Rampion 2 Wind Farm

Category 7: Other Documents

Outline Scour Protection and Cable Protection Plan

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Executive Summary

This Outline Scour Protection and Cable Protection Plan (the Outline Plan) (Document Reference: 7.12) sets out the key principles of how Rampion Extension Development Limited (RED) intends to manage the protection of cable and foundations from the effects of scour, both immediately post installation and then throughout the operational life of Rampion 2 offshore wind farm. The production of this Outline Plan will be a requirement of the deemed Marine Licences (dML) (generation and transmission).

This is an Outline Plan which seeks to identify the main areas of information that will be conveyed in the Final Plan submitted to the Marine Management Organisation (MMO). The content will continue to develop as knowledge of the development site improves and details on the target burial depths and the selection of foundation types for the turbines becomes known.

The Final Scour Protection and Cable Protection Plan (the Final Plan) will provide information on how scour and cable protection will be managed across the development site, providing justification over the need, choice and source of scour and cable protection being used, the methods proposed for installation of protection measures and the locations of where protection will be used.

At this outline stage, it is known that scour protection material may be required around the base of some or all wind turbine generator (WTG) and offshore substation foundations to protect from current and wave action ensuring structural integrity. Several methods of scour protection types are currently being considered, including rock or gravel placement, concrete mattresses, flow energy dissipation devices, or bagged solutions.

Cable protection will be required around the inter-array cables as they transition from the seabed to enter the WTG. Cable protection will also be required where target cable burial depth is not achieved along array, interconnector and export cables associated with Rampion 2, as well as at third party cable crossings which may occur on the cable routes.

The exact form of cable protection used will depend upon local ground conditions, hydrodynamic processes and the selected cable protection contractor. Options being considered include concrete ‘mattresses’; rock; geotextile bags filled with stone, rock, or gravel; polyethylene or steel pipe half shells or sheathes; and bags of grout, concrete, or similar.

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1. Introduction

1.1 Project background

1.1.1 Rampion Extension Development Limited (hereafter referred to as 'RED') (the Applicant) is developing the Rampion 2 Offshore Wind Farm Project (Rampion 2) located adjacent to the existing Rampion Offshore Wind Farm Project ('Rampion 1') in the English Channel.

1.1.2 Rampion 2 will be located between 13km and 26km from the Sussex Coast in the English Channel and the offshore array area will occupy an area of approximately 160km^2.

1.1.3 The key offshore elements of the Proposed Development will be as follows:

- up to 90 offshore wind turbine generators (WTGs) and associated foundations;
- blade tip of the WTGs will be up to 325m above Lowest Astronomical Tide (LAT) and will have a 22m minimum air gap above Mean High Water Springs (MHWS);
- inter-array cables connecting the WTGs to up to three offshore substations;
- up to two offshore interconnector export cables between the offshore substations;
- up to four offshore export cables each in its own trench, will be buried under the seabed within the final cable corridor; and
- the export cable circuits will be High Voltage Alternating Current (HVAC), with a voltage of up to 275kV

1.1.4 The key onshore elements of the Proposed Development will be as follows:

- a single landfall site near Climping, Arun District, connecting offshore and onshore cables using Horizontal Directional Drilling (HDD) installation techniques;
- buried onshore cables in a single corridor for the maximum route length of up to 38.8km using:
  - trenching and backfilling installation techniques; and
  - trenchless and open cut crossings.
- a new onshore substation, proposed near Cowfold, Horsham District, which will connect to an extension to the existing National Grid Bolney substation, Mid Sussex, via buried onshore cables; and
- extension to and additional infrastructure at the existing National Grid Bolney substation, Mid Sussex District to connect Rampion 2 to the national grid electrical network.

1.1.5 A full description of the Proposed Development is provided in **Chapter 4: The Proposed Development, Volume 2** of the ES (Document Reference: 6.2.4).

1.2 Purpose of this document

1.1.1 This **Outline Scour Protection and Cable Protection Plan** (the Outline Plan) (Document Reference: 7.12) sets out the key principles of how RED intends to manage the protection of cable and foundations from the effects of scour or damage, both immediately post installation and then on throughout the operational phase of the offshore wind farm.

1.1.2 This Outline Plan forms part of the suite of documents submitted to the Secretary of State (SoS) in support of the application for a DCO for Rampion 2. A Final Scour Protection and Cable Protection Plan will be developed post-consent as the project design is finalised and as informed by pre-construction surveys. The Final Plan will be provided as required under the deemed Marine Licence (dML) Conditions, which are contained within two Schedules of the Development Consent Order (DCO). Schedule 11 is associated with the generation assets whereas Schedule 12 is associated with the transmission asset. The timescale in advance of commencement of the licensed activities, alongside relevant reporting requirements following the deployment of protection material, including volume, location and other relevant information, are also secured within the dMLs.

1.1.3 The potential effects of scour are heavily influenced by the marine processes acting upon the assets installed on the seabed in combination with the geological character of that substrate. The amount of scour induced is also a function of the size of structure.

1.1.4 Information on the geological character of the site continues to be developed from on-going geophysical and geotechnical surveys, and whilst a marine processes model has been developed to predict the potential for scour, until cables and foundations have been installed across the development site it is not possible to accurately identify what scour protection and cable armouring will be required in practice. The **Environmental Statement** (ES) (Document Reference: 6.2) has assumed a conservative figure for scour requirements in order to define a worst-case amount for assessment.

1.1.5 Consequently, at the time of drafting this Plan there remains much information still to collate before a Final Scour Protection Management and Cable Protection Plan can be submitted to the Marine Management Organisation (MMO) for approval.

1.1.6 This Outline Plan seeks to identify the main areas of information that will be conveyed in the Final Plan submitted to the MMO. The content will continue to develop as knowledge of the development site improves and details on the target burial depths and the selection of foundation types for the turbines becomes known.

1.1.7 The Final Plan will provide information on how scour and cable protection will be managed across the development site, providing justification over the need and choice of scour and cable protection being used, the methods proposed for installation of protection measures and the locations of where protection will be used. This Final Plan will include details of protection type, vessels and equipment used, and charts of deposit areas.

1.1.8 The Final Plan will include plans as to how scour will be managed throughout the operational life, identifying a schedule of surveys and subsequent maintenance requirements.

1.1.9 Although presented as a single document at present, due to Offshore Transmission Operator (OFTO) considerations, separate dMLs are included in the DCO the offshore wind farm (generation) and the electrical transmission assets. Two Scour Protection and Cable Protection Plans will therefore be prepared for submission to the MMO, one specifically covering issues arising from the array and the other from the electrical transmission assets (including the substations and interconnector cables).

1.3 Environment impacts of the scour and cable protection

1.3.1 The environmental impacts of the proposed scour and cable protection have been assessed as part of the Environmental Impact Assessment (EIA) for Rampion 2 and are reported in **Chapter 6: Coastal processes, Volume 2** of the ES (Document Reference: 6.2.6).

1.3.2 The impacts of scour and cable protection were assessed on a "*maximum design scenario (MDS)*" basis. The final design will fall within the parameters assessed within the application.

1.4 Document structure

1.4.1 This Plan is structured as follows:

- **Section 1: Introduction;**
- **Section 2: Foundation scour protection; and**
- **Section 3: Cable protection.**

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2. Foundation scour protection

2.1.1 Scour protection material may be required around the base of some or all WTG foundations to protect from current and wave action ensuring structural integrity. Scour protection types currently being considered are rock or gravel placement, concrete mattresses, flow energy dissipation devices, or bagged solutions.

2.1.2 Protection measures may be placed alone or in combination and may be secured to the seabed where appropriate. Typical options include one, or a combination of the following examples:

- Rock or gravel placement;
- Concrete mattresses;
- Flow energy dissipation devices (used to describe various solutions that dissipate flow energy and entrap sediment, and including options such as frond mats, mats of large, linked hoops, and structures covered with long spikes[1]);
- Protective aprons or coverings (solid structures of varying shapes, typically prefabricated in concrete or high-density plastics), and;
- Bagged solutions, (including geotextile sand containers, rock-filled gabion bags or nets, and grout bags, filled with material sourced from the site or elsewhere).

2.1.3 **Chapter 4: The Proposed Development, Volume 2** of the ES (Document Reference: 6.2.4) contains worst-case key scour protection assessment assumptions, which are also provided below in **Table 2-1** and **Table *2-2*** for WTG and offshore substations respectively. These are provided for the different types of WTG that may be used.

2.1.4 Further information on scour protection measures, including details of the need, type, sources, quantity, installation methods and monitoring / surveys will be provided in the Final Plan.

[1] It is noted that these technologies are often only appropriate for use in areas with significant mobile seabed sediments, and examples such as the spiked designs are only appropriate for use in areas which are not trawled.

Table 2-1 Summary of predicted maximum scour dimensions for different foundation types for the WTGs

	Smaller WTG Type	Larger WTG Type
MONOPILE FOUNDATION		
Scour Protection type	Rock or gravel placement, Concrete mattresses, flow energy dissipation devices, or bagged solutions	Rock or gravel placement, Concrete mattresses, flow energy dissipation devices, or bagged solutions
Total area of seabed take for foundation and scour protection (per structure)	2,000m^2	3,580m^2
Scour protection volume (per structure)	6,000m^3	10,500m^3
MULTI-LEG FOUNDATION (PIN PILES)		
Scour protection type	Rock or gravel placement, Concrete mattresses, flow energy dissipation devices, or bagged solutions	Rock or gravel placement, Concrete mattresses, flow energy dissipation devices, or bagged solutions
Area of seabed take for foundation including scour protection (per structure)	2,500m^2	3,600m^2
Scour protection volume (per structure)	7,500m^3	10,800m^3
MULTI-LEG FOUNDATION (SUCTION BUCKETS)		
Scour protection type	Rock or gravel placement, Concrete mattresses, flow energy dissipation devices, or bagged solutions	Rock or gravel placement, Concrete mattresses, flow energy dissipation devices, or bagged solutions
Area of seabed take for foundation including scour protection (per structure)	4,500m^2	6,000m^2
Scour protection volume (per structure)	13,500m^3	18,000m^3

Table 2-2 Summary of predicted maximum scour dimensions for different foundation types for offshore substations

OFFSHORE SUBSTATION FOUNDATION – maximum design scenario values (Multi-leg with pin piles foundations)	
Total number of substation structures	Up to 3
Scour protection type	Rock or gravel placement, Concrete mattresses, flow energy dissipation devices, or bagged solutions
Area of seabed take for foundation including scour protection (per structure)	7,300m^2
Scour protection volume (per structure)	21,900m^3
Scour protection volume (3 substations)	65,700m^3

2.1.5 A summary of relevant scour protection material volumes and area totals for the Proposed Development are presented below in **Table 2-3** as these are parameters for scour protection reflected within the draft DCO.

Table 2-3 Summary of maximum scour protection areas and volumes, using maximum design scenario

Structure	Scour protection area per foundation (m^2)	Scour protection volume per foundation (m^3)	Maximum number of foundations	Total scour protection area (m^2)	Total scour protection volume (m^3)
WTG (multi-leg foundation with suction buckets	4,500	13,500	90	**405,000**	**1,215,000**
Offshore substation	7,300	21,900	3	**21,900**	**65,700**

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3. Cable protection

3.1 Introduction

3.1.1 This provides a description of the proposed cable protection that is available at this Outline Plan stage. The Final Plan will contain more detailed information including:

- details of the volumes, material, locations, and seabed footprints for cable protection measures;
- proposals for the volume and areas of cable protection to be used for each cable crossing and;
- proposals for monitoring offshore cables including cable protection during the operational lifetime of the authorised project which includes a risk based approach to the management of unburied or shallow buried cables.

3.2 Inter-array cable protection

3.2.1 There is likely to be a requirement for cable protection to be installed around the inter-array cables as they transition from the seabed to enter the WTG via internal or external J-tubes or I-tubes (hollow tubes hung from the foundation that are in the shape of an “I” or “J”). The exact amount of cable protection required on each cable end will depend on the burial depths achieved by the inter-array cable installation and assessment of the scour and movement that could occur during the operating life of the offshore wind farm.

3.2.2 Cable protection will also be required where cable burial depth is not achieved or possible due to ground conditions and at third party cable crossings which may occur on the cable routes. It is estimated that approximately 20% of the array cable may require protection measures.

3.2.3 The exact form of cable protection used will depend upon local ground conditions, hydrodynamic processes, and the selected cable protection contractor, however, the final choice will include one or more of the following:

- concrete ‘mattresses’;
- rock placement;
- geotextile bags filled with stone, rock, or gravel;
- polyethylene or steel pipe half shells, or sheathes; and/or
- bags of grout, concrete, or another substance that cures hard over time.

3.2.4 If rock placement, or filled bags are used to protect cables, they are typically used to construct a berm on the seabed on top of the cable. The rock placement method of cable protection involves placing rocks of different grade sizes from a fall pipe vessel over the cable. Initially smaller stones are placed over the cable as a covering layer. This provides protection from any impact from larger grade size rocks, which are then placed on top. The rock berm will be up to 1m in height and a maximum of 6m wide.

3.2.5 Cable crossings are a potential requirement within the array area as the AQUIND Interconnector, a project currently seeking consent. Whilst this project is currently with the Secretary of State to be redetermined, if approved and built the AQUIND interconnector cable is proposed to cross the western part of the Rampion 2 DCO Order Limits. In the eventuality that cable crossings are required for this cable or any other potentially unknown subsea cables / pipelines, then a methodology will be agreed in collaboration with the relevant infrastructure owners. An assumed need for cable crossings has therefore been included within the Rampion project design to accommodate such potential interaction with the AQUIND project.

3.2.6 **Table 3-1** sets out the maximum design parameters for the installation and protection of inter-array cables.

Table 3-1 Maximum inter-array cable protection assessment assumptions

Assessment assumption	Maximum value
Installation methodology	Plough, trencher or jetter (using pre- or post-lay burial techniques)
Target burial depth	1m
Cable protection placement	
Cable protection area	300,000m^2
Cable protection volume	175,000m^3
Number of crossings (estimate)	4
Cable/pipe crossings: total impacted area	10,000m^2
Cable/pipe crossings: pre-lay rock berm volume	10,000m^3
Cable/pipe crossings: post-lay rock berm volume	10,000m^3
Height of cable protection berm	1m
Width of cable protection berm	6m
Proportion of array cable requiring protection	20%
Replenishment during operations (% of construction total)	25%
Cable rock protection: maximum rock size	0.3m

3.3 Offshore interconnector cable protection

3.3.1 Like the installation of array cables, the installation of the interconnector cables is expected to require either ploughing, trenching, jetting, or a combination of these techniques.

3.3.2 Cable protection will also be required where cable burial depth is not achieved or possible due to ground conditions and at third party cable crossings which may occur on the cable routes. It is estimated that approximately 20% of the interconnector cable length may require protection. Options for the type of cable protection that will be employed are as presented in **paragraph 3.2.3**. No cable crossings are predicted to be required for the interconnector cabling.

3.3.3 **Table 3-2** sets out sets out the maximum design parameters for the installation and protection of inter-array cables for the installation and protection of offshore interconnector cables between the offshore substations.

Table 3-2 Maximum offshore interconnector cable protection assessment assumptions

Assessment assumption	Maximum value
Installation methodology	Plough, trencher or jetter (using pre- or post-lay burial techniques)
Target burial depth	1m
Cable protection area	122,000m^2
Cable protection volume	110,500m^3
Proportion of array cable requiring protection	20%
Replenishment during operations (% of construction total)	25%
Cable rock protection: maximum rock size	0.3m

3.4 Export cable installation

3.4.1 Similar to the installation of array cables and interconnector cables, the installation of the export cables is likely to involve the burial of the cables below the seabed using ploughing, trenching, or jetting. It is anticipated that a combination of these three methods may be used depending on seabed conditions. No crossings are required along the export cable route. Installation is likely to involve the following activities:

- jet-trenching;
- pre-cut and post-lay ploughing or simultaneous lay and plough;

- mechanical trenching (such as chain or wheel cutting);
- dredging (typically trailing hopper suction dredging (THSD) and backhoe dredging or water injection dredging);
- mass flow excavation (MFE);
- rock cutting;
- burial sledge;
- surface laid / self-burying cable;
- cable installed in pipe/duct; and
- cable protection installed, where necessary.

3.4.2 In the inshore area approaching the landfall, duct extensions may be required to enable the landfall Horizontal Directional Drilling (HDD) ducts to be extended further offshore to facilitate cable installation from an installation vessel situated offshore. These duct extensions will be of a similar diameter to the HDD ducts and installed in their own trench at a similar depth of cover to the export cables. The duct extensions will be backfilled before the arrival of the cable installation vessel.

3.4.3 In shallow water sections of the cable route, where ground conditions are not suitable to 'ground out' the export cable installation vessel on the seabed, the construction of temporary sand/gravel beds may be required. These beds will allow the vessel to safely 'ground out' before pulling and installing the cables. Following cable installation, these sand/gravel beds will be removed.

3.4.4 The cables will be manufactured at a specialist supplier’s factory. The manufactured cables will be spooled from the factory to cable carousels situated on a transport vessel or directly onto the installation vessel itself, moored at the adjacent quayside. If a transport vessel is used, the cables will be subsequently transpooled onto the installation vessel at a local port before it transits to the Proposed Development site for installation.

3.4.5 A Cable Specification and Installation Plan will be submitted prior to the commencement of licensed activities, as specified in Schedule 12, condition 11 of the draft DCO.

3.4.6 **Table 3-3** sets out the sets out the maximum design parameters for the installation and protection of export cables.

Table 3-3 Maximum export cable protection assessment assumptions

Assessment assumption	Maximum value
Installation methodology	Plough, trencher, dredging (THSD, backhoe or water injection), MFE, mechanical cutter, burial sledge, surface lay, pipe/duct
Target burial depth	1-1.5m
Cable protection area	517,000m^2
Cable protection volume	470,000m^3
Proportion of array cable requiring protection	20%
Replenishment during operations (% of construction total)	25%
Cable rock protection: maximum rock size	0.3m

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4. Glossary of terms and abbreviations

Table 4-1 Glossary of terms and abbreviations

Term	Definition
DCO	Development Consent Order
DML	Deemed Marine Licence
EIA	Environmental Impact Assessment
ES	Environmental Statement
HDD	Horizontal Directional Drilling
MCA	Maritime and Coastguard Agency
MDS	Maximum Design Scenario
MHWS	Mean High Water Springs
MMO	Marine Management Organisation
MW	Megawatts
OFTO	Offshore Transmission Operator
RED	Rampion Extension Development Limited
SoS	Secretary of State
THSD	Trailing Hopper Suction Dredging
WTG	Wind Turbine Generator