Outer Dowsing Offshore Wind

Outline Plans

Document 8.5 Outline Cable Specification and Installation Plan

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Acronyms & Terminology

Abbreviations / Acronyms

Abbreviation / Acronym	Description
ANS	Artificial Nesting Structure
CBRA	Cable Burial Risk Assessment
CFE	Controlled Flow Excavation
CSIP	Cable Specification and Installation Plan
DCO	Development Consent Order
dML	deemed Marine Licence
EIA	Environmental Impact Assessment
ES	Environmental Statement
GT R4 Limited	GT R4 or GT R4 Limited, the incorporated joint venture development Co.
MDS	Maximum Design Scenario
MFE	Mass Flow Excavation
MMO	Marine Management Organisation
MPA	Marine Protected Area
NEQ	Net Explosive Quantity
NERC	Natural Environment Research Council
ODOW	Outer Dowsing Offshore Wind, trading name of GT R4 Limited
ORCP	Offshore Reactive Compensation Platform
OSS	Offshore Substation
OWF	Offshore Wind Farm
RIAA	Report to Inform Appropriate Assessment
SAC	Special Area of Conservation
SPMP	Scour Protection Management Plan
TSHD	Trailer Suction Hopper Dredger
UXO	Unexploded Ordnance
WTG	Wind Turbine Generator

Terminology

Term	Definition
Afl array area	The area of the seabed awarded to GT R4 Ltd. through an Agreement for Lease (AfL) for the development of an offshore windfarm, as part of The Crown Estate's Offshore Wind Leasing Round 4.
Array area	The area offshore within which the generating stations (including wind turbine generators (WTG) and inter array cables), offshore accommodation platforms, offshore transformer substations and associated cabling are positioned.
deemed Marine Licence (dML)	A marine licence set out in a Schedule to the Development Consent Order and deemed to have been granted under Part 4 (marine licensing) of the Marine and Coastal Access Act 2009.
Development Consent Order (DCO)	An order made under the Planning Act 2008 granting development consent for a Nationally Significant Infrastructure Project (NSIP).

Term	Definition
Effect	Term used to express the consequence of an impact. The significance of an effect is determined by correlating the magnitude of an impact with the sensitivity of a receptor, in accordance with defined significance criteria.
Environmental Impact Assessment (EIA)	A statutory process by which certain planned projects must be assessed before a formal decision to proceed can be made. It involves the collection and consideration of environmental information, which fulfils the assessment requirements of the EIA Regulations, including the publication of an Environmental Statement (ES).
Environmental Statement (ES)	The suite of documents that detail the processes and results of the EIA
Impact	An impact to the receiving environment is defined as any change to its baseline condition, either adverse or beneficial.
Inter-array cables	Cable which connects the wind turbines to each other and to the offshore substation(s), which may include one or more auxiliary cables (normally fibre optic cables).
Intertidal	The area between Mean High Water Springs (MHWS) and Mean Low Water Springs (MLWS).
Landfall	The location at the land-sea interface where the offshore export cables and fibre optic cables will come ashore.
Maximum Design Scenario	The project design parameters, or a combination of project design parameters that are likely to result in the greatest potential for change in relation to each impact assessed
Mitigation	Mitigation measures, or commitments, are commitments made by the Project to reduce and/or eliminate the potential for significant effects to arise as a result of the Project. Mitigation measures can be embedded (part of the project design) or secondarily added to reduce impacts in the case of potentially significant effects.
Offshore Export Cable Corridor (ECC)	The Offshore Export Cable Corridor (Offshore ECC) is the area within the Order Limits within which the export cable running from the array to landfall will be situated.
Offshore Reactive Compensation Station (ORCP)	A structure attached to the seabed by means of a foundation, with one or more decks and a helicopter platform (including bird deterrents) housing electrical reactors and switchgear for the purpose of the efficient transfer of power in the course of HVAC transmission by providing reactive compensation
Offshore Substation (OSS)	A structure attached to the seabed by means of a foundation, with one or more decks and a helicopter platform (including bird deterrents), containing— (a) electrical equipment required to switch, transform, convert electricity generated at the wind turbine generators to a higher voltage and provide reactive power compensation; and (b) housing accommodation, storage, workshop auxiliary equipment, radar and facilities for operating, maintaining and controlling the substation or wind turbine generators
Onshore Infrastructure	The combined name for all onshore infrastructure associated with the Project from landfall to grid connection.

Term	Definition
Order Limits	The area subject to the application for development consent, The limits shown on the works plans within which the Project may be carried out.
Outer Dowsing Offshore Wind (ODOW)	The Project.
Pre-construction and post-construction	The phases of the Project before and after construction takes place.
Project Design Envelope	A description of the range of possible elements that make up the Project's design options under consideration, as set out in detail in the project description. This envelope is used to define the Project for Environmental Impact Assessment (EIA) purposes when the exact engineering parameters are not yet known. This is also often referred to as the "Rochdale Envelope" approach.
Receptor	A distinct part of the environment on which effects could occur and can be the subject of specific assessments. Examples of receptors include species (or groups) of animals or plants, people (often categorised further such as 'residential' or those using areas for amenity or recreation), watercourses etc.
Subsea	Subsea comprises everything existing or occurring below the surface of the sea.
The Applicant	GT R4 Ltd. The Applicant making the application for a DCO. The Applicant is GT R4 Limited (a joint venture between Corio Generation, TotalEnergies and Gulf Energy Development (GULF)), trading as Outer Dowsing Offshore Wind. The project is being developed by Corio Generation (a wholly owned Green Investment Group portfolio company), TotalEnergies and GULF.
The Project	Outer Dowsing Offshore Wind, an offshore wind generating station together with associated onshore and offshore infrastructure.
Wind turbine generator (WTG)	A structure comprising a tower, rotor with three blades connected at the hub, nacelle and ancillary electrical and other equipment which may include J-tube(s), transition piece, access and rest platforms, access ladders, boat access systems, corrosion protection systems, fenders and maintenance equipment, helicopter landing facilities and other associated equipment, fixed to a foundation.

Reference Documentation

Document Number	Title
6.1.3	Project Description

1 Introduction

1.1 Project Background

1. GT R4 Limited (trading as Outer Dowsing Offshore Wind) hereafter referred to as the 'Applicant', is proposing to develop Outer Dowsing Offshore Wind hereafter referred to as the 'Project'. The Project will include both offshore and onshore infrastructure including an offshore generating station (windfarm) approximately 54km offshore of the Lincolnshire coast, export cables to landfall, Offshore Reactive Compensation Platforms (ORCPs), onshore cables, connection to the electricity transmission network, ancillary and associated development and areas for the delivery of up to two Artificial Nesting Structures (ANS) and the creation of a biogenic reef (if these compensation measures are deemed to be required by the Secretary of State) (see Volume 1, Chapter 3: Project Description (document reference 6.1.3) for full details).
2. The detailed and final design of the Project will be determined post-consent.

1.2 Purpose of this document

3. This outline Cable Specification and Installation Plan (CSIP) is intended to provide an outline of the information which will be contained within the CSIP to be developed post-consent. This Outline CSIP also details mitigation measures relevant to the installation of the cables which will be adhered to during the construction of the Project.
4. The purpose of the CSIP will be to provide information relating to the inter-array cables, interlink cables and offshore export cables, including the final technical specification of the cables, a detailed installation plan, including a Cable Burial Risk Assessment, proposals for cable protection measures and proposals for monitoring offshore cables, including a risk based approach to the management of unburied or shallow buried cables. The CSIP will also set out the associated potential mitigation required, including in relation to the Inner Dowsing, Race Bank and North Ridge (IDRBNR) Special Area of Conversation (SAC).
5. The final detailed design of the Project will be determined post-consent. The CSIP, which will accord with this outline CSIP, will be submitted to the Marine Management Organisation (MMO) for approval in accordance with the conditions of the dMLs.
6. Geophysical and geotechnical surveys were undertaken for the Project AfL array area and Export Cable Corridor (ECC) in 2021 and 2022. As such, a good understanding of the prevailing ground conditions is available relative to this pre-Front End Engineering (FEED) stage of the Project, to inform both the EIA and the development of the Outline Cable Specification and Installation Plan and the mitigation measures that might be required. Further geophysical and geotechnical surveys will be completed prior to construction to inform the final project design.

7. With the exception of cable/pipeline crossing locations cable burial is expected to be possible throughout the majority of the array area and export cable corridor; this is based on current design assumptions and understanding of ground conditions. However, as a precaution, an estimate for cable protection is included within the impact assessment in order to address any situation where cable burial is not ultimately possible (e.g., due to unforeseen ground conditions being encountered during the pre-construction surveys or cable installation.
8. The final CSIP will be structured as follows:
    - Introduction
    - Purpose of the Document
    - Consultation
    - Technical Specification of the Cables
    - Cable Burial Risk Assessment (CBRA)
    - Review of Cable Route Locations where Water Depths may be reduced by >5%
    - Cable Laying Plan and Installation Methodology

1.3 Consultation

This section will provide information on the relevant consultation undertaken post-consent and pre-submission, in relation to this plan. This includes the MMO who will be required to approve the final plan.

2 Technical Specification

9. This section will detail the technical specifications of the offshore cables to be used for the Project. For full details of current parameters please see Volume 1, Chapter 3: Project Description.
10. To allow for design flexibility at this stage of the Project, the Environmental Statement has considered a range of parameters for each aspect of the Project, defined as the Maximum Design Scenario (MDS). For full details please see Volume 1, Chapter 3: Project Description.
11. The key design parameters for the offshore cables at the point of application are presented below. These will be refined during the detailed design phase post consent.

2.1 Inter-array Cables

12. Inter-Array cables (IAC) will link the turbines to the OSSs. A small number of WTGs will typically be grouped together on the same cable string, branch or loop connecting to the OSSs, and multiple array cables will connect each string back to each OSS.
13. The cable system will use HVAC technology. The IACs will consist of several conductor cores, usually made from copper or aluminium surrounded by layers of insulating material, as well as material to armour the cable for protection from external damage. As standard, cables will also include an embedded fibre optic bundle. The maximum design parameters for the inter-array cables are presented in Table 2.1.

Table 2.1: Indicative key maximum design parameters for the inter-array cables

Parameters	Design Envelope
Cable diameter (mm)	260
Cable length (km)	380
Voltage (kV)	66 or 132

2.2 Offshore Inter-link Cables

14. The Project may require cables to interconnect between the OSSs to provide redundancy in the case of cable or grid transformer failure elsewhere, or to connect to the offshore accommodation platform to provide power for operation. The cables will have a similar design and installation process to the inter-array and/or export cables. The parameters for design and installation of the offshore interlink cables are presented in Table 2.2.

Table 2.2: Indicative maximum design parameters for offshore interlink cables

Parameters	Design Envelope
Number of circuits	6
Cable/circuit length (km)	125
Voltage (kV)	66, 132, 220 or 275

2.3 Offshore Export Cables

15. The transmission technology for the Project will be HVAC technology. Table 2.3 presents the design envelope for the offshore export cables.

Table 2.3: Indicative key maximum design parameters for offshore export cables

Parameters	Design Envelope
Number of circuits	4
Voltage (kV)	220 or 275
External cable diameter (mm)	390

3 Cable Burial Risk Assessment

16. This section will summarise the results of the cable burial risk assessment which will be undertaken for the Project. Once the risk assessment has been completed, this section will include the following information:
    - Overview of the risk assessment;
    - Overview of the site (bathymetry and seabed compositions);
    - Mobile sediments (sandwaves and megaripples; and
    - Seabed conditions (steep slopes, boulders and debris).
17. A localised Cable Burial Risk Assessment (CBRA) has already been undertaken on a relatively limited section of the cable corridor crossing the Annex I Sandbanks within the Special Area of Conservation (SAC) (see Volume 2, Appendix 3.1: Cable Burial Risk Assessment).
18. The results of the undertaken CBRA and the sediment mobility study (confidential) have confirmed that the risk of requiring cable protection over the sandbanks is very low; however, to allow for the unlikely event that adverse ground conditions or poor cable burial tool performance is encountered as the cable installation passes over/through the sandbank features of the SAC, placement of removable cable protection (including e.g. rock bags or concrete mattresses), covering up to 5% of the cable length over the sandbanks has been assessed in the ES. More widely within the SAC, and outside of the sandbank features, due to the quaternary sediment potentially being a thin layer over the bedrock/underlying hard sediments, cable protection over up to 20% of the cable length within the SAC (between the sandbanks) is the worst case scenario.
19. The Project has committed to micro-siting of the cable through the SAC to avoid areas of biogenic reef identified during the pre-construction surveys.

4 Review of Cable Route Locations Where Water Depth is Reduced by >5%

20. This section will incorporate a burial risk assessment encompassing the identification of any cable protection that exceeds 5% of navigable depth referenced to Chart Datum and, in the event that any area of cable protection exceeding 5% of navigable depth is identified, and details of any steps to be taken.

5 Cable Laying Plan and Installation Methodology

5.1 Overview

21. This section will include:

- A detailed cable laying plan for cables within the offshore order limits;
- detailed cable installation methodology for the Project; and
- details of any pre-installation activities required, including sandwave clearance, debris removal (e.g. pre-lay grapnel run), and/or boulder clearance (as described in paragraph 3.6.26 *et seq* in Volume 1, Chapter 3: Project Description).

5.2 Mitigation

22. A number of key mitigation or best-practice measures specific to the CSIP have been made alongside the ES, which are secured within this Outline CSIP:

- Where reasonably practicable, subsea cable burial will be the preferred option for cable protection. Cable burial will be informed by the cable burial risk assessment (CBRA) and Burial Assessment Study as developed during the pre-construction engineering;
- Cable burial will be aligned with best industry practice, where burial has not been achieved, the project may consider additional burial attempts with specific tools where it is considered feasible and effective. Remedial works will be considered where no other option is considered practical;
- Cables will be installed to a target burial depth informed by the findings of a CBRA;
- Any material dredged from within the Inner Dowsing, Race Bank and North Ridge Special Area of Conservation (SAC) will be deposited back within the Inner Dowsing, Race Bank and North Ridge SAC;
- Cables will be micro-sited around any known *S. spinulosa* reef within the Inner Dowsing, Race Bank and North Ridge SAC;
- Outside the Inner Dowsing, Race Bank and North Ridge SAC, cables will be micro-sited around biogenic reef, where practicable;
- No jack-up vessels will be used within the Inner Dowsing, Race Bank and North Ridge SAC;
- Any cable protection required over the sandbanks within the Inner Dowsing, Race Bank and North Ridge SAC will be removable (i.e. mattresses or rock bags or other demonstrably removable protection);
- If any out of service cables are encountered during installation within the Inner Dowsing, Race Bank and North Ridge SAC, where reasonably practicable, relevant sections will be cut and removed to avoid cable crossings, in accordance with ICPC guidelines;

- During boulder clearance activities, where boulders are grabbed and moved, boulders will be placed nearby in an area of similar habitat and all areas of known *S. spinulosa* reef within the Inner Dowsing, Race Bank and North Ridge SAC will be avoided; outside of the SAC, boulder placement will avoid any biogenic reef, where practicable; and
- HDD will be utilised for the landfall drill to avoid interactions with surface features by installing ducts under the intertidal area to exit pits which will be located~~,~~ a minimum of 500m offshore from MLWS. The HDD will be of sufficient depth to have no effect on the beach. ~~The installation of the offshore export cables at landfall will be undertaken by HDD. The exit pits will be designed to a target of 500m offshore of the Mean Low Water Springs (MLWS) mark~~.

5.3 Project Parameters

23. The following installation (burial) methodologies are considered appropriate for the export, array and interlink cables, and have therefore been included for assessment within the MDS for the Project:
    - Jet-trenching;
    - Pre-cut and post-lay ploughing or simultaneous lay and plough;
    - Mechanical trenching (such as chain cutting);
    - Dredging (typically Trailer Suction Hopper Dredger (TSHD), backhoe dredging or water injection dredging);
    - Controlled flow excavation (CFE);
    - Rock cutting;
    - Burial sledge;
    - Jet sledding (hybrid of jet trencher and cable plough); and
    - Vertical injector burial.
24. The cables will either be directly buried using the above techniques or, for cables at landfall where HDD will be employed, pulled into a duct/pipe.

Table 5.1: Indicative maximum design parameters for cable installation

Parameter	Maximum design parameters		
	Array cables	Interlink	Offshore export corridor
Installation methodology	Surface lay, Simultaneous lay and burial, mechanical trenching, dredging, jetting, ploughing, controlled flow excavation, vertical injection, rock cutting.	Surface lay, Simultaneous lay and burial, mechanical trenching, dredging, jetting, ploughing, controlled flow excavation,	Mechanical Simultaneous lay and burial, trenching, dredging, jetting, ploughing, controlled flow excavation, vertical injection, rock cutting, Horizontal Directional Drilling,

Parameter	Maximum design parameters		
	Array cables	Interlink	Offshore export corridor
		vertical injection, rock cutting.	Trenchless Installation Methods,
Installation details - Maximum burial depth below project referenced seabed level (m)	3		
Total length of cable (km)	3877.4	123.75	440
Boulder and sandwave clearance width (m), per cable	33	33	51
Cable installation width (m)	18		
Total seabed disturbed (m^2)	11,520,746	3,777,469	7,528,263
Boulder clearance – seabed disturbance (m^2)	7,472,916	2,450,250	4,313,866
Sandwave clearance – seabed disturbance (m^2)	4,047,830	1,327,219	3,,214,397
Sandwave clearance spoil volume (m^3)	7,819,671	2,563,945	5,750,513
Burial spoil: jetting (m^3)	452,904	148,500	528,000
Jetting excavation rate soft soil (soft or loose soil) (m/hr)	300 (125)		
Ploughing excavation rate medium soil (hard soil) (m/hr)	125 (55)		
Burial spoil: ploughing/ mass flow excavation (m^3)	6,038,720	1,980,000	7,040,000
Duration total (months)	24	24	24

Table 5.2 Indicative maximum design parameters for cable installation within the SAC

Parameter	Within SAC (outside of sandbanks)	Sandbank 1 area	Sandbank 2 area
Length (km)	23.7	2	2
Installation details - Boulder and sandwave clearance width (m)	30	51	33

Parameter	Within SAC (outside of sandbanks)	Sandbank 1 area	Sandbank 2 area
Installation details - Cable installation width (m)	18		
Seabed disturbance from sandwave clearance (m^2)	369,782	408,00	246,000
Seabed disturbance from boulder clearance (m^2)	853,344	122,400	79,200

6 Summary

25. This document comprises the Outline CSIP. Within the document, the Applicant has summarised information relating to the offshore cables, including the current design parameters for the technical specification and installation of the cables, information on the approach to the Cable Burial Risk Assessment and specific mitigation in relation to cable burial activities.
26. The Project considers the cables on this project to have a high probability of successful installation through the means noted in this outline plan, with the aim of minimising the impact within the offshore order limits.
27. The final detailed design of the Project will be determined post-consent. The CSIP will be developed by the Applicant and submitted to the Marine Management Organisation (MMO) for approval (as required under the conditions of the dMLs).