Environmental Impact Assessment Report
Volume 4: Outline Construction Method Statement

MarramWind Offshore Wind Farm

December 2025

MarramWind

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1. Introduction

1.1 Overview

1.1.1.1 This Outline Construction Method Statement (CMS) has been produced along with the Environmental Impact Assessment (EIA) Report and aims to outline the approach to constructing the MarramWind Offshore Wind Farm Project (hereafter referred to as 'the Project').

1.1.1.2 The Outline CMS applies only in the offshore environment below Mean High Water Springs (MHWS). It does not include any onshore construction activities.

1.1.1.3 The Outline CMS is related to the mitigation measure M-120 of **Volume 3, Appendix 5.2: Commitments Register**.

1.2 Project background

1.2.1.1 MarramWind Offshore Wind Farm is wholly owned by ScottishPower Renewables UK Limited (SPR).

1.2.1.2 The Project is a proposed floating wind farm located in the North Sea, with a grid connection capacity of up to 3 gigawatts (GW). The location of the Project is determined by the Option Area Agreement (OAA), which is the spatial boundary of the Northeast 7 (NE7) Plan Option within which the electricity generating infrastructure will be located. The NE7 Plan Option is located north-east of Rattray Head on the Aberdeenshire coast in north-east Scotland, approximately 75 kilometres (km) at its nearest point to shore and 110km at its furthest point. An Option to Lease Agreement (OLA) for the Project within the NE7 Plan Option was signed in April 2022.

1.2.1.3 A summary of the Project is provided in **Volume 1, Chapter 1: Introduction** and a comprehensive description of the Project is provided in **Volume 1, Chapter 4: Project Description.**

1.2.1.4 In March 2024, National Grid Electricity System Operator Limited published the Beyond 2030 report, which presented the ScotWind elements of the Holistic Network Design Follow Up Exercise. This report confirmed that the full 3GW connection for the Project will be connected to the Scottish and Southern Electricity Networks (SSEN) Netherton Hub at Longside, to the west of Peterhead.

1.2.1.5 The Project's offshore infrastructure, located seaward of MHWS, may include the following:

- wind turbine generators (WTGs), including floating units (platforms and station keeping system);
- array cables;
- subsea distribution centres;
- subsea substations;
- offshore substations;
- reactive compensation platform(s) (RCPs) (if required); and
- offshore export cables to connect the wind farm area to the landfall(s).

1.2.1.6 The EIA Report accompanies applications for offshore consents, licences and permissions for the Project to Marine Directorate – Licensing Operations Team (MD-LOT) under Section 36 (s.36) of the Electricity Act 1989, the Marine (Scotland) Act 2010 and the Marine and Coastal Access Act 2009, for the offshore infrastructure seaward of MHWS.

1.2.1.7 The EIA Report also accompanies an application to Aberdeenshire Council for Planning Permission in Principle consent under The Town and Country Planning (Scotland) Act 1997, for the onshore infrastructure landward of Mean Low Water Springs (MLWS).

1.2.1.8 There are four sets of EIA regulations applicable to the Project: the Electricity Works (EIA) (Scotland) Regulations 2017 for offshore generating stations requiring s.36 consent; the Marine Works (EIA) (Scotland) Regulations 2017 and the Marine Works (EIA) Regulations 2007 for marine licence applications within Scottish territorial waters (0-12 nautical miles) and offshore waters (12-200 nautical miles) respectively; and the Town and Country Planning (EIA) (Scotland) Regulations 2017 for planning applications submitted to Aberdeenshire Council for onshore infrastructure located landward of MLWS.

1.3 Purpose of the Outline CMS

1.3.1.1 The Outline CMS will form the basis of the Final CMS. The Final CMS will be finalised and approved post-consent and approved as part of condition discharge prior to construction by Scottish Ministers in accordance with s.36 and associated marine licences.

1.3.1.2 The broad objective of the Outline CMS is to provide key information on the offshore construction methods, including vessel requirements, and details of anticipated installation techniques. This will be provided for the following activities:

- pre-construction surveys and seabed preparation activities;
- anchor and mooring line installation;
- floating unit and wind turbine preparatory works;
- floating wind turbine towing to site;
- array cable and Subsea Distribution Centre (SDC) installation;
- offshore platform foundation installation and piling;
- offshore platform topside installation;
- offshore export cable installation; and
- WTG commissioning.

1.3.1.3 This CMS is a ‘live’ document and as such it will be further developed post-consent in consultation with the regulatory bodies and stakeholders, such as MD-LOT, Marine Directorate Science, Evidence, Data and Digital (formerly Marine Scotland Science) and NatureScot, once the Project design has been finalised and the relevant condition discharged.

1.4 Implementation of the Final CMS

1.4.1.1 The Outline CMS will be submitted to the Scottish Ministers / Licensing Authority and other stakeholders in relation to monitoring compliance with the specific requirements of the relevant consent conditions. A Final CMS will be issued post-consent following further engineering progress / definition and in line with the discharge of the relevant condition(s).

1.4.1.2 During construction activities the Final CMS will be monitored by the Project's Construction Manager (or equivalent), Environmental Manager (or equivalent) and MD-LOT.

1.5 Scope of Outline CMS

1.5.1.1 The Outline CMS will cover the following:

- preliminary offshore construction methods; and
- installation methodology.

1.6 Other related implementation plans

1.6.1.1 The Outline CMS will be developed with consideration of the content and requirements of other relevant Implementation Plans. These are set out in **Table 1.1** below with details of the linkages.

Table 1.1 Other related implementation plans to the Outline CMS

Implementation plan	Linkage with Outline CMS
Project Environmental Monitoring Programme	The **Project Environmental Monitoring Programme** will set out the Applicant's commitments to monitoring the potential effects of the Project on key receptors and provide detail on how that monitoring will be delivered across all stages of the Project (pre-construction, construction, O&M and decommissioning). **Volume 4: Outline Project Environmental Monitoring Programme** has been submitted with the application.
Offshore Invasive Non-Native Species	The **Offshore Invasive Non-Native Species Management Plan** aims to secure specific measures to avoid, reduce or remedy likely significant adverse effects associated with INNS. **Volume 4: Outline Offshore Invasive Non-Native Species Management Plan** has been submitted with the application.
Cable Plan	The **Cable Plan** will provide details on cable specification, installation and cable protection, their interactions with the environment and safety consideration. The approach for analysis of geophysical data in the context of benthic habitats will help inform cable routing. **Volume 4: Outline Cable Plan** has been submitted with the application.

2. Construction Method Statement

2.1 Pre-construction surveys and seabed preparation

2.1.1.1 Geophysical and geotechnical surveys of the OAA and offshore export cable corridor will be conducted to determine the seabed preparation activities necessary in advance of construction, and to characterise the suitability of the ground to support structures that will interact with the sub-seabed profile. These surveys will be undertaken by a dedicated marine survey vessel, and will identify bedforms, obstacles and debris on the seabed within the Offshore Red Line Boundary, in addition to sampling seabed characteristics.

2.1.1.2 Seabed preparation activities can be necessary to clear and stabilise the seabed in advance of construction activities. Works can include the removal of boulders, sand wave levelling, and the removal of debris such as lost fishing gear.

2.1.1.3 Depending on the density and obstruction of boulders to the planned development, these will typically be relocated to a nearby position on the seabed and a safe distance from the planned construction activities if necessary.

2.1.1.4 Sediment displacement during the seabed preparation phase would be undertaken by suitable dredging techniques, which will be selected based on soil types, water depths and environmental factors. Dredging would be performed by multiple passes of the area until the required depth of dredging has been achieved.

2.1.1.5 Any licensing requirements for the removal of materials from the seabed will be identified following these pre-construction surveys and applied for by MarramWind Limited (hereafter, referred to as 'the Applicant') under the Marine (Scotland) Act 2010 for activities within 12nm of the coast, and under the Marine and Coastal Access Act 2009 for activities beyond 12nm.

2.2 Anchor and mooring line installation

2.2.1 Overview

2.2.1.1 Anchors and mooring lines will be transported to the OAA by vessels prior to the installation of the floating units. Given likely weather window and storage constraints, anchors may be installed year-round and up to several years in advance of the mooring lines and floating units. Mooring lines would be installed in advance (typically within the same installation year) and wet stored on the seabed awaiting the installation of floating units.

2.2.2 Installation of drag embedment anchors

2.2.2.1 The anchor and mooring lines will be deployed from a vessel to a pre-determined location and orientation. Once in location load will be applied to the anchor drawing it forward and embedding the anchor into the seabed. The load and displacement will be closely monitored throughout and upon completion of the requisite load tests the final position shall be determined and either the mooring line length compensated or in some cases the anchor may be recovered and relayed in an alternate location and process repeated before the floating unit may be connected. A length of mooring chain will remain connected to the anchor and wet stored on the seabed awaiting the installation of the remaining mooring line or floating unit.

2.2.3 Installation of suction anchors

2.2.3.1 Suction anchors will be deployed from a vessel by crane to a predetermined location and orientation on the seabed. Water will then be pumped out of the suction anchor creating a reduced pressure within the anchor, this will result in the anchor being drawn into the seabed. Mooring lines will then be connected to the anchor later prior to installation of the floating unit.

2.2.4 Installation of driven pile anchors

2.2.4.1 Driven pile anchors will be deployed from a vessel by crane to a predetermined location and orientation on the seabed. The crane will lower the pile to the seabed and will be kept in position using a pile gripper. To enable pile placement, a pile installation frame may be temporarily placed on the seabed and removed once the piles are installed. A hydraulic hammer will be positioned onto the pile, driving it to the target depth.

2.2.4.2 Piling will commence with a low hammer energy that slowly ramps up to the maximum necessary. It is anticipated that the maximum hammer energy will only be necessary at certain (not yet defined) piling locations.

2.2.4.3 Detailed geotechnical data of the OAA will be reviewed to inform a driveability assessment. The findings will allow the final hammer energies to be optimised, maintaining piling progress while minimising required hammer energy.

2.2.4.4 Up to two piling events occurring simultaneously at WTG locations (or at WTG and offshore substation locations) are considered within the design envelope. However, no concurrent piling of offshore substation foundations is proposed (see **Volume 4: Outline Piling Strategy** for further information).

2.2.4.5 Mooring lines will then be connected to the anchor later prior to installation of the floating unit.

2.2.5 Installation of mooring lines

2.2.5.1 Final installation of the mooring lines/mooring line sections will be completed by a suitable anchor handling vessel using ROVs to make subsea connections of mooring lines to anchors or of mooring line segments. These fully installed mooring lines will then be wet stored on the seabed ready for installation of the floating units.

2.3 Floating unit and wind turbine preparatory works

2.3.1.1 Floating unit fabrication will occur at a suitable facility subject to market availability at the time of fabrication. Floating unit assembly (if required), will occur at a suitable port, depending on port availability at the time of assembly. The specific locations of the fabrication facility and assembly port are not yet confirmed.

2.3.1.2 Once the floating unit is assembled and launched, it will be positioned along a quayside or facility for WTG integration. Where possible, tower sections and other components may be preassembled and pre-commissioned prior to integration.

2.3.1.3 Following WTG integration, the floating unit may be relocated to a secondary site to finalise commissioning activities and prepare for tow-out.

2.3.1.4 Ports with adequate capacity to support the marshalling, integration and assembly work will be required but are not yet confirmed.

2.3.1.5 It may be required to temporarily relocate or hold the floating units at a wet storage location to complete these activities or await a suitable installation weather window, but wet storage is not expected for prolonged periods.

2.3.1.6 The location of possible areas for wet storage has not yet been identified but is expected to be within or vicinity of the selected integration port. The consent and assessment covering the temporary storage of floating units is outside the remit of the project EIA and will be considered as part of any separate consents for wet storage (for example harbour development works).

2.4 Floating wind turbine tow to site and hookup

2.4.1.1 Floating units will be prepared for towage to site at the integration port fitted with the requisite navigation aids and towed during an acceptable weather period by a predetermined arrangement of vessels.

2.4.1.2 Once the floating unit arrives in the OAA, the vessels may change from a towing arrangement to an installation arrangement. The floating unit will be positioned at the intended installation location within the OAA by the installation vessels utilising dynamic positioning. The floating unit will be held in position whilst further installation vessels will lift the pre-laid mooring system from the seabed and connect it to the floating unit. Once a storm safe arrangement of moorings has been achieved, the vessels holding the floating unit may be released and any final mooring lines connected.

2.4.1.3 Upon completion of the mooring line connections, further mooring line and floating unit commissioning activities may be progressed. These may include any tensioning and adjustments to mooring lines and ballasting of the floating unit to ensure the station and condition of the floating unit is correct in readiness for further installation or WTG commissioning activities.

2.5 Array cables and subsea distribution centres Installation

2.5.1.1 The array cables will typically be installed on powered reels or carousels from a cable lay vessel. The cable is led along a trackway and overboard through a cable chute of the vessel.

2.5.1.2 The array cables will typically be pulled into the floating unit via an I-tube or J-Tube (or alternative cable entry system) for connection to the WTG. In all cases, the section of the array cable from the floating unit to the seabed will be dynamic and subject to water column movements. Dynamic sections are typically laid in a lazy 's' pliant wave configuration, potentially with the addition of a tether to maintain the dynamic section of the array cable in position.

2.5.1.3 Dependant on the layout, the cable may then be routed to an adjacent floating unit or statically connected via an SDC. Where SDCs are utilised, it is anticipated that that these will be installed via a Construction Support Vessel (CSV) using the vessel's crane.

2.5.1.4 The cables will be laid by the cable laying vessel in sections and joined together. The cables are then typically buried 1m–2m beneath the seabed.

2.5.1.5 Site preparation activities, unexploded ordnance (UXO) and boulder clearance activities may be required along cable routes and at SDC locations. Pre-lay grapnel run is also expected to be performed to clear any objects or debris along cable routes prior to installation.

2.6 Offshore platform installation and piling

2.6.1 Overview

2.6.1.1 The following is relevant to all offshore platforms (i.e. offshore substations and RCPs). The first step is the installation of the foundation. This will be transported to the OAA by a specialist installation vessel or as a towed structure. It will then be up righted via an engineered procedure (heavy lift or de-ballasted) and lowered to the seabed at the prepared location. The foundation is then secured to the seabed by driven piles or suction caissons.

2.6.2 Jacket foundations secured by driven piles

2.6.2.1 For piled jacket foundations, the piles could be installed by either post-piled (piled post installation of the jacket) or pre-piled (before the jacket structure is placed on the seabed). It is anticipated that piles would generally be driven, but alternative installation techniques and mitigations (e.g. drilling or vibration) may be required depending on ground conditions and operational constraints.

2.6.2.2 For post-piled jackets, the sequence would typically be:

- jacket piles transported to site by construction vessel or offshore transportation barge;
- lifting of driven piles from barge and placement into sleeves on jacket;
- driven piles allowed to naturally penetrate seabed;
- driven piles driven to depth using pilling hammer;
- levelling of jacket via jacking off piles; and
- grouting and / or mechanical locking of jacket to pile connections.

2.6.2.3 The overall installation methodology for a pre-piled arrangement would typically be:

- driven piles and driven pile installation frame transported to site by construction vessel or offshore transportation barge;
- driven pile installation frame placed on seabed;
- driven piles placed on seabed within frame and driven to target depth;
- driven pile installation frame recovered;
- installed driven pile locations surveyed and jacket dimensions adjusted;
- jacket installed;
- levelling of jacket, grouting and / or mechanical locking of jacket-to-pile connections; and
- scour protection installation (if required).

2.6.3 Spoil removal and disposal for jacket foundations

2.6.3.1 For jacket foundations, the amount of spoil requiring disposal is likely to be limited.

2.6.3.2 Some dredging may be required for levelling the seabed prior to the installation of a pile template (if used). It should be possible to spread this material close to the installation works, within the Red Line Boundary.

2.6.3.3 Based on preliminary geotechnical information, it is thought likely that pile driving would be possible across the OAA. This would be confirmed via pre-construction surveys. Driven pile is unlikely to generate spoil material.

2.6.4 Jacket foundations secured by suction caisson

2.6.4.1 Jackets secured by suction caisson foundations would be transported to site as outlined in **paragraph 2.6.1** and installed using an appropriate installation vessel that lowers the structure to the seabed.

2.6.4.2 Once positioned on the seabed at the desired location, the initial penetration occurs under foundation self-weight. Pumps are then attached to the caisson and water is evacuated. Reducing pressure within the caissons and drawing the structure into the seabed. Water jetting may additionally be used at the tip of the skirt to facilitate penetration. Once at the predetermined penetration equipment is removed.

2.6.4.3 In areas where the seabed is level, the suction caisson foundation may not require significant seabed preparation. However, measures may be required in areas where sand waves are present to provide a level and stable seabed for the installation and to allow scour protection to be later placed around the foundation. It is possible that excavation to the trough of the sand wave would be necessary before installing the suction caisson foundation structure. If this foundation type is adopted, detailed work would be required pre-construction to determine the preparation required for each foundation.

2.6.4.4 Scour protection would be provided around the installed suction caisson (if required).Error! Reference source not found.

2.6.4.5 Detailed pre-construction work would be required to design the scour protection for each foundation. However, it is anticipated that the scour protection area would be twice the diameter of the foundation for suction caisson foundations.

2.6.5 Spoil removal and disposal for jacket and suction caisson foundations

2.6.5.1 For jacket foundations, the amount of spoil requiring disposal is likely to be limited.

2.6.5.2 Some dredging may be required for levelling the seabed prior to the installation of a pile frame (if used). It should be possible to spread this material close to the installation works, within the Red Line Boundary.

2.6.5.3 Any sediment displaced during seabed preparation for jackets with suction caissons would be deposited within the OAA. Should this not be possible, any marine licensing requirements for spoil removal or disposal will be identified and applied for by the Applicant under the Marine and Coastal Access Act 2009 for activities beyond 12nm.

2.7 Offshore platform topside installation

2.7.1.1 Installation of the offshore topsides would be undertaken by heavy lift or float over operation. Depending on the selected methodology for installation, the topside unit and associated foundation will be specifically designed for that operation. The operation for the installation will be highly engineered and subject to specific weather and operational limits.

2.7.1.2 **Heavy lift**: the topside unit will be transported to the OAA on a suitable offshore barge, or if a small topside, like an RCP could be on the deck of the heavy lift vessel itself. A large capacity heavy lift crane vessel will then connect to the topside unit, lifting it from the offshore barge or vessel deck before moving the topside unit into position over the pre-installed foundation and setting it down on the foundation.

2.7.1.3 **Float over**: The topside unit will be transported to the OAA on suitable offshore barges or specialist heavy lift vessels. The barges or vessels will then undergo ballasting operations to ensure sufficient clearance with the installed foundation before positioning over the pre-installed foundation and undergoing further ballasting operation to transfer the topside unit on top of the foundation.

2.8 Export cable installation

2.8.1 Cable installation

Pre-lay works

2.8.1.1 In areas with large ripples and sand waves, the seabed may first require (subject to detailed studies) sand wave levelling by dredging before the cable could be installed. Sand wave levelling would be in discrete areas and not along the full length of the corridor.

2.8.1.2 The offshore export cable would be routed as far as possible in soft sediments to allow it to be buried into the seabed. If boulders or debris are encountered on the seabed, these would be removed before the cable is laid.

2.8.1.3 The maximum cable installation swathe will encompass the pre-lay grapnel run. A conservative maximum width of seabed disturbance along the pre-lay grapnel run has been assumed to account for potential future increases in cable laying plough and pre-lay grapnel run requirements.

2.8.1.4 If the offshore cable corridor intersects an out of service cable, the latter may be recovered, but more likely it will be cut and the cut ends laid on the seabed with clump weights to stabilise the free end. The out of service cable removal method is subject to detailed surveys, engineering, accessibility and agreement with the cable owners that the cable or sections of it can be removed or crossed.

2.8.1.5 The removal of material would be subject to separate consent as outlined in **paragraph 2.1.1.5**.

Offshore export cable laying

2.8.1.6 The cable installation method and burial details for the offshore export cable will be determined upon completion of pre-construction surveys. The method selected will consider risks during cable laying and lifetime maintenance. This may vary or be a combination of techniques over the offshore export cable corridor route. The Project anticipates burying the cable along its length as this protects the cables from damage. Where burial is not possible, typically rock placement, would be installed. Other examples or more localised protection could be in the form of concrete mattresses / bags or steel split pipe, used in isolation or under rock placement, but only where not introducing hazards for vessels, such as fishing vessels. Other protection would be installed directly onto the cable, such as steel split pipe, typically only used at exit of cable bores where rock placement may not be possible or in sensitive environmental areas where seabed intervention is not acceptable.

2.8.1.7 There are two main installation techniques for the offshore export cables:

- cables are laid and buried in a simultaneous operation with burial equipment being towed by the cable laying vessel; and

- cables and burial are done in separate operations. For example, cable laid and later buried / protection, or trench created then cable laid and closed at a later date.

2.8.1.8 Cable burial is undertaken using a combination of the following installation strategies, depending on soil conditions along the cable route and will be informed by the cable burial risk assessment:

- **ploughing**: a plough is towed by a vessel along the cable route, creating a trench into which the cable is placed and buried with backfill material. This technique is commonly used in simultaneous cable lay and burial operations, where the cable is laid and buried in one step;
- **jet trenching**: Jet trenches use water jets to fluidise the seabed along the cable route, allowing the cable to settle below the seabed;
- **mechanical trenching**: this method involves using a chain or wheel to cut a trench, enabling the cable to be buried and covered with backfill material; and
- **pre-cut trenching**: this method uses a barge mounted excavator. The trench is pre-cut with spoil heaps placed to side of trench for later back filling after cable is laid. This is a possible solution in nearshore areas.

2.8.1.9 The Project will select the cable burial method that provides the best results considering the length, impact and challenges of the respective cable lay operations, this may vary or be a combination of techniques over the cable route both for the offshore export cable corridor and within the OAA.

Cable burial methods: ploughing

2.8.1.10 Ploughing is typically done simultaneously with cable lay - termed simultaneous lay and burial. This technique involves the cable lay vessel towing the plough at a set distance behind the touch down point of the cable. This could be in the region of 200m, depending on water depth.

2.8.1.11 Ploughs are towed along on flat skids that keep the plough on the surface of the seabed. At the start of trenching, the cable is mechanically lifted into the plough and guided into the burial system by handling arms. During ploughing, the cable is pushed into the bottom of the trench by a depressor arm on the back of the plough share. This ensures the cable is buried at the target trench depth.

2.8.1.12 At crossing locations, the plough transitions out of the trench, the cable is released, and the plough is recovered and re-launched once the crossing is passed.

2.8.1.13 The plough may be a hybrid type plough, which includes water jet nozzles on the share to fluidize the seabed and reduce the tow force required

Cable burial methods: jet trenching

2.8.1.14 Jet trenching is a post lay burial technique, where a jet trencher is landed over the cable by the support vessel and engages two powerful jet swords into the soil either side of the cable. The jetting device uses pressurised water to fluidise sediment in a trench which allows the cable to embed within the trench. Once jetting stops or moves on sediment is no longer fluidised and so the cable is buried.

Cable burial methods: mechanical trenching

2.8.1.15 Mechanical trenching is a post-lay trenching technique, operating in a similar manner to jet trenching. The trenching tool is deployed from a support vessel and landed over the cable. The trencher then lifts the cable inside the body of the trencher and into the cable guide system.

2.8.1.16 Rather than using water jets to penetrate the soil, the mechanical trencher uses either a cutting wheel or cutting chain to break up the seabed and lower the cable into the bottom of the trench. Tracks fitted to the trencher allow it to move along the cable.

2.8.1.17 Mechanical trenchers are designed to work in stiffer soil conditions such as stiff clay and weak rock, compared to jet trenchers which are predominantly for sands or soft clays.

2.8.1.18 Some mechanical trenchers are designed with both jetting swords and cutting tools to maintain flexibility in operations.

Cable burial methods: pre-cut trenching

2.8.1.19 Pre-cut trenching typically involves backhoe excavator mounted on a barge and using a sophisticated survey system to accurately excavate a pre-cut trench in the seabed, or removal of small seabed features to facilitate cable lay. This technique would be used where other methods for burying the cable are not economically and / or technically feasible. One such area is in the nearshore area at the cable bores' exit location.

2.8.1.20 First a trench is excavated or cut, then the cable is laid into the trench, then the excavated sediment is used to backfill the trench.

Cable laying and burial speeds

2.8.1.21 The speed of cable laying would differ between the lay and burial method being used, and will depend on the ground conditions, seabed profile and water depth.

2.8.1.22 Offshore export cable lay vessels can lay at a rate of up to 1km/hr (typically 600 to 800m/hr), depending on the number of cables being laid, the type of burial planned and the seabed conditions.

2.8.1.23 Arrays cable lay vessels can typically lay at a rate of up to 400 to 500m/hr, depending on the layout configuration (for instance, faster if laying straight compared to curves).

Separation distance between offshore export cables and trenches

2.8.1.24 The minimum separation of the offshore export cables is determined primarily to reduce the risk involved of damaging a pre-laid cable during installation of an adjacent cable. In addition, the separation distance allows a working area for the recovery of a cable requiring maintenance or repair, and its re-installation without disturbing or damaging the adjacent cables.

2.8.1.25 The space required to install a repaired cable would depend on the water depth at the fault location. Obstacles including wrecks and other sub-sea cables or pipelines are also secondary factors that would influence this spacing.

2.8.1.26 The offshore cable corridor width needs to allow for:

- sufficient space to allow crossing of existing cables and pipelines as close as possible to a 90-degree angle;
- sufficient space that the offshore export cable route does not inhibit the operation and maintenance activities of existing cables and pipelines;

- sufficient width for installation vessels to manoeuvre and anchor (if required);
- sufficient width between offshore export cables to allow for any maintenance activities, including space to effect cable recovery and repairs;
- to incorporate seabed lease requirements from the Crown Estate Scotland; and
- to incorporate best practice guidelines (as far possible) from latest DNV-KEMA guidelines.

2.8.1.27 The offshore cable corridor width will be widened along the location(s) of the RCP(s) (if required).

2.8.1.28 When offshore export cables are installed, there needs to be sufficient space between them to:

- mitigate cable systems constraints such as mutual heating and electrical interaction between adjacent cables;
- minimise the risk of plough (or another burial tool) over-run;
- allow for installation vessels to manoeuvre during installation where there are bends in the offshore cable corridor; and
- allow the repair bight to be laid out where repairs are needed.

2.8.1.29 Based on the above requirements, an offshore export cable corridor has been determined that takes into account a minimum distance of three times the varying water depth along the route between the export cables, to have sufficient space, to necessitate a repair, and a further 1km boundary either side of the corridor to take account of any issues found during offshore installation. For instance, pre-lay survey findings that require a re-route. The offshore export cable corridor will be located within the Offshore Red Line Boundary, which has a minimum width of 3.5km and widens to over 8km in some areas to account for constraints to cable routing on the seabed. The width of the Offshore Red Line Boundary takes into account the necessary minimum cable separation distances. The actual cable corridor width is expected to be refined throughout the design process, following detailed cable burial risk assessment and pre-lay surveys, prior to the construction of the Project.

2.8.2 Cable protection installation

2.8.2.1 In the few areas where cable burial cannot be achieved, other alternative methods of cable protection will be used. This may be where unsuitable seabed conditions exist or where another cable or pipeline is already in place. External cable protection options include rock armour or concrete mattresses, the exact type, location and dimensions of which are yet to be determined.

2.8.2.2 Rock armour involves the placement of rocks on top of the cable to provide protection that is effective on crossings or areas where unsuitable seabed conditions are encountered. This can be used where long sections of cable require protection.

2.8.2.3 Concrete mattresses are prefabricated flexible concrete coverings that are laid on top of the cable, as an alternative to rock placement. The placement of concrete mattresses is slow and as such is only be used for short sections of cable protection. Bags or steel split pipe can be used for smaller scale applications. Concrete mattresses, bags or steel split pipe will only be installed where safe to do and they do not cause a snagging risk for other sea users, for example fishing vessels along the offshore export cable corridor, where the route will be designed to be over trawlable.

2.8.2.4 The worst-case estimate for the offshore export cable protection required due to unsuitable ground conditions and cable crossings in the offshore cable corridor is based on up to 20% of the offshore export cables being unable to be buried because of ground conditions and therefore requiring cable protection. This will be refined subject to Cable Burial Risk Assessment which will confirm the type of protection required along the route (for instance buried or otherwise).

2.8.2.5 It is considered likely that, due to the sandy and gravely nature of the sediment along the offshore cable corridor, most of the offshore export cables will be buried and will not require external cable protection.

2.8.3 Cable crossings

2.8.3.1 Where cable or pipeline crossings occur (whether by an array cable or the offshore export cables), they will be subject to respective crossing agreements between the infrastructure owner and the Applicant.

2.8.3.2 Where the offshore export cable intersects existing infrastructure, external protection is required to protect the pipeline or cable being crossed and to protect the new cable being laid because it cannot be buried at this location.

2.8.3.3 It is anticipated that a combination of some of the following rock placement; or localised concrete mattresses, bags or steel split pipe would be used for protection at cable crossings. However, in all cases the design will be over trawlable and discussed with seabed users, for example fisheries. In shallow waters, the height of cable crossings may be required to be reduced to avoid reduced water depth for navigation.

2.8.3.4 The design required would depend on the size, type and vertical position of the asset to be crossed, the number of cables crossed and the separation of the cables that can be achieved at the point of the crossing.

2.8.3.5 Each crossing will be specifically reviewed and designed for the site conditions and constraints.

2.8.3.6 There are currently 16 known cable crossings required along the offshore export cable route. The Applicant has included an additional six number of crossings as a contingency. This is calculated from the Applicant's current understanding of the likely cables to be present but with contingency built in to include potential cable discoveries post-consent, which will be informed by pre-construction magnetometer surveys.

2.8.3.7 Where the offshore export cable crosses an out of service cable, the Applicant may wish to cut the disused cable at each end and bury the offshore export cable through the path created. Clump weights would likely be placed at each end of the cut cable to prevent its re-emergence. This procedure would be subject to detailed magnetometer surveys and agreement with the cable owner.

2.9 Floating wind turbine commissioning

2.9.1.1 Upon installation and hook up of the floating unit to the mooring system, completion of the dynamic array cable pull-in and connection to the floating unit, the final commissioning of the WTG will commence. This involves a process of electrical and mechanical testing to ensure that all components are operational. WTG commissioning allows the energisation of the WTGs and the generation and transmission of electricity to commence.

2.10 Access and logistics for construction

2.10.1.1 The number and specification of vessels employed during the construction of the Project would be determined by the appointed marine contractor and in line with the construction strategy. It is anticipated that several types of construction vessel could work in parallel during the construction period.

2.10.1.2 Indicative vessel types required during the construction and operation stages are shown in Table 2.1. The vessel estimates are based on the construction of three phases delivering a total of 3GW installed capacity, in accordance with the outline construction programme. Overlaps between phases have been included where appropriate.

Table 2.1 Indicative vessel requirements at construction stage

Activity	Vessel type	Indicative number	Round transits[1]
Offshore substations foundation installation	Heavy lift vessel	1	12
	Support vessel	5	90
	Barge (if required)	1	12
Floating units towage	Anchor handling tug supply (AHTS) vessel	3	675
Floating units installation / mooring hook up	AHTS vessel	5	1125
Cable installation for the offshore export cable corridor	Survey vessel (pre- and post-lay)	1	20
	Cable lay vessel	1	70
	AHTS vessel (for trenching / bounder removal / pre-lay grapnel run / UXO removal)	2	40
	Offshore construction / larger AHTS vessel (for sand wave clearance)	2	40
	Rock placement vessel	2	80 to Norway
Cable installation for the array cables	Survey vessel (pre- and post-lay)	2	60
	Cable lay vessel	2	50
	AHTS vessel (for trenching)	2	80
	Rock placement vessel	2	30 to Norway

[1] A transit is defined as a single uninterrupted journey either from port to worksite or from worksite to port. Each leg of the journey constitutes one transit. Therefore, for a single operation where a vessel departs from port, performs work offshore, and returns to port, this would be classed as two transits. This definition applies to vessel movements only; helicopter movements are referred to separately as 'trips'.

Activity	Vessel type	Indicative number	Round transits[1]
Anchor installation	Offshore construction vessel / larger AHTS	2	675
Mooring line installation	Offshore construction vessel	2	144
	AHTS vessel	2	675
Support vessels	Guard vessel	2	208
	Service operation vessel (SOV)	2	208
	Support vessel	3	312

2.10.1.3 It is anticipated that approximately 10 vessels would be on site at any one time during the construction of the Project. The numbers of vessels will be confirmed with further input from construction contractors post-consent.

2.10.1.4 It is estimated that approximately 4,000 individual vessels transits (each representing a one-way journey between port and worksite) would be required during the construction of the Project. It is estimated that the installation of each floating unit will require up to three vessel transits of the installation vessel.

2.10.1.5 Upon arrival at the offshore worksite, installation vessel(s) may require repositioning within the field to complete the installation procedure. Following completion of the procedure, the vessel(s) may undertake a return transit to port.

2.10.1.6 The routing of vessel trips will depend upon the final selection of the port facilities required to construct and operate the Project, which has not yet been determined.

2.10.1.7 There may also be a requirement for helicopters to travel to and from the OAA to assist with construction activities. Helicopters will largely be used to transfer personnel in between port visits and to any accommodation vessels but may also be used for construction materials or to support specific construction activities. It is estimated that two helicopter trips per week for duration of the main offshore construction, approximately 1,040 helicopter round trips may be required during the offshore construction period. The helicopter port or airfield location has not yet been determined but is expected to be Aberdeen bases on facilities at time of writing.

3. References

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4. Glossary of Terms and Abbreviations

4.1 Abbreviations

Acronym	Definition
CSV	Construction Support Vessel
EIA	Environmental Impact Assessment
GW	Gigawatts
HDD	Horizontal Directional Drilling
km	kilometre
LAT	Lowest Astronomical Tide
m	metres
MD-LOT	Marine Directorate – Licensing Operations Team
MHWS	Mean High Water Springs
MLWS	Mean Low Water Springs
MPA	Marine Protected Area
NE7	North East 7
O&M	Operation and Maintenance
OAA	Option Agreement Area
RCP	Reactive Compensation Platform
ROV	Remotely Operated Vehicle
SDC	Subsea Distribution Centre
s.36	Section 36

Acronym	Definition
CMS	Construction Method Statement
SPR	ScottishPower Renewables UK Limited
SSEN	Scottish and Southern Electricity Networks
UXO	Unexploded Ordnance
WTG	Wind Turbine Generator

4.2 Glossary of terms

Term	Definition
Array cables	Array cables are a crucial component of subsea infrastructure, particularly in offshore wind farms. They are used to connect wind turbines to the offshore substation, transferring power and auxiliary power when turbines are not generating.
Crown Estate Scotland	The public corporation of the Scottish government that is responsible for the management of land and property in Scotland, as owned by the monarch "*in right of the Crown*".
Front End Engineering Design	An early design stage of a capital project that specifies technical requirements and investment costs prior to the detailed engineering design stage.
Marine Directorate- Licensing Operations Teams	Formerly known as Marine Scotland- Licensing operations Team, MD-LOT is the regulator for determining marine licence applications on behalf of the Scottish Ministers in the Scotland 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 Marine and Coastal Access Act 2009.
Marine licence	Licence required for certain activities in the marine environment and granted under either the Marine and Coastal Access Act 2009 or the Marine (Scotland) Act 2010.
Marine Protected Area	A Marine Protected Area is a legally designated zone in UK waters established to safeguard vulnerable species and habitats through restrictions on activities that could harm ecological integrity. MPAs include sites such as Special Areas of Conservation (SAC), Special Protection Areas (SPA), and Marine Conservation Zones (MCZ), and their presence requires careful

Term	Definition
	assessment and mitigation within Environmental Impact Assessments for offshore wind projects
Offshore	Pertaining to the seaward side of the MLWS, and typically in reference to locations some distance from the coast.
Offshore Wind Farm	An offshore wind farm is a group of wind turbines generators in the same location (offshore) in the sea, which are used to produce electricity.
Planning Permission in Principle	Planning Permission in Principle is a type of planning application that allows a proposal to be assessed without requiring detailed plans of the layout, design, or finish of any buildings. It is typically used for larger developments, such as residential projects, where the specifics can be determined later.
Scottish Ministers	The devolved government of Scotland.
Scour	Scour is the process of sediment erosion and transport that occurs around marine structures under the action of water flow. The level of scour depends on the water flow and the seabed conditions.

MarramWind