FIVE ESTUARIES OFFSHORE WIND FARM

10.20.1 TECHNICAL NOTE: METHODOLOGY FOR DETERMINING MDS (OFFSHORE)

Application Reference:	EN010115
Application Document Number:	10.20.1
Revision:	A
Pursuant to:	Deadline 2
EcoDoc Number:	005395492-01
Date:	October 2024

Revision	Date	Status/Reason for Issue	Originator	Checked	Approved
A	Oct-24	Deadline 2	VEOWF	VEOWF	VEOWF

CONTENTS

FIGURES

1. CONTEXT

1.1.1 To aid the understanding of the works the EXA has requested a Technical Note providing further description of how some of the values in the MDS have been calculated.

1.1.2 The Applicant is able to provide a general explanation and demonstrate how the values presented in the DCO application documents link together; however there are some areas where the Applicant considers the information to be confidential or propriety information that is sensitive.

1.2 ACRONYMNS & DEFINITIONS

1.2.1 For ease a list of commonly used acronyms related to this document is provided below

DCO	Development Consent Order
ExA	Examining Authority
VE	Five Estuaries
TCE Guide	Guide to an offshore wind farm; The Crown Estate (TCE) 2019
OoS	Out of Service. *This is the term used for cables left in the seabed that are no longer of use. Many are from the 1970s telecoms industry.*
WTG	Wind Turbine Generator
MDS	Maximum Design Scenario
OWF	Offshore Wind Farm

1.2.2 For ease a list of the relevant documents from the DCO library is provided below

AS-041	6.3.1 Onshore Project Description
APP-069	6.2.1 Offshore Project Description
APP-070	6.2.1.1 Detailed Offshore Project Design Envelope
APP-229	8.1 Cable Statement
Jan Riezebos, 2023	Hendrik Jan Riezebos; Lasse Hybel &Andreas Roulund; “Field performance of cable crossings rock berms in the North Sea.” proceedings of the 11th International Conference on Scour and Erosion; 2023

2. ISH1 – ACTION POINT 4: SELECTED MDS VALUES FOR EXPLANAITON

2.1 CABLES CROSSINGS

2.1.1 Table 1.25 Maximum design envelope for cable crossings is repeated below.

Parameter	Design envelope for export cables	Design envelope of inter-array cables	Total
Total number of crossings required	30	26	56
Length of crossings (m)	300	300	N/A
Total length of cable crossings (m)	9,000	7,800	16,800
Width of crossing (m)	13	13	N/A
Height of rock berm (m)	1.4	1.4	N/A
Cross sectional area of trapezoid (m^2)	12.2	12.2	N/A
Total area of seabed covered by cable crossings (m^2)[5]	119,300	103,400	222,700
Total volume of cable protection required (m^3)	111,400	96,500	207,900

2.1.2 Total number of crossings is comprised of the export cable and inter array cables. These are maximum values. The project has identified in use and out of service (OoS) cables that cross the export cable corridor and array area. The project has also identified cables that are likely to be installed before the VE project. Some of these will need to be crossed. Some OoS cables may be removed instead, and not crossed.

2.1.3 As is common for companies operating in the offshore cable industry, the project is in active discussion regarding crossing agreements for the active assets, and in discussion with the owners regarding removal of OoS cables. Because of this potential for removal of cables, and uncertainty regarding the WTG layout and number of array cables, the project cannot determine the exact number of crossings pre DCO. To allow for the Rochdale envelop approach it has been determined that the number of crossings will be less than 56. 56 has hence been assessed in the environmental assessments.

2.1.4 Cables crossings and external protection are described in section 3.7.5 of 8.1 Cable Statement [APP-229]. To aid in the understanding of the terms used, Figure 1 is provided. Please note that the cover layer is the same as the “secondary layer”. For clarity a typical concrete mattress is shown in Figure 2 For crossings, multiple concrete mattresses may be used to provide the necessary separation and cover. Figure 3 provides a guide to help understand the values quoted in the MDS.

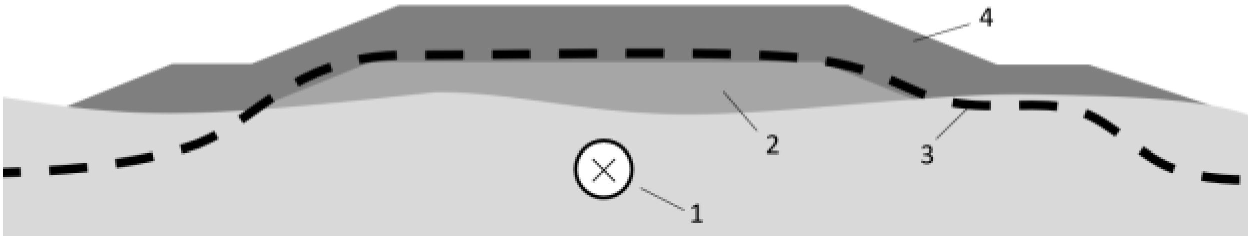

Figure 2. Definition of typical cable crossing rock berm elements.
1: Crossed asset. 2: Separation layer. 3: Crossing asset. 4: Cover layer.

Figure 1 Indicative cable crossing (Jan Riezebos, 2023).

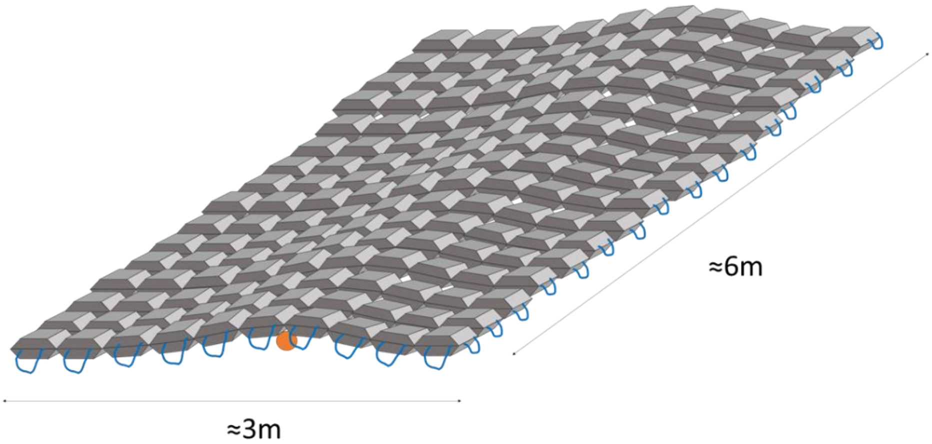

Figure 2 Single concrete mattress (note single mattresses are typically combined to make a crossing)

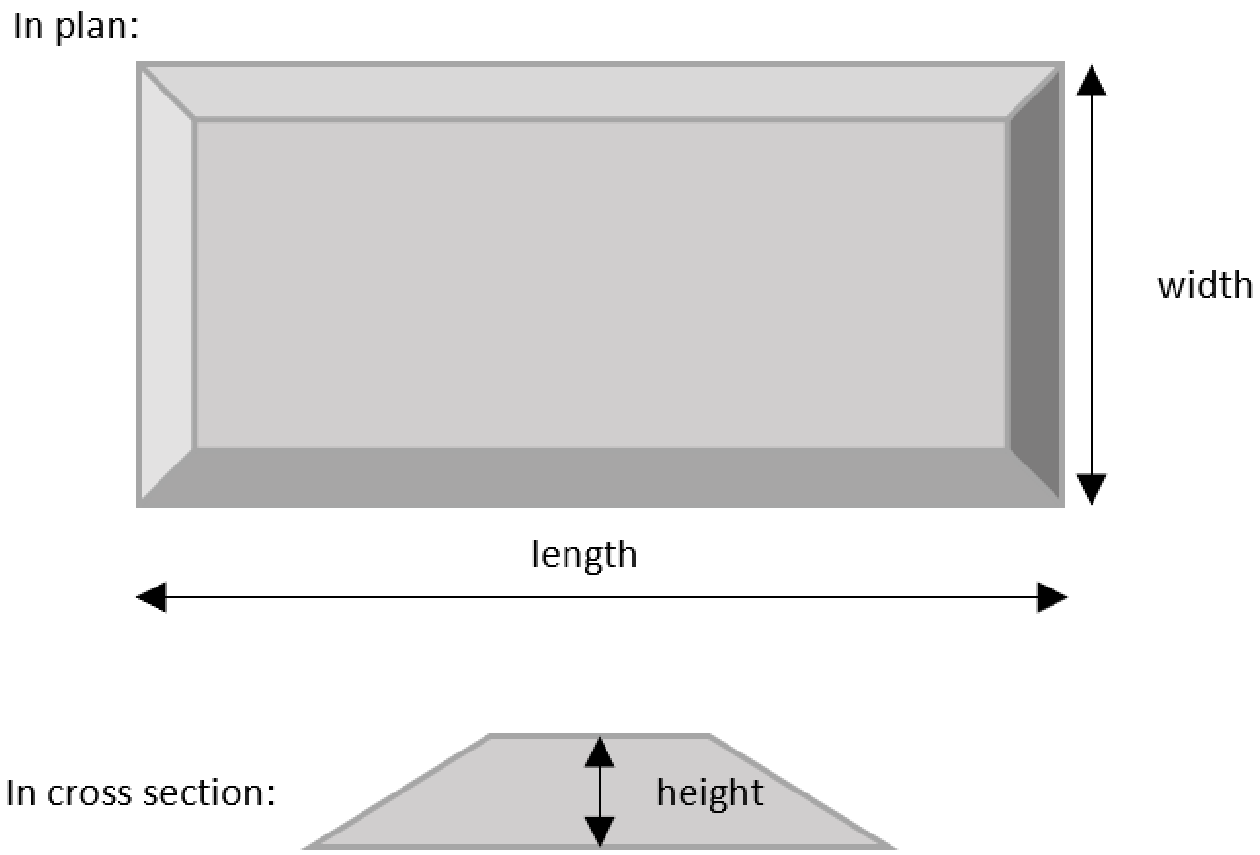

Figure 3 Crossing dimensions

2.1.5 The values assumed in the MDS are typical values from experience and no project specific design has been conducted. In detailed design either rock berms or mattresses will be chosen and detailed design will be conducted to confirm the hydrodynamic, mechanical and electromagnetic suitability of the design. The Applicant notes that the conditions at site are within normal ranges for the design of crossings.

2.2 CONSTRUCTION IMPACTS ON SEABED MORPHOLOGY

2.2.1 The Applicant has undertaken a detailed assessment of the potential for cable protection measures to interrupt sediment transport pathways within and nearby to MLS SAC, but also within the wider ECC and Array Areas. This is underpinned by a robust understanding of baseline sediment transport processes, developed through analysis of high-resolution geophysical datasets and complemented by numerical modelling of sediment transport pathways.

2.2.2 The Applicant acknowledges that the presence of cable protection could lead to a very small volume of sediment being trapped within the rock voids, whilst a similarly small volume of material could also accumulate on the updrift side of the berms, before the slope reaches an equilibrium position defined by the angle of repose of the accumulated material. However, thereafter sediment can reasonably be expected to be transported at the same rate (and in the same direction) as under baseline conditions. Any indirect changes to sediment transport arising from modification of tidal currents and waves as they interact with the berms will be highly spatially restricted - order of 10's of metres (maximum) from the feature. Given that only very minor changes are expected to the sediment transport regime, any associated morphological impacts are also expected to be very limited. This is reflected in both 6.2.5 Benthic and Intertidal Ecology chapter [APP-074] and the 5.4 Report to Inform Appropriate Assessment [APP-040].

2.2.3 Furthermore, cable crossings, scour protection at foundations (which are at least 830m apart) and foundations are very spatially distant, small and construction occurs in a very short timescale. As a result, there will be no meaningful impact on large scale seabed morphology / morphological features.

2.2.4 This is confirmed by the monitoring and observations of operational wind farms whereby large scale morphological features are not affected by the presence of the assets and only very small scale impacts occur in the form of scour (in the order of magnitude of meters rather than 100s of meters or kms).

2.3 BOULDER CLEARANCE & PRE LAY GRAPNEL RUN

2.3.1 Table 1.3 MDS for Boulder clearance from 6.2.1.1 Detailed Offshore Project Design Envelope [APP-070] is repeated below.

Parameter	Design envelope for export cables	Design envelope of inter-array cables	Total
Length of cable route requiring boulder clearance	25%	25%	N/A
Length of cable route requiring boulder clearance (km)	48.875	50	98.875
Width of boulder plough/ clearance tool (m)	18	18	N/A
Total area of seabed disturbed by boulder plough/ clearance (m^2)	879,750	900,000	1,779,750
Total area of seabed disturbed by boulder clearance (km^2)	0.88	0.90	1.78
Additional isolated boulders in remainder of route which may need cleared with grab type tool	100	200	300

2.3.2 To estimate the length of the cable route requiring boulder clearance (%) and the length of cable route requiring clearance (km) a study has been conducted on the project obtained geophysical data to estimate the number of boulders over the cable route that would have to be relocated to allow cable installation tools to progress unimpeded. The value estimated is an upper bound, and additional more refined survey and detailed routing is likely to reduce this number.

2.3.3 The maximum width of the clearance area is based on the boulder clearance plough width. The final tool however, will be selected after detailed design.

2.3.4 The total area of seabed disturbed by boulder plough/ clearance is the maximum length of cable route requiring clearance multiplied by the width of the boulder plough/ clearance tool.

2.3.5 In the case where there are boulders that can't be moved by a plough because they are sitting too low in the seabed, or are too large but cannot be avoided, then they can be removed by a grab tool.

2.4 FLUIDIZED MATERIAL (50% ASSUMPTION)

2.4.1 Table 1.6 MDS for trial trenching from 6.2.1.1 Detailed Offshore Project Design Envelope [APP-070] is repeated below.

Parameter	Design Envelope		
	Export cables	Inter-array cables	Total
Total length of trial trenching (km)	5	5	10
Maximum burial depth (m)	3.5	3.5	N/A
Maximum installation tool seabed disturbance width (jetting) (m)	18	18	N/A
Total area of seabed disturbed by cable installation (m^2)	90,000	90,000	180,000
Total area of seabed disturbed by cable installation (km^2)	0.09	0.09	0.18
Total volume of sediment disturbed by cable installation[1] (m^3)	78,750	78,750	157,500

2.4.2 The values in this table are estimated with a 50% assumption, regarding the amount of sediment disturbed. This value is used because during the trenching not 100% of the material is dispersed into the water column. An example of this for jetting is shown in the sketch in Figure . Some of the sand is fluidized into the water column and may disperse, however some backfills over the cable. The values in the table for the maximum volume are calculated from a typical average burial depth of 1.75 m, the maximum value of 3.5 m is a maximum indicative value. The actual burial depth will be below the average, hence this value has been used to assess the impact of sediment dispersal on sensitive receptors in the marine environment.

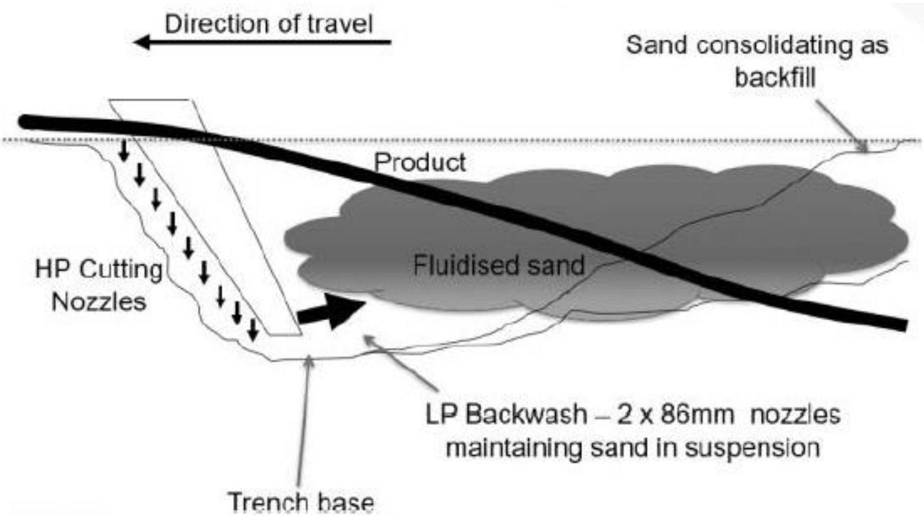

Figure 4 Sediment dispersal during jetting (IMCA Code of Practice for Offshore Cable Laying in the Renewable Energy Industry M264 Rev. 0.1 – November 2023)

3. QUESTIONS RELATING TO MARGATE & LONG SANDS SPA [ME.1.07 FROM EXQ1]

3.1 HOW HAS MAXIMUM LENGTH OF CABLE PROTECTION REQUIRED WITHIN MARGATE AND LONG SANDS (MLS) SPECIAL AREA OF CONSERVATION (SAC) BEEN DETERMINED?

3.1.1 Theoretical max single cable length is estimated at circa 2.5 km as shown in Figure 5 below. It can also be seen that the Long Sand Head sand bank feature is 4-5km from the cable corridor and separated by the Long Sand Head two way route (Shipping Lane) used by vessels transiting to the ports.

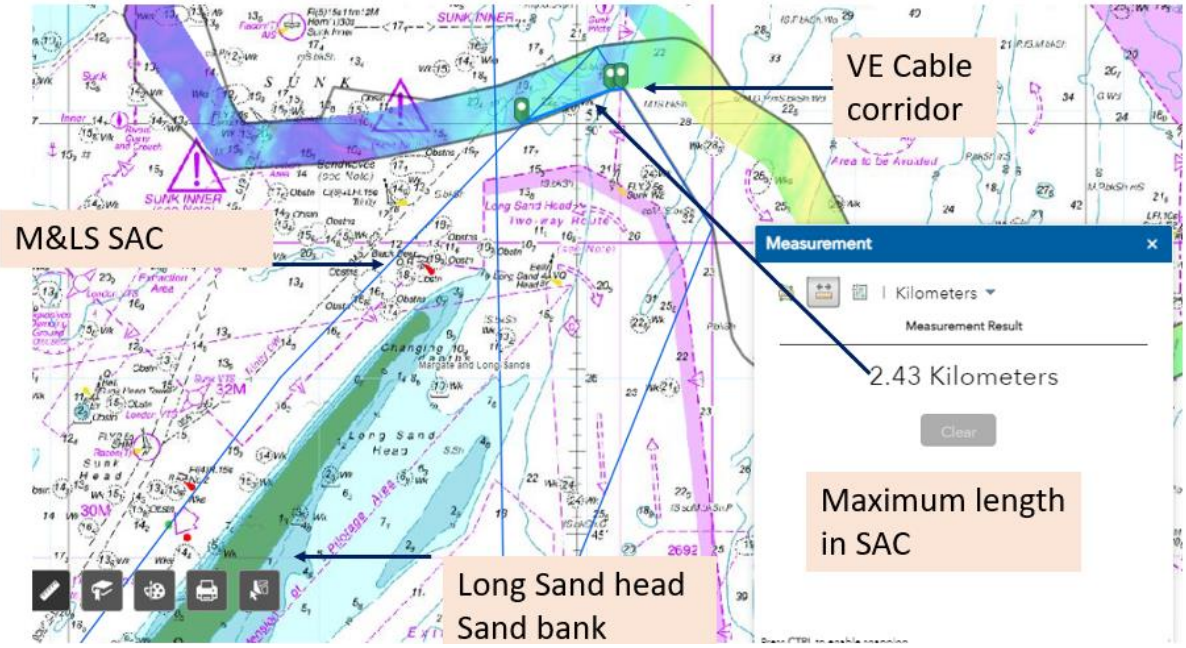

Figure 5 Maximum length of cable in SAC

3.1.2 This would be hugging the southern corridor edge. The project cannot conduct the final routing until post DCO, however the Applicant has committed to the following *"Final cable routing will seek to take the shortest route through the M&LS SAC where possible"* (9.13 Margate and Long Sands SAC Benthic Mitigation Plan [APP-243 Table 9.1]).

3.1.3 In practice this means this will mean that during detailed routing weighting is applied to minimising the length of the cable routes in the SAC. This is then balanced against other constraints such as minimising the time in the vicinity of the sunk pilot diamond to the north to avoid shipping & navigation impacts for the ports, physical constraints on the seabed such as UXO or archaeological features, targeting preferred geology for cable burial, avoiding sand waves etc.

3.1.4 Based on the preliminary work conducted to date this is resulting in indicative routes with between 0.4-1.5km within the SAC.

3.1.5 A highly conservative assumption of 50% of the cable would require protection has then been applied to an assumed routing of 900 m per cable in the SAC. This has been combined with an assumed mattress width of 6m to result in the 5,400 m^2. This value is considered highly conservative by the Applicant and the most likely scenario is that no external cable protection will be used.

3.2 WHAT EFFECTS WOULD THE PRESENCE OF CABLE PROTECTION WITHIN AND OUTSIDE OF THE MLS SAC HAVE IN RELATION TO SEDIMENT TRANSPORT PROCESSES, WITH PARTICULAR REGARD TO ANNEX I SANDBANKS.

3.2.1 The Applicant has undertaken a detailed assessment of the potential for cable protection measures to interrupt sediment transport pathways within and nearby to MLS SAC. This is underpinned by a robust understanding of baseline sediment transport processes, developed through analysis of high-resolution geophysical datasets and complemented by numerical modelling of sediment transport pathways.

3.2.2 The Applicant acknowledges that the presence of cable protection could lead to a very small volume of sediment being trapped within the rock voids, whilst a similarly small volume of material could also accumulate on the updrift side of the berms, before the slope reaches an equilibrium position defined by the angle of repose of the accumulated material. However, thereafter sediment can reasonably be expected to be transported at the same rate (and in the same direction) as under baseline conditions. Any indirect changes to sediment transport arising from modification of tidal currents and waves as they interact with the berms will be highly spatially restricted - order of 10's of metres (maximum) from the feature. Given that only very minor changes are expected to the sediment transport regime, any associated morphological impacts are also expected to be very limited. This is reflected in both 6.2.5 Benthic and Intertidal Ecology chapter [APP-074] and the 5.4 Report to Inform Appropriate Assessment [APP-040].

3.3 HAS THE POTENTIAL FOR THE ADDITION OF FURTHER SCOUR/CABLE PROTECTION, INCLUDING ANY REQUIRED AS A RESULT OF CABLE REPAIR AND REPLACEMENT OR CABLE EXPOSURE DURING OPERATION, BEEN INCLUDED WITHIN THE CALCULATIONS FOR THE WORST-CASE SCENARIO FOR CABLE PROTECTION WITHIN THE MLS SAC? IF SO, WHAT ASSUMPTIONS HAVE BEEN MADE FOR WORST-CASE ASSESSMENTS CONCERNING CABLE PROTECTION EXPOSURE?

3.3.1 The word additional in the context around cable protection as stated in the 5.4 Report to Inform Appropriate Assessment [APP-040] and the 9.13 Margate and Long Sands SAC Benthic Mitigation Plan [APP-243] was with reference to the addition of ‘any’ volume of cable protection should cable burial without any protection not be feasible. For clarity within the context of the assessments, the word additional has been removed from all relevant documents which will be submitted at a future deadline.

3.3.2 The Applicant considers the requirements for cable protection within the SAC has been considered and is covered within the MDS of 5,400 m^2. Available data indicates burial within M&LS SAC is likely to be successful, and as such the 5,400 m^2 of cable protection is highly precautionary.

3.4 WHAT IS PROPOSED IN TERMS OF ANY CABLE PROTECTION AT THE DECOMMISSIONING STAGE FOR THE PROPOSED DEVELOPMENT? HOW HAS THIS BEEN CONSIDERED IN THE ASSESSMENTS?

3.4.1 There is a commitment to remove the cable protection (such as mattresses) from within MLS SAC should any ultimately be required at the point of decommissioning.

3.4.2 The removal of cable protection has been considered as part of the assessment, as decommissioning impacts were assessed as being of a similar size/scale as that of construction (installation of concrete mattresses involves lifting them to the seafloor, while removing is lifting them back up). Whereby there would be a degree of temporary disturbance during the removal of cable protection.

PHONE 0333 880 5306
EMAIL fiveestuaries@rwe.com
WEBSITE www.fiveestuaries.co.uk
ADDRESS Five Estuaries Offshore Wind Farm Ltd
Windmill Hill Business Park
Whitehill Way, Swindon, SN5 6PB

COMPANY NO Registered in England and Wales
company number 12292474