FIVE ESTUARIES
OFFSHORE WIND FARM

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PRELIMINARY ENVIRONMENTAL INFORMATION REPORT

VOLUME 2, ANNEX 1.1: DETAILED OFFSHORE PROJECT DESIGN ENVELOPE

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CONTENTS

DEFINITION OF ACRONYMS

Term	Definition
CTVs	Crew Transfer Vessels
ECC	Export Cable Corridor
GBS	Gravity Based Structure
HDD	Horizontal Directional Drilling
HVAC	High Voltage Alternating Current
JUV	Jack Up Vessel
LAT	Lowest Astronomical Tide
MDS	Maximum Design Scenario
MHWS	Mean High Water Springs
O&M	Operation and Maintenance
OSPs	Offshore Substation Platforms
PLGR	Pre-Lay Grapnel Run
PVMs	Permanent Vessel Moorings
SOVs	Service Operation Vehicles
TJB	Transition Joint Bay Compound
UXO	Unexploded Ordnance
VE	Five Estuaries Offshore Wind farm
WTGs	Wind turbine generators

1 DETAILED OFFSHORE PROJECT DESIGN ENVELOPE

1.1 INTRODUCTION

1.1.1 Volume 2, Chapter 1: Offshore Project Description presents a detailed description of the design of Five Estuaries Offshore Wind Farm (VE), setting out design and components for both the onshore and offshore infrastructure, as well as the main activities associated with the construction, operation and maintenance, and decommissioning of VE.

1.1.2 The Design Envelope approach has been used to include sufficient flexibility to accommodate further project refinement during detailed design, post consent. The final project design will depend on factors including ground conditions, wave and tidal conditions, project economics and procurement approach.

1.1.3 The purpose of this annex is to provide a useful summary of the Maximum Design Scenario (MDS) tables in one place as presented in Volume 2, Chapter 1: Offshore Project Description. The green shaded cells represent the maximum design envelope for each design scenario.

1.2 PRE-CONSTRUCTION SURVEYS

MDS for boulder clearance			
Parameter	**Design envelope for export cables**	**Design envelope of inter-array cables**	**Total**
Length of cable route requiring boulder clearance	100%	100%	N/A
Length of cable route requiring boulder clearance (km)	370	200	570
Width of boulder plough/ clearance tool (m)	18	18	N/A
Total area of seabed disturbed by boulder plough/ clearance (m^2)	6,660,000	3,600,000	10,260,000
Total area of seabed disturbed by boulder clearance (km^2)	6.66	3.60	10.26
MDS for the use of a PLGR			
Parameter	**Design envelope for export cables**	**Design envelope of inter-array cables**	**Total**
Length of cable route requiring Pre-Lay Grapnel Run (PLGR)	100%	100%	N/A
Length of cable route requiring PLGR (km)	370	200	570
Width of PLGR (m)	15	15	N/A
Total area of seabed disturbed by PLGR (m^2)	5,550,000	3,000,000	8,550,000

Total area of seabed disturbed by PLGR (km^2)	5.55	3.00	8.55
MDS for Unexploded Ordnance (UXO) clearance			
Parameter		**Design Envelope**	
Expected total number of potential UXO targets		2,000	
Expected number of UXO requiring clearance in the pre-construction phase		60	
Maximum number of clearance events within 24 hours		2	
MDS for trial trenching			
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

[1]Assuming a V-shaped trench in which 50% of sediment is fluidised and the remaining 50% re-suspended in the water column

MDS for sandwave clearance			
Parameter	**Design envelope for export cables**	**Design envelope of inter-array cables**	**Total**
Length of cable route requiring sandwave clearance	50%	50%	N/A
Length of cable route requiring sandwave clearance (km)	185	100	285
Illustrative width of sandwave clearance disturbance corridor (m)	70	70	N/A
Indicative depth of sandwave clearance dredging (m)	5	5	N/A
Total area of seabed disturbed by sandwave clearance (m^2)	12,950,000	7,000,000	19,950,000
Total area of seabed disturbed by sandwave clearance (km^2)	13.0	7.0	19.95
Total volume of sediment disturbed by sandwave clearance (m^3)	64,750,000	35,000,000	99,750,000
Maximum volume of material cleared from sandwaves requiring disposal (m^3)	64,750,000	35,000,000	99,750,000
MDS for seabed preparation			
Parameter	**Wind Turbine Generators (WTG) foundations**	**Offshore Substation Platform (OSP) foundations**	**Total**
Foundation type	79 x gravity base jacket foundations	2 x gravity base monopile foundation	N/A

Seabed preparation area per foundation (m^2)	3,600	7,000	N/A
Seabed preparation area for all foundations (m^2)	284,400	14,000	298,400
Seabed preparation depth (m)	4	4	N/A
Seabed preparation spoil volume per foundation (m^3)	14,400	28,000	N/A
Seabed preparation spoil volume for all foundations (m3)	1,137,600	56,000	1,193,600
Volume of gravel bed (m^3)[2]	284,400	14,000	298,400

[2] Assuming a gravel bed is required at all foundation locations

1.3 CONSTRUCTION OF STRUCTURES IN THE ARRAY AREAS

Minimum spacing for structures in the northern and southern arrays		
Structure	**Minimum spacing (m)**	
WTGs	830	
OSPs	450	
Design envelope for WTGs		
Parameter	**Design Envelope**	
	Small WTG	**Large WTG**
Number of WTGs	79	41
Minimum blade tip height above Mean High Water Springs (MHWS) (m)	28	28
Maximum blade tip height above MHWS (m)	320	420
Maximum blade tip height above Lowest Astronomical Tide (LAT) (m)	324	424
Rotor diameter (m)	260	360

Design envelope for oils and fluids for WTGs		
Parameter	**Design Envelope**	
	Small WTG	**Large WTG**
Grease (l)	898	1,736
Hydraulic oil (l)	1,696	3,278
Gear oil (l)	3,330	6,437
Nitrogen (l)	,728	210,207
Transformer silicon/ ester oil (l/ kg)	20,000	20,000
Diesel fuel (l)	1,000	1,000
Sulphur hexafluoride (SF6) kg)	180	180
Glycol/ coolant (l)	23,541	45,513
Batteries (kg)	2,700	4,100
Design envelopes for OSP		
Parameter		**Design Envelope**
Number of OSPs		2
Topside dimensions (m)		125 x 100
Topside height above LAT (excluding stowed crane, helideck and mast) (m)		105

Topside height above LAT (including stowed crane, helideck and mast)	195
Maximum unstowed crane height above LAT (m)	195
Maximum High Voltage Alternating Current (HVAC) system voltage (primary) (kV)	400
Maximum HVAC system voltage (secondary) (kV)	132

Design envelope for oils and fluids per OSP	
Parameter	**Design Envelope**
Grease (l)	Minimal
Hydraulic oil (l)	3,000
Gear oil (l)	1,000
Nitrogen (l)	Minimal
Transformer silicon/ ester oil (l/kg)	340,000
Diesel fuel (l)	120,000
Sulphur hexafluoride (SF6) kg)	10,000
Glycol/ coolant (l)	90,000
Batteries (kg)	350,000
Grey water (l)	5,000
Black water (l)	3,000

Design envelope for lighting requirements		
Parameter	**Design Envelope**	
	WTGS	**OSP**
Aviation lighting (cd)	Up to 2000	N/A
Navigation lighting (nominal range (nm))	Significant Peripheral Structure (SPS): 5 Intermediate Peripheral Structure (IPS): 2	N/A
Heli-hoist lighting (OSPs only)		Low intensity green light (200 cd) at the heli-hoist platform. Lighting will only be activated when a structure is being prepared for helicopter approach.
ID marker board lighting		Typically low level baffled (5 – 10 cd/m^2) lighting directed towards the ID marker board. Located on the foundation body or Main Access Platform (MAP).
Workplace lighting		Illumination levels for external areas will typically be 50 lux located at the foundation level of structures, providing illumination for the access ladder, resting platforms and MAP. Workplace lighting will only be activated during the O&M phase when a structure is infrequently manned for maintenance activities.

1.4 CONSTRUCTION OF FOUNDATIONS IN ARRAY AREAS

Foundation options considered for VE			
Foundation Type		**WTG**	**OSP**
Monopile		✓	✓
Multi-leg pin-piled jacket		✓	✓
Mono suction caisson		✓	×
Multi-leg suction caisson jacket		✓	✓
Monopile Gravity Based Structure (GBS)		✓	✓
Multi-leg GBS jacket		✓	✓
Design envelope for monopiles			
Parameter	**Design Envelope**		
	Large WTG	**Small WTG**	**OSP**
Number of monopiles	41	79	2
Diameter (m)	15	13	15
Typical embedment depth (m)	68	68	68

Design envelope for multi-leg pin piled jackets			
Parameter	Design Envelope		
	Large WTG	Small WTG	OSP
Number of jacket foundations	41	79	2
Number of legs per foundation	4	4	6
Pin-piles per leg	1	1	2
Total pin-piles	164	316	24
Pin-pile diameter (m)	3.5	3.5	3.5
Typical pin-pile embedment depth (m)	60	60	60
Maximum separation of adjacent legs at seabed level (m)	45	45	60 x 100
Maximum separation of adjacent legs at sea level (LAT) (m)	35	35	50 x 90

Piling Scenarios						
	Soft Start	Ramp Up				Max
Monopile						
Hammer energy (kJ)	1,050	1,400	2,800	4,200	5,600	7,000
Strikes	100	100	100	100	100	14,280
Duration (s)	600	300	300	300	300	25,200
Strike rate (strikes per minute)	10	20	20	20	20	34
Pin Pile						
Hammer energy (kJ)	450	600	1,200	1,800	2,400	3,000
Strikes	100	100	100	100	100	8,100
Duration (s)	600	300	300	300	300	14,580
Strike rate (strikes per minute)	10	20	20	20	20	33

Maximum design parameters for drilling			
Parameter	**WTG foundations**	**OSP foundations**	**Total**
Foundation type	79 x monopiles	2 x monopile	N/A
Drilling spoil volume for all foundations (m^3)	540,084	27,346	567,430

Design envelope for mono suction caisson foundations		
Parameter	**Design Envelope**	
	Large WTG	**Small WTG**
Number of foundations	41	79
Suction caisson diameter (m)	40	40
Monopile diameter at sea surface (MSL) (m)	15	13
Typical suction caisson penetration depth (m)	25	25
Height of suction caisson above seabed level (m)	8	8

Design envelope for multi-leg suction caisson jacket foundations		
Parameter	**Design Envelope**	
	Large WTG	**Small WTG**
Number of foundations	41	79

Number of buckets per foundation		4	4
Suction caisson diameter per leg (m)		20	20
Typical suction caisson penetration depth (m)		25	25
Height of suction caisson above seabed level (m)		5	5
Separation of adjacent legs at seabed level (m)		40	40
Separation of adjacent legs at sea level (LAT) (m)		30	30
Design envelope for mono GBS foundations			
Parameter	**Design Envelope** **Large WTG**	**Small WTG**	**OSP**
Number of jacket foundations	41	79	2
GBS base diameter (m)	55	55	55
Shaft diameter at sea surface (MSL) (m)	15	15	15
Maximum height of base above the seabed (m) (will taper down above this height)	8	8	8
Gravel bed requirements			

Area of gravel bed (m^2) per foundation	2,827	2,827	7,000
Thickness of gravel bed (m)	1	1	1
Volume of gravel bed per foundation (m^3)	2,827	2,827	7,000
Total area of gravel bed required (m^2)	115,907	223,333	14,000
Total volume of gravel bed required (m^3)	115,907	223,333	14,000
Surface area			
Surface area of water facing structure per foundation (m^2)	5,450	5,450	6,700
Total surface area of water facing structure (m^2)	223,450	430,550	13,400

Design envelope for multi-leg GBS foundations		
Parameter	**Design Envelope**	
	Large WTG	**Small WTG**
Number of jacket foundations	41	79
Separation of adjacent legs at seabed level (m)	45	45
Separation of adjacent legs at sea level (LAT) (m)	35	35

Number of bases per foundation	4	4
GBS diameter (m)	20	20
Height of GBS above seabed level (m)	8	8
Gravel bed requirements		
Area of gravel bed (m^2) per foundation (the maximum area assumes a single base rather than up to four separate bases per WTG)	3,600	3,600
Thickness of gravel bed (m)	1	1
Volume of gravel bed per foundation (m^3) (the maximum area assumes a single base rather than up to four separate bases per WTG)	3,600	3,600
Total area of gravel bed required (m^2)	147,600	284,400
Total volume of gravel bed required (m^3)	147,600	284,400

MDS for scour protection

Parameter	WTG foundations	OSP foundations	Total
Foundation type	79x GBS monopiles	2 x GBS monopiles	N/A
Foundation and scour area per foundation (m^2)	16,628	40,828	N/A
Foundation and scour area, all foundations (m^2)	1,313,612	81,656	1,395,268

Scour volume per foundation (m^3)	26,700	74,065	N/A
Scour volume for all foundations (m^3)	2,109,300	148,100	2,257,430
MDS for array cables			
Parameter		**Design Envelope**	
Cable parameters			
Maximum system voltage (kV)		132	
External cable diameter (mm)		250	
Total length of array cables (km)		200	
Cable installation			
Maximum burial depth (m)		3.5	
Minimum burial depth (m)		0 (see cable protection requirements in Section 1.10 of Volume 2, Chapter 1: Offshore Project Description)	
Maximum installation tool seabed disturbance width (jetting) (m)		18	
Total area of seabed disturbed by cable installation (m^2)		3,600,000	
Total area of seabed disturbed by cable installation (km^2)		3.6	

Total volume of sediment disturbed by cable installation[3] (m^3)	3,150,000
Total volume of sediment disturbed by cable installation[3] (km^3)	0.00315

1.5 CONSTRUCTION IN THE EXPORT CABLE CORRIDOR

MDs for offshore export cables	
Parameter	**Design Envelope**
Cable parameters	
Maximum system voltage (kV)	400
Indicative external cable diameter (mm)	310
Number of export cable circuits	4
Total length of export cables (km)	370
Cable installation	
Indicative maximum burial depth (m) [4]	3.5

[3] Assuming a V-shaped trench in which 50% of sediment is fluidised and the remaining 50% re-suspended in the water column
[4] The maximum cable burial depth will be dependent on numerous factors and will vary along the offshore ECC. The cables will be buried below the seabed wherever possible, with a target burial depth defined post-consent in a Cable Burial Risk Assessment (CBRA) taking account of the ground conditions and other factors.

MDs for offshore export cables	
Minimum burial depth (m)	0 (see cable protection requirements in Section 1.10 of Volume 2, Chapter 1: Offshore Project Description)
Maximum installation tool seabed disturbance width (jetting) (m)	18
Total area of seabed disturbed by cable installation (m^2)	6,660,000
Total area of seabed disturbed by cable installation (km^2)	6.66
Total volume of sediment disturbed by cable installation[3] (m^3)	2,156,175
Total volume of sediment disturbed by cable installation[3] (km^3)	0.00216

1.6 DISPOSAL OF DREDGED MATERIAL

MDS for dredged material disposal				
Parameter	**Disposal site 1**	**Disposal site 2**	**Disposal site 3**	**Total**
Project Location	**Northern array**	**Southern array**	**Offshore ECC**	**N/A**
Drill arisings (m^3)	283,715	283,715	N/A	567,430
Seabed preparation spoil volume for all foundations (m^3)	596,800	596,800	N/A	1,193,600
Maximum volume of material cleared from sandwaves requiring disposal (m^3)	17,500,000	17,500,000	64,750,000	99,750,000
Total (m^3)	18,380,515	18,380,515	64,750,000	101,511,030
Total (km^3)	0.018	0.018	0.065	0.102

1.7 CABLE PROTECTION

MDS for cable protection			
Parameter	**Design envelope for export cables**	**Design envelope of inter-array cables**	**Total**
Length of cable requiring cable protection (including cable ends protection) (%)	20	20	N/A
Length of cable requiring cable protection (minus cable crossings) (km)	69	54	123
Width of cable protection on seabed (m)	16	6	N/A
Height of cable protection berm (m)	1.4	1	N/A
Total area of seabed covered by cable protection (m^2)	1,104,000	324,000	1,428,000
Total volume of cable protection (m^3)	966,000	189,000	1,155,000

1.8 CABLE CROSSINGS

Maximum design envelope for cable crossings			
Parameter	**Design envelope for export cables**	**Design envelope of inter-array cables**	**Total**
Cables to be crossed	21	N/A	N/A
Total number of crossings required	84	26	110
Length of crossings (m)	300	300	N/A
Total length of cable crossings (m)	25,200	7,800	33,000
Width of crossing (m)	15.22	15.22	N/A
Height of rock berm (m)	1.4	1.4	N/A
Cross sectional area of trapezoid (m^2)	13.7	13.7	N/A
Total area of seabed covered by cable crossings (m^2)	383,544	118,716	502,260
Total volume of cable protection required (m^3)	345,240	106,860	452,100

1.9 CONSTRUCTION AT LANDFALL

MDS for trenchless techniques	
Parameter	**Design Envelope**
Number of cable circuits	4
Number of cable ducts/ Horizontal Directional Drilling (HDD) bores	5 (one per circuit plus one contingency)
Minimum HDD spacing (offshore) (m)	50 (100-200 m is anticipated)
Maximum HDD depth below the surface (m)	20
Maximum HDD length (m)	1,100

MDS for release of drilling mud	
Parameter	**Design envelope**
Maximum number of bores	5
Realistic case drilling mud volume based on forward ream (from the beach to offshore) per bore (m^3)	677
Realistic case drill cuttings based on forward ream (from the beach to offshore) per bore (m^3)	50
Worst case drilling mud volume based on back beam (from offshore towards the beach) (m^3)	4,940
Worst case drill cuttings volume based on back beam (from offshore towards the beach) (m^3)	900

Total volume of drilling mud which could be released (m^3)	24,700
Total volume of drill cuttings which could be released (m3)	4,500
Maximum drilling mud volume to be released per tidal cycle (m3)	500
MDS for exit pits	
Parameter	**Design Envelope**
Number of exit pits	5
Location of exit pits	See Figure 1.15 in Volume 2, Chapter 1: Offshore Project Description.
Width of each exit pit (m)	10
Length of each exit pit (m)	75
Area of each exit pit (m^2)	750
Total area of all exit pits (m^2)	3,750
Depth of each exit pit (m)	2.5
Volume excavated per exit pit (m^3)	1,875
Total volume excavated from exit pits (m^3)	9,375

Design envelope for sheet piled exit pits associated with trenchless techniques	
Parameter	**Design Envelope**
Number of sheet piled exit pits required	5
Design envelope for piling for sheet piled exit pits installation	
Parameter	**Design Envelope**
Indicative hammer energy for sheet piled exit pits installation (kJ)	300 (assumes a 60 kJ soft start for 30 mins and up to full power in 5 minutes)
Sheet pile width (mm)	750
Total number of sheet piles	1,100
Maximum number of piles to be installed per day	8
Maximum installation per sheet pile (hr)	1
Design envelope for the Transition Joint Bay (TJB) compound	
Parameter	**Design Envelope**
Number of export cable circuits	4
Number of TJBs	4
TJB dimensions (m)	20 x 5
Land take for TJBs compound during construction (m^2)	100 x 200

Permanent land take for all of TJBs during O&M (m^2)[5]	30 x 80

1.10 OPERATION AND MAINTENANCE

MDs for Operation and Maintenance (O&M) activites	
Parameter	**Design Envelope**
O&M strategy	
Project lifetime (years)	Approximately 40
Surface infrastructure (WTGs and OSPs)	
Number of WTG and OSP major component replacements requiring JUVs over project lifetime	284
Scour replenishment	20%
Array cables	
Number of array cable repairs/ replacements over project lifetime	8
Seabed disturbance per array cable repair/replacement event (including vessel anchors) (m^2)	34,582

[5] This is the total area. It should be noted that TJBs may be spaced apart i.e. this area may consist of several smaller areas

Total seabed disturbance for array cables over project lifetime (m^2)	276,656
Total length of array cables requiring remedial burial over project lifetime via jetting or rock placement (m)	5,000
Seabed disturbance volume per array cable repair/replacement event (including vessel anchors) (m^3)	14,072
Total seabed disturbance volume for array cables over project lifetime (m^3)	112,576
Offshore export cables	
Number of offshore export cable repairs over project lifetime	16
Seabed disturbance per array cable repair event (including vessel anchors) (m^2)	16,205
Total seabed disturbance for offshore export cables over project lifetime (m^2)	259,280
Total length of array cables requiring remedial burial over project lifetime via jetting or rock placement (m)	5,000
Seabed disturbance volume per offshore export cable repair event (including vessel anchors) (m3)	9,307

Total seabed disturbance volume for offshore export cables over project lifetime (m3)	148,912

1.11 PROJECT VESSELS

Peak construction vessels and round trips to site		
Vessel Type	**Peak Vessels**	**Round Trips**
Foundations		
WTG and OSP foundation installation vessels (includes tugs and feeders)	38	1359
WTGs and OSPs		
WTG installation vessels (includes tugs and feeders)	15	71
OSP topside installation vessels (includes tugs and feeders)	4	8
Other installation vessels		
Commissioning (including accommodation vessels)	5	130
Other vessels	15	2,300
Cable installations vessels (incl. seabed preparation vessels)		
Array cable installation vessels (includes support, cable protection and anchor handling vessels)	12	166
Export cable installation spreads (includes support, cable protection and anchor handling vessels)	12	1,076
Total construction vessels		
Maximum total construction vessels	101	5,110

Indicative peak vessels on-site simultaneously	35	N/A
MDS for Jack Up Vessel (JUV) operations during the construction phase		
Parameter		**Design Envelope**
Maximum JUV operations during construction		504
Individual spud can footprint (m^2)		275
Maximum seabed area per JUV operation (m^2)		1,100
Maximum seabed area impacted for all JUV operations (m^2)		554,400
Typical seabed penetration (m)		15
Maximum volume of sediment disturbed per JUV operation (m^3)		16,500
Maximum volume of sediment disturbed for all JUV operations (m^3)		8,316,000
MDS for anchor footprints for WTG and OSP installation (foundations and topsides) during the construction phase		
Parameter		**Design Envelope**
Number of locations		81 (79 WTGS + 2 OSPs)
Number of anchors per deployment		8
Number of deployments per location		5 (4 per foundation, 1 per topside)
Anchor footprint (deployment and recovery per anchor) (m^2)		117

Total anchor footprint per location (m^2)	936
Total impact area for WTG and OSP installation in the array (m^2)	379,080
Typical anchor penetration depth (m)	4
Total impact volume for WTG and OSP installation in the array (m^2)	1,516,320
Design envelope for anchor footprints for the inter-array cables during the construction phase	
Parameter	**Design Envelope**
Number of vessel moves	455
Number of anchors per deployment	9
Anchor footprint (deployment and recovery per anchor) (m^2)	61
Total anchor footprint per deployment	549
Total impact area for all anchors for inter-array cables (m^2)	249,795
Typical anchor penetration depth (m)	1.5
Total impact volume for all anchors for inter-array (m^2)	374,693
Design envelope for anchor footprints in the offshore Export Cable Corridor (ECC) during the construction phase	
Parameter	**Design Envelope**
Number of vessel moves	841
Number of anchors per deployment	9

Anchor footprint (deployment and recovery per anchor) (m^2)		61
Total anchor footprint per deployment		549
Total impact area for all anchors in the offshore ECC (m^2)		461,709
Typical anchor penetration depth (m)		1.5
Total impact volume for all anchors in the offshore ECC (m^3)		692,564
MDS O&M vessel requirements		
Vessels	**Design Envelope** **Peak Vessels**	**Annual Road Trips**
Vessel description		
JUVs	3	9
Service Operation Vehicles (SOVs)	2	52
Crew Transfer Vessels (CTVs)	9	1,642
Lift vessels	3	8
Cable maintenance	2	1
Auxiliary vessels	8	64
Total O&M Vessels		
Total O&M vessels	27	1,776

Indicative peak vessels on-site simultaneously	27	N/A
MDS for JUV requirements during O&M		
Parameter		**Design Envelope**
Number of major component replacements requiring JUVs over project lifetime		284
Number of JUV operations per replacement		1
Individual spud can footprint (m^2)		275
Maximum seabed area per JUV operation (m^2)		1,100
Maximum seabed area impacted for all JUV operations (m^2)		312,400
Typical seabed penetration (m)		15
Maximum volume of sediment disturbed per JUV operation (m^3)		16,500
Maximum volume of sediment disturbed for all JUV operations (m^3)		4,686,000
MDS for PVMs		
Parameter		**Design Envelope**
Number of Permanent Vessel Moorings (PVMs)		6
Buoy diameter (m)		6
Maximum number of anchors per mooring		6
Maximum anchor width (m)		7

Anchor installation drag length (m)	80
Anchor penetration depth (m)	6
Total area of seabed disturbed by anchor installation (m^2)	20,160
Total volume of seabed disturbed by anchor installation (m^3)	120,960
Maximum impact footprint of all buoy chains on sea floor during operation (m^2)	283,200

FIVE ESTUARIES
OFFSHORE WIND FARM

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