



Awel y Môr Offshore Wind Farm

Ornithology Monitoring Plan

Date: July 2026

Revision: 4

Document Reference: 005174290-04



PROJECT	Awel y Môr Offshore Wind Farm
PACKAGE	Consents
DOCUMENT TITLE	Offshore Ornithology Monitoring Plan
DOCUMENT REFERENCE	005174290-04
REVISION	4
WORKS	Activity 1
ML CONDITION	ORML2233T and ORML2233G: 3.32 (ornithology monitoring elements only)
DISCHARGING AUTHORITY	Natural Resources Wales

REVISION	DATE	STATUS/ REASON FOR ISSUE	AUTHOR	CHECKED BY	APPROVED BY
1	April 2024	New document	GoBe Consultants Ltd	Thomas Crawford	Jo Pickard
2	August 2025	Second draft	GoBe Consultants Ltd	Thomas Crawford	Jo Pickard
3	December 2025	Third Draft	GoBe Consultants Ltd	Thomas Crawford	Jo Pickard
4	July 2026	Final document for submission	GoBe Consultants Ltd	Thomas Crawford	Jo Pickard

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Abbreviation and Acronyms

TERM	DEFINITION
AyM	Awel y Môr Offshore Wind Farm
BACI	Before-After-Control-Impact
BDMPS	Biologically Defined Minimum Population Scale
CREEM	Centre for Research into Ecological and Environmental Modelling
CV	Coefficient of Variation
DAS	Digital Aerial Survey
DCO	Development Consent Order
DESNZ	Department for Energy Security and Net Zero
EIA	Environmental Impact Assessment
EMP	Environmental Management Plan
ES	Environmental Statement
GSD	Ground Sampling Distance
GyM	Gwynt y Môr Offshore Wind Farm
JNCC	Joint Nature Conservation Committee
ML	Marine Licence
MRSea	Marine Renewables Strategic Environmental Assessment
NRW	Natural Resources Wales
NRW(A)	Natural Resources Wales Advisory
OMP	Ornithological Monitoring Plan
OWF	Offshore Wind Farm
PEMP	Project Environmental Management Plan
RTD	Red Throated Diver
RWE	RWE Renewables UK

TERM	DEFINITION
SNCBs	Statutory Nature Conservation Bodies
SoS	Secretary of State
SPA	Special Protection Area
WTG	Wind Turbine Generator

1 Introduction

1.1 Project Overview

- 1 Awel y Môr Offshore Wind Farm Limited submitted an application for a Development Consent Order (DCO) in April 2022; consent was granted by the Secretary of State (SoS) for the Department for Energy Security and Net Zero (DESNZ) on 19th September 2023. The Marine Licences were awarded by Natural Resources Wales (NRW) on behalf of the Welsh Government on 15th November 2023.
- 2 Awel y Môr Offshore Wind Farm (AyM) is a sister project to the operational Gwynt y Môr Offshore Wind Farm (GyM) which is located off the coast of north Wales adjacent to AyM and has been operational since 2015.
- 3 The AyM DCO granted development consent for the construction and operation of an offshore energy generation station with electrical connections comprising:
 - Up to 50 offshore wind turbine generators;
 - Substation platforms;
 - An interlink (by sub-sea cable) to the existing GyM (to the east of AyM);
 - Up to two offshore export cable circuits to bring the power generated to shore;
 - Landfall and onshore electrical connections and cabling; and
 - A new onshore substation to allow transmission of electricity to the National Grid.
- 4 Following award of the DCO by the SoS, NRW granted the following associated Marine Licences:
 - Marine Licence ORML2233G, issued 15 November 2023, for the generation assets of AyM;
 - Marine Licence ORML2233L, issued 15 November 2023, for the connection between AyM and GyM;
 - Marine Licence ORML2233C, issued 15 November 2023, for the directional drilling and cable laying under Clwyd Estuary; and
 - Marine Licence ORML2233T, issued 15 November 2023, for the transmission assets of AyM.

1.2 Document Purpose and Consent Considerations

- 5 The requirement for an Ornithological Monitoring Plan (OMP) is captured within Marine Licence ORML2233G and ORML2233T Condition 3.32 (Table 1).
- 6 This document presents the OMP, the focus of which is red-throated diver, as agreed with NRW and evidenced in the Marine Licensing Decision Document of 14 November 2023, summarised below.

"NRW welcome the applicant's commitment to carry out validation monitoring in relation to displacement of red-throated divers and are content that this can be incorporated into the monitoring programme as proposed by the applicant (Document 8.12 Schedule of Mitigation and Monitoring Rev G), which can be agreed post consent as part of the Environmental Monitoring Plan (EMP)".

- 7 Following consultation post-consent (see Section 2 for further information), it was agreed that monitoring should focus on whether there is displacement and subsequent habituation of red-throated diver (e.g. the return of individuals following displacement), rather than solely focusing on displacement (Table 3). It should be noted that whilst the Marine Licensing Decision Document refers to monitoring in relation to displacement rather than habituation, this OMP provides the relevant information to ensure the Marine Licence conditions regarding pre- and post-construction monitoring described in Table 1 will still be met.
- 8 The OMP comprises a red-throated diver monitoring plan and includes the objectives of, and the methodology for, a digital aerial survey (DAS) study to monitor potential displacement and subsequent habituation of red-throated diver (i.e. a reduction in displacement response, resulting in the return of red-throated divers to habitat that they had initially been displaced from) from the area within, and around, the AyM array area.
- 9 This document represents the formal submission of the OMP, fulfilling the requirement for an OMP under Marine Licence ORML2233G and ORML2233T Condition 3.32.

Table 1: Summary of the AyM OMP consent requirements.

CONDITION	DESCRIPTION	DISCHARGE APPROACH
ORML2233G and ORML2233T Condition 3.32.1	The Licence Holder must submit an Environmental Monitoring Plan (EMP) including the specification of the pre-construction, construction, and post construction monitoring to the Licensing Authority for written approval. No Licensed Activities may be undertaken prior to written approval from the Licensing Authority. The EMP must include, but not limited to, specification for: i. monitoring, including methodologies and timings; ii. physical and ecological pre- and post-construction monitoring surveys to take place across the construction area; iii. monitoring surveys designed to ensure minimal disturbance to and loss of key benthic habitats and species during the construction including the identification of areas for micro siting where possible; iv. underwater noise monitoring to measure noise generated from piled foundations; v. ornithological monitoring plan; and vi. timetable for related reporting.	This document represents the formal submission of the OMP to partially fulfil the monitoring requirements of Condition 3.32.1. This OMP includes details of the monitoring methodologies, proposed timing, and reporting requirements. Note, other monitoring topics will be covered in a separate Environmental Monitoring Plan(s) (EMP) which will discharge the remainder of the Licence Conditions.
ORML2233G and ORML2233T Condition 3.32.2	The Licence Holder must ensure that any actions outlined in the EMP detailed in condition 3.32.1 are implemented as approved in writing by the Licensing Authority. Any proposed changes to the actions outlined in the documents must be submitted to and approved in writing by the Licensing Authority prior to any changes being enacted.	Ornithological monitoring will be undertaken in accordance with this OMP once approved by the Licensing Authority.

CONDITION	DESCRIPTION	DISCHARGE APPROACH
ORML2233G and ORML2233T Condition 3.32.3	The pre-construction monitoring EMP required under condition 3.32.1 must be submitted to the Licensing Authority for written approval at least 4 months before surveys commence	This OMP has been issued in accordance with these timescales.
ORML2233G and ORML2233T Condition 3.32.4	The construction monitoring EMP required under condition 3.32.1 must be submitted to the Licensing Authority for written approval at least 4 months prior to construction.	Ornithological construction monitoring is not required and therefore no further consideration is required on this aspect.
ORML2233G and ORML2233T Condition 3.32.5	The post construction monitoring EMP required under condition 3.32.1 must be submitted to the Licensing Authority for written approval at least 4 months prior to operation of the Wind Turbine Generators.	This OMP provides details of post-construction monitoring for red-throated diver.
ORML2233G and ORML2233T Condition 3.32.6	The Licence Holder must submit environmental monitoring reports for approval to the Licensing Authority in accordance with the timetable approved within the EMP.	Details of the environmental monitoring reports required for ornithological monitoring are presented in Section 6.3.

1.3 Document Structure

10 The following detail is provided within this document:

- Section 2: Consultation;
- Section 3: Presents an overview of red-throated diver abundance and distribution based on available survey data;
- Section 4: Provides the key objectives that the monitoring plan aims to address;
- Section 5: Details the methodology for undertaking the ornithological monitoring including relevant survey specifications;
- Section 6: Outlines the proposed analysis that will take place in order to address the ornithological monitoring objectives; and
- Section 7: Summary.

2 Consultation

11 Following consent award, in September 2023, a draft OMP detailing the approach to monitoring red-throated diver (focusing on potential disturbance from the offshore wind farm (OWF)) was submitted to NRW Advisory (NRW(A)) (Document Reference: 005174290-01) on 24 April 2024. The draft OMP outlined a DAS monitoring plan with two years of pre-construction and two years of post-construction monitoring. Following meetings held to discuss the plan on 9 May 2024 and 29 July 2024, NRW responded to the draft OMP and associated power analyses via email on 23 October 2024. Comments and responses from this initial consultation process are summarised in Table 2. In summary, NRW(A) requested that the OMP should focus on monitoring habituation (the return of individuals to an area after displacement has occurred) and therefore requested the survey design to be altered to allow for increased longevity in the surveys post-construction (monitoring for six to 10 years, rather than two years post-construction). As a result of these discussions, AyM have altered the survey specifications to align with the NRW(A) request for monitoring habituation, specifically:

- Reducing survey effort to one survey per month (instead of two surveys per month);
- Reducing the number of surveys per year from seven to five; and
- Reducing the survey effort in the north of the survey area to remove areas of deeper water, where red-throated diver are not present.

Table 2: NRW(A) comments on the draft OMP (2024) and AyM responses.

NRW(A) COMMENT	AYM RESPONSE
NRW Advisory has considered the information supplied in the power analysis report and newer addendum. When both documents are read together, this suggests that providing the surveys are targeted to the correct months for the target species (Red Throated Diver (RTD), October-April) and cover an appropriate survey area, gaining sufficient statistical power to be	AyM welcomes the comments from NRW regarding the draft OMP and associated power analyses and agree with the conclusions made. It is noted that based on the preference of NRW(A) to focus on monitoring habituation rather than displacement, the survey programme has been adapted (based on comments in the rows below) and it has

NRW(A) COMMENT	AYM RESPONSE
able to detect trends for model-based analysis may be possible. However, it does appear as if lack of power could still be an issue in some scenarios (e.g. if the density of RTD is very low and there is low sampling effort).	subsequently been agreed with NRW(A) that a model-based approach to statistical analysis will unlikely be viable based on the updated survey requirements (see Table 3 for further information).
The Applicant has suggested undertaking a total of four years of monitoring, consisting of two years of pre-construction monitoring, and two years of post-construction monitoring. NRW (A) has previously advised that if the pre-application baseline data were used in this way then it may be possible to eliminate or reduce the need for pre-construction monitoring to 0-1 years, with 3-4 years of post-construction monitoring (with the potential to conduct this over a much longer period, e.g. 6-10 years). However, after considering the results of the power analyses, NRW (A) would prefer if the applicant used the existing baseline data from the AyM pre-application surveys as the only baseline data in place of dedicated pre-construction monitoring. This would mean that the four years of monitoring was carried out post-construction, increasing the sample size of the post-construction monitoring data.	AyM has considered the use of the pre-application baseline data, however notes that a single year of pre-construction monitoring would be required. The rationale for this is based upon the age of the existing baseline dataset, which is expected to be in excess of 10 years old at the point of post-construction data collection. Further information is provided in Section 5. AyM proposes to reduce the pre-construction monitoring surveys to one year rather than two to aid in providing more post-construction monitoring (along with additional changes to the survey design). See Section 5 for further details.
If using pre-construction monitoring data as the baseline, for the purposes of data comparability, the four years of post-construction surveys should ideally cover the array and the 4-8km buffer as was agreed for RTD in the original AyM baseline surveys. Although, if necessary to increase statistical power, due to the location of AyM, this buffer area could potentially be reduced to the areas where RTD are located within Liverpool Bay SPA. Surveys should be carried out between October	As discussed above, AyM proposes to undertake one year of pre-construction monitoring. To enable a longer period of post-construction monitoring, AyM suggests redistributing the remaining post-construction survey effort through the following: ➤ Reducing survey effort to one survey per month (instead of two surveys per month); ➤ Reducing the number of surveys per year from seven to five; and

NRW(A) COMMENT	AYM RESPONSE
and April, to target the overwintering period for the species. If possible, it would be preferable if the 4 years of data collection were spread out across a longer period (e.g. 6-10 years).	▲ Reducing the survey effort in the north of the survey area to remove areas of deeper water, where red-throated diver are not present. Through these reductions in survey effort, AyM propose to extend the post-construction monitoring to up to five survey years, up to nine years post-construction (see Section 5 for further details).
If there are issues with statistical power for model-based analysis once data collection has finished it would be possible to explore other options, such as design-based analysis at that stage.	AyM welcomes this comment from NRW(A), and notes that statistical power is likely to be lower when monitoring for habituation as any changes in diver distribution or density are expected to be smaller in scale than the initial displacement, which itself may have been difficult to detect using a model-based approach.

12 Following the NRW(A) responses to the draft OMP, further discussion via email was undertaken to align and agree on the focus of the OMP (i.e. focus on habituation rather than solely displacement). An additional meeting (13 March 2025) was then held to agree on the key topics raised in the initial feedback, including the analysis and monitoring methodology (Table 3). It was agreed that the focus would be on monitoring for habituation rather than displacement. The detail provided within this document reflects the outcomes of this consultation process.

Table 3: AyM and NRW(A) consultation (2025).

TOPIC	DISCUSSION
Analysis methodology	AyM noted the difficulties in ensuring sufficient statistical power if altering the focus of the monitoring from displacement to habituation, this is due to the fact that if habituation was to occur it would likely be gradual and incomplete. AyM therefore proposed the use of a design-based approach, which NRW(A) agreed with. AyM and NRW(A) also agreed to review the approach to data analysis once the data has been collected.

TOPIC	DISCUSSION
	NRW(A) requested kernel density maps and raw data tables to be presented within monitoring reports. The above has been incorporated into the OMP in Section 6.
Focused monitoring effort	To enable longer term monitoring for habituation, AyM proposed refocusing monitoring effort, for example: ▲ Reducing the number of surveys per year i.e. a minimum of three surveys per year; and ▲ Refining the area of monitoring to exclude the part of the buffer where red-throated diver are unlikely to be present based on water depth. NRW(A) queried how many surveys would be carried out in total, and whether this would be equal to the 48 previously proposed. AyM clarified that costs of monitoring for habituation differ from monitoring for displacement. This is because the proposed monitoring occurs over longer timeframes, therefore there are changes in cost based on mobilisation fees, inflation, ongoing project management and reporting commitments. AyM stated that survey requirements differ between the two studies, with the two surveys a month for seven months per year previously proposed to increase statistical power, which is not required for the habituation study. NRW(A) requested further justification for the design changes prior to providing formal comments. The above has been incorporated into the OMP in Section 5.
Pre-construction monitoring	As discussed in Table 2, AyM stated a preference for undertaking one year of pre-construction monitoring to provide a more recent baseline, as the existing data would be more than 10 years old when post-construction monitoring commences. NRW(A) agreed with this approach.
Post-construction monitoring	AyM queried whether NRW(A) had a preference for the post-construction monitoring duration. It was agreed that the monitoring should be undertaken for between six and 10 years. AyM noted that habituation is the return of birds that have previously been displaced, and queried that if no initial displacement is identified, would the project be required to continue monitoring. NRW(A) noted that if no displacement is identified, monitoring for habituation would not be able to be undertaken. NRW(A) advised to instigate check-ins at set

TOPIC	DISCUSSION
	intervals to discuss next steps, including discussing whether any displacement has been identified, therefore whether monitoring should continue. AyM and NRW(A) discussed that the matter of adaptive monitoring requirements should also be discussed with the NRW Marine Licensing Team. The above has been incorporated into the OMP in Sections 5 and 6.

13 On 09 April 2026, NRW(A) issued comments on the most recent iteration of the AyM OMP, as submitted to NRW(A) on 19 January 2026. The response highlighted a number of minor points requiring clarification or justification. In summary, NRW(A) provided commentary on survey frequency and coverage, importance of adherence to the survey plan after any unplanned weather delays, incorporating baseline ES data into any baseline used for comparison with post-construction data, and emphasising that the OMP clearly states that the focus of the monitoring should be on assessing whether there is displacement and then subsequently habituation of RTD. These comments and responses are summarised in Table 4.

Table 4 NRW(A) comments on the draft OMP (2026) and AyM responses

NRW(A) COMMENT	AYM RESPONSE
NRW (A) suggest that rather than undertaking 5 surveys between October and March for each survey year, you could perhaps consider focusing on surveying the key months (i.e. those when the highest/peak numbers of RTDs are likely to be present). Therefore, we suggest conducting monthly surveys from November through to February (which would make a total of 4 surveys per year). As this approach would reduce the overall total number of surveys required, you could then look at increasing the percentage survey coverage from the minimum 13% currently proposed.	The AyM OMP proposes five surveys across the red-throated diver non-breeding season, each aligned with ecologically meaningful periods rather than calendar months. This approach was adopted because previous AyM and GyM data did not identify consistent monthly patterns of occurrence, while ecological periods provide a repeatable monitoring framework and greater flexibility to accommodate weather constraints. Importantly, the survey schedule extends into spring, when GyM monitoring recorded peak diver abundance, likely reflecting both wintering and migrating birds.

NRW(A) COMMENT	AYM RESPONSE
	While NRW(A) suggested reducing the programme to four surveys to increase spatial coverage per survey, AyM considers the proposed 13% coverage sufficient. Retaining five surveys, particularly the spring survey, is considered more beneficial to meeting the monitoring objectives than achieving a modest increase in survey coverage. Accordingly, no amendment to the OMP survey schedule is proposed.
NRW (A) acknowledge the issues and safety concerns associated with surveying over the winter months and appreciate that surveys may not be able to take place if weather conditions do not allow. However, we note that our recommendation in instances where surveys are missed due to bad weather is that the agreed survey plan is adhered to and missed surveys are completed as soon as possible, when weather conditions do allow. The overall survey effort should not be reduced. We would suggest that in such circumstances, proposed approaches are discussed with NRW.	AyM note that by using ecological periods (generally covering 34 to 43 days) rather than calendar months, the issue of surveys being missed within specified periods due to bad weather is reduced. The spring survey period is only 27 days but it is assumed that this is the monitoring period least likely to be impacted by adverse weather. Should any surveys within the programme set out in the OMP not be carried out during the allotted period due to poor weather, the surveys will be carried out as soon as is possible. AyM will engage with NRW should such circumstances arise.
NRW (A) recommend that in addition to the one-year of pre-construction data to be collected, the baseline ES data should also be incorporated into any baseline used for comparison with the post-construction data. This approach will allow inter-annual variation during pre-construction to be accounted for, as well as having multiple years of data post-construction.	AyM will investigate the use of the ES baseline data alongside the proposed year of pre-construction data to form the pre-construction baseline. AyM advise that it would not be appropriate to use these data until a thorough review of the available data has been carried out. The approach for this review will be based on an assessment of the differences seen between the ES baseline data and the pre-construction data. If the differences in abundance or areas of high density differ more greatly between the ES baseline and the pre-construction data than the inter-annual variation shown within the ES baseline (and other relevant baselines such

NRW(A) COMMENT	AYM RESPONSE
	as that of GyM) then the ES baseline data will not be considered appropriate to inform the pre-construction baseline.
The overall objective of the monitoring plan is to collect data to assess whether RTD show displacement from the presence of a wind farm array, and subsequently whether they show, or do not show, (a degree of) habituation to the presence of the wind farm, which we consider acceptable. NRW (A) suggest that the background information in Sections 1-3 is amended to make it clear that the focus of the monitoring is on assessing whether there is displacement and subsequently habituation, rather than just stating the focus is on habituation. Habituation can only be meaningfully assessed if there is evidence of displacement to begin with.	AyM agrees with NRW(A) that demonstrating initial displacement is key if habituation is to be studied. The OMP will be refined as suggested by NRW(A) in order to make it clear that this is the case.

3 Baseline Occurrence of Red-Throated Diver

14 Understanding the habitat requirements of red-throated diver, and the distribution and abundance of the species in the area around AyM, is essential to defining a robust approach to monitoring, as it informs the spatial and temporal elements of survey design. Studies of red-throated diver abundance and density at both AyM and GyM have been used to provide this context.

15 The following section provides background information on red-throated diver ecology and lifecycle, and context for the monitoring proposal detailed within this plan. Reference is made to relevant AyM Environmental Statement (ES) documentation below, with links to the documents provided in Table 5.

Table 5: Relevant ES documentation.

REFERENCE DOCUMENT	DOCUMENT LINK
Awel y Môr Offshore Wind Farm Category 6: Environmental Statement Volume 2, Chapter 4: Offshore Ornithology	8.70 D8 AyM ES Volume 2 Chapter 4 Offshore Ornithology RevC (planninginspectorate.gov.uk)
Awel y Môr Offshore Wind Farm Category 6: Environmental Statement Volume 4, Annex 4.2: Offshore Ornithology Displacement	Volume 4, Annex 4.2: Offshore Ornithology Displacement (planninginspectorate.gov.uk)
Awel y Môr Offshore Wind Farm Category 6: Environmental Statement Volume 4, Annex 4.5: Offshore Ornithology Scoping and Consultation Responses	Volume 4, Annex 4.5: Offshore Ornithology Scoping and Consultation Responses (planninginspectorate.gov.uk)

3.1 Red-Throated Diver Ecology

16 The red-throated diver is the smallest of the UK's divers. The UK breeding population is primarily in Scotland, with birds wintering around the coast of the UK (RSPB, 2021). The defined biological seasons (bio-seasons; Furness, 2015) are presented in Table 6.

Table 6: Defined bio-seasons for red-throated diver (Furness, 2015).

SEASON	MONTHS
Breeding (Migration free)	March to August (May to August)
Migration – Autumn	September to November
Winter	December to January
Migration - Spring	February to April

3.2 Red-Throated Diver at AyM

17 AyM is located to the north of the western portion of Liverpool Bay/Bae Lerpwl Special Protection Area (SPA). This SPA is designated for its non-breeding population of red-throated divers (amongst other non-breeding and breeding season features). Between the non-breeding periods of 2004/5 and 2010/11, the SPA supported an average of 1,171 individual divers, representing 6.89% of the GB non-breeding population.

18 The conservation objectives for the features of the SPA are as follows:

Ensure that the integrity of the site is maintained or restored as appropriate, and ensure that the site contributes to achieving the aims of the Wild Birds Directive, by maintaining or restoring:

The extent and distribution of the habitats of the qualifying features;

The structure and function of the habitats of the qualifying features;

The supporting processes on which the habitats of the qualifying features rely;

The population of each of the qualifying features; and

The distribution of the qualifying features within the site.

19 A series of comprehensive surveys have been undertaken covering AyM, and the surrounding areas. Details of these are provided in the following section.

3.3 AyM Baseline Surveys

- 20 To inform the AyM DCO application and Environment Impact Assessment (EIA) submission, baseline surveys were undertaken across AyM using monthly DAS over the 24-month period of March 2019 to February 2021. These surveys covered the full extent of the array area, and an asymmetric 8 km buffer (8 km buffer to the south, 4 km buffer to the north). Red-throated diver occurred in low densities across the AyM survey area and associated buffers. Densities were highest in the southern part of the survey area, which is closer to the coast (Figure 1). Peak counts per bio-season (as defined by Furness *et al.* (2015)) are presented in Table 7 and distribution and relative density of birds per bio-season is presented in Figure 1. A monthly breakdown of raw counts, abundances and densities for the array and buffer areas is presented in Table 8.
- 21 The baseline survey design included transects that were spaced 4 km apart and there was a minimum of 10% coverage of the survey area, sampled with images at 2 cm Ground Sampling Distance (GSD). These surveys utilised buffers of 4 km to the north, and 8 km to the south. The rationale for the 10% survey coverage was based on the objective of obtaining a Coefficient of Variation (CV – a measure of variation that indicates the size of a standard deviation in relation to its mean) of 0.16 where possible (noting that at low densities, a CV of ≤ 0.16 may not be achievable regardless of coverage %).

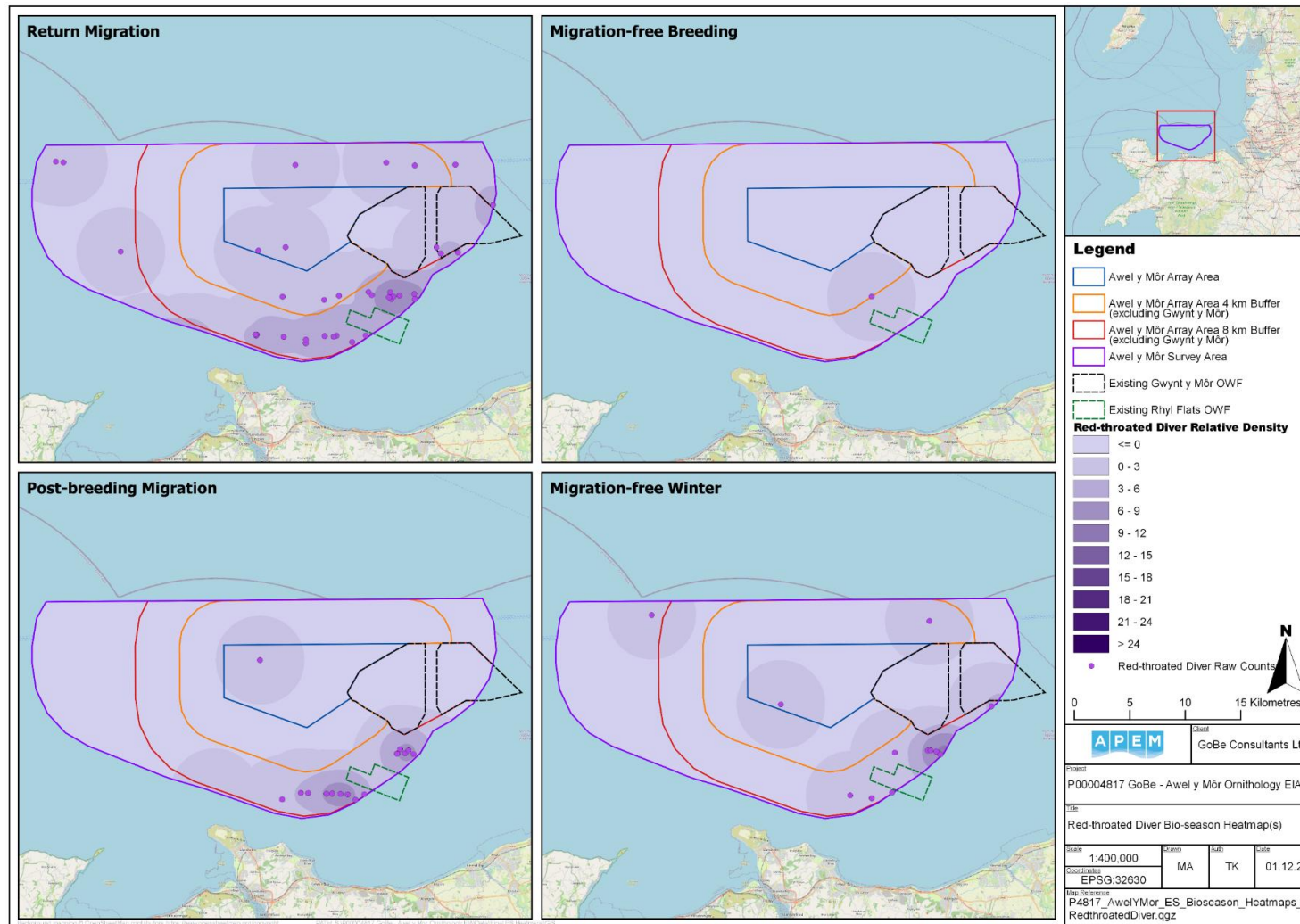


Figure 1: Distribution and relative density of red-throated diver at AyM during baseline characterisation surveys.

Table 7: Baseline occurrence of red-throated diver at the AyM array and buffer areas (March 2019-February 2021).

	ARRAY AREA		5 KM BUFFER		5 - 8 KM BUFFER	
	Peak count	Peak density	Peak count	Peak density	Peak count	Peak density
Spring migration	9	0.12	28	0.13	50	0.36
Migration free breeding	0	0	5	0.02	0	0
Autumn migration	4	0.05	0	0	58	0.42
Migration free winter	4	0.05	5	0.02	39	0.28

Table 8: Baseline monthly raw count, abundance and density for the array and buffer areas.

	ARRAY AREA			0 - 5KM BUFFER			5 - 8 KM BUFFER		
	Raw count	Abundance	Density	Raw count	Abundance	Density	Raw count	Abundance	Density
Mar-19	0	0	0	4	46	0.21	5	54	0.4
Apr-19	1	10	0.13	3	32	0.15	0	0	0
May-19	0	0	0	0	0	0	0	0	0
Jun-19	0	0	0	0	0	0	0	0	0
Jul-19	0	0	0	0	0	0	0	0	0
Aug-19	0	0	0	0	0	0	0	0	0
Sep-19	0	0	0	0	0	0	0	0	0
Oct-19	1	8	0.1	0	0	0	8	66	0.49
Nov-19	0	0	0	0	0	0	2	17	0.13
Dec-19	0	0	0	1	9	0.04	1	9	0.07

	ARRAY AREA			0 - 5KM BUFFER			5 - 8 KM BUFFER		
	Raw count	Abundance	Density	Raw count	Abundance	Density	Raw count	Abundance	Density
Jan-20	0	0	0	0	0	0	9	77	0.57
Feb-20	1	8	0.1	0	0	0	5	42	0.31
Mar-20	0	0	0	1	9	0.04	5	41	0.3
Apr-20	0	0	0	0	0	0	3	22	0.16
May-20	0	0	0	0	0	0	0	0	0
Jun-20	0	0	0	1	9	0.04	0	0	0
Jul-20	0	0	0	0	0	0	0	0	0
Aug-20	0	0	0	0	0	0	0	0	0
Sep-20	0	0	0	0	0	0	0	0	0
Oct-20	0	0	0	0	0	0	1	7	0.05
Nov-20	0	0	0	0	0	0	6	49	0.36

	ARRAY AREA			0 - 5KM BUFFER			5 - 8 KM BUFFER		
	Raw count	Abundance	Density	Raw count	Abundance	Density	Raw count	Abundance	Density
Dec-20	1	8	0.1	0	0	0	0	0	0
Jan-21	0	0	0	0	0	0	0	0	0
Feb-21	0	0	0	0	0	0	7	57	0.42

Table 9: Scale of impact predicted for red-throated diver at the AyM array and buffers, taken from RWE 2023.

	PEAK COUNT (ARRAY TO 8 KM BUFFER)	PREDICTED MORTALITY (BIRDS)	INCREASE TO BASELINE MORTALITY (%AGE)	MAGNITUDE OF IMPACT
Spring migration	86	0.6	0.057	Negligible
Migration free breeding	5	0	0	No Impact
Autumn migration	62	0.3	0.032	Negligible
Migration free winter	47	0.3	0.071	Negligible
Annual (BDMPS)	200	1.2	0.116	Negligible
Annual (Biogeographic)	200	1.2	0.019	Negligible

3.3.1 Conclusion of AyM ES

22 The conclusions relating to the potential impact on red-throated diver during the four bio-seasons within the array and buffers together, are presented in Table 9. A negligible impact was predicted for all bio-seasons (apart from the migration free breeding season, where no impact was predicted at all), and annually at both the Biologically Defined Minimum Population Scale (BDMPs) and the biogeographic scale.

3.4 GyM Surveys

23 Under the GyM Marine Licence requirements, ornithological monitoring was completed during all phases of the project (APEM, 2019). Given the proximity to AyM, the findings of that monitoring campaign are applicable to this OMP in terms of giving context to the baseline (although the monitoring objectives were not the same). Wider surveys covering the Colwyn Bay area (referred to in the GyM monitoring reports as NW5) were also undertaken alongside the GyM specific monitoring. A summary is provided in the following section.

24 DAS data was collected on the basis of a Before-After-Control-Impact (BACI) design which allowed for statistical analysis to be undertaken to assess any effect of the wind farm on the abundance and densities of diversⁱ.

25 At GyM and the wider area of Colwyn Bay, a pre-construction survey was undertaken in 2010/11, a construction survey in 2012/13 and then three post-construction surveys in 2016/17, 2017/18 and 2018/19. Baseline surveys to inform the GyM Section 36 consent application were also undertaken in 2004 for the purpose of informing the EIA.

26 Recorded abundance estimates are provided in Table 10, with an overview of the recorded distribution of red-throated diver during the post-construction surveys is presented in Figure 2.

ⁱ Note, additional receptors were required of the GyM monitoring however the focus of this OMP is red-throated diver.

- 27 Generally, the overall distribution of birds associated with GyM and the wider Colwyn Bay area, showed higher densities along near-shore regions south of the wind farm and buffer. Numbers of birds recorded during post construction monitoring are presented in Table 10. Distribution demonstrated low numbers in and around the close vicinity of the wind farm (pre- and post- construction). It is important to note that the GyM survey programme concluded that there was no significant change in red-throated diver densities between the construction phases, however it was noted that there can be large inter-annual variation in seabird numbers (Maclean *et al.*, 2013) and that very low numbers of red-throated diver were present before construction.
- 28 AyM and GyM studies found similar densities and distributions of birds as one another, with highest densities in inshore areas, beyond the boundaries of the respective array areas.
- 29 In regard to the survey design, surveys were flown on a 500 m grid across GyM and a surrounding 2km buffer to achieve a minimum coverage of 13%. However, in terms of coverage of the GyM array area and buffers, actual coverage achieved averaged 17%. A total of 5 surveys per year were flown:
- Survey 1 (summer): 1 July – 31 July;
 - Survey 2 (autumn): 17 October – 20 November;
 - Survey 3 (early winter): 21 November – 31 December;
 - Survey 4 (mid-winter): 1 January – 12 February; and
 - Survey 5 (late winter): 13 February – 20 March.
- 30 For the wider NW5 area a smaller minimum coverage area of 3% was achieved using a larger grid size (1,250 m). Three surveys a year were undertaken across the wider NW5 area:
- Survey 1 (autumn): 15 October – 19 November;
 - Survey 2 (mid-winter): 1 January – 12 February; and
 - Survey 3 (late winter): 13 February – 20 March.

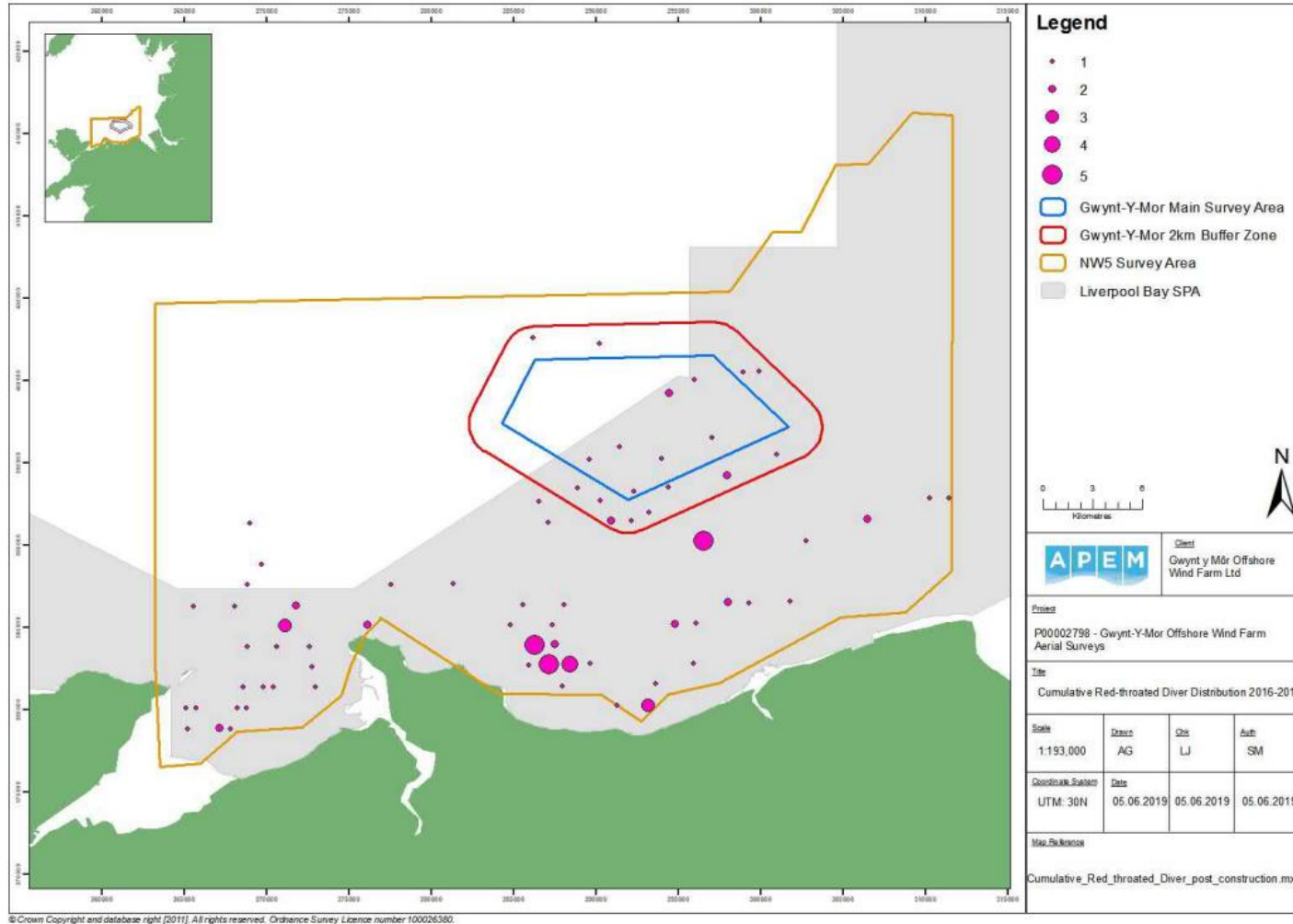


Figure 2: Cumulative distribution of red-throated divers recorded in GyM and NW5 during post-construction year monitoring (2016/17, 2017/18 and 2018/19).

Table 10: Post construction monitoring data for red-throated diver from GyM (APEM, 2019). Survey months where red-throated diver were present only.

MONTH	SURVEY AREA	RAW COUNT	ABUNDANCE	DENSITY
Oct-16	NW5	3	95	0.08
Feb-17	NW5	6	198	0.16
Mar-17	GyM	1	6	0.03
Mar-17	NW5	3	97	0.08
Nov-17	GyM	6	33	0.17
Nov-17	GyM	1	6	0.03
Jan-18	GyM	1	6	0.03
Jan-18	NW5	2	53	0.04
Mar-18	NW5	54	932	0.77
Oct-18	NW5	2	34	0.03
Nov-18	GyM	4	22	0.11
Feb-18	NW5	7	200	0.16
Mar-19	NW5	11	254	0.16

32

4 Monitoring Plan Objectives:

33 The overall objective of the monitoring plan will be to collect data to assess whether red-throated diver show displacement from the presence of an OWF array, and subsequently whether they show, or do not show, (a degree of) habituation to the presence of the OWF.

34 On this basis, the objectives of this monitoring study are presented below:

- ▲ Monitor the distribution and density of the red-throated diver population within and around the AyM development site (one pre-construction survey period (five surveys));
- ▲ Monitor for any effects on the abundance and density of red-throated divers within and around the AyM development site (two survey periods with five surveys each, carried out in Year 1 post-construction and Year 3 post-construction); and
- ▲ If displacement is identified within Year 1 and/or Year 3 of post-construction monitoring), monitor for the potential habituation of red-throated divers to the AyM development site (three survey periods with five surveys each, carried out in Year 5, Year 7 and Year 9 post-construction).

35 To test these objectives, the following data will be collected via DAS:

- ▲ Red-throated diver abundance pre- and post-construction within the AyM array and buffer areas; and
- ▲ Red-throated diver distribution pre- and post-construction within the AyM array and buffer areas.

36 Following data collection, a comparison will be conducted between pre- and post-construction for both the abundance (density) and distribution of red-throated diver. This will be undertaken through a design-based approach (see Section 6 for further details).

5 Methods

5.1 Survey Area

37 The DAS will be undertaken across the AyM array area and buffer, which will extend 4 km seaward (north) and 8 km landward (south), as used previously to assess red-throated diver displacement within the Environmental Statement (RWE, 2022). These buffers have been selected as they focus the survey effort on the shoreward (southern) extent of the area where red-throated diver occur in higher abundances (see Lawson *et al.*, 2016). This is due to red-throated diver foraging in shallow water (preferring waters around 8 m deep (Thompson *et al.*, 2023)). A buffer larger than 4 km is deemed unnecessary at the northern (seaward) boundary as red-throated diver densities decline rapidly with increasing water depth (Lawson *et al.*, 2016). Furthermore, the seaward buffer has been amended to remove a section of the survey which is located in water depths deemed unsuitable for red-throated diver (>36m) (Figure 3). The survey area has therefore been reduced by 82.3km² (506.1km² to 423.8km²).

38 Given the preference for foraging in shallower water demonstrated by Lawson *et al.* (2016) and Thompson *et al.* (2023) birds displaced by an OWF are highly likely to disperse into the shallower waters on the landward side, than the deeper waters on the seaward side of the survey area.

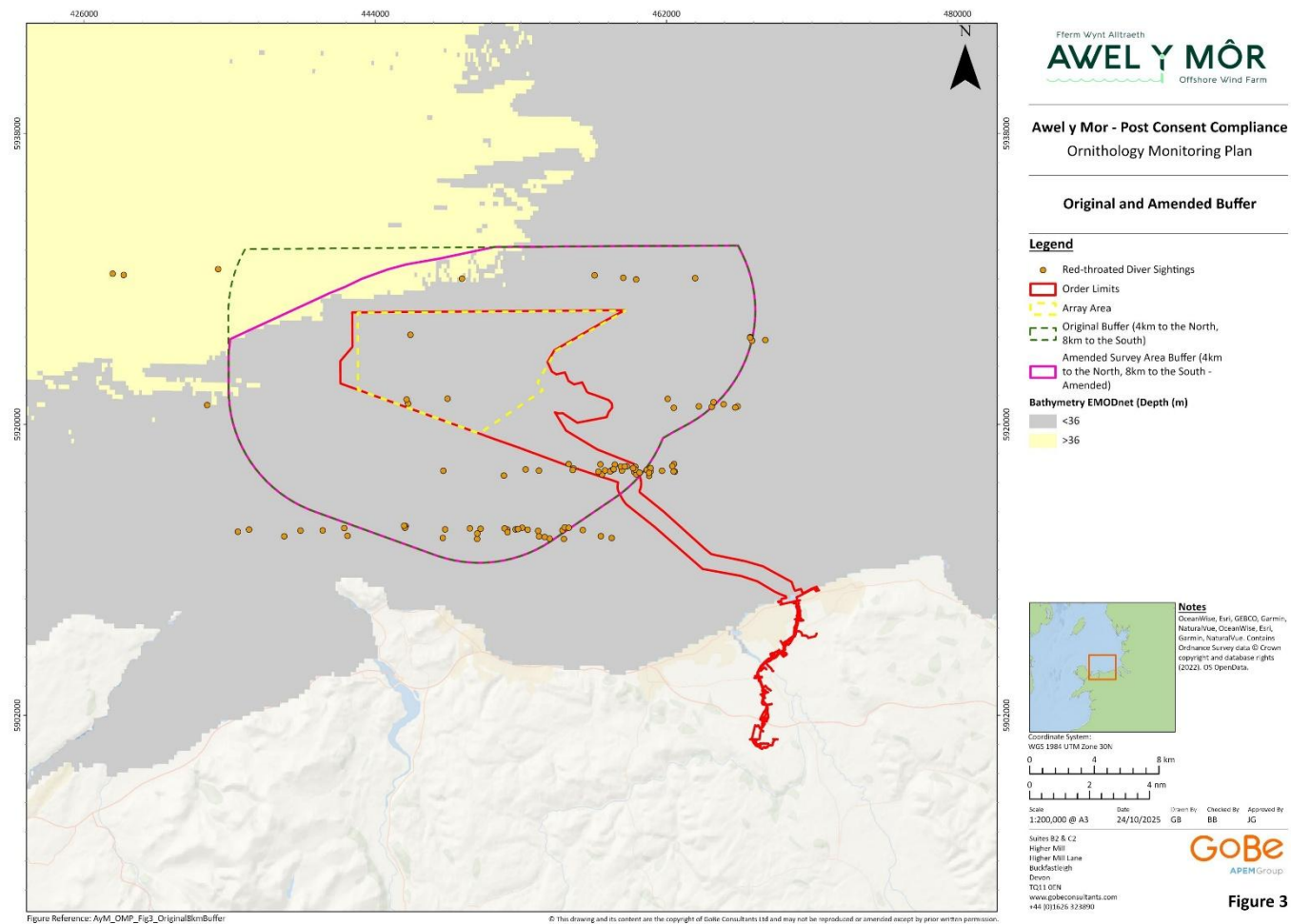


Figure 3: Original and Amended Survey Buffer.

5.2 Survey Design

39 A summary of the OMP pre- and post-construction monitoring survey specifications are provided in Table 11, with an indicative survey programme provided in Table 12. Note the specifications and programme are subject to any potential disruption from unforeseen circumstances, for example adverse weather conditions.

Table 11: Summary of survey specification.

DESIGN ELEMENT	SPECIFICATION	DETAIL AND JUSTIFICATION
Survey Coverage	Minimum coverage of 13%	Sampling will aim to cover, at minimum, 13% of the survey area. Monitoring the displacement of red-throated divers at the nearby GyM utilised a survey which sampled 13% of the survey area. This sampling coverage was deemed appropriate to answer monitoring objectives pertaining to determining the overall distribution of birds across the GyM survey area, and to determine whether use of the wind farm and adjacent areas changed as a result of construction of the wind farm. Transects will be aligned across the water depth gradient so far as possible. This will allow more accurate modelling of density and distribution as water depth is a key factor determining diver distribution, however the design of the survey will be finalised in discussion with the survey provider.
Survey Months	Non-breeding season (Oct – Apr)	The survey months identified cover the peak red-throated diver occurrence, which is during the non-breeding season (and subsequent migrations). As red-throated diver raw abundances within the surveys varied between months and years (Table 8 and Table 10), it is proposed to use a survey schedule covering the months of October to April to align with the GyM surveys, in line with the indicative schedule below (subject to weather and logistical constraints):
Survey Frequency	One survey period consisting of five surveys per survey year, each survey spaced approximately 4 weeks apart (with exact spacing dependent on weather and logistical constraints)	

DESIGN ELEMENT	SPECIFICATION	DETAIL AND JUSTIFICATION
		▲ Survey 5 (spring): 21 March – 17 April. A summer survey (as carried out for GyM) will not be undertaken based on the low densities of divers observed in the baseline surveys (Table 7). Instead, a survey will be undertaken in the spring based on the observations in Table 8. A total of five surveys will be undertaken each year as set out above.
Survey Period	One year pre-construction Up to five survey years post-construction over a nine-year period	With one survey per month (and five surveys per survey year), there will be five surveys across the entire pre-construction survey period (one year of monitoring), and up to 25 surveys for post-construction (a total of five years of surveys spread out over up to nine years). Surveys will not be carried out during the construction period. Red-throated diver are sensitive to the presence of vessels and vessel presence is anticipated to be higher during construction than post-construction. Surveying during the construction period would therefore likely return an unrepresentative sample of diver distribution and abundance, with birds being displaced or disturbed by the presence of the vessels (rather than the presence of wind turbine generators (WTGs)) or altering density and distribution of the baseline, making it an invalid comparison for post-construction.
Survey Start Month	October/November 2028 (indicative programme)	To collect one year of pre-construction baseline data, the surveys are anticipated to begin from October/November 2028 to be completed for an indicative March/April 2029 construction commencement date. The post-construction monitoring surveys will commence in the first October/November post-construction.

Table 12: Indicative monitoring programme.

	OCT 28 - APR 29	MAY 30 - SEP 30	OCT 30 - APR 31	MAY 31 - SEP 31	OCT 31 - APR 32	MAY 32 - SEP 32	OCT 32 - APR 33	MAY 33 - SEP 33	OCT 33 - APR 34	MAY 34 - SEP 34	OCT 34 - APR 35	MAY 35 - SEP 35	OCT 35 - APR 36	MAY 36 - SEP 36	OCT 36 - APR 37	MAY 37 - SEP 37	OCT 37 - APR 38	MAY 38 - SEP 38	OCT 38 - APR 39	MAY 39 - SEP 39	OCT 39 - APR 40	MAY 40 - SEP 40	OCT 40 - APR 41	MAY 41 - SEP 41	OCT 41 - APR 42	MAY 42 - SEP 42
Pre-Construction Survey																										
Review of Pre-Construction Surveys																										
OWF Construction																										
Post-Construction Surveys																										
Review of Post-Construction Surveys																										
Consultation										1*				2*				3*				3*				4*

1) Initial presentation of the pre- and post-construction monitoring. Preliminary discussions on whether displacement may have occurred.

2) Presentation of the pre- and post-construction monitoring, decision required for whether to continue post-construction monitoring depending on if displacement has / has not been observed.

3) Presentation of the pre- and post-construction monitoring. Preliminary discussions regarding whether habituation may have occurred.

4) Presentation of the final results of the monitoring programme.

5.3 DAS Technical Specifications

- 40 During each DAS the camera technician will collect digital imagery and contextual observations to a standard which (following processing and analysis) will enable the following details to be recorded:
- Identification to species level and species grouping;
 - Location / coordinates (to one (1) metre accuracy);
 - Behaviour (e.g., flying, sitting, preening etc);
 - Flight direction / orientation (on 16-point compass);
 - Georeferenced location (date and time) and footprint of image; and
 - Contextual information of any relevant observations that may affect the survey results, e.g., shipping, types of vessels and direction.
- 41 The camera system will be operated by a trained aerial survey technician to ensure successful data collection. Adjustments will be made to the angle of the camera system to avoid glare from the sea surface. The technician will also keep a record of the order in which the transects are flown, the time which the first node of each transect is captured, transect orientation and ground speed.
- 42 Survey flights will take place at a height in accordance with minimum safe altitude regulations which will also avoid disturbance to birds (and marine megafauna) whilst optimising ground resolution (minimum 2cm GSD). Survey flights will only take place during suitable weather conditions.

6 Analyses

6.1 Pre-Construction Analysis

- 43 The pre-construction surveys will identify the baseline of red-throated diver in the study area, building on the extensive body of evidence contextualising the baseline. The individuals identified in the survey will be counted and georeferenced. To characterise the baseline, it is expected that a design-based approach will be undertaken. Given the generally low counts expected, it is deemed unlikely that there will be sufficient data for a robust model-based analysis. As agreed with NRW(A) (Table 3), a design-based approach is appropriate for fulfilling the requirements of this monitoring plan. However, this will be kept under review and, if deemed appropriate, a model-based approach will be undertaken. Any model-based approach would consider the use of relevant environmental covariates such as water depth to parametrise the model, with inclusion in the final model subject to the availability of covariate data at a suitable spatial and temporal scale, and an appropriate model selection process.
- 44 The data will be collected and analysed for abundance and distribution of red-throated diver as identified in the objectives (Section 4). Abundance and density will be estimated per survey, and peak months will be identified. Assumptions regarding availability bias (i.e., the likelihood that a bird is on the surface and 'available' for survey as opposed to under water) will be applied consistently across the survey period.
- 45 The pre-construction surveys will be used as a baseline to compare with the post-construction surveys. Therefore, the comparative before-after analysis will only take place after the post-construction surveys are completed (see Section 6.2 below).

6.2 Post-Construction Analysis

- 46 The post-construction DAS will follow the same data collection and analysis methodology as the pre-construction survey including analysis methods for abundance and distribution of red-throated diver as detailed in Section 6.1.

47 As discussed in Table 3, it is unlikely that model-based analysis will be feasible, therefore comparisons to the pre-construction data will be undertaken through comparing distribution maps (i.e. kernel density maps) as well comparing abundances.

48 Two comparisons will be undertaken:

- 1) Comparison of the first two post-construction monitoring surveys (years one and three) to the pre-construction monitoring (alongside comparison with other available data detailed within Section 3); and
- 2) Comparison of the third to fifth post-construction monitoring surveys (years five, seven and nine) to the first two post-construction monitoring surveys (years one and three) and to the pre-construction monitoring.

49 The above will allow for comparison of (1), whether displacement has been observed (percentage reduction of individuals / an observed change in the distribution of the species), and (2) whether the birds have returned to the site to pre-construction levels.

50 It is noted that if no displacement is identified within analysis (1), further discussion will be undertaken with NRW to agree if there is a requirement for proceeding with the remaining post-construction survey years (see Table 12).

6.3 Reporting

51 Following each year of surveys (pre- and post-construction), a short report will be provided which summarises the abundance, density, and distribution of red-throated diver. Any notable trends in abundances or distributions will be highlighted, to allow for relevant consultation with NRW.

52 After the second post-construction survey period (Year three post-construction), a pre- vs post-construction comparison will be presented, with conclusions of whether displacement has been observed. The results will be discussed with NRW and a decision will be made on the requirement to continue the post-construction surveys.

53 Following completion of the final year of post-construction monitoring, a detailed report will be produced presenting the comparisons of the abundance and distribution of red-throated diver between survey years, discussing whether any displacement occurred as well as the potential habituation (if required). The report will discuss the observed changes, implications for the red-throated diver population and limitations of the data collection and analysis.

54 All reports will broadly include the following details:

- Survey methodology including survey timings, transect routes, coverage and other specifications;
- Survey limitations;
- Analysis limitations;
- Methods of data analysis for both abundance and distribution;
- Detailed results for abundance and distribution of red-throated diver. For post-construction this will include results of the comparative before-after analysis; and
- The final post-construction report will discuss the potential implications on the red-throated diver population.

7 Summary

55 This OMP has been produced to seek approval from NRW for discharge of conditions under the AyM marine licences ORML2233G and ORML2233T. The proposed plan meets the requirements of the consent Condition 3.32 (Table 1).

56 Red-throated diver abundance and distribution data will be collected via DAS commencing from October/November 2028 (indicative programme) over one winter pre-construction and over up to five winters (over a nine year period) post-construction (Oct – Apr inclusive).

57 The surveys will follow the below specifications:

- The survey will cover the AyM array plus a 4 km buffer to the north (modified to remove areas in depths >36m) and an 8 km buffer to the south;
- The survey will cover a minimum of 13% of the survey area at a GSD of 2 cm;
- There will be one pre-construction survey period;
- There will be up to five post-construction survey periods over a nine-year timeframe; should no displacement be recorded within the first two post-construction surveys in Year 1 and Year 3 post-construction, AyM will consult with NRW(A) to discuss whether monitoring for habituation should continue for the remaining three survey periods; and
- During each survey period, five surveys will be undertaken, spaced approximately 4 weeks apart (non-breeding season: October to April)

58 This approach will meet the agreed objectives:

- Identification of red-throated diver density and distribution both pre- and post-construction; and
- Comparative analysis of abundance and distribution between survey years to identify changes in density/distribution.

59 As such, AyM will review the extent of any changes in red-throated diver distribution and density as a result of the construction of the OWF, as well as the potential habituation to the wind farm.

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