



Minesto ORML 1618v1 Marine License Variation: Environmental Report KIOP003-MNT-760-REP-0002

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Document Number: KIOP003-MNT-760-REP-0002	Revision: Issued for Use	Project: Minesto Deep Green Holyhead Deep Project	Author: Anna Chaffey

20th August 2021

Dear Maria,

Minesto ORML 1618v1 Marine Licence Variation, review of Environmental Impact Assessment (EIA).

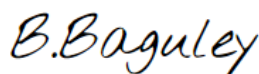
The DG500 has been successfully installed, commissioned and tested during 2018 and 2019. To facilitate further commercial demonstration of the Deep Green technology, Minesto plans to continue testing of its' Deep Green Technology under the existing Marine Licence. Further testing of the replacement DGU unit the Dragon 12 is to occur in Summer 2022.

Beyond 2022, Minesto plan further tests of the Deep Green Technology. In order to facilitate this, Minesto request the existing Marine Licence (ORML 1618v1) is extended for a year, in order account for Project delays to date and to enable future operational testing. With the extension of ML ORML 1618v1, it would enable Minesto operations to continue seamlessly till the planned consent for the 10 MW array in 2024.

The remaining pages of this letter demonstrate that all project infrastructure and activities associated with ongoing operations over the proposed extension period remain within the worst-case design envelope assessed in the June 2016 EIA / ES and the previously submitted 2019 Marine License variation.

Yours sincerely,

for Minesto UK Ltd



pp

David Collier

Chief Operations Officer Minesto UK

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APPENDIX II: SUMMARY OF OFFSHORE ORNITHOLOGY COLLISION RISK 32

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1 OVERVIEW

The DG500 was successfully installed, commissioned and tested during 2018 and 2019. During this period, the kite was only flown operationally for a short period of time, due to technical issues that needed to be resolved. To facilitate further testing and commercial viability of the Deep Green technology, Minesto require the replacement of the DG500, with an updated Deep Green Unit (DGU) design called Deep Dragon 12 (“Dragon 12”). The Dragon 12 has been designed within the same design envelope parameters (as assessed in the June 2016 EIA / ES) of the DG500. The Dragon 12 will be flown with support of the existing offshore infrastructure at the current site.

This document provides further information with regards to the request for extension of Marine Licence No. ORML 1618v1 (valid until 11th April 2023) and replacement of the DG500, to support ongoing operational testing of the Deep Green technology. This document demonstrates that the extended operational period and project parameters are within the assessed and consented design envelope and do not change the outcomes of the assessment presented in the June 2016 EIA / ES and associated variation which supports the current Marine Licence.

1.1 Supporting Renewable Tidal Energy in Wales

Through its operations and ongoing development in Holyhead Deep, Minesto is committed to delivering commercially viable energy from marine renewable sources, in direct support of the Welsh National Marine Plan and the Welsh Government decarbonisation and low carbon targets (Welsh Government, 2019a; 2019b).

The Welsh Government is very supportive of marine renewable energy in Wales, with ambitions to make Wales a leading player in the marine energy field, with energy generated from waves and the tide providing an important role in achieving a low-carbon economy. Part of the sector objective for Energy – Low Carbon includes (Welsh Government, 2019b):

- Supporting the development and demonstration of wave energy and tidal stream technologies in the short to medium term; and
- Increasing (where appropriate) the number of wave energy and tidal stream energy generation devices deployed in commercial scale developments over the medium term.

Minesto’s further refinement of the Deep Green technology, within consented design envelope parameters, means Minesto can contribute towards achieving the Welsh Government’s low-carbon ambitions.

1.2 Existing Infrastructure and Ongoing Operation

Marine Licence ORML 1618 was varied in June 2019 to account for changes in the Project operations and superseded by ORML 1618v1. The variation was applied to allow for some reconfiguration to the tether, bottom joint and umbilical system, to enable ease of recovery from sea, and the reduction of the tether length from 105 m to 49.5 m.

The following existing infrastructure which supported the operation of the DG500 are anticipated to be re-used in operational tests of the Dragon 12.

- Tether (up to 105 m in length¹);
- Umbilical; and
- Gravity Based Structure (GBS) foundation.

All infrastructure, set up and operations remain unchanged and are within the parameters of the existing Marine Licence (ORML 1618v1, valid until 11th April 2023).

¹ Marine Licence ORML 1618v1 still states a tether length up to 105 m.

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1.3 Proposed Variation to Marine License

1.3.1 Marine Licence Extension

The DG500 was successfully installed, commissioned and tested during 2018 and 2019. During this time the kite was only flying operationally for a relatively short period of time, due to technical issues that needed to be resolved. To facilitate further testing and commercial viability of the Deep Green technology, Minesto would like to continue testing of its Deep Green Technology at the current site under the existing Marine Licence.

The current Marine License is due to expire in April 2023. Minesto wish to extend the current Marine License by one year, thereby achieving an expiry date of April 2024. The additional year will enable Minesto to continue the operational testing of the Dragon 12 in advance of obtaining consent for the planned 10 MW array. The time will also help account for lapses between deployment tests, and component maintenance which sometimes can take a relatively long time. Although an extension is sought for an additional year, field deployments and test flights would be intermittent within the extended period, to allow for recovery, adjustments and redeployment. Minesto propose a deployment period of up to 12-weeks each year.

1.3.2 Deep Dragon Unit Design and Deployment

Minesto plan to replace the existing DG500 kite with an updated version named Dragon 12. The Dragon 12 has been designed to be within the design envelope, in terms of the wing span and kite height, as assessed in the June 2016 EIA / ES and consented under Marine Licence ORML 1618 and superseded by ORML 1618v1. The Dragon 12 kite will be tethered to the existing GBS foundation and supported by the existing offshore infrastructure listed in Section 1.2 above, Minesto requested pre-application advice from Natural Resources Wales (NRW) in March 2020 with regards to the appropriate consenting strategy for the DGU. NRW provided the following advice:

'Where the replacement kite is within the design envelope consented and within the parameters detailed within condition 1.2 of the current Marine Licence (No. ORML 1618) we concur that the replacement may be deployed under the current licence. A written notification to the marine licencing team would be required confirming this prior to deployment.'

A brief comparison of the parameters between the DG500 and Dragon 12, as assessed within the June 2016 EIA / ES, are summarised in

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Table 1-1. Although the weight of the Dragon 12 is heavier than the DG500, it is noted that this does not provide any environmental impact and as such was not specifically assessed within the June 2016 EIA / ES.

Minesto also intend to reinstate the use of a “barge or similar platform” as consented under Marine Licence ORML 1618v1. Minesto propose to use a barge type vessel with dynamic positioning (DP). The DP barge vessel would be used to house the Micro Grid System (MGS) unit, which had previously been contained in a moored MGS buoy. Although a specific vessel has not yet been contracted, it is anticipated that the DP barge vessel will of a size similar to that of a small workboat vessel with a length over all (LOA) of around 50 m and draught of less than 3 m.

As indicated above, kite deployments and therefore use of a DP barge vessel would be intermittent, with Minesto planning up to 12-weeks deployment per year for the remainder of the Marine Licence period and extension.

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Table 1-1 Summary of the design envelope assessed within the June 2016 EIA / ES and Dragon 12 parameters

	DG500	Dragon 12
DGU unit	Up to 12 m (wing span) ^(Note 1) 4.1 m height (rudder tip to tip) 3.3 m ^(Note 1) at widest width/chord Weighing between 10 and 16 tonnes ^(Note 1)	12 m wingspan 4.1 m height (winglets) 3.5 m average chord ^(Note 2) Weight 24 tonnes ^(Note 2)
Tether between DGU and foundation	Dyneema cable with plastic casing, up to 105 m length ^(Note 1)	Cable with plastic casing, up to 49.5 m length ^(Note 3)
Subsea umbilical	Braided steel cable, up to 200 m on seabed + water depth (maximum of 100 m) 100 mm width ^(Note 1)	No change
Gravity base structure foundation	Concrete, up to 12 m by 25 m, approximately 1,000 tonnes ^(Note 1)	No change as using existing infrastructure
Scour protection	Rock armour, up to 15 m ² , approximately 1 m in height around foundation ^(Note 1)	No change as using existing infrastructure
Anchor clump weights for barge, hook up barge or self-contained barge	Concrete or steel, 9 m ² per clump weight, eight anchors totalling 72 m ² ^(Note 1)	Not applicable due to use of DP barge vessel
<p>Note 1 – Denotes parameters that are detailed within condition 1.2 of Marine Licence ORML 1618v1</p> <p>Note 2 – Although these parameters are detailed in the existing Marine Licence, they have not had any influence on the assumptions made or data inputs to any of the impact assessment studies</p> <p>Note 3 – In 2019, a Marine Licence variation application was made to reduce the tether length, however, it is noted that a tether length of up to 105 m is still included within ORML 1618v1.</p>		

1.3.3 Maintenance of Scour Protection

As part of ongoing maintenance of the GBS foundation, Minesto may need to deploy additional scour protection. This will be managed via the ongoing scour monitoring programme.

1.4 Summary of impacts

The proposed increase in the duration of the operation and maintenance phase of the project, the deployment of the Dragon 12 kite and use of a DP barge vessel do not result in adverse or significant impacts to what was assessed within the June 2016 EIA / ES. Instead there are positive impacts associated with reinstatement of the seabed due to the removal of the drag anchor and chains that were previously used for the mooring of the MGS Buoy, with the use of a DP barge vessel.

The following is also applicable to the proposed changes:

- The proposed increase in the duration of the operation and maintenance phase of the project will not increase the duration of the impacts, only the period over which the impacts may occur (due to non-continuous testing operations). Impacts during the operations maintenance phase were principally assessed to be short-term within the June 2016 EIA / ES (and associated variation which supports the current Marine Licence (Marine Licence No. ORML 1618v1 valid until 11th April 2023). Future deployment tests will continue to be periodic, with operational periods being relatively short and within the temporal range assessed in the June 2016 EIA / ES. The Dragon 12 will be flown at the consented clearance depth of 20 m.
- The proposed deployment of the Dragon 12 and supporting DP barge vessel will not introduce or increase any impacts beyond those which were assessed within the June 2016 EIA / ES, which are mainly assessed to be short-term and /or not significant. There is a positive impact with the

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introduction of a DP barge vessel, in that the seabed would be reinstated to its original state with the removal of the anchors and chains associated with the MGS buoy. In addition the DP barge vessel will be manned when on site, which provides an advantage from a navigational risk perspective.

In summary, impacts will be no more significant than predicted in the June 2016 EIA / ES and all existing mitigation and monitoring requirements will remain in place, except where it is agreed with stakeholders that it is no longer applicable. For example in the case of any shipping and navigation mitigation with respect to the MGS buoy, where these are no longer valid due to the use of a manned DP barge vessel.

Relevant results from monitoring and additional studies completed to date (since the commencement of Minesto activities in Holyhead Deep and as required by Marine Licence conditions) have been used to inform this variation request. The implications of the proposed Marine Licence extension are discussed further on a topic by topic basis in Section 2 of this document.

2 EIA REVIEW

A review of any potential implications to the EIA undertaken for the Holyhead Deep project due to the proposed Marine Licence extension, Dragon 12 and DP barge vessel has been undertaken and is reported on a topic by topic basis. No new potential impacts have been identified to be associated with the proposed activities. There is however considered to be a positive reduction in impacts associated with the removal of drag anchor and chains from the seabed and use of a manned DP barge vessel to house the MGS.

Subsequent to the 2016 EIA / ES and Marine Licence award there has been ongoing environmental studies associated with the Minesto Project. These are summarised in Table 2-1 and have been used to inform this environmental report as applicable.

Table 2-1 Environmental studies following the June 2016 EIA / ES

Topic	Further environmental studies
Physical Processes	<p>Survey work was undertaken in 2017 by SEACAMS in order to inform the final project location for the DGU500. The survey work undertaken comprised a seabed survey and acoustic doppler current profiler (ADCP) deployment in May 2017 and ADCP recovery in August 2017. These data were reported in Xodus (2018). Additional seabed surveys through Remote Operated Vehicle (ROV) or geophysical instruments have been completed by Minesto and SEACAMS2. A further ROV survey is planned for 2021.</p> <p>As required by the Marine Licence (Condition 8.3) and detailed in the project Environmental Monitoring Strategy (EMS), monitoring has been undertaken of scour around the gravity base foundation and two reports submitted to NRW:</p> <ul style="list-style-type: none"> • 1st Scour Monitoring Report, July 2019 (Minesto, 2019) • 2nd Scour Monitoring Report, March 2020 (Minesto, 2020a) <p>A further update is to be provided to NRW in Q4 2021.</p>
Benthic Ecology	<p>Survey work was undertaken in 2017 by SEACAMS in order to inform the final project location for the DGU500. The survey work undertaken comprised a seabed survey and ADCP deployment in May 2017 and ADCP recovery in August 2017. The acquired data was reported in Xodus (2018).</p>
Marine Mammals and Megafauna	<p>Two years of European Seabirds at Sea (ESAS) surveys were undertaken between August 2016 and July 2018 and are reported in Jackson and Urquhart (2018), which observations of marine mammal and shark species.</p> <p>As required by the Marine Licence (Condition 8.3) and detailed in the project Environmental Monitoring Strategy (EMS), monitoring of marine mammals around the DG500 during operations</p>

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Topic	Further environmental studies
	<p>has been undertaken. This was completed through survey work investigating the cetacean response around the DGU500 was completed by SEACAMS2. The work involved deployment of a passive acoustic monitoring (PAM) hydrophone system to enable near-field vocalisation detection of marine mammal species. Outputs from the work was reported to NRW in March 2020 (Minesto, 2020b) and also published in Veneruso, <i>et al.</i>, 2021).</p> <p>As required by the Marine Licence (Condition 8.3) and detailed in the project Environmental Monitoring Strategy (EMS), monitoring of underwater noise during offshore testing operations has been undertaken, the results of which were used to validate the noise modelling predictions and estimations sources levels presented in the 2016 ES. This was reported to NRW in April 2020 (Xodus, 2020a). Between July and September 2021, Minesto will be completing a hydrophone survey of the Holyhead Deep site in order to understand the baseline noise and also support the identification of marine mammal species and their utilisation of the marine area. Results of this survey will be reported in the underwater noise monitoring report, to be submitted to NRW by the end of the year.</p>
Ornithology	Two years of European Seabirds at Sea (ESAS) surveys were undertaken between August 2016 and July 2018 and are reported in Jackson and Urquhart (2018).
Shipping and navigation	<p>A summer maritime traffic survey was undertaken from South Stack, Anglesey in 2017. This was a survey undertaken by Anatec to inform both the Minesto array and Morlais demonstration zone EIAs (Xodus, 2017).</p> <p>Xodus (2020b) completed a study that reviewed AIS vessel traffic from 2019 for the purpose of understanding traffic intensity and draughts associated with transits across a study area.</p>

It should be noted that the June 2016 EIA / ES was undertaken in accordance with the relevant and appropriate EIA regulations at the time of writing. On 16th May 2017 a new set of EIA Regulations came into force, termed the EIA Regulations (2017) and introduced several key changes and additions to the EIA process. The key change which is deemed applicable to this Marine License variation report is the inclusion of 'new' impacts resulting from the Project on climate change resilience, biodiversity, human health and natural resource. The proposed Dragon 12 activities do not have sufficient scale, duration or close proximity to sensitive receptors (such as human health receptors) ,with no material issues with regard to the additional EIA topics required to be considered under the EIA Regulations (2017).

2.1 Physical Processes

Table 2-2 provides a summary of the worst case design envelope as relevant to the physical processes impact assessment and sensitive receptors, and demonstrates that the proposed Marine Licence variation does not have the potential to change the outcomes of the impact assessment presented in the June 2016 EIA / ES and associated variation which supports the current Marine Licence.

Table 2-2 Summary of worst case design envelope

Physical Processes	
Worst case design envelope assessed in 2016 EIA / ES and associated 2019 Marine Licence variation	<p><i>"A single DGU foundation comprising either a gravity based structure (approximately 12 m x 25 m footprint), pin piled (up to three piles of 3 m diameter) or monopiled (one pile of up to 4 m in diameter), with piles installed by drilling or vibro-hammering or combination of both, resulting in the release of up to 141.4 m³ of spoil per pile or 424.2 m³ of spoil per DGU;</i></p> <p><i>200 m of bare subsea umbilical (100 mm width) lying on the seabed; and</i></p>

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Physical Processes	
<i>Text in italics direct lift from June 2016 ES</i>	<i>A barge (or similar such surface platform) moored using a four to eight point catenary system (with marker buoys) for five years."</i>
Impacts assessed & residual significance (following mitigation) in June 2016 EIA / ES and associated 2019 Marine License variation	<p>Impacts during construction / installation:</p> <ul style="list-style-type: none"> > Effect of seabed infrastructure installation on water quality – not significant. <p>Impacts during operations and maintenance:</p> <ul style="list-style-type: none"> > Introduction of seabed scour to the Project Development Area (PDA) – not significant.
Are the proposed activities within the worst-case design envelope assessed in 2016 EIA / ES and associated 2019 Marine License variation?	<p>Yes.</p> <p>There are no changes to the seabed area occupied by subsea infrastructure associated with kite, as the subsea infrastructure associated with the kite remains unchanged. However, the subsea infrastructure associated with the moorings for the MGS buoy will no longer be required due to the use of a DP barge vessel. As a result, the drag anchor and chains would be removed, thereby reinstating the seabed to its original state around the anchor moorings.</p> <p>The increase in the duration of the operation and maintenance phase of the project will not influence the significance of impacts associated with the introduction of scour to the PDA. Operational scour impacts are driven by the size and shape of the GBS foundation on the seabed, eventually reaching an equilibrium scale and extent in relation to the metocean conditions, irrespective of duration.</p>
Are there any implications to 2016 EIA / ES and associated 2019 Marine License variation?	<p>No.</p> <p>The additional operation time of the subsea infrastructure over the requested extension period is not anticipated to cause significantly greater levels of scour beyond the equilibrium depth and extent. Due to the existing irregular seabed, and highly energetic environment at the PDA, the overall effect of scour surrounding the GBS foundation is within natural levels of variation.</p> <p>Scour monitoring of the GBS foundation and reported in COAS3-MNT-660-REP-0001 (July 2019, Minesto 2019) and COAS3-MNT-660-REP-0002 (March 2020, Minesto 2020a) and approved by NRW, indicate a gradual increase in the development of scour. However, the scour was not assessed to be significant, with maximum extents of 15 m and depths of less than 1 m in the southwest corner and even less on the eastern side of the foundation. The identified scour is considered to still be within the assessed parameters of the 2016 EIA / ES and is therefore not significant. The scour around the GBS will continue to be monitored and should additional protection around the GBS be required, it will be managed through the ongoing scour monitoring programme.</p> <p>Minesto will continue to monitor scour surrounding the GBS foundation to ensure that scour impacts remain within the range predicted in the June 2016 EIA / ES and report these results to NRW.</p> <p>The process of replacing the DG500 with the Dragon 12 will result in minor disturbance to the seabed as the dry mate connector and umbilical are lifted from the seabed to facilitate DGU connection to the tether at the sea surface. The original impact assessment concluded that any changes to suspended sediment concentrations would be temporary and intermittent and quickly dispersed to background levels of negligible consequence and therefore insignificant. This conclusion remains valid for the project going forward.</p>

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2.2 Benthic Ecology

Table 2-3 provides a summary of the worst case design envelope as relevant to benthic ecology impact assessment and sensitive receptors and demonstrates that the proposed Marine Licence variation does not have the potential to change the outcomes of the impact assessment presented in the June 2016 EIA / ES and associated variation which supports the current Marine Licence.

Table 2-3 Summary of worst case design envelope

Benthic Ecology	
<p>Worst case design envelope assessed in 2016 EIA / ES and associated 2019 Marine License variation</p> <p><i>Text in italics direct lift from June 2016 ES</i></p>	<p><i>“DGU foundation – one 12 m x 25 m GBS with a total footprint of 300 m² represents worst case in terms of direct physical disturbance/habitat loss, pin piled tripod using three 20 m x 3 m piles is worst case in terms of releasing drill cuttings (maximum volume of 424.2 m³);</i></p> <p><i>Scour protection – maximum of 15 m² around the foundation structure;</i></p> <p><i>Subsea umbilical – 200 m long and up to 100 mm wide (20 m²); and</i></p> <p><i>A maximum of eight anchor clump weights, each with a footprint of 9 m².”</i></p>
<p>Impacts assessed & residual significance (following mitigation) in June 2016 EIA / ES and associated 2019 Marine License variation</p>	<p>Impacts during construction / installation:</p> <ul style="list-style-type: none"> > Direct physical disturbance and loss of habitat – not significant. > Release of drill cuttings and fluid – not significant. > Pollution of water and sediment environment through disturbances of existing contaminated sediments – not significant. > Introduction of invasive non-native species (INNS) – not significant (mitigation identified). > Pollution from accidental events – not significant (mitigation identified). <p>Impacts during operations and maintenance:</p> <ul style="list-style-type: none"> > Modified hydrodynamic regime and sediment dynamics – not significant. > Colonisation of introduced hard substrata – not significant.
<p>Are the proposed activities within the worst-case design envelope assessed in 2016 EIA / ES and associated 2019 Marine License variation</p>	<p>Yes.</p> <p>The seabed infrastructure associated with the kite remains unchanged and there are no proposed alterations to the already introduced hard substrate i.e. GBS and scour protection and no changes proposed to the measures which have been successfully utilised to minimise biosecurity risk (consent requirement). However, the drag anchor and chains previously used for the MGS buoy will be removed, thereby reinstating the seabed to its original state.</p> <p>The increase in the duration of the operation and maintenance phase of the project will not influence the significance of impacts associated with benthic ecology sensitive receptors as the impacts are driven by the size and nature of the area subject to potential change, as opposed to the duration that the infrastructure is on the seabed.</p> <p>There are no changes proposed to oil and chemical inventories associated with the Dragon 12 that could result in pollution. Emergency response procedures as required as part of consent will remain in place.</p>
<p>Are there any implications to 2016</p>	<p>No.</p>

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Benthic Ecology	
EIA / ES and associated 2019 Marine License variation?	<p>Operational and maintenance impacts to benthic ecology were determined as not significant due to the conclusion that any changes occurring would affect an area that is so small as to be negligible in comparison to the local and regional resource. The increase in duration of the impact does not increase the size and / or sensitivity of the area potentially subject to change, and therefore the conclusion remains valid for the project going forward.</p> <p>The process of replacing the DG500 with the Dragon 12 will result in minor disturbance to the seabed as the dry mate connector and umbilical are lifted from the seabed to facilitate DGU connection to the tether at the sea surface. The original impact assessment concluded that the proportion of benthic habitat that this will affect in relation to local and regional resource is extremely small and therefore impacts are considered to be in the bounds of natural variability and not anticipated to affect the functioning of benthic communities of wider ecosystems and therefore insignificant. This conclusion remains valid for the project going forward. This also applies to the potential for pollution of water and sediment environment through the disturbance of existing contaminated sediments.</p>

2.3 Marine Mammals and Megafauna

Table 2-4 provides a summary of the worst case design envelope as relevant to marine mammals and megafauna impact assessment and sensitive receptors and demonstrates that the proposed Marine Licence variation does not have the potential to change the outcomes of the impact assessment presented in the June 2016 EIA / ES and associated variation which supports the current Marine Licence.

Table 2-4 Summary of worst case design envelope

Marine Mammals and Megafauna	
<p>Worst case design envelope assessed in 2016 EIA / ES and associated 2019 Marine License variation</p> <p><i>Text in italics direct lift from June 2016 ES</i></p>	<p><i>"Single DGU unit as per the indicative location shown in Figure 1.2, with a wing span of 12 m and a turbine diameter of 2 m² (the turbine being suspended beneath the wing);</i></p> <p><i>DGU unit that will move up to 70 m either side of the fixed foundation and take up a footprint of 0.034 km² on plan view; Note that following the 2019 Marine License variation there was a reduction in the maximum swept area of the kite to 0.01 km².</i></p> <p><i>DGU unit typically operating at 20 – 60 m water depth providing a minimum clearance of approximately 31 m from the seabed and 12.5 m from the sea surface (Note 1);</i></p> <p><i>DGU unit will cut-in at a tidal flow of 0.5 m/s with no upper cut-out speed, meaning they will be operational for approximately 77% of the tidal cycle;</i></p> <p><i>DGU unit tethered to the seabed by a 105 m long, 0.3 m thick streamlined fairing (in direction of travel) anchored to the mooring point with a bottom joint approximately 3 to 10 m above the seabed; Note that following the 2019 Marine License variation there was a reduction in the maximum tether length to 49.5 m.</i></p> <p><i>A subsea umbilical running from a location on the seabed 200 m away from the DGU foundation and up through the water column to the barge (or similar such surface platform).</i></p> <p><i>Four DGU foundation options comprising either a gravity based structure, mud mat foundation, pin piled (up to three piles of 3 m diameter) or monopiled (one pile of up to 4 m in diameter), with piles installed by drilling or vibro-hammering or combination of both, resulting in the release of up to 424.2 m³ of spoil;</i></p>

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Marine Mammals and Megafauna	
	<p><i>A barge (or similar such surface platform) moored using a four to eight point catenary system (with marker buoys) for up to five years;</i></p> <p><i>Vessel requirement during installation:</i></p> <ul style="list-style-type: none"> > <i>DP vessel or underslung barge (depending on foundation selection)– up to five days;</i> > <i>Anchor handler tug or multicat to deploy barge moorings – approximately one week;</i> > <i>Tug to transport barge to/from site – one day per transfer but multiple transfers expected;</i> > <i>Support vessel with ROV capabilities to attach tether to foundation – less than one week; and</i> > <i>LARS support vessel to transport, launch and recover DGU – daily during final few weeks of installation period and crossover into operational period;</i> <p><i>Vessel requirement during operations:</i></p> <ul style="list-style-type: none"> > <i>Barge (or similar such surface platform) – up to five years – worst-case permanently present on site during this period, but highly unlikely to remain on-site throughout winter months;</i> > <i>LARS support vessel to launch and recover DGU and perform guard vessel duty – approximately once per week for up to five years but could be present daily during final few weeks of installation/first few weeks of operation.</i> > <i>Tug to transport barge to/from site – one day per transfer but multiple transfers expected throughout operational period (up to five years); and</i> > <i>Additional service/maintenance vessel, potentially with DP – a maximum of six days per year.”</i> <p><u>Additional notes</u></p> <p><small>Note 1 Condition of current Marine Licence ORML 1618v1 (condition 8.12) specifies a minimum clearance depth of 20 m below Lowest Astronomical Tide (LAT) datum and the kite is to be maintained at all times during operation. However, the 2016 EIA and supporting NRA was conducted on a 12.5 m clearance depth.</small></p>
<p>Impacts assessed & residual significance (following mitigation) in June 2016 EIA / ES and associated 2019 Marine License variation</p>	<p>Impacts during construction / installation:</p> <ul style="list-style-type: none"> > Turbidity – not significant. > Underwater noise – not significant. > Pollution from accidental events – not significant (mitigation identified). <p>Impacts during operations and maintenance:</p> <ul style="list-style-type: none"> > Underwater noise – not significant. > Pollution from accidental events – not significant (mitigation identified). > Physical interaction with barge mooring system and subsea umbilical – not significant. > Collision with kite and tether – not significant and managed through adaptive management.

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Are the proposed activities within the worst-case design envelope assessed in 2016 EIA / ES and associated 2019 Marine License variation

Yes.

There are no changes proposed to oil and chemical inventories that could result in pollution and current emergency response procedures will remain in place (consent requirement). The assessed potential for interaction with the mooring system and subsea umbilical would be reduced due to the removal of the mooring lines, as these are not required for the DP barge vessel.

A detailed review of the marine mammal collision risk modelling has been undertaken to confirm the design parameters associated with the Dragon 12 are within the same design envelope (see Appendix I) and therefore there is no change to the collision risk associated with the Dragon 12. The assessment in the June 2016 EIA / ES was conservative in that it assumed a worst-case solid 12 m by 4.5 m cross section area (CSA) that could intersect with marine mammals. In reality, the 12 m by 4.1 m measurement of the Dragon 12 is less than the assessed CSA and the Dragon 12 components only occupy approximately 10 m², equating to approximately 19% of the worst-case assessed CSA. This is detailed further in Appendix I, which compares the potential impact between the assessed DG500 and the Dragon 12. There is therefore not considered to be any change to the collision risk associated with the new Dragon 12 unit and will continue to be managed through adaptive management (see below).

Although the use of a DP vessel has the potential to introduce a noise source into the environment, the underwater noise assessment undertaken to inform the 2016 EIA / ES considered the potential use of DP and identified that such impacts would not be significant.

Due to the update of marine mammal injury and disturbance thresholds (since the 2016 EIA), an updated noise assessment was completed for the Holyhead Deep Project area based on the use of a DP vessel. The completed noise assessment is submitted with this environmental report. This work identified that the worst-case Permanent Threshold Shift (PTS) injury zone for impulsive sound, would be approximately 6 m for high-frequency (HF) cetaceans (such as harbour porpoise), based with an assumed swimming speed of 1.5 m/s. For the non-impulsive continuous sound, the PTS injury impact zone is a lot smaller, with no risk of injury for species which move away from the source at the onset of noise. Based on the updated injury and disturbance thresholds, and with regards to the assessment of behaviour response or disturbance effects, the noise level from the DP thrusters at full capacity could elicit a behavioural response within a radius of 4.8 km from the noise source, equating to an approximate area of 72.5 km² around the DP thrusters. The potential impact area equates to approximately 2% of the North Anglesey Marine / Gogledd Môn Forol SAC designated for harbour porpoise. Consistent operation over the proposed 12-week deployment period per year would only equate to an average of 1% of the SAC area over a season, which JNCC (2020) identifies as 183-days or approximately six-weeks.

Based on the JNCC (2020) significance assessment criteria, use of the DP barge vessel and operations as part of the Holyhead Deep Project would not have an adverse impact on harbour porpoise species and by proxy other marine mammal species. This also confirms the assessment and conclusions presented in the June 2016 EIA / ES.

The DP thrusters would not be operating at full capacity all the time, which will only occur during periods of the fastest flow speeds or larger wave conditions. Therefore, the estimated impact area and duration would be even less.

The noise from the Dragon 12 is anticipated to be similar to that from the DG500. Therefore, the assessment completed in the June 2016 EIA / ES is again relevant, where the potential impact was considered to be not significant, due to the kite noise levels being below the marine mammal injury and disturbance thresholds. Measurements of underwater noise during operation validated the findings of the 2016 EIA / ES (Xodus, 2020a).

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	<p>The increase in the duration of the operation and maintenance phase of the project will also not influence the significance of impacts associated with marine mammals and megafauna due to the low frequency of these impacts occurring and to the successful monitoring measures implemented (detailed further below) which will be maintained throughout the operation of the Dragon 12 kite.</p>
<p>Are there any implications to 2016 EIA / ES and associated 2019 Marine License variation?</p>	<p>No.</p> <p>The June 2016 EIA / ES included marine mammal collision risk modelling predictions undertaken by SMRU which took into account kite movement behaviour under different tidal speeds and how the probability of collision was affected by the swimming speed and water column use of different marine mammal species and the anchoring position of the device (seabed vs surface). The assessment concluded that with respect to collision risk for grey seals and harbour porpoises, very high encounter rates would be required to achieve collision rates that would be of concern at the population level. It was suggested that very high encounter rates for these species are well in excess of what one would reasonably expect to see at any site on the scale of the DG500 project. However, for bottlenose dolphins, based on the collision probabilities and population consequence assessment (assuming no avoidance), even a single collision could be detrimental to the species.</p> <p>Minesto embarked on the successful implementation of an adaptive management strategy to monitor the behaviour of cetaceans around the operational kite, to further investigate the potential for marine mammal collision risk. The monitoring has included 2-years of ESAS surveys documenting the occurrence of marine mammal and shark species. Further monitoring involved an underwater noise survey to understand the potential usage of the marine area by marine mammal species. The completed monitoring confirmed the baseline and assessment presented and discussed within the June 2016 EIA / ES in terms of the utilisation of the area by marine mammals. The results of the monitoring in relation to the operation of the DG500 were also reported to NRW in March 2020 and concluded that there had been no marine mammal collisions to date. This is also confirmed by recent studies published by <i>Gillespie et al., (2021)</i>, which suggest high avoidance rates around tidal turbines by harbour porpoise, which can be considered to be applicable to other marine mammal species.</p> <p>Nonetheless, Minesto will continue to implement this adaptive management strategy to support ongoing operations of the Dragon 12. Therefore the increase in duration of the potential impact does not increase the impact's significance, but in fact will contribute to further understanding of the potential collision risk to marine mammals from the Deep Green technology. It should additionally be noted that the collision risk modelling conducted to support the June 2016 EIA / ES embedded the assumption that the operational phase of the DG500 would be up to five years. In reality, the DG500 was only operational for a total period of 180 minutes throughout trials undertaken to date. Operation flights of the Dragon 12 will also not be continuous, with a maximum 12-week deployment period per year. The deployment of the Dragon 12 will therefore not pose a collision risk to marine mammals, for the full duration of the year extension and as a result does not pose a greater collision risk to marine mammals as originally reported in the June 2016 EIA / ES.</p> <p>Minesto has additionally conducted underwater noise measurements of the DG500 and marine mammal monitoring during previous test flights, which have been submitted to NRW as document COAS3-MNT-670-TNO-0001. The evidence gathered to date support the following conclusions reported in the June 2016 EIA / ES:</p> <ul style="list-style-type: none"> > The possibility that the operational DG500 will exceed the injury thresholds for marine mammals (cetacean and pinniped) even when operating continuously are very low due to the low source level.

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	<p>> The onset for potential behavioural change has not been exceeded (based on measurements taken to date) even at distances less than 1 m from the DG500 and therefore there has been no potential for disturbance as a result of the operational DG500 noise emissions.</p> <p>Noise emissions from the Dragon 12 are expected to be the same as measured with the DG500 due to the turbine rating being limited to that of the DG500. Nonetheless, Minesto will continue to monitor underwater noise in relation to the baseline environment and during operational flights, the results of which will be reported to NRW as required.</p>

2.4 Offshore Ornithology

Table 2-5 provides a summary of the worst case design envelope as relevant to offshore ornithology impact assessment and sensitive receptors and demonstrates that the proposed Marine Licence variation does not have the potential to change the outcomes of the impact assessment presented in the June 2016 EIA / ES and associated variation which supports the current Marine Licence.

Table 2-5 Summary of worst case design envelope

Offshore Ornithology	
<p>Worst case design envelope assessed in 2016 EIA / ES and associated 2019 Marine License variation</p> <p><i>Text in italics direct lift from June 2016 ES</i></p>	<p><i>“For common guillemot the worst case scenario (based on modelling output) is the DGU unit operated in normal mode, as illustrated in Chapter 5: Project Description, Figure 5.3 (June 2016 ES); Note that this worst case scenario comprises of a minimum clearance depth of 12.5 m.</i></p> <p><i>For razorbill, puffin and gannet the worst case scenario (based on modelling output) is the DGU unit operated in upside-down mode, as illustrated in Chapter 5: Project Description, Figure 5.3 (June 2016, ES). Although the DGU unit operates in the same part of the water column irrespective of operational mode, upside-down mode introduces additional risk for these species because of the increased potential exposure to tether collisions in shallow water; and Note that this worst case scenario comprises of a minimum clearance depth of 12.5 m.</i></p> <p><i>Presence of the barge (or similar such surface platform) for up to 5 years.”</i></p>
<p>Impacts assessed & residual significance (following mitigation) in June 2016 EIA / ES and associated 2019 Marine License variation</p>	<p>Impacts during construction / installation:</p> <ul style="list-style-type: none"> > Disturbance from vessels – not significant. > Pollution from accidental events – not significant (mitigation identified). <p>Impacts during operations and maintenance:</p> <ul style="list-style-type: none"> > Displacement due to presence of barge – not significant. > Collision risk with DGU – not significant. > Disturbance from vessels – not significant. > Pollution from accidental events – not significant (mitigation identified). > Indirect effects to habitat and prey - not significant.
<p>Are the proposed activities within the worst-case design</p>	<p>Yes.</p>

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Offshore Ornithology	
envelope assessed in 2016 EIA / ES and associated 2019 Marine License variation	<p>The collision risk modelling conducted for offshore ornithology was based upon a minimum clearance depth of 12.5 m. However, the ongoing operation of the Dragon 12 will be at the consented clearance depth of 20 m. Disturbance impacts included consideration of a barge or similar platform for the duration of the deployment. Therefore, the deployment of a DP barge vessel is already within the design envelope and assessed to be not significant.</p> <p>The proposed changes will not change the oil and chemical inventories that could result in pollution and current emergency response procedures will remain in place (consent requirement). There will also be no change to the suite of vessels assumed for the disturbance impact assessment for the operational phase of the project.</p> <p>The increase in the duration of the operation and maintenance phase of the project will not influence the significance of impacts associated with offshore ornithology because the impacts are driven by the extremely small and localised effects which affect only a very small proportion of the individuals of receptor populations, as opposed to the duration of the potential operational and maintenance activities.</p> <p>There will be no change to the ornithology collision risk with the deployment of the Dragon 12. Modelling completed for the DG500 was based on the potential collision risk area and a comparison of the total area for the Dragon 12 demonstrates this will be smaller to that of the DG500 and is therefore within the assessed design envelope. This is detailed further in Appendix II, which compares the potential impact between the assessed DG500 and the Dragon 12.</p>
Are there any implications to 2016 EIA / ES and associated 2019 Marine License variation?	<p>No.</p> <p>Operational and maintenance impacts to offshore ornithology sensitive receptors were determined as not significant due to the conclusion that any changes occurring would affect only a very small proportion of the individuals of receptor populations. The increase in duration of the impact does not increase the proportion of individuals within receptor populations impacted, while the deployment of the Dragon 12 and the use of a DP vessel does not alter the collision risk. Therefore, the conclusion determined as part of the June 2016 EIA / ES remain valid for the project going forward.</p> <p>Following the June 2016 EIA / ES, Minesto completed two-years of site specific bird surveys (through the European Seabirds at Sea (ESAS) surveys). Information obtained as part of the surveys show a high level of similarity to the results from previous ESAS survey work in the Irish Sea (undertaken mostly in the 1980s and 1990s), and with aerial survey work undertaken in 2007/2008. The survey results corroborate the baseline used to inform the June 2016 EIA / ES, which shows that this offshore area is of low importance for the majority of seabird species. Information obtained as part of the surveys indicated that of the species recorded who utilised the survey area, only the common guillemot and razorbill were rated as having a high potential generic vulnerability to tidal stream devices due to the risk of collision. However, examination of the usage and the risk due to the Minesto Deep Green devices were considered to be low, due to the relative deep operation of the Minesto device.</p> <p>It should additionally be noted that the collision risk modelling conducted to support the June 2016 EIA / ES embedded the assumption that the operational phase of the DG500 would be up to five years. In reality, the DG500 was only operational for a total period of 180 minutes throughout trials undertaken to date. Operational flights of the Dragon 12 will also not be continuous, with a maximum 12-week deployment period per year. The deployment of the Dragon 12 will therefore not pose a collision risk to offshore ornithology sensitive receptors, for the full duration of the year extension and as a result does not pose a greater collision risk to offshore ornithology as originally reported in the June 2016 EIA / ES.</p>

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2.5 Fisheries

Table 2-6 provides a summary of the worst case design envelope as relevant to fisheries impact assessment and sensitive receptors and demonstrates that the proposed Marine Licence variation does not have the potential to change the outcomes of the impact assessment presented in the June 2016 EIA / ES and associated variation which supports the current Marine Licence (No. ORML 1618v1).

Table 2-6 Summary of worst case design envelope

Fisheries	
<p>Worst case design envelope assessed in 2016 EIA / ES and associated 2019 Marine License variation</p> <p><i>Text in italics direct lift from June 2016 ES</i></p>	<p><i>"The DGU unit will typically sit at a water depth between 20 to 60 m and never less than 12.5 m (Note 1) from the surface;</i></p> <p><i>The single DGU unit will occupy a maximum swept area on plan view of 0.034 km² when active; and Note that following the 2019 Marine License variation there was a reduction in the maximum swept area of the kite to 0.01 km².</i></p> <p><i>500 m safety zones may be present during construction and installation activities and maintenance operations which will cover a total area of 0.84 km² around vessels in the PDA (safety zones will need to be applied for).</i></p> <p><i>Potential 500 m safety zone around the barge (or similar such surface platform) which will be present for up to five years (safety zone will need to be applied for). It should be noted that a safety zone around the barge does not represent a standard industry measure and further consultation with navigational stakeholders is planned to support the application.</i> <i>(Note 2)"</i></p> <p>Additional notes</p> <p>Note 1 Condition of Marine Licence ORML 1618v1 (condition 8.12) specifies a minimum clearance depth of 20 m below Lowest Astronomical Tide (LAT) datum and the DGU unit is to be maintained at all times during operation.</p> <p>Note 2 Following consent award and further consultation with MCA, it was agreed there was no need for a safety zone, as the MGS buoy acted as a navigational mark (in accordance with MCA, Trinity House requirements). The use of a manned DP barge vessel that will only be present when the kite is present, will act as an Aid to Navigation. With the removal of the MGS buoy from site, Admiralty charts have been updated to reflect this. Therefore, there is only the presence of a tidal device and an associated clearance depth recorded on Admiralty charts. Any further changes to charting requirements be discussed and agreed with all relevant authorities and the Hydrographic Office notified as required.</p>
<p>Impacts assessed & residual significance (following mitigation) in June 2016 EIA / ES and associated 2019 Marine License variation</p>	<p>Impacts during construction / installation:</p> <ul style="list-style-type: none"> > Loss of access to fishing grounds –PDA and navigational safety zones – not significant. <p>Impacts during operations and maintenance:</p> <ul style="list-style-type: none"> > Loss of access to fishing grounds – PDA and possible barge safety zone – not significant.
<p>Are the proposed activities within the worst-case design envelope assessed in 2016 EIA / ES and associated 2019</p>	<p>Yes.</p> <p>There is no change to the swept area associated with the Dragon 12 unit. There will be a reduction in the snagging risk associated with mooring lines for the MGS Buoy. Going forward, a manned DP barge vessel, will be used instead of the MGS Buoy, which can be considered a benefit.</p>

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Fisheries	
Marine License variation	The increase in the duration of the operation and maintenance phase of the project will not influence the significance of impacts associated with commercial fisheries because the impacts are driven by the extremely small area where fishing activity is restricted, as opposed to the duration of the potential operational and maintenance activities.
Are there any implications to 2016 EIA / ES and associated 2019 Marine License variation?	No. Operational and maintenance impacts to commercial fisheries were determined as not significant due to most fishing effort taking place outside the PDA and the area in which fishing activity will be restricted is very small. The increase in duration of the impact does not increase the size of the area restricted to fishing activity, and therefore the conclusion remains valid for the project going forward.

2.6 Shipping and Navigation

Table 2-7 provides a summary of the worst case design envelope as relevant to shipping and navigation impact assessment and sensitive receptors and demonstrates that the proposed Marine Licence variation does not have the potential to change the outcomes of the impact assessment presented in the June 2016 EIA / ES and associated variation which supports the current Marine Licence.

Table 2-7 Summary of worst case design envelope

Shipping and Navigation	
Worst case design envelope assessed in 2016 EIA / ES and associated 2019 Marine License variation <i>Text in italics direct lift from June 2016 ES</i>	<p><i>“Total maximum developable area (total swept area of DGU unit) of approximately 0.01 nm² (0.034 km²); Note that following the 2019 Marine License variation there was a reduction in the maximum swept area of the kite to 0.01 km².</i></p> <p><i>A single Deep Green Utility (DGU) tidal device;</i></p> <p><i>A single fixed barge – worst-case is that it is permanently present on site during the 5 year project, but it is highly unlikely to remain permanently on site throughout the winter months;</i></p> <p><i>Maximum DGU wing span of 12 m; and</i></p> <p><i>Minimum under water clearance of 12.5 m (LAT) (Note 1).”</i></p> <p>Additional notes</p> <p>Note 1 Condition of Marine Licence ORML 1618v1 (condition 8.12) specifies a minimum clearance depth of 20 m below Lowest Astronomical Tide (LAT) datum and the DGU unit is to be maintained at all times during operation.</p>
Impacts assessed & residual significance (following mitigation) in June 2016 EIA / ES and associated 2019 Marine License variation	<p>Impacts during construction / installation:</p> <ul style="list-style-type: none"> > Increased passing vessel to vessel collision risk – moderate (tolerable) risk (mitigation identified). > Passing vessel collision with works vessel – moderate (tolerable) risk (mitigation identified). > Restricted SAR capability and oil spill response – low (broadly acceptable) (mitigation identified). > Dropped object – low (broadly acceptable). > Man overboard – low (broadly acceptable) (mitigation identified).

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Shipping and Navigation	
	<p>Impacts during operations and maintenance:</p> <ul style="list-style-type: none"> > Commercial (powered) vessel allison with moored barge – low (broadly acceptable) (mitigation identified). > Fishing (powered) vessel allison with moored barge - moderate (tolerable) risk (mitigation identified). > Recreational (powered) vessel allison with moored barge - moderate (tolerable) risk (mitigation identified). > Commercial (drifting) vessel allison with moored barge – low (broadly acceptable) (mitigation identified). > Fishing (drifting) vessel allison with moored barge - moderate (tolerable) risk (mitigation identified). > Recreational (drifting) vessel allison with moored barge - moderate (tolerable) risk (mitigation identified). > Commercial (powered) vessel allison with DGU – low (broadly acceptable) (mitigation identified). > Fishing (powered) vessel allison with DGU - low (broadly acceptable) (mitigation identified). > Recreational (powered) vessel allison with DGU - low (broadly acceptable) (mitigation identified). > Commercial (drifting) vessel allison with moored barge – low (broadly acceptable) (mitigation identified). > Fishing (drifting) vessel allison with moored barge - low (broadly acceptable) (mitigation identified). > Recreational (drifting) vessel allison with moored barge - low (broadly acceptable) (mitigation identified). > Fishing gear interaction with subsea equipment within site - moderate (tolerable) risk (mitigation identified). > Anchoring interaction with subsea equipment within site - low (broadly acceptable) > Loss of station of barge - low (broadly acceptable) (mitigation identified). > Loss of DGU Unit (component or full DGU unit) - low (broadly acceptable) (mitigation identified). > Unauthorised entry to barge- low (broadly acceptable) (mitigation identified). <p>The shipping and navigation assessment identified a series of standard industry measures and project specific mitigation measures that would be implemented in order to reduce the frequency and consequence any potential shipping and navigation risks. These are detailed throughout Chapter 14 of the June 2016 ES.</p>
Are the proposed activities within the worst-case design envelope assessed in	Yes

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Shipping and Navigation	
2016 EIA / ES and associated 2019 Marine License variation	<p>The MGS buoy will be replaced by a manned DP barge vessel to house the MGS unit which will only be present when the kite is present, which will be up to 12-weeks per year. This is still within the design envelope assessed and consented as part of the 2016 EIA / ES. The swept area for the kite at 0.01 km² and the operational clearance depth of 20 m will be maintained during ongoing operations. The presence of a manned barge vessel and testing over the proposed extension period will mean an increase in the duration for potential allision with the barge vessel or Dragon 12 unit. However, mitigation measures implemented to date will continue to be implemented, which include:</p> <ul style="list-style-type: none"> > Operations will only occur within the consented test site; > The presence of a tidal device and an associated clearance depth are recorded on Admiralty charts that cover the site; > Monitoring of marine traffic when manned operations are on site; > Active fisheries stakeholder engagement; > Advance promulgation of information; > The manned DP barge vessel will act as an Aid to Navigation; and > Implementation of emergency response plans in the event of the loss of the Dragon 12 unit.. <p>In addition to the above mitigation, the DP vessel barge will be manned during all on site operations, which will be up to 12-weeks per year, and during which time all IMO operational requirements will be adhered to.</p> <p>A marine traffic survey undertaken in summer of 2017 (Xodus 2017) and a further marine traffic study (AIS data analysis) in 2020 (Xodus 2020b) identified that there has been no material change over the past few years to the vessel activity across the PDA and beyond. Therefore, the assessment completed as part of the 2016 EIA / ES is still representative of the conditions to date and as anticipated over the proposed Marine Licence extension period. With ongoing mitigation measures implemented as part of the Project operations, the increase in the duration of the operation and maintenance phase of the project will still be within the worst-case residual impact as identified within the 2016 EIA/ ES.</p>
Are there any implications to 2016 EIA / ES and associated 2019 Marine License variation?	<p>No</p> <p>Mitigation measures and monitoring will be ongoing during the proposed Marine Licence extension period. The implementation of a manned DP barge vessel will further reduce the risk of allision with moored barge, thereby providing a positive benefit.</p>

2.7 Marine Archaeology and Cultural Heritage

Table 2-8 provides a summary of the worst case design envelope as relevant to marine archaeology and cultural heritage impact assessment and sensitive receptors and demonstrates that the proposed Marine Licence variation does not have the potential to change the outcomes of the impact assessment presented in the June 2016 EIA / ES and associated variation which supports the current Marine Licence.

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Table 2-8 Summary of worst case design envelope

Marine Archaeology and Cultural Heritage	
<p>Worst case design envelope assessed in 2016 EIA / ES and associated 2019 Marine License variation</p> <p><i>Text in italics direct lift from June 2016 ES</i></p>	<p><i>“Mooring of the barge or similar such surface platform (measuring approximately 50 m x 12 m) on site for up to 5 years;</i></p> <p><i>Mooring the barge to the seabed via a four to eight catenary mooring, using embedment anchors, clump weights and chains;</i></p> <p><i>Seabed preparation, if required, prior to the installation of DGU unit foundation;</i></p> <p><i>Installation of anchor foundation for the DGU unit using one of four options (GBS, pin piled tripod foundation, mud mat or monopile foundation), each of which will have a direct impact on the seabed though in varying degrees due to their different techniques and dimensions;</i></p> <p><i>Laying 200 m subsea umbilical cable (100 mm diameter) onto the seabed;</i></p> <p><i>Use of other vessels’ anchors when mooring within the PDA;</i></p> <p><i>Increased marine traffic as a result of Project activities throughout the installation and operational stages;</i></p> <p><i>Maintenance activities up to 6 times per year; and</i></p> <p><i>Removal of seabed infrastructure as part of the decommissioning stage, using similar methods to the installation.”</i></p>
<p>Impacts assessed & residual significance (following mitigation) in June 2016 EIA / ES and associated 2019 Marine License variation</p>	<p>Impacts during construction / installation and operations and maintenance:</p> <ul style="list-style-type: none"> > Impact to known and potential submerged prehistoric features – not significant (mitigation identified). > Impact of known seabed features: maritime sites and aviation sites – no impact > Impact of potential seabed features: maritime sites and aviation sites – not significant (mitigation identified). > Impact to setting of terrestrial heritage assets – not significant. > Impact to seascape character – not significant.
<p>Are the proposed activities within the worst-case design envelope assessed in 2016 EIA / ES and associated 2019 Marine License variation</p>	<p>Yes.</p> <p>The seabed area occupied by subsea infrastructure will be reduced due to the removal of the drag anchor and chains (associated with the MGS Buoy), while the kite seabed infrastructure will stay the same. The reinstatement of a barge vessel to house the MGS unit is within the consented scope and therefore there is no change with regards to setting and landscape impacts.</p> <p>The increase in the duration of the operation and maintenance phase of the project will not influence the significance of direct impacts associated with marine archaeology and cultural heritage because the impacts are driven by the extremely small area which the project occupies, and therefore directly impacts, as opposed to the duration of the potential operational and maintenance activities.</p> <p>The increase in the duration of the operation and maintenance phase of the project will not influence the significance of indirect settings impacts associated with marine archaeology and cultural heritage because the sea surface infrastructure represents a relatively small scale element in a location where frequent vessel movements from an established part of the baseline and therefore does not pose a significant impact to setting of the Heritage Coastline.</p>

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Marine Archaeology and Cultural Heritage	
Are there any implications to 2016 EIA / ES and associated 2019 Marine Licence variation?	No. It should be noted that the Archaeological WSI will continue to be adhered to throughout the project (consent requirement).

2.8 Seascape, Landscape and Visual

Table 2-9 provides a summary of the worst case design envelope as relevant to seascape, landscape and visual impact assessment and sensitive receptors and demonstrates that the proposed Marine Licence variation does not have the potential to change the outcomes of the impact assessment presented in the June 2016 EIA / ES and associated variation which supports the current Marine Licence (No. ORML 1618v1).

Table 2-9 Summary of worst case design envelope

Seascape, Landscape and Visual	
Worst case design envelope assessed in 2016 EIA / ES and associated 2019 Marine Licence variation	<p><i>"It is anticipated that the DGU would be deployed in the southern part of the offshore PDA shown in Figure 16.2 (in June 2016 ES). No elements of the DGU would be seen above water, however a barge will be required within the PDA during the 5 year Project. Therefore, the SLVIA will focus on the presence and visibility of this barge within the PDA. The barge would be present continually during the initial operation/testing phase, but as testing progresses it may not be on site full time.</i></p>
Text in italics direct lift from June 2016 ES	<p><i>It is anticipated that the barge (or similar such surface platform) will be moored to 4 - 8 buoys. There may be an additional buoy to which the DGU tether will be attached during periods when the DGU is taken off site, as well as buoy from which the mooring spread and subsea umbilical would be suspended from during period when the barge is off site. The buoys are likely to be yellow in colour and lit at night (visibility of not less than five nautical miles) in conformance with guidance from Trinity House and the International Association of Marine Aids to Navigation and Lighthouse Authorities (IALA) (ALA Recommendation O-139 on The Marking of Man-Made Offshore Structures, Edition 2, December 2013 and IALA Recommendation E-108 on The Surface Colours used as Visual Signals on Aids to Navigation, Edition 3, May 2013) to ensure that key elements are conspicuous to marine traffic. The main structure of the barge is expected to extend to approximately 4 m above the waterline and would be 50 m long by 12 m wide. There could also be a crane on the barge, which would extend to over 4 m. However, this would represent a relatively slender structure and is therefore expected to be less conspicuous than the main superstructure of the barge. In addition, the crane is only expected to be in operation for up to two hours per day.</i></p> <p><i>Normal offshore operations would take place during daylight hours, therefore floodlighting would typically be avoided. However, floodlighting will be required on the barge to allow safe working conditions during hours of darkness, and at times this may involve periods of 24 hour working. As the proposed Project will involve periods of testing, the duration of operations that may take place during hours of darkness are uncertain, but it is anticipated this will be unlikely to exceed 30 nights per year and later afternoon periods during winter months. The requirement for working in hours of darkness is also likely to reduce as the testing progresses.</i></p> <p><i>To ensure that the maximum potential zone of theoretical visibility (ZTV) has been prepared on the basis of the outermost extent of PDA and the maximum height of the main structure of the barge (excluding the crane). The sea level has also been placed at 3.28 m</i></p>

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Seascape, Landscape and Visual	
	<p><i>relative to Ordnance Datum to ensure this maximises the relative height of the barge and therefore the ZTV depicts the greatest likely extent of theoretical visibility.</i></p> <p><i>For the purpose of the visualisations, the most realistic scenario is to link the position of the barge with the likely location of the Deep Green Utility units (DGUs). To ensure the assessment considered a likely worst case, this has been positioned on the eastern side of the DGU unit so that it is placed closer to the coastline. The specific detail of the barge is not known at present, so the visualisations are based on a block model reflecting its expected dimensions. The barge has been coloured red (the entire structure) to ensure that it is as visible as possible. Four buoys have been included in the visualisations. These have been coloured yellow as this is in conformance with the guidance referenced above and is the likely requirement of the relevant navigation authorities and consultees (Note 1)''</i></p> <p><u>Additional notes:</u> Note 1 Following consent award and further consultation with MCA, it was agreed the MGS buoy acted a navigational mark (in accordance with MCA, TH requirements). The manned DP barge vessel will again be employed in line MCA and TH requirements. Therefore, the four buoys included in the visualisations presented in the June 2016 ES, have not been required, thereby reducing the seascape, landscape and visual impact of the project from that predicted in the June 2016 EIA / ES.</p>
Impacts assessed & residual significance (following mitigation) in June 2016 EIA / ES and associated 2019 Marine License variation	<p>Impacts during construction / installation and operations and maintenance:</p> <ul style="list-style-type: none"> > Visibility analysis. > Potential effects on seascape / landscape resource. > Potential effects on designations. > Potential effects on visual amenity. <p>The assessment identified that the local context of the project includes a range of seascape, landscape and visual receptors that are valued and sensitive to potential developments. Notably much of the land based part of the study area is designated as an AONB and the coastline is designated as Heritage Coast. These designations both reflect the scenic quality of the seascape/landscape and as a consequence draw visitors for outdoor recreation and enjoyment of the local character.</p> <p>However, analysis as part of the landscape, seascape and visual assessment identified that the potential changes to this context as a result of the project would be limited and the likelihood significant effects occurring in relation to seascape, landscape and visual receptors are remote, as clearly indicated by the visualisations prepared as part of the SLVIA (see Figures in Section 16 of the June 2016 EIA / ES). This conclusion was reached based on a combination of the relative location, scale and nature of the elements of the project that have the potential to change the baseline. In addition, the temporary and reversible nature of these changes would also greatly influence the potential for significant adverse effects to occur.</p>
Are the proposed activities within the worst-case design envelope assessed in 2016 EIA / ES and associated 2019 Marine License variation	<p>Yes.</p> <p>The reinstatement of a barge vessel to house the MGS buoy is in line with what has been assessed within the June 2016 EIA / ES and consented under Marine Licence ORML 1618v1. There is therefore no change anticipated with regards to landscape impacts.</p> <p>There is no change proposed with regard to above sea surface infrastructure and therefore no change to landscape impacts. The increase in duration that sea surface infrastructure will be in place is not anticipated to increase impact to landscape because the sea surface infrastructure represents a small scale element in a location where frequent vessel movements from an established part of the baseline. Therefore, the proposed Marine Licence extension period is still within the predicted worst case landscape impacts assessed in the June 2016 EIA / ES.</p>

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Seascape, Landscape and Visual	
Are there any implications to 2016 EIA / ES and associated 2019 Marine License variation?	No. All infrastructure and operations over the proposed Marine Licence extension period will be within the design envelope assessed under the 2016 EIA / ES and consented under the existing Marine Licence.

2.9 Socio-Economics

Table 2-10 provides a summary of the worst case design envelope as relevant to socio-economics impact assessment and sensitive receptors and demonstrates that the proposed Marine Licence variation does not have the potential to change the outcomes of the impact assessment presented in the June 2016 EIA / ES and associated variation which supports the current Marine Licence.

Table 2-10 Summary of worst case design envelope

Socio-economics	
Worst case design envelope assessed in 2016 EIA / ES and associated 2019 Marine License variation <i>Text in italics direct lift from June 2016 ES</i>	N/A for socio economic assessment.
Impacts assessed & residual significance (following mitigation) in June 2016 EIA / ES and associated 2019 Marine License variation	Impacts during construction / installation and operations and maintenance: <ul style="list-style-type: none"> > Direct, indirect and induced impacts on employment and GVA; <ul style="list-style-type: none"> o Minor positive impacts in terms of local employment and GVA in Anglesey. o Minor positive indirect and induced impacts on employment and GVA at a regional (North Wales), national (Wales) and UK level. o Project makes a positive contribution towards making new employment opportunities. > Impacts on tourism and recreation – not significant.
Are the proposed activities within the worst-case design envelope assessed in 2016 EIA / ES and associated 2019 Marine License variation	Yes. The proposed changes do not introduce any additional infrastructure or activities (to those already assessed) that could increase impacts on tourism and recreation. The continued operation of the project enabled through the extension to the current Marine Licence will also continue to make minor positive impacts to the local economy. Over and above the continued operation to the offshore testing facility and associated onshore infrastructure, the final assembly and testing of the Dragon 12 will take place in the Minesto assembly hall at Holyhead.
Are there any implications to 2016 EIA / ES and associated 2019	No.

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Socio-economics	
Marine License variation?	

2.10 Hydrocarbon and Chemical Releases

Table 2-11 provides a summary of the worst case design envelope as relevant to hydrocarbon and chemical releases impact assessment and sensitive receptors and demonstrates that the proposed Marine Licence variation does not have the potential to change the outcomes of the impact assessment presented in the June 2016 EIA / ES and associated variation which supports the current Marine Licence.

Table 2-11 Summary of worst case design envelope

Hydrocarbon and Chemical Releases	
<p>Worst case design envelope assessed in 2016 EIA / ES and associated 2019 Marine License variation</p> <p><i>Text in italics direct lift from June 2016 ES</i></p>	<p><i>The DGU unit will contain an inventory of approximately 30 litres of biodegradable hydraulic oil;</i></p> <p><i>The DGU unit will contain an inventory of tens of litres of liquid coolant;</i></p> <p><i>Bunded fuel store on barge holding approximately 200 l of diesel for the generator & support vessel;</i></p> <p><i>Small volumes of chemicals on the barge in a basic workshop, bunded in COSHH cupboard;</i></p> <p><i>The maximum total oil inventory for a large installation vessel or DP vessel will be approximately 8,000,000 litres of marine diesel stored across a number of separate tanks. A worst case spill from the rupture of a single tank is likely to be approximately 600,000 litres of marine diesel;</i></p> <p><i>Vessel requirement during installation:</i></p> <ul style="list-style-type: none"> > <i>DP vessel or underslung barge (depending on foundation selection)– ~5 days;</i> > <i>Anchor handler tug or multicat to deploy barge moorings – ~1 week;</i> > <i>Tug to transport barge to/from site – 1 day per transfer but multiple transfers expected;</i> > <i>Support vessel with ROV capabilities to attach tether to foundation – <1 week; and</i> > <i>LARS support vessel to transport, launch and recover DGU – daily during final few weeks of installation period and crossover into operational period;</i> <p><i>Vessel requirement during operations:</i></p> <ul style="list-style-type: none"> > <i>Barge – up to 5 years – worst-case permanently present on site during this period, but highly unlikely to remain permanently on-site throughout winter months;</i> > <i>LARS support vessel to launch and recover DGU, perform guard vessel duty and routine maintenance – approximately once per week for up to 5 years, but could be present daily during final stages of installation/first few weeks of operation.</i> > <i>Tug to transport barge to/from site – 1 day per transfer but multiple transfers expected throughout operational period (up to 5 years); and</i>

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Hydrocarbon and Chemical Releases	
	> <i>Additional service/maintenance vessel – a maximum of 6 days per year.”</i>
Impacts assessed & residual significance (following mitigation) in June 2016 EIA / ES and associated 2019 Marine License variation	<p>Impacts during construction / installation and operations and maintenance:</p> <ul style="list-style-type: none"> > Oil spills from vessels and barge – not significant (with mitigation). <p>Impacts during operations and maintenance:</p> <ul style="list-style-type: none"> > Leak of fluid associated with DGU unit – not significant (with mitigation).
Are the proposed activities within the worst-case design envelope assessed in 2016 EIA / ES and associated 2019 Marine License variation	<p>Yes.</p> <p>No new sources of pollution will be introduced as a result of the proposed changes.</p> <p>Current emergency procedures and pollution prevention procedures will remain in place (consent requirement) and therefore the increase in operation and maintenance duration is not anticipated to pose further risk in relation to hydrocarbon and chemical releases.</p>
Are there any implications to 2016 EIA / ES and associated 2019 Marine License variation?	No.

2.11 Other Sea Users

Table 2-12 provides a summary of the worst case design envelope as relevant to other sea users impact assessment and sensitive receptors and demonstrates that the proposed Marine Licence variation does not have the potential to change the outcomes of the impact assessment presented in the June 2016 EIA / ES and associated variation which supports the current Marine Licence (No. ORML 1618v1).

Table 2-12 Summary of worst case design envelope

Other Sea Users	
<p>Worst case design envelope assessed in 2016 EIA / ES and associated 2019 Marine License variation</p> <p><i>Text in italics direct lift from June 2016 ES</i></p>	<p><i>“Agreement for Lease (AFL) area of 9.1 km²;</i></p> <p><i>PDA area of 4 km²;</i></p> <p><i>The DGU unit will occupy a maximum swept area of 0.034 km²; Note that following the 2019 Marine License variation there was a reduction in the maximum swept area of the kite to 0.01 km².</i></p> <p><i>Barge or similar such surface platform (with safety zone of 0.84 km², subject to further consultation (Note 1)) moored on site and associated support vessel for up to 5 years;</i></p> <p><i>Increased vessel activity in AFL during construction and installation; and</i></p> <p><i>Maximum operational period of 5 years.”</i></p> <p><u>Additional notes</u></p> <p>Note 1 Following consent award and further consultation with MCA, it was agreed there was no need for a safety zone as the MGS buoy acted as a navigational mark (in accordance with MCA, TH requirements).). The use of a manned DP barge vessel that will only be present when the kite is present and will act as an Aid to Navigation. Any changes to charting requirements be discussed and agreed with all relevant authorities and the Hydrographic Office notified as required.</p>

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Other Sea Users	
Impacts assessed & residual significance (following mitigation) in June 2016 EIA / ES and associated 2019 Marine License variation	<p>Impacts during construction / installation:</p> <ul style="list-style-type: none"> > Loss of access to Holyhead Deep disposal site ISO40^(Note 1) – not significant (with mitigation). > Inadvertent interaction with UXO – potentially significant. Need for UXO risk assessment identified. <p>Impacts during operations and maintenance:</p> <ul style="list-style-type: none"> > Introduction of seabed scour to the PDA – not significant. <p><u>Additional notes</u></p> <p>Note 1 Since the June 2016 EIA / ES the Holyhead Deep disposal site ISO40 has been reduced in size and re-designated to avoid any overlap with the Minesto AfL area.</p>
Are the proposed activities within the worst-case design envelope assessed in 2016 EIA / ES and associated 2019 Marine License variation	<p>Yes.</p> <p>The proposed changes remain within the project area and therefore there are no changes to the other sea users affected. It should be noted that the Holyhead Deep disposal site has now been re-designated to avoid any overlap with the Minesto AfL area and therefore no longer any issue around potential for loss of access to the disposal site.</p> <p>Interaction with UXO has not been encountered through installation or operation of the DG500 and is not anticipated to be relevant to the project moving forward as the same area of seabed will be occupied.</p> <p>Consideration with regard to scour impacts are discussed in Physical Processes and Benthic Ecology EIA topics.</p>
Are there any implications to 2016 EIA / ES and associated 2019 Marine License variation?	No.

3 SUMMARY

This review concludes that the replacement of the DG500 with the Dragon 12 and extending the current Marine License by one year does not change the previously predicated impacts and therefore the EIA previously undertaken remains valid. This has been backed up by the results of ongoing monitoring associated with the DG500 and are applicable to the Dragon 12 due to the same design envelope.

Additional site-specific data and studies completed since the June 2016 EIA / ES confirm the baseline environment presented in the EIA and further supports the completed assessment. The proposed changes to the Marine Licence ORML 1618v1 do not constitute a material change, introduce any additional sources of impact not already identified and do not introduce sources of impact in relation to 'new' impacts which need to be assessed under the 2017 EIA Regulations. Therefore, Minesto anticipate being able to vary the current Marine License in order to gain approval to facilitate progression in the commercial demonstration of the Deep Green technology in Holyhead Deep.

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APPENDIX I: SUMMARY OF MARINE MAMMAL COLLISION RISK

DG500 Component Parameters	Collision Risk Assessment Approach	Dragon 12 Component Parameters	Dragon 12 Collision Risk Assessment
DG500 length: 12 m DG500 height: 4.5 m Tether length: 100 m Tether thickness: 0.1 m	<ul style="list-style-type: none"> The collision risk area was determined based on the cross-sectional area at the front of the unit and tether independently. Collision risk is calculated on the basis of the cross sectional area, the speed of movement of the kite (12 m/s) and the probability of impact with marine mammals travelling on varying trajectories through the water column. As the collision risk was based on the entire area including the rotating turbine, the rotation speed was implicit. Impact distance was set to 0 m so collision occurred if an animal intersected the collision risk area for the unit or tether. 	Dragon 12 length: 12 m Dragon 12 Height: 4.1 m Tether length: 49.5 m Tether thickness: 0.1 m	<ul style="list-style-type: none"> The unit has the same length and height due to the integration of the nacelle into the wing and struts have been removed. The Dragon 12 winglets are within the same height as the DG500 rudder. The unit is considered to be within the design envelope on the basis of the cross section area (CSA) associated with the length and height. The collision risk assessment for the DG500 assumed a worst-case 54 m² CSA (12 x 4.5 m) for the unit. The DG500 unit occupied approximately 20% of the CSA (based on the components considered within the marine mammal assessment, excluding the turbine diameter and tether). Analysis of the Dragon 12 structure shows that it occupies approximately 19% of the assessed CSA, meaning a small reduction in the collision risk area.

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APPENDIX II: SUMMARY OF OFFSHORE ORNITHOLOGY COLLISION RISK

DG500 Component Parameters (Length and thickness)	Collision Risk Assessment Approach	Dragon 12 Component Parameters (Length and thickness)	Dragon 12 Collision Risk Assessment
<p>Wing: 12 m and 0.6 m</p> <p>Turbine: 2 m diameter</p> <p>Turbine pylon: 0.3 m and 0.25 m</p> <p>Struts x3: 7.5 m and 0.2 m</p> <p>Rudder x2: 2.5 m and 0.12 m</p> <p>Elevators x2: 2.5 m and 0.12 m</p> <p>Tether: 100 m and 0.08 m</p> <p>Total cross section area: 24.12 m²</p>	<ul style="list-style-type: none"> Encounter rate model (ERM) developed by SAMS and CEH was applied as it was compatible to the kite and operation mode. This approach accounted for the component size, shape, velocities and number. The size and shape were again used to calculate the cross-section area as the collision risk area. Encounter rate of birds was determined based in the sea-surface density and scaled with depth. Collision risk was a function of the collision risk area, kite movement speed, bird surface density and diving depth. The worst-case upside down mode of operation based on a 12.5 m clearance depth was assessed. 	<p>Wing: 12 m and 0.5 m</p> <p>Winglets x2: 4.1 m and 0.3 m</p> <p>Turbine: 3.5 m diameter</p> <p>Rudder x2: 2.2 m and 0.2 m</p> <p>Elevators x2: 2.2 m and 0.2 m</p> <p>Tether: 49.5 m and 0.08 m</p> <p>Total cross section area: 23.80 m²</p>	<ul style="list-style-type: none"> The operational mode, where the DGU is flown from the seabed reduces the encounter rate due to the depth. The shorter tether, absence of some DGU components (including the struts and turbine pylon) reduces the encounter rate. The introduction of winglets increases the encounter rate. However, these are still considerably less than assessed for the removed components, leading to an overall reduction in the encounter rate. The larger turbine means a larger collision risk area, although this now overlaps with the wing, thereby reducing the overall collision risk area. In terms of the assessed risk the Dragon 12 is within the design envelope with respect to the total collision risk area assessed as part of the 2016 EIA.

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