

A large, stylized sun logo in the top right corner, composed of light blue curved segments radiating from a white center.

MORAY EAST

OFFSHORE WINDFARM

A series of overlapping wavy lines in shades of blue and teal, spanning the width of the page.

Construction Survey Summary Report

December 2020

Moray Offshore Windfarm (East) Limited

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List of Abbreviations

CMS	Caithness Moray Shetland
CPT	Cone Penetration Testing
DoC	Depth of Cover
DoL	Depth of Lowering
DPPFV	Dynamic Positioning Fall Pipe Vessel
GPS	Global Positioning System
GVI	General Visual Inspection
IAC	Inter-Array Cable
LAT	Lowest Astronomical Tide
MBES	Multibeam Echo Sounder
OEC	Offshore Export Cable
OFTI	Offshore Transmission Infrastructure
OSP	Offshore Substation Platform
OW	Ocean Winds
PPP GPS	Precise Point Positioning GPS
ROV	Remotely Operated Vehicle
RPL	Route Position List
RTK DGPS	Real Time Kinematic Differential GPS
TSS-440	Teledyne Buried Pipeline / Cable Tracking System
USBL	Ultra-Short Baseline (Positioning System)
WROV	Work-class Remotely Operated Vehicle
WTG	Wind Turbine Generator

Definitions

The following definitions have been used throughout this document with respect to the company, the consented wind farms and how these definitions have changed since submission of the Moray East Environmental Statement (ES) in 2012 and the Moray East Modified Transmission Infrastructure ES in 2014.

- **Moray Offshore Windfarm (East) Limited (formerly known as Moray Offshore Renewables Limited)** – the legal entity submitting this Construction Survey Summary Report;
- **Moray East Offshore Wind Farm** - the wind farm to be developed in the Moray East site (also referred as the Wind Farm);
- **The Moray East site** - the area in which the Moray East Offshore Wind Farm will be located. Section 36 Consents and associated Marine Licences to develop and operate up to three generating stations on the Moray East site were granted in March 2014. At that time the Moray East site was known as the “Eastern Development Area (EDA)” and was made up of three sites known as the Telford, Stevenson and MacColl offshore wind farm sites; The Section 36 Consents and Marine Licences were subsequently varied in March 2018; with the Marine Licences additionally varied in July 2019, April 2020, October 2020 (MacColl) and November 2020 (Telford and Stevenson).
- **Telford, Stevenson and MacColl wind farms** – these names refer to the three consented offshore wind farm sites located within the Moray East site;
- **Transmission Infrastructure (TI)** - includes both offshore and onshore electricity transmission infrastructure for the consented Telford, Stevenson and MacColl wind farms. Includes connection to the national electricity transmission system near New Deer in Aberdeenshire encompassing AC (alternating current) offshore substation platforms (OSPs), AC OSP interconnector cables, AC export cables offshore to landfall point at Inverboyndie continuing onshore to the AC collector station (onshore substation) and the additional regional Transmission Operator substation near New Deer. A Marine Licence for the offshore TI was granted in September 2014 and a further Marine Licence for two additional distributed OSPs was granted in September 2017. Both Licences were subsequently varied in July 2019 and the Licence for the offshore TI was additionally varied in December 2020. The onshore TI was awarded Planning Permission in Principle in September 2014 by Aberdeenshire Council and a Planning Permission in Principle under Section 42 in June 2015. In June 2018 Aberdeenshire Council granted Approval of Matters Specified in Conditions for both the Cable Route and the Substation;
- **Offshore Transmission Infrastructure (OfTI)** – the offshore elements of the transmission infrastructure, comprising AC OSPs, OSP inter-connector cables and AC export cables offshore to landfall (for the avoidance of doubts some elements of the OfTI will be installed in the Moray East site);
- **Moray East ES 2012** – The ES for the Telford, Stevenson and MacColl wind farms and Associated Transmission Infrastructure, submitted August 2012;
- **Moray East Modified TI ES 2014** – the ES for the TI works in respect to the Telford, Stevenson and MacColl wind farms, submitted June 2014;
- **The Development** – the Moray East Offshore Wind Farm and Offshore Transmission Infrastructure (OfTI);
- **Design Envelope** – the range of design parameters used to inform the assessment of impacts;
- **OfTI Corridor** – the export cable route corridor, i.e. the OfTI area as assessed in the Moray East Modified TI ES 2014 excluding the Moray East site;

- **the Applications** – (1) the Application letter and ES submitted to the Scottish Ministers on behalf of Telford Offshore Windfarm Limited, on 2nd August 2012 and the Additional Ornithology Information submitted to the Scottish Ministers by Moray Offshore Renewables Limited on the 17th June 2013; (2) the Section 36 Consents Variation Application Report for Telford, Stevenson and MacColl Offshore Wind Farms dated December 2017 and (3) the Marine Licence Applications and associated documents submitted for the OfTI Licences and OSP Licences in June 2014 and May 2017 respectively;
- **Moray East Offshore Wind Farm Consents** – are comprised of the following:

Section 36 Consents:

- Section 36 consent for the Telford Offshore Wind Farm (as varied) – consent under Section 36 of the Electricity Act 1989 for the construction and operation of the Telford Offshore Wind Farm assigned to Moray East on 19 June 2018.
- Section 36 consent for the Stevenson Offshore Wind Farm (as varied) – consent under Section 36 of the Electricity Act 1989 for the construction and operation of the Stevenson Offshore Wind Farm assigned to Moray East on 19 June 2018.
- Section 36 consent for the MacColl Offshore Wind Farm (as varied) – consent under Section 36 of the Electricity Act 1989 for the construction and operation of the MacColl Offshore Wind Farm assigned to Moray East on 19 June 2018.

Marine Licences

- Marine Licence for the Telford Offshore Wind Farm (as varied) – Licence Number: MS-00009051 (formerly 04629/20/0) – granted under the Marine (Scotland) Act 2010 & Marine and Coastal Access Act 2009, Part 4 marine licensing for marine renewables construction works and deposits of substances or objects in the Scottish Marine Area and the United Kingdom Marine Licensing Area transferred to Moray East on 19 July 2018.
 - Marine Licence for the Stevenson Offshore Wind Farm (as varied) – Licence Number: MS-00008985 (formerly 04627/20/0) – granted under the Marine (Scotland) Act 2010 & Marine and Coastal Access Act 2009, Part 4 marine licensing for marine renewables construction works and deposits of substances or objects in the Scottish Marine Area and the United Kingdom Marine Licensing Area transferred to Moray East on 19 July 2018.
 - Marine Licence for the MacColl Offshore Wind Farm (as varied) – Licence Number: MS-00008972 (formerly 04628/20/0) – granted under the Marine (Scotland) Act 2010 & Marine and Coastal Access Act 2009, Part 4 marine licensing for marine renewables construction works and deposits of substances or objects in the Scottish Marine Area and the United Kingdom Marine Licensing Area transferred to Moray East on 19 July 2018.
- **OfTI Licences** – are comprised of the following:
 - Marine Licence for the Offshore Transmission infrastructure (as varied) – Licence Number MS-00008919 (formerly 05340/19/0) – granted under the Marine (Scotland) Act 2010 & Marine and Coastal Access Act 2009, Part 4 marine licensing for marine renewables construction works and deposits of substances or objects in the Scottish Marine Area and the United Kingdom Marine Licensing Area (referred to as the “OfTI Marine Licence”).
 - Marine Licence for two additional distributed OSPs (as varied) – Licence Number 06347/19/0 – granted under the Marine (Scotland) Act 2010 & Marine and Coastal Access Act 2009, Part 4 marine licensing for marine renewables construction, operation and maintenance works and the deposit of substances or objects in the Scottish Marine Area and the United Kingdom Marine Licensing Area (referred to as the “OSP Marine Licence”).

1 Introduction

1.1 Background

Moray East is a joint venture partnership between OW Offshore, Diamond Generating Europe and China Three Gorges and has been established to develop, finance, construct, operate, maintain and decommission the Moray East Offshore Wind Farm.

Section 36 Consents were granted in March 2014 and were subsequently varied in March 2018 for the construction and operation of three offshore wind farms (Telford, Stevenson and MacColl) within the Moray East site. Marine Licences for the three offshore wind farms were granted in September 2014 and were subsequently varied in July 2019, April 2020, October 2020 (MacColl) and November 2020 (Telford and Stevenson). Together the Section 36 Consents and Marine Licences for the Wind Farm are referred to as the Moray East Offshore Wind Farm Consents.

A Marine Licence for the Modified Offshore Transmission Infrastructure (OfTI) was granted in September 2014 and subsequently varied in July 2019 and December 2020 (Modified OfTI Marine Licence Licence). A Marine Licence for two additional distributed offshore substation platforms (OSPs) was granted in September 2017 and subsequently varied in July 2019 (together these are referred to as the OfTI Marine Licences).

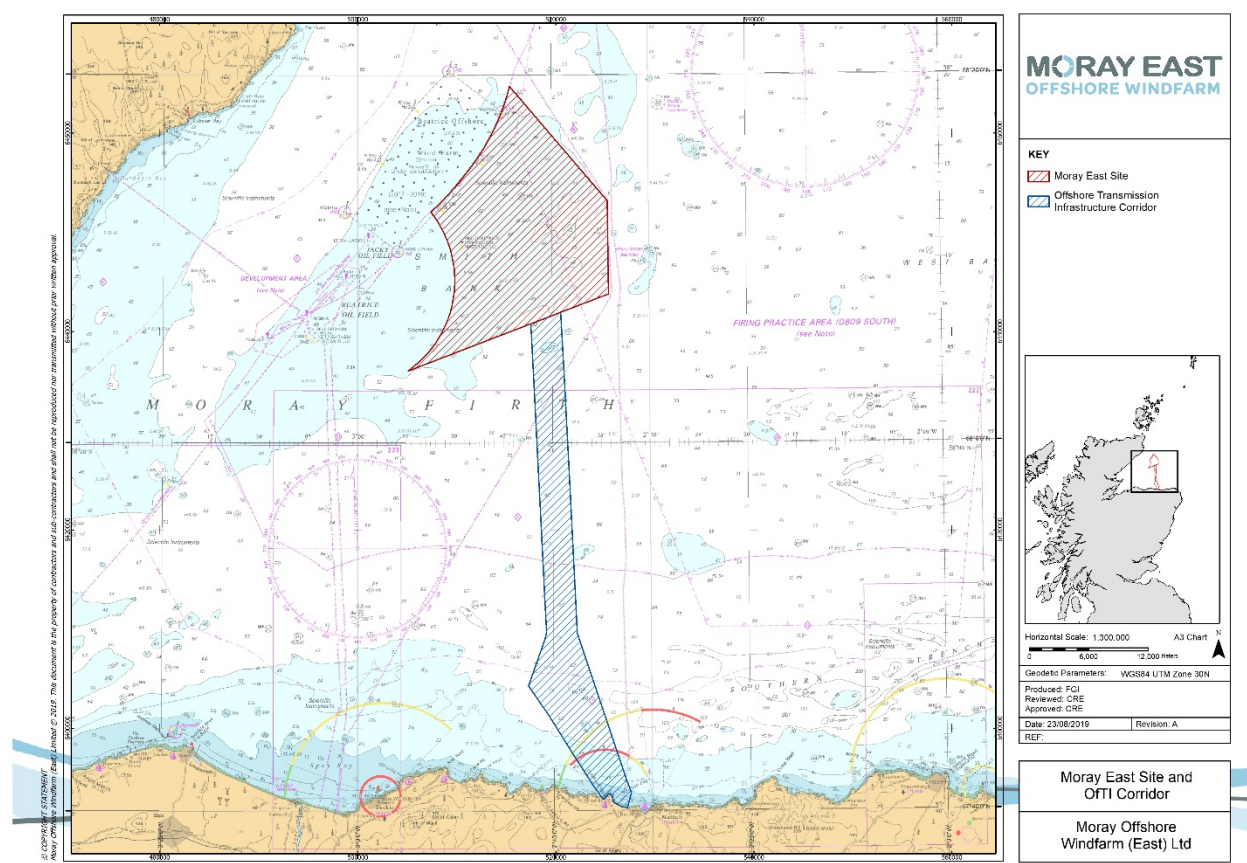


Figure 1-1: Moray East site and OfTI Corridor

2 Construction Survey Programme

Table 2-1 provides an overview of the surveys undertaken at the Moray East site and at the Moray East OfTI Corridor during the period from January 2020 to September 2020. Key details and information for the respective surveys are provided in Section 3.

Table 2-1 - Moray East site and OfTI corridor surveys summary

Survey	Survey Detail	Coverage	Date
Moray East Site			
Geophysical survey	Bathymetric survey: multibeam echo sounder	Moray East Wind Farm Site. Jacket Locations further specified in Section 3	April 2020 – May 2020
Geophysical survey	Scour protection: multibeam echo sounder	OSP locations and selected WTG locations	May 2020
Geophysical survey	Bathymetric survey: multibeam echo sounder	All OSP and WTG locations	August 2020 – Ongoing
Geophysical survey	Bathymetric survey: multibeam echo sounder	OSP1 and OSP2	September 2020 – October 2020
Geophysical survey	Route clearance survey: multibeam echo sounder	Inter-Array Cable Routes	May 2020 – June 2020
Geophysical survey	Route clearance survey: multibeam echo sounder and side scan sonar	Inter-Array Cable Routes	June 2020 – July 2020
Geophysical Survey	Route clearance survey: general visual inspection	Inter-Array Cable Routes	August 2020 – September 2020
Moray East OfTI Corridor			
Geotechnical survey	Cone penetration testing	Offshore Export Cable Corridor	February 2020 – March 2020
Geophysical Survey	Route clearance survey: general visual inspection	Offshore Export Cable Corridor	April 2020 – May 2020
Geophysical survey	Route clearance survey: general visual inspection and multibeam echo sounder	Offshore Export Cable Corridor	June 2020
Geophysical survey	Route clearance survey: general visual inspection	Offshore Export Cable Corridor	July 2020 – August 2020
Geophysical survey	Post-installation inspection: general visual inspection	Offshore Export Cable Corridor	August 2020 – September 2020
Geophysical survey	Post-trenching survey: multibeam echo sounder	Offshore Export Cable Corridor	August 2020 – September 2020
Geophysical survey	Installation inspection: general visual inspection	Offshore Export Cable Corridor	August 2020 – October 2020

3 Construction Survey Summary Information

3.1 Wind Farm Site

3.1.1 WTG and OSP Substructures

Type of Survey: Apollo Footprint Campaign	Coverage: Wind Farm Site 100 WTG, 3 OSP and 1 Safe Haven
Timescales: 9 th April 2020 – 6 th May 2020	
Contractor: iSurvey	
A bathymetry survey was conducted at 104 locations on site including 100 WTGs, 3 OSPs and 1 safe haven. The survey covered the seabed where the Apollo (piling installation vessel) was jacked up and hammered 3 pin piles into the seabed. The surveys were carried out initially using the autonomous iXblue Drix vessel supported by the MV Coral Wind; however, the quality was very poor and, along with a slow survey speed, resulted in the surveys moving to the MV Coral Wind. A pole mounted multibeam echosounder was used to collect the data and proved far more reliable than the Drix. Data was taken by a NORBIT Wideband Multibeam Sonar (for high resolution bathymetry) of approximately 40 W power. The results provided information on the cavity depths left by the Apollo spudcans which ranged from 0.2 m to 5.4 m deep. It was determined that 4 cavities were close enough to the cable routes that remedial works was required to stabilise the route and 15 jack up vessel headings changed to avoid overlaps with cavities. A further 3 WTG locations still required backfilling of cavities to allowed for safe jacking.	

Type of Survey: Scour Protection Campaign	Coverage: Wind Farm Site 3 OSP Jackets Locations (E06, F15, I10) 2 WTG Jackets Locations (C04, E04)
Timescales: 4 th May 2020 – 6 th May 2020	
Contractor: Tideway Offshore Solutions	
Scour protection installation was completed by Tideway Offshore Solutions from the dynamically positioned fall pipe vessel (DPDPV) Flintstone. A multibeam echo sounder survey was completed pre- and post-installation from an ROV that was operated from the DPFPV Flintstone. The multibeam echo sounder was a Seabat T50-S. The scour protection design required at the 3 OSP locations and 2 WTG locations ensuring coverage was 1 m thick above seabed around the piles. The results of the surveys produced two XYZ point files with a resolution of 0.2 m grid sizing over the scour protection. These showed the seabed pre- and post-installation and confirmed the scour protection met the design specification.	

Type of Survey: Scylla Footprint Campaign	Coverage: Wind Farm Site All WTG and OSP Jackets
Timescales: 13 th August – ongoing	
Contractor: InterOcean / Braveheart Marine / DEME	
A bathymetry survey is currently ongoing over the footprints of the Scylla Jack Up Vessel which is currently completing the jacket installation. The first 47 locations where jackets have been installed (3 OSPs and 44 WTGs) have been surveyed by the Windcat 17 which mobilised from the Port of Buckie. The remaining locations are due to be completed by the Braveheart Marine Patriot which will operate out of Wick. The Windcat 17 has a pole mounted multibeam echosounder whilst the Patriot has a hull mounted system. The hull mounted system allows the Patriot to collect accurate data in a worse sea states. This will allow the surveys to continue over the winter. These surveys will continue until all jacket foundations are installed. Due to the sequence of the construction works it is not possible to complete all the surveys after the Scylla has left the field. The results are providing information on the cavity depths left by the Scylla spudcans to assist in future jack up vessel positioning and to determine if the cavities have any impact on cable routes. To date the surveys have	

Type of Survey: Scylla Footprint Campaign	Coverage: Wind Farm Site All WTG and OSP Jackets
Timescales: 13 th August – ongoing	
Contractor: InterOcean / Braveheart Marine / DEME	
determined no cable routes have been impacted by the cavities left by the Scylla; however, the impact to future jack up vessels is still being assessed.	

Type of Survey: Rock Bag Installation Campaign	Coverage: Wind Farm Site OSP1 and OSP2
Timescales: 18 th September – 21 st October	
Contractor: Deep Ocean	
Deep Ocean were contracted to install rock bags to protect the cable routes near OSP1 and OSP2. The seabed had been disturbed by the piling jack up vessel (the Apollo). A bathymetry survey was conducted post-installation of the rock bags to confirm that the installation was to the specifications required. The survey was completed by an ROV supported by the Maersk Connector; this was the same vessel that also installed the rock bags. The multibeam echo sounder was a Reson 8125 and produced a high resolution (0.2 m) surface of the seabed. The survey confirmed the bags were placed within tolerance and allow for successful cable lay.	

3.1.2 Inter-Array Cables

Type of Survey: Post Plough Route Clearance Survey	Coverage: Moray East site Inter-Array Cable Routes
Timescales: 15 th May 2020 – 3 rd June 2020	
Contractor: Oceaneering / Boskalis	
The Post Plough Route Clearance survey for the Moray East IAC site was undertaken between the 15th May 2020 and 03rd June 2020 by the Havila Venus. The works were subcontracted to Oceaneering by the main contractor Boskalis. The survey comprised 14 full IAC routes and 44 further partial IAC routes in the plough launch/recovery zones. These covered the total 58 IAC routes on which ploughing works had been undertaken. The objective of the surveys was to make an initial assessment of the effectiveness of the ploughing works with respect to achieved route clearance, and also to assess any evidence of embedment. The launch/recovery zones were surveyed on all ploughed routes, with the periodic full route surveys to better establish the ongoing progress. The choice of full routes to survey was determined by time passed and expected soil conditions. The equipment used comprised a work-class ROV fitted with multi-beam echo sounder. The ROV, positioned by USBL and depth pressure sensor, flew close to the seabed, making multiple passes where necessary to ensure sufficient data coverage. The results of the survey highlighted 4 IAC routes where remedial ploughing works were deemed necessary. This was determined by evidence of both plough off-track and embedment instances.	

Type of Survey: Post Boulder Clearance Survey	Coverage: Moray East site Inter-Array Cable Routes
Timescales: 29 th June 2020 – 22 nd July 2020	
Contractor: Gardline / Boskalis	
The Post Boulder Clearance Survey for the Moray East IAC site was undertaken between the 29th June 2020 and the 22nd July 2020 by the MV Ivero. The works were subcontracted to Gardline by the main contractor Boskalis. The survey covered the full length of all 102 IAC and Interconnector routes. The survey consisted of a centre line along each proposed route and one wing line either side spaced at 10 m to ensure a minimum corridor of 30m was covered for the multi-beam data and a minimum of 15 m was covered for the side scan sonar data. The objective of the survey was to prove the cable installation routes are free of any obstacles. This was achieved through the simultaneous collection of swathe bathymetry and side scan sonar data along and adjacent to the ship's	

Type of Survey: Post Boulder Clearance Survey	Coverage: Moray East site Inter-Array Cable Routes
Timescales: 29 th June 2020 – 22 nd July 2020	
Contractor: Gardline / Boskalis	
track. The swathe bathymetry equipment comprised a vessel mounted multibeam echo sounder (MBES) system. The side scan sonar system, towed subsea aft of the vessel, was positioned by USBL. The collected data from both systems was used to locate and identify seabed obstructions and to investigate seabed soil properties and boundaries. The side scan sonar data was interpreted to identify any potential seabed objects which could cause obstruction to cable lay and/or burial works. Objects with hard responses and measurable heights which met these criteria were recorded in a contact listing. This was subsequently used to inform a continuous route clearance strategy in advance of the cable installation works.	

Type of Survey: GVI and Position Fixes	Coverage: Moray East site Inter-Array Cable Routes
Timescales: 8 th August – 2 nd September 2020	
Contractor: UTROV / Boskalis	
Prior to undertaking boulder clearance with the boulder clearance grabs, the Contractor, using the Olympic Triton, performed a visual search for individual boulders using grab-mounted camera. Position fixes of the boulders were taken using UBSL transponder, both before and after relocation outside the construction corridor. The position fix confirms the coordinates of the boulder, ROV pictures of the as-found and as-relocated positions of the boulders were also taken.	

3.2 OfTI Corridor

3.2.1 Offshore Export Cables

Type of Survey: shallow geotechnical CPT survey via WROV	Coverage: Offshore Export Cables Corridor
Timescales: 23 rd February 2020 – 2 nd March 2020	
Contractor: Enshore / NKT	
In order to acquire additional soil data pertinent to the burial of the offshore export cable, the Contractor’s trenching subcontractor undertook a short campaign of QTYx38 shallow penetration Cone Penetration Tests. In areas expected to exhibit particularly high levels of localised variations, these were carried out to corroborate or provide more detailed information to supplement the existing site data. This helps ensure efficient planning of trenching operations (e.g. definitions between cutting & jetting areas) and expected trencher performance. This was executed by an ROV with an “ROVcone” system, from the vessel Maersk Connector. Conditions observed were predominantly silty sand seabed, occasionally encountering areas with cobbles.	

Type of Survey: GVI and MBES Survey	Coverage: Offshore Export Cables Corridor
Timescales: 27 th April 2020 – 11 th May 2020	
Contractor: Oceaneering International	
Prior to undertaking boulder clearance with the boulder clearance plough, a general visual inspection of some of the boulder clearance areas were undertaken, this was suspended when visibility when became poor. Following	

Type of Survey: GVI and MBES Survey	Coverage: Offshore Export Cables Corridor
Timescales: 27 th April 2020 – 11 th May 2020	
Contractor: Oceaneering International	
Boulder Clearance, MBES surveys were performed of the as-boulder cleared surveys, these surveys undertaken from the Havila Venus confirmed the as-left status of the Seabed, the position of any boulder clearance berms.	

Type of Survey: pre-lay survey works	Coverage: Offshore Export Cables Corridor
Timescales: 19 th June 2020 – 24 th June 2020	
Contractor: MMT / NKT	
As part of the programmed “pre-lay survey” works, the Contractor (via subcontract to MMT) undertook a pre-lay survey of the export cable corridor in June. This is part of the original planned scope of work, which is undertaken a few months before the commencement of cable lay in order to ensure the cable routes is free of obstructions and debris. This comprised visual GVI and MBES, from a WROV. This survey flagged occasional wire debris, which was subsequently removed prior to installation, in addition to numerous additional boulders in and around the route not previously accounted for in the site data	

Type of Survey: GVI and Position Fixes	Coverage: Offshore Export Cables Corridor
Timescales: 23 rd July - 9 th August	
Contractor: UTROV	
Prior to undertaking boulder clearance with the boulder clearance grabs, the Contractor, using the Olympic Triton, performed position fixes using UBSL transponder on individual boulders both before and after relocation outside the construction corridor (up to 10m from the Route Position List (RPL)).	
The position fix confirms the coordinates of the boulder, ROV pictures of the as-found and as-relocated positions of the boulders were also taken.	

Type of Survey: Post cable installation crossing inspection	Coverage: Offshore Export Cable Corridor
Timescales: During cable lay OEC2: 10 August 2020 OEC3: 04 September 2020 OEC1: 24 September 2020	
Contractor: NKT	
After the cable has been laid over the CMS crossing (and before the cable lay vessel moves off and continues laying the rest of the export route) a post-installation survey was conducted of the crossing area. The WROV performed a GVI along the Moray East OEC route, 25 m either side of the crossing intersection location, taking positional fixes along the way. This survey took positional fixes of various key features e.g. existing rock berm locations, along with temporary free spans of the ME cable prior to the crossing being installed. Moreover, these fixes noted the height of the cable at the intersection and, therefore, reported the cover height on the CMS cable and expected vertical separation between the two cables.	

Type of Survey: As-Trenched Survey	Coverage: Offshore Export Cable Corridor
Timescales: 31 st August – 30 th September (completed 23 rd November)	
Contractor: Enshore Subsea/ DeepOcean NKT	
MBES and TSS-440 surveys were intermittently performed following completion of trenching passes to establish the achieved Depth of Lowering (DoL) and Depth of Cover (DoC) of the as-trenched cable, this provides the cable altitude i.e. absolute depth of top of cable from which DoL and DoC can be computed. The data is used to confirm specification compliance and also inform the as-built records and allow MOWEL to perform an as-built Cable Burial Risk Assessment. These surveys inform where remedial trenching and/or, rock placement is required.	

Type of Survey: Touch down monitoring	Coverage: Offshore Export Cable Corridor
Timescales: 07 August – 5 October 2020	
Contractor: NKT	
Cable as-laid position is ascertained by continuous cable touchdown point (visual) monitoring during lay via onboard WROV. As the cable lay vessel (NKT Victoria) moves ahead, laying the cable on the seabed, the WROV follows at the touchdown point, logging the position (easting, northing, KP) every metre.	



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