feasibility, environmental sensitivities, economic viability, and stakeholder priorities.

4.4.2.6 Further feedback was received during Phase 1 Public Consultation (PC1) undertaken in September and October 2024, when Project design parameters and draft photomontages were presented, this highlighted concerns from the local community in relation to visual impact of the Offshore Project, with respect to the Array Area.

4.4.2.7 In response to these consultations, further measures were identified, including defining a Turbine Area within the Array Area at an increased distance from the coastline and NSA, as shown in **Figure 4-2a-c: Offshore Site Selection – Turbine Area Selection, Volume 1b**.

4.4.2.8 Increased setback of the Turbine Area from the NSA, was achieved with a reduction in footprint through the omission of the southwest portion of the Array Area boundary closest to the NSA. This increased the distance from the NSA and contributed to a likely reduction in landscape and visual effects through a reduction in the lateral spread of development, an increase in open sea separation distance between the Turbine Area and the NSA, and a reduction in spatial scale and visibility of the WTGs and OSP (if required) from the NSA.

4.4.2.9 In addition to this, a 6 km setback buffer of all WTGs and the OSP from the coastline of Lewis/*Eilean Leòdhais*, resulted in an increased distance of the closest WTGs from the nearest parts of Lewis/*Eilean Leòdhais*. This reduced the scale of the WTGs when viewed from the Lewis/*Eilean Leòdhais* coast, particularly the 'regionally distinctive' coast identified between Shawbost/*Siabost* and Carloway/*Càrlabhagh* (including Dalmore/*Dail Mor* and Dalbeg/*Dail Beag*).

4.4.2.10 The analysis of these refinements, which were incorporated into the design to form the Turbine Area also considered further technical, environmental, and engineering constraints outlined below while ensuring that sufficient flexibility remained in the Turbine Area to maximise the generation capacity of the Project:

- **Marine ornithology**: Hot and cold spot analysis was undertaken to determine the distribution of 5 key sensitive seabird species within the Array Area (using 24 months of digital aerial survey data) which indicated the highest density of 4 of the key seabird species (gannet *Sula bassana*, Guillemot *Uria aalge*, Razorbill *Alca torda* and Puffin *Fratercula arctica*) in the south and southwest region of the Array Area nearest to Little Bernera/*Beàrnaraigh Beag* island and surrounding islets. As all these species are susceptible to the effects of disturbance, which may occur beyond the boundaries of the Array Area itself, increasing the distance to this hot spot may reduce the risk of birds being displaced;
- **Fish ecology**: Langavat Special Area of Conservation (SAC) is a European designated site, that includes Atlantic salmon *Salmo salar* as a qualifying species, located approximately 19.5 km at the closest point from the southwest of the Array Area. Atlantic salmon migrate annually from the River Grimersta/*Abhainn Grimersta* within the boundaries of the SAC through Loch Roag/*Loch Ròg* to feeding grounds off the coasts of Norway and Greenland. The piling methods assumed to be required to install the WTG foundations generate percussive underwater noise, which has the potential to impact on the key migratory pathway. This refinement increased the distance of the Turbine Area from Loch Roag/*Loch Ròg* and the shoreline; therefore also reducing the potential for impacts on Atlantic salmon migration from underwater noise during construction;
- **Shipping and navigation**: The Turbine Area created additional sea room for navigation, relevant for those vessels routeing in the nearshore area between the Turbine Area and coast and for those vessels entering and exiting Loch Roag/*Loch Ròg*;
- **Underwater noise and airborne noise**: Through the Turbine Area refinement, the available area for locating WTGs was reduced. This reduction in area led to the reduction in maximum WTGs proposed (see Section 4.4.3) and has therefore reduced the potential for overall underwater noise and airborne noise impacts as a result of reducing the volume of infrastructure to be installed in the marine environment;
- **Water depth**: Variation of water depths across the Array Area with the deeper areas that could pose technical delivery challenges considered for removal from Array Area.

4.4.2.11 In response to consultation feedback, consideration of landscape and visual design objectives, and the analysis of technical, environmental, and engineering constraints, the Array Area was refined to form the Turbine Area for the Offshore Project. As defined in Commitment M036, the Project will only install above sea infrastructure (i.e. WTGs and the OSP (if required)) within the Turbine Area. This is defined by an 11 km setback buffer of the NSA and 6 km setback buffer from the Lewis/*Eilean Leòdhais* coastline and ensures that impacts on the SLQs of the NSA and regionally distinctive parts of the west coast of Lewis/*Eilean Leòdhais* have been reduced in the project design, as well as seeking to reduce impacts on marine ornithology, fish, and shipping and navigation while responding to technical constraints and to maximise capacity to achieve the objectives of the Project.

4.4.3 WIND TURBINE GENERATORS

4.4.3.1 The EIA Scoping Report (Spiorad na Mara Limited, 2023) defined the maximum parameters for the WTGs as up to 66 turbines with a blade tip height of 380 m above mean sea level (msl). Following review of the feedback received in the Scoping Opinion (MD-LOT, 2024) and prior to PC1 (see paragraph 4.4.2.3), the Applicant refined the WTG parameters to the values shown in **Table 4.2**. This identified 2 bounding design scenarios based upon the anticipated characteristics of turbine models available at the point of procurement: one with up to 66 smaller WTG type turbines and another with up to 48 larger WTG type turbines. Intermediate scenarios (such as 52 WTGs) may also be deployed, on the basis that they fall within these bounding scenarios (for further information on use of the bounding scenarios see Section 3.3.2 in **Chapter 3, Volume 1a**).

4.4.3.2 As described in Section 4.4.2, the feedback received at PC1 from the local community emphasised the importance of minimising the visual impacts of the Offshore Project. In response to this feedback, the Applicant reduced the maximum parameters in the PDE including the number of WTGs, maximum blade tip height, and chord (blade width) for which consent is sought as shown in **Table 4.2** (green cells show where a reduction has occurred). The PDE for the Offshore Project is described in **Chapter 3, Volume 1a**.

Table 4.2: WTG parameter refinement following PC1

	Key parameters prior PC1		Key parameters after PC1	
Parameter Type	**Smaller WTG Type**	**Larger WTG Type**	**Smaller WTG Type**	**Larger WTG Type**
Number of WTGs	66	48	60	44
Maximum Rotor Diameter	236 m	310 m	236 m	280 m
Maximum Blade Tip Height (above msl)	300 m	365 m	293 m	339 m
Maximum Chord (rotor blade width)	5.5 m	9 m	5.3 m	8 m
Hub Height (above msl)	175 m	215 m	175.8 m	198.4 m

4.4.3.3 Further to the design refinements made after Scoping and PC1 to minimise visual and landscape impacts and underwater noise impacts to marine sensitivities (such as migratory Atlantic salmon), the Minimum Blade Tip Clearance (Air Gap) above msl was increased to 30 m which is considered to be the feasible height for the Air Gap at this time, when considering engineering risk, safety at sea, and collision risk impact to seabirds. Due to the water depths, metocean conditions, and WTG sizes, there are a limited number of heavy lift vessels that are available from the supply chain which the Project can utilise. Additionally forces on the WTG during operation must also be considered and with current understanding of the site conditions, 30m Air Gap is feasible to deliver from an engineering risk perspective (both installation and operation) whilst also considering risk to ornithology receptors. Technical considerations, such as optimising turbine layout within the available Array Area and accommodating site-specific engineering challenges were also incorporated, with due consideration of installation feasibility in areas with challenging ground conditions and water depths, to ensure the Offshore Project could deliver efficient and reliable generation while maintaining compliance with regulatory and navigational requirements.

4.4.3.4 This balanced approach ensures that the Project's generation objectives are met, to support national decarbonisation and energy security goals, whilst maintaining sufficient flexibility to maximise the generation capacity within the PDE, and proceed within the framework of environmental constraints and stakeholder engagement.

4.4.4 TURBINE LAYOUT

4.4.4.1 At this stage of the Project, WTG and Offshore Cable layout is indicative within the Turbine Area and the final layout will be determined during design optimisation based on further investigations and in communication with stakeholders post-consent. It was necessary to identify a worst-case scenario for assessment purposes to be reported within this EIAR and this is defined in **Chapter 3**,

Volume 1a. During the design process, consideration was given to WTG layout design concepts for assessment in the EIAR, including a 'fanned' layout, with WTG rows in a fanned arrangement with increasing angles towards the north from the first column at the south of the Array Area and a 'grid' layout, with WTGs in rows arranged perpendicular to the coast on the same angle from southern to northern most rows. The 'grid' layout optimises the available space and thus constitutes the highest density layout of WTGs.

4.4.4.2 It was agreed in consultation with NatureScot that the worst-case impact should be assessed in the EIAR. In terms of seascape, landscape and visual effects, it was agreed in consultation with NatureScot that the 'fanned' layout generally had a more organic/less regimented character, which related better to its orientation to the receiving landscape/seascape, however, it was noted that it was difficult to define what is worst-case in landscape and visual terms, as the appearance of the 'fanned' and 'grid' layouts varied depending on the viewpoint location. A 'grid' layout has been selected to be assessed in the EIAR as a realistic worst-case for potential effects associated with seascape, landscape and visual as this presents a less organic layout to the coastline.

4.4.4.3 Further consultation undertaken included Hazard Workshops for shipping and navigation stakeholders, at which concerns were raised about the potential for ship allision with the Offshore Project infrastructure (WTGs and OSP), should vessels lose power.

4.4.4.4 While reflecting a viable/buildable scenario, the layout is indicative and subject to further detailed design pursuant to the conditions of the marine licences and s.36 consent if granted.

4.4.5 FOUNDATION TYPES

4.4.5.1 The selection of foundation types for the Offshore Project was primarily driven by engineering feasibility. Environmental factors were considered alongside the key feasibility considerations of ground conditions, water depth, met ocean and wind conditions, fabrication and installation requirements/constraints, turbine size and constructability. As a result, rationale for the preferred foundation types is summarised below. This approach ensures the section remains focused and accessible, highlighting only the most relevant factors that influenced the final foundation selection.

4.4.5.2 An initial (Level 1) screening of the foundation options was undertaken based on qualitative criteria such as metocean suitability, ground condition suitability, fabrication and installation requirements, transportation logistics, and environmental considerations. Options that were considered unsuitable for the Offshore Project site conditions, due to factors like challenging ground conditions, water depth, or installation complexity, were eliminated at this stage. The shortlist of feasible foundation concepts was then subject to a second stage (level 2) semi-qualitative assessment, considering performance in both deep and shallow rockhead scenarios.

4.4.5.3 The outcomes of the level 1 and 2 exercise concluded that jacket foundations with driven (using percussive piling) or drilled and grouted pin piles were identified as the most suitable option for

the majority of the site with split jacket and hybrid Gravity Base System (GBS) concepts considered as mitigation for specific installation or supply chain risks. Further development of foundation details will be subject to ongoing ground investigation and detailed design post-consent, as described in **Chapter 3, Volume 1a**.

Foundation Installation Refinement

4.4.5.4 After PC1, initial Underwater Noise (UWN) modelling was undertaken to inform the Project's understanding of the Zone of Influence (ZoI) of UWN associated with foundation installation approaches, including percussive piling. Due to the location of the Offshore Project, consideration of migratory Atlantic salmon was required.

4.4.5.5 This initial UWN modelling considered multiple impact piling locations to provide a representative ZoI across the Turbine Area, demonstrating the effect of UWN from percussive piling of pin piles and jackets in different conditions and depths, with a view to assessing use of percussive piling within the PDE. From reviewing the initial UWN modelling, the Applicant refined the foundation installation approach to include both percussive piling, and drill and grout techniques. Additionally, the Project reduced the area in which percussive piling installation can take place within the Turbine Area to minimise ensonified areas away from the mouth of Loch Roag. **Figure 4-3: Refinement of Turbine Area Foundation Installation, Volume 1b** shows the location within the Turbine Area that the foundation installation techniques can be utilised.

4.4.5.6 Subsequent UWN modelling has since been undertaken, this has led to further design refinement of the Offshore Project piling approach. The subsequent modelling, assessment, and approach to further design refinement and mitigation measures has been consulted upon with key stakeholders (MD-LOT, NatureScot, MD-SEDD). These refinements include a package of embedded mitigation measures to reduce the potential impacts associated with UWN on environmental receptors. The Offshore Project's piling approach is discussed further in **Chapter 3**, **Volume 2a, Appendix 3.1: Percussive Piling Installation Approach, Volume 1c** and the UWN modelling is provided in **Appendix 13.3: Underwater Noise Modelling Assessment**, **Volume 2b**.

4.4.6 LANDFALL CABLE AND SUBSTATION

Overview

4.4.6.1 The landfall cable and substation works include the installation of ducts for the connection of offshore and onshore cables using Horizontal Directional Drilling (HDD). The HDD technique will be used from onshore at the Transition Joint Bays (TJB) to the offshore exit pits. It also includes for the Landfall Substation (Scenario 2) and associated construction works.

4.4.6.2 The identification of the proposed Landfall location described in **Chapter 3, Volume 1a** was undertaken through an iterative desktop study that included an initial screening exercise followed by 3 Red-Amber-Green (RAG) constraints analyses based on a detailed review of onshore and

offshore constraints along the west coast of Isle of Lewis/*Eilean Leòdhais* on identified Areas of Search (AoS). Consultation with stakeholders was also undertaken to inform the process. No other areas (outside of the west coast) on the Isle of Lewis/*Eilean Leòdhais* were considered due to technical and economic feasibility.

Screening Exercise

4.4.6.3 The initial screening exercise identified 7 AoS (01 to 07 shown in **Figure 4-4: Landfall and Landfall Substation Options Longlist**, **Volume 1b**) which were defined through desk based assessment with consideration to both offshore electrical and engineering requirements and onshore environmental and land use constraints, including:

- Located within 2 km of the foreshore;
- Avoidance of crofts and croft land;
- Located a minimum of 500 m from residential properties;
- Avoidance of cultural heritage features designations;
- Avoidance of other environmental designations.

RAG assessment No.1

4.4.6.4 The 7 AoS identified from the screening exercise were then assessed through a desktop RAG constraints analysis. In addition to the 7 AoS identified, 2 additional AoS were identified (A1 and A2) through assessing areas that exhibited achievable distances to suitable offshore landfall working depths, and areas with suitable onshore workspace to develop the onshore workspace required for the HDD works along the northern coastline of the Isle of Lewis/*Eilean Leòdhais*. These locations are shown in **Figure 4-4**, **Volume 1b**.

4.4.6.5 Project and publicly available data and information were collated and reviewed for a range of constraints criteria across all 9 AoS to determine level of constraint to the installation and operation of the proposed landfall infrastructure. These criteria included both onshore and offshore constraints:

Onshore

- Space requirements and developable area;
- Construction and access considerations (including terrain, road access, and watercourses);
- Pros/cons with regards to electrical transmission;
- Ground conditions;
- Suitability for trenchless landfall installation techniques;
- Suitability for open-cut landfall techniques (and overall optionality in landfall installation approach);
- Land-use and legal aspects;
- Natural environment;
- Cultural heritage;

- Visual impacts.

Offshore

- Designated sites (biological and geological);
- Priority Marine Features (PMF);
- Benthic habitats;
- Fish spawning habitats;
- Marine archaeological protected sites (i.e. shipwrecks);
- Commercial fisheries;
- Marine infrastructure and associated activities;
- Aquaculture;
- Other users.

4.4.6.6 On completion of the constraints review the RAG assessment was undertaken to assess suitability and risks of the proposed AoS. This allowed for an efficient comparison of the AoS identified. Each AoS was then given a score based on professional judgement on the level of each constraint. **Table 4.3** provides a summary of the constraints associated with the 9 proposed AoS, including the recommendations for identification of AoS to be taken forward for further constraints analysis.

Table 4.3 Summary of: Landfall options longlist analysis (RAG assessment No 1)

Landfall Option	Onshore Key Constraints	Offshore Key Constraints	Key Opportunities	Recommendation
1	Longer distance from Array Area. Widespread peat (a priority habitat) across whole AoS. Requirement for OSP. Located in Galson Common grazing land. Geological Conservation Review (GCR) site along full extent of coastline within landfall. Close to residential properties. Non-favourable ground conditions along HDD alignment. Cliff height 30-50 m.	Overlaps with Annex I[1] reef and a GCR site and is within 250 m of a wreck/obstruction. Also overlaps with known fish spawning grounds and a mobile PMF. Seabed immediately offshore coastline shows potentially significant bathymetric feature.	Sufficient space for development of TJB, HDD works, and Landfall Substation. Minor watercourses.	**Not taken forward for further appraisal** due to distance from Array Area, distance to Grid Substation, height of sea-cliffs, and offshore works in potentially significant bathymetric feature.
2	Widespread peat across majority of AoS but areas where less peat present. Area of historic environment interest identified by local authority archaeology service in the south of AoS, and additional smaller areas in north of AoS. Southern area of AoS encroaches into Ness and Barvas Special Protection Area.	Overlaps with Annex I reef and is within 250 m of a wreck/obstruction. Also overlaps with known fish spawning grounds and mobile PMFs, as well as Barvas Beach and Machair and Brue Shore.	AoS sufficiently large to identify multiple landfall locations >250 m from residential area. >500 m from recreational beaches Low cliff height. Sufficient space for development of TJB, HDD works and Landfall Substation. Feasible land access. Lower visual amenity impact from Landfall Substation. Favourable ground conditions along HDD alignment. More central location to Array Area for Offshore Cables so less cable required. More central location to minimise onshore cable route.	**Taken forward for further appraisal** due to closer proximity to Array Area, generally favourable conditions for trenchless landfall methods, avoidance of croft land and predicted low visual impact from Landfall Substation in southern area of AoS.
3	New 1.5 km haul road requirement, Water Framework Directive (WFD) assessment requirement, hard rock ground conditions, widespread peat, overlap with RSPB reserve. Widespread peat across whole AoS. Sea cliffs 35-40 m in height.	Overlaps with Annex I reef and is within 250 m of a wreck/obstruction. Also overlaps with known fish spawning grounds and mobile PMFs, as well as Barvas/*Barabhas* Beach and Machair and Brue/*Brù* Shore.	>500 m from residential area. >500m from GCR designated site Favourable ground conditions along HDD alignment. Sufficient space for development of TJB, HDD works and Landfall Substation. Close proximity to Array Area. No scheduled monuments. More central location to Array Area for Offshore Cables so less cable required. More central location to minimise onshore cable route.	**Taken forward for further appraisal** due closer proximity to Array Area. Generally favourable conditions for trenchless landfall methods, and predicted low visual impact from Landfall Substation.
4	New 1.5 km haul road requirement, Rocky terrain with steep slopes onshore, hard rock ground conditions, widespread peat, Sea cliffs 40 m in height, Scheduled monument (a cairn) within the centre of the area where landfall works would take place. Distance to Grid Substation means more onshore cable.	Overlap with Annex I reef and within 250 m of a wreck/obstruction. Also overlap with known fish spawning grounds and mobile PMFs and kelp beds, as well as both Dailbeag Beach and Dalmore Beach.	>300 m from residential area. >500m from GCR Designated site Favourable ground conditions along HDD alignment. Sufficient space for development of TJB, HDD works and Landfall Substation. Minor watercourses. Feasible land access. No onshore environmental designations.	**Not taken forward for further appraisal** due to increased height of sea-cliffs, steep rocky terrain, and likely impact on scheduled monument, as well as relatively long distance to the Grid Substation.

[1] Habitats Directive (92/43/EEC)

Landfall Option	Onshore Key Constraints	Offshore Key Constraints	Key Opportunities	Recommendation
5	New 2.5 km haul road requirement, widespread peat, rocky terrain with steep slopes onshore, hard rock ground conditions, Sea cliffs 40 m in height. Distance to Grid Substation means more onshore cable.	Overlap with Annex I reef and within 250 m of a wreck/obstruction. Also overlap with known fish spawning grounds and mobile PMFs and kelp beds, as well as both Dailbeag Beach and Dalmore Beach.	>500m from GCR Designated site Sufficient space for development of TJB, HDD works and Landfall Substation. No WFD waterbodies. Favourable ground conditions along HDD alignment. Feasible land access. No onshore environmental designations.	**Not taken forward for further appraisal** due to increased height of sea-cliffs, and steep rocky terrain, as well as relatively long distance to the Grid Substation.
6	Longer distance from Array Area. Widespread peat. Close proximity to residential area <100 m. Rocky terrain with steep slopes onshore and hard rock cliff.	Overlaps with Annex I reef and is within 250 m of three wrecks/obstructions. Also overlaps with known fish spawning grounds and mobile PMFs and kelp beds, as well as three active aquaculture sites. Also, within a region of slightly higher pot and trap fishing and overlaps with a small port situated near Borrowston/*Borghastan*.	>500m from GCR designated site >500 m from recreational beaches Sufficient space for development of TJB, HDD works and Landfall Substation. Low cliff height (25 m). No onshore environmental designations. Avoidable archaeological interests no scheduled monuments.	**Not taken forward for further appraisal** due to increased distance from Array Area and Grid Substation. Potential reduction in thermal capacity due to overburden thickness, and steep rocky terrain within areas of likely construction works. Increased risk of cable damage due to vessel movements associated with adjacent port area.
7	Longer distance from Array Area. Widespread peat. Rocky terrain with steep slopes onshore and hard rock cliff. Scheduled monument (prehistoric roundhouse) and large area of historic environment interest difficult to avoid.	Overlaps with Annex I reef and known fish spawning grounds, as well as mobile PMFs and kelp beds and two active aquaculture sites. Also, within a region of slightly higher pot and trap fishing and overlaps with two small ports situated near Breascleat/*Brèascleit* and Kirkibost/*Chirceaboist*.	>500m from GCR Designated site >500 m from recreational beaches >250m from a wreck Sufficient space for development of TJB, HDD works and Landfall Substation. Low cliff height (25-30 m) No onshore environmental designations. Residential area 100-250 m from landfall location. Minor water courses.	**Not taken forward for further appraisal** due to increased distance from Array Area and requirement for OSP, so optionality for OSP or Landfall Substation cannot be retained. Identified steep rocky terrain which technically is less feasible.
A1	Moderate distance from Array Area Close proximity to residential area <100 m. Widespread peat. Visual impact from Landfall Substation due to proximity to residential area.	Overlaps with Annex I reef and a GCR site and is within 250 m of a wreck/obstruction. Also overlaps with known fish spawning grounds and a mobile PMF.	Sufficient space for development of TJB, HDD works and Landfall Substation. Low cliff height (25-30 m). No onshore environmental designations that cannot be avoided. Low sea cliffs, Avoidable archaeological interests, no scheduled monuments. Good potential road access, favourable ground conditions.	**Recommended for further appraisal** due to good potential road access, favourable ground conditions.
A2	Moderate distance from Array Area. Haulage road access through residential area. Unfavourable land access. High visual impact.	Overlaps with Annex I reef and is within 250 m of a wreck/obstruction. Also overlaps with known fish spawning grounds and mobile PMFs and kelp beds, as well as Shawbost/*Siabost* Beach.	Landfall >500 m from residential area. >500m from GCR Designated site Less peat within area that could be avoided. Low sea cliffs. No onshore environmental designations.	**Recommended for further appraisal** due to close proximity to Array Area, favourable ground conditions and distant location from sensitive receptors.

Summary

4.4.6.7 On completion of the RAG assessment No.1, 4 AoS (02, 03, A1, A2) were recommended to be taken forward for further assessment. This conclusion was based primarily on the comparison of onshore constraints as the constraints analysis undertaken on offshore environmental constraints showed that of the 7 AoS (01-05, A1, and A2) were considered similar with a low level of risk identified and AoS 06 and 07 showed a medium level of risk.

Site Visit

4.4.6.8 A site visit was then undertaken for AoS 02, 03, A1, and A2 to validate key onshore environmental, social and technical constraints identified as part of the first RAG assessment. Public consultation was also undertaken as part of events in June 2023 and which sought to gain feedback on proposed AoS locations. Following this, an interim position was reached:

- **AoS 02** was preferred for engineering in relation to the needs for the TJB, HDD, Landfall Substation, and access. It was recognised that AoS 2 offered the consideration of 2 potential Landfall Substation sites, located in the northern and southern portions of the AoS. The northern area of the AoS had a higher potential visual impact to residential properties, proximity to the Clach an Truiseil standing stone and presence of a Canmore site, the southern portion of the AoS had a reduced visual impact to both the Clach an Truiseil standing stone and residential properties although the southern area contained a high potential for unknown archaeological remains. The central portion of the AoS contains large areas of deep peat with limited access opportunity.
- **AoS 03** was less preferred due to the technically challenging build due to presence of undulating waterlogged peat bog terrain and requirements for a new access road to be constructed through this environment and impacts on priority habitat.
- **AoS A1** had potential technical/engineering benefits for HDD construction and overall construction access due to existing roads, however visual impacts of the Landfall Substation remained, and it is located in an area that has an increased distance from both the Array Area and Grid Substation.
- **AoS A2** was discounted at this stage due to the likely impacts on local residents from the visual impact of substation buildings and crofting/grazing land associated with the onward cable-corridor requirements from this site.

Scoping Consultation

4.4.6.9 The Applicant then undertook consultation on AoS 02, 03, and A1 from key stakeholders through issue of the EIA Scoping Report (Spiorad na Mara Limited, 2023) requesting a Scoping Opinion from MD-LOT. While no formal objection was raised specifically against the proposed Landfall options or Landfall Substation locations, feedback from statutory consultees, particularly CnES, highlighted the need for careful consideration of visual impacts, proximity to residential areas, and potential effects on designated sites.

RAG Assessment No.2

4.4.6.10 On completion of the site visit, scoping consultation and public consultation the 3 recommended AoS (02, 03, and A1) were further assessed (**Figure 4-5: Landfall Site Selection – RAG Assessment no. 2**, **Volume 1b**). As part of this assessment, specific locations for TJB and Landfall Substation were identified within each AoS. Each option was then tested and challenged through a detailed weighted scoring appraisal against a wide range of criteria under 3 main constraint topics:

- Engineering/construction;
- Land use, planning and consenting;
- Onshore environment.

4.4.6.11 Each AoS was then given a score based on professional judgement on the level of each constraint. Weightings were then allocated across constraint topics. **Table 4.4** shows ranking of each Landfall location compared with each other for each constraint topic.

Table 4.4 Ranking of landfall locations for each constraint topic

Constraint Topic	**AoS 02**	**AoS 03**	**AoS A1**
Engineering / Construction	1st	3rd	2nd
Land use planning and consenting	1st	2nd	3rd
Environment	2nd	1st	3rd

4.4.6.12 Based on the above appraisal, it was proposed that AoS A1 was de-selected from further assessment, and that AoS 02 and AoS 03 were to be taken forward for further consideration.

AoS Refinement

4.4.6.13 AoS 02 and 03 were then refined to identify specific locations within the AoS to which onshore landfall infrastructure could be located based on initial public consultation and further detailed constraints assessment. Two landfall sites were developed within AoS 02 (Sites 2a and 2b, see **Figure 4-6: Landfall Site Selection – RAG Assessment no. 3**, **Volume 1b**) as it was identified the southern area of AoS 02 (Site 2b) was less constrained due to cultural heritage constraints identified within the northern area of AoS 02 (Site 2a) which included presence of Scheduled Ancient Monuments, Canmore site designation, and visual constraints from the substation. AoS 03 was also refined (Site 3) to limit effects on deep peat, maximise the distance from the RSPB reserve and the Arnol Blackhouse heritage attraction together with maximising the use the of the access opportunities available on eastern side of Site 3. However, the refinement of AoS 03 to Site 3 led to an increase in visibility from the residential properties within Brue/*Brù*.

4.4.6.14 Sites 2a, 2b, and Site 03 were then subject to further consultation with key stakeholders including CnES, RSPB, NatureScot, Historic Environment Scotland, and the public as part of several public

consultation events (see **Pre-Application Consultation Report**). The results of these consultations informed the RAG Assessment No. 3 described below.

RAG Assessment No. 3

4.4.6.15 RAG assessment No.3 was then undertaken of landfall sites 2a, 2b, and 03 to identify the preferred site to take forward into the EIA (**Figure 4-6**, **Volume 1b**). RAG ratings were identified across all identified onshore and offshore technical, environmental and social constraints for each Landfall Site option. Based on this assessment Landfall Site option 2b was identified as the most feasible. Key risks that were identified as lower for Landfall Site option 2b compared with Landfall Site options 2a and 03 were generally onshore related due to the similarities of offshore constraints across all three Site options. The key opportunities to select Landfall Site option 2b are summarised below:

- Increased distances from residential properties;
- Limited presence of peat;
- Limited areas identified of flooding risk;
- Not within a GCR site;
- Good road access opportunities;
- Increased distance to RSPB reserve;
- Greater distance to both Clach an Truiseil Standing Stone and the Arnol Blackhouse heritage attraction, minimising visual impacts arising from the OTW Project from both of these locations.

4.4.7 OFFSHORE CABLE AREA OF SEARCH REFINEMENT

4.4.7.1 An OCAS was first identified following the outputs of initial Landfall assessment (RAG Assessment No. 1) for the location of the Offshore Cables that connect the WTGs or OSP to Landfall. The OCAS was refined to align with the conclusion and final Landfall location (RAG Assessment No. 3). This OCAS boundary is shown on **Figure 4-7: Offshore Cable Area of Search refinement, Volume 1b**.

4.4.7.2 During the EIA process, it was identified that existing key fishing grounds are located within the OCAS and due to the potential for Offshore Cables to be present across the OCAS this could impact the commercial fishing industry during the Operation and Maintenance phase of the Offshore Project.

4.4.7.3 The Applicant undertook a technical feasibility analysis to understand how the OCAS could be refined to minimise the impact on commercial fisheries. Following this analysis a smaller OCAS was identified encompassing only the most northern part of the original OCAS. The OCAS was reduced from an area of 90.6 km^2 to 47.0 km^2 i.e., a reduction of 48% area. **Figure 4-6, Volume 1b** illustrates the refined OCAS together with the previously defined wider area for comparison.

4.4.7.4 The design refinement has been driven by the inshore fisheries mapping presented in **Chapter 21: Commercial Fisheries, Volume 2a** which integrates fishing vessel plotter data with Automatic Identification System-derived analysis of individual potting vessel activity.

4.4.8 ENERGY TRANSMISSION INFRASTRUCTURE

4.4.8.1 This EIAR considers 2 scenarios for delivery of either an OSP or a Landfall Substation (Scenario 1 OSP, Scenario 2 Onshore Landfall Substation, for further detail see Section 3.3.2 in **Chapter 3, Volume 1a**). Only one of these 2 scenarios will be delivered. It is necessary to retain both options even though only one will be executed as there are several unknown elements and risks that still exist at this stage of development. The main consideration is centred around what technology may or may not be available at the time of project execution. This will directly impact the size and number of Offshore Cables that will be required to come to shore (make landfall). By retaining both options, the Project will be able to assess any new technology developed or made available in the market between the time of this assessment and detailed design and the consequent feasibility of the 2 options for the Project. It also allows the Applicant the opportunity to understand the feasibility of all options when informed by further design information.

4.4.8.2 The Onshore Landfall Substation option (Scenario 2) reduces the amount of construction required in the marine environment, in lieu of the OSP, however necessitates the installation of more Offshore Cables via HDD in comparison to Scenario 1. This results in a higher level of complexity and technical risk associated with the construction works.

4.4.8.3 Each Scenario has receptors that are unique to the offshore or onshore environment, as well as overlapping receptors such as those affected by landscape and visual impacts of either option.

4.4.8.4 These two scenarios have been assessed in this EIAR and further description of each scenario is provided in **Chapter 3, Volume 1a**.

4.5 SUMMARY

4.5.1.1 This chapter provides an overview of the structured assessment of alternatives for the Offshore Project. Site selection was based on constraints mapping, technical feasibility, and stakeholder input. The PDE was iteratively narrowed reducing turbine numbers, increasing setbacks, and optimising layout to minimise environmental and visual impacts while maintaining generation targets. Landfall and offshore cable routes were selected using multi-stage RAG assessments, with the preferred options minimising engineering, environmental, and social concerns. Foundation and substation choices were driven by ground conditions and installation feasibility, with jacket foundations and two substation scenarios retained for flexibility. Stakeholder engagement and embedded mitigation measures were integral throughout, ensuring a robust, evidence-based design process.

4.6 REFERENCES

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4.7 GLOSSARY OF TERMS AND ABBREVIATIONS

4.7.1.1 A list of key terms and acronyms used in this chapter are provided in **Table 4-5** and **Table 4-6**.

Table 4-5 Acronyms and abbreviations

Term	Definition
BRAG	Black, Red, Amber, Green
CES	Crown Estate Scotland
CnES	Comhairle nan Eilean Siar / Western Isles Council
EIA	Environmental Impact Assessment
EIAR	Environmental Impact Assessment Report
GBS	Gravity Base System
GCR	Geological Conservation Review
GHG	Greenhouse Gas
GW	gigawatts
HDD	Horizontal Direction Drilling
HND	Holistic Network Design
HRA	Habitats Regulations Appraisal
MD-LOT	Marine Directorate - Licensing Operations Team
MHWS	Mean High Water Springs
NESO	National Energy System Operator
NGESO	National Grid Electricity Systems Operator
NSA	National Scenic Area
OAA	Option Agreement Area
OCAS	Offshore Cable Area of Search
OSP	Offshore Substation Platform
OTW	Onshore Transmission Works
OWF	Offshore Wind Farm
PAC	Pre-Application Consultation
PDE	Project Design Envelope
PMF	Priority Marine Feature
PO	Plan Option
RAG	Red, Amber, Green
SAC	Special Area of Conservation
SMP	Sectoral Marine Plan
SSEN	Southern Electricity Networks
TJB	Transmission Joint Bay
UK	United Kingdom
UWN	Under Water Noise
WFD	Water Framework Directive
WTG	Wind Turbine Generators

Table 4-6 Glossary

Term	Meaning
The Applicant	Spiorad na Mara Limited (the Project owner).
Applicant's Approach	The assessment parameters proposed by the Applicant, based on the most recent and compelling research and evidence.
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: • Scenario 1: Array Cables will be used to connect Wind Turbine Generators (WTGs) to each other, and to connect WTGs to the OSP. • Scenario 2: Array Cables will be 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.
Annex I Habitat	A natural habitat type of community interest, defined in Annex I of the Council Directive 92/43/EEC on the Conservation of natural habitats and of wild fauna and flora (Habitats Directive). The designation of Special Areas of Conservation (SAC) is required in the United Kingdom (UK) to ensure the conservation of these habitats. The protection afforded to sites designated prior to European Union (EU) Exit persists in UK law.
Consultation	The dynamic process of dialogue between individuals or groups, based on a genuine exchange of views and, normally, with the objective of influencing decisions, policies or programmes of action.
Department for Business, Energy & Industrial Strategy (BEIS)	BEIS existed until 2023 when it was split to form the Department for Business and Trade (DBT), the Department for Energy Security and Net Zero (DESNZ) and the Department for Science, Innovation and Technology (DSIT). Responsibility for national security and investment policy has gone to the Cabinet Office. Up until 2023, BEIS was the Government department responsible for business; industrial strategy; science; research and innovation; energy and clean growth; and climate change.
EIA Regulations	Terminology used in the Environmental Impact Assessment Report to refer to three sets of EIA regulations:

Term	Meaning
	• The Electricity Works (Environmental Impact Assessment) (Scotland) Regulations 2017, with regard to the Section 36 consent application for the Offshore Project; • The Marine Works (Environmental Impact Assessment) (Scotland) Regulations 2017, in relation to the Offshore Project with regard to marine licence applications; Town and Country Planning (Environmental Impact Assessment) (Scotland) Regulations 2017, with regard to consent for the Onshore Transmission Works (OTW).
Environmental Impact Assessment (EIA)	The process of evaluating the likely significant environmental effects of a proposed project or development over and above the existing circumstances (or 'baseline').
Environmental Impact Assessment Report (EIAR)	The Environmental Impact Assessment Report (EIAR) prepared to assess the likely significant effects of the Project on the environment.
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.
European Sites	Formerly known as 'Natura Sites', European Sites are those that are designated through the Habitats Directive and Birds Directive (via national legislation as appropriate). European sites in Scotland/*Alba* are considered to be Special Protection Areas (SPAs), Special Areas of Conservation (SACs), candidate SACs and Sites of Community Importance (SCI), Potential SPAs (pSPA), possible SACs (pSACs), Ramsar sites (designated under international convention) and proposed Ramsar sites.
Geological Conservation Review (GCR)	The Geological Conservation Review (GCR) is a process to select areas of national and international importance for their geology and geomorphology within Great Britain.
Gigawatt (GW)	One billion watts.
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.
High Voltage Direct Current (HVDC)	A high voltage, direct current (HVDC) electric power transmission system uses direct current for electric power transmission, in contrast to the more common alternating current systems. Most HVDC links use voltages between 100 kV and 800 kV.

Term	Meaning
Horizontal Directional Drilling (HDD)	A trenchless crossing engineering technique using a drill steered underground without the requirement for open trenches. This method is able to carry out the underground installation of pipes and cables with minimal surface disruption.
Horizontal Directional Drill (HDD) Exit Pit	Represents one exit pit that will be located within the Landfall Exit Pit Area.
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/*Eilean Leòdhais*. 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.
Marine Directorate - Licensing Operations Team (MD-LOT)	The regulator for determining marine licence applications on behalf of the Scottish Ministers in the Scottish inshore region (between 0 and 12 nautical miles) under the Marine (Scotland) Act 2010, and in the Scottish offshore region (between 12 and 200 nautical miles) under the Marine and Coastal Access Act 2009.
Mean High Water Springs (MHWS)	The average throughout a year of the heights of two successive high waters during those periods of 24 hours (approximately once a fortnight) when the tidal range is greatest.
N4	The ScotWind Plan Option Area within the Proposed Development is located.
National Scenic Area (NSA)	A national level designation applied to those landscapes considered to be outstanding scenic value in a national context. The NSA designation was given a statutory basis in Scotland by the Town and Country Planning (Scotland) Act 2006.
NatureScot	NatureScot is the lead public body responsible for Scotland/*Alba*'s natural environment.
Offshore	Pertaining to seaward of Mean High Water Springs (MHWS).
Offshore Application	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.

Term	Meaning
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 electrical and communication cables 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).
Offshore Project	The components of the Spiorad na Mara offshore wind farm (the Project) located seaward of Mean High Water Springs (MHWS).
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.
Offshore Wind Farm (OWF)	A group of WTGs located offshore.
Onshore	Pertaining to landward of MLWS.
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 which is routed from the Transition Joint Bays (TJB) 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)	A compound housing electrical equipment enabling connection to the grid. The onshore substation also contains equipment to help maintain stable grid voltage. Arnish/*Àirinis*, 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

Term	Meaning
	be converted to high-voltage direct current (HVDC) before being transmitted across the Minch/*A' Mhaoil* to mainland Scotland/*Alba*.
Onshore Transmission Works (OTW) / Onshore Project	The components of the Spiorad na Mara offshore wind farm (the Project) located landward of Mean Low Water Springs (MLWS).
Onshore Transmission Works Boundary / Onshore Project Boundary	The 'red line boundary' encompassing all temporary and permanent works associated with the OTW/Onshore Project.
Percussive Piling	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. 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.
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.
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.
Scoping Report	A document submitted by a developer that outlines the potential environmental issues and effects of a proposed project to determine which topics, methods, and

Term	Meaning
	level of detail should be included in the full Environmental Impact Assessment (EIA).
Scottish and Southern Electricity Networks Transmission (SSEN Transmission)	The owner, operator and developer of the high voltage electricity transmission system in the north of Scotland/*Alba* and remote islands.
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.
Section 36 Consent	Consent that can be granted under section 36 of the Electricity Act 1989 for the construction or extension, and operation, of an electricity generating station.
Special Area of Conservation (SAC)	An area designated under the EC Habitats Directive to ensure that rare, endangered or vulnerable habitats or species of community interest are either maintained at or restored to a favourable conservation status.
Special Protection Area (SPA)	An area designated under the Wild Birds Directive (Directive74/409/EEC) to protect important bird habitats. Implemented under the Wildlife and Countryside Act 1981.
The Crown Estate Scotland (CES)	The public corporation of the Scottish government that is responsible for the management of land and property in Scotland/*Alba*, as owned by the monarch "*in right of the Crown*".
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.
United Kingdom (UK)	The United Kingdom of Great Britain and Northern Ireland, comprising England, Scotland/*Alba*, Wales and Northern Ireland.
Water Framework Directive (WFD)	European Community (EC)'s Water Framework Directive, sets out rules to halt deterioration in the status of water bodies and achieve good status for Europe's rivers, lakes and groundwater.
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.